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# PHOTONICS WEST.

## TECHNICAL PROGRAM

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The Moscone Center  
San Francisco, California, USA

Conferences & Courses  
13-18 February 2016

BIOS EXPO  
13-14 February 2016

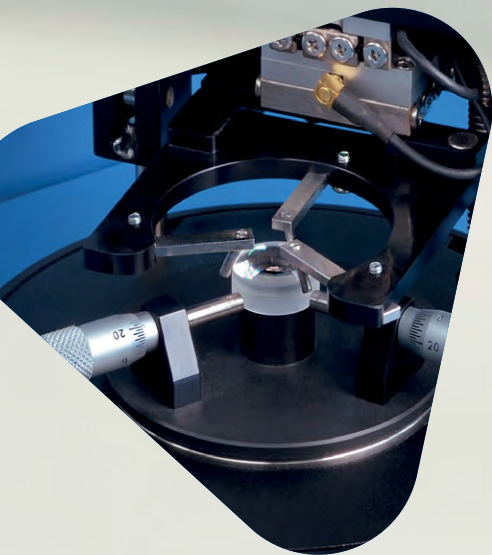
Photonics West Exhibition  
16-18 February 2016

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# SPIE. PHOTONICS WEST

The Moscone Center  
San Francisco, California, USA

## DATES

Conferences & Courses:  
13-18 February 2016

## TWO EXHIBITIONS

BiOS EXPO: 13-14 February 2016  
Photonics West: 16-18 February 2016

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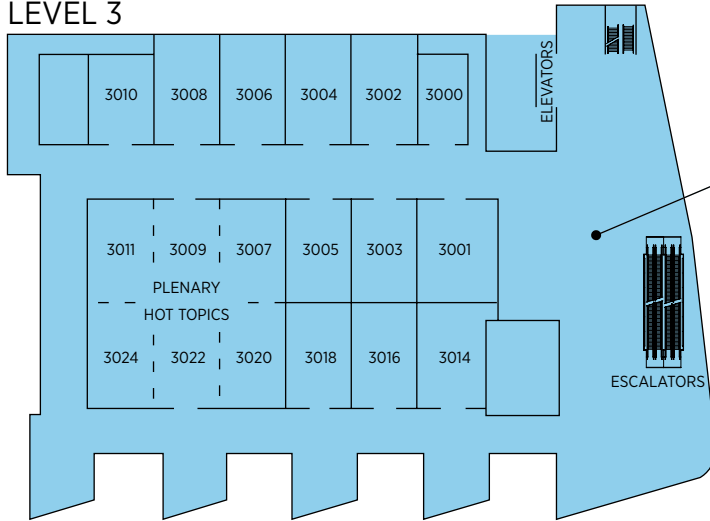
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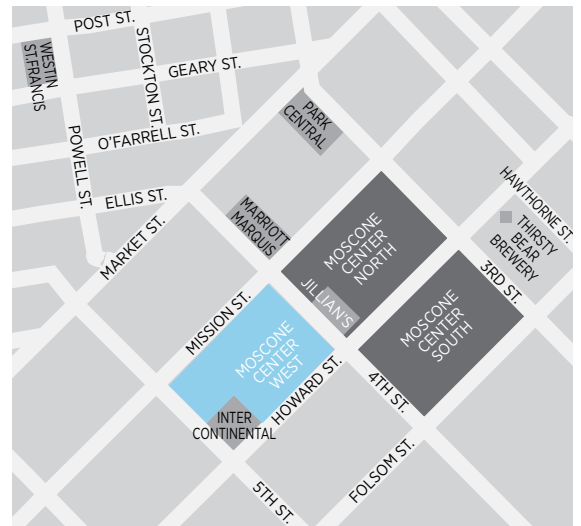
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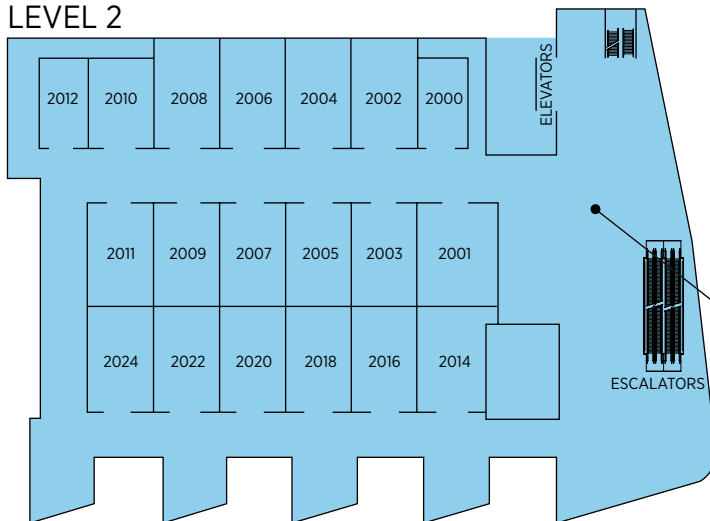


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PLENARY

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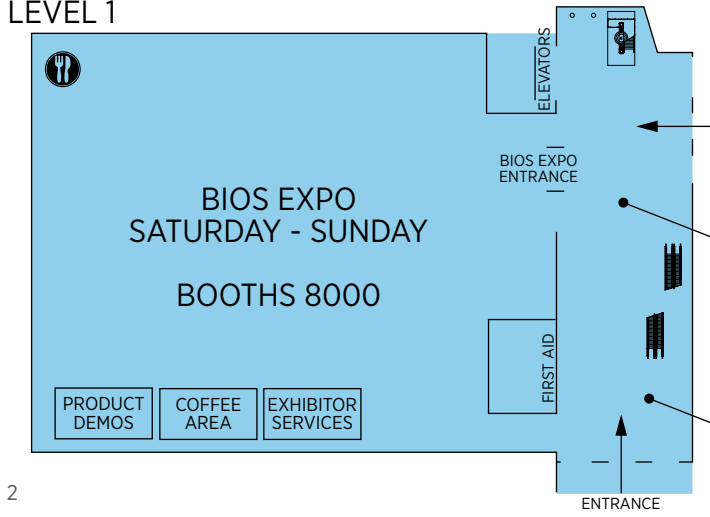
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**LEVEL 2 LOBBY:**  
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= FOOD OUTLETS

### LEVEL 1



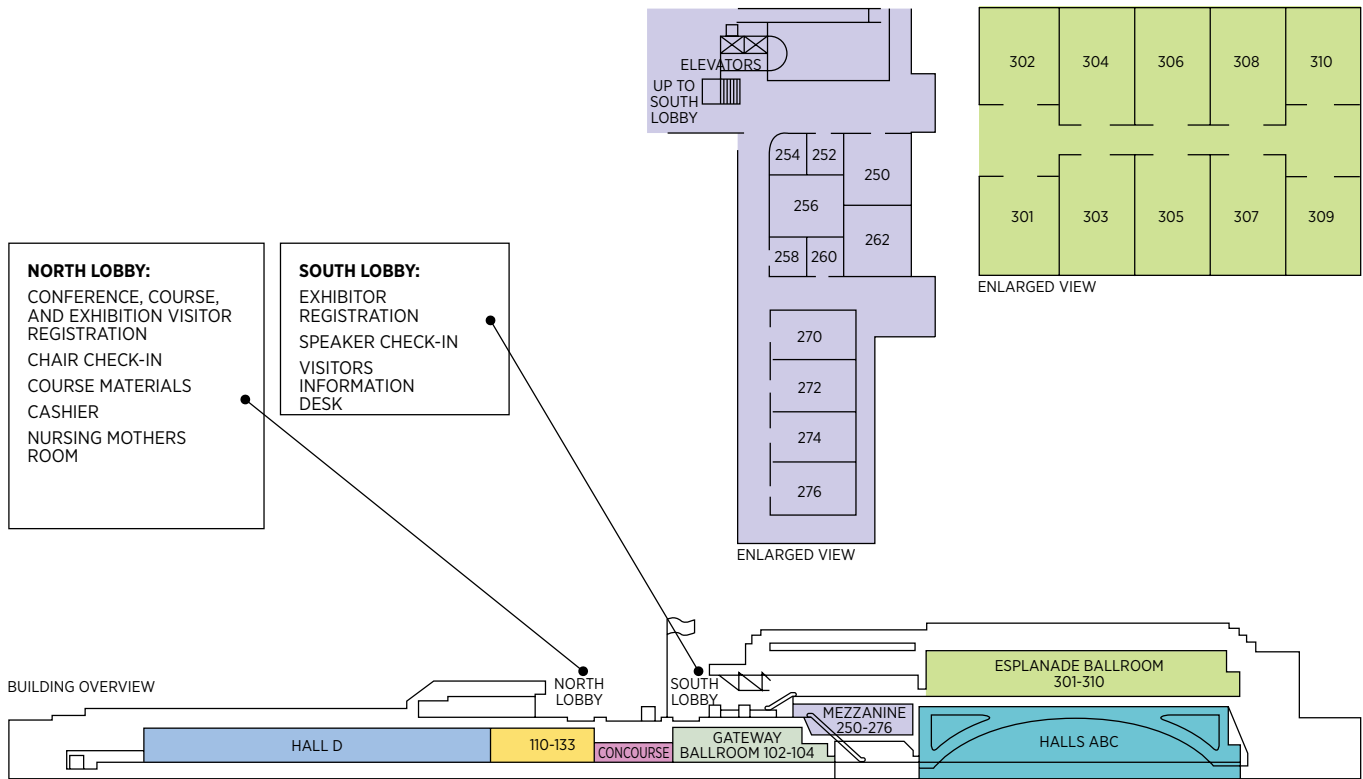
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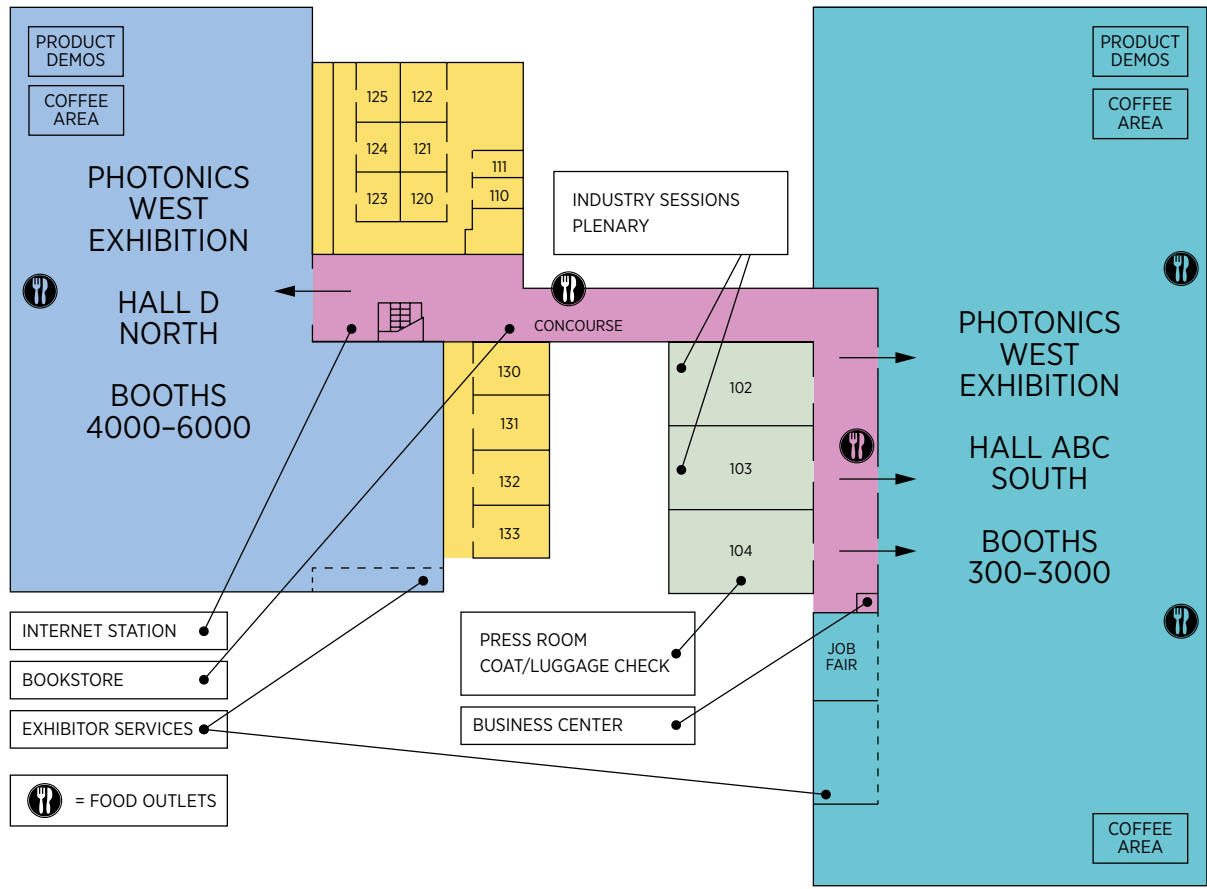
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# MEZZANINE

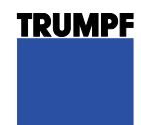
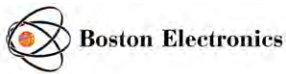
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# BIOS.

BIOS IS THE WORLD'S LARGEST BIOMEDICAL OPTICS AND BIOPHOTONICS CONFERENCE

## SYMPOSIUM CHAIRS:



**James Fujimoto**  
Massachusetts Institute of  
Technology (USA)



**R. Rox Anderson**  
Wellman Ctr. for  
Photomedicine,  
Massachusetts General  
Hospital and Harvard  
School of Medicine (USA)

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# Hot Topics Presentations

Don't miss these world-class speakers discussing game-changing technology and valuable insights.

Featuring:

### David Boas

Massachusetts General Hospital, Harvard Medical School (USA)

### Melissa Skala

Vanderbilt Univ. (USA)

### Aaron Aguirre

Massachusetts General Hospital, Harvard Univ. (USA)

### David Sampson

Univ. of Western Australia (Australia)

### Paul Beard

Univ. College London (UK)

### Jennifer Hunter

Univ. of Rochester (USA)

### Eric Potma

Univ. of California/Irvine (USA)

### Heather Franklin

Blaze BioScience, Inc. (USA)

## TUESDAY

# Nano/Biophotonics Plenary

Featuring:

### Halina Rubinsztein-Dunlop

Univ. of Queensland (Australia)

## BIOS 2016 BEST PAPER AWARDS

See page 34 for a complete list of Awards available at BIOS 2016 conferences.

## BIOS POSTER SESSIONS

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Tuesday 16 February . . . . . 6:00 to 8:00 PM



# TRANSLATIONAL RESEARCH TRACK INDEX

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### SYMPOSIUM CHAIRS:



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Beckman Laser Institute,  
Univ. of California, Irvine (USA)



**Gabriela Apiou**

Harvard Medical School,  
Wellman Ctr. for Photomedicine,  
Massachusetts General Hospital  
(USA)

SPIE Translational Research 2016 highlights papers from BiOS that showcase the latest photonics technologies, tools, and techniques with high potential to impact healthcare.

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**Clinical Technologies and Systems**

**Tissue Optics, Laser-Tissue Interaction, and  
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**Biomedical Spectroscopy, Microscopy, and  
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**Nano/Biophotonics**

**Neurophotonics, Neurosurgery, and  
Optogenetics**

### Translational Research Lunchtime Forum

*Sunday 14 February · 12:30 to 2:00 pm*

*Location: Room 3018 (Moscone West Level 3)*

Discussion Facilitators: **Bruce J. Tromberg** and **Gabriela Apiou**

A discussion of outcomes-based studies that can change the lives of patients. Select participants from the Translational Research virtual symposium will have the opportunity to present their methodology and findings. These speakers will demonstrate the use of optical/light-based techniques that are innovative and clever and can change the outcome for patients in a positive and life-giving way.

Best Paper Awards in the category of evidence-based medicine will be presented.

# LASE.

THE LASER TECHNOLOGY AND INDUSTRIAL LASER CONFERENCE

## SYMPOSIUM CHAIRS:



**Guido Hennig**  
Daetwyler Graphics AG  
(Switzerland)



**Yongfeng Lu**  
Univ. of  
Nebraska-  
Lincoln (USA)

## SYMPOSIUM CO-CHAIRS:



**Reinhart Poprawe**  
Fraunhofer-Institut für  
Lasertechnik (Germany)



**Koji Sugioka**  
RIKEN (Japan)

## WEDNESDAY

# LASE Plenary Presentations

Featuring:

### Philip Russell

Max-Planck Institute for the Science  
of Light (Germany) and Univ. of  
Erlangen-Nuremberg (Germany)

### Satoshi Kawata

Osaka Univ. (Japan) and RIKEN  
(Japan)

### Scott Keeney

nLight Corp. (USA)

## LASE 2016 BEST PAPER AWARDS

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# OPTO.

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## SYMPOSIUM CHAIRS:



**Jean Emmanuel Broquin**  
IMEP-LAHC  
(France)



**Shibin Jiang**  
AdValue Photonics,  
Inc. (USA)

## SYMPOSIUM CO-CHAIRS:



**David L. Andrews**  
Univ. of East Anglia  
(United Kingdom)



**Alexei L. Glebov**  
OptiGrate Corp.  
(USA)

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ChipShop GmbH (Germany) and **Winston V.  
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Photonics, Univ. of Central Florida (USA)0

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Program Chair: **Liang-Chy Chien**, Kent State Univ. (USA)

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### MONDAY

## OPTO Plenary Presentations

Don't miss these world-class speakers discussing game-changing technology and valuable insights.

Featuring:

#### **Xiang Zhang**

Univ. of California, Berkeley (USA)

#### **Robert W. Boyd**

Univ. of Ottawa (Canada) and Univ. of Rochester (USA)

#### **Michael Liehr**

American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

### OPTO POSTER SESSION

Wednesday 17 February ..... 6:00 to 8:00 PM



# GREEN PHOTONICS + 3D PRINTING TRACK INDEX

## **SPIE.** PHOTONICS WEST GREEN PHOTONICS

### SYMPOSIUM CHAIR



**Stephen J. Eglash**  
Stanford Data Science Initiative,  
Stanford Univ. (USA)

SPIE Green Photonics 2016 highlights papers from OPTO and LASE that showcase the latest photonics and optoelectronic tools and materials that will reduce power consumption, enable cleaner manufacturing, and create new energy generation for a broad range of applications.

**TOPIC AREAS .....370-373**

**Laser-assisted Manufacturing and Micro/Nano Fabrication**

**Renewable Energy Generation: Fusion and Photovoltaics**

**Environmental Monitoring and Sensing**

**Solid State Lighting and Displays**

**Communications**



## **SPIE.** PHOTONICS WEST 3D PRINTING

### SYMPOSIUM CHAIR



**Henry Helvajian**  
The Aerospace Corp. (USA)

SPIE Applications of 3D Printing 2016 highlights papers from BiOS, LASE, and OPTO that showcase innovative ways to apply this multidimensional/multidisciplinary technology.

**TOPIC AREAS .....374-378**

**Additive Manufacturing**

**Selective Laser Melting, Maser Sintering, Laser Photopolymerization**

**Novel Materials, Protean Materials, and Laser Interactions**

**Software That Increases Efficiencies and Speed**

**In-situ Sensors or Probes to Verify and Quantify Additive Manufacturing Processes in Real Time**

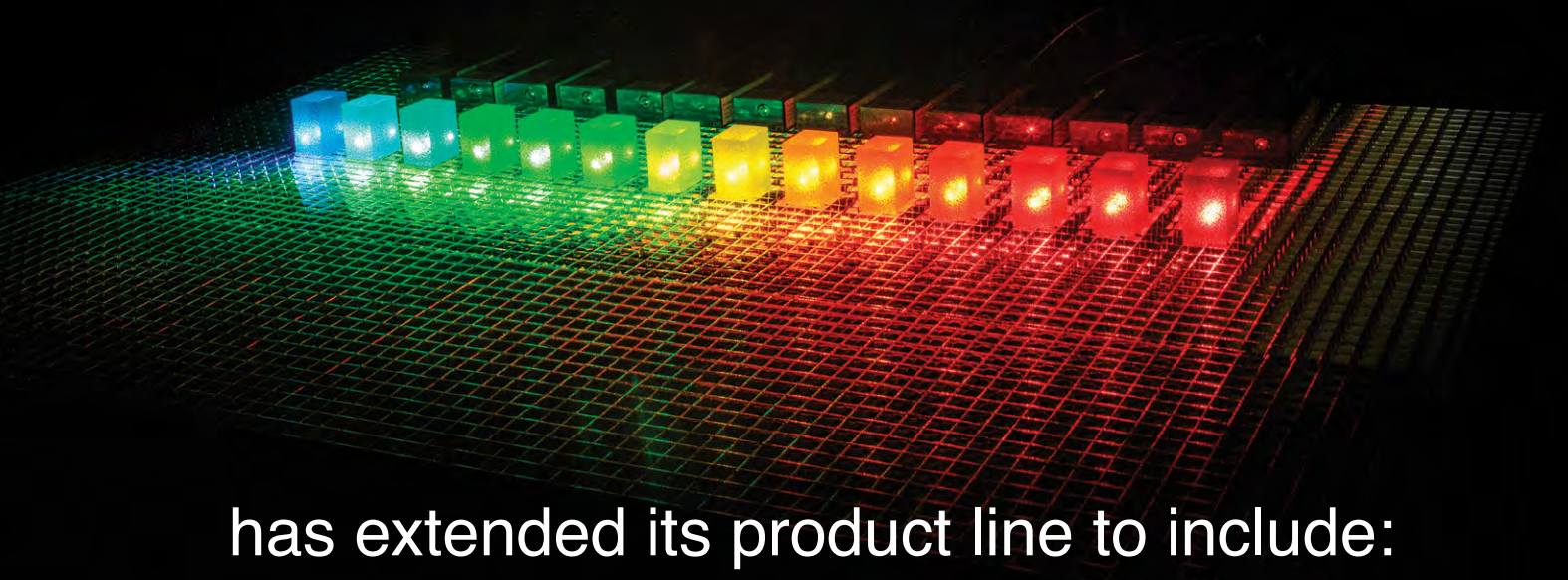
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# SPECIAL EVENTS DAILY SCHEDULE

Saturday · 13 February	Sunday · 14 February	Monday · 15 February
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**BiOS EXPO**  
**LOCATION: MOSCONE WEST**  
 Saturday · 12:00 to 5:00 pm  
 Sunday · 10:00 am to 5:00 pm

**BiOS Hot Topics**, 7 to 9 pm, p. 16

- Lunch with the Experts: A BiOS Student Networking Event**, 12:30 to 1:30 pm, p. 38
- Translational Research Lunchtime Forum**, 12:30 to 2 pm, p. 22
- Charting a Course in the Photonics Industry**, 2:30 to 4:30 pm, p. 36
- BRAIN Initiative Hot Topics & Networking Reception**, 4 to 6:30 pm, p. 22
- FDA Policies and Procedures**, 5 to 7 pm, p. 22
- BiOS Interactive Poster Session**, 5:30 to 7:30 pm, p. 23
- Student Chapter Meeting**, 6 to 9 pm, p. 38



- OPTO Plenary Session**, 8 to 10:10 am, p. 18
- The Craft of Scientific Presentations: A Workshop on Technical Presentations**, 8:30 to 12:30 am, p. 36
- Modeling Camera Performance Without A Camera: The Use and Advantages of an Online Simulation Engine**, 9 to 10 am, p. 24
- Inbound Marketing: How to Bring Customers to You**, 10:30 to 12:30 pm, p. 24
- SPIE Fellows Luncheon**, 12 to 1:30 pm, p. 38
- Marketing Roundtable: Wins and Lessons Learned**, 1 to 2:30 pm, p. 24
- The Craft of Scientific Writing: A Workshop on Technical Writing**, 1:30 to 5:30 pm, p. 36
- ITAR and Other International Trade Regulations**, 3 to 4 pm, p. 24
- Updates to the U.S. Munitions List (USML) That Will Affect ITAR**, 4 to 5:30 pm, p. 24
- Photonics Cluster Reception**, 5 to 6:30 pm, p. 25
- Women in Optics Presentation**, 5 to 6:30 pm, p. 38
- BiOS Interactive Poster Session**, 5:30 to 7:30 pm, p. 23
- Photonics West Welcome Reception**, 7 to 8:30 pm, p. 39



## PHOTONICS WEST WELCOME RECEPTION

### Tomorrow Is Yesterday

Monday 15 February • 7:00 to 8:30 pm  
 Location: Marriott Marquis Hotel, Yerba Buena Ballroom

Come celebrate some of the amazing achievements of the past 50 years.

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# SPECIAL EVENTS DAILY SCHEDULE

Tuesday · 16 February

Wednesday · 17 February

Thursday · 18 February

## PHOTONICS WEST EXHIBITION

Tuesday · 10:00 am to 5:00 pm  
 Wednesday · 10:00 am to 5:00 pm  
 Thursday · 10:00 am to 4:00 pm

### SPIE Career Center JOB FAIR

Tuesday · 10:00 am to 5:00 pm  
 Wednesday · 10:00 am to 5:00 pm



- SPIE Senior Member Breakfast**, 8 to 9 am, p. 39
- Critical Skills for Compelling Research Proposals**, 8:30 am to 12:30 pm, p. 36
- Career Advancement through SPIE Involvement**, 10 to 11 am, p. 36
- Nano/Biophotonics Plenary Session**, 10:30 to 11:30 am, p. 19
- Lunch with the Experts - A Student Networking Event**, 12:30 to 1:30 pm, p. 39
- Silicon Photonics and Photonic Integrated Circuits: An Industry Perspective**, 1:30 to 3 pm, p. 25
- Patent Filing Considerations and Portfolio Evaluation for Photonics Engineers and Managers**, 1:30 to 3 pm, p. 26
- Resumes to Interviews: Strategies for a Successful Job Search**, 1:30 to 5:30 pm, p. 36
- Non-Financial Reporting: Managing Risks and Leveraging Opportunities**, 3 to 4:30 pm, p. 26
- Financing Photonics Businesses**, 3:30 to 5 pm, p. 26
- Speed Networking Social**, 4:30 to 6 pm, p. 39
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- IBOS: International Biomedical Optics Society Session**, 7:30 to 9 pm, p. 23
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- Industry Panel on 3D Printing: Outlook and Opportunities**, 8:00 to 10:00 am, p. 27
- Great Workplaces in Optics and Photonics**, 8:00 to 10:00 am, p. 27
- LASE Plenary Session**, 10:20 am to 12:30 pm, p. 20
- Executive Perspectives on the World of Optics and Photonics**, 1:30 to 2:30 pm, p. 28
- Getting Hired Panel**, 1:30 to 3 pm, p. 28
- Conflict Minerals Workshop: For Wherever You Are in the Supply Chain**, 3 to 4:30 pm, p. 28
- SPIE Startup Challenge**, 3:30 to 6 pm, p. 30
- OPTO Interactive Poster Session**, 6 to 8 pm, p. 23
- PRISM Awards Ceremony and Banquet**, 6 to 10 pm, p. 30
- "No Ties" Student Social**, 8 to 10 pm, p. 39

- The Basics of Laser Material Processing**, 8 to 10 am, p. 30
- Photonics Industry Update**, 9:15 to 9:45 am, p. 30
- Introduction to Silicon PM Performance and How to Characterize It**, 10 to Noon, p. 31
- Startup Alley: Commercialization and Prototype Showcase**, 11 am to 1 pm, p. 31
- Use Supply Chain Transparency to Beat the Competition**, 1:30 to 3 pm, p. 31





# HOT TOPICS AND PLENARY PRESENTATIONS

Don't miss these world-class speakers discussing game-changing technology and valuable insights.

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SATURDAY 13 FEBRUARY

## BiOS Hot Topics

7:00 to 9:00 PM • Location: Room 3022 (Moscone West Level 3)



7:00 to 7:10 pm  
**Welcome and Opening Remarks**

**James Fujimoto**  
Massachusetts Institute of Technology (USA)  
*BiOS 2016 Symposium Chair*



7:40 to 7:45 pm  
**Hot Topics Facilitator Remarks**

**Sergio Fantini**  
Tufts Univ. (USA)



8:15 to 8:25 pm  
**Photoacoustic Imaging: From Light to Sound and Back**

**Paul Beard**  
Univ. College London (UK)



**R. Rox Anderson**  
Wellman Ctr. for Photomedicine, Massachusetts General Hospital and Harvard School of Medicine (USA)  
*BiOS 2016 Symposium Chair*



7:45 to 7:55 pm  
**Imaging Cellular Heterogeneity in Cancer**

**Melissa Skala**  
Vanderbilt Univ. (USA)



8:25 to 8:35 pm  
**Advances in Adaptive Optics Retinal Imaging**

**Jennifer Hunter**  
Univ. of Rochester (USA)



7:10 to 7:15 pm  
**Presentation of 2016 Britton Chance Biomedical Optics Award**

**Robert Lieberman**  
Lumoptix LLC (USA)  
*SPIE President*



7:55 to 8:05 pm  
**New Microscopy Techniques for Assessing the Beating Heart**

**Aaron Aguirre**  
Massachusetts General Hospital, Harvard Univ. (USA)



8:35 to 8:45 pm  
**Stimulated Nonlinear Optical Microscopy: Imaging with a Boost**

**Eric Potma**  
Univ. of California/Irvine (USA)



7:15 to 7:35 pm  
**From Chance to Neurophotonics**

**David Boas**  
Massachusetts General Hospital, Harvard Medical School (USA)  
*(2015 Britton Chance Biomedical Optics Award Winner)*



8:05 to 8:15 pm  
**Addressing Biophotonics Challenges: Deep Penetration with Needles and Alternate Contrast with Micro-elastography**

**David Sampson**  
Univ. of Western Australia (Australia)



8:45 to 8:55 pm  
**Targeted Fluorescence Image-Guided Surgery**

**Heather Franklin**  
Blaze BioScience, Inc. (USA)



7:35 to 7:40 pm  
**Tribute to Lee Rosen (1947-2015)**



*Presented by*  
**Behrouz Shabestari**  
NIH/NIBIB



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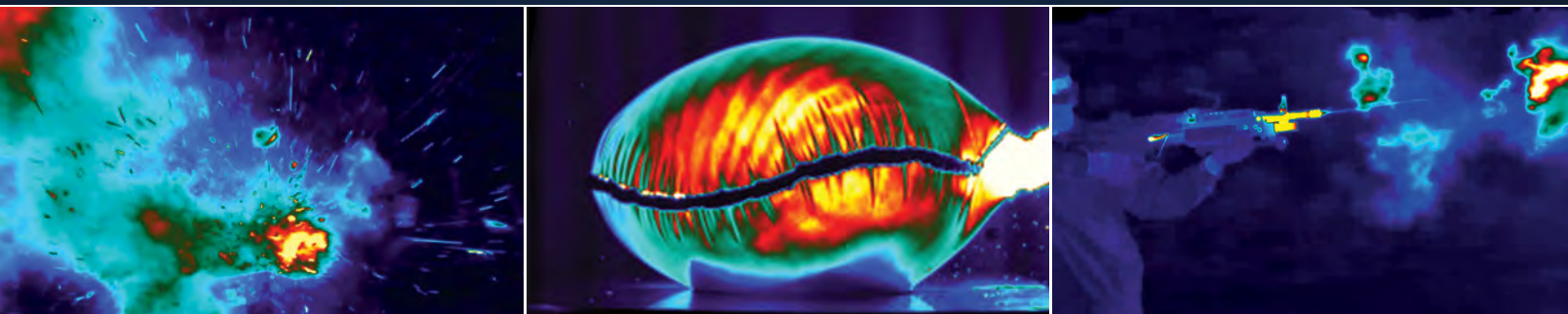


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# PLENARIES AND HOT TOPIC PRESENTATIONS

MONDAY 15 FEBRUARY

## OPTO Plenary Session

8:00 to 10:10 AM • Location: Room 3009 (Moscone West Level 3)



8:00 am  
**Welcome and Opening Remarks**

**Jean Emmanuel Broquin**  
IMEP-LAHC (France)  
OPTO 2016 Symposium Chair



**Shibin Jiang**  
AdValue Photonics, Inc. (USA)  
OPTO 2016 Symposium Chair



8:05 am  
**Announcement of the Green Photonics Awards**

**Stephen J. Eglash**  
Stanford Data Science Initiative,  
Stanford Univ. (USA)



8:10 am  
**Parity-time Symmetry Photonics**

**Xiang Zhang**  
Univ. of California, Berkeley (USA)

Judiciously designed balanced gain and loss structures, a hallmark of parity-time (PT) symmetric synthetic systems, are attractive due to their extraordinary dynamical properties. In this talk I will discuss the notion of PT symmetry in optical systems. Moreover, I will discuss the recent progress in this emerging field regarding the novel lasing schemes such as single mode lasing in PT symmetric periodically modulated ring lasers and simultaneous unidirectional lasing and zero reflection PT symmetric cavities.

**Xiang Zhang** is the inaugural Ernest S. Kuh Endowed Chaired Professor at UC Berkeley and the Director of NSF Nano-scale Science and Engineering Ctr. He is the Director of the Materials Sciences Division at Lawrence Berkeley National Laboratory (LBNL), as well as a member of the Kavli Energy Nano Science Institute. Prof. Zhang is an elected member of US National Academy of Engineering (NAE), Academia Sinica (National Academy in Republic of China), and Fellow of five scientific societies: APS, OSA, AAAS, SPIE, and ASME. Professor Zhang's current research focuses on nanoscale science and technology, materials physics, photonics and biotechnologies. He has published over 240 journal papers, including over 50 publications in Science, Nature series, PNAS and Physical Review Letters. He has given over 280 Keynote, Plenary, and Invited talks at international conferences and institutions. He served as a Co-Chair of NSF Nanoscale Science and Engineering Annual Grantee Conferences in 2004 and 2005, Chair of Technical Program of IEEE 2nd International Conference on Micro and Nano Engineered and Molecular Systems in 2007, and current Chair of Academic Advisory Board for Research Center for Applied Science (RCAS), Academia Sinica, Taiwan, ROC. In 2008, Prof. Zhang's research was selected by *Time Magazine* as one of the "Top Ten Scientific Discoveries of the Year" and "50 Best Inventions of the Year," *Discover Magazine's* "Top 100 Science Stories" in 2007, and *R&D Magazine's* top 25 Most Innovative Products of 2006.

Prof. Zhang is a recipient of the NSF CAREER Award (1997); SME Dell K. Allen Outstanding Young Manufacturing Engineer Award (1998) and ONR Young Investigator Award (1999). He was awarded the Chancellor's Professorship by UC Berkeley (2004-2009), Distinguished Lecturer by Univ. of Texas at Austin in 2004 and SEMETECH in 2005, respectively, Rohsenow Lecturer at MIT (2009) and William Reynolds Lecturer at Stanford (2012). In 2011, he was awarded Fred Kavli Distinguished Lectureship by Materials Research Society (MRS), Miller Professorship by UC Berkeley, and Distinguished Visiting Scientist (DVS) by the Univ. of Toronto. In 2014, he was awarded the Fitzroy Medal for pioneering contribution in metamaterials and superlens.



8:50 am  
**Quantum Nonlinear Optics: Nonlinear Optics Meets the Quantum World**

**Robert W. Boyd**  
Univ. of Ottawa (Canada) and  
Univ. of Rochester (USA)

This presentation first reviews the historical development of the field of nonlinear optics, starting from its inception in 1961. It then reviews some of its more recent developments, including especially how nonlinear optics has become a crucial tool for the developing field of quantum technologies. Fundamental quantum processes enabled by nonlinear optics, such as the creation of squeezed and entangled light states, are reviewed. We then illustrate these concepts by means of specific applications, such as the development of secure communication systems based on the quantum states of light.

**Robert W. Boyd** is an American physicist noted for his work in optical physics and especially in nonlinear optics. He is currently Canada Excellence Research Chair in Quantum Nonlinear Optics at the Univ. of Ottawa and on the Faculty at the Univ. of Rochester. His research interests include studies of slow and fast light propagation, quantum imaging techniques, nonlinear optical interactions, studies of the nonlinear optical properties of materials, and the development of photonic devices including photonic biosensors. Professor Boyd has written two books, co-edited two anthologies, published over 300 research papers, and been awarded five patents. He is the 2009 recipient of the Willis E. Lamb Award for Laser Science and Quantum Optics. Prof. Boyd is a fellow of the American Physical Society (APS), the Optical Society of America (OSA), and SPIE. He is a past chair of the Division of Laser Science of APS and has been a member of the Board of Directors of OSA. He has also served as an APS representative and chair of the Joint Council on Quantum Electronics (it is joint among APS, OSA and IEEE/LEOS). Prof. Boyd has served as a member of the Board of Editors of Physical Review Letters and of the Board of Reviewing Editors of Science Magazine, and is on the Board of Advisors of the Templeton Foundation.



9:30 am  
**Merging Photonics with Nanoelectronics**

**Michael Liehr**  
American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

The recently established American Institute for Manufacturing Photonics (AIM Photonics) is a manufacturing consortium headquartered in New York, with funding from the US Department of Defense (DoD), New York State, and industrial partners to advance the state of the art in the design, manufacture, testing, assembly, and packaging of integrated photonic devices. Dr. Michael Liehr, CEO of AIM Photonics, will describe

# PLENARIES AND HOT TOPIC PRESENTATIONS

the technical goals, operational framework, near-term milestones, and opportunities for the broader photonics community.

The Institute intends to organize a currently fragmented domestic capability in integrated photonics. AIM Photonics will develop and demonstrate innovative manufacturing technologies for a number of key application sectors for integrated photonics devices:

- ultra-high-speed transmission of signals for the internet and telecommunications
- new high-performance information-processing systems and computing
- compact sensor applications enabling dramatic medical advances
- multi-sensor applications including urban navigation and free space optical communications.

The Institute will furthermore specifically focus on establishing and building out an infrastructure in key areas required to accelerate the further adoption of integrated photonics. Specifically, we will enhance the available hardware development capability to include Si-based Multi-Project Wafer runs, InP-based Photonic Integrated Circuits, first and second level packaging, test and assembly.

**Michael Liehr** is the Chief Executive Officer of the American Institute for Manufacturing of Integrated Photonics. As SUNY Polytechnic Institute's Executive Vice President of Innovation and Technology, Michael focuses on the creation of new business opportunities, and is responsible for the effective and efficient operation of the SUNY Poly core strategic 300mm semiconductor and packaging partnership engagements. Prior to this assignment, he led the Global 450mm Consortium through the start-up phase as the General Manager.

TUESDAY 16 FEBRUARY

## Nano/Biophotonics Plenary

10:30 to 11:30 AM

Location Room 3002 (Moscone West Level 3)



### Welcome and Opening Remarks

**Dan Nicolau**  
McGill Univ. (Canada)



### Light Moves Life

**Halina Rubinsztein-Dunlop**  
Univ. of Queensland (Australia)

Light can be made to do the work. Imagine tweezers made out of light. Such optical tweezers can trap and move materials noninvasively at length scales ranging from tens of nanometers to tens of micrometers, and so have provided unprecedented access to physical, chemical and biological processes on a microscale. Since a light beam can carry angular momentum it is possible to use optical tweezers to exert torques to twist or rotate nano and microscopic objects. These optical rotors can be used to map the mechanical properties of cells. They can also be used in biotechnology and optomechanics.

**Professor Rubinsztein-Dunlop** is a Director of the Quantum Science Laboratory in the School of Mathematics and Physics at the University of Queensland. She obtained her PhD degree at the University of Gothenburg in Sweden. Halina's research interests are in quantum atom optics, laser micromanipulation, laser physics, linear and nonlinear high resolution spectroscopy, and nano-optics.

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# PLENARIES AND HOT TOPIC PRESENTATIONS

WEDNESDAY 17 FEBRUARY

## LASE Plenary

10:20 AM TO 12:30 PM • Location: Room 103 (Moscone South Exhibit Level)



10:20 am  
**Welcome and Opening Remarks**  
**Guido Hennig**  
Daetwyler Graphics AG (Switzerland)  
*LASE 2016 Symposium Chair*



**Yongfeng Lu**  
Univ. of Nebraska-Lincoln (USA)  
*LASE 2016 Symposium Chair*



10:25 am  
**Announcement of the 3D Printing, Fabrication, and Manufacturing Best Paper Award**  
**Henry Helvajian**  
The Aerospace Corp. (USA)



**Announcement of the Green Photonics Best Paper Award**  
**Stephen J. Eglash**  
Stanford Data Science Initiative,  
Stanford Univ. (USA)



10:30 am  
**Emerging Applications of Photonic Crystal Fibers**  
**Philip Russell**  
Max-Planck Institute for the Science of Light (Germany) and Univ. of Erlangen-Nürnberg (Germany)

The well-controlled guided modes and long path-lengths offered by both solid and hollow core photonic crystal fibres (PCFs) permit remarkable enhancements (and in some cases reductions) in many kinds of light-matter interaction. Recent examples include: Ultrafast spectrally bright deep and vacuum UV sources based on gas-filled hollow core PCF (pressure-tunable dispersion is a unique feature); generation of stable bright deep UV supercontinuum light in PCF drawn from the fluorozirconate glass ZBLAN; OAM-birefringent helically twisted PCF that preserves the sign of orbital angular momentum; and light-driven optoacoustic devices that permit stable high harmonic mode-locking of fiber ring lasers at GHz repetition rates.

**Philip Russell** is a Director at the Max-Planck Institute for the Science of Light in Erlangen, Germany. A fellow of the Royal Society and the Optical Society (OSA), he specializes in scientific applications of photonic crystal fibre, which he first proposed in 1991. He is the 2015 President of OSA.



11:10 am  
**Optical 3D Nano-fabrication: Drawing or Growing?**  
**Satoshi Kawata**  
Osaka Univ. (Japan) and RIKEN (Japan)

Conventional nanotechnology based on the lithography and scanning probe microscopy is limited to 2D fabrication and modification. Here, I will talk about the method for 3D laser fabrication with two-photon polymerization, two-photon isomerization, and two-photon photo-reduction. Self-growth technology, such as self-grown fiber structures of polymer and self-grown metallic fractal metamaterials structures will be also discussed.

**Satoshi Kawata** is a Distinguished Professor of Osaka University and an Honorary Scientist of RIKEN. He serves as the President of Japan Society of Applied Physics and as a General Chair of Nano Science and Engineering in SPIE. His research topics includes near field optics, plasmonics, laser trapping, and two-photon nano-engineering. He is fellow of OSA, SPIE, IOP, and JSAP.



11:50 am  
**High Power Semiconductor Lasers: Disrupting a Fragmented Industry**  
**Scott Keeney**  
nLight Corp. (USA)

The laser industry has historically been fragmented with many small and medium sized companies serving a broad range of applications. Continued improvements in high-power semiconductor lasers are beginning to transform the laser industry as sustaining development in current applications drives growth and scale economies lead to consolidation. However, new more disruptive applications will truly transform the laser industry.

**Scott Keeney** is President/CEO and Co-Founder of nLIGHT, a high-power semiconductor laser manufacturer with facilities in Vancouver, Washington, Hillsboro, Oregon; Shanghai, China; and Lohja, Finland. nLIGHT's venture capital investors include: Oak Investment Partners, Menlo Ventures, Mohr Davidow Ventures, and Samsung Ventures. Previously, Scott was CEO of Aculight (acquired by Lockheed) and a consultant with McKinsey & Company in San Francisco and Seattle. Scott is Co-Chair of the National Photonics Initiative on High Power Lasers and he is founder and Chair for nConnect, an education non-profit focused on enhancing rigorous high school science and math programs. Scott holds an M.B.A. from Harvard and a B.A. from the University of Washington.





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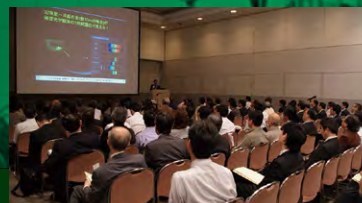
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- **LIC '16** : The 4th Laser Ignition Conference 2016
- **LSSE 2016** : Laser Solution for Space and the Earth
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THESE PROGRAMS ARE FREE TO ATTEND

## Translational Research Lunchtime Forum

Sunday 14 February • 12:30 to 2:00 PM  
Location: Room 3018 (Moscone West Level 3)

CHAIRS:



**Bruce J. Tromberg**  
Beckman Laser  
Institute,  
Univ. of California,  
Irvine (USA)



**Gabriela Apiou**  
Harvard  
Medical School,  
Wellman  
Ctr. for  
Photomedicine,  
Massachusetts  
General  
Hospital (USA)

Join your colleagues in a discussion of outcomes-based studies that can change the lives of patients. Select participants from the Translational Research virtual symposium will have the opportunity to present their methodology and findings. These speakers will demonstrate the use of optical/light-based techniques that are innovative and clever and can change the outcome for patients in a positive and life-giving way.

## FDA Policies and Procedures: What Academic Investigators and Small Business Should Know

Sunday 14 February • 5:00 to 7:00 PM  
Location: Room 2002 (Moscone West Level 2)

Chairs: **Warren Grundfest**, Univ. of California, Los Angeles;  
**Ramesh Raghavachari**, U.S. Food and Drug Administration

Come hear speakers from industry and regulatory agencies share their perspectives and advice on incorporating regulatory requirements into product development and how to achieve successful regulatory strategies. In addition, small business owners will gain valuable business perspectives concerning 3rd party review and regulatory approval for medical devices.

- 5:00 to 5:05 pm: **Tribute to Lee Rosen**  
**Behrouz Shabestari**, National Institutes of Health, Warren Grundfest, Univ. of California, Los Angeles
- 5:05 to 5:30 pm: **Communicating with FDA...Through Your Medical Device Life Cycle**  
**Anya Harry**, GSK
- 5:30 to 5:55 pm: **Navigating Early Stage Drug/Device Regulatory Strategy: Do's and Don'ts**  
**Linda Black**, Medicus Biosciences
- 5:55 to 6:20 pm: **Recent Developments in Medical Device Software – Overview of Mobile Medical Apps and Medical Device Data Systems**  
**John Grimes**, U.S. Food and Drug Administration
- 6:20 to 6:50 pm: **Panel Discussion**
- 6:50 to 7:00 pm: **Final Questions and Remarks**

## BRAIN Initiative Hot Topics & Networking Reception

Sunday 14 February • 4:00 to 5:30 pm  
Followed by a networking reception 5:30 to 6:30 pm  
Location: InterContinental Hotel, Sutter Room

MODERATOR:



**Tom Baer**  
Executive Director,  
Stanford Photonics Research Center

Join members of the National Photonics Initiative's Neuroscience Task Force for a review of recent progress and developments in President Obama's BRAIN initiative: Brain Research through Advancing Innovative Neurotechnologies. Moderator and NPI Task Force Chairman, Tom Baer will present highlights from the NPI BRAIN Technology Roadmap followed by progress updates from participating companies and researchers including presentations by Spectra-Physics, Hamamatsu, Inscopix and Coherent, Inc. The presentations will be followed by an open forum discussion and networking reception with refreshments.

## Laser Communications

Tuesday 16 February • 7:30 to 9:00 PM  
Location: InterContinental Hotel, Fremont Room  
Session Chairs: **Hamid Hemmati**, Facebook Inc. (USA);  
**Don Boroson**, MIT Lincoln Lab. (USA)

This technical event on Laser Communications will hold its informal annual meeting in conjunction with the Free-Space Laser Communication and Atmospheric Propagation conference. All professionals involved in theory and applications of free-space laser communications, remote sensing and supporting technologies are invited to participate in an open discussion on a variety of topics related to the challenges and advancement of the field. Attendees are invited to bring suggestions for discussion topics.

## Holography

Tuesday 16 February • 7:30 to 9:00 PM  
Location: InterContinental Hotel, Ballroom B  
Session Chairs: **Hans I. Bjelkhagen**, Glyndŵr Univ. (United Kingdom) and Hansholo Consulting Ltd. (United Kingdom);  
**V. Michael Bove**, MIT Media Lab. (USA)

The Holography Technical Group is involved with the whole record of research, engineering, recording materials, and applications of holography. The main fields of interest are display holograms, commercial and artistic, holographic optical elements (HOEs), holographic interferometry and holographic non-destructive testing (HNDT), computer-generated holography (CGH), electro and digital holography, holographic microscopy, and holographic data storage (HDS).

This meeting will focus on recent developments and directions, in particular, in regard to new materials, color display holography, digital holography, CGHs and HOEs.



## IBOS: International Biomedical Optics Society

Tuesday 16 February • 7:30 to 9:00 PM

Location: InterContinental Hotel, Ballroom C

Session Chairs: **Jennifer Barton**, The Univ. of Arizona (USA),  
**Wolfgang Drexler**, Medical Univ. Vienna (Austria)

Biomedical optics is a major growth area in modern medicine. The International Biomedical Optics Society is a nonprofit interdisciplinary group that provides a unique channel for communications among physicians and clinicians employing optics in medicine and the scientists and engineers who provide foundations for advancements in this field. The BIOS symposium, where IBOS meets, is the premier annual international forum for discussions and announcements of technical/clinical and educational/pedagogical developments in the use of lasers, optical fibers, spectroscopic diagnostic techniques, and related areas of optical medicine.

All registered conference participants are encouraged to attend this evening session. Attendees are required to wear their conference badges.

The 2016 program will include the following presentation:



### LIGHT SHEET IMAGING

**Kishan Dholakia**

Univ. of St. Andrews (United Kingdom)

This talk will cover the emergent area of light sheet imaging. This method allows for fast acquisition and very low photo toxicity and is poised to make a major impact, particularly in developmental biology and neuroscience. The use of shaped light beams to enhance this imaging mode will be discussed.

## The Nature of Light: What Are Photons?

Tuesday 16 February • 7:30 to 9:00 PM

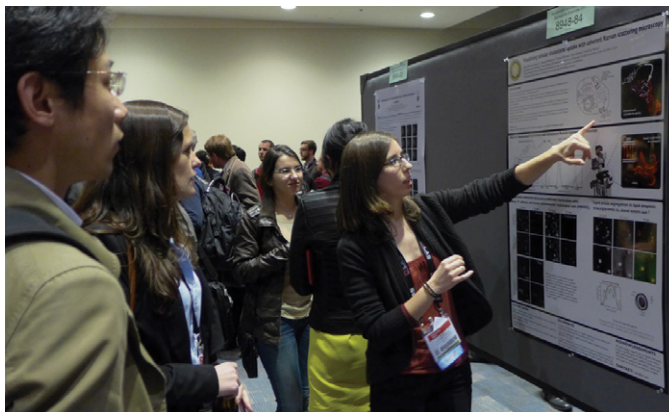
Location: InterContinental Hotel, Ballroom A

Session Chair: **Narasimha S. Prasad**, NASA Langley Research Ctr. (USA)

The purpose of this workshop is to stimulate optical engineers to become more effective innovators by paying closer attention to visualize the invisible interaction processes that go on between light and matter in instruments. Specifically one should explore the physical processes behind the emergence of superposition effect as “interference” fringes in our detectors. The participants will be able to appreciate the universal property of all waves: Non-Interaction of Waves (NIW). Huygens, the original proponent of the “secondary wavelets,” had underscored that wavelets pass through each other unperturbed by each other as they evolve. Nobel Laureate, Glauber is known for saying, “I see a photon when I detect one.” We should not neglect the deeper implication of Huygens’ NIW-property. The superposition effect becomes manifest through transformation experienced by detecting dipoles based on their (i) intrinsic quantum properties and (ii) the device time constant, after being simultaneously stimulated by multiple superposed waves. Waves themselves do not interact. The following optical observations will help one to appreciate the significance of this workshop.

In a two beam interferometer, two superposed coherent light beams help generate fringes of visibility unity only when the two amplitudes are exactly equal and the polarizations are exactly parallel. But they give zero visibility when one of the two beams is rotated to become orthogonal; because, a detecting dipole cannot sum orthogonal stimulations. When multiple frequencies are involved, a Michelson interferometer will give (i) heterodyne oscillatory current with a fast detector; (ii) but, the data out of a slow detector helps us carry out Michelson’s Fourier transform spectrometry. In spectrometry of short pulses, one can discern the carrier frequency from the Fourier frequencies of the pulse envelope. These and other examples will be elaborated to better appreciate that many new innovations and inventions become possible when one explicitly recognizes Huygens’ NIW property of EM waves.

This presentation will be given by Prof. Chandrasekhar (Chandra) Roychoudhuri of the Univ. of Connecticut. Chandra will explain the basic optical phenomena (interference, diffraction, polarization, spectrometry, mode locking, and basic photon counting) in view of the hitherto neglected NIW-property. The workshop will be based upon his recent book, “Causal Physics: Photon Model by Non-Interaction of waves”, CRC/Taylor & Francis, 2014.



## Interactive Poster Sessions

Location: Moscone West (Levels 2 and 3)

### BIOS POSTER SESSIONS

Sunday 14 February . . . . . 5:30 to 7:00 PM

Monday 15 February . . . . . 5:30 to 7:30 PM

Tuesday 16 February . . . . . 6:00 to 8:00 PM

### LASE POSTER SESSION

Tuesday 16 February . . . . . 6:00 to 8:00 PM

### OPTO POSTER SESSION

Wednesday 17 February . . . . . 6:00 to 8:00 PM

Conference attendees are invited to attend the poster sessions on evenings and times listed above. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

## Late-Breaking Results and Awards for Breakthroughs in Human-Centered Research

Tuesday 16 February • 7:30 to 9:00 PM

Location: InterContinental Hotel, Howard Room

Session Chair: **Manijeh Razeghi**, Northwestern Univ. (USA)

SPIE announces the continuation of the Awards for Breakthroughs in Human-Centered Research. The awards will recognize the scientific contributions of the best student(s) who present the most notable recent discoveries with broad impact to benefit our understanding of the human body, its diagnosis, or its medical treatment, in the fields of biosensing, spectroscopy, nanomedicine, and related fields. Presentations will be given and the winner(s) will be announced and awarded a commemorative plaque as well as a cash prize.

# INDUSTRY EVENTS

## Business Perspectives That Help You Grow.

Grow your skills and grow your business with insights, opportunities, and personal connections that will give you a competitive edge. Learn from veteran executives, technology thought-leaders, and talented entrepreneurs there to share and connect with you.

**THESE PROGRAMS ARE FREE TO ATTEND**

## MONDAY

### Modeling Camera Performance Without A Camera: The Use and Advantages of an Online Simulation Engine

Monday 15 February • 9:00 to 10:00 AM  
Location: South Exhibit Level, Room 102

### Inbound Marketing: How to Bring Customers to You

Monday 15 February • 10:30 AM to 12:30 PM  
Location: South Exhibit Level, Room 102

INSTRUCTOR:



**Michele Nichols**  
Launch Team Inc.

Your customer is changing, and your strategy must, too. You may have heard a lot of talk about inbound marketing, but how does it translate to our industry? Engineers, scientists and program managers want to come to their own conclusion, and do their own research before they engage with you. Learn from others in the industry about what works in attracting and engaging with the new customer.

Intended Audience: CEOs, VP of Marketing or Sales, product managers, marketing staff, and others in "customer development" with responsibility for ensuring a healthy pipeline.

Join Michele after the workshop for a roundtable discussion over lunch. 12:00 to 1:00 pm

### Marketing Roundtable: Wins and Lessons Learned

Monday 15 February • 1:00 to 2:30 PM  
Location: South Exhibit Level, Room 102

INSTRUCTOR:

**Michele Nichols**  
Launch Team Inc.

Looking to improve the ROI on your marketing and sales? Compare notes with your peers in this open discussion. Speaker Michele Nichols will share successes and lessons learned across many of the optics and photonics companies she works with, and will facilitate this roundtable session.

INTENDED AUDIENCE: CEOs, VP of Marketing or Sales, product managers, marketing staff, and others in "customer development" with responsibility for ensuring a healthy pipeline.

### ITAR and Other International Trade Regulations

Monday 15 February • 3:00 to 4:00 PM  
Location: South Exhibit Level, Room 102

INSTRUCTOR:



**Ian Moss**  
BakerHostetler Law Firm

If your company's sales activities, products or services come into contact with foreign jurisdictions, this is a must-attend program. The stakes have never been higher. Anyone who wants to answer questions such as, "How do U.S. export controls apply to me?" or "What are the legal pitfalls of doing business internationally?" or "What are best practices for engaging in global trade?" will benefit from attending this workshop.

INTENDED AUDIENCE: Owners, executives, product managers who wish to learn how to grow business while effectively and efficiently navigating U.S. international trade laws and regulations.

### Updates to the US Munitions List (USML) That Affect ITAR

Monday 15 February • 4:00 to 5:30 PM  
Location: South Exhibit Level, Room 102

MODERATOR:



**Jennifer Douris**  
Lobbyist for SPIE

Join us for a discussion on changes to the US Munitions List (USML) that will impact export control regulations for both industry and research universities. The rewrite of category XII of the USML is part of the overall effort undertaken by the Administration's Export Control Reform (ERC) Initiative.

The USML contains the items controlled under the International Traffic in Arms Regulations (ITAR). Category XII covers much of the optic and photonic commodities and components controlled under ITAR. Most of the other categories have already been addressed, but they have saved Category XII for last due to its complexity and importance to both industry and the military.

On May 5th, 2015, a proposed Category XII rule was released and opened for comment in the Federal Register. We now await an interim rule to be released in the coming weeks and months. Come hear what changes are being made and how you can influence the rule before it is finalized.

## Photonics Cluster Reception

Monday 15 February • 5:00 to 6:30 PM

Location: InterContinental Hotel, Fremont, Ballroom A



KEYNOTE SPEAKER:

### Stephen G. Anderson

Director, Industry Development, SPIE

All leaders from regional optics and photonics clusters are invited to join this SPIE-hosted reception. Connect with your peers while enjoying drinks and appetizers, compare notes, and hear an update from Stephen Anderson called

“Photonics Industry Update: A Global Industry Profile. 2014 vs 2012.”



## TUESDAY



## Job Fair

Tuesday 16 February • 10:00 AM to 5:00 PM

Location: South Exhibit Hall

Top employers are coming together to interview and hire candidates at Photonics West 2016

Whether you are looking for employees or looking for a job, this is your chance to connect with the best.

Meet over 30 recruiters on the exhibition floor including Apple, Daylight Solutions, DSI, II-VI, KLA Tencor, Lumentum, Microsoft, ACT, Newport, Rockley, Thorlabs, and more.

## Silicon Photonics and Photonic Integrated Circuits: an Industry Perspective

Tuesday 16 February • 1:30 to 3:00 PM

Location: South Exhibit Level, Room 103

Demand for smaller and cheaper optical interconnections inside networks and computers will create a new market of miniaturized, low-cost photonic components that can leverage the scale of CMOS manufacturing. Learn what industry leaders have developed at the frontier of the silicon photonics market.

MODERATOR:



### Peter Hallett

Director of Marketing and Industry Relations, SPIE

PANELISTS:



### Philippe Absil

3D and Optical Technologies Department Director, imec



### Douglas Gill

Research Staff, IBM T. J. Watson Research Center



### Peter De Dobbelaere

VP of Engineering, Luxtera



### Ashok Krishnamoorthy

Architect and Chief Technologist, Photonics, Oracle



### Joan Fong

Staff Engineer, Mellanox



# INDUSTRY EVENTS

## TUESDAY

### Patent Filing Considerations and Portfolio Evaluation for Photonic Engineers and Managers

Tuesday 16 February • 1:30 to 3:00 PM  
Location: South Exhibit Level, Room 102

INSTRUCTORS:



**Babak Tehranchi**  
Perkins Coie



**Bing Ai**  
Perkins Coie

This optics-flavored workshop begins with an introduction to U.S. patents and global patent protection, including legal and business impacts of the first-inventor-to-file regime under the America Invents Act (AIA). The workshop also covers patent valuation and intellectual property due diligence considerations for small and large companies that may be the target of acquisition, may be looking to secure financing or purchase/license another companies IP assets. Time permitting, the workshop will also venture into additional issues faced by IP managers such as pros and cons of patent filings versus trade secrets.

### Non-Financial Reporting: Managing Risks and Leveraging Opportunities

Tuesday 16 February • 3:00 to 4:30 PM  
Location: South Exhibit Level, Room 102

SPEAKER:



**Douglas Hileman**  
Douglas Hileman Consulting,  
Compliance Expert

Corporate reporting on sustainability, corporate responsibility, and other non-financial matters has become routine. The Global Reporting Initiative (GRI) and CDP are two frameworks commonly used for non-financial reporting.

Besides the “voluntary” reporting mechanisms intended for public release, other avenues of non-financial reporting (such as disclosures to customers) have grown in scope and importance. Some reporting requirements that were “emerging issues” just a few years ago are now regulatory requirements: conflict minerals, human trafficking, forced labor in the supply chain, and greenhouse gas emissions. This workshop will outline reporting frameworks, stakeholders and their expectations, and common pitfalls in approach to non-financial reporting.

The session will provide practical tips on approaches to non-financial reporting.

Douglas Hileman has 40 years of experience in operations, compliance, financial and non-financial reporting, business strategy, and risk management. He launched his firm eight years ago, after six years at Price-waterhouseCoopers. He has been deeply involved in conflict minerals since providing comments on the draft SEC Rule. His firm has conducted two of only 10 Independent Private Sector Audits (IPSA) voluntarily submitted to the SEC in the first two reporting periods – and is one of only three U.S.-based firms to do so. He helped a Fortune 400 electronics company build their conflict minerals program, and has supported numerous external reviews by customers and auditors. He supports clients nationwide in areas of Sustainability/ Social Responsibility, external reporting of non-financial information, specialty audits, audit readiness, and risk management. He has written Sustainability reports for clients, and performed risk assessments and pre-assurance reviews of non-financial reporting. He holds CRMA, CPEA, and P.E. credentials. He is on the Board of the Institute of Internal Auditors (Los Angeles Chapter) and a global IIA committee that writes professional guidance.

### Financing Photonics Businesses

Tuesday 16 February • 3:30 to 5:00 PM  
Location: South Exhibit Level, Room 103

This seminar will address early to late stage venture capital and private equity, strategic corporate investing, licensing, venture debt, and crowd sourcing. Learn about financing and exit strategies, as well as micro and macro trends influencing competition for capital and valuations.

MODERATOR:



**Linda Smith**  
Ceres Technology Advisors

PANELISTS:



**Jim Haack**  
SVP Technology Banking  
Citibank, Citi Commercial Bank



**Faz Bashi**  
Chair,  
Digital Health & Sciences Committee  
Life Science Angels



**Jeremy R. Salesin**  
VP of Acquisitions  
Intellectual Ventures



## WEDNESDAY

### Industry Panel on 3D Printing: Outlook and Opportunities

Wednesday 17 February • 8:00 to 10:00 AM  
Location: South Exhibit Level, Room 103

Kick off the 3D conference with this informative business session.

Market analysts valued the global 3D printing market at \$2.3B in 2013 and are projecting global revenues of \$8.6B by 2020—an impressive compound annual growth rate of more than 20% over seven years! At the same time, Siemens estimates that 3D printing will become 50% less expensive and 400% faster over the next five years.

However, 3D printing can only reach its economic potential and fulfill its promise of revolutionizing manufacturing across multiple industries if a number of significant real-world structural challenges are addressed. Hurdles to widespread implementation of 3D printing include implementation of a proper regulatory framework, provisions to protect intellectual property, and establishment of appropriate standards and certification, to name a few.

Join us for a panel discussion about these hurdles and how they might be overcome. Hear expert perspectives on 3D printing technology, cyber security, intellectual property, and other key elements to be addressed before the widespread adoption of 3D printing. Find out how industry leaders view the outlook for 3D printing and learn what they think needs to happen for digital manufacturing to go mainstream and fulfill its promise to create a broad range of new opportunities.

#### Industry Panel on 3D Printing: Outlook and Opportunities

CHAIR:



**Bo Gu**  
Bos Photonics

PANEL MODERATOR:



**Stephen G. Anderson**  
Director, Industry Development, SPIE

### Great Workplaces in Optics and Photonics

Wednesday 17 February • 8:00 to 10:00 AM  
Location: South Exhibit Level, Room 102

What makes for a great optics and photonics workplace? What do employees want? What environment should managers strive to create? What are the key elements that make a workplace enjoyable, productive, and innovative?

Young leaders from the optics and photonics community will share their insights in a lively round table discussion. Provocative data from the SPIE Global Salary Survey Report will inform the conversation.

Coffee and breakfast starting at 8:00 am. Program begins 8:30 am. Free and open to all registered attendees.

MODERATOR:



**Adam Resnick**  
Marketing Analyst, SPIE

SPEAKERS/PANELISTS:

8:00 to 8:15 AM



#### 3D Printing Will Rock the World

**John F. Hornick**  
Partner Finnegan, Henderson, Farabow, Garrett & Dunner, L.L.P.

8:15 to 8:25 AM



#### Smart Additive Manufacturing Systems (S-AMS)

**Jyoti Mazumder**  
University of Michigan

8:25 to 8:35 AM



#### 3D Printing and the Future of Manufacturing

**John D. Murray**  
Concept Laser Inc.

8:35 to 8:45 AM



#### Cyber Security Concerns in 3D Printing

**Rebecca R. Taylor**  
Sr. VP for the National Center for Manufacturing Sciences (NCMS)

Panel Discussion with Q&A to follow

PANELISTS:



**Nishant Mohan**  
Director of Product Management and Marketing, Systems Division, Wasatch Photonics



**Christina Willis**  
Laser Scientist, Fibertek, Inc.



**Aaron Weinroth**  
Vice President, Technology Commercialization, Tornado Spectral Systems



# INDUSTRY EVENTS

## WEDNESDAY

### Job Fair

Wednesday 17 February • 10:00 AM to 5:00 PM  
Location: South Exhibit Hall

Top employers are coming together to interview and hire candidates at Photonics West 2016

Whether you are looking for employees or looking for a job, this is your chance to connect with the best.

Meet over 30 recruiters on the exhibition floor including Apple, Daylight Solutions, DSI, II-VI, KLA Tencor, Lumentum, Microsoft, ACT, Newport, Rockley, Thorlabs, and more.

### Executive Perspectives on the World of Optics and Photonics

Wednesday 17 February • 1:30 to 2:30 PM  
Location: South Exhibit Level, Room 103

MODERATOR:



**Stephen G. Anderson**

Director, Industry Development, SPIE

Join us as industry leaders share their unique views of the current and future state of the optics and photonics business. From the challenges of ever-changing business landscapes to the uncertainties created by new competitive forces and technical innovation, the operating environment for photonics businesses continues to evolve rapidly. You will hear informed commentary on emerging opportunities and new challenges from around the world. Leaders representing different aspects of the photonics marketplace provide a personal perspective of this fast-paced industry with observations about technology and market trends based on high-level business insight. Listening to and asking questions of these photonics industry executives will help you better understand the current industry environment and set priorities for your business.

PANELISTS:



**Gloria Hoefler**

Director, Optical Integrated Components Group, Infinera



**Christof Lehner**

General Manager, North America, TRUMPF



**Dirk Rothweiler**

Executive VP, Optical Systems, Jenoptik



**Sam Sadoulet**

President and CEO, Edmund Optics



**Alex Schoenfelder**

VP Commercial Lasers, Lumentum

### Getting Hired Panel

Wednesday 17 February • 1:30 to 3:00 PM  
Location: South Exhibit Level, Room 102

Join us for a panel discussion on careers in optics and photonics outside the academic world. Learn about the process of getting hired at tech-based companies and non-academic jobs directly from professionals in the optics and photonics sector.

### Conflict Minerals Workshop: For Wherever You Are in the Supply Chain

Wednesday 17 February • 3:00 to 4:30 PM  
Location: South Exhibit Level, Room 102

Many publicly-traded companies are busy preparing their third annual SEC filings to comply with the SEC's conflict minerals rule. Companies in their supply chain must provide them with information, and answers to a dizzying array of additional questions. What began as a social issue is now a regulatory requirement, a contractual requirement with customers, and subject to audit in periodic business reviews with customers.

NGOs, the Social Responsible Investment community and others have used conflict minerals to promote their views, and to drive companies to change. This session will provide insights on trends, drivers, and good practices for companies affected by this rule. It is a repeat from a well-received session at the 2015 SPIE Photonics West. The presenters represent a leading global law firm; a leading auditor and consultant in the field; an industry perspective; and a leader in facilitating industry sector meetings on this topic.

INTENDED AUDIENCE: Procurement and supply chain managers, sales executives, compliance officers and in-house counsel who want to maintain and grow their companies' customer relationships and comply with the US rule on conflict minerals.

MODERATOR:



**Lydia Hultquist**

Founder and Moderator; Silicon Valley Conflict Minerals Forum Responsibility

PANELISTS:



**Charlie Brown**

Director, Global Supply Chain Management, Newport Corporation



**Douglas Hileman**

Douglas Hileman Consulting, Compliance Expert



**Dynda Thomas**

Partner, Squire Patton Boggs Law Firm, Legal knowledge of SEC Conflict Minerals Rule



**6 FINALISTS, 5 MINUTES**  
**\$10,000**

**WEDNESDAY**

**3:30 TO 6PM**



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**ROOM 103**

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# INDUSTRY EVENTS

## WEDNESDAY

### SPIE Startup Challenge

Wednesday 17 February • 3:30 to 6:00 PM

Location: South Exhibit Level, Room 103

**PITCH IT! @ PHOTONICS WEST | WIN IT! \$10,000**

See and hear pitches for the “best of the best” new photonics businesses. This pitch competition is a lively, interactive event showcasing the power of entrepreneurs to move photonics technology to the global marketplace. New entrepreneurs in photonics will have just 5 minutes each to pitch their businesses to a team of expert judges.

The top pitch presenter will go home with \$10,000 in cash from JENOPTIK and \$5,000 of equipment from Edmund Optics. Join fellow business development, investment, and product managers to scout new talent and see what the future of entrepreneurship in photonics looks like.

The event will conclude with a networking reception from 5-6:00pm where you can meet the presenters and fellow attendees involved in photonics entrepreneurship. See the Startup Challenge webpage for more details on presenters, logistics, prizes, and sponsors: <http://spie.org/startup>

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### PRISM Awards Ceremony and Banquet

Wednesday 17 February • 6:00 to 10:00 PM

Location: Marriott Marquis Hotel, Yerba Buena Ballroom

**Seating is limited. Tickets are required in advance.**

Join this gala event in which the most innovative photonic products on the market are recognized. 27 companies (finalists) from nine categories will share the room with industry leaders and visionaries. The event has become one of the largest gatherings of CEOs and VIPs in the photonics industry. The evening begins with a reception, followed by an elegant dinner and award ceremony. Dress is business and formal attire.

Questions? Email [innovation@spie.org](mailto:innovation@spie.org) or visit [www.prismawards.org](http://www.prismawards.org).

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## THURSDAY

### The Basics of Laser Material Processing

Thursday 18 February • 8:00 to 10:00 AM

Location: South Exhibit Level, Room 102

INSTRUCTOR:



**Jean-Philippe Lavoie**

Coherent

Learn the basics of lasers and laser applications in this interesting workshop.

- Discuss what happens when a laser beam hits a material

- Review process threshold and process window
- Discussions of how you can optimize a process. Including examples of marking and ablation / engraving or cutting
- Discussion around some common things that can go wrong
- Additional examples of successful laser applications

Q&A and networking to follow

### Photonics Industry Update

Thursday 18 February • 9:15 to 9:45 AM

Location: South Exhibit Level, Room 103

KEYNOTE SPEAKER:



**Stephen G. Anderson**

Director, Industry Development, SPIE

In a unique analysis of the global optics and photonics industry, Stephen G. Anderson presents an updated comparative profile of the industry (2012 vs 2014) that highlights the importance of photonics to the world economy. The profile is based on a continuing SPIE review of industry trends and also includes a first-look at key end-use market segments. Don't miss this valuable presentation after the Photonics West Exhibitor Breakfast. Free and open to all attendees.



## Introduction to Silicon PM Performance and How to Characterize It

Thursday 18 February • 10:00 AM to Noon  
Location: South Exhibit Level, Room 102

INSTRUCTOR:

### Slawomir Piatek

Rutgers University and Hamamatsu Corporation

Silicon photomultiplier users can expand on basic operating principles by understanding methods that experimentally determine key parameters of this detector such as gain, photon detection efficiency, and prevalence of noise.

## Startup Alley: Commercialization and Prototype Showcase

Thursday 18 February • 11:00 AM to 1:00 PM  
Location: North Exhibit Hall

Meet with the entrepreneurs featured in the Startup Challenge as they pitch their new photonics businesses. See the prototypes and talk with the entrepreneurs to explore potential partnerships, investment, or sales.

## Use Supply Chain Transparency to Beat the Competition

Thursday 18 February 2016 • 1:30 to 3:00 PM  
Location: South Exhibit Level, Room 102

SPEAKER:



### Dynda Thomas

Partner, Squire Patton Boggs Law Firm

How can supply chain transparency help you win customers? What's involved in a robust supply chain compliance plan? How do you get started?

A growing number of government regulations require you to know (and disclose) detailed information about your supply chains. And more of your customers are demanding to know where your products come from and that every company in your supply chain treats its employees and workers with dignity and respect. Suppliers to US Government contractors are required to have compliance programs. If you cannot keep up, you will not be a qualified supplier. Suppliers with strategies to deal with these requirements will be successful.



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# JOB FAIR

Sponsored by SPIE Career Center

# GET A JOB

Visit the Job Fair in the South Exhibition Hall.

— **FREE ADMISSION** —

Tuesday 16 February, 10:00 am to 5:00 pm  
Wednesday 17 February, 10:00 am to 5:00 pm

Participating Companies:



APPLE



**SPIE.** CAREER  
CENTER

For more information visit the SPIE Career Center Booth #1100.





**SPIE.**

# 3...2...1...go!

happy anniversary [optics.org](http://optics.org)

optics.org is celebrating 20 years of online media excellence in the optics and photonics industry.

Join us on the booth to say happy anniversary and sample some of the best bourbons and whiskeys around.

booth #1100



daily coverage of the optics and photonics industry and the markets that it serves



# PRISM AWARDS

## Winners Announced at Photonics West

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### Award Ceremony

Wednesday 17 February

6:00 pm

Formal or business attire

For ticket information,  
go to the SPIE Cashier

*"It's amazing to have an idea at a university and to see it installed at a BP refinery and to make one place in the world a little bit safer."*

—Allison Lami Sawyer  
Rebellion Photonics CEO  
2013 Wall Street Journal Startup of the Year  
Prism Award Presenter

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# Congratulations to the 2016 finalists.

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## Category of Biomedical Instrumentation

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Avotec  
Biodesy  
Convergent Dental

---

## Category of Detectors and Sensors

---

Alakai Defense  
Systems  
Hamamatsu  
Spectral Engines

---

## Category of Displays and Lighting

---

Crystal IS  
Dolby, Christie,  
Necsel  
QD Laser

---

## Category of Imaging + Cameras

---

First Light Imaging  
Rochester Precision  
Optics  
Stream Technologies

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## Category of Industrial Laser

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Coherent  
LightFab  
Onefive

---

## Category of Materials and Coatings

---

Element Six  
Nanoco  
Shasta Crystals

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## Category of Optics and Optical Components

---

Boulder Nonlinear  
Systems  
GLOphotonics  
OZ Optics

---

## Category of Optical Metrology Instrumentation

---

4D Technology  
neaspec  
PI (Physik  
Instrumente)

---

## Category of Scientific Lasers

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KMLabs  
Lasertel  
Lytid



# PROFESSIONAL DEVELOPMENT EVENTS

Spend some time focusing on your career development while you're at Photonics West. Workshops and presentations will help you hone valuable job skills.

**SOME EVENTS OPEN TO ALL ATTENDEES; SOME REQUIRE REGISTRATION AND PAYMENT. SEE INDIVIDUAL EVENT DESCRIPTIONS FOR DETAILS.**

## Charting a Course in the Photonics Industry

Sunday 14 February • 2:00 to 4:00 PM  
Location: Room 2002, Moscone West

### SHAPE YOURSELF FOR A FUTURE IN PHOTONICS

This speaker series will help you explore potential career pathways in the world of photonics outside of academia. Get solid advice on how you can translate your knowledge, abilities, and interests into meaningful work. Whether you work for an existing company, or start your own, getting a clear picture of the options from experienced leaders will help you better manage your career trajectory. The series will conclude with a question-and-answer session (with all speakers) and a light refreshment reception to promote networking.



**MODERATOR:**  
**David Giltner**  
Director of Field Operations at Zolo Technologies

**PANELISTS:** To be announced.

## Professional Development Workshops

### THE CRAFT OF SCIENTIFIC PRESENTATIONS: A WORKSHOP ON TECHNICAL PRESENTATIONS

Monday 15 February • 8:30 am to 12:30 pm

**WS667** • Course Level: Introductory

CEU: 0.35 \$75 Members | \$125 Non-Members USD  
SPIE Student Members can attend this course for \$10.

This course provides attendees with an overview of what distinguishes the best scientific presentations. The course introduces a new design for presentation slides that is both more memorable and persuasive from what is typically shown at conferences.

Instructor: **Christine Haas** brings over ten years of experience working at the intersection of communication and science. She's held positions as the director of marketing for Drexel's College of Engineering and director of operations for the dean of engineering at Worcester Polytechnic Institute.

### THE CRAFT OF SCIENTIFIC WRITING: A WORKSHOP ON TECHNICAL WRITING

Monday 15 February • 1:30 pm to 5:30 pm

**WS668** • Course Level: Introductory

CEU: 0.35 \$75 Members | \$125 Non-Members USD  
SPIE Student Members can attend this course for \$10.

This course provides an overview on writing a scientific paper. The course focuses on the structure, language, and illustration of scientific papers.

Instructor: **Christine Haas** brings over ten years of experience working at the intersection of communication and science. She's held positions as the director of marketing for Drexel's College of Engineering and director of operations for the dean of engineering at Worcester Polytechnic Institute.

### CRITICAL SKILLS FOR COMPELLING RESEARCH PROPOSALS

Tuesday 16 February • 8:30 am to 12:30 pm

**WS1058** • Course Level: Introductory

CEU: 0.35 \$75 Members • \$125 Non-Members USD

*This workshop is free to SPIE Student Members.*

*You must register to attend. See SPIE Cashier, North Hall*

A successful research proposal requires hundreds of hours of effort, and the stakes are high. Just beginning the process is intimidating. This interactive workshop teaches students to overcome their apprehensions by starting with small steps, building a strong proposal from the inside out.

Instructor: **Damon Diehl** is the founder and owner of Diehl Research Grant Services.

### RESUMES TO INTERVIEWS: STRATEGIES FOR A SUCCESSFUL JOB SEARCH

Tuesday 16 February • 1:30 pm to 5:30 pm

**WS1059** • Course Level: Introductory

CEU: 0.25 \$75 Members | \$125 Non-Members USD

*This workshop is free to SPIE Student Members.*

*You must register to attend.*

This course reviews effective strategies and techniques for a successful job search such as: compiling resumes, writing cover letters, and interview tips. The primary goal of the course is to provide creative and proven techniques for new college graduates and professionals to plan and conduct their job search and secure a job. This workshop presents introductory information and is intended primarily for university students and others with little professional experience.

Instructor: **Paige Lawson** has been in professional recruiting for more than 20 years. She has extensive experience with both in-house corporate environments as well as outside agency/consulting environments.

## Career Advancement through SPIE Involvement

Tuesday 16 February • 10:00 to 11:00 AM

Location: Room 102 (Moscone South Exhibit Level)

Get plugged in to the SPIE community. SPIE has volunteer opportunities at all levels of the organization. Come to this informal session to learn what opportunities best match your interests and career plans.



# When your job demands answers ...

... find what you are looking for with  
Photonics Media's popular online resources

## ➤ Your online gateway to the photonics industry

Top industry news, features, videos, webinars,  
white papers and more

[Photonics.com](http://Photonics.com)



## ➤ A NEW online buyers' tool

Find Lasers — and now Cameras — to your  
exact specifications; download spec sheets

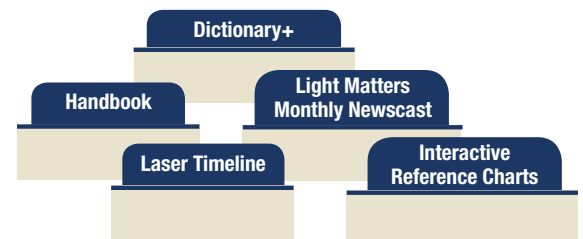
[PhotonicsProdSpec.com](http://PhotonicsProdSpec.com)



## ➤ Your favorite resources all in one place

Photonics Dictionary, Photonics Handbook,  
Laser Timeline and Interactive Reference Charts

[EDU.photonics.com](http://EDU.photonics.com)



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company or industry served; request info  
direct from suppliers

[PhotonicsBuyersGuide.com](http://PhotonicsBuyersGuide.com)



[photonics.com](http://photonics.com)

**PHOTONICS** MEDIA

THE PULSE OF THE INDUSTRY

# NETWORK

Networking Receptions · Student Social Events · SPIE Member Events

Join your colleagues and develop new relationships at these relaxed-atmosphere networking events.

**SOME EVENTS OPEN TO ALL ATTENDEES; SOME REQUIRE TICKETS OR INVITATIONS.**

**SEE INDIVIDUAL EVENT DESCRIPTIONS FOR DETAILS.**

## Student Chapter Leadership Workshop

Friday 12 February • 12:30 to 5:30 PM  
Location: Marriott Marquis Hotel, Golden Gate C3  
Open to SPIE Student Chapter Members

Join SPIE student chapter leaders from around the world at this half-day Leadership Workshop. The workshop will start with lunch and follow with a professional development talk, student chapter problem solving, and SPIE student chapter news and benefits.

## Lunch with the Experts: A BiOS Student Networking Event

Sunday 14 February • 12:30 to 1:30 PM  
Location: InterContinental Hotel, Ballroom B  
Open to BiOS Student Attendees

Enjoy a casual meal with colleagues at this engaging networking opportunity, hosted by SPIE Student Services. This event features experts willing to share their experience and wisdom on career paths in biomedical optics and an award presentation for SPIE scholarships. Seating is limited and will be granted on a first-come, first-served basis.

## Student Chapter Meeting

Sunday 14 February • 6:00 to 9:00 PM  
Location: InterContinental Hotel, Ballroom C  
Open to SPIE Student Chapter Members

Get the latest news on the Student Chapter program direct from SPIE Student Services. Join us for dinner, professional development and networking with chapter members from around the world.

## SPIE Fellows Luncheon

Monday 15 February • 12:00 to 1:30 PM  
Location: InterContinental Hotel, Ballroom B

All Fellows of SPIE are invited to join your colleagues for an SPIE hosted lunch. The new SPIE Fellows attending Photonics West will be introduced and recognized. Please join us for this informal gathering and a chance to interact with other Fellows.

FELLOWS LUNCHEON PRESENTATION:

## IMAGING CELLS IN HUMAN TISSUES WITH OPTICS: HOW ARE WE GOING?



**Prof. David Sampson**  
University of Western Australia

Winthrop Professor David Sampson is Director of the Centre for Microscopy, Characterisation & Analysis, which is The University of Western Australia's micro-imaging core facility, and a node of the Australian Microscopy & Microanalysis Research Facility and the (Australian) National

Imaging Facility. He heads the Optical+Biomedical Engineering Laboratory in the School of Electrical, Electronic & Computer Engineering. He is an Editorial Board Member of the SPIE's Journal of Biomedical Optics. He is an Associate Editor for the IEEE Transactions on Biomedical Engineering and for IEEE Photonics Journal. He was previously an Associate Editor for Applied Optics. Prof Sampson is a Fellow of the OSA and SPIE.

His personal research interests are in optics and photonics applied to medicine and biology and range from the fundamental – methods in optical microscopy and light propagation in tissue, to the engineering of optical instruments, to the application of optical imaging methods in clinical medicine. His current focus is on microscope-in-a-needle technology and its applications, and optical elastography – both using optical coherence tomography.

## Women in Optics Presentation

Monday 15 February • 5:00 to 6:30 PM  
Location: InterContinental Hotel, Ballroom B

### WOMEN IN TECH: EVIDENCE, DATA, AND TRENDS

Join us for an early evening presentation with Rachel Thomas, Software Developer and Instructor at Hackbright Academy, and Lina Nilsson, Biomedical Engineer and Head of Market Development at Enlitic.

Only 20% of engineering degrees in the U.S. are awarded to women and 40% of those women end up leaving the field. In the burgeoning tech industry, females make up a similarly low percentage of computer scientists. University engineering departments and tech firms alike are announcing new initiatives in droves that aim to improve these numbers. In this session, we will dig into the data and research on female participation in computer science, across engineering fields, and throughout the tech sector in general. What evidence is there of underlying causes of this gender imbalance? How can and should it be addressed? Why does it matter?

Thomas O. Nilsson's research and analyses on issues around women in tech have been published in the New York Times and Medium, and have been featured on KQED, NPR, and more.

Refreshments will follow the presentation.

# SOCIAL NETWORKING EVENTS



## Photonics West Welcome Reception

Monday 15 February • 7:00 to 8:30 PM

Location: Marriott Marquis Hotel, Yerba Buena Ballroom

### TOMORROW IS YESTERDAY

Come celebrate some of the amazing achievements of the past 50 years. 2016 is the 50th anniversary of television's *Star Trek*—take a look at some of the ideas from the popular series that visionary scientists and engineers have turned from science fiction into reality.

All paid registered conference attendees are welcome. Please wear your conference badge.

## SPiE Senior Member Breakfast

Tuesday 16 February • 8:00 to 9:00 AM

Location: InterContinental Hotel, Ballroom C

All SPiE Senior Members are invited to join your colleagues for this SPiE-hosted buffet breakfast and a chance to interact with other Senior Members. Please plan to wear your yellow Senior Member ribbon for entry into this event.

## Lunch with the Experts - A Student Networking Event

Tuesday 16 February • 12:30 to 1:30 PM

Location: InterContinental Hotel, Ballroom B

Open to Student Attendees

Enjoy a casual meal with colleagues at this engaging networking opportunity. This event features experts willing to share their experience and wisdom on career paths in optics and photonics. Seating is limited and will be granted on a first-come, first-served basis.

SPONSORED BY:



### NEWPORT RESEARCH EXCELLENCE TRAVEL AWARDS

The Newport Research Excellence Travel Awards Program provides financial support for university students to attend the two largest SPiE meetings in order to present their research. These travel grants are open to any student who has an accepted paper for presentation at Photonics West or Optics + Photonics. Recipients will be selected based on both the quality of the original research described in the submitted paper(s) and financial need.

For application information for this and other SPiE travel grants visit Scholarships and Grants online at [spie.org/scholarships](http://spie.org/scholarships)

## Speed Networking Social

Tuesday 16 February • 4:30 to 6:00 PM

Open to All Attendees

Join us for the next generation of networking. Add a new contact to your network every three minutes while enjoying appetizers at an off-site venue. Bring plenty of business cards, practice your pitch, and prepare to expand your network.

### ThirstyBear Brewing Co.

The Moscone Center is at 747 Howard St;

ThirstyBear is located one block away at 661 Howard St.

## SPiE After-Dinner Member Reception

Tuesday 16 February • 8:00 to 9:30 PM

For SPiE Members Only

### Alexandra's

Westin St. Francis Hotel

335 Powell Street

SPiE Members are invited to the Alexandra's on the top of the Westin St. Francis Hotel for an after dinner reception in their honor. Come relax and talk with your colleagues while enjoying dessert, coffee. Please note: this reception is limited to SPiE Members only. Membership cards or invitations will be requested at the entrance. If you join SPiE on-site, please bring your registration receipt. Dress is casual or business attire.

## "No Ties" Student Social

Wednesday 17 February • 8:00 to 10:00 PM

Student Conference Attendees Only.

Relax and hang out with new friends and peers while enjoying the atmosphere of a great off-site venue. No ties required but please bring your student conference badge.

### Jillian's Billiards Club

175 4th Street

### From the Moscone Center:

Head Southwest on Howard St toward 4th St

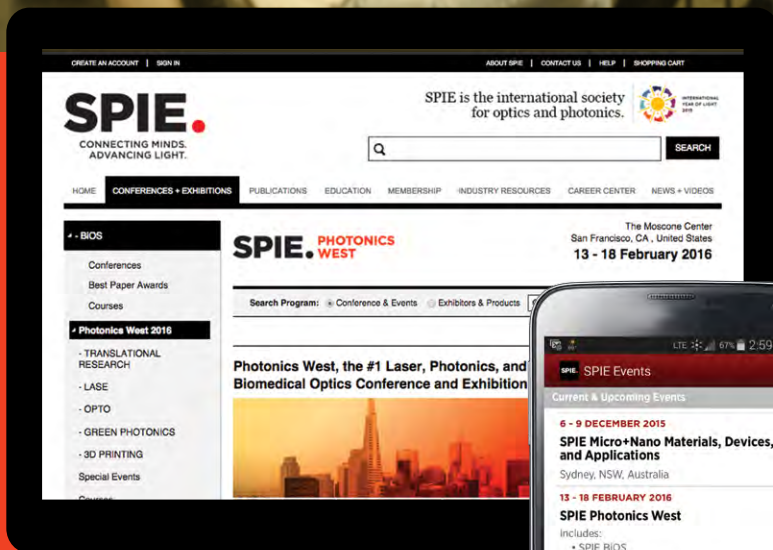
Turn right on 4th St

Jillian's is on the right





# CONNECT WITH PHOTONICS WEST.



## SPIE Event Mobile App

SPIE Conference and Exhibitions are known for their networking and information gathering opportunities.

Schedule your time in the conferences... find your way around the exhibition floor... make new connections. Download a free Conference + Exhibition App for iPhone and Adroid.

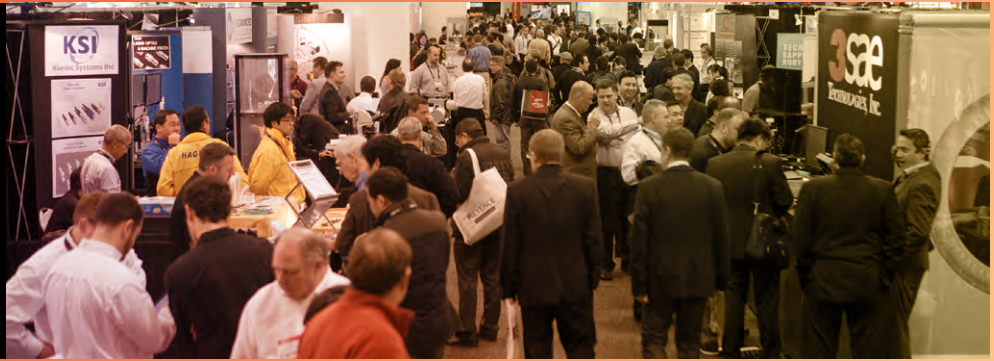


COURTESY OF  
**SPIE.**



# E.

**EXHIBITION**



## Discover new possibilities at two free world-class exhibitions

### **BIOS EXPO**

*Location: Moscone West*

Saturday 13 February · Noon to 5:00 pm  
Sunday 14 February · 10:00 am to 5:00 pm

The world's largest biomedical optics and biophotonics exhibition. BIOS EXPO, held Saturday and Sunday, kicks off the Photonics West week. Find the latest technologies from 220 suppliers in biomedical optics and photonics.

Technologies you will see:

- Biomedical optics components, products, instrumentation, and applications
- Lasers
- Molecular Imaging
- Therapeutic Lasers
- Nano/Biophotonics
- Biosensors
- Spectroscopic/Microscopic Imaging

#### **Plan to Attend FREE Exhibitor product demonstrations**

Refer to pages 42–44 for complete times, schedules, and locations.

### **PHOTONICS WEST**

*Location: Moscone North and South*

Tuesday 16 February · 10:00 am to 5:00 pm  
Wednesday 17 February · 10:00 am to 5:00 pm  
Thursday 18 February · 10:00 am to 4:00 pm

Photonics West is the premier photonics and laser event. With 1,250 companies on the show floor, this exhibition is the place to find the latest products, tools, and devices.

Technologies you will see:

- Lasers, Laser Systems, Laser Accessories, and Other Light Sources
- Laser Accessories, Laser Systems
- Cameras and CCD Components
- Fiber Optic Components, Equipment, Systems
- Optoelectronics
- Other Light Sources; LEDs
- Optical Detectors
- High Speed Imaging and Sensing
- Optical; Amplifiers, Transmitters, Receivers
- Optical Materials and Substrates
- IR Sources and Detectors
- Electronic Imaging Components
- Optical Coatings
- Lenses, Filters, and Optical Components
- Positions and Mounts
- Metrology Tools

“Photonics West is very well known as the best photonics show in the world.”

**Prof. Hubertus van Bergmann**

PAR Systems

# PRODUCT DEMONSTRATIONS

Product Demonstrations are open to all attendees. Exhibiting companies will be showcasing products in half-hour demonstrations.

TIME	SATURDAY 13 FEBRUARY	SUNDAY 14 FEBRUARY
	BIOS DEMO AREA / WEST HALL	
10:30 am		<b>Key Considerations When Setting Up Your Two-Photon Rig</b> Phil Golding, <b>Scientifica</b>
11:30 am		<b>The latest development in compact spectrometers</b> Thomas Rasmussen, <b>Ibsen Photonics</b>
12:30 pm	<b>Linear Variable Bandpass Filters for Hyperspectral Imaging</b> Oliver Pust, <b>Delta Optical Thin Film A/S</b>	<b>VersaChrome® Edge™ Filter</b> Prashant Prabhat, <b>Semrock</b>
1:30 pm	<b>Low-Noise InGaAs Camera Accelerates Melanoma Diagnosis</b> Herve Copin, <b>Xenics</b>	<b>Focus-Tunable Lenses Enable 3-D Microscopy</b> David Leuenberger, <b>Optotune</b>
2:30 pm	<b>Next generation fluorescence microscopy in the palm of your hand</b> Dr. Chris Shumate, <b>Etaluma, Inc.</b>	
3:30 pm	<b>Daybook, quality control software for your microscopes</b> Gautier Papon, <b>Argolight</b>	

## SPIE THANKS THE FOLLOWING BIOS SPONSORS

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			<b>PROMOTIONAL PARTNERS</b> optics.org Biophotonics BioOptics World



# PRODUCT DEMONSTRATIONS

## TUESDAY 16 FEBRUARY

TIME	Demo Area 1 / South Hall ABC	Demo Area 2 / North Hall D
10:30 am	<b>Scan Head For High Speed Lasers</b> Glenn Stutz, <b>Lincoln Laser Co.</b>	<b>COFFEE BREAK</b>
11:30 am	<b>The Latest Development in Compact Spectrometers</b> Thomas Rasmussen, <b>Ibsen Photonics</b>	<b>Advanced Thermal Management Solutions: Heat Pipes, Pumped Two Phase Cooling, Corrosion Resistant ANCER™ Coating</b> Peter Ritt, <b>Advanced Cooling Technologies, Inc.</b>
12:30 pm	<b>1 mJ Pulsed Energy Single Frequency Fiber Laser at 1030nm</b> Dr. Shibin Jiang, <b>AdValue Photonics</b>	<b>BeST-SLED Spectrometer</b> Yonathan Dattner, <b>Luxmux Technology Corporation</b>
1:30 pm	<b>SCHOTT LG-960 - New Laser Glass for Range Finding and Cosmetics</b> Dr. Simi George, <b>SCHOTT North America, Inc.</b>	<b>Low-Cost, High Frequency SWIR Cameras</b> Herve Copin, <b>Xenics</b>
2:30 pm	<b>The Asphere Myths – Facts and Fiction</b> Sabrina Matthias, <b>asphericon, Inc.</b>	<b>Varioptic Auto Focus Liquid Lenses</b> Frédéric LAUNE, <b>Varioptic BU of Parrot</b>
3:30 pm	<b>Photonic Professional GT - Ultra-High Precision 3D-Printing</b> Dr. Wanyin Cui, <b>Nanoscribe GmbH</b>	<b>COFFEE BREAK</b>
4:30 pm	<b>50W Compact Fiber Isolator Array</b> Dr. Shibin Jiang, <b>AdValue Photonics</b>	<b>MR303 World's First MRI Safe Linear Encoder Enables New Medical Applications</b> Robert Rickenbach, <b>Micronor</b>

## WEDNESDAY 17 FEBRUARY

TIME	Demo Area 1 / South Hall ABC	Demo Area 2 / North Hall D
10:30 am	<b>SCHOTT - Optical Glass News</b> Dr. Ralf Jedamzik, <b>SCHOTT North America, Inc.</b>	<b>COFFEE BREAK</b>
11:30 am	<b>SCHOTT BOROFLOAT® - The World's First Floated Borosilicate Glass - Made in Germany with IQ</b> Thomas Kloss, <b>SCHOTT North America, Inc.</b>	<b>MLA Maskless Aligners for Rapid Prototyping and Microfabrication</b> Niels Wijnaendts van Resandt, <b>Heidelberg Instruments Inc.</b>
12:30 pm	<b>SigFit: Interfacing Mechanical Analysis with Optical Analysis</b> Gregory J. Michels, <b>Sigmadyne, Inc.</b>	<b>The Spectrum of Material Selection</b> Mark Middleton, <b>Crystran Ltd.</b>
1:30 pm	<b>Beam shaping with Aspheric Components</b> Sabrina Matthias, <b>asphericon, Inc.</b>	<b>Fast and Reliable Focusing with Tunable Lenses</b> Mark Ventura, <b>Optotune</b>
2:30 pm	<b>Linear Variable Filters for Fluorescence and Hyperspectral Imaging</b> Oliver Pust, <b>Delta Optical Thin Film A/S</b>	<b>PowerXP Compact Motorized Attenuator</b> Laimonas Jacunskas, <b>UAB Altechna</b>
3:30 pm	<b>The Illusion of the Laws of Nature</b> Habakuk Tibatong (AKA Prof. Dr. René Beigang), <b>HÜBNER GmbH &amp; Co KG</b>	<b>COFFEE BREAK</b>
4:30 pm	<b>Analyze Materials in the Palm of Your Hand Using the Latest TI DLP® Near-Infrared Spectroscopy Solution</b> Trevor Dowd, <b>Texas Instruments</b>	<b>Recent advances in fs-Written Fiber Bragg Grating Technology</b> Dr. Margarethe Kampling, <b>FemtoFiberTec GmbH</b>

# PRODUCT DEMONSTRATIONS

THURSDAY 18 FEBRUARY		
TIME	Demo Area 1 / South Hall ABC	Demo Area 2 / North Hall D
10:30 am	<b>Manipulating Visible and NIR Laser Light Using Photonic ICs</b> Joost van Kerkhof, <b>XIO Photonics</b>	<b>COFFEE BREAK</b>
11:30 am	<b>New LZM-110 Series Glass Processing and Splicing System</b> Doug Duke, <b>AFL</b>	11:00 am to 1:00 pm <b>Start Up Alley</b> <b>Startup Challenge Semi-Finalists</b>
12:30 pm	<b>ASAP NextGen 2016</b> Mary G. Turner, Ph.D., <b>Breault Research Organization, Inc.</b>	
1:30 pm	<b>Cool Running Optics: Anti-Reflection Nano-Structures</b> Bruce MacLeod, <b>TelAztec LLC</b>	<b>New Transmission Technologies For Vision Applications</b> John Phillips, <b>Pleora Technologies Inc.</b>
2:30 pm	<b>Precision Optical Components Industry in Taiwan &amp; Typical Products</b> Jason Cheng, <b>Taiwan External Trade Development Council, TAITRA</b>	<b>UV- A, B, and C Transmitting Glass Optic for UV LED Arrays</b> Adam Willsey, <b>Kopp Glass</b>
3:30 pm	<b>Integrated Solid State Illumination for Biophotonics</b> Iain Johnson, <b>Lumencor, Inc.</b>	<b>COFFEE BREAK</b>



**Expand Your Network with SPIE Social Media.**

 [Facebook.com/SPIE.org](https://www.facebook.com/SPIE.org)
 [#PhotonicsWest @SPIEevents](https://twitter.com/SPIEevents)

 [SPIE Group](https://www.linkedin.com/company/spie-group)
 [PublicRelations@SPIE.org](mailto:PublicRelations@SPIE.org)

**SPIE.**



# SPIE THANKS THE FOLLOWING PHOTONICS WEST SPONSORS



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- Laser Focus World
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- Photonics Spectra/
- Photonics Media Publication
- Physics Today
- Solar Novus
- SVC TechCon



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[info@eksmaoptics.com](mailto:info@eksmaoptics.com)

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2017

# PHOTONICS WEST.

THE PREMIER EVENT FOR THE PHOTONICS AND LASER INDUSTRIES

**Mark Your Calendar**

**28 January–2 February 2017**

BIOS—Biomedical Optics  
Translational Research  
LASE—Lasers and Sources  
OPTO—Optoelectronic Devices  
Green Photonics  
3D Printing  
Industry Panels and Keynotes

The Moscone Center  
San Francisco, California, USA

Conferences & Courses  
28 January–2 February 2017

Photonics West Exhibition  
31 January–2 February 2017

[WWW.SPIE.ORG/PW2017](http://WWW.SPIE.ORG/PW2017)

BIOS EXPO  
28–29 January 2017





# 67.

## SPIE COURSES & WORKSHOPS

SPIE STUDENT MEMBERS GET 50% OFF

Take advantage of face-to-face instruction from some of the biggest names in industry and research and earn CEUs to fulfill ongoing professional education requirements.

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
<b>New Courses for 2016</b>					
	SC1174 <b>Improving Laser Reliability, an Introduction</b> (Grossman, Asbury) 8:30 am to 5:30 pm, \$600 / \$710	SC1163 <b>Lithium Niobate Devices and Applications</b> (Toney) 8:30 am to 5:30 pm, \$745 / \$855	SC1175 <b>Optics in the Hospital - Endoscope Specification and Design</b> (Leiner) 8:30 am to 12:30 pm, \$375 / \$410	SC1176 <b>Computational Nanomedicine</b> (Letfullin) 8:30 am to 12:30 pm, \$375 / \$410	
	SC1179 <b>Optical Glass - Properties and Application-oriented Specification</b> (Hartmann) 8:30 am to 5:30 pm, \$645 / \$755	SC967 <b>High Dynamic Range Imaging: Sensors and Architectures</b> (Darmont) 8:30 am to 5:30 pm, \$645 / \$755	SC1177 <b>How to Construct Your Own Spectrometer</b> (Kaltenbacher) 8:30 am to 12:30 pm, \$375 / \$410	SC1178 <b>Fundamentals of Molded Optics</b> (Symmons, Schaub) 8:30 am to 12:30 pm, \$375 / \$410	
	SC1180 <b>Passive and Active Fiber Optics</b> (Paschotta) 8:30 am to 5:30 pm, \$600 / \$710		SC1167 <b>Gradient Index (GRIN) Optical Design</b> (Moore), 1:30 to 5:30 pm, \$375 / \$410	SC1181 <b>Ultrafast Lasers and Amplifiers</b> (Paschotta) 8:30 am to 5:30 pm, \$600 / \$710	
				SC1186 <b>Fluorescence Sensing and Imaging: Towards Portable Healthcare</b> (Levi) 8:30 am to 12:30 pm, \$375 / \$410	

**See SPIE Cashier to register for courses**

### MONEY-BACK GUARANTEE

We are confident that once you experience an SPIE course for yourself you will look to us for your future education needs. However, if for any reason you are dissatisfied, we will gladly refund your money. We just ask that you tell us what you did not like; suggestions for improvement are always welcome.

### CONTINUING EDUCATION UNITS



SPIE has been approved as an authorized provider of CEUs by IACET, The International Association for Continuing Education and Training (Provider #1002091). In obtaining this approval, SPIE has demonstrated that it complies with the ANSI/IACET Standards which are widely recognized as standards of good practice.

SPIE reserves the right to cancel a course due to insufficient advance registration.

# DAILY COURSE SCHEDULE

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
<b>Optical Systems and Lens Design</b>					
	SC156 <b>Basic Optics for Engineers</b> (Boreman) 8:30 am to 5:30 pm, \$640 / \$750	SC935 <b>Introduction to Lens Design</b> (Bentley) 8:30 am to 5:30 pm, \$635 / \$745	SC1177 <b>How to Construct Your Own Spectrometer</b> (Kaltenbacher) 8:30 am to 12:30 pm, \$375 / \$410	SC720 <b>Cost-Conscious Tolerancing of Optical Systems</b> (Youngworth) 1:30 pm to 5:30 pm, \$375 / \$410	Thu SC003 <b>Practical Optical System Design</b> (Youngworth) 8:30 am to 5:30 pm, \$690 / \$800
	SC690 <b>Optical System Design: Layout Principles and Practice</b> (Greivenkamp) 8:30 am to 5:30 pm, \$635 / \$745	SC1080 <b>Modeling and Simulation with Computational Fourier Optics</b> (Voelz) 8:30 am to 5:30 pm, \$655 / \$765	SC1167 <b>Gradient Index (GRIN) Optical Design</b> (Moore), 1:30 to 5:30 pm, \$375 / \$410		
	SC011 <b>Design of Efficient Illumination Systems</b> (Cassarly) 1:30 pm to 5:30 pm, \$375 / \$410	SC609 <b>Basic Optics for Non-Optics Personnel</b> (Harding) 1:30 pm to 4:00 pm, \$175 / \$225			
		SC1123 <b>The Building Blocks of IR Instrument Design</b> (Grant) 1:30 pm to 5:30 pm, \$375 / \$410			
<b>Optomechanics</b>					
	SC014 <b>Introduction to Optomechanical Design</b> (Vukobratovich) 8:30 am to 5:30 pm, \$1,075 / \$1,330		SC010 <b>Introduction to Optical Alignment Techniques</b> (Castle) 8:30 am to 5:30 pm, \$600 / \$710		SC1085 <b>Optomechanical Systems Engineering</b> (Kasunic) 8:30 am to 5:30 pm, \$670 / \$780
		Mon SC015 <b>Fastening Optical Elements with Adhesives</b> (Daly) 8:30 am to 12:30 pm, \$375 / \$410			
		Mon SC1147 <b>Vibration Control for Optomechanical Systems</b> (Ryaboy) 8:30 am to 5:30 pm, \$600 / \$710			
<b>Optical Materials and Fabrication</b>					
	SC1179 <b>Optical Glass – Properties and Application-oriented Specification</b> (Hartmann) 8:30 am to 5:30 pm, \$645 / \$755		SC1086 <b>Optical Materials, Fabrication and Testing for the Optical Engineer</b> (DeGroote Nelson) 1:30 pm to 5:30 pm, \$375 / \$410	SC1178 <b>Fundamentals of Molded Optics</b> (Symmons, Schaub) 8:30 am to 12:30 pm, \$375 / \$410	SC386 <b>Advanced Thermal Management Materials for Optoelectronic, Microelectronic and MEMS Packaging</b> (Zweben) 8:30 am to 5:30 pm, \$600 / \$710

**See SPIE Cashier to register for courses**

# DAILY COURSE SCHEDULE

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
<b>Metrology and Standards</b>					
	SC1153 <b>A Practical Guide to Specifying Optical Components</b> (Aikens) 8:30 am to 12:30 pm, \$375 / \$410	SC212 <b>Modern Optical Testing</b> (Wyant) 8:30 am to 12:30 pm, \$410 / \$465		SC700 <b>Understanding Scratch and Dig Specifications</b> (Aikens) 8:30 am to 12:30 pm, \$445 / \$500	SC1017 <b>Optics Surface Inspection Workshop</b> (Aikens) 8:30 am to 12:30 pm, \$375 / \$410
		SC1003 <b>Optical Scatter Metrology for Industry</b> (Stover) 1:30 pm to 5:30 pm, \$445 / \$500			
<b>Imaging</b>					
		SC967 <b>High Dynamic Range Imaging: Sensors and Architectures</b> (Darmont) 8:30 am to 5:30 pm, \$645 / \$755		SC157 <b>MTF in Optical and Electro-Optical Systems</b> (Boreman) 8:30 am to 5:30 pm, \$640 / \$750	
<b>Biomedical Spectroscopy, Microscopy, and Imaging</b>					
SC1148 <b>Introduction to Quantitative Phase Imaging (QPI)</b> (Popescu, Park) 8:30 am to 5:30 pm, \$600 / \$710		SC1150 <b>Flow Cytometry Trends and Drivers</b> (Vacca) 1:30 pm to 5:30 pm, \$375 / \$410			
SC1072 <b>Statistics for Imaging and Sensor Data</b> (Bajorski) 8:30 am to 5:30 pm, \$680 / \$790					
<b>Clinical Technologies and Systems</b>					
	SC312 <b>Principles and Applications of Optical Coherence Tomography</b> (Fujimoto) 1:30 pm to 5:30 pm, \$375 / \$410	SC981 <b>Biomedical Applications of Specialty Optical Fibers and Fiber Sensors</b> (Mendez, McLaughlin) 1:30 pm to 5:30 pm, \$435 / \$490			
	SC868 <b>Optical Design for Biomedical Imaging</b> (Liang) 8:30 am to 12:30 pm, \$455 / \$510				
<b>Tissue Optics, Laser-Tissue Interaction, and Tissue Engineering</b>					
	SC029 <b>Tissue Optics</b> (Jacques) 1:30 pm to 5:30 pm, \$375 / \$410	SC1152 <b>Monte Carlo Modeling Explained</b> (Kanick) 8:30 am to 12:30 pm, \$410 / \$465			
<b>Photonic Therapeutics and Diagnostics</b>					
			SC1175 <b>Optics in the Hospital - Endoscope Specification and Design</b> (Leiner) 8:30 am to 12:30 pm, \$375 / \$410		

# DAILY COURSE SCHEDULE

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
<b>Nano/Biophotonics</b>					
				SC1176 <b>Computational Nanomedicine</b> (Letfullin) 8:30 am to 12:30 pm, \$375 / \$410	
				SC1186 <b>Fluorescence Sensing and Imaging: Towards Portable Healthcare</b> (Levi) 8:30 am to 12:30 pm, \$375 / \$410	
<b>Neurophotonics, Neurosurgery, and Optogenetics</b>					
	SC1126 <b>Neurophotonics</b> (Levi, Dufour) 1:30 pm to 5:30 pm, \$375 / \$410				
<b>Laser Source Engineering</b>					
	SC748 <b>High-Power Fiber Sources</b> (Nilsson) 8:30 am to 5:30 pm, \$600 / \$710			SC972 <b>Basic Laser Technology</b> (Sukuta) 8:30 am to 12:30 pm, \$375 / \$410	
	SC1174 <b>Improving Laser Reliability, an Introduction</b> (Grossman, Asbury) 8:30 am to 5:30 pm, \$600 / \$710				
	SC1180 <b>Passive and Active Fiber Optics</b> (Paschotta) 8:30 am to 5:30 pm, \$600 / \$710			<b>See SPIE Cashier to register for courses</b>	
	SC752 <b>Solid State Laser Technology</b> (Hodgson) 8:30 am to 5:30 pm, \$600 / \$710				
	SC1020 <b>Splicing of Specialty Fibers and Glass Processing of Fused Components for Fiber Laser and Medical Probe Applications</b> (Wang) 8:30 am to 12:30 pm, \$375 / \$410				
<b>Laser Applications</b>					
	SC743 <b>Micromachining with Femtosecond Lasers</b> (Nolte, Schaffer) 8:30 am to 12:30 pm, \$375 / \$410		SC1144 <b>Laser Systems Engineering</b> (Kasunic) 8:30 am to 5:30 pm, \$600 / \$710	SC1181 <b>Ultrafast Lasers and Amplifiers</b> (Paschotta) 8:30 am to 5:30 pm, \$600 / \$710	
				SC744 <b>Ultrafast Fiber Lasers and Frequency Combs</b> (Fermann) 1:30 pm to 5:30 pm, \$375 / \$410	



# DAILY COURSE SCHEDULE

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
<b>Laser Micro-/Nanoengineering</b>					
	SC689 <b>Precision Laser Micromanufacturing</b> (Schaeffer) 1:30 pm to 5:30 pm, \$375 / \$410				
<b>MOEMS-MEMS in Photonics</b>					
	SC1125 <b>Design Techniques for Micro-optics</b> (Kress) 8:30 am to 5:30 pm, \$600 / \$710		SC454 <b>Fabrication Technologies for Micro- and Nano-Optics</b> (Suleski) 8:30 am to 12:30 pm, \$375 / \$410		
<b>Semiconductor Lasers and LEDs</b>					
	SC052 <b>Light-Emitting Diodes</b> (Schubert) 8:30 am to 12:30 pm, \$450 / \$505		SC1146 <b>Laser Diode Beam Basics, Characteristics and Manipulation</b> (Sun) 1:30 pm to 5:30 pm, \$375 / \$410	SC1145 <b>Powering and Integration of Laser Diode Systems</b> (Bystryak, Trestman) 1:30 pm to 5:30 pm, \$375 / \$410	
<b>Optoelectronic Materials and Devices</b>					
	SC747 <b>Semiconductor Photonic Device Fundamentals</b> (Linden) 8:30 am to 5:30 pm, \$600 / \$710	SC1163 <b>Lithium Niobate Devices and Applications</b> (Toney) 8:30 am to 5:30 pm, \$745 / \$855			
		SC1091 <b>Fundamentals of Reliability Engineering for Optoelectronic Devices</b> (Leisher) 1:30 pm to 5:30 pm, \$375 / \$410			
<b>Displays and Holography</b>					
			SC1096 <b>Head Mounted Displays for Augmented Reality Applications</b> (Browne, Melzer) 8:30 am to 5:30 pm, \$640 / \$750		
<b>Nonlinear Optics</b>					
	SC746 <b>Introduction to Ultrafast Optics</b> (Trebino) 1:30 pm to 5:30 pm, \$375 / \$410	SC047 <b>Introduction to Nonlinear Optics</b> (Fisher) 8:30 am to 12:30 pm, \$375 / \$410			
<b>Photonic Integration</b>					
		SC1071 <b>Understanding Diffractive Optics</b> (Soskind) 8:30 am to 5:30 pm, \$635 / \$745		SC817 <b>Silicon Photonics</b> (Michel) 1:30 pm to 5:30 pm, \$375 / \$410	

# DAILY COURSE SCHEDULE

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
Professional Development Workshop					
		<b>WS667 The Craft of Scientific Presentations: A Workshop on Technical Presentations</b> (Haas) 8:30 am to 12:30 pm, \$125 / \$175	<b>WS1058 Critical Skills for Compelling Research Proposals</b> (Diehl) 8:30 am to 12:30 pm, \$125 / \$175	<b>See SPIE Cashier to register for courses</b>	
		<b>WS668 The Craft of Scientific Writing: A Workshop on Technical Writing</b> (Haas) 1:30 pm to 5:30 pm, \$125 / \$175	<b>WS1059 Resumes to Interviews: Strategies for a Successful Job Search</b> (Lawson, Krinsky) 1:30 pm to 5:30 pm, \$125 / \$175		



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# Journal of Biomedical Optics

**Lihong V. Wang, Ph.D.**

Washington University in St. Louis, USA  
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Recent growth in the use of optics technology for biomedical research and health care has been explosive. New applications are made possible by emerging technologies in lasers, optoelectronic devices, fiber optics, physical and chemical sensors, and imaging, all of which are being applied to medical research, diagnostics, and therapy. The *Journal of Biomedical Optics* publishes peer-reviewed papers that utilize modern optical technology for improved health care and biomedical research.

Topics suitable for the *Journal of Biomedical Optics* include:

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# BiOS 2016 Best Paper Awards.

## PASCAL ROL AWARD 2016

Ophthalmic Technologies XXVI (Conf. 9693)

Outstanding extended abstracts submitted to the Ophthalmic Technologies conference will be nominated for the Pascal Rol Award for Best Paper in Ophthalmic Technologies. The award and prize will be presented after the last scientific session of the conference to recognize the best paper and presentation. The 2015 recipient of the Pascal Rol Award was Dr. Francesco LaRocca and his colleagues from Duke University (see [www.pascalrolfoundation.org](http://www.pascalrolfoundation.org)).

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## BEST STUDENT PAPER AWARD

Microfluidics, BioMEMS, and Medical Microsystems (Conf. 9705)

We are pleased to announce that a cash prize will be awarded to the best student paper in this conference. Qualifying papers and presentations will be evaluated by the awards committee and the winner will be notified at the end of or after the meeting.

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## SENO MEDICAL BEST PAPER AWARDS

Photons Plus Ultrasound: Imaging and Sensing 2016 (Conf. 9708)

Seno Medical Instruments of San Antonio, Texas, will sponsor the "Best Paper Award" at this conference (Certificate of recognition to all coauthors and \$3,000). To qualify for the Award authors must present their papers at the conference (oral or poster) and submit proceedings manuscripts (4 to 12 pages) by no later than midnight, **Saturday, 27 February 2016**. Awards will be announced on the SPIE website and by email no later than **1 June 2016** and officially presented at the opening ceremony of next year's conference.

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## JENLAB YOUNG INVESTIGATOR AWARD

Multiphoton Microscopy in the Biomedical Sciences XVI (Conf. 9712)

We encourage graduate students, postdocs, and scientists or junior faculty who are not more than 32 years old to apply for the JenLab Young Investigator Award. To be eligible for this \$2000 cash award, participants must:

- be both the primary author and presenter of an accepted abstract
- submit the proceedings paper by the due date, prior to the meeting, for review by the selection committee
- self-nominate by entering "Jen Lab Young Investigator Award" as a keyword in the abstract

All the submitted abstracts for this award will be listed for poster presentation only. Then, two abstracts will be selected for oral presentation.

Submitted proceedings manuscripts may be resubmitted to the *Journal of Biomedical Optics* (please visit <http://spie.org/x85029.xml> for details). Prize donated by JenLab GmbH, Germany.

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## PICOQUANT YOUNG INVESTIGATOR AWARD

Single Molecule Spectroscopy and Superresolution Imaging IX (Conf. 9714)

Young scientists (age 32 or below and not yet full faculty members) are encouraged to participate in this best paper competition, which offers a \$1000 USD cash award. Participants must be both the primary author and presenter of an accepted abstract to be eligible. Please note in your abstract submission to this conference "Young Investigator best paper competition BO403" to be considered. This award is sponsored by PicoQuant GmbH Berlin and presented Sunday afternoon.

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## STUDENT POSTER SESSION COMPETITION

Multiphoton Microscopy in the Biomedical Sciences XVI (Conf. 9712)

Graduate students and postdoctoral fellows are welcome to participate in the poster session competition of the conference on Multiphoton Microscopy in the Biomedical Sciences. There is a cash award for the winner(s). The winner(s) will be informed in person or by email and must receive the award in person in the conference hall. Participants should follow the rules and regulations of SPIE for submission of their abstract and manuscript. Participants should also register their names for the competition with the Conference Chairs during the first day of the conference. Submitted proceeding manuscripts are allowed for resubmission to the *Journal of Biomedical Optics* (please visit <http://spie.org/x85029.xml> for details).

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**THE HIGH-SPEED BIOMEDICAL IMAGING AND SPECTROSCOPY CONFERENCE BEST PAPER AWARDS**

**High-Speed Biomedical Imaging and Spectroscopy: Toward Big Data Instrumentation and Management (Conf. 9720)**

We are pleased to announce that Hamamatsu, PiPhotonics, and Hitachi High-Tech will sponsor six Best Paper Awards for this Conference, with a total cash prize of \$3000: two Hamamatsu Best Paper Awards (\$500 each), two PiPhotonics Best Paper Awards (\$500 each), and two Hitachi High-Tech Best Paper Awards (\$500 each). Participants must be both the primary author and presenter of an accepted abstract to be eligible. Qualifying papers and presentations will be evaluated by the awards committee. The winners will be notified at the end of, or after, the meeting.

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**OCEAN OPTICS YOUNG INVESTIGATOR AWARD**

**Colloidal Nanocrystals for Biomedical Applications XI (Conf. 9722)**

The Ocean Optics Young Investigator Awards will be given for the best contributed papers presented by a leading author who is either a graduate student or has graduated within less than five years of the paper submission date. In 2016, for the first time, two prizes will be awarded. The First Prize will consist of a \$1,000 cash prize for the Young Investigator and \$2,000 Ocean Optics equipment credit for the laboratory where the work was performed. The Second Prize will consist of a \$500 cash prize for the Young Investigator and \$1,000 Ocean Optics equipment credit for the laboratory where the work was performed. To be eligible, manuscripts of self-nominating authors must be received by the due date. Nominations should be sent to osinski@chtm.unm.edu and should include a brief CV of the leading author.

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The *Journal of Micro/Nanolithography, MEMS, and MOEMS* (JM3) publishes peer-reviewed papers on the science, development, and practice of lithographic, fabrication, packaging, and integration technologies necessary to address the needs of the electronics, microelectromechanical systems, micro-optoelectromechanical systems, and photonics industries. The wide range of such devices also includes biomedical microdevices, microfluidics, sensors and actuators, adaptive optics, and digital micromirrors. The scope is broad to facilitate synergy and interest between the communities served by the journal.

Topical areas covered include:

**Lithography:** tools, materials, and processes associated with the patterning of structures that have submicrometer and nanometer-scale features. Included are imaging and nonimaging approaches using optics, electron and other particle beams, nanoimprint, molecular self-assembly, and their hybrids. Applications include semiconductor fabrication, but also patterning for other micro/nanodevices.

**Microelectromechanical systems (MEMS):** the design, fabrication, operation, reliability, and testing of microdevices that contain both electrical and mechanical elements.

**Micro-optoelectromechanical systems (MOEMS):** the design, fabrication, operation, reliability, and testing of microdevices that contain electrical, mechanical, and optical elements (that is, the merging of micro-optics and MEMS).

**Microfabrication:** technologies to shape three-dimensional structures leading to the fabrication of active and passive electronics, photonics, MEMS, MOEMS, micro/nano-optics, and other micro/nanodevices.

**Metrology:** metrology and process control for the above devices and their fabrication processes.

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SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
<b>BIOS HOT TOPICS</b> 7:00 to 9:00 pm	<b>TRANSLATIONAL RESEARCH LUNCHTIME FORUM</b> 12:30 to 2:00 pm	<b>BIOS POSTER SESSION</b> 5:30 to 7:30 pm	<b>NANO/ BIOPHOTONICS PROGRAM TRACK PLENARY SESSION</b> 10:30 to 11:30 am		
	<b>FDA POLICIES AND PROCEDURES</b> 5:00 to 7:00 pm		<b>BIOS POSTER SESSION WITH LASE</b> 6:00 to 8:00 pm		
	<b>BIOS POSTER SESSION</b> 5:30 to 7:00 pm		<b>IBOS: INTERNATIONAL BIOMEDICAL OPTICS SOCIETY</b> 7:30 to 9:00 pm		

## Photonic Therapeutics and Diagnostics

Program Chair: **Brian Jet-Fei Wong**, Beckman Laser Institute and Medical Clinic, Univ. of California, Irvine (USA)

9689A **Photonics in Dermatology and Plastic Surgery** (Choi, Kollias, Zeng), p. 64

9689B **Therapeutics and Diagnostics in Urology** (Kang), p. 67

9691A **Endoscopic Microscopy XI** (Tearney, Wang), p. 84

9689C **Optical Imaging, Therapeutics, and Advanced Technology in Head and Neck Surgery and Otolaryngology** (Wong, Ilgner), p. 69

9689D **Diagnostic and Therapeutic Applications of Light in Cardiology** (Tearney, Gregory, Marcu), p. 71

9689E **Diagnosis and Treatment of Diseases in the Breast and Reproductive System II** (Skala, Campagnola), p. 74

9692 **Lasers in Dentistry XXII** (Rechmann, Fried), p. 89

9689F **Optics in Bone Surgery and Diagnostics** (Mandelis, Morris), p. 76

9691B **Optical Techniques in Pulmonary Medicine III** (Suter, Lam, Brenner), p. 87

9693 **Ophthalmic Technologies XXVI** (Manns, Söderberg, Ho), p. 91

9694 **Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXV** (Kessel, Hasan), p. 95

9695 **Mechanisms of Photo-biomodulation Therapy XI** (Hamblin, Carroll, Arany), p. 98

9696 **Molecular-Guided Surgery: Molecules, Devices, and Applications II** (Pogue, Gioux), p. 100



# BIOS DAILY CONFERENCE SCHEDULE

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
<b>BIOS HOT TOPICS</b> 7:00 to 9:00 pm	<b>TRANSLATIONAL RESEARCH LUNCHTIME FORUM</b> 12:30 to 2:00 pm	<b>BIOS POSTER SESSION</b> 5:30 to 7:30 pm	<b>NANO/ BIOPHOTONICS PROGRAM TRACK PLENARY SESSION</b> 10:30 to 11:30 am		
	<b>FDA POLICIES AND PROCEDURES</b> 5:00 to 7:00 pm		<b>BIOS POSTER SESSION WITH LASE</b> 6:00 to 8:00 pm		
	<b>BIOS POSTER SESSION</b> 5:30 to 7:00 pm		<b>IBOS: INTERNATIONAL BIOMEDICAL OPTICS SOCIETY</b> 7:30 to 9:00 pm		

## Neurophotonics, Neurosurgery, and Optogenetics

Program Chair: **Rafael Yuste**, Columbia Univ. (USA)

9690A **Clinical and Translational Neurophotonics** (Madsen, Yang), p. 77

9690B **Neural Imaging and Sensing** (Jansen, Luo, Ding, Roe), p. 79

9690C **Optogenetics and Optical Manipulation** (Mohanty, Thakor), p. 82

## Clinical Technologies and Systems

Program Chairs: **Tuan Vo-Dinh**, Fitzpatrick Institute for Photonics, Duke Univ. (USA) and **Anita Mahadevan-Jansen**, Vanderbilt Univ. (USA)

9697 **Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XX** (Izatt, Fujimoto, Tuchin), p. 103

9698 **Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV** (Vo-Dinh, Mahadevan-Jansen, Grundfest), p. 109

9699 **Optics and Biophotonics in Low-Resource Settings II** (Levitz, Ozcan, Erickson), p. 112

9700 **Design and Quality for Biomedical Technologies IX** (Raghavachari, Liang, Pferer), p. 114

9701 **Multimodal Biomedical Imaging XI** (Azar, Intes), p. 117

9702 **Optical Fibers and Sensors for Medical Diagnostics and Treatment Applications XVI** (Gannot), p. 119

9704 **Biomedical Vibrational Spectroscopy 2016: Advances in Research and Industry** (Mahadevan-Jansen, Petrich), p. 126

9703 **Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis** (Alfano, Demos), p. 122

9705 **Microfluidics, BioMEMS, and Medical Microsystems XIV** (Gray, Becker), p. 128

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
<b>BIOS HOT TOPICS</b> 7:00 to 9:00 pm	<b>TRANSLATIONAL RESEARCH LUNCHTIME FORUM</b> 12:30 to 2:00 pm	<b>BIOS POSTER SESSION</b> 5:30 to 7:30 pm	<b>NANO/ BIOPHOTONICS PROGRAM TRACK PLENARY SESSION</b> 10:30 to 11:30 am		
	<b>FDA POLICIES AND PROCEDURES</b> 5:00 to 7:00 pm		<b>BIOS POSTER SESSION WITH LASE</b> 6:00 to 8:00 pm		
	<b>BIOS POSTER SESSION</b> 5:30 to 7:00 pm		<b>IBOS: INTERNATIONAL BIOMEDICAL OPTICS SOCIETY</b> 7:30 to 9:00 pm		

## Tissue Optics, Laser-Tissue Interaction, and Tissue Engineering

Program Chair: **Steven L. Jacques**, Oregon Health & Science Univ. (USA)

9706 **Optical Interactions with Tissue and Cells XXVII** (Jansen), p. 131

9707 **Dynamics and Fluctuations in Biomedical Photonics XIII** (Tuchin, Larin, Leahy, Wang), p. 134

9708 **Photons Plus Ultrasound: Imaging and Sensing 2016** (Oraevsky, Wang), p. 137

9709 **Biophotonics and Immune Responses XI** (Chen), p. 145

9710 **Optical Elastography and Tissue Biomechanics III** (Larin, Sampson), p. 147

9740 **Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XVI** (Heisterkamp, Herman, Meunier, Nolte), p. 255

# BIOS DAILY CONFERENCE SCHEDULE

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
<b>BIOS HOT TOPICS</b> 7:00 to 9:00 pm	<b>TRANSLATIONAL RESEARCH LUNCHTIME FORUM</b> 12:30 to 2:00 pm	<b>BIOS POSTER SESSION</b> 5:30 to 7:30 pm	<b>NANO/ BIOPHOTONICS PROGRAM TRACK PLENARY SESSION</b> 10:30 to 11:30 am		
	<b>FDA POLICIES AND PROCEDURES</b> 5:00 to 7:00 pm		<b>BIOS POSTER SESSION WITH LASE</b> 6:00 to 8:00 pm		
	<b>BIOS POSTER SESSION</b> 5:30 to 7:00 pm		<b>IBOS: INTERNATIONAL BIOMEDICAL OPTICS SOCIETY</b> 7:30 to 9:00 pm		

## Biomedical Spectroscopy, Microscopy, and Imaging

Program Chairs: **Ammasi Periasamy**, Univ. of Virginia (USA); **Daniel L. Farkas**, Univ. of Southern California and SMI (USA)

9708 **Photons Plus Ultrasound: Imaging and Sensing 2016**  
(Oraevsky, Wang), p. 137

9711 **Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX** (Farkas, Nicolau, Leif, Leary, Tarnok), p. 150

9712 **Multiphoton Microscopy in the Biomedical Sciences XVI**  
(Periasamy, So, König), p. 153

9714 **Single Molecule Spectroscopy and Superresolution Imaging IX** (Enderlein, Gregor, Gryczynski, Erdmann, Koberling), p. 161

9713 **Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XXIII** (Brown, Cogswell, Wilson), p. 158

9716 **Optical Methods in Developmental Biology IV**  
(Rollins, Fraser, Choma), p. 167

9715 **Optical Diagnostics and Sensing XVI: Toward Point-of-Care Diagnostics** (Coté), p. 164

9717 **Adaptive Optics and Wavefront Control for Biological Systems II** (Bifano, Kubby, Gigan), p. 169

9718 **Quantitative Phase Imaging II** (Popescu, Park), p. 172

9719 **Biophysics, Biology and Biophotonics: the Crossroads** (Wax, Backman), p. 177

9720 **High-Speed Biomedical Imaging and Spectroscopy: Toward Big Data Instrumentation and Management**  
(Tsia, Goda, Jalali, Lam, Wong), p. 179

## Nano/Biophotonics

Program Chairs: **Paras Prasad**, SUNY/Univ. Buffalo (USA); **Dan V. Nicolau**, McGill Univ. (Canada)

9721 **Nanoscale Imaging, Sensing, and Actuation for Biomedical Applications XIII** (Cartwright, Nicolau, Fixler), p. 182

9722 **Colloidal Nanoparticles for Biomedical Applications XI** (Parak, Osirński, Liang), p. 184

9723 **Reporters, Markers, Dyes, Nanoparticles, and Molecular Probes for Biomedical Applications VIII** (Achilefu, Raghavachari), p. 188

9724 **Plasmonics in Biology and Medicine XIII** (Vo-Dinh, Lakowicz, Ho, Ray), p. 191

9725 **Frontiers in Biological Detection: From Nanosensors to Systems** (Miller, Cunningham, Danielli, Liu, Weiss), p. 194

# CONFERENCE 9689A

LOCATION: ROOM 3014 (WEST LEVEL 3)

Saturday–Sunday 13–14 February 2016 • Part of Proceedings of SPIE Vol. 9689

# Photonics in Dermatology and Plastic Surgery

*Conference Chairs:* **Bernard Choi**, Beckman Laser Institute and Medical Clinic (USA); **Nikiforos Kollias**, Consultant (USA); **Haishan Zeng**, The BC Cancer Agency Research Ctr. (Canada)

*Program Committee:* **Anthony J. Durkin**, Beckman Laser Institute and Medical Clinic (USA); **Conor L. Evans**, Wellman Ctr. for Photomedicine (USA); **Kristen Marie Kelly M.D.**, Univ. of California, Irvine School of Medicine (USA); **Milind Rajadhyaksha**, Memorial Sloan-Kettering Cancer Ctr. (USA); **Jessica C. Ramella-Roman**, The Catholic Univ. of America (USA); **Lise Lyngsnes Randeberg**, Norwegian Univ. of Science and Technology (Norway)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 3014 (WEST LEVEL 3) . . . SAT 8:30 AM TO 9:00 AM

### Keynote

Session Chair: **Bernard Choi**,  
Beckman Laser Institute and Medical Clinic (USA)

8:30 am: **Assessing the colors of human skin** (*Keynote Presentation*),  
Nikiforos Kollias, Consultant (USA) . . . . . [9689-1]

### SESSION 2

LOCATION: ROOM 3014 (WEST LEVEL 3) .. SAT 9:00 AM TO 10:10 AM

### Skin Cancer I

Session Chair: **Milind Rajadhyaksha**,  
Memorial Sloan-Kettering Cancer Ctr. (USA)

9:00 am: **Diagnosis of female genital tract melanocytic lesions based on pigment chemistry using pump-probe laser microscopy**, Francisco E. Robles, Duke Univ. (USA); Maria A. Selim, Duke Univ. School of Medicine (USA); Warren S. Warren, Duke Univ. (USA) . . . . . [9689-2]

9:20 am: **New imaging-based biomarkers for melanoma diagnosis using CARS microscopy** (*Invited Paper*), Hequn Wang, Wellman Ctr. for Photomedicine (USA); Sam Osseiran, Wellman Ctr. for Photomedicine (USA) and Harvard-MIT Health Sciences and Technology (USA); Elisabeth Roider, David E. Fisher, Cutaneous Biology Research Ctr., Massachusetts General Hospital (USA); Conor L. Evans, Massachusetts General Hospital (USA) [9689-3]

9:50 am: **Noninvasive skin cancer diagnosis using multimodal optical spectroscopy**, Austin J. Moy, Xu Feng, Mia K. Markey, Jason S. Reichenberg, James W. Tunnell, The Univ. of Texas at Austin (USA) . . . . . [9689-4]  
Coffee Break . . . . . Sat 10:10 am to 10:40 am

### SESSION 3

LOCATION: ROOM 3014 (WEST LEVEL 3) . . SAT 10:40 AM TO 11:50 AM

### Skin Cancer II

Session Chair: **Kristen M. Kelly M.D.**,  
Beckman Laser Institute and Medical Clinic (USA)

10:40 am: **Non-invasive Evaluation of oxidative stress in human skin exposed to common sun filters using multiphoton microscopy**, Sam Osseiran, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA) and Harvard-MIT Health Sciences and Technology (USA); Yusuke Suita, Elisabeth Roider, Hequn Wang, David E. Fisher, Conor L. Evans, Cutaneous Biology Research Ctr., Massachusetts General Hospital (USA) . . . . . [9689-5]

11:00 am: **Latest advances in confocal microscopy of skin cancers toward guiding patient care: a Mohs surgeon's review and perspective** (*Invited Paper*), Kishwer S. Nehal, Milind Rajadhyaksha, Memorial Sloan-Kettering Cancer Ctr. (USA) . . . . . [9689-6]

11:30 am: **A machine learning method for identifying morphological patterns in reflectance confocal microscopy mosaics of melanocytic skin lesions in-vivo**, Kivanc Kose, Memorial Sloan-Kettering Cancer Ctr. (USA); Christi Alessi-Fox, Caliber Imaging & Diagnostics, Inc. (USA); Jennifer G. Dy, Dana H. Brooks, Northeastern Univ. (USA); Milind Rajadhyaksha, Memorial Sloan-Kettering Cancer Ctr. (USA) . . . . . [9689-7]

Lunch/Exhibition Break . . . . . Sat 11:50 am to 1:20 pm

### SESSION 4

LOCATION: ROOM 3014 (WEST LEVEL 3) . . . . SAT 1:20 PM TO 1:50 PM

### Clinical Perspective

Session Chair: **Anthony J. Durkin**,  
Beckman Laser Institute and Medical Clinic (USA)

1:20 pm: **If I had a magic wand...A dermatology photonics wish list** (*Invited Paper*), Kristen M. Kelly M.D., Univ. of California, Irvine (USA) . . . . . [9689-8]

### SESSION 5

LOCATION: ROOM 3014 (WEST LEVEL 3) . . . . SAT 1:50 PM TO 3:10 PM

### Wide-Field Imaging I

Session Chair: **Anthony J. Durkin**,  
Beckman Laser Institute and Medical Clinic (USA)

1:50 pm: **Simulation of polarized light in birefringent samples**, Joseph Chue-Sang, Jessica C. Ramella-Roman, Florida International Univ. (USA) . . . . [9689-9]

2:10 pm: **Clinical skin imaging using color spatial frequency domain imaging**, Bin Yang, John Lesicko, Austin J. Moy, Jason S. Reichenberg, James W. Tunnell, The Univ. of Texas at Austin (USA) . . . . . [9689-10]

2:30 pm: **Imaging of skin surface architecture with out of plane polarimetry**, Joseph Chue-Sang, Jessica C. Ramella-Roman, Florida International Univ. (USA) . . . . . [9689-11]

2:50 pm: **Modeling laser speckle imaging of perfusion in the skin**, Caitlin Regan, Carole K. Hayakawa, Bernard Choi, Univ. of California, Irvine (USA) . . . . . [9689-12]

Coffee Break . . . . . Sat 3:10 pm to 3:40 pm

### SESSION 6

LOCATION: ROOM 3014 (WEST LEVEL 3) . . . SAT 3:40 PM TO 4:20 PM

### Wide-Field Imaging II

Session Chair: **Jessica C. Ramella-Roman**,  
Florida International Univ. (USA)

3:40 pm: **Use of a smart phone based thermo camera for skin prick allergy testing: a feasibility study**, Rudolf M. Verdaasdonk, Lindi Barla, Thomas Rustemeyer, John H. Klaessens, Albert J. van der Veen, Vrije Univ. Medical Ctr. (Netherlands) . . . . . [9689-13]

4:00 pm: **Spectral-spatial classification of hyperspectral images for biomedical applications**, Lukasz A. Paluchowski, Asgeir Bjorgan, Norwegian Univ. of Science and Technology (Norway); Håvard Nordgaard M.D., St. Olavs Hospital (Norway); Lise L. Randeberg, Norwegian Univ. of Science and Technology (Norway) . . . . . [9689-14]



# CONFERENCE 9689A

## LOCATION: ROOM 3014 (WEST LEVEL 3)

**SESSION 7**  
LOCATION: ROOM 3014 (WEST LEVEL 3) . . . SAT 4:20 PM TO 5:40 PM

### Wound Healing

Session Chair: **Jessica C. Ramella-Roman**,  
Florida International Univ. (USA)

4:20 pm: **Fluorescence imaging of tryptophan and collagen cross-links to evaluate keratinocytes proliferation and quantitate wound size**, Ying Wang, Antonio Ortega-Martinez, William A. Farinelli, Apostolos G. Doukas, Richard R. Anderson M.D., Walfre Franco, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA) and Harvard Medical School (USA) . . . . . [9689-15]

4:40 pm: **Noninvasive measurement of burn wound depth applying infrared thermal imaging**, Mariëlle E. H. Jaspers, Ilse M. Maltha, Rode Kruis Ziekenhuis (Netherlands); John H. Klaessens, Henrica C. Vet, Rudolf M. Verdaasdonk, Vrije Univ. Medical Ctr. (Netherlands); Paul P. Zuijlen, Rode Kruis Ziekenhuis (Netherlands) . . . . . [9689-16]

5:00 pm: **Investigation of an angiogenesis-promoting topical treatment for diabetic wounds using multimodal microscopy**, Joanne Li, Andrew J. Bower, Univ. of Illinois at Urbana-Champaign (USA); Zane A. Arp, Claire Holland, Eric Olson, GlaxoSmithKline (USA); Eric J. Chaney, Marina Marjanovic, Stephen A. Boppart M.D., Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9689-17]

5:20 pm: **Imaging peripheral nerve graft revascularization and myelination using angiographic and polarization-sensitive optical coherence tomography (OCT)**, Ahhyun S. Nam, Isabel Chico-Calero D.V.M., Jeena M. Easow, Martin Villiger, Mark A. Randolph, Robert W. Redmond, Benjamin J. Vakoc, Wellman Ctr. for Photomedicine (USA) . . . . . [9689-18]

**BiOS Hot Topics**  
**SAT 7:00 PM TO 9:00 PM**  
**LOCATION: ROOM 3022 (WEST LEVEL 3)**  
See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

**SESSION 8**  
LOCATION: ROOM 3014 (WEST LEVEL 3) . . SUN 8:30 AM TO 9:00 AM

### Optical Clearing

Session Chair: **Haishan Zeng**, BC Cancer Research Ctr. (Canada)

8:30 am: **Advances in skin optical clearing (Invited Paper)**, Valery V. Tuchin, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) and Institute of Precision Mechanics and Control (Russian Federation) and National Research Tomsk State Univ. (Russian Federation) . . . . . [9689-19]

**SESSION 9**  
LOCATION: ROOM 3014 (WEST LEVEL 3) . SUN 9:00 AM TO 10:30 AM

### OCT

Session Chair: **Haishan Zeng**, BC Cancer Research Ctr. (Canada)

9:00 am: **Optical coherence tomography based microangiography in dermatology applications (Invited Paper)**, RuiKang K. Wang, Utku Baran, Woo J. Choi, Univ. of Washington (USA) . . . . . [9689-20]

9:30 am: **High-resolution label-free vascular imaging using a commercial, clinically approved dermatological OCT scanner**, Robert A. Byers, Gillian M. Tozer, Nicola J. Brown, Stephen J. Matcher, The Univ. of Sheffield (United Kingdom) . . . . . [9689-21]

9:50 am: **Three-dimensional multifunctional optical coherence tomography for skin imaging**, En Li, Shuichi Makita, Young-Joo Hong, Univ. of Tsukuba (Japan); Tomoko Sasaoka, Tsukuba Univ. of Technology (Japan); Masahiro Yamanari, Tomey Corp. (Japan); Satoshi Sugiyama, Tomey Corp. (Japan) and Univ. of Tsukuba (Japan); Yoshiaki Yasuno, Univ. of Tsukuba (Japan) . [9689-22]

10:10 am: **Towards the use of OCT angiography in clinical dermatology**, Utku Baran, Woo June Choi, RuiKang K. Wang, Univ. of Washington (USA) . . . . . [9689-23]

Coffee Break . . . . . Sun 10:30 am to 11:00 am

**SESSION 10**  
LOCATION: ROOM 3014 (WEST LEVEL 3) . SUN 11:00 AM TO 12:40 PM

### Therapeutics

Session Chair: **Bernard Choi**,  
Beckman Laser Institute and Medical Clinic (USA)

11:00 am: **Monitoring femtosecond laser microscopic photothermolysis with multimodal microscopy**, Yimei Huang, BC Cancer Agency Research Ctr. (Canada); Harvey Lui, The Univ. of British Columbia (Canada) and Vancouver Coastal Health Research Institute (Canada); Jianhua Zhao, BC Cancer Agency Research Ctr. (Canada); David I. McLean, The Univ. of British Columbia (Canada) and Vancouver Coastal Health Research Institute (Canada); Haishan Zeng, BC Cancer Agency Research Ctr. (Canada) . . . . . [9689-24]

11:20 am: **New insights into photodynamic therapy treatment through the use of 3D Monte Carlo radiation transfer modelling**, Catherine L. Campbell, Kenneth Wood, Christian T. A. Brown, Univ. of St. Andrews (United Kingdom); Harry Moseley, Univ. of Dundee (United Kingdom) . . . . . [9689-25]

11:40 am: **Laser ablation of basal cell carcinomas guided by confocal microscopy**, Heidy Sierra, Kishwer S. Nehal, Chih-Shan Jason Chen, Anthony Rossi, Milind Rajadhyaksha, Memorial Sloan-Kettering Cancer Ctr. (USA) . . . . . [9689-26]

12:00 pm: **Antimicrobial blue light inactivation of bacterial biofilms: in vitro and in vivo studies**, Yucheng Wang, Chinese PLA General Hospital (China) and Nankai Univ. (China) and Wellman Ctr. for Photomedicine (USA); Ximing Wu, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Jia Chen, Shanghai Dermatology Hospital (China) and Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Clinton K. Murray, Brooke Army Medical Ctr. (USA); Mark S. Vrahas, Harvard Medical School (USA); Michael R. Hamblin, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Ying Gu, Chinese PLA General Hospital (China); Tianhong Dai, Massachusetts General Hospital (USA) and Harvard Medical School (USA) . . . . . [9689-27]

12:20 pm: **Photodynamic therapy for skin rejuvenation**, Xia Lei M.D., Hang Yang, Yang Tan, Jinjin Wu M.D., Third Military Medical Univ. (China); Zheng Huang, Fujian Normal Univ. (China) and Univ. of Colorado Denver (USA) . . . . . [9689-28]

Lunch/Exhibition Break . . . . . Sun 12:40 pm to 2:00 pm

**SESSION 11**  
LOCATION: ROOM 3014 (WEST LEVEL 3) . . . SUN 2:00 PM TO 3:20 PM

### Optical Microscopy I

Session Chair: **Lise L. Randeberg**,  
Norwegian Univ. of Science and Technology (Norway)

2:00 pm: **Dermoscopy-guided reflectance confocal microscopy of skin using high-NA objective lens with integrated wide-field color camera**, David L. Dickensheets, Seth Kreitinger, Montana State Univ. (USA); Gary Peterson, Milind Rajadhyaksha, Memorial Sloan-Kettering Cancer Ctr. (USA) . . . . . [9689-29]

2:20 pm: **Space travel thins skin as multiphoton tomography shows**, Karsten König, Univ. des Saarlandes (Germany) and JenLab GmbH (Germany) . . . . . [9689-30]

2:40 pm: **Investigation of the effect of hydration on dermal collagen in ex vivo human skin tissue using second harmonic generation microscopy**, Ravikant V. Samatham, Steven L. Jacques, Nicholas Wang, Oregon Health & Science Univ. (USA) . . . . . [9689-31]

3:00 pm: **Depth resolved imaging of human skin comparing a compact sub-40fs Yb fiber laser and a ~200fs Ti:Sapphire laser**, Ilyas Saytashev, Michigan State Univ. (USA); Mihaela Balu, Jue Hou, Bruce J. Tromberg, Beckman Laser Institute and Medical Clinic (USA); Marcos Dantus, Michigan State Univ. (USA) . . . . . [9689-32]

Coffee Break . . . . . Sun 3:20 pm to 3:50 pm

# CONFERENCE 9689A

## LOCATION: ROOM 3014 (WEST LEVEL 3)

### SESSION 12

LOCATION: ROOM 3014 (WEST LEVEL 3) . . . SUN 3:50 PM TO 4:30 PM

#### Optical Microscopy II

Session Chair: **Conor L. Evans**, Wellman Ctr. for Photomedicine (USA)

3:50 pm: **In vivo multimodality video microscopy of human skin in the vertical plane**, Zhenguo Wu, Yunxian Tian, Jianhua Zhao, Harvey Lui, BC Cancer Agency Research Ctr. (Canada) and Photomedicine Institute, The Univ. of British Columbia (Canada); David I. McLean, Photomedicine Institute, The Univ. of British Columbia (Canada); Haishan Zeng, BC Cancer Agency Research Ctr. (Canada) and Photomedicine Institute, The Univ. of British Columbia (Canada) . . . . . [9689-33]

4:10 pm: **Unsupervised machine learning method for delineating stratum corneum in reflectance confocal microscopy stacks of human skin in vivo**, Alican Bozkurt, Northeastern Univ. (USA); Kivanc Kose, Memorial Sloan-Kettering Cancer Ctr. (USA); Christi Alessi-Fox, Caliber Imaging & Diagnostics, Inc. (USA); Jennifer G. Dy, Dana H. Brooks, Northeastern Univ. (USA); Milind Rajadhyaksha, Memorial Sloan-Kettering Cancer Ctr. (USA) . . . . . [9689-34]

### SESSION 13

LOCATION: ROOM 3014 (WEST LEVEL 3) . . . SUN 4:30 PM TO 5:30 PM

#### Fluorescence and Raman Spectroscopy

Session Chair: **Conor L. Evans**, Wellman Ctr. for Photomedicine (USA)

4:30 pm: **Cutaneous porphyrins exhibit anti-stokes fluorescence that is detectable in acnes**, Yunxian Tian, Haishan Zeng, Jianhua Zhao, Zhenguo Wu, BC Cancer Agency Research Ctr. (Canada); Mohammed Al Jasser, Harvey Lui, David I. Mclean, Photomedicine Institute, The Univ. of British Columbia (Canada) . . . . . [9689-35]

4:50 pm: **Fluorescence excitation-emission matrix spectroscopy of vitiligo skin in vivo**, Jianhua Zhao, The Univ. of British Columbia (Canada) and BC Cancer Agency Research Ctr. (Canada); Vincent Richer, Mohammed Al Jasser, Soodabeh Zandi, Nikiforos Kollias, Sunil Kalia, The Univ. of British Columbia (Canada); Haishan Zeng, BC Cancer Agency Research Ctr. (Canada) and The Univ. of British Columbia (Canada); Harvey Lui, The Univ. of British Columbia (Canada) and BC Cancer Agency Research Ctr. (Canada) . . . . . [9689-36]

5:10 pm: **Measurement of diffusion of fluorescent compounds and autofluorescence in skin in vivo using a confocal instrument**, Kim K. Buttenschoen, Durham Univ. (United Kingdom) and Lein Applied Diagnostics (United Kingdom); Emily E. Sutton, The Univ. of Birmingham (United Kingdom); Daniel J. Daly, Lein Applied Diagnostics Ltd. (United Kingdom); John M. Girkin, Durham Univ. (United Kingdom) . . . . . [9689-37]

### POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BiOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Investigation of temporal effects induced by microneedles for transdermal drug delivery with optical coherence tomography**, Hsin-Yi Chou, Wei-Chuan Chen, Chung-Fu Lee, Yo-Chun Choi, FengYu Preston Chang, Meng-Tsan Tsai, Chang Gung Univ. (Taiwan); I-Chi Lee, Chih-Hsun Yang M.D., Chang Gung Memorial Hospital (Taiwan) . . . . . [9689-38]

**Development of 3D printing probe for dermatologic optical coherence tomography**, Wei-Chuan Chen, Cheng-Chuan Li, Yo-Chun Choi, Feng-Yu Chang, Cheng-Kuang Lee, Meng-Tsan Tsai, Chang Gung Univ. (Taiwan); Chi-Hsun Yang, Chang Gung Memorial Hospital (Taiwan) . . . . . [9689-39]

**Metal-clad waveguide characterization for contact-based light transmission into tissue**, Jeff A. Chininis, Paul J. D. Whiteside, Heather K. Hunt, Univ. of Missouri (USA) . . . . . [9689-40]

**Remote optical configuration of pigmented lesion detection and diagnosis of bone fractures**, Nisan Ozana, Yael Bishitz, Yevgeny Beiderman, Bar-Ilan Univ. (Israel); Javier García-Monreal, Univ. de València (Spain); Zeev Zalevsky, Bar-Ilan Univ. (Israel) . . . . . [9689-41]

**Fabrication of multilayered optical tissue phantoms with 3D deposition for phototherapeutics**, Hanna Kim, Trung Hau Nguyen, Yu-Gyeong Chae, Pukyong National Univ. (Korea, Republic of); Byeong-il Lee, Korea Photonics Technology Institute (Korea, Republic of); Hyun Wook Kang, Pukyong National Univ. (Korea, Republic of) and Ctr. for Marine-Integrated Biomedical Technology (Korea, Republic of) . . . . . [9689-42]

**Application of circumferential irradiation for low-temperature laser lipolysis**, Jieun Hwang, Pukyong National Univ. (Korea, Republic of); Trung Hau Nguyen, Minwoo Ahn, Pukyong National Univ. (Korea, Republic of); Sung Yeon Park, Univ. of California, San Diego (USA); Hyun Wook Kang, Pukyong National Univ. (Korea, Republic of) . . . . . [9689-43]

**UV photostability of insect repellents evaluated through Raman spectroscopy**, Viviane G. Bório, Adjaci U. Fernandes, Landulfo Silveira Jr., Univ. Camilo Castelo Branco (Brazil) . . . . . [9689-44]

# CONFERENCE 9689B

LOCATION: ROOM 3012 (WEST LEVEL 3)

Saturday 13 February 2016 • Part of Proceedings of SPIE Vol. 9689

# Therapeutics and Diagnostics in Urology

Conference Chair: **Hyun Wook Kang**, Pukyong National Univ. (Korea, Republic of)

Program Committee: **Geoffrey N. Box M.D.**, The Ohio State Univ. (USA); **Kin Foong Chan**, Dermira, Inc. (USA); **Nathaniel M. Fried**, The Univ. of North Carolina at Charlotte (USA); **Babak Shadgan M.D.**, The Univ. of British Columbia (Canada); **Ronald Sroka**, Laser-Forschungslabor (Germany); **Joel M. Teichman M.D.**, St. Paul's Hospital (Canada); **Matthias Trottmann**, Univ. München (Germany); **Rudolf M. Verdaasdonk**, Vrije Univ. Medical Ctr. (Netherlands)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 3012 (WEST LEVEL 3) .. SAT 9:00 AM TO 10:20 AM

### Advanced Technology in Urology

Session Chairs: **Nathaniel M. Fried**,

The Univ. of North Carolina at Charlotte (USA); **Hyun Wook Kang**, Pukyong National Univ. (Korea, Republic of)

9:00 am: **Fluorescence spectroscopy incorporating a ratiometric approach for the diagnosis and classification of urothelial carcinoma**, Suresh Anand, European Lab. for Non-linear Spectroscopy (Italy); Riccardo Cicchi, Istituto Nazionale di Ottica (Italy) and European Lab. for Non-linear Spectroscopy (Italy); Alfonso Crisci, Gabriella Nesi, Marco Carini, Univ. degli Studi di Firenze (Italy); Francesco S. Pavone, European Lab. for Non-linear Spectroscopy (Italy) and Istituto Nazionale di Ottica (Italy) and Univ. degli Studi di Firenze (Italy) [9689-45]

9:20 am: **Cavitation bubble dynamics during thulium fiber laser lithotripsy**, Luke A. Hardy, Christopher R. Wilson, Joshua Kennedy, The Univ. of North Carolina at Charlotte (USA); Pierce B. Irby M.D., Carolinas Medical Ctr. (USA); Nathaniel M. Fried, The Univ. of North Carolina at Charlotte (USA) . . . [9689-46]

9:40 am: **In-vivo investigation of the human testis by the probe-based and microscopic optical coherence tomography (OCT)**, Matthias Trottmann, Christian Homann, Vera Mai, Tom Betz, Christian S. Betz, Robin Wein, Julian Marcon, Armin J. Becker, Christian G. Stief, Ronald Sroka, Klinikum der Univ. München (Germany) . . . [9689-47]

10:00 am: **Multimodal, 3D pathology-mimicking bladder phantom for evaluation of cystoscopic technologies**, Gennifer T. Smith, Kristen L. Lurie, Stanford Univ. (USA); Dimitar V. Zlatev, Joseph C. Liao, Stanford School of Medicine (USA) and VA Palo Alto Health Care System (USA); Audrey K. Ellerbee, Stanford Univ. (USA) . . . [9689-48]

Coffee Break . . . Sat 10:20 am to 10:50 am

### SESSION 2

LOCATION: ROOM 3012 (WEST LEVEL 3) .. SAT 10:50 AM TO 12:10 PM

### Phototherapeutics

Session Chairs: **Kin Foong Chan**, BioPharmX, Inc. (USA); **Joel M. Teichman M.D.**

10:50 am: **Cavitation bubble dynamics during Ho:YAG laser lithotripsy by high-speed camera**, Jian J. Zhang, Jason R. Xuan, Honggang Yu, Dennis Devincentis, American Medical Systems (USA) . . . [9689-49]

11:10 am: **Feasibility of laser-integrated high intensity focused ultrasound (HIFU) treatment for bladder tumors: in vitro study**, Van Phuc Nguyen, Pukyong National Univ. (Korea, Republic of); Suhyun Park, Samsung Advanced Institute of Technology (Korea, Republic of); Junghwan Oh, Ctr. for Marine-Integrated Biomedical Technology (Korea, Republic of); Hyun Wook Kang, Ctr. for Marine-Integrated Biomedical Technology (Korea, Republic of) . . . [9689-50]

11:30 am: **Thulium fiber laser lithotripsy using miniature ball tip optical fibers**, Christopher R. Wilson, Luke A. Hardy, The Univ. of North Carolina at Charlotte (USA); Pierce B. Irby M.D., Carolinas Medical Ctr. (USA); Nathaniel M. Fried, The Univ. of North Carolina at Charlotte (USA) . . . [9689-51]

11:50 am: **Application of novel optical diffuser for urethral stricture treatment**, Trung Hau Nguyen, Pukyong National Univ. (Korea, Republic of); Yun-Hee Rhee, Jin-Chul Ahn, Dankook Univ. (Korea, Republic of); Hyun Wook Kang, Pukyong National Univ. (Korea, Republic of) . . . [9689-52]

Lunch/Exhibition Break . . . Sat 12:10 pm to 1:40 pm

### SESSION 3

LOCATION: ROOM 3012 (WEST LEVEL 3) . . . SAT 1:40 PM TO 3:00 PM

### Tissue imaging

Session Chairs: **Ronald Sroka**, Laser-Forschungslabor (Germany); **Hyun Wook Kang**, Pukyong National Univ. (Korea, Republic of)

1:40 pm: **Miniaturized rapid scanning, forward-viewing catheterscope for optical coherence tomography**, Kristen L. Lurie, Stanford Univ. (USA); Robin Guay Lord, Caroline Boudoux, Ecole Polytechnique de Montréal (Canada); Eric J. Seibel, Univ. of Washington (USA); Audrey K. Ellerbee, Stanford Univ. (USA) . . . [9689-53]

2:00 pm: **High efficiency for prostate biopsy qualification after training with full-field OCT**, Eugénie Dalimier, Arnaud Duc, LLTech SAS (France); Riccardo Riccio, Nicolas B. Delongchamps, Hôpital Cochin (France); Fabrice Harms, Claude Boccard, Institut Langevin (France) and LLTech SAS (France); Chongqing Yang, Beijing Hospital of the Ministry of Health (China) . . . [9689-54]

2:20 pm: **Automated high speed analysis of optical coherence tomography (OCT) for quantification of ischemic damage prior to kidney transplant**, Brandon Konkel, Erik Anderson M.D., Georgetown Univ. Medical Ctr. (USA); Matthew Cooper, Jennifer E. Verbese, Seyed R. Ghasemian, Peter Abrams, MedStar Georgetown Univ. Hospital (USA); Yu Chen, Univ. of Maryland, College Park (USA); Peter M. Andrews, Georgetown Univ. Medical Ctr. (USA) . . [9689-55]

2:40 pm: **In vivo optical coherence tomography (OCT) examination of living kidney**, Wei Gong, Jianshu Xu, Zhenlin Zhan, Shusen Xie, Fujian Normal Univ. (China); Yu Chen, Univ. of Maryland, College Park (USA); Zheng Huang, Fujian Normal Univ. (China) . . . [9689-57]

Coffee Break . . . Sat 3:00 pm to 3:30 pm

### SESSION 4

LOCATION: ROOM 3012 (WEST LEVEL 3) . . . SAT 3:30 PM TO 4:50 PM

### Tissue Diagnostics

Session Chair: **Ronald Sroka**, Laser-Forschungslabor (Germany)

3:30 pm: **Virtual 3D bladder reconstruction for augmented medical records from white light cystoscopy**, Kristen L. Lurie, Dimitar V. Zlatev, Stanford Univ. (USA); Roland Angst, Max Planck Ctr. for Visual Computing and Communication (Germany); Joseph C. Liao, Audrey K. Ellerbee, Stanford Univ. (USA) . . [9689-58]

3:50 pm: **Partial wave spectroscopic microscopy can predict prostate cancer progression and mitigate over-treatment**, Di Zhang, Taylor Graff, Northwestern Univ. (USA); Susan Crawford, NorthShore Univ. HealthSystem (USA); Hariharan Subramanian, Northwestern Univ. (USA) and Nanocytomics LLC (USA); Sebastian Thompson, Northwestern Univ. (USA); Justin R. Derbas, Radha Lyengar, NanoCytomics LLC (USA); Hemant K. Roy, Boston Medical Ctr. (USA); Charles B. Brendler, NorthShore Univ. HealthSystem (USA); Vadim Backman, Northwestern Univ. (USA) . . . [9689-59]

4:10 pm: **Using optical coherence tomography (OCT) to evaluate the status of human donor kidneys**, Peter M. Andrews, Brandon Konkel, Erik Anderson M.D., Matthew Stein, Georgetown Univ. Medical Ctr. (USA); Matthew Cooper, Jennifer E. Verbese, Seyed R. Ghasemian, MedStar Georgetown Univ. Hospital (USA); Yu Chen, Univ. of Maryland, College Park (USA) . . . [9689-60]

4:30 pm: **A method for tuning the excitation wavelength of an LED light source during fluorescence-based cystoscopy**, Lars R. Lindvold, DTU Risø Campus (Denmark); Gregers G. Hermann M.D., Frederiksberg Hospital (Denmark) . . . [9689-61]

# CONFERENCE 9689B

LOCATION: ROOM 3012 (WEST LEVEL 3)

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM  
LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BiOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.*

**Proximal fiber optic tip degradation during Holmium:YAG and Thulium fiber laser lithotripsy**, Christopher R. Wilson, Luke A. Hardy, The Univ. of North Carolina at Charlotte (USA); Pierce B. Irby M.D., Carolinas Medical Ctr. (USA); Nathaniel M. Fried, The Univ. of North Carolina at Charlotte (USA) . . . [9689-62]

**Computer simulations of laser thermal remodeling during minimally invasive transvaginal and transurethral approaches to treatment of female stress urinary incontinence**, Luke A. Hardy, Chun-Hung Chang, The Univ. of North Carolina at Charlotte (USA); Erinn Myers M.D., Michael J. Kennelly M.D., Carolinas Medical Ctr. (USA); Nathaniel M. Fried, The Univ. of North Carolina at Charlotte (USA) . . . [9689-63]

**Comparison of diffusing and side-firing laser balloon catheters for creation of subsurface thermal lesions in tissue**, Chun-Hung Chang, Nathaniel M. Fried, The Univ. of North Carolina at Charlotte (USA) . . . [9689-64]

**Indocyanine green (ICG)-enhanced photoacoustic imaging of bladder tumors**, Van Phuc Nguyen, Pukyong National Univ. (Korea, Republic of); Suhyun Park, Samsung Advanced Institute of Technology (Korea, Republic of); Junghwan Oh, Pukyong National Univ. (Korea, Republic of); Hyun Wook Kang, Pukyong National Univ. (Korea, Republic of) and Ctr. for Marine-Integrated Biomedical Technology (Korea, Republic of) . . . [9689-65]

**Thermal damage control in kidney tumor model during diffuser-assisted photocoagulation**, Trung Hau Nguyen, Hyun Wook Kang, Kyu Kyu Hlaing, Pukyong National Univ. (Korea, Republic of) . . . [9689-66]



# CONFERENCE 9689C

LOCATION: ROOM 3005 (WEST LEVEL 3)

Saturday–Sunday 13–14 February 2016 • Part of Proceedings of SPIE Vol. 9689

# Optical Imaging, Therapeutics, and Advanced Technology in Head and Neck Surgery and Otolaryngology

BIOS

Conference Chairs: **Brian J. F. Wong M.D.**, Beckman Laser Institute and Medical Clinic (USA); **Justus F. Ilgner M.D.**, Univ. Hospital Aachen (Germany)

Program Committee: **Waseem K. Jerjes**, Univ. College London (United Kingdom); **Joseph C. Jing**, Beckman Laser Institute and Medical Clinic (USA); **Milind Rajadhyaksha**, Memorial Sloan-Kettering Cancer Ctr. (USA); **Chung-Ku Rhee M.D.**, Dankook Univ. Hospital (Korea, Republic of); **Jennifer E. Rosen**, Boston Univ. (USA); **Henricus J. C. M. Sterenberg**, Erasmus MC (Netherlands)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 3005 (WEST LEVEL 3) . SAT 8:50 AM TO 10:30 AM

### Clinical and Operative Head and Neck Cancer Imaging

Session Chairs: **Brian J. F. Wong**, Beckman Laser Institute and Medical Clinic (USA); **Justus F. Ilgner M.D.**, Uniklinik RWTH Aachen (Germany)

8:50 am: **Noncontact diffuse optical assessment of blood flow changes in head and neck free tissue transfer flaps**, Chong Huang, Jeffrey P. Radabaugh, Rony K. Aouad, Yu Lin, Thomas J. Gal, Amit B. Patel, Joseph Valentino, Yu Shang, Guoqiang Yu, Univ. of Kentucky (USA) . . . . . [9689-67]

9:10 am: **Monitoring longitudinal changes in irradiated head and neck cancer xenografts using diffuse reflectance spectroscopy**, Karthik Vishwanath, Miami Univ. (USA); Shudong Jiang, Jason R. Gunn, Kayla Marra, Jacqueline M. Andreozzi, Brian W. Pogue, Dartmouth College (USA) . . . . . [9689-68]

9:30 am: **Progress in reflectance confocal microscopy for imaging oral tissues in vivo**, Gary Peterson, Miguel A. Cordova, Snehal Patel M.D., Milind Rajadhyaksha, Memorial Sloan-Kettering Cancer Ctr. (USA) . . . . . [9689-69]

9:50 am: **Intraoperative detection and elimination of microscopic tumors in head and neck (Invited Paper)**, Ekaterina Y. Lukianova-Hleb, Rice Univ. (USA); Yoo-Shin Kim, The Methodist Hospital Research Institute (USA); Ihar Belatsarkouski, N.N. Alexandrov National Cancer Ctr. of Belarus (Belarus); Ehab Y. Hanna, Ann M. Gillenwater, The Univ. of Texas M.D. Anderson Cancer Ctr. (USA); Brian O'Neill, The Methodist Hospital Research Institute (USA); Dmitri Lapotko, Rice Univ. (USA) . . . . . [9689-70]

10:10 am: **Comparison of the OCT image contrast of tissue-engineered oral cancer models and biopsy samples at 1300 nm and 890 nm OCT**, Stephen J. Matcher, Joseph Boadi, Robert A. Byers, Jon Fernandes, Shweta Mittar, Vanessa Hearnden, Zenghai Lu, Sheila MacNeil, Martin Thornhill, Craig Murdoch, Alasdair McKechnie, Keith D. Hunter, The Univ. of Sheffield (United Kingdom) . . . . . [9689-72]

Coffee Break . . . . . Sat 10:30 am to 11:00 am

### SESSION 2

LOCATION: ROOM 3005 (WEST LEVEL 3) . SAT 11:00 AM TO 12:20 PM

### OCT Applications in the Head, Neck, and Upper Airway I

Session Chair: **Joseph C. Jing**, Beckman Laser Institute and Medical Clinic (USA)

11:00 am: **Development of a high-speed VCSEL OCT system for real-time imaging of conscious patients larynx using a hand-held probe**, Swathi Rangarajan, OCT Medical Imaging Inc. (USA); Li-Dek Chou, OCT Medical Imaging Inc. (USA) and Beckman Laser Institute and Medical Clinic (USA); Carolyn Coughlan, Giriraj Sharma, Univ. of California, Irvine (USA); Brian J. F. Wong, Univ. of California, Irvine (USA) and Beckman Laser Institute and Medical Clinic (USA); Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA) and Univ. of California, Irvine (USA); Tirunelveli S. Ramalingam, OCT Medical Imaging Inc. (USA) . . . . . [9689-73]

11:20 am: **A study of balloon treatment for circopharyngeal dysfunction by using full range optical coherence tomography**, Shanshan Liang, Sun Yat-Sen Univ. (China); Xiaomei Wei, Zulin Dou, The Third Affiliated Hospital of Sun Yat-Sen Univ. (China); Jun Zhang, Sun Yat-Sen Univ. (China) . . . . . [9689-74]

11:40 am: **Long range OCT during drug induced sleep endoscopy: preliminary investigations**, Erica Su, Joseph C. Jing, Emon Heidari, Beckman Laser Institute and Medical Clinic (USA); Max Wiedmann, Univ. of California, Irvine (USA); Bryan Lemieux, Beckman Laser Institute and Medical Clinic (USA); Gurpreet S. Ahuja, Univ. of California, Irvine (USA); Zhongping Chen, Brian J. F. Wong, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9689-75]

12:00 pm: **Swept-source anatomic optical coherence elastography of porcine trachea**, Ruofei Bu, Hillel B. Price, Sorin Mitran, Carlton Zdanski, Amy L. Oldenburg, The Univ. of North Carolina at Chapel Hill (USA) . . . . . [9689-76]

Lunch/Exhibition Break . . . . . Sat 12:20 pm to 1:40 pm

### SESSION 3

LOCATION: ROOM 3005 (WEST LEVEL 3) . . . SAT 1:40 PM TO 3:00 PM

### OCT Applications in the Head, Neck, and Upper Airway II

Session Chairs: **Justus F. Ilgner M.D.**, Uniklinik RWTH Aachen (Germany); **Joseph C. Jing**, Beckman Laser Institute and Medical Clinic (USA)

1:40 pm: **Intraoperative handheld probe for 3D imaging of pediatric benign vocal fold lesions using optical coherence tomography**, Fouzi Benboujja, Ecole Polytechnique de Montréal (Canada); Jordan Garcia, Harvard Medical School (USA); Kathy Beaudette, Mathias Strupler, Ecole Polytechnique de Montréal (Canada); Christopher J. Hartnick M.D., Harvard Medical School (USA); Caroline Boudoux, Ecole Polytechnique de Montréal (Canada) . [9689-77]

2:00 pm: **Subglottic stenosis in a rabbit model: OCT and texture analysis**, Erica Su, Ashley Hamamoto, Alex Wang, Tony D. Nguyen, Jason Chen, Beckman Laser Institute and Medical Clinic (USA); Kathryn Osann, Univ. of California, Irvine (USA); Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA); Gurpreet S. Ahuja, Univ. of California, Irvine (USA); Brian J. F. Wong, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9689-78]

2:20 pm: **OCT measurement of ciliary beat frequency changes in response to pharmacotherapy**, Jason Chen, Joseph C. Jing, Christopher Badger, Beckman Laser Institute and Medical Clinic (USA); Carolyn Coughlan, Univ. of California, Irvine (USA); Zhongping Chen, Brian J. F. Wong, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9689-79]

2:40 pm: **Airway compliance measurements using optical coherence tomography**, Joseph C. Jing, Li-Dek Chou, Bryan Lemieux, Brian J. F. Wong, Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA) . . [9689-80]

Coffee Break . . . . . Sat 3:00 pm to 3:30 pm

# CONFERENCE 9689C

LOCATION: ROOM 3005 (WEST LEVEL 3)

## SESSION 4

LOCATION: ROOM 3005 (WEST LEVEL 3) . . SAT 4:00 PM TO 5:20 PM

### Endocrine Imaging and Spectroscopy

Session Chair: **Milind Rajadhyaksha**,  
Memorial Sloan-Kettering Cancer Ctr. (USA)

4:00 pm: **Raman spectroscopy and oral exfoliative cytology: investigating misclassifications between contralateral normal and tumor sites**, Aditi Sahu, Sneha Tawde, Poonam Gera, Sudhir Nair, C. Murali Krishna, Advanced Ctr. for Treatment, Research & Education in Cancer (India) . . . . . [9689-81]

4:20 pm: **Simultaneous multi-scale microscopy as a potential dedicated tool for intra-operative parathyroid identification during thyroid surgery**, Étienne De Montigny, Nadir Goulamhousen, Wendy-Julie Madore, Mathias Strupler, Ecole Polytechnique de Montréal (Canada); Anastasios Maniakas M.D., Tarek Ayad M.D., Ctr. Hospitalier de l'Univ. de Montréal (Canada); Caroline Boudoux, Ecole Polytechnique de Montréal (Canada) . . . . . [9689-82]

4:40 pm: **Biochemical and molecular characterization of thyroid lesions by micro-Raman spectroscopy and gene expression analysis**, Lázaro P. Medeiros Neto, Luís Felipe C. Carvalho, Airton A. Martin D.D.S., Claudio A. Soto, Univ. do Vale do Paraíba (Brazil); André B. O. Santos, Evandro S. de Melo, Marina A. Pereira, Claudio R. Cernea, Lenine G. Brandao, Univ. de São Paulo (Brazil); Renata D. Canevari, Univ. do Vale do Paraíba (Brazil) . . . . . [9689-83]

5:00 pm: **Simultaneous fingerprint and high-wavenumber fiber-optic Raman endoscopy for in vivo diagnosis of laryngeal cancer**, Kan Lin, Wei Zheng, Jianfeng Wang, C. M. Lim, Zhiwei Huang, National Univ. of Singapore (Singapore) . . . . . [9689-84]

9:30 am: **A short-wave infrared otoscope for middle ear disease diagnostics**, Jessica A. Carr, Massachusetts Institute of Technology (USA); Tullio A. Valdez, Connecticut Children's Medical Ctr. (USA); Oliver T. Bruns, Mounji G. Bawendi, Massachusetts Institute of Technology (USA) . . . . . [9689-88]

9:50 am: **Signal and response properties indicate an optoacoustic effect underlying the intracochlear laser-optical stimulation**, Nicole Kallweit, Laser Zentrum Hannover e.V. (Germany) and Cluster of Excellence Hearing4all (Germany); Peter Baumhoff, Medizinische Hochschule Hannover (Germany); Alexander Krüger, Nadine Tinne, Alexander Heisterkamp, Laser Zentrum Hannover e.V. (Germany) and Cluster of Excellence Hearing4all (Germany); Andrej Kral, Medizinische Hochschule Hannover (Germany) and Cluster of Excellence Hearing4all (Germany); Hannes Maier, Medizinische Hochschule Hannover (Germany) and Cluster of Excellence Hearing4all (Germany); Tammo Ripken, Laser Zentrum Hannover e.V. (Germany) and Cluster of Excellence Hearing4all (Germany) . . . . . [9689-89]

Coffee Break . . . . . Sun 10:10 am to 10:40 am

10:10 am: **Three-dimensional imaging of intracochlear tissue by scanning laser optical tomography (SLOT)**, Nadine Tinne, Laser Zentrum Hannover e.V. (Germany) and Cluster of Excellence Hearing4all (Germany); Lena Nolte, Georgios C. Antonopoulos, Laser Zentrum Hannover e.V. (Germany); Jennifer Schulze, Medizinische Hochschule Hannover (Germany) and Cluster of Excellence Hearing4all (Germany); Jose Andrade, Medizinische Hochschule Hannover (Germany); Alexander Heisterkamp, Laser Zentrum Hannover e.V. (Germany) and Leibniz Univ. Hannover (Germany) and Cluster of Excellence Hearing4all (Germany); Heiko Meyer, Laser Zentrum Hannover e.V. (Germany); Athanasia Warnecke, Omid Majdani, Medizinische Hochschule Hannover (Germany) and Cluster of Excellence Hearing4all (Germany); Tammo Ripken, Laser Zentrum Hannover e.V. (Germany) and Cluster of Excellence Hearing4all (Germany) . . . . . [9689-90]

10:30 am: **Combination therapy of antioxidant and LLLT in noise induced hearing loss**, Chung-Ku Rhee M.D., So-Young Chang, Dankook Univ. Hospital (Korea, Republic of); Sung Kyu Lim, Dankook Univ. (Korea, Republic of); Jin-Chul Ahn, Phil-Sang Chung, Jae-Yun Jung, Dankook Univ. Hospital (Korea, Republic of) . . . . . [9689-91]

10:50 am: **Comparison of advanced optical imaging techniques with current otolaryngology diagnostics for improved middle ear assessment**, Ryan M. Nolan, Ryan L. Shelton, Guillermo L. Monroy, Darold R. Spillman Jr., Univ. of Illinois at Urbana-Champaign (USA); Michael A. Novak M.D., Carle Foundation Hospital (USA); Stephen A. Boppart M.D., Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9689-175]

### BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 5

LOCATION: ROOM 3005 (WEST LEVEL 3) . SUN 8:30 AM TO 11:40 AM

### Inner and Middle Ear Imaging and Physiology

Session Chairs: **Chung-Ku Rhee M.D.**, Dankook Univ. Hospital (Korea, Republic of); **Justus F. Ilgner M.D.**, Uniklinik RWTH Aachen (Germany)

8:30 am: **A novel mosaicking algorithm for in vivo full-field thickness mapping of the human tympanic membrane using low coherence interferometry**, Paritosh Pande, Ryan L. Shelton, Guillermo L. Monroy, Ryan M. Nolan, Stephen A. Boppart M.D., Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9689-85]

8:50 am: **Effect of low level laser therapy (LLLT) on ouabain induced spiral ganglion neuron damaged auditory neuropathy in gerbils**, Chung-Ku Rhee M.D., Sung Huyn Bae, So-Young Chang, Phil-Sang Chung, Jae-Yun Jung, Dankook Univ. Hospital (Korea, Republic of) . . . . . [9689-86]

9:10 am: **Differentiation of bacterial versus viral otitis media using a combined Raman scattering spectroscopy and low coherence interferometry probe**, Youbo Zhao, Ryan L. Shelton, Haohua Tu, Ryan M. Nolan, Guillermo L. Monroy, Eric J. Chaney, Stephen A. Boppart M.D., Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9689-87]

### SESSION 6

LOCATION: ROOM 3005 (WEST LEVEL 3) .SUN 11:40 AM TO 12:20 PM

### Surgical Therapeutics

Session Chair: **Justus F. Ilgner M.D.**,  
Uniklinik RWTH Aachen (Germany)

11:40 am: **Histologic evaluation of blood vessels sealed with 1470-nm diode laser: determination of adequate condition for laser vessel sealing**, Seung-Kuk Baek M.D., Nu-Ri Im, Korea Univ. College of Medicine (Korea, Republic of); Jungho Moon, Wonshik Choi, Korea Univ. (Korea, Republic of); Byoungjae Kim, Korea Univ. College of Medicine (Korea, Republic of) and Korea Univ. (Korea, Republic of); Jung Joo Lee, Heejin Kim, LivsMed Inc. (Korea, Republic of); Hyun-Ji Lee, Tae Hoon Kim, Doh Young Lee, Kwang-Yoon Jung, Korea Univ. College of Medicine (Korea, Republic of) . . . . . [9689-176]

12:00 pm: **Primary investigations on the potential of a novel diode pumped Er:YAG laser system for middle ear surgery**, Karl Stock, Florian Hausladen, Holger Wurm, Univ. Ulm (Germany) . . . . . [9689-177]

# CONFERENCE 9689D

LOCATION: ROOM 3016 (WEST LEVEL 3)

Saturday–Sunday 13–14 February 2016 • Part of Proceedings of SPIE Vol. 9689

# Diagnostic and Therapeutic Applications of Light in Cardiology

BIOS

Conference Chairs: **Guillermo J. Tearney M.D.**, Wellman Ctr. for Photomedicine (USA); **Kenton W. Gregory M.D.**, Oregon Medical Laser Ctr. (USA); **Laura Marcu**, Univ. of California, Davis (USA)

Program Committee: **Gijs van Soest**, Erasmus MC (Netherlands); **Carlo Di Mario**, Univ. College London (United Kingdom); **Stanislav Y. Emelianov**, The Univ. of Texas at Austin (USA)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 3016 (WEST LEVEL 3) .. SAT 8:50 AM TO 10:30 AM

#### Advanced OCT

Session Chair: **Gijs van Soest**, Erasmus MC (Netherlands)

8:50 am: **Heartbeat OCT: a new tool for interventional imaging**, Tianshi Wang, Erasmus MC (Netherlands); Tom Pfeiffer, Institut für Biomedizinische Optik, Univ. zu Lübeck (Germany) and Ludwig-Maximilians-Univ. München (Germany); Wolfgang Wieser, Ludwig-Maximilians-Univ. München (Germany); Evelyn Regar M.D., Charles T. Lancee, Geert Springeling, Erasmus MC (Netherlands); Antonius F. W. van der Steen, Erasmus MC (Netherlands) and Shenzhen Institutes of Advanced Technology (China); Robert A. Huber, Univ. zu Lübeck (Germany) and Ludwig-Maximilians-Univ. München (Germany); Gijs van Soest, Erasmus MC (Netherlands) ..... [9689-92]

9:10 am: **Accurate vectorial flow measurements in catheter-based optical coherence tomography**, Néstor Uribe-Patarroyo, Brett E. Bouma, Wellman Ctr. for Photomedicine (USA) ..... [9689-93]

9:30 am: **First clinical pilot study with intravascular polarization sensitive OCT**, Martin Villiger, Harvard Medical School (USA); Antonios Karanasos, Erasmus MC (Netherlands); Jian Ren, Wellman Ctr. for Photomedicine (USA); Norman Lippok, Milen Shishkov, Harvard Medical School (USA); Joost Daemen, Nicolas Van Mieghem, Roberto Diletti, Marco Valgimigli, Robert-Jan van Geuns M.D., Peter de Jaegere, Felix Zijlstra, Gijs van Soest, Erasmus MC (Netherlands); Seemantini K. Nadkarni, Harvard Medical School (USA); Evelyn Regar M.D., Erasmus MC (Netherlands); Brett E. Bouma, Harvard Medical School (USA) ..... [9689-94]

9:50 am: **Mechanical modeling of cholesterol crystallization in atherosclerotic plaques base on Micro-OCT images**, Yuemei Luo M.D., Xinyu Liu Sr., Si Chen M.D., Dongyao Cui M.D., Xianghong Wang, Linbo Liu, Nanyang Technological Univ. (Singapore) ..... [9689-96]

10:10 am: **Endomyocardial imaging using ultrahigh resolution spectral domain optical coherence tomography (SD-OCT)**, Xinwen Yao, Columbia Univ. (USA); Charles C. Marboe, Columbia Univ. Medical Ctr. (USA); Christine P. Hendon, Columbia Univ. (USA) ..... [9689-97]

Coffee Break ..... Sat 10:30 am to 11:00 am

### SESSION 2

LOCATION: ROOM 3016 (WEST LEVEL 3) .. SAT 11:00 AM TO 12:20 PM

#### Blood

Session Chair: **Seemantini K. Nadkarni**, Harvard Medical School (USA)

11:00 am: **Blood coagulation profiling in patients using optical thromboelastography (OTEG)**, Markandey M. Tripathi, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Diane M. Tshikudi, Wellman Ctr. for Photomedicine (USA); Zeinab Hajjarian Kashany, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Elizabeth M. Van Cott, Massachusetts General Hospital (USA); Seemantini K. Nadkarni, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA) ..... [9689-98]

11:20 am: **Optical profiling of anticoagulation status**, Diane M. Tshikudi, Massachusetts General Hospital (USA); Markandey M. Tripathi, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Zeinab Hajjarian Kashany, Seemantini K. Nadkarni, Massachusetts General Hospital (USA) ..... [9689-99]

11:40 am: **Brillouin spectroscopy of clotting dynamics in a model system**, Sandra C. Bustamante-Lopez, Swansea Univ. (United Kingdom) and Texas A&M Univ. (United Kingdom); Andrew J. Traverso, Vladislav V. Yakovlev, Texas A&M Univ. (USA); Kenith E. Meissner, Swansea Univ. (United Kingdom) ... [9689-100]

12:00 pm: **In-vivo continuous monitoring of mixed venous oxygen saturation by photoacoustic transesophageal echocardiography**, Li Li, Harvard Medical School (USA) and Massachusetts General Hospital (USA); Balachundhar Subramaniam, Beth Israel Deaconess Medical Ctr. (USA); Aaron D. Aguirre, Michael N. Andrawes, Guillermo J. Tearney, Massachusetts General Hospital (USA) ..... [9689-101]

Lunch/Exhibition Break ..... Sat 12:20 pm to 1:50 pm

### SESSION 3

LOCATION: ROOM 3016 (WEST LEVEL 3) .... SAT 1:50 PM TO 3:30 PM

#### Multimodality Imaging

Session Chair: **Hongki Yoo**, Hanyang Univ. (Korea, Republic of)

1:50 pm: **Evaluation of combined near-IR spectroscopic (NIRS)-IVUS imaging as a means to detect lipid-rich plaque burden in human coronary autopsy specimens**, Jimmy L. Su, Stephanie J. Grainger, Cherry A. Greiner, Michael J. Hendricks, Meghan M. Goode, InfraReDx, Inc. (USA); Matthew D. Saybolt M.D., Robert L. Wilensky M.D., Hospital of the Univ. of Pennsylvania (USA); Sean P. Madden, James E. Muller M.D., InfraReDx, Inc. (USA) [9689-102]

2:10 pm: **In-vivo validation of a multi-modal fluorescence lifetime imaging (FLIm)-IVUS catheter in swine coronary arteries**, Julien Bec, Dimitris S. Gorpas, Hussain Fatakawala, Jennifer E. Phipps, Dinglong M. Ma, Diego R. Yankelevich, Univ. of California, Davis (USA); Jeffrey A. Southard M.D., UC Davis Medical Ctr. (USA); Laura Marcu, Univ. of California, Davis (USA) ..... [9689-103]

2:30 pm: **Assessment of intravascular stent-associated inflammation and intraplaque hemorrhage using fully integrated high-speed intravascular OCT/NIRF imaging**, Tae Shik Kim, KAIST (Korea, Republic of); Min Woo Lee, Hanyang Univ. (Korea, Republic of); Sunwon Kim, Jae Joong Lee, Korea Univ. (Korea, Republic of); Joon Woo Song, Korea Univ. Guro Hospital (Korea, Republic of); Han Saem Cho, Sun-Joo Jang, KAIST (Korea, Republic of); Hyeon Soo Nam, Hanyang Univ. (Korea, Republic of); Kyeongsoon Park, Korea Basic Science Institute (Korea, Republic of); Jin Won Kim, Korea Univ. (Korea, Republic of); Hongki Yoo, Hanyang Univ. (Korea, Republic of); Wang-Yuh Oh, KAIST (Korea, Republic of) ..... [9689-104]

2:50 pm: **Ultrafast IVUS-OCT imaging of rabbit and swine arteries in vivo at 72 frames per second**, Jiawen Li, Beckman Laser Institute and Medical Clinic (USA) and The Univ. of Western Australia (Australia); Ma Teng, The Univ. of Southern California (USA); Yueqiao Qu, Youmin He, Beckman Laser Institute and Medical Clinic (USA); Dilbahar Mohar, Earl Steward, Univ. of California, Irvine (USA); Zhonglie Piao, Beckman Laser Institute and Medical Clinic (USA); Mingyue Yu, K. Kirk Shung, Qifa Zhou, The Univ. of Southern California (USA); Pranav M. Patel, Univ. of California, Irvine (USA); Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA) ..... [9689-105]

3:10 pm: **Compensation of spectral artifacts in dual-modality intravascular optical coherence tomography and near-infrared spectroscopy**, Ali M. Fard, Joseph A. Gardecki, Giovanni J. Ughi, Harvard Medical School (USA); Chulho Hyun, Massachusetts General Hospital (USA); Guillermo J. Tearney, Harvard Medical School (USA) ..... [9689-106]

Coffee Break ..... Sat 3:30 pm to 4:00 pm

# CONFERENCE 9689D

LOCATION: ROOM 3016 (WEST LEVEL 3)

## SESSION 4

LOCATION: ROOM 3016 (WEST LEVEL 3) . . . SAT 4:00 PM TO 5:40 PM

### Photacoustics and Spectroscopy

Session Chair: **Laura Marcu**, Univ. of California, Davis (USA)

4:00 pm: **High speed intravascular photoacoustic imaging of atherosclerotic arteries**, Zhonglie Piao, Beckman Laser Institute and Medical Clinic (USA) and Pusan National Univ. (Korea, Republic of); Teng Ma, The Univ. of Southern California (USA); Yueqiao Qu, Jiawen Li, Beckman Laser Institute and Medical Clinic (USA); Mingyue Yu, The Univ. of Southern California (USA); Youmin He, Beckman Laser Institute and Medical Clinic (USA); K. Kirk Shung, Qifa Zhou, The Univ. of Southern California (USA); Chang-Seok Kim, Pusan National Univ. (Korea, Republic of); Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9689-107]

4:20 pm: **Lipid detection by intravascular photoacoustic imaging with flexible catheter at 20 frames per second**, Min Wu, Verva Daeichin, Geert Springeling, Erasmus MC (Netherlands); Antonius F. W. van der Steen, Erasmus MC (Netherlands) and ICIN (Netherlands) and Delft Univ. of Technology (Netherlands); Gijs van Soest, Erasmus MC (Netherlands) . . . . . [9689-108]

4:40 pm: **Design and validation of the ball lens-based intravascular catheter for fluorescence lifetime imaging microscopy of atherosclerosis**, Xi Chen, Wihan Kim, Michael J. Serafino, Javier A. Jo, Brian E. Applegate, Texas A&M Univ. (USA) . . . . . [9689-109]

5:00 pm: **Localization analysis of lipid core plaques detected by a near infrared spectroscopy system as compared to histological finding: intracoronary imaging application**, Zhihua He, Stephen T. Sum, InfraReDx, Inc. (USA) . . . . . [9689-110]

5:20 pm: **Support vector machine based classification and mapping of atherosclerotic plaques using fluorescence lifetime imaging**, Hussain Fatakdawala, Dimitris S. Gorpas, Julien Bec, Dinglong M. Ma, Diego R. Yankelevich, John W. Bishop M.D., Laura Marcu, Univ. of California, Davis (USA) . . . . . [9689-111]

### BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 5

LOCATION: ROOM 3016 (WEST LEVEL 3) . SUN 8:00 AM TO 10:00 AM

### Myocardium

Session Chair: **Kenton W. Gregory M.D.**, Oregon Medical Laser Ctr. (USA)

8:00 am: **Optical mapping models of the atria enabled by OCT tissue characterization**, Theresa H. Lye, Columbia Univ. (USA); Andrew D. McCulloch, Univ. of California, San Diego (USA); Christine P. Hendon, Columbia Univ. (USA) . . . . . [9689-112]

8:20 am: **OptoDyCE: automated system for high-throughput all-optical dynamic cardiac electrophysiology**, Aleksandra Klimas, Jinzhu Yu, Christina M. Ambrosi, John C. Williams, Harold Bien, Emilia G. Entcheva, Stony Brook Univ. (USA) . . . . . [9689-113]

8:40 am: **Functional cardiac imaging platform by using ultrahigh-phase-stable swept source optical coherence tomography**, Christine P. Hendon, Yuye Ling, Columbia Univ. (USA) . . . . . [9689-114]

9:00 am: **Development of multifunctional optical coherence tomography and application to mouse myocardial infarction model in vivo**, Sun-Joo Jang, Taejin Park, Inho Shin, Hyun Sang Park, Paul Shin, Wang-Yuhl Oh, KAIST (Korea, Republic of) . . . . . [9689-115]

9:20 am: **Real-time optical monitoring of permanent lesion progression during RF ablation: Implications for treatment of atrial fibrillation**, Rajinder P. Singh-Moon, Columbia Univ. Medical Ctr. (USA); Christine P. Hendon, Columbia Univ. (USA) . . . . . [9689-116]

9:40 am: **OCT imaging of myocardium extending to pulmonary vein based on optical scattering coefficient**, Zhifang Li, Fujian Normal Univ (China); Timm Dickfeld, Univ. of Maryland School of Medicine (USA); Qinggong Tang, Bohan Wang, Yu Chen, Univ. of Maryland (USA) . . . . . [9689-117]

Coffee Break . . . . . Sun 10:00 am to 10:30 am

### SESSION 6

LOCATION: ROOM 3016 (WEST LEVEL 3) . SUN 10:30 AM TO 11:50 AM

### Intravascular OCT

Session Chair: **Guillermo J. Tearney**, Wellman Ctr. for Photomedicine (USA)

10:30 am: **Influence of distance and incident angle on light intensities in intravascular optical coherence tomography pullback runs**, Shengnan Liu, Jeroen Eggermont, Ron Wolterbeek, Jouke Dijkstra, Leiden Univ. Medical Ctr. (Netherlands) . . . . . [9689-118]

10:50 am: **Common path ball lens probe for optical coherence tomography**, Kanwarpal Singh, Massachusetts General Hospital (USA); Daisuke Yamada, Massachusetts General Hospital (USA) and Canon U.S.A., Inc. (USA); Guillermo J. Tearney, Massachusetts General Hospital (USA) . . . . . [9689-119]

11:10 am: **Light intensity matching between different intravascular optical coherence tomography systems**, Shengnan Liu, Jeroen Eggermont, Leiden Univ. Medical Ctr. (Netherlands); Boudewijn P. F. Lelieveldt, Jouke Dijkstra, Leiden Univ. Medical Ctr. (Netherlands) . . . . . [9689-120]

11:30 am: **The Lumivascular technology platform: real time OCT guidance for therapeutic intra-vascular revascularization**, Manish Kankaria, Arjun Desai, Avinger, Inc. (USA) . . . . . [9689-121]

Lunch/Exhibition Break . . . . . Sun 11:50 am to 1:20 pm



# CONFERENCE 9689D

LOCATION: ROOM 3016 (WEST LEVEL 3)

## SESSION 7

LOCATION: ROOM 3016 (WEST LEVEL 3) . . . SUN 1:20 PM TO 3:20 PM

### New Diagnostic Techniques

Session Chair: **Adrien E. Desjardins**,  
Univ. College London (United Kingdom)

1:20 pm: **Aortic endothelium detection using spectral estimation optical coherence tomography**, Xinyu Liu Sr., Si Chen M.D., Yuemei Luo M.D., En Bo, Nanshuo Wang, Xiaojun Yu, Linbo Liu, Nanyang Technological Univ. (Singapore) . . . . . [9689-122]

1:40 pm: **A pilot study using laser-based technique for non-invasive diagnostics of hypertensive conditions in transgenic mice**, Karina S. Litvinova, Aston Univ. (United Kingdom); Shakil Ahmad, Keqing Wang, Aston Medical Research Institute, Aston Univ. (United Kingdom); Ilya E. Rafailov, Sergei G. Sokolovsky, Edik U. Rafailov, Aston Univ. (United Kingdom); Asif Ahmed, Aston Medical Research Institute, Aston Univ. (United Kingdom) . . . . . [9689-123]

2:00 pm: **All-optical pulse-echo ultrasound probe for intravascular imaging**, Richard J. Colchester, Sacha Noimark, Charles A. Mosse, Edward Z. Zhang, Paul C. Beard, Ivan P. Parkin, Ioannis Papakonstantinou, Adrien E. Desjardins, Univ. College London (United Kingdom) . . . . . [9689-124]

2:20 pm: **Non-contact measurement of carotid arterial stiffness by two-point heart pulse laser detection**, Mauro Benedetti, Univ. degli Studi di Pavia (Italy); Valentina Favalli, Fondazione IRCCS Policlinico San Matteo (Italy); Antonio Mariano, Univ. degli Studi di Pavia (Italy); Natalia Rebrova, Tyndall National Institute (Ireland) and Cork Institute of Technology (Ireland); Angelo Consoli, Jaouhar Ayadi, Eclexys SAGL (Switzerland); Mariano Perna, SAPHYRION Sagl (Switzerland); Paolo Minzioni, Univ. degli Studi di Pavia (Italy); Eloisa Arbustini, Fondazione IRCCS Policlinico San Matteo (Italy); Guido Giuliani, Julight S.r.l. (Italy) . . . . . [9689-125]

2:40 pm: **Intravascular laser speckle imaging for the mechanical analysis of coronary plaques**, Masaki Hosoda, Massachusetts General Hospital (USA) and Canon USA, Inc. (USA); Jing Wang, Harvard Medical School (USA) and Massachusetts General Hospital (USA); Diane M. Tshikudi, Massachusetts General Hospital (USA); Seemantini K. Nadkarni, Harvard Medical School (USA) and Massachusetts General Hospital (USA) . . . . . [9689-126]

3:00 pm: **Assessment of atherosclerotic plaque collagen content and architecture using polarization-sensitive optical coherence tomography**, Pallavi Doradla, Harvard Medical School (USA) and Wellman Ctr. for Photomedicine (USA); Martin Villiger, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Diane M. Tshikudi, Wellman Ctr. for Photomedicine (USA); Brett E. Bouma, Seemantini K. Nadkarni, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA) . . . . . [9689-95]

## POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.*

**Feasibility of linear-array based co-registered photoacoustic and high frequency multi-modal ultrasound for non-invasive carotid imaging**, Haroon Zafar, National Univ. of Ireland, Galway (Ireland); Faisal Sharif, Galway Univ. Hospitals (Ireland) and National Univ of Ireland, Galway (Ireland); Martin J. Leahy, National Univ. of Ireland, Galway (Ireland) . . . . . [9689-127]

**Optical evaluation of myocardial infarction and its treatment effects using PS-OCT, fluorescence mapping and SHG microscopy**, Yong-Guk Kang, Korea Univ. College of Health Sciences (Korea, Republic of); Mirim Kim, Korea Univ. College of Medicine (Korea, Republic of); Min-Gyu Hyeon, Korea Univ. (Korea, Republic of); Yong-Doo Park, Korea Univ. College of Medicine (Korea, Republic of); Beop-Min Kim, Korea Univ. College of Health Sciences (Korea, Republic of) and Korea Univ. (Korea, Republic of) . . . . . [9689-128]

**Characterization of atherosclerotic plaques by cross-polarization optical coherence tomography**, Ekaterina Gubarkova, Nizhny Novgorod State Medical Academy (Russian Federation); Varvara V. Dudenkova, Nizhny Novgorod State Medical Academy (Russian Federation) and N.I. Lobachevsky State Univ. of Nizhny Novgorod (Russian Federation); Felix Feldchtein, Lidia Timofeeva, Elena B. Kiseleva, Sergei S. Kuznetsov M.D., Nizhny Novgorod State Medical Academy (Russian Federation); Alexander A. Moiseev, Institute of Applied Physics of the RAS (Russian Federation); Gregory V. Gelikonov, Institute of Applied Physics of the RAS (Russian Federation) and Nizhny Novgorod State Medical Academy (Russian Federation); Alex Vitkin, Univ. of Toronto (Canada) and Nizhny Novgorod State Medical Academy (Russian Federation); Natalia D. Gladkova, Nizhny Novgorod State Medical Academy (Russian Federation) . . . . . [9689-129]

**Quantitative imaging of lipid volume fraction in atherosclerotic plaque phantom under saline by a multispectral angioscope at wavelengths around 1200 nm**, Katsunori Ishii, Daichi Matsui, Kunio Awazu, Osaka Univ. (Japan) . . . . . [9689-130]

BIOS

# CONFERENCE 9689E

LOCATION: ROOM 3010 (WEST LEVEL 3)

Saturday 13 February 2016 • Prt of Proceedings of SPIE Vol. 9689

# Diagnosis and Treatment of Diseases in the Breast and Reproductive System II

Conference Chairs: **Melissa C. Skala**, Vanderbilt Univ. (USA); **Paul J. Campagnola**, Univ. of Wisconsin-Madison (USA)

Program Committee: **Ji-Xin Cheng**, Purdue Univ. (USA); **Darren M. Roblyer**, Boston Univ. (USA); **Anita Mahadevan-Jansen**, Vanderbilt Univ. (USA); **Bruce J. Tromberg**, Beckman Laser Institute and Medical Clinic (USA)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 3010 (WEST LEVEL 3) . . SAT 8:50 AM TO 10:10 AM

### Gynecology

Session Chairs: **Anita Mahadevan-Jansen**, Vanderbilt Univ. (USA);  
**Melissa C. Skala**, Vanderbilt Univ. (USA)

8:50 am: **Three-photon imaging of ovarian cancer** (*Invited Paper*), Jennifer K. Barton, The Univ. of Arizona (USA); Elizabeth J. Swan, College of Optical Sciences, The Univ. of Arizona (USA); B. Amirsolaimani, Photini Faith Rice, The Univ. of Arizona (USA); Khanh Q. Kieu, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9689-131]

9:10 am: **Improved selection of cortical ovarian strips for autotransplantation of ovarian tissue using full-field optical coherence tomography (FFOCT)**, Paulien L. Stegehuis, Inge T. Peters, Tjalling Bosse, Peter J. K. Kuppen, Baptist J. Trimpos, Boudewijn P. F. Lelieveldt, Cornelis J. H. van de Velde, Leiden Univ. Medical Ctr. (Netherlands); Carina G. J. M. Hilders, Erasmus MC (Netherlands) and Reinier de Graaf Hospital (Netherlands); Jouke Dijkstra, Alexander L. Vahrmeijer M.D., Leiden Univ. Medical Ctr. (Netherlands) . . . . . [9689-132]

9:30 am: **Functional optical coherence tomography for high-resolution mapping of cilia beat frequency in mouse oviduct in vivo**, Shang Wang, Jason C. Burton, Baylor College of Medicine (USA); Richard Behringer, The Univ. of Texas M.D. Anderson Cancer Ctr. (USA); Irina V. Larina, Baylor College of Medicine (USA) . . . . . [9689-133]

9:50 am: **Cervical Intraepithelial Neoplasia treatment: a non-invasive translational technology**, Natalia M. Inada, Fernanda M. Carbinatto, Univ. de São Paulo (Brazil); Wellington Lombardi M.D., UNIARA (Brazil); Natália F. Cossetin M.D., UNIARA (Brazil); Jose R. Trujillo M.D., Johns Hopkins Univ. (USA); Cristina Kurachi, Vanderlei Bagnato, Univ. de São Paulo (Brazil) . . . . . [9689-135]

Coffee Break . . . . . Sat 10:10 am to 10:40 am

### SESSION 2

LOCATION: ROOM 3010 (WEST LEVEL 3) . SAT 10:40 AM TO 12:00 PM

### Tumor Margin Assessment

Session Chair: **Paul J. Campagnola**, Univ. of Wisconsin-Madison (USA)

10:40 am: **Polarimetry for margin assessment of breast cancer**, Adam Gribble, Univ. of Toronto (Canada) and Ontario Cancer Institute (Canada); Manuela Ventura, Univ. Health Network (Canada); Milan Ganguly, STTARR Innovation Ctr. (Canada); Alessandra Tata, Emma Bluemke, Univ. Health Network (Canada); Arash Zarrine-Afsar, Univ. Health Network (Canada) and Univ. of Toronto (Canada) and St. Michael's Hospital (Canada); Alex Vitkin, Univ. of Toronto (Canada) and Ontario Cancer Institute (Canada) . . . . . [9689-136]

11:00 am: **Intraoperative assessment of breast tumor margins using a multimodal photoacoustic tomography system**, Rui Li, Lu Lan, Pu Wang, Purdue Univ. (USA); Linda K. Han M.D., Indiana Univ. Melvin and Bren Simon Cancer Ctr. (USA); Ji-Xin Cheng, Purdue Univ. (USA) . . . . . [9689-137]

11:20 am: **3D structured light scanning facilitates clinical validation of structured illumination microscopy for intra-operative tumor margin assessment of prostate resections**, David B. Tulman, Mei Wang, Andrew B. Sholl, Hillary Z. Kimbrell, Katherine N. Elfer, Benjamin R. Lee, Samuel Luethy, Sidney Chstler, Jonathon Q. Brown, Tulane Univ. (USA) . . . . . [9689-138]

11:40 am: **Towards intra-operative visualization of breast tumour margins using low-cost epi-fluorescence endomicroscopy**, Khushi K. Vyas, Michael Robert Hughes, Imperial College London (United Kingdom); Roshneen Ali, The Univ. of Birmingham (United Kingdom); Rathi Ramakrishnan, Ara W. Darzi, Sami Shousha, Daniel Leff, Guang-Zhong Yang, Imperial College London (United Kingdom) . . . . . [9689-139]

Lunch/Exhibition Break . . . . . Sat 12:00 pm to 2:20 pm

### SESSION 3

LOCATION: ROOM 3010 (WEST LEVEL 3) . . . SAT 2:20 PM TO 3:00 PM

### Optical Coherence Tomography and Fluorescence Imaging

Session Chair: **Melissa C. Skala**, Vanderbilt Univ. (USA)

2:20 pm: **Dispersion analysis of collagen fiber networks in cervical tissue using optical coherence tomography**, Yu Gan, Wang Yao, Kristin M. Myers, Columbia Univ. (USA); Joy Y. Vink, Ronald J. Wapner, Columbia Univ. Medical Ctr. (USA); Christine P. Hendon, Columbia Univ. (USA) . . . . . [9689-140]

2:40 pm: **Visualization of tumor vascular reactivity in response to respiratory challenges by optical coherence tomography**, Hoon Sup Kim, Songhyun Lee, Kiri Lee, Gwangju Institute of Science and Technology (Korea, Republic of); Tae Joong Eom, Gwangju Institute of Science and Technology (Korea, Republic of) and Advanced Photonics Research Institute (Korea, Republic of); Jae G. Kim, Gwangju Institute of Science and Technology (Korea, Republic of) . . . . . [9689-141]

Coffee Break . . . . . Sat 3:00 pm to 3:30 pm

# CONFERENCE 9689E

LOCATION: ROOM 3010 (WEST LEVEL 3)

SUNDAY 14 FEBRUARY

BIOS

## SESSION 4

LOCATION: ROOM 3010 (WEST LEVEL 3) . . . SAT 3:30 PM TO 5:10 PM

### Breast Cancer

Session Chair: **Darren M. Roblyer**, Boston Univ. (USA)

3:30 pm: **Redox subpopulations and the risk of breast cancer progression**, He N. Xu, Julia C. Tchou, Lin Z. Li, The Univ. of Pennsylvania Health System (USA) . . . . . [9689-145]

3:50 pm: **High-throughput autofluorescence flow cytometry of breast cancer metabolism**, Amy T. Shah, Taylor M. Cannon, Jim N. Higginbotham, Melissa C. Skala, Vanderbilt Univ. (USA) . . . . . [9689-146]

4:10 pm: **Using a reflectance-based correction on Cherenkov images to strengthen in vivo correlation with surface dose in whole-breast radiotherapy patients**, Jacqueline Andreozzi, Thayer School of Engineering at Dartmouth (USA); Rongxiao Zhang, Harvard Medical School (USA); Adam K. Glaser, Thayer School of Engineering at Dartmouth (USA); David J. Gladstone, Lesley A. Jarvis, Dartmouth Hitchcock Medical Ctr. (USA); Brian W. Pogue, Thayer School of Engineering at Dartmouth (USA) . . . . . [9689-147]

4:30 pm: **Diffuse optical tomography with structured-light patterns to quantify breast density**, Jessica Kwong, Farouk Nouizi, Jaedu Cho, Yifan Li, Jie Zheng, Jeon-Hor Chen, Min-Ying Su, Gultekin Gulsen, Univ. of California, Irvine (USA) . . . . . [9689-148]

4:50 pm: **Photoacoustic spectroscopy based investigatory approach to discriminate breast cancer from normal: a pilot study**, Mallika Priya, Bola Sadashiva Satish Rao, Subhash Chandra, Satadru Ray, Stanley Mathew M.D., Anirbit Datta, Manipal Univ. (India); Subramanya G. Nayak, Manipal Univ. (India) and Manipal Institute of Technology (India); Krishna Kishore Mahato, Manipal Univ. (India) . . . . . [9689-149]

### BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM  
LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BiOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Design of an everting balloon to deploy a microendoscope to the fallopian tubes**, Molly Keenan, Caitlin Howard, Tyler Tate, The Univ. of Arizona (USA); John Black, Glannaventa, Inc. (USA); Urs Utzinger, Jennifer K. Barton, The Univ. of Arizona (USA) . . . . . [9689-134]

**Wide-field lifetime-based FRET imaging for the assessment of early functional distribution of transferrin-based delivery in breast tumor-bearing small animals**, Nattavut Sinsuebphon, Rensselaer Polytechnic Institute (USA); Alena Rudkouskaya, Margarida Barroso, Albany Medical College (USA); Xavier Intes, Rensselaer Polytechnic Institute (USA) . . . . . [9689-143]

**Large area 3-D optical coherence tomography imaging of lumpectomy specimens for radiation treatment planning**, Cuihuan Wang, Rutgers, The State Univ. of New Jersey (USA); Leonard Kim, Atif Khan, Rutgers Cancer Institute of New Jersey (USA); Mark C. Pierce, Rutgers, The State Univ. of New Jersey (USA) . . . . . [9689-151]

**Cervical collagen imaging for determining preterm labor risks using a colposcope with full mueller matrix capability**, Susan Stoff, Jessica C. Ramella-Roman, Florida International Univ. (USA); Amir Gandjbakhche, Viktor V. Chernomordik, National Institutes of Health (USA) . . . . . [9689-152]

**Photodynamic therapy of Cervical Intraepithelial Neoplasia (CIN) High Grade**, Fernanda M. Carbinatto, Instituto de Física de São Carlos (Brazil); Natalia M. Inada, Univ. de São Paulo (Brazil); Wellington Lombardi, Eduardo V. da Silva, UNIARA (Brazil); Renata Belotto, Hospital Perola Byington (Brazil); Cristina Kurachi, Vanderlei Bagnato, Univ. de São Paulo (Brazil) . . . . . [9689-153]

**Targeted and cooperative ablation of Her2-positive breast cancer cells via functionalized GNR@mSiO<sub>2</sub>-Kadcyla conjugates**, Xiuhong Wang, Beijing Univ. of Technology (China); Fei Cao, Beijing Univ. of Technology (China); Qian Yao, Beijing Univ. of Technology (China) . . . . . [9689-156]

**The lavender procedure: how we do it**, Phillip Bretz M.D., Richard Lynch, David Mantik, The Visionary Breast Ctr. (USA) . . . . . [9689-157]

**A fiber-delivered optoacoustic guide for precise breast-conserving surgery**, Lu Lan, Purdue Univ. (USA); Kaiming Liu, Tsinghua Univ. (China); Rui Li, Pu Wang, Purdue Univ. (USA); Linda K. Han M.D., Indiana Univ. Melvin and Bren Simon Cancer Ctr. (USA); Ji-Xin Cheng, Purdue Univ. (USA) . . . [9689-158]

**Morphologic 3D scanning of fallopian tubes to assist ovarian cancer diagnosis**, Wendy-Julie Madore, Étienne De Montigny, Andréanne Deschênes, Fouzi Benboujja, Mikael Leduc, Ecole Polytechnique de Montréal (Canada); Anne-Marie Mes-Masson, Diane Provencher M.D., Kurosh Rahimi M.D., Ctr. Hospitalier de l'Univ. de Montréal (Canada); Caroline Boudoux, Nicolas Godbout, Ecole Polytechnique de Montréal (Canada) . . . . . [9689-159]

**Spectroscopic imaging system for high-throughput viability assessment of ovarian microtumors in a microfluidic system**, Amelie St-Georges-Robillard, Mathieu Masse, Ecole Polytechnique de Montréal (Canada) and Ctr. Hospitalier de l'Univ. de Montréal Research Ctr. (Canada); Jennifer Kendall-Dupont, Ctr. Hospitalier de l'Univ. de Montréal Research Ctr. (Canada) and Institut du Cancer de Montréal (Canada); Mathias Strupler, Ecole Polytechnique de Montréal (Canada); Michael Jermyn, McGill Univ. (Canada) and Ecole Polytechnique de Montréal (Canada); Anne-Marie Mes-Masson, Ctr. Hospitalier de l'Univ. de Montréal Research Ctr. (Canada) and Institut du Cancer de Montréal (Canada) and Univ. de Montréal (Canada); Frédéric Leblond, Ecole Polytechnique de Montréal (Canada) and Ctr. Hospitalier de l'Univ. de Montréal Research Ctr. (Canada); Thomas Gervais, Ecole Polytechnique de Montréal (Canada) and Ctr. Hospitalier de l'Univ. de Montréal Research Ctr. (Canada) and Institut du cancer de Montréal (Canada) . . . . . [9689-160]

# CONFERENCE 9689F

LOCATION: ROOM 2006 (WEST LEVEL 2)

Saturday 13 February 2016 • Part of Proceedings of SPIE Vol. 9689

# Optics in Bone Surgery and Diagnostics

Conference Chair: **Andreas Mandelis**, Univ. of Toronto (Canada)

Conference Co-Chair: **Michael D. Morris**, Univ. of Michigan (emeritus) (USA)

Program Committee: **Robert R. Alfano**, The City College of New York (USA); **Bennett T. Amaechi**, The Univ. of Texas Health Science Ctr. at San Antonio (USA); **Peter Fratzl**, Max-Planck-Institut für Kolloid- und Grenzflächenforschung (Germany); **Huabei Jiang**, Univ. of Florida (USA); **Stephen J. Matcher**, The Univ. of Sheffield (United Kingdom); **Eleftherios P. Paschalis**, Ludwig Boltzmann Institut (Austria); **Rahul Tandon D.D.S.**, Loma Linda Univ. (USA); **Xueding Wang**, Univ. of Michigan Medical School (USA); **Victor X. D. Yang**, Ryerson Univ. (Canada)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 2006 (WEST LEVEL 2) . SAT 8:00 AM TO 10:10 AM

### Musculoskeletal Imaging and Diagnostics I

Session Chair: **Andreas Mandelis**, Univ. of Toronto (Canada)

8:00 am: **Photoacoustic 3D imaging in bone assessment** (*Invited Paper*), Ting Feng, Univ. of Michigan Medical School (USA) and Nanjing Univ. (China); Ken Kozloff, Joseph Perosky, Univ. of Michigan (USA); Sidan Du, Jie Yuan, Nanjing Univ. (China); Cheri Deng, Xueding Wang, Univ. of Michigan (USA) . . . [9689-164]

8:30 am: **Determining early markers of disease using Raman spectroscopy in a rat combat-trauma model of heterotopic ossification**, Katherine E. Cilwa, Meron Ghebremedhin, Naval Medical Research Ctr. (USA) and The Henry M. Jackson Foundation for the Advancement of Military Medicine (USA); Jonathan A. Forsberg, Naval Medical Research Ctr. (USA) and Uniformed Services Univ. of the Health Sciences (USA) and Walter Reed National Military Medical Ctr. (USA); Nicole J. Crane, Naval Medical Research Ctr. (USA) and The Henry M. Jackson Foundation for the Advancement of Military Medicine (USA) . . . [9689-162]

8:50 am: **Photoacoustic imaging of inflammatory arthritis in human joints**, Janggun Jo, Guan Xu, April Marquardt, Sheeja Francis, Univ. of Michigan (USA); Jie Yuan, Nanjing Univ. (China); Dhanuj Girish, Huron High School (USA); Gandikota Girish, Xueding Wang, Univ. of Michigan (USA) . . . [9689-163]

9:10 am: **Optical diagnostics of osteoblast cells and osteogenic drug screening**, Deepak K. Khajuria, Elayaraja Kolanti, Sarath C. Veerla, D. Roy Mahapatra, Indian Institute of Science (India) . . . [9689-166]

9:30 am: **Fourth NIR optical window for assessment of bone abnormalities and other diseases**, Diana C. Sordillo, Laura A. Sordillo, Peter P. Sordillo M.D., Robert R. Alfano, Institute for Ultrafast Spectroscopy and Lasers (USA) . . . [9689-167]

9:50 am: **A portable cross-shape near-infrared spectroscopic detector for bone marrow lesions diagnosis**, Yu Su, Ting Li, Yunlong Sun, Kai Li, Yuan Gao, Univ. of Electronic Science and Technology of China (China) . . . [9689-165]

Coffee Break . . . Sat 10:10 am to 10:40 am

### SESSION 2

LOCATION: ROOM 2006 (WEST LEVEL 2) SAT 10:40 AM TO 11:40 AM

### Bone Surgery and Diagnostics

Session Chair: **Michael D. Morris**, Univ. of Michigan (USA)

10:40 am: **Simultaneous fluorescence-Raman imaging tools for in vivo investigation of biomineralization processes** (*Invited Paper*), Admir Masic, Max-Planck-Institut für Kolloid- und Grenzflächenforschung (Germany) . . . [9689-174]

11:00 am: **Noninvasive assessment of fracture healing using spatially offset Raman spectroscopy** (*Invited Paper*), Hao Ding, Guijin Lu, Christopher West, Gloria Gogola, James Kellam, Catherine Ambrose, Xiaohong Bi, The Univ. of Texas Health Science Ctr. at Houston (USA) . . . [9689-173]

11:20 am: **In-situ photopolymerized and monitored implants: successful application to an intervertebral disc replacement**, Andreas Schmocker, Christophe Moser, Azadeh Khoushabi, Pierre-Etienne Bourban, Dominique Pioletti, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . [9689-168]

Lunch/Exhibition Break . . . Sat 11:40 am to 1:30 pm

### SESSION 3

LOCATION: ROOM 2006 (WEST LEVEL 2) . . . SAT 1:30 PM TO 3:00 PM

### Musculoskeletal Imaging and Diagnostics II

Session Chair: **Xueding Wang**, Univ. of Michigan (USA)

1:30 pm: **Supercontinuum ballistic imaging of bone using the fourth NIR optical window** (*Invited Paper*), Laura A. Sordillo, The City College of New York (USA) and Institute for Ultrafast Spectroscopy and Lasers (USA); Diana C. Sordillo, Lingyan Shi, Peter P. Sordillo M.D., Robert R. Alfano, Institute for Ultrafast Spectroscopy and Lasers (USA) . . . [9689-169]

2:00 pm: **Quantitative assessment of optical properties in healthy cartilage and repair tissue by optical coherence tomography and histology**, Sanne M. A. Jansen M.D., Paul Cernohorsky M.D., Daniel M. de Bruin, Edwin van der Pol, Cemile D. Savci-Heijink M.D., Simon D. Strackee M.D., Dirk J. Faber, Ton G. van Leeuwen, Academisch Medisch Centrum (Netherlands) . . . [9689-170]

2:20 pm: **Imaging and characterizing cancellous bone tissue with photoacoustic and ultrasound modalities**, Bahman Lashkari, Univ. of Toronto (Canada); Lifeng Yang, Univ. of Electronic Science and Technology of China (China); Joel W. Y. Tan, Andreas Mandelis, Univ. of Toronto (Canada) [9689-171]

2:40 pm: **Reliability analysis of instrument design of noninvasive bone marrow disease detector**, Yu Su, Ting Li, Yunlong Sun, Yuan Gao, Kai Li, Univ. of Electronic Science and Technology of China (China) . . . [9689-172]

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times



# CONFERENCE 9690A

LOCATION: ROOM 3000 (WEST LEVEL 3)

Saturday–Sunday 13–14 February 2016 • Part of Proceedings of SPIE Vol. 9690

# Clinical and Translational Neurophotonics

Conference Chairs: **Steen J. Madsen**, Univ. of Nevada, Las Vegas (USA); **Victor X. D. Yang**, Ryerson Univ. (Canada)

Program Committee: **David Abookasis**, Ariel Univ. of Samaria (Israel); **Frederic Leblond**, Ecole Polytechnique de Montréal (Canada); **Herbert Stepp**, Ludwig-Maximilians-Univ. München (Germany); **Pablo A. Valdes**, Dartmouth College (USA)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 3000 (WEST LEVEL 3) . SAT 8:50 AM TO 10:10 AM

#### Optical Spectroscopy and Tomography I

Session Chair: **Steen J. Madsen III**, Univ. of Nevada, Las Vegas (USA)

8:50 am: **Assessing the feasibility of time-resolved fNIRS to detect brain activity during motor imagery**, Androu Abdalmalak, Western Univ. (Canada) and Lawson Health Research Institute (Canada); Daniel Milej, Mamadou Diop, Western Univ. (Canada) and Lawson Health Research Institute (Canada); Lorina Naci, Adrian M. Owen, Brain and Mind Institute, Western Univ. (Canada); Keith St. Lawrence, Western Univ. (Canada) and Lawson Health Research Institute (Canada) . . . . . [9690-1]

9:10 am: **Applying support vector machine on hybrid fNIRS/EEG signal to classify driver's conditions**, Thien Nguyen, Sangtae Ahn, Hoyjung Jang, Sung C. Jun, Jae G. Kim, Gwangju Institute of Science and Technology (Korea, Republic of) . . . . . [9690-2]

9:30 am: **Functional connectivity during phonemic and semantic verbal fluency test: a multi-channel near infrared spectroscopy study**, Chun-Jung Huang, Chia-Wei Sun, National Chiao Tung Univ. (Taiwan); Po-Han Chou, Taichung Veterans General Hospital (Taiwan); Ching-Cheng Chuang, National Chiao Tung Univ. (Taiwan). . . . . [9690-3]

9:50 am: **Deception detection by EEG and fNIRS**, Hong Di, Univ. of International Relations (China). . . . . [9690-4]

Coffee Break . . . . . Sat 10:10 am to 10:40 am

### SESSION 2

LOCATION: ROOM 3000 (WEST LEVEL 3) SAT 10:40 AM TO 12:00 PM

#### Microscopy

Session Chair: **Victor X. D. Yang M.D.**, Ryerson Univ. (Canada)

10:40 am: **Visualization of microhemorrhages with optical histology in mouse model of cerebral amyloid angiopathy**, Patrick Lo, Christian Crouzet, Beckman Laser Institute and Medical Clinic (USA); Vitaly Vasilevko, Univ. of California, Irvine (USA); Bernard Choi, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9690-5]

11:00 am: **Novel fiber-optic imaging platform reveals behaviorally-relevant astrocyte network activation in the brain of freely-moving animals**, Yung-Tian A. Gau M.D., Jaepyong Cha, Dwight E. Bergles, Jin U. Kang, Johns Hopkins Univ. (USA). . . . . [9690-6]

11:20 am: **Adaptive optics microscopy enhances image quality in deep layers of CLARITY processed brains of YFP-H mice**, Xiaodong Tao, Florian Ermini, Univ. of California, Santa Cruz (USA); Laurent A. Bentolilla, Dustin G. Roberts, Allan MacKenzie-Graham, Univ. of California, Los Angeles (USA); Joel Kubby, Univ. of California, Santa Cruz (USA). . . . . [9690-7]

11:40 am: **Effects of cranial window on monitoring neurovasculature using laser speckle contrast imaging**, Hang Yu, Janaka Senarathna, Johns Hopkins Univ. (USA); Betty M. Tyler, The Johns Hopkins Hospital (USA); Arvind P. Pathak, Nitish V. Thakor, Johns Hopkins Univ. (USA). . . . . [9690-8]

Lunch/Exhibition Break . . . . . Sat 12:00 pm to 1:40 pm

### SESSION 3

LOCATION: ROOM 3000 (WEST LEVEL 3) . . . SAT 1:40 PM TO 3:00 PM

#### Operative and Postop Therapy I

Session Chair: **Frédéric Leblond**, Ecole Polytechnique de Montréal (Canada)

1:40 pm: **First multiphoton tomography of brain in man**, Karsten König, Univ. des Saarlandes (Germany); Sven Rainer Kantelhardt M.D., Alf Giese M.D., Johannes Gutenberg Univ. Mainz (Germany) . . . . . [9690-9]

2:00 pm: **Neural networks improve brain cancer detection with Raman spectroscopy in the presence of light artifacts**, Michael Jermyn, Montreal Neurological Institute and Hospital (Canada); Joannie Desroches, Jeanne Mercier, Karl St-Arnaud, Ecole Polytechnique de Montréal (Canada); Marie-Christine Guiot, Kevin Petrecca, McGill Univ. (Canada); Frédéric Leblond, Ecole Polytechnique de Montréal (Canada) . . . . . [9690-10]

2:20 pm: **Optical coherence tomography and fluorescence spectroscopy for brain tumor detection**, Neda Haj-Hosseini, Peter Milos, Camilla Hildesjö, Martin Hallbeck, Johan Richter, Karin Wårdell, Univ. Hospital Linköping (Sweden) . . . . . [9690-11]

2:40 pm: **Increasing the efficacy of antitumor glioma vaccines by photodynamic therapy and local injection of allogeneic glioma cells**, Steen J. Madsen, Univ. of Nevada, Las Vegas (USA); Catherine Christie, Beckman Laser Institute and Medical Clinic (USA), Qian Peng, Oslo Univ. Hospital (Norway), Henry Hirschberg, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9690-12]

Coffee Break . . . . . Sat 3:00 pm to 3:30 pm

### SESSION 4

LOCATION: ROOM 3000 (WEST LEVEL 3) . . . SAT 3:30 PM TO 4:50 PM

#### Operative and Postop Therapy II

Session Chair: **Pablo A. Valdes**, Thayer School of Engineering at Dartmouth (USA)

3:30 pm: **An intraoperative spectroscopic imaging system for quantification of Protoporphyrin IX during glioma surgery**, Leticia M. Angulo-Rodríguez, Audrey Laurence, Ecole Polytechnique de Montréal (Canada); Michael Jermyn, Ecole Polytechnique de Montréal (Canada) and Montreal Neurological Institute and Hospital (Canada); Guillaume Sheehy, Ecole Polytechnique de Montréal (Canada); Mira Sibai, Princess Margaret Cancer Ctr. (Canada) and Univ. of Toronto (Canada); Kevin Petrecca, Montreal Neurological Institute and Hospital (Canada); David W. Roberts M.D., Dartmouth Hitchcock Medical Ctr. (USA); Keith D. Paulsen, Thayer School of Engineering at Dartmouth (USA); Brian C. Wilson, Princess Margaret Cancer Ctr. (Canada) and Univ. of Toronto (Canada); Frédéric Leblond, Ecole Polytechnique de Montréal (Canada). . . . . [9690-14]

3:50 pm: **Fiber-based tissue identification for electrode placement in deep brain stimulation neurosurgery**, Damon T. DePaoli, Nicolas Lapointe, Laurent Goetz, Institut Univ. en Santé Mentale de Québec (Canada); Martin Parent, Univ. Laval (Canada); Michel Prudhomme M.D., Ctr. Hospitalier Univ. Laval (Canada); Léo Cantin M.D., Univ. Laval (Canada); Tigran Galstian, Younès Messaddeq, Ctr. d'Optique, Photonique et Laser (Canada); Daniel C. Côté, Ctr. de Recherche de l'Univ. Laval Robert-Giffard (Canada) and Ctr. d'Optique, Photonique et Laser (Canada). . . . . [9690-15]

4:10 pm: **Effective transvascular drug delivery to glioma in rats by using a pulsed laser-induced photomechanical wave**, Yusuke Akutsu, Keio Univ. (Japan); Shunichi Sato, Arata Tomiyama, National Defense Medical College (Japan); Yasuyuki Tsunoi, Keio Univ. (Japan); Satoko Kawachi, Kentaro Mori, National Defense Medical College (Japan); Mitsuhiro Terakawa, Keio Univ. (Japan). . . . . [9690-16]

BIOS

# CONFERENCE 9690A

LOCATION: ROOM 3000 (WEST LEVEL 3)

4:30 pm: **Intraoperative brain hemodynamic response assessment with real-time hyperspectral optical imaging**, Audrey Laurence, Julien Pichette, Leticia M. Angulo-Rodriguez, Catherine St. Pierre M.D., Frédéric Lesage, Ecole Polytechnique de Montréal (Canada); Alain Bouthillier M.D., Univ. de Montréal (Canada); Dang Khoa Nguyen, Ctr. Hospitalier de l'Univ. de Montréal (Canada); Frédéric Leblond, Ecole Polytechnique de Montréal (Canada) . . . . . [9690-17]

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 5

LOCATION: ROOM 3000 (WEST LEVEL 3) . . SUN 8:10 AM TO 8:30 AM

### Operative and Postop Therapy III

Session Chair: **David Abookasis**, Ariel Univ. (Israel)

8:10 am: **Fluorescence-guided tumor visualization using a custom designed NIR attachment to a surgical microscope for high sensitivity imaging**, David S. Kittle, Chirag G. Patil M.D., Adam Mamelak M.D., Cedars-Sinai Medical Ctr. (USA); Stacey Hansen, Jeff Perry, Laura Ishak, Blaze Bioscience, Inc. (USA); Keith L. Black M.D., Pramod V. Butte, Cedars-Sinai Medical Ctr. (USA) [9690-18]

### SESSION 6

LOCATION: ROOM 3000 (WEST LEVEL 3) . SUN 8:30 AM TO 10:10 AM

### OCT

Session Chair: **David Abookasis**, Ariel Univ. (Israel)

8:30 am: **Application of optical coherence tomography based microangiography for cerebral imaging**, Utku Baran, Ruikang K. Wang, Univ. of Washington (USA) . . . . . [9690-18]

8:50 am: **OCT imaging of acute vascular changes following mild traumatic brain injury in mice**, Isabel Chico-Calero D.V.M., Milen Shishkov, Jonathan Welt, Cedric Blatter, Wellman Ctr. for Photomedicine (USA); Benjamin J. Vakoc, Massachusetts General Hospital (USA) . . . . . [9690-19]

9:10 am: **Non-destructive optical clearing technique enhances optical coherence tomography (OCT) for real-time, 3D histomorphometry of brain tissue**, Akshay Paul, Beckman Laser Institute and Medical Clinic (USA) and OCT Medical Imaging Inc. (USA); Theodore H. Chang, Li-Dek Chou, OCT Medical Imaging Inc. (USA) and Beckman Laser Institute and Medical Clinic, Univ. of California, Irvine (USA); Tirunelveli S. Ramalingam, OCT Medical Imaging Inc. (USA) . . . . . [9690-20]

9:30 am: **Polarization properties of amyloid-beta plaques in Alzheimer's disease**, Bernhard Baumann, Adelheid Wöhrer, Gerda Ricken, Michael Pircher, Gabor G. Kovacs, Christoph K. Hitzberger, Medizinische Univ. Wien (Austria) . . . . . [9690-21]

9:50 am: **High-throughput volumetric brain imaging using serial optical coherence tomography**, Junwon Lee, Eun Jung Min, Ulsan National Institute of Science and Technology (Korea, Republic of); Sunwoo Jung, Ulsan National Institute of Science and Technology (Korea, Republic of) and Institute of Basic Science (Korea, Republic of); Andrey Vavilin, Ulsan National Institute of Science and Technology (Korea, Republic of); Yong-Jin Lee, Live Cell Instrument (Korea, Republic of); Woonggyu Jung, Ulsan National Institute of Science and Technology (Korea, Republic of) and Institute of Basic Science (Korea, Republic of) . . . . . [9690-22]

Coffee Break . . . . . Sun 10:10 am to 10:40 am

### SESSION 7

LOCATION: ROOM 3000 (WEST LEVEL 3) SUN 10:40 AM TO 12:00 PM

### Optical Spectroscopy and Tomography II

Session Chair: **Ronald Sroka**, Laser-Forschungslabor (Germany)

10:40 am: **Multimodal optical platform for functional monitoring of cerebral response to cardiac arrest and resuscitation**, Robert H. Wilson, Univ. of California, Irvine School of Medicine (USA); Christian Crouzet, Beckman Laser Institute and Medical Clinic (USA); Maryam Hosseini-Farahabadi, Afsheen K. Bazrafkan, Univ. of California, Irvine School of Medicine (USA); Donald Lee, Univ. of California, Irvine (USA); Anthony J. Durkin, Bernard Choi, Beckman Laser Institute and Medical Clinic (USA); Yama Akbari M.D., Univ. of California, Irvine School of Medicine (USA); Bruce J. Tromberg, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9690-23]

11:00 am: **Study the efficacy of neuroprotective drugs on brain physiological properties during focal head injury using optical spectroscopy data analysis**, David Abookasis, Ariel Shochat, Ariel Univ. (Israel) . . . . . [9690-24]

11:20 am: **In vivo imaging of cerebral hemodynamics and regional oxygen saturation in rats with a digital red-green-blue camera**, Izumi Nishidate, Yoshika Harasaki, Tokyo Univ. of Agriculture and Technology (Japan); Satoko Kawauchi, Shunichi Sato, National Defense Medical College (Japan); Manabu Sato, Yasuaki Kokubo, Yamagata Univ. (Japan) . . . . . [9690-25]

11:40 am: **Spatiotemporal characteristics of spreading depolarization, hypoxemia and vasoconstriction caused by a laser-induced shock wave in the rat brain**, Satoko Kawauchi, National Defense Medical College (Japan); Wataru Okuda, Izumi Nishidate, Tokyo Univ. of Agriculture and Technology (Japan); Hiroshi Nawashiro, Tokorozawa Central Hospital (Japan); Shunichi Sato, National Defense Medical College (Japan) . . . . . [9690-26]

# CONFERENCE 9690B

LOCATION: ROOM 3001 (WEST LEVEL 3)

Monday–Tuesday 15–16 February 2016 • Part of Proceedings of SPIE Vol. 9690

## Neural Imaging and Sensing

BIOS

Conference Chairs: **E. Duco Jansen**, Vanderbilt Univ. (USA); **Qingming Luo**, Huazhong Univ. of Science and Technology (China)

Conference Co-Chairs: **Jun Ding**, Stanford School of Medicine (USA); **Anna W. Roe**, Vanderbilt Univ. (USA)

Program Committee: **David A. Boas**, Massachusetts General Hospital (USA); **Yu Chen**, Univ. of Maryland, College Park (USA); **Javier DeFelipe**, Univ. Politécnica de Madrid (Spain); **Hongwei Dong**, Univ. of California, Los Angeles (USA); **Congwu Du**, Stony Brook Univ. (USA); **Beop-Min Kim**, Korea Univ. (Korea, Republic of); **Vesa Kiviniemi**, Univ. of Oulu (Finland); **Pengcheng Li**, Britton Chance Ctr. for Biomedical Photonics (China); **Anita Mahadevan-Jansen**, Vanderbilt Univ. (USA); **Francesco Saverio Pavone**, European Lab. for Non-linear Spectroscopy (Italy); **Kambiz Pourrezaei**, Drexel Univ. (USA); **Claus-Peter Richter**, Northwestern Univ. (USA); **Shy Shoham**, Technion-Israel Institute of Technology (Israel); **Vladislav Toronov**, Ryerson Univ. (Canada); **Shaoqun Zeng**, Britton Chance Ctr. for Biomedical Photonics (China)

### MONDAY 15 FEBRUARY

#### SESSION 1

LOCATION: ROOM 3001 (WEST LEVEL 3) MON 8:00 AM TO 10:10 AM

#### Neural Imaging I

Session Chair: **Qingming Luo**,  
Huazhong Univ. of Science and Technology (China)

8:00 am: **Non-invasive assessment of cerebral microcirculation with diffuse optics and coherent hemodynamics spectroscopy** (*Invited Paper*), Sergio Fantini, Angelo Sassaroli, Tufts Univ. (USA); Jana M. Kainerstorfer, Tufts Univ. (USA) and Carnegie Mellon Univ. (USA); Kristen T. Tgavalekos, Xuan Zang, Tufts Univ. (USA) . . . . . [9690-27]

8:30 am: **A novel time-domain diffuse correlation spectroscopy (DCS) system for improved transcranial measurement of cerebral blood flow (CBF)**, Jason Sutin, Massachusetts General Hospital (USA) and Boston Univ. (USA); Danil Tyulmankov, Athinoula A. Martinos Ctr. for Biomedical Imaging (USA) and Massachusetts Institute of Technology (USA); Bernhard Zimmermann, Massachusetts General Hospital (USA); Juliette Selb, Massachusetts General Hospital (USA) and Harvard Medical School (USA); David A. Boas, Athinoula A. Martinos Ctr. for Biomedical Imaging (USA) and Harvard Medical School (USA); Maria Angela Franceschini, Massachusetts General Hospital (USA) and Harvard Medical School (USA) . . . . . [9690-28]

8:50 am: **Elucidation of the role of biological factors and device design in cerebral NIRS using an in vivo hematoma model based on high-frequency ultrasound**, Jianting Wang, Stanley Huang, Matthew Myers, U.S. Food and Drug Administration (USA); Yu Chen, Univ. of Maryland, College Park (USA); Cristin G. Welle, T. Joshua Pfeifer, U.S. Food and Drug Administration (USA) . . . . . [9690-29]

9:10 am: **A portable, multi-channel fNIRS system for prefrontal cortex: Preliminary study on neurofeedback and imagery tasks**, Seung-ho Paik, Beop-Min Kim, Korea Univ. (Korea, Republic of) . . . . . [9690-30]

9:30 am: **NIRS-based noninvasive cerebrovascular regulation assessment**, Stephanie Miller, Isabelle L. Richmond M.D., Florida Institute of Technology (USA); John Borgos, Brain Check Medical LLC (USA); Kunal Mitra, Florida Institute of Technology (USA) . . . . . [9690-31]

9:50 am: **Wearable wireless cerebral oximeter**, Xin Zhang, Tianzi Jiang, Institute of Automation (China) . . . . . [9690-32]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

#### SESSION 2

LOCATION: ROOM 3001 (WEST LEVEL 3) MON 10:40 AM TO 12:00 PM

#### Neural Imaging II

Session Chair: **David A. Boas**,  
Athinoula A. Martinos Ctr. for Biomedical Imaging (USA)

10:40 am: **A spatially resolved diffuse correlation spectroscopy for cerebral blood flow measurement in the layered structure of head**, Yu Shang, Univ. of Kentucky (USA) and North Univ. of China (China); Guoqiang Yu, Univ. of Kentucky (USA) . . . . . [9690-33]

11:00 am: **Evaluation of time-resolved multi-distance methods to retrieve absorption and reduced scattering coefficients of adult heads in vivo: Optical parameters dependences on geometrical structures of the models used to calculate reflectance**, Tadatashi Tanifuji, Kitami Institute of Technology (Japan) . . . . . [9690-34]

11:20 am: **Chronic monitoring of cortical hemodynamics in behaving, freely-moving rats using a miniaturized head-mounted optical microscope**, Iliya Sigal, Raanan Gad, Univ. of Toronto (Canada); Margaret Koletar, Sunnybrook Research Institute (Canada); Dene Ringuette, Univ. of Toronto (Canada); Bojana Stefanovic, Sunnybrook Health Sciences Ctr. (Canada); Ofer Levi, Univ. of Toronto (Canada) . . . . . [9690-35]

11:40 am: **Multi-modal in vivo imaging of brain blood oxygenation, blood flow and neural calcium dynamics during acute seizures**, Dene Ringuette, Univ. of Toronto (Canada); Melanie A. Jeffrey, Peter L. Carlen M.D., Toronto Western Hospital (Canada); Ofer Levi, Univ. of Toronto (Canada) and Institute of Biomaterials & Biomedical Engineering (IBBME) (Canada) . . . . . [9690-36]

Lunch Break . . . . . Mon 12:00 pm to 1:30 pm

#### SESSION 3

LOCATION: ROOM 3001 (WEST LEVEL 3) . . . MON 1:30 PM TO 3:10 PM

#### Neural Imaging III

Session Chair: **Jun Ding**, Stanford Univ. Medical Ctr. (USA)

1:30 pm: **Mapping whole-brain activity with cellular resolution by light-sheet microscopy and high-throughput image analysis**, Ludovico Silvestri, European Lab. for Non-linear Spectroscopy (Italy); Nikita Rudinskiy, Massachusetts General Hospital (USA); Marco Paciscopi, Univ. degli Studi di Firenze (Italy); Marie Caroline Mullenbroich, Irene Costantini, Leonardo Sacconi, European Lab. for Non-linear Spectroscopy (Italy); Paolo Frasconi, Univ. degli Studi di Firenze (Italy); Bradley T. Hyman, MassGeneral Institute for Neurodegenerative Disease (USA); Francesco Saverio Pavone, European Lab. for Non-linear Spectroscopy (Italy) . . . . . [9690-37]

1:50 pm: **Fast whole-brain optical tomography capable of automated slice-collection**, Jing Yuan, Tao Jiang, Lei Deng, Beng Long, Jie Peng, Qingming Luo, Hui Gong, Huazhong Univ. of Science and Technology (China) . . . [9690-38]

2:10 pm: **High throughput optical imaging of the CLARITY-processed tissue**, Heejin Choi, Massachusetts Institute of Technology (USA); Xi Zhou, Shih-Chi Chen, The Chinese Univ. of Hong Kong (Hong Kong, China); Kwanghun Chung, Massachusetts Institute of Technology (USA) . . . . . [9690-39]

# CONFERENCE 9690B

LOCATION: ROOM 3001 (WEST LEVEL 3)

2:30 pm: **Low-light CoDiM super-resolution imaging to observe ultrastructural effects of cannabinoid receptor activation on neuronal growth and synaptic connections**, Stephane Oddos, Bioaxial (France); Maureen McFadden, Ecole Supérieure de Physique et de Chimie Industrielles de la Ville de Paris (France); Judith Pineau, Bioaxial (France) and Ecole Supérieure de Physique et de Chimie Industrielles de la Ville de Paris (France); Roger Persson, Clément Fallet, Bioaxial (France); Jean-Yves Tinevez, Audrey Salles, Institut Pasteur (France); Gabriel Y. Sirat, Bioaxial (France); Lionel Moisan, René Descartes Univ. (France); Spencer L. Shorte, Institut Pasteur (France); Zolt Lenkei, Ecole Supérieure de Physique et de Chimie Industrielles de la Ville de Paris (France) . . . . . [9690-40]

2:50 pm: **Two-photon multiplane imaging of neural circuits**, Weijian Yang, Jae-eun K. Miller, Luis Carrillo-Reid, Columbia Univ. (USA); Eftychios Pneumatikakis, Simons Foundation (USA) and Columbia Univ. (USA); Liam Paninski, Darcy S. Peterka, Rafael Yuste, Columbia Univ. (USA) . . . . . [9690-41]

Coffee Break . . . . . Mon 3:10 pm to 3:40 pm

## SESSION 4

LOCATION: ROOM 3001 (WEST LEVEL 3) . . MON 3:40 PM TO 5:00 PM

### Neural Imaging IV

Session Chair: **Anna Wang Roe**, Vanderbilt Univ. (USA)

3:40 pm: **Fluorescent nanodiamond and lanthanide labeled in situ hybridization for the identification of RNA transcripts in fixed and CLARITY-cleared central nervous system tissues**, Lindsay M. Parker, Macquarie Univ. (Australia); Vicky Staikopoulos, Mark R. Hutchinson, The Univ. of Adelaide (Australia); Nicole H. Packer, Macquarie Univ. (Australia) . . [9690-42]

4:00 pm: **Novel phosphorescent materials for in-vivo imaging of brain structure and function**, Gregory Boverman, Xiaolei Shi, Alok M. Srivastava, Robert J. Filkins, Victoria E. Coter, Peter W. Lorraine, A. Nadeem Ishaque, GE Global Research (USA) . . . . . [9690-44]

4:20 pm: **Network inference from functional experimental data**, Patrick Desrosiers, Simon Labrecque, Maxime Tremblay, Institut Univ. en Santé Mentale de Québec (Canada); Mathieu Bélanger, Bertrand De Dorlodot, Univ. Laval (Canada); Daniel C. Côté, Institut Univ. en Santé Mentale de Québec (Canada) . . . . . [9690-45]

4:40 pm: **Multi-channel fiber photometry for population neuronal activity recording**, Qingchun Guo, Huazhong Univ. of Science and Technology (China); Jingfeng Zhou, National Institute of Biological Sciences (China); Qian Liu, Huazhong Univ. of Science and Technology (China); Qiru Feng, Rui Lin, National Institute of Biological Sciences (China); Hui Gong, Qingming Luo, Shaoqun Zeng, Huazhong Univ. of Science and Technology (China); Minmin Luo, National Institute of Biological Sciences (China); Ling Fu, Huazhong Univ. of Science and Technology (China) . . . . . [9690-46]

## POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

Conference attendees are invited to attend the BIOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Obstructive sleep apnea-hypopnea results in significant variations in cerebral hemodynamics detected by diffuse optical spectroscopies**, Yu Shang, Univ. of Kentucky (USA) and North Univ. of China (China); Yajun Hou, Univ. of Kentucky (USA) and Shenyang Ligong Univ. (China); Ran Cheng, Univ. of Kentucky (USA) and Univ. of Louisville (USA); Youquan Zhao, Univ. of Kentucky (USA) and Tianjin Univ. (China); Don Hayes M.D., Univ. of Kentucky (USA) and Ohio State Univ. (USA); Guoqiang Yu, Univ. of Kentucky (USA) . . . . . [9690-63]

**An optical topography guided scheme of diffuse optical tomography for visual cortex functional imaging**, Feng Gao, Jiao Li, Huijuan Zhao, Tianjin Univ. (China) . . . . . [9690-64]

**Shed a light in fatigue detection with Near-infrared spectroscopy during long-lasting driving**, Ting Li, Yuan Gao, Univ. of Electronic Science and Technology of China (China) . . . . . [9690-65]

**Hemodynamic responses can modulate the brain oscillations in low frequency**, Zhen Yuan, Fengmei Lu, Univ. of Macau (Macao, China) . . [9690-66]

**The hemodynamic changes in the human prefrontal cortex during the Flanker and Simon tasks: a fNIRS study**, Zhen Yuan, Univ. of Macau (Macao, China) . . . . . [9690-67]

**Combination of hyperspectral imaging and skull optical clearing for dynamic oxygen saturation in cortical microvessels**, Wei Feng, Chao Zhang, Rui Shi, Yanjie Zhao, Dan Zhu, Huazhong Univ. of Science and Technology (China) . . . . . [9690-68]

**Image intensity restoration for whole brain dataset of micro-optical sectioning tomography**, Anan Li, Jie Peng, Yalun Zhang, Qingming Luo, Hui Gong, Huazhong Univ. of Science and Technology (China) . . . . . [9690-69]

**Investigating vascular remodeling in the cerebral cortex of mice due to chronic cranial window**, Baoqiang Li, Athinoula A. Martinos Ctr. for Biomedical Imaging (USA); Michèle Desjardins, Céline Matéo, Univ. of California, San Diego (USA); Buyin Fu, Sreekanth Kura, Jonghwan Lee, Athinoula A. Martinos Ctr. for Biomedical Imaging (USA); David Kleinfeld, Univ. of California, San Diego (USA); David A. Boas, Sava Sakadžić, Anna Devor, Athinoula A. Martinos Ctr. for Biomedical Imaging (USA) . . . . . [9690-70]

**Functional brain imaging of moving mouse using fiber-based multi-channels near infrared spectroscopy (NIRS)**, Young Kyu Kim, Seung-ho Paik, Beop-Min Kim, Korea Univ. (Korea, Republic of) . . . . . [9690-71]

**A single camera, two channel hemodynamic imaging of the mouse brain without removing skull**, Sedef Erdogan, Seung-ho Paik, Young Kyu Kim, Beop-Min Kim, Korea Univ. (Korea, Republic of) . . . . . [9690-72]

**Cerebral hemodynamic correlates of blood-brain barrier integrity in hyperacute focal ischemia**, Aishwarya Bandla, Xiaolei Cai, Yu-Hang Liu, National Univ. of Singapore (Singapore); Bin Liu, National Univ. of Singapore (Singapore); Nitish V. Thakor, Lun-De Liao, National Univ. of Singapore (Singapore) . . . . . [9690-73]

**Fluorescent tracer compatible optical clearing methods for imaging peripheral nervous system**, Tingting Yu, Yisong Qi, Jianyi Xu, Huazhong Univ. of Science and Technology (China); Wentao Chen, Youlai Yu, Bo Chen, Xiaofeng Yin, Baoguo Jiang, Peking Univ. People's Hospital (China); Dan Zhu, Huazhong Univ. of Science and Technology (China) . . . . . [9690-74]

**Ablation efficiency and thermal damage of infrared lasers on ex vivo lamp brain tissues**, Baturay Ozgurun, Bogaziçi Univ. (Turkey) . . . . . [9690-75]

## TUESDAY 16 FEBRUARY

### SESSION 5

LOCATION: ROOM 3001 (WEST LEVEL 3) . . TUE 8:00 AM TO 10:00 AM

### Neural Imaging V

Session Chair: **Beop-Min Kim**,

Korea Univ. Medical Library (Korea, Republic of)

8:00 am: **Acute changes associated with electrode insertion measured with optical coherence microscopy**, Daniel X. Hammer, Andrea Lozzi, Adam Boretzky, Anant Agrawal, Cristin G. Welle, U.S. Food and Drug Administration (USA) . . . . . [9690-47]

8:20 am: **Ultra-high resolution polarization-sensitive optical coherence microscopy for brain imaging at 6  $\mu\text{m}$ , 3.4  $\mu\text{m}$  and 1.3  $\mu\text{m}$  resolution**, Hui Wang, Athinoula A. Martinos Ctr. for Biomedical Imaging (USA); Taner Akkin, Univ. of Minnesota, Twin Cities (USA); Caroline V. Magnain, Mohamad A. Yaseen, Avilash Cramer, Ruopeng Wang, Sava Sakadžić, David A. Boas, Athinoula A. Martinos Ctr. for Biomedical Imaging (USA) . . . . . [9690-48]

8:40 am: **Assessing the effects of electrical stimulation on peripheral nerve vasculature using speckle variance optical coherence angiography**, Srikanth Vasudevan, Doe Kumsa, Pavel Takmakov, Cristin G. Welle, Daniel X. Hammer, U.S. Food and Drug Administration (USA) . . . . . [9690-49]

9:00 am: **Quantifying axis orientation in 3D using polarization-sensitive optical coherence tomography**, Chao Liu, Adam J. Black, Hui Wang, Taner Akkin, Univ. of Minnesota, Twin Cities (USA) . . . . . [9690-50]

9:20 am: **Optical coherence tomography for detection of compound action potential in *Xenopus laevis* sciatic nerve**, Francesca Troiani, Konstantin Nikolic, Timothy G. Constandinou, Imperial College London (United Kingdom) . . . . . [9690-51]

9:40 am: **High-spatial-resolution mapping of the oxygen concentration in cortical tissue**, Rajeshwer S. Jaswal, Mohammad A. Yaseen, Athinoula A. Martinos Ctr. for Biomedical Imaging (USA); Buyin Fu, Massachusetts General Hospital (USA); David A. Boas, Sava Sakadžić, Athinoula A. Martinos Ctr. for Biomedical Imaging (USA) . . . . . [9690-52]

Coffee Break . . . . . Tue 10:00 am to 10:30 am



SESSION 6

LOCATION: ROOM 3001 (WEST LEVEL 3) . TUE 10:30 AM TO 11:50 AM

Neural Imaging VI

Session Chair: **Qingming Luo**,  
Huazhong Univ. of Science and Technology (China)

10:30 am: **Statistical parametric mapping of stimuli-evoked changes in quantitative blood flow using extended-focus optical coherence microscopy**, Paul J. Marchand, Arno Bouwens, Vincent Shamaei, David Nguyen, Jerome Extermann, Tristan Bolmont, Theo Lasser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9690-53]

10:50 am: **Optical microangiography enabling visualization of change in meninges after traumatic brain injury in mice in vivo**, Woo June Choi, Wan Qin, Xiaoli Qi, Ruikang K. Wang, Univ. of Washington (USA) . . . . . [9690-54]

11:10 am: **Study the neurovascular effects of the integrated therapeutic intervention for ischemic stroke by using the ECoG-fPAM system**, Yu-Hang Liu, Aishwarya Bandla, Nitish V. Thakor, Lun-De Liao, National Univ. of Singapore (Singapore) . . . . . [9690-55]

11:30 am: **In vitro and in vivo analysis and characterization of engineered spinal neural implants**, Erez Shor, Shy Shoham, Shulamit Levenberg, Technion-Israel Institute of Technology (Israel) . . . . . [9690-56]

Lunch/Exhibition Break . . . . . Tue 11:50 am to 1:20 pm

SESSION 7

LOCATION: ROOM 3001 (WEST LEVEL 3) . . . . TUE 1:20 PM TO 3:20 PM

Optical Manipulation

Session Chairs: **E. Duco Jansen**, Vanderbilt Univ. (USA);  
**Shy Shoham**, Technion-Israel Institute of Technology (Israel)

1:20 pm: **Short infrared (IR) laser pulses can cause nanoporation-induced activation of the IP3 pathway**, Caleb C. Roth, The Univ. of Texas Health Science Ctr. at San Antonio (USA); Melissa Tarango, Gleb P. Tolstykh, General Dynamics Information Technology (USA); Bennett L. Ibey, Tri Service Research Lab. (USA); Randolph D. Glickman, The Univ. of Texas Health Science Ctr. at San Antonio (USA); Hope T. Beier, Air Force Research Lab. (USA) . . . . . [9690-57]

1:40 pm: **Studying the mechanism of neurostimulation with infrared laser light using GCaMP6s and Rhodamine B imaging**, David Moreau, Claire Lefort, Sylvia Bardet-Coste, Rodney P. O'Connor, XLIM Institut de Recherche (France) . . . . . [9690-58]

2:00 pm: **Selective control of small versus large diameter axons using infrared laser light**, Emilie H. Lothet, Kendrick M. Shaw, Case Western Reserve Univ. (USA); Charles C. Horn, Univ. of Pittsburgh Cancer Institute (USA); Hui Lu, Yves T. Wang, Case Western Reserve Univ. (USA); E. Duco Jansen, Vanderbilt Univ. (USA); Hillel J. Chiel, Michael W. Jenkins, Case Western Reserve Univ. (USA) . . . . . [9690-59]

2:20 pm: **Modeling the effect of elevated temperatures on action potential propagation in unmyelinated axons**, Mohit Ganguly, Vanderbilt Univ. (USA); Michael W. Jenkins, Hillel J. Chiel, Case Western Reserve Univ. (USA); E. Duco Jansen, Vanderbilt Univ. (USA) . . . . . [9690-60]

2:40 pm: **All optical experimental design for neuron excitation, inhibition, and action potential detection**, Alex J. Walsh, National Research Council (USA) and Air Force Research Lab. (USA); Jody C. Ullery, Air Force Research Lab. (USA); Ibtissam Echchgadda, Air Force Research Lab (USA); Hope T. Beier, Air Force Research Lab. (USA) . . . . . [9690-61]

3:00 pm: **Analysis of optical neural stimulation effects on neural networks affected by neurodegenerative diseases**, Mihail Zverev, Félix Fanjul-Vélez, Irene Salas-García, Univ. de Cantabria (Spain); Noé Ortega-Quijano, Institut de Physique de Rennes (France) and Univ. de Cantabria (Spain); José Luis Arce-Diego, Univ. de Cantabria (Spain) . . . . . [9690-62]

# CONFERENCE 9690C

LOCATION: ROOM 3001 (WEST LEVEL 3)

Saturday–Sunday 13–14 February 2016 • Part of Proceedings of SPIE Vol. 9690

# Optogenetics and Optical Manipulation

Conference Chairs: **Samarendra K. Mohanty**, The Univ. of Texas at Arlington (USA); **Nitish V. Thakor**, Johns Hopkins Univ. (USA)

Program Committee: **Antoine Adamantidis**, McGill Univ. (Canada); **George J. Augustine**, Duke–NUS Graduate Medical School (Singapore); **Klaus B. Gerwert**, Ruhr–Univ. Bochum (Germany); **Xue Han**, Boston Univ. (USA); **Elizabeth M. Hillman**, Columbia Univ. (USA); **Richard Kramer**, Univ. of California, Berkeley (USA); **Alfred L. Nuttall**, Oregon Health & Science Univ. (USA); **Anna W. Roe**, Vanderbilt Univ. (USA); **Ulrich T. Schwarz**, Fraunhofer IAF (Germany), IMTEK, Univ. of Freiburg (Germany); **John P. Welsh**, Univ. of Washington (USA); **Rafael Yuste M.D.**, Columbia Univ. (USA)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 3001 (WEST LEVEL 3) . . . SAT 9:00 AM TO 12:10 PM

### Optogenetics and Optical Control I

Session Chair: **Samarendra K. Mohanty**,  
The Univ. of Texas at Arlington (USA)

9:00 am: **Engineering brighter probes for advanced cellular imaging** (*Keynote Presentation*), Luke Lavis, Howard Hughes Medical Institute (USA) . . . . . [9690-76]

9:50 am: **Design considerations for miniaturized optical neural probes**, Linda Rudmann, Juan S. Ordonez, Thomas Stieglitz, Univ. of Freiburg (Germany) . . . . . [9690-77]

Coffee Break . . . . . Sat 10:10 am to 10:40 am

10:40 am: **Modulation of Channelrhodopsin-2 mediated currents by femtosecond pulse shaping** (*Invited Paper*), Kush Paul, Univ. of Illinois at Urbana-Champaign (USA); Eugene D. Ark, Univ. of Illinois at Urbana Champaign (USA); Haohua Tu, Youbo Zhao, Yuan-Zhi Liu, Javier I. Suarez, Parijat Sengupta, Stephen A. Boppart M.D., Univ. of Illinois at Urbana-Champaign (USA) [9690-78]

11:10 am: **Activation of cells using femtosecond laser beam**, Subrata Batabyal, Sarmishtha Satpathy, Young-tae Kim, Samarendra K. Mohanty, The Univ. of Texas at Arlington (USA) . . . . . [9690-79]

11:30 am: **Targeted illumination and tracking using optical fiber probe for optogenetics application**, Anant B. Shinde, Sandeep M. Perinchery, Vadakke Matham Murukeshan, Nanyang Technological Univ. (Singapore) . . . . . [9690-80]

11:50 am: **Spatially controlled optogenetic light stimulation and recording platform via imaging fiber bundles**, Javier I. Suárez, Parijat Sengupta, Jonathan Guo-Han Mun, Rajashekar Iyer, Justin Rhodes, Martha U. Gillette, Stephen A. Boppart M.D., Univ. of Illinois at Urbana-Champaign (USA) [9690-81]

Lunch/Exhibition Break . . . . . Sat 12:10 pm to 1:40 pm

### SESSION 2

LOCATION: ROOM 3001 (WEST LEVEL 3) . . . SAT 1:40 PM TO 4:30 PM

### Optogenetics and Optical Control II

Session Chair: **Nitish V. Thakor**, Johns Hopkins Univ. (USA)

1:40 pm: **Optogenetic stimulation of myelination**, In Hong Yang, Johns Hopkins Univ. (USA) and National Univ. of Singapore (Singapore); Hae Ung Lee, Nitish V. Thakor, National Univ. of Singapore (Singapore) [9690-82]

2:00 pm: **Nano-enhanced optical delivery into targeted cells**, Weldon Wright, Sanjay Pradhan, Nanoscope Technologies, LLC (USA) . . . . . [9690-83]

2:20 pm: **Optogenetic stimulation of multiwell MEA plates for neural and cardiac applications**, Isaac P. Clements, Daniel C. Millard, Anthony M. Nicolini, James D. Ross, Axion BioSystems (USA) . . . . . [9690-84]

2:40 pm: **Label free detection of optogenetically stimulated cellular activity by low coherence interferometry**, Sarmishtha Satpathy, Subrata Batabyal, Digant P. Dave, Samarendra K Mohanty, The Univ. of Texas at Arlington (USA) . . . . . [9690-85]

Coffee Break . . . . . Sat 3:00 pm to 3:30 pm

3:30 pm: **Optogenetic control of the cardiac conduction system**, Claudia Crocini, European Lab. for Non-linear Spectroscopy (Italy); Cecilia Ferrantini, Raffaele Coppini, Univ. degli Studi di Firenze (Italy); Leslie M. Loew, Univ. of Connecticut Health Ctr. (USA); Elisabetta Cerbai, Corrado Poggessi, Univ. degli Studi di Firenze (Italy); Francesco S. Pavone, Leonardo Sacconi, European Lab. for Non-linear Spectroscopy (Italy) . . . . . [9690-86]

3:50 pm: **Optogenetic pacing in Drosophila melanogaster**, Aneesh Alex, Jing Men, Chao Zhou, Lehigh Univ. (USA) . . . . . [9690-87]

4:10 pm: **Temporal and spatial mapping of neuronal signals in brain slice using image-guided recording system**, Jeonghyeon Lee, Ulsan National Institute of Science and Technology (Korea, Republic of); Jaemyung Jang, Seoul National Univ. (Korea, Republic of); Nam Hyun Cho, Songye Baek, Ulsan National Institute of Science and Technology (Korea, Republic of); Noo Li Jeon, Seoul National Univ. (Korea, Republic of); Woonggyu Jung, Ulsan National Institute of Science and Technology (Korea, Republic of) and Institute for Basic Science (Korea, Republic of) . . . . . [9690-88]

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 3

LOCATION: ROOM 3001 (WEST LEVEL 3) . . SUN 9:30 AM TO 12:10 PM

### Optogenetics and Optical Control III

Session Chair: **Nitish V. Thakor**, Johns Hopkins Univ. (USA)

9:30 am: **Experimental assessment of thermal effects of high power density light stimulation for optogenetics control of deep brain structures**, Yann Suhan Senova, C.H.U. Henri-Mondor (France) and INSERM (France) and Univ. Paris-EST (France); Ilona Scisniak, Univ. Paris-Sud 11 (France) and Univ. Paris-Saclay (France); Chih Chieh Chiang, National Tsing Hua Univ. (Taiwan); Claire Martin, Institut National de Physique Nucléaire et de Physique des Particules (France) and Univ. Paris-Saclay (France) and Ctr. National de la Recherche Scientifique (France); Stephane Palfi, C.H.U. Henri-Mondor (France) and INSERM (France) and Univ. Paris-Est Créteil Val de Marne (France); Antoine Chaillet, Univ. Paris-Sud 11 (France) and Univ. Paris-Saclay (France) and Lab. des Signaux et Systèmes (France); Frederic Pain, Univ. Paris-Sud 11 (France) and Univ. Paris-Saclay (France) and Ctr. National de la Recherche Scientifique (France) . . . . . [9690-90]

9:50 am: **Computational modeling of optogenetic neuronal excitation under complex illumination conditions using a Matlab-Neuron interface**, Guy Yona, Yonatan Weissler, Nizan Meitav, Eilran Guzi, Dafna D. Rifold, Itamar Kahn, Shy Shoham, Technion-Israel Institute of Technology (Israel) . . . . . [9690-91]

10:10 am: **Gold nanoparticle plasmonics enhanced ultrafast laser-induced optoporation and stimulation of targeted cells** (*Invited Paper*), Michel Meunier, Eric Bergeron, Ecole Polytechnique de Montréal (Canada); Flavie Lavoie-Cardinal, Univ. Laval (Canada); Christos Boutopoulos, Ecole Polytechnique de Montréal (Canada); Charleen Salses, Univ. Laval (Canada); Françoise M. Winnik, Univ. de Montréal (Canada); Paul De Koninck, Univ. Laval (Canada) . . . . . [9690-92]

Coffee Break . . . . . Sun 10:40 am to 11:10 am

11:10 am: **Hybrid polymer waveguide characterization for microoptical tools with integrated laser diode chips for optogenetic applications at 430 nm and 650 nm**, Michael Schwaerzle, Julian Nehlich, Ulrich T. Schwarz, Oliver Paul, Patrick Ruther, Univ. of Freiburg (Germany) . . . . . [9690-93]

11:30 am: **In vivo all-optical electrophysiology in mice using two-photon fluorescence microscopy and optogenetic techniques**, James R. Mester, Univ. of Toronto (Canada) and Sunnybrook Research Institute (Canada); Paolo Bazzigaluppi, Univ. of Toronto (Canada) and Toronto Western Hospital (Canada); John G. Sled, Univ. of Toronto (Canada) and Toronto Ctr. for Phenogenomics (Canada); Bojana Stefanovic, Sunnybrook Health Sciences Ctr. (Canada) and Univ. of Toronto (Canada) . . . . . [9690-94]

11:50 am: **Laser nano-surgery for neuronal manipulation**, Hori Pada Sarker, Lalit Chudal, Vasu Mahapatra, Young-tae Kim, Samarendra K. Mohanty, The Univ. of Texas at Arlington (USA) . . . . . [9690-95]

Lunch/Exhibition Break . . . . . Sun 12:10 pm to 1:40 pm

**SESSION 4**

**LOCATION: ROOM 3001 (WEST LEVEL 3) . . . SUN 1:40 PM TO 3:00 PM**

**Optogenetics and Optical Control IV**

Session Chair: **Samarendra K. Mohanty**,  
The Univ. of Texas at Arlington (USA)

1:40 pm: **Light distribution properties in spinal cord for optogenetic stimulation**, Alicja Gąsecka, Mohamed Bahdine, Nicolas Lapointe, Veronique Rioux, Jimena Perez-Sanchez, Robert P. Bonin, Yves De Koninck, Univ. Laval (Canada); Daniel Côté, Ctr. de Recherche de l'Univ. Laval Robert-Giffard (Canada) . . . . . [9690-96]

2:00 pm: **Head-mounted LED for optogenetic experiments of freely-behaving animal**, Ki Yong Kwon, Andrew G. Gnade, Alexander D. Rush, Craig D. Patten, Plexon Inc. (USA) . . . . . [9690-97]

2:20 pm: **Digital holographic microscopy for imaging biophysical changes in cells during migration**, Kien V. Nham, Dong Hur, Young-tae Kim, Samarendra K. Mohanty, The Univ. of Texas at Arlington (USA) . . . . . [9690-98]

2:40 pm: **Two-photon holographic optogenetics of neural circuits**, Weijian Yang, Luis Carrillo-Reid, Darcy S. Peterka, Rafael Yuste, Columbia Univ. (USA) . . . . . [9690-99]

# CONFERENCE 9691A

LOCATION: ROOM 3012 (WEST LEVEL 3)

Sunday–Monday 14–15 February 2016 • Part of Proceedings of SPIE Vol. 9691

## Endoscopic Microscopy XI

Conference Chairs: **Guillermo J. Tearney M.D.**, Wellman Ctr. for Photomedicine (USA); **Thomas D. Wang**, Univ. of Michigan (USA)

Program Committee: **David L. Dickensheets**, Montana State Univ. (USA); **Arthur F. Gmitro**, The Univ. of Arizona (USA); **Ralf Kiesslich M.D.**, Johannes Gutenberg Univ. Mainz (Germany); **Francois Lacombe**, Mauna Kea Technologies (France); **Stephen Lam M.D.**, The BC Cancer Agency Research Ctr. (Canada); **Hiroshi Mashimo**, VA Boston Healthcare System (USA); **Kenzi Murakami**, Olympus Corp. (Japan); **Norman S. Nishioka M.D.**, Massachusetts General Hospital (USA); **Wibool Piyawattanametha**, King Mongkut's Institute of Technology Ladkrabang (Thailand); **Mark J. Schnitzer**, Stanford Univ. School of Medicine (USA); **Peter T. C. So**, Massachusetts Institute of Technology (USA); **Melissa J. Suter**, Massachusetts General Hospital (USA)

### SUNDAY 14 FEBRUARY

#### SESSION 1

LOCATION: ROOM 3012 (WEST LEVEL 3) . SUN 8:00 AM TO 10:00 AM

#### Virtual Biopsy of the Gut

Session Chair: **Alex J. Thompson**, Imperial College London (United Kingdom)

8:00 am: **A horizon scan on the use of virtual biopsy techniques to study and monitor environmental enteric dysfunction** (*Invited Paper*), Alex J. Thompson, Michael R. Hughes, Salzitsa Anastasova, Guang-Zhong Yang, Imperial College London (United Kingdom) ..... [9691-53]

8:30 am: **Imaging the intestinal barrier defect in Environmental Enteropathy using confocal laser endomicroscopy** (*Invited Paper*), M. Paul Kelly, Queen Mary, Univ. of London (United Kingdom) ..... [9691-54]

9:00 am: **High resolution microendoscopy for early detection of esophageal cancer in low-resource settings** (*Invited Paper*), Rebecca Richards-Kortum, Rice Univ. (USA) ..... [9691-55]

9:30 am: **Tethered capsule endomicroscopy of the intestine** (*Invited Paper*), Michalina J. Gora, CNRS (France) and Massachusetts General Hospital (USA) ..... [9691-56]

Coffee Break ..... Sun 10:00 am to 10:30 am

#### SESSION 2

LOCATION: ROOM 3012 (WEST LEVEL 3) . SUN 10:30 AM TO 11:50 AM

#### OCT I

Session Chair: **Michalina J. Gora**, CNRS (France), Massachusetts General Hospital (United States)

10:30 am: **Tethered capsule OCT endomicroscopy: from bench to bedside at the primary care office**, Michalina J. Gora, CNRS (France) and Massachusetts General Hospital (USA); Leigh H. Simmons, Massachusetts General Hospital (USA); Aubrey R. Tiernan, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA) and Harvard Medical School (USA); Catriona N. Grant, Amna R. Soomro, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA); Elizabeth S. Walker Corkery, Massachusetts General Hospital (USA); Mireille Rosenberg, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA) and Harvard Medical School (USA); Joshua P. Metlay, Massachusetts General Hospital (USA); Guillermo J. Tearney M.D., Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA) and Harvard Medical School (USA) ..... [9691-1]

10:50 am: **Flexible micro-OCT endobronchial probe for imaging of mucociliary transport**, Dongyao Cui, Wellman Ctr. for Photomedicine (USA) and Nanyang Technological Univ. (Singapore); Kengyeh K. Chu, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Carolin I. Unglert, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Timothy N. Ford, Robert W. Carruth, Daryl Hyun, Kanwarpal Singh, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Susan E. Birket, Gregory Fleming James Cystic Fibrosis Research Ctr. (USA) and The Univ. of Alabama at Birmingham School of Medicine (USA); George M. Solomon, Steven M. Rowe M.D., Gregory Fleming James Cystic Fibrosis Research Ctr. (USA) and The Univ. of Alabama at Birmingham (USA); Guillermo J. Tearney M.D., Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA) ..... [9691-2]

11:10 am: **Broadband rotary joint for high speed ultrahigh resolution endoscopic OCT imaging**, Milad Alemohammad, Wu Yuan, Jessica Mavadia-Shukla, Wenxuan Liang, Xiaoyun Yu, Shaoyong Yu, Xingde Li, Johns Hopkins Univ. (USA) ..... [9691-3]

11:30 am: **Endoscopic micro-OCT with extended depth of focus using binary phase spatial filter**, Jun Young Kim, Jingchao Xing, Hanyang Univ. (Korea, Republic of); Joon Woo Song, Korea Univ. (Korea, Republic of); Hongki Yoo, Hanyang Univ. (Korea, Republic of); Jin Won Kim, Korea Univ. (Korea, Republic of) ..... [9691-4]

Lunch Break ..... Sun 11:50 am to 1:20 pm

#### SESSION 3

LOCATION: ROOM 3012 (WEST LEVEL 3) . . . SUN 1:20 PM TO 3:00 PM

#### Confocal and Multimodality Imaging

Session Chair: **Arthur F. Gmitro**, The Univ. of Arizona (USA)

1:20 pm: **A novel piezoelectric microstage with embedded sensor for dual axes confocal endomicroscopy**, Jongsoo Choi, Zhen Qiu, Choong-Ho Rhee, Thomas D. Wang M.D., Kenn R. Oldham, Univ. of Michigan (USA) . . . . . [9691-5]

1:40 pm: **Surgical multi-color probe based confocal endomicroscopy: when pathologists finally enter the OR**, Francois Lacombe, Christof Schäffauer, Sophie Clade, Mauna Kea Technologies (France) ..... [9691-6]

2:00 pm: **A prospective cohort: probe based confocal laser endomicroscopy for peripheral pulmonary lesions**, Yuji Matsumoto, Takehiro Izumo, Yoshihisa Hiraishi, Takaaki Tsuchida, National Cancer Ctr. Hospital East (Japan) ..... [9691-7]

2:20 pm: **Performance of combined OCT/MFI microendoscope for ovarian cancer detection**, Molly Keenan, The Univ. of Arizona (USA); Tyler Tate, College of Optical Sciences, The Univ. of Arizona (USA); John Black, Glanvanta, Inc. (USA); Urs Utzinger, Jennifer K. Barton, The Univ. of Arizona (USA) ..... [9691-8]

2:40 pm: **Two-photon autofluorescence/FLIM/SHG endoscopy to study the oral cavity and wound healing in humans**, Karsten König, Univ. des Saarlandes (Germany) and JenLab GmbH (Germany) ..... [9691-9]

Coffee Breaks ..... Sun 3:00 pm to 3:30 pm

#### SESSION 4

LOCATION: ROOM 3012 (WEST LEVEL 3) . . . .SUN 3:30 PM TO 5:10 PM

#### Novel Endoscopic Probes

Session Chair: **Thomas D. Wang M.D.**, Univ. of Michigan (USA)

3:30 pm: **High-resolution and ultra-thin endo-microscopy using a GRIN rod lens**, Hyung-Jin Kim, Changhyeong Yoon, Taeseok D. Yang, Wonshik Choi, Korea Univ. (Korea, Republic of); Beop-Min Kim, Korea Univ. College of Health Sciences (Korea, Republic of) and Korea Univ. (Korea, Republic of); Youngwoon Choi, Korea Univ. (Korea, Republic of) ..... [9691-10]

3:50 pm: **Two-photon lensless endoscopy by controlling the wave front in a multi-core optical fiber**, Siddharth Sivankutty, Esben R. Andresen, Institut Fresnel (France); Géraud Bouwmans, Lab. de Physique des Lasers, Atomes et Molécules (France); Serge Monneret, Hervé Rigneault, Institut Fresnel (France) ..... [9691-11]

4:10 pm: **Extra flat, flexible and disposable endoscope for lateral imaging**, Guillaume Basset, Benjamin Gallinet, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland); Christophe Hofer, Cattaneo Stefano, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland); Patrick Volet, Marc Schnieper, Rolando Ferrini, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland) ..... [9691-12]



# CONFERENCE 9691A

## LOCATION: ROOM 3012 (WEST LEVEL 3)

### SESSION 6

LOCATION: ROOM 3012 (WEST LEVEL 3) . MON 10:30 AM TO 11:50 AM

### OCT II

Session Chair: **Melissa J. Suter**, Massachusetts General Hospital (USA)

10:30 am: **Reducing the cost of tethered capsule endomicroscopy for Barrett's esophagus screening**, Rohith Reddy, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Michalina J. Gora, CNRS (France) and Massachusetts General Hospital (USA); Matthew Beatty, Massachusetts General Hospital (USA); Wolfgang Trasischker, Jing Dong, Kanwarpal Singh, Kengyeh K. Chu, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Weina Lu, Wellman Ctr. for Photomedicine (USA); Robert W. Carruth, Aubrey R. Tiernan, Amna R. Soomro, Catriona N. Grant, Mireille Rosenberg, Massachusetts General Hospital (USA); Guillermo J. Tearney M.D., Massachusetts General Hospital (USA) and Harvard Medical School (USA) . . . . . [9691-21]

10:50 am: **Tethered capsule OCT endomicroscopy for upper gastrointestinal tract imaging by using ball lens based probe**, Jing Dong, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Michalina J. Gora, CNRS (France) and Massachusetts General Hospital (USA); Rohith Reddy, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA); Wolfgang Trasischker, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Oriane Poupart, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Weina Lu, Wellman Ctr. for Photomedicine (USA); Robert W. Carruth, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA); Catriona N. Grant, Wellman Ctr. for Photomedicine (USA); Amna R. Soomro, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA); Aubrey R. Tiernan, Harvard Medical School (USA); Mireille Rosenberg, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA); Norman S Nishioka M.D., Massachusetts General Hospital (USA); Guillermo J. Tearney M.D., Wellman Ctr. for Photomedicine (USA) . . . . . [9691-22]

11:10 am: **Feasibility of optical coherence tomography to detect radiation-induced esophageal damage in small animal models**, Pouya Jelvehgaran, Academisch Medisch Centrum (Netherlands) and Institute for Lasers, Life and Biophotonics Amsterdam (Netherlands); Tanja Alderliesten, Academisch Medisch Centrum (Netherlands); Javier Salguero, Gerben Borst, Ji-Ying Song, The Netherlands Cancer Institute (Netherlands); Ton G. van Leeuwen, Academisch Medisch Centrum (Netherlands); Johannes F. de Boer, Vrije Univ. Amsterdam (Netherlands) and Institute for Lasers, Life and Biophotonics Amsterdam (Netherlands); Daniel M. de Bruin, Academisch Medisch Centrum (Netherlands); Marcel B. van Herk, The Univ. of Manchester (United Kingdom) and Academisch Medisch Centrum (Netherlands) . . . . . [9691-23]

11:30 am: **Detection of colon polyps using Doppler optical coherence tomography imaging of microvascular hemodynamics**, Weston A. Welge, College of Optical Sciences, The Univ. of Arizona (USA); Jennifer K. Barton, The Univ. of Arizona (USA) . . . . . [9691-24]

Lunch Break . . . . . Mon 11:50 am to 1:20 pm

### SESSION 7

LOCATION: ROOM 3012 (WEST LEVEL 3) . . . MON 1:20 PM TO 2:20 PM

## Miniature Instruments for Endoscopic Microscopy

Joint Session with Conferences 9691A and 9760

Session Chair: **Wibool Piyawattanametha**, King Mongkut's Institute of Technology Ladkrabang (Thailand)

1:20 pm: **Development of a MEMS-based endoscopic OCT probe to detect bladder cancer**, Liliana M. Peinado, Academisch Medisch Centrum (Netherlands); Jaap P. Verheggen, Innoluce BV (Netherlands); Paul R. Bloemen, Xu U. Zhang, Anouk L. Post, Ton G. van Leeuwen, Dirk J. Faber, Academisch Medisch Centrum (Netherlands) . . . . . [9691-25]

1:40 pm: **A microfabricated water-immersible scanning mirror with a small form factor for handheld ultrasound and photoacoustic microscopic imaging applications**, Song Xu, Chih-Hsien Huang, Jun Zou, Texas A&M Univ. (USA) . . . . . [9760-1]

2:00 pm: **A microfabricated two-axis water-immersible scanning mirror for scanning optical and acoustic microscopy**, Song Xu, Chih-Hsien Huang, Jun Zou, Texas A&M Univ. (USA) . . . . . [9760-2]

4:30 pm: **Nonlinear endoscope using Kagomé lattice hollow-core fibers**, Alberto Lombardini, Siddharth Sivankutty, Xueqin Chen, Jérôme Wenger, Institut Fresnel (France); Rémi Habert, Coralie Fourcade-Dutin, Lab. de Physique des Lasers, Atomes et Molécules (France); Esben R. Andresen, Institut Fresnel (France); Alexandre Kudlinski, Lab. de Physique des Lasers, Atomes et Molécules (France); Hervé Rigneault, Institut Fresnel (France) . . . . . [9691-13]

4:50 pm: **The integration of single fiber reflectance (SFR) spectroscopy during endoscopic ultrasound-guided fine needle aspirations (EUS-FNA) in pancreatic masses: a feasibility study**, Paulien L. Stegehuis, Leonora S. F. Boogerd M.D., Akin Inderson, Roeland A. Veenendaal, Bert A. Bonsing, Leiden Univ. Medical Ctr. (Netherlands); Arjen Amelink, TNO (Netherlands); Alexander L. Vahrmeijer M.D., Jouke Dijkstra, Leiden Univ. Medical Ctr. (Netherlands); Dominic J. Robinson, Erasmus MC (Netherlands) . . . . . [9691-14]

## MONDAY 15 FEBRUARY

### SESSION 5

LOCATION: ROOM 3012 (WEST LEVEL 3) . MON 8:00 AM TO 10:00 AM

## Spectral Encoding

Session Chair: **DongKyun Kang**, Massachusetts General Hospital (USA)

8:00 am: **Optically sectioned spatial-spectral coded holographic fluorescence microscopy**, Hsi-Hsun Chen, Chen-Yen Lin, Wei Tang Lin, Yuan Luo, National Taiwan Univ. (Taiwan) . . . . . [9691-15]

8:20 am: **Clinical experience of using the tethered capsule-based spectrally encoded confocal microendoscopy for diagnosis of eosinophilic esophagitis**, Dukho Do, Wellman Ctr. for Photomedicine (USA); Sanaz Alali, Massachusetts General Hospital (USA); DongKyun Kang, Wellman Ctr. for Photomedicine (USA); Nima Tabatabaie, York Univ. (Canada); Weina Lu, Wellman Ctr. for Photomedicine (USA); Catriona N. Grant, Massachusetts General Hospital (USA); Amna R. Soomro, Wellman Ctr. for Photomedicine (USA); Norman S. Nishioka M.D., Massachusetts General Hospital (USA); Mireille Rosenberg, Wellman Ctr. for Photomedicine (USA); Paul E. Hesterberg, Qian Yuan, John J. Garber, Aubrey J. Katz M.D., Wayne G. Shreffler, Massachusetts General Hospital (USA); Guillermo J. Tearney M.D., Wellman Ctr. for Photomedicine (USA) . . . . . [9691-16]

8:40 am: **SECM half-inch tethered endoscopic capsule for esophageal imaging**, DongKyun Kang, Minkyu Kim, Robert W. Carruth, Weina Lu, Tao Wu, Sanaz Alali, Dukho Do, Amna R. Soomro, Catriona N. Grant, Aubrey R. Tiernan, Mireille Rosenberg, Norman S. Nishioka M.D., Guillermo J. Tearney M.D., Massachusetts General Hospital (USA) . . . . . [9691-17]

9:00 am: **Reflectance confocal microscopy of red blood cells: simulation and experiment**, Adel Zeidan, Daniella Yeheskely-Hayon, Limor Minai, Dvir Yelin, Technion-Israel Institute of Technology (Israel) . . . . . [9691-18]

9:20 am: **Simple, monolithic optical element for forward-viewing spectrally encoded endoscopy**, Dukho Do, Wellman Ctr. for Photomedicine (USA); Dongkyun Kang, Massachusetts General Hospital (USA); Mitsuhiro Ikuta, Canon U.S.A., Inc. (USA); Guillermo J. Tearney M.D., Wellman Ctr. for Photomedicine (USA) . . . . . [9691-19]

9:40 am: **Image-guided optical measurement of blood oxygen saturation within capillary vessels**, Kfir Akons, Adel Zeidan, Daniella Yeheskely-Hayon, Limor Minai, Dvir Yelin, Technion-Israel Institute of Technology (Israel) . [9691-20]

Coffee Break . . . . . Mon 10:00 am to 10:30 am

# CONFERENCE 9691A

**LOCATION: ROOM 3012 (WEST LEVEL 3)**

## POSTERS-MONDAY

**LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM**

Conference attendees are invited to attend the BiOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Optical coherence tomography imaging of colonic crypts in a mouse model of colorectal cancer**, Weston A. Welge, College of Optical Sciences, The Univ. of Arizona (USA); Jennifer K. Barton, The Univ. of Arizona (USA) . . . . . [9691-26]

**Tethered capsule endomicroscopy with capsule position localization for diagnosis of diseases of the upper gastrointestinal tract**, Oriane Poupart, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA) and Ecole Centrale Marseille (France) and Harvard Medical School (USA); Michalina J. Gora, CNRS (France) and Massachusetts General Hospital (USA); Jing Dong, Wolfgang Trasischker, Rohith Reddy, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA); Weina Lu, Wellman Ctr. for Photomedicine (USA); Robert W. Carruth, Massachusetts General Hospital (USA); Matthew Beatty, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA); Aubrey R. Tiernan, Harvard Medical School (USA); Mireille Rosenberg, Massachusetts General Hospital (USA); Guillermo J. Tearney M.D., Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA) and Harvard Medical School (USA) and Harvard-MIT Health Sciences and Technology (USA) . . . . . [9691-27]

# CONFERENCE 9691B

LOCATION: ROOM 3018 (WEST LEVEL 3)

Saturday–Sunday 13–14 February 2016 • Part of Proceedings of SPIE Vol. 9691

# Optical Techniques in Pulmonary Medicine III

BIOS

Conference Chairs: **Melissa J. Suter**, Massachusetts General Hospital (USA); **Stephen Lam M.D.**, The BC Cancer Agency Research Ctr. (Canada); **Matthew Brenner**, Univ. of California, Irvine (USA)

Program Committee: **Michael A. Choma M.D.**, Yale School of Medicine (USA); **Johannes de Boer**, Vrije Univ. Amsterdam (Netherlands); **Lida P. Hariri M.D.**, Massachusetts General Hospital (USA); **Edmund Koch**, Universitätsklinikum Carl Gustav Carus Dresden (Germany); **Robert A. McLaughlin**, The Univ. of Western Australia (Australia); **Septimiu D. Murgu M.D.**, The Univ. of Chicago (USA); **David D. Sampson**, The Univ. of Western Australia (Australia); **Luc Thiberville**, Rouen Univ. Hospital (France); **Victor X. D. Yang**, Ryerson Univ. (Canada)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 3018 (WEST LEVEL 3) .. SAT 8:30 AM TO 10:30 AM

### Clinical Imaging

Session Chair: **Stephen Lam M.D.**, BC Cancer Research Ctr. (Canada)

8:30 am: **Pulmonary applications of confocal microendoscopy** (*Invited Paper*), Luc Thiberville M.D., Rouen Univ. Hospital (France) ..... [9691-29]

9:10 am: **In vivo imaging of pulmonary nodule and vasculature using endoscopic co-registered optical coherence tomography and autofluorescence imaging**, Hamid Pahlevaninezhad, Anthony Lee M.D., Geoffrey Hohert, Carley Schwartz, Tawimas Shaipanich M.D., Alexander J. Ritchie, BC Cancer Agency Research Ctr. (Canada); Wei Zhang M.D., BC Cancer Agency Research Ctr. (Canada) and Peking Univ. First Hospital (China); Calum E. MacAulay, Stephen Lam M.D., Pierre M. Lane, BC Cancer Agency Research Ctr. (Canada) ..... [9691-30]

9:30 am: **Assessing airway response to a segmental allergen challenge using OCT**, David C. Adams, Alyssa J. Miller, Jasmin A. Holz, Margit V. Szabari, Lida P. Hariri M.D., R. Scott Harris, Jocelyn L. Cho, Daniel L. Hamilos M.D., Andrew D. Luster, Benjamin D. Medoff, Melissa J. Suter, Massachusetts General Hospital (USA) ..... [9691-31]

9:50 am: **Real-time endoscopic Raman spectroscopy for in vivo early lung cancer detection**, Michael A. Short, Hanna C. McGregor, Annette McWilliams M.D., BC Cancer Agency Research Ctr. (Canada); Tawimas Shaipanich M.D., BC Cancer Agency Research Ctr. (Canada) and The Univ. of British Columbia (Canada); Diana N. Ionescu, The Univ. of British Columbia (Canada); Jianhua Zhao, Wenbo Wang, Guannan Chen, BC Cancer Agency Research Ctr. (Canada); Stephen Lam M.D., BC Cancer Agency Research Ctr. (Canada) and The Univ. of British Columbia (Canada); Haishan Zeng, BC Cancer Agency Research Ctr. (Canada) ..... [9691-32]

10:10 am: **A study of airway smooth muscle in asthmatic and non-asthmatic airways using PS-OCT**, David C. Adams, Jasmin A. Holz, Margit V. Szabari, Lida P. Hariri M.D., R. Scott Harris, Jocelyn L. Cho, Daniel L. Hamilos M.D., Andrew D. Luster, Benjamin D. Medoff, Melissa J. Suter, Massachusetts General Hospital (USA) ..... [9691-33]

Coffee Break ..... Sat 10:30 am to 11:00 am

### SESSION 2

LOCATION: ROOM 3018 (WEST LEVEL 3) .. SAT 11:00 AM TO 12:20 PM

### Animal Models

Session Chair: **Lida P. Hariri M.D.**, Massachusetts General Hospital (USA)

11:00 am: **Using optical frequency domain imaging in the evaluation of airway dynamics in Methacholine challenged sheep**, Margit V. Szabari, Vanessa J. Kelly, Matthew B. Applegate, Chunmin Chee, Khay M. Tan, Lida P. Hariri M.D., R. Scott Harris, Tilo Winkler, Melissa J. Suter, Massachusetts General Hospital (USA) ..... [9691-34]

11:20 am: **Visualization of rat airway damage from toxic chemical agents using an all fiber based OCT imaging probe**, Joseph C. Jing, Beckman Laser Institute and Medical Clinic (USA) and Univ. of California, Irvine (USA); Livia A. Veress, Carl W. White, Univ. of Colorado Denver (USA); Sari B. Mahon, Beckman Laser Institute and Medical Clinic (USA); Matthew Brenner M.D., Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA) and Univ. of California, Irvine (USA) ..... [9691-35]

11:40 am: **Monitoring the impact of bronchial thermoplasty on airway smooth muscle using polarization sensitive optical coherence tomography**, Jasmin A. Holz, David C. Adams, Lida P. Hariri M.D., Christopher Manley, Massachusetts General Hospital (USA); Sean Fleury, Seamus O'Shaughnessy, Jason Weiner, Boston Scientific Corp. (USA); Melissa J. Suter, Massachusetts General Hospital (USA) ..... [9691-36]

12:00 pm: **The effect of low level laser therapy on ventilator-induced lung injury in mice**, Margit V. Szabari, Alyssa J. Miller, Lida P. Hariri M.D., Michael R. Hamblin, Guido Musch, Helene Stroh, Melissa J. Suter, Massachusetts General Hospital (USA) ..... [9691-37]

Lunch/Exhibition Break ..... Sat 12:20 pm to 1:50 pm

### SESSION 3

LOCATION: ROOM 3018 (WEST LEVEL 3) .... SAT 1:50 PM TO 3:30 PM

### Cilia and Mucus Transport

Session Chairs: **Michael A. Choma M.D.**, Yale School of Medicine (USA); **Melissa J. Suter**, Massachusetts General Hospital (USA)

1:50 pm: **Imaging of mucus clearance in the airways of living spontaneously breathing mice by optical coherence microscopy**, Mario Pieper, Hinnerk Schulz-Hildebrandt, Gereon Hfttmann, Univ. zu Lfbeck (Germany) and Airway Research Ctr. North (Germany) and Deutsche Zentrum ffr Lungenforschung (Germany); Peter KÜnig, Univ. zu Lfbeck (Germany) and Airway Research Ctr. North (Germany) and Deutsche Zentrum ffr Lungenforschung (Germany) ..... [9691-38]

2:10 pm: **OCT-based three-dimensional, three vector component imaging of cilia-driven fluid flow in animal models of ciliated respiratory epithelium**, Brendan K. Huang, Kevin C. Zhou, Ute A. Gamm, Vineet Bhandari, Mustafa K. Khokha M.D., Michael A. Choma M.D., Yale Univ. (USA) ..... [9691-39]

2:30 pm: **Comprehensive imaging of mucociliary clearance, pH, and rheology**, Diana Mojahed, Tufts Univ. (USA); Kengyeh K. Chu, Timothy N. Ford, Massachusetts General Hospital (USA); Susan E. Birket, Courtney Fernandez, Steven M. Rowe, The Univ. of Alabama at Birmingham (USA); Guillermo J. Tearney, Massachusetts General Hospital (USA) ..... [9691-40]

2:50 pm: **Towards all-optical quantification of force- and power-based performance metrics in cilia-driven fluid flow physiology**, Brendan K. Huang, Mustafa K. Khokha M.D., Michael Loewenberg, Michael A. Choma M.D., Yale Univ. (USA) ..... [9691-41]

3:10 pm: **Endoscopic optical coherence microscopy for imaging the upper airways in humans**, Hinnerk Schulz-Hildebrandt, Mario Pieper, Peter KÜnig, Gereon Hfttmann, Univ. zu Lfbeck (Germany) ..... [9691-42]

Coffee Break ..... Sat 3:30 pm to 4:00 pm

# CONFERENCE 9691B

LOCATION: ROOM 3018 (WEST LEVEL 3)

## SESSION 4

LOCATION: ROOM 3018 (WEST LEVEL 3) . . . SAT 4:00 PM TO 5:20 PM

### New Techniques for Clinical Imaging

Session Chair: **Melissa J. Suter**, Massachusetts General Hospital (USA)

4:00 pm: **Assessing idiopathic pulmonary fibrosis with bronchoscopic optical coherence tomography**, Lida P. Hariri M.D., David C. Adams, Massachusetts General Hospital (USA); Thomas V. Colby M.D., Mayo Clinic Arizona (USA); Andrew M. Tager M.D., Melissa J. Suter, Massachusetts General Hospital (USA) . . . . . [9691-43]

4:20 pm: **Rapid multispectral imaging endoscopy system for real-time mapping of the mucosa blood supply in the lung**, Yasser Fawzy, Stephen Lam M.D., Haishan Zeng, BC Cancer Agency Research Ctr. (Canada) . [9691-44]

4:40 pm: **Using polarization-sensitive optical coherence tomography to identify tumor stromal fibrosis and increase tumor biopsy yield**, Lida P. Hariri M.D., David C. Adams, Alyssa J. Miller, Mari Mino-Kenudson M.D., Melissa J. Suter, Massachusetts General Hospital (USA) . . . . . [9691-45]

5:00 pm: **Exploiting the relationship between birefringence and force to measure airway smooth muscle contraction with PS-OCT**, David C. Adams, Lida P. Hariri M.D., Jasmin A. Holz, Margit V. Szabari, R. Scott Harris, Jocelyn L. Cho, Daniel L. Hamilos M.D., Andrew D. Luster, Benjamin D. Medoff, Melissa J. Suter, Massachusetts General Hospital (USA) . . . . . [9691-46]

**BiOS Hot Topics**  
**SAT 7:00 PM TO 9:00 PM**  
**LOCATION: ROOM 3022 (WEST LEVEL 3)**  
See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

## SESSION 5

LOCATION: ROOM 3018 (WEST LEVEL 3) . . SUN 8:30 AM TO 10:30 AM

### New Approaches, Advancements and Techniques

Session Chair: **Robert A. McLaughlin**,  
The Univ. of Western Australia (Australia)

8:30 am: **Multimodal in vivo imaging of lung cancer and its microenvironment**, Lida P. Hariri M.D., Matthew J. Niederst, Hillary Mulvey, David C. Adams, Haichuan Hu, Isabel Chico-Calero, Margit V. Szabari, Benjamin J. Vakoc, Tayyaba Hasan, Brett E. Bouma, Jeffrey A. Engelman M.D., Melissa J. Suter, Massachusetts General Hospital (USA) . . . . . [9691-47]

8:50 am: **Optical coherence tomography imaging to analyze biofilm thickness from distal to proximal regions of endotracheal tubes**, Robert E. Dunn, Andrew E. Heidari, Samer Moghaddam M.D., Univ. of California, Irvine (USA) and Beckman Laser Institute and Medical Clinic (USA); Mengke Zhang, Beckman Laser Institute and Medical Clinic (USA); Changhoon Han, Kyung-Jin Oh, Chonnam National Univ. Medical School (Korea, Republic of); Steve Leven, Univ. of California, Irvine (USA); Matthew Brenner M.D., Univ. of California, Irvine (USA) and Beckman Laser Institute and Medical Clinic (USA); Carl Genberg, N8 Medical, Inc. (USA); Zhongping Chen, Univ. of California, Irvine (USA) . . . . . [9691-48]

9:10 am: **Correction of motion artifacts in OCT-AFI data collected in airways**, Elham Abouei, The Univ. of British Columbia (Canada); Pierre M. Lane, Hamid Pahlevaninezhad, Anthony Lee M.D., Stephen Lam M.D., Calum E. MacAulay, BC Cancer Agency Research Ctr. (Canada) . . . . . [9691-49]

9:30 am: **Ultra-small 3D printed micro-lens and mirror assembly for endoscopic assessment of the airway**, Peter Fejes, Jiawen Li, Rodney W. Kirk, Bryden C. Quirk, Dirk Lorensen, Fiona M. Wood, David D. Sampson, Robert A. McLaughlin, The Univ. of Western Australia (Australia) . . . . . [9691-50]

9:50 am: **Needle catheter optical coherence tomography in lung tissue**, Jasmin A. Holz, Yan Wang, Massachusetts General Hospital (USA); Milen Shishkov, Wellman Ctr. for Photomedicine (USA); David C. Adams, Lida P. Hariri M.D., Colleen L. Channick, Colleen M. Keyes, Michael Lanuti, Melissa J. Suter, Massachusetts General Hospital (USA) . . . . . [9691-51]

10:10 am: **Basophils activation test as a new implementation of optics in medicine**, Anna Skotny, Wroclaw Medical Univ. (Poland); Barbara Kmiecik, Wroclaw Univ. of Technology (Poland) . . . . . [9691-52]



# CONFERENCE 9692

LOCATION: ROOM 3010 (WEST LEVEL 3)

Sunday 14 February 2016 • Proceedings of SPIE Vol. 9692

# Lasers in Dentistry XXII

Conference Chairs: **Peter Rechmann**, Univ. of California, San Francisco (USA); **Daniel Fried**, Univ. of California, San Francisco (USA)

Program Committee: **Gregory B. Altshuler**, Palomar Medical Technologies, Inc. (USA); **Tatjana Dostálová M.D.**, Charles Univ. in Prague (Czech Republic); **Thomas Ertl**, Univ. Stuttgart (Germany); **David M. Harris**, Bio-Medical Consultants, Inc. (USA); **Jörg Meister**, Universitätsklinikum Bonn (Germany); **Eric J. Seibel**, Univ. of Washington (USA)

## SUNDAY 14 FEBRUARY

### SESSION 1

LOCATION: ROOM 3010 (WEST LEVEL 3) . . SUN 9:10 AM TO 10:10 AM

### Lasers and Endodontics, Nanoparticle Dentin Conditioning

Session Chair: **Peter Rechmann**, Univ. of California, San Francisco (USA)

9:10 am: **Comparing irradiation parameters on disinfecting enterococcus faecalis in root canal disinfection**, Ayse S. Kabas Sarp, Murat Gülsoy, Bogaziçi Univ. (Turkey) . . . . . [9692-1]

9:30 am: **405-nm diode laser, alone and in conjunction with a Fenton's reaction system in the endodontic root canal disinfection**, Giuseppe Lagori, Jean Paul Rocca D.D.S., Carlo Fornaini M.D., Univ. de Nice Sophia Antipolis (France); Elisabetta Merigo D.D.S., Univ. de Nice Sophia Antipolis (France) . . . . . [9692-2]

9:50 am: **A digital moiré interferometric analysis on the effect of nanoparticle conditioning on the mechanical behavior of dentin**, Fang-Chi Li, Anil Kishen II, Univ. of Toronto (Canada) . . . . . [9692-3]

Coffee Break . . . . . Sun 10:10 am to 10:40 am

### SESSION 2

LOCATION: ROOM 3010 (WEST LEVEL 3) . SUN 10:40 AM TO 12:00 PM

### CO<sub>2</sub> Lasers in Ablation and Caries Prevention, Er:YAG for Debonding

Session Chair: **Daniel Fried**, Univ. of California, San Francisco (USA)

10:40 am: **Microsecond enamel ablation with 10.6µm CO<sub>2</sub> laser radiation**, Wojciech S. Góra, Heriot-Watt Univ. (United Kingdom); Ailbhe McDonald, Eastman Dental Institute (United Kingdom); Duncan P. Hand, Jonathan D. Shephard, Heriot-Watt Univ. (United Kingdom) . . . . . [9692-4]

11:00 am: **A new sealed RF-excited CO<sub>2</sub> laser for hard tissue ablation operating at 9.4µm with pulse duration of 26 µs**, Kenneth H. Chan, Jamison Jew, Cynthia L. Darling, Daniel Fried, Univ. of California, San Francisco (USA) . . . . . [9692-5]

11:20 am: **Enhancing caries resistance with a short-pulsed CO<sub>2</sub> 9.3-µm laser: a laboratory study**, Peter Rechmann, Beate M.T. Rechmann, Univ. of California San Francisco (USA); William H. Groves Jr., Convergent Dental Inc. (USA); Charles Le, Marcia L. Rapozo-Hilo, John D. B. Featherstone, Univ. of California San Francisco (USA) . . . . . [9692-6]

11:40 am: **Er:YAG laser metal and ceramic bracket debonding**, Tatjana Dostálová, Charles Univ. in Prague (Czech Republic); Helena Jelínková, Jan Šulc, Michal Němec, David Vyhřídál, Czech Technical Univ. in Prague (Czech Republic); Marek Remes, Charles Univ. in Prague (Czech Republic) . . . . . [9692-7]

Lunch/Exhibition Break . . . . . Sun 12:00 pm to 2:00 pm

### SESSION 3

LOCATION: ROOM 3010 (WEST LEVEL 3) . . . SUN 2:00 PM TO 3:20 PM

### Imaging of Dental Hard Tissues

Session Chair: **Peter Rechmann**, Univ. of California, San Francisco (USA)

2:00 pm: **Long-wave infrared thermophotonic imaging of early demineralization in dental hard tissue**, Ashkan Ojaghi, Artur Parkhimchik, Nima Tabatabaei, York Univ. (Canada) . . . . . [9692-8]

2:20 pm: **A system for simultaneous near-infrared reflectance and transillumination imaging of occlusal lesions**, Jacob C. Simon, Cynthia L. Darling, Daniel Fried, Univ. of California, San Francisco (USA) . . . . . [9692-9]

2:40 pm: **Structured changes in dentin lesions after remineralization with PS-OCT, thermal and near-infrared reflectance imaging**, Robert C. Lee, Cynthia L. Darling, Daniel Fried, Univ. of California, San Francisco (USA) . . . . . [9692-10]

3:00 pm: **Noninvasive optical spectroscopy technique for measuring optical properties of human teeth**, Mohamed M. Gadallah, Military Technical College (Egypt); Yasser H. El-Sharkawy, Military Technical College (Egypt) . . . [9692-11]

Coffee Break . . . . . Sun 3:20 pm to 3:50 pm

### SESSION 4

LOCATION: ROOM 3010 (WEST LEVEL 3) . . . SUN 3:50 PM TO 4:30 PM

### Lasers in Oral Surgery

Session Chair: **Daniel Fried**, Univ. of California, San Francisco (USA)

3:50 pm: **Comparative study for labial frenectomy: diode laser 980 nm vs Nd:YAG laser**, Elisabetta Merigo, Carlo Fornaini M.D., Fabrizio Grati D.D.S., Paolo Vescovi, Maddalena Manfredi D.D.S., Univ. degli Studi di Parma (Italy) . . . . . [9692-12]

4:10 pm: **Blue diode laser: a new approach in oral surgery?**, Carlo Fornaini M.D., Elisabetta Merigo D.D.S., Stefano Selleri, Annamaria Cucinotta, Univ. degli Studi di Parma (Italy) . . . . . [9692-13]

### POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWVPosterGuidelines>.

**Evaluation of gingival thickness and biotype using optical coherence tomography**, Chiaki Maeda, National Ctr. for Geriatrics and Gerontology (Japan); Junji Tagami, Tokyo Medical and Dental Univ. (Japan); Yasunori Sumi D.D.S., National Ctr. for Geriatrics and Gerontology (Japan) . . . . . [9692-14]

**Non-destructive inspection methods for metal-ceramic restoration using swept-source optical coherence tomography**, Chiaki Maeda, National Ctr. for Geriatrics and Gerontology (Japan); Junji Tagami, Tokyo Medical and Dental Univ. (Japan); Yasunori Sumi D.D.S., National Ctr. for Geriatrics and Gerontology (Japan) . . . . . [9692-15]

**Two-dimensional detection and quantification of dental plaque using swept-source optical coherence tomography (SS-OCT)**, Yoshihiro Heshiki, Chiaki Maeda, National Ctr. for Geriatrics and Gerontology (Japan); Junji Tagami, Tokyo Medical and Dental Univ. (Japan); Yasunori Sumi D.D.S., National Ctr. for Geriatrics and Gerontology (Japan) . . . . . [9692-16]

BIOS

# CONFERENCE 9692

## LOCATION: ROOM 3010 (WEST LEVEL 3)

**Three-dimensional quantification of dental plaque using swept-source optical coherence tomography**, Yoshihiro Heshiki, National Ctr. for Geriatrics and Gerontology (Japan) . . . . . [9692-17]

**Evaluation of Vickers hardness of bulk-fill composites cured by different light sources**, Turki A. Bakhsh, Mohammed A. Yagmoor, King Abdulaziz Univ. (Saudi Arabia); Ahmad Jamleh, King Saud bin Abdulaziz Univ. for Health Sciences (Saudi Arabia) . . . . . [9692-18]

**Hard-tissue drilling by short-pulse CO<sub>2</sub> laser with controllable pulse-tail energy**, Kazuyuki Uno, Tatsufumi Sasaki, Takuya Yamamoto, Tetsuya Akitsu, Univ. of Yamanashi (Japan); Takahisa Jitsuno, Osaka Univ. (Japan) . . . [9692-19]

**Diode 830nm laser associated with hydroxyapatite and biological membrane: bone repair in rats**, Vanda Carneiro, Univ. Federal de Pernambuco (Brazil); Francisco A. Limeira Jr., Univ. Federal da Paraíba (Brazil); Marleny E. M. Gerbi, Rebeca F. Menezes, Alexandrino P. Santos-Neto, Natália C. Araújo, Univ. Federal de Pernambuco (Brazil) . . . . . [9692-20]

**Structural changes in the irradiated dentin with Nd:YAG and Er:YAG lasers for cervical hypersensitivity treatment and their influence on the microtensile resistance in resin-dentin interface**, Claudia C. B. O. Mota, Associação Caruaruense de Ensino Superior e Técnico (Brazil) and Univ. Federal de Pernambuco (Brazil); Tatiane V. N. S. Sena D.D.S., Centro Univ. Maurício de Nassau (Brazil); Roseane F. Castro D.D.S., Ana C. Araujo D.D.S., Anderson S. L. Gomes, Univ. Federal de Pernambuco (Brazil) . . . . . [9692-21]

**Evaluation of microshear bond strength of composite to enamel of dental adhesive systems associated with Er,Cr:YSGG laser**, Patricia F. Cassimiro-Silva, Univ. Federal de Pernambuco (Brazil); Carolina Benetti, Instituto de Pesquisas Energéticas e Nucleares (Brazil) and Univ. de São Paulo (Brazil); Gabriela Q. Monteiro, Univ. Federal de Pernambuco (Brazil); Denise M. Zzell, Instituto de Pesquisas Energéticas e Nucleares (Brazil) and Univ. de São Paulo (Brazil); Carlos D. Eduardo D.D.S., Univ. de São Paulo (Brazil); Anderson S. L. Gomes, Univ. Federal de Pernambuco (Brazil) . . . . . [9692-22]

**Evaluation of the erosive action of juices on dental enamels by laser fluorescence and x-rays microfluorescence**, Rebeca F. Menezes, Natália C. Araújo, Vanda Carneiro, Alexandrino P. Santos-Neto, Marleny E. M. Gerbi, Univ. Federal de Pernambuco (Brazil) . . . . . [9692-23]

**Optical coherence tomography investigations of ceramic Lumineers**, Luana O. Fernandes, Natalia D. R. L. Graça, Luciana S. A. de Melo, Claudio H. V. Silva, Anderson S. L. Gomes, Univ. Federal de Pernambuco (Brazil). [9692-24]

**Monitoring the gingival regeneration after aesthetic surgery with optical coherence tomography**, Luana O. Fernandes, Natalia D. R. L. Graça, Luciana S. A. de Melo, Claudio H. V. Silva, Anderson S. L. Gomes, Univ. Federal de Pernambuco (Brazil) . . . . . [9692-25]

**A comparative study of shear bond strength of orthodontic bracket after acid-etched and Er:YAG treatment on enamel surface**, Juliana C. Leao, Claudia C. B. O. Mota, Patricia F. Cassimiro-Silva, Anderson S. L. Gomes, Univ. Federal de Pernambuco (Brazil) . . . . . [9692-26]

**Selective removal of dental composite with a diode-pumped Er:YAG laser**, William A. Fried, Kenneth H. Chan, Daniel Fried, Cynthia L. Darling, Univ. of California, San Francisco (USA) . . . . . [9692-27]

**Enhancement of OCT images with PVS**, Hobin J. Kang, Cynthia L. Darling, Daniel Fried, Univ. of California, San Francisco (USA) . . . . . [9692-28]

**Selective removal of esthetic composite restorations with spectral guided laser ablation**, Ivana Yi, Kenneth H. Chan, Michal Staninec, Cynthia L. Darling, Daniel Fried, Univ. of California, San Francisco (USA) . . . . . [9692-29]

**Analysis of smooth surface structural changes on primary and permanent teeth exposed to acidulated phosphate fluoride in simulated enamel lesion with PS-OCT**, Wilson Tam, Robert C. Lee, Brent P. Lin, Cynthia L. Darling, Daniel Fried, Univ. of California, San Francisco (USA) . . . . . [9692-30]

**Evaluation of the respective thresholds for surface modification and increased acid resistance after CO<sub>2</sub> laser irradiation using PS-OCT and digital microscopy**, Jin Wan Kim, Kenneth H. Chan, Cynthia L. Darling, Daniel Fried, Univ. of California, San Francisco (USA) . . . . . [9692-31]

**A comparison of transillumination at 830 nm vs. 1300 nm for imaging stained and potentially carious occlusal surfaces**, Elias C. Almaz, Jacob C. Simon, Daniel Fried, Cynthia L. Darling, Univ. of California, San Francisco (USA) . . . . . [9692-32]

# CONFERENCE 9693

LOCATION: ROOM 3004 (WEST LEVEL 3)

Saturday–Sunday 13–14 February 2016 • Proceedings of SPIE Vol. 9693

# Ophthalmic Technologies XXVI

BIOS

Conference Chairs: **Fabrice Manns**, Univ. of Miami (USA); **Per G. Söderberg**, Uppsala Univ. (Sweden); **Arthur Ho**, Brien Holden Vision Institute (Australia)

Program Committee: **Rafat R. Ansari**, NASA Glenn Research Ctr. (USA); **Michael Belkin**, Tel Aviv Univ. (Israel); **Kostadinka Bizheva**, Univ. of Waterloo (Canada); **David Borja**, Alcon Labs., Inc. (USA); **Ralf Brinkmann**, Univ. zu Lübeck (Germany); **Wolfgang Drexler**, Medizinische Univ. Wien (Austria); **Daniel X. Hammer**, U.S. Food and Drug Administration (USA); **Karen M. Joos**, Vanderbilt Univ. (USA); **Kirill V. Larin**, Univ. of Houston (USA); **Ezra Maguen**, American Eye Institute (USA); **Donald T. Miller**, Indiana Univ. (USA); **Daniel V. Palanker**, Stanford Univ. (USA); **Jean-Marie Parel**, Bascom Palmer Eye Institute (USA); **Roberto Pini**, Istituto di Fisica Applicata Nello Carrara (Italy); **Luigi Rovati**, Univ. degli Studi di Modena e Reggio Emilia (Italy); **Georg Schuele**, OptiMedica Corp. (USA); **Jerry Sebag**, VMR Institute (USA); **Peter Soliz**, VisionQuest Biomedical, LLC (USA); **Valery V. Tuchin**, N.G. Chernyshevsky Saratov State Univ. (Russian Federation)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 3004 (WEST LEVEL 3) .. SAT 8:30 AM TO 9:30 AM

### Ocular Angiography and Blood Flow

Session Chairs: **Daniel X. Hammer**, U.S. Food and Drug Administration (USA); **Rafat R. Ansari**, NASA Glenn Research Ctr. (USA)

8:30 am: **Total retinal blood flow and reproducibility evaluation by three beam optical Doppler tomography**, Richard Haindl, Wolfgang Trasischker, Andreas Wartak, Bernhard Baumann, Michael Pircher, Christoph K. Hitznerberger, Medizinische Univ. Wien (Austria) . . . . . [9693-1]

8:45 am: **Wide field OCT based microangiography in living human eye**, Qinqin Zhang, Chieh-Li Chen, Zhongdi Chu, Anqi Zhang, Univ. of Washington (USA); Lin An, Mary Durbin, Utkarsh Sharma, Carl Zeiss Meditec, Inc. (USA); Philip J. Rosenfeld, Bascom Palmer Eye Institute (USA); Ruikang K. Wang, Univ. of Washington (USA) . . . . . [9693-2]

9:00 am: **Accurate presentation of choroidal neovascularization in patients using feature space OCT micro-angiography**, Anqi Zhang, Qinqin Zhang, Univ. of Washington (USA); Philip J. Rosenfeld, Univ. of Miami (USA); Ruikang K. Wang, Univ. of Washington (USA) . . . . . [9693-3]

9:15 am: **Retinal axial and transversal flow quantification using Doppler OCT with noise-bias correction**, Maximilian G. O. Gräfe, Vrije Univ. Amsterdam (Netherlands) and Rotterdam Ophthalmic Institute (Netherlands); Leah S. Wilk, Vrije Univ. Amsterdam (Netherlands) and Rotterdam Ophthalmic Institute (Netherlands); Boy Braaf, Vrije Univ. Amsterdam (Netherlands); Jan H. de Jong, Rotterdam Ophthalmic Institute (Netherlands); Jelena Novosel, Rotterdam Ophthalmic Institute (Netherlands) and Technische Univ. Delft (Netherlands); Koenraad A. Vermeer, Rotterdam Ophthalmic Institute (Netherlands); Johannes F. de Boer, Vrije Univ. Amsterdam (Netherlands) . . . . . [9693-4]

### SESSION 2

LOCATION: ROOM 3004 (WEST LEVEL 3) ..SAT 9:30 AM TO 11:30 AM

### Ophthalmic Imaging: Clinical and Surgical

Session Chairs: **Per G. Söderberg M.D.**, Uppsala Univ. (Sweden); **Michael Belkin**, Tel Aviv Univ. (Israel)

9:30 am: **4D microscope-integrated OCT improves accuracy of ophthalmic surgical maneuvers**, Oscar Carrasco-Zevallos, Brenton Keller, Christian Viehland, Liangbo Shen, Duke Univ. (USA); Bozho Todorich, Christine Shieh, Duke Univ. Medical Ctr. (USA); Anthony N. Kuo, Duke Univ. School of Medicine (USA); Cynthia A. Toth M.D., Duke Univ. Medical Ctr. (USA); Joseph A. Izatt, Duke Univ. (USA) . . . . . [9693-5]

9:45 am: **Imaging of fibrotic lesions in neovascular age related macular degeneration by polarization sensitive OCT**, Christoph K. Hitznerberger, Bernhard Baumann, Philipp Roberts, Medizinische Univ. Wien (Austria); Mitsuro Sugita, Medizinische Univ. Wien (Austria) and Canon Inc. (Japan); Michael Pircher, Ursula Schmidt-Erfurth M.D., Medizinische Univ. Wien (Austria) . . . . . [9693-6]

Coffee Break . . . . . Sat 10:00 am to 10:30 am

10:30 am: **long working distance optical coherence tomography for pediatric imaging**, Ruobing Qian, Oscar Carrasco-Zevallos, Duke Univ. (USA); Lejla Vajzovic M.D., Duke Univ. School of Medicine (USA); Boris I. Gramatikov, Johns Hopkins Univ. (USA); David L. Guyton M.D., The Johns Hopkins Hospital (USA); Cynthia A. Toth M.D., Duke Univ. School of Medicine (USA); Joseph A. Izatt, Duke Univ. (USA) . . . . . [9693-7]

10:45 am: **Simultaneous hand-held contact color fundus and SD-OCT imaging for pediatric retinal diseases**, Marco Ruggeri, Victor M. Hernandez, Carolina De Freitas, Nidhi Relhan, Juan Silgado, Fabrice Manns, Jean-Marie A. Parel, Bascom Palmer Eye Institute (USA) . . . . . [9693-8]

11:00 am: **A novel handheld optical coherence tomography imaging system for pediatric retinoblastoma patients: technology development and clinical study**, Oleg Nadiarnykh, Vrije Univ. Amsterdam (Netherlands); Annette C. Moll, Vrije Univ. Medical Ctr. (Netherlands); Johannes F. de Boer, Vrije Univ. Amsterdam (Netherlands) . . . . . [9693-9]

11:15 am: **Comparison of the effectiveness of three retinal camera technologies for malarial retinopathy detection in Malawi**, Peter Soliz, VisionQuest Biomedical, LLC (USA); Sheila C. Nemeth, VisionQuest Biomedical LLC (USA); Terrie Taylor, Michigan State Univ. (USA); Ian MacCormick, Univ. of Liverpool (United Kingdom); Susan Lewallen, Kilimanjaro Ctr. for Community of Ophthalmology (South Africa); Simon Barriga, Vinayak Joshi, Visionquest Biomedical LLC (USA) . . . . . [9693-10]

### SESSION 3

LOCATION: ROOM 3004 (WEST LEVEL 3) ..SAT 11:30 AM TO 12:15 PM

### Pascal Rol Lecture

Session Chair: **Per G. Söderberg M.D.**, Uppsala Univ. (Sweden)

11:30 am: **Need for technologies for advancement in delivering community-based eye care service (Keynote Presentation)**, Mingguang He M.D., The Univ. of Melbourne (Australia) . . . . . [9693-11]

Lunch/Exhibition Break . . . . . Sat 12:15 pm to 1:15 pm

### SESSION 4

LOCATION: ROOM 3004 (WEST LEVEL 3) . . . SAT 1:15 PM TO 2:30 PM

### Ophthalmic Imaging: Small Animal Models

Session Chair: **Kirill V. Larin**, Univ. of Houston (USA)

1:15 pm: **Imaging cellular structures of rat and swine cornea ex vivo using micro optical coherence tomography**, Si Chen, Xinyu Liu, Xiaojuan Yu, Yuemei Luo, Linbo Liu, Nanyang Technological Univ. (Singapore) . . . . . [9693-12]

1:30 pm: **Fluorescent scanning laser ophthalmoscopy for cellular resolution in vivo mouse retinal imaging: benefits and drawbacks of implementing adaptive optics**, Pengfei Zhang, Mayank Goswami, Edward N. Pugh Jr., Univ. of California, Davis (USA); Robert J. Zawadzki, Univ. of California, Davis (USA) and UC Davis Eye Ctr. (USA) . . . . . [9693-13]

1:45 pm: **A wet AMD mouse model investigated by multi-functional OCT**, Marco Augustin, Stanislava Fialová, Roberto Plasenzotti, Michael Pircher, Christoph K. Hitznerberger, Bernhard Baumann, Medizinische Univ. Wien (Austria) . . . . . [9693-14]

2:00 pm: **Visualization of chorioretinal vasculature in mice in vivo using combined OCT/SLO imaging system**, Mayank Goswami, Pengfei Zhang, Edward N. Pugh Jr., UC Davis RISE Eye-Pod Lab. (USA); Robert J. Zawadzki, UC Davis Medical Ctr. (USA) . . . . . [9693-15]

2:15 pm: **In vivo functional optical coherence tomography of fast intrinsic optical signals in mouse retina**, Benquan Wang, Xincheng Yao, Univ. of Illinois at Chicago (USA) . . . . . [9693-16]

# CONFERENCE 9693

LOCATION: ROOM 3004 (WEST LEVEL 3)

## SESSION 5

LOCATION: ROOM 3004 (WEST LEVEL 3) . . SAT 2:30 PM TO 4:45 PM

### Ophthalmic Image Processing and Analysis

Session Chairs: **Donald T. Miller**, Indiana Univ. (USA);  
**Peter Soliz**, VisionQuest Biomedical LLC (USA)

2:30 pm: **Registration of orthogonally oriented wide-field of view OCT volumes using orientation-aware optical flow and retina segmentation**, Jose Lezama, Dibyendu Mukherjee, Ryan P. McNabb, Guillermo Sapiro, Joseph A. Izatt, Sina Farsiu, Anthony N. Kuo, Duke Univ. (USA) . . . . . [9693-17]

2:45 pm: **Length-adjusted graph cuts for automatic segmentation of pathological features in OCT images**, Brenton Keller, Duke Univ. (USA); David L. Cuneffare, Dilraj S. Grewal M.D., Tamer H. Mahmoud M.D., Duke Univ. School of Medicine (USA); Joseph A. Izatt, Sina Farsiu, Duke Univ. (USA) . . . . . [9693-18]

3:00 pm: **Fully-automated segmentation of cone photoreceptors in split detector adaptive optics scanning light ophthalmoscope images**, David L. Cuneffare, Duke Univ. (USA); Robert F. Cooper, Marquette Univ. (USA); Brian Higgins, Alfredo Dubra, Joseph Carroll, Medical College of Wisconsin (USA); Sina Farsiu, Duke Univ. (USA) and Duke Univ. Medical Ctr. (USA) . . . . . [9693-19]

3:15 pm: **Anterior-segment polarization-sensitive OCT with efficient polarimetric speckle reduction**, Masahiro Yamanari, Tomey Corp. (Japan); Satoru Tsuda, Tohoku Univ. School of Medicine (Japan); Taiki Kokubun, Tohoku Univ. School of Medicine (Japan) and Katta General Hospital (Japan); Kazuko Omodaka, Yu Yokoyama, Noriko Himori, Morin Ryu, Shiho Kunimatsu-Sanuki, Hidetoshi Takahashi, Kazuichi Maruyama, Hiroshi Kunikata, Toru Nakazawa, Tohoku Univ. School of Medicine (Japan) . . . . . [9693-20]

Coffee Break . . . . . Sat 3:30 pm to 4:00 pm

4:00 pm: **Quantitative polarization and flow evaluation of choroid and sclera by multifunctional Jones matrix optical coherence tomography**, Satoshi Sugiyama, Univ. of Tsukuba (Japan) and Tomey Corp. (Japan); Young-Joo Hong, Deepa K. Kasaragod, Shuichi Makita, Univ. of Tsukuba (Japan); Masahiro Miura, Tokyo Medical Univ. (Japan); Yasushi Ikuno M.D., Osaka Univ. (Japan); Yoshiaki Yasuno, Univ. of Tsukuba (Japan) . . . . . [9693-21]

4:15 pm: **Estimating a structural bottle neck for eye-brain transfer of visual information from 3D-volumes of the optic nerve head from a commercial OCT device**, Filip Malmberg, Camilla Sandberg-Melin M.D., Per G. Söderberg M.D., Uppsala Univ. (Sweden) . . . . . [9693-22]

4:30 pm: **Analysis of the variation in OCT measurements of a structural bottle neck for eye-brain transfer of visual information from 3D-volumes of the optic nerve head, PIMD(0-2pi)**, Per G. Söderberg M.D., Filip Malmberg, Uppsala Univ. (Sweden); Camilla Sandberg-Melin M.D., Uppsala Univ. (Sweden) and Ophthalmology, Gävle Sjukhus (Sweden) . . . . . [9693-23]

## SESSION 6

LOCATION: ROOM 3004 (WEST LEVEL 3) . . SAT 4:45 PM TO 6:00 PM

### Ophthalmic OCT and SLO Technology

Session Chairs: **Kostadinka Bizheva**, Univ. of Waterloo (Canada);  
**Wolfgang Drexler**, Medizinische Univ. Wien (Austria)

4:45 pm: **Eye motion corrected OCT imaging with Lissajous scan pattern**, Young-Joo Hong, Univ. of Tsukuba (Japan); Yiwei Chen, Univ. of Tsukuba (Japan) and 3Computational Optics and Ophthalmology Group (Japan); Shuichi Makita, En Li, Univ. of Tsukuba (Japan); Masahiro Miura, Tokyo Medical Univ. (Japan); Yoshiaki Yasuno, Univ. of Tsukuba (Japan) . . . . . [9693-24]

5:00 pm: **Multimodal ophthalmic imaging using swept source spectrally encoded scanning laser ophthalmoscopy and optical coherence tomography**, Joseph Malone, Cleveland Clinic (USA); Mohamed T. El-Haddad, The Cleveland Clinic (USA); Logan A. Tye, Case Western Reserve Univ. (USA); Lucas Majeau, Nicolas Godbout, Castor Optics (Canada); Andrew M. Rollins, Case Western Reserve Univ. (USA); Caroline Boudoux, Ctr. d'Optique Photonique et Lasers, Ecole Polytechnique de Montréal (Canada); Yuankai K. Tao, The Cleveland Clinic (USA) . . . . . [9693-25]

5:15 pm: **Parallel scanning light ophthalmoscope for retinal imaging**, Kari V. Vienola, Vrije Univ. Amsterdam (Netherlands) and Rotterdam Ophthalmic Institute (Netherlands); Mathivanan Damodaran, Boy Braaf, Vrije Univ. Amsterdam (Netherlands); Koenraad A. Vermeer, Rotterdam Ophthalmic Institute (Netherlands); Johannes F. de Boer, Vrije Univ. Amsterdam (Netherlands) . . . . . [9693-26]

5:30 pm: **In-vivo, real-time cross-sectional images of retina using a GPU enhanced master slave optical coherence tomography system**, Adrian Bradu, Konstantin Kapinchev, Frederick Barnes, Adrian G. H. Podoleanu, Univ. of Kent (United Kingdom) . . . . . [9693-27]

5:45 pm: **Enhancing sensitivity of high resolution optical coherence tomography using an optional spectrally encoded extended source**, Xiaojun Yu, Xinyu Liu, Si Chen, Xianghong Wang, Linbo Liu, Nanyang Technological Univ. (Singapore) . . . . . [9693-28]

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 7

LOCATION: ROOM 3004 (WEST LEVEL 3) .SUN 8:30 AM TO 10:00 AM

### Ocular Biometry, Morphology and Mechanics

Session Chairs: **David Borja**, Alcon Labs., Inc. (USA);  
**Luigi Rovati**, Univ. degli Studi di Modena e Reggio Emilia (Italy)

8:30 am: **Influence of corneal hydration on optical coherence elastography**, Michael D. Twa, The Univ. of Alabama at Birmingham (USA); Srilatha Vantipalli, Manmohan Singh, Jiasong Li, Kirill V. Larin, Univ. of Houston (USA) . . . [9693-29]

8:45 am: **Imaging of Keratoconic and normal human cornea with a Brillouin imaging system**, Sebastien Besner, Massachusetts General Hospital (USA); Peng Shao, Wellman Ctr. for Photomedicine (USA); Giuliano Scarcellini, Univ. of Maryland, College Park (USA); Roberto Pineda, Massachusetts Eye and Ear Infirmary (USA); Seok-Hyun (Andy) Yun, Harvard Medical School (USA) and Wellman Ctr. for Photomedicine (USA) . . . . . [9693-30]

9:00 am: **Assessing the viscoelasticity of green light induced CXL in the rabbit cornea by noncontact OCE and FEM**, Zhaolong Han, Jiasong Li, Manmohan Singh, Srilatha Vantipalli, Univ. of Houston (USA); Salavat R. Aglyamov, The Univ. of Texas at Austin (USA); Chen Wu, Chih-Hao Liu, Univ. of Houston (USA); Michael D. Twa, The Univ. of Alabama at Birmingham (USA); Kirill V. Larin, Univ. of Houston (USA) . . . . . [9693-31]

9:15 am: **Morphological characterization of keratoconus-affected human cornea provided by SHG imaging and correlation analysis**, Raffaella Mercatelli, Riccardo Cicchi D.D.S., Fulvio Ratto, Francesca Tatini, Francesca P. Rossi, Consiglio Nazionale delle Ricerche (Italy); Ricardo Nicoletti, Costruzione Strumenti Oftalmici srl (Italy); Roberto Pini, Consiglio Nazionale delle Ricerche (Italy); Luca Menabuoni M.D., Hospital of Prato (Italy); Francesco S. Pavone, Univ. degli Studi di Firenze (Italy) . . . . . [9693-32]

9:30 am: **OCT-based profiler for automating ocular surface prosthetic fitting**, Mircea Mujat, Ankit H. Patel, Gopi N. Maguluri, Nicusor V. Iftimia, Physical Sciences Inc. (USA); Chirag Patel, Josh Agranat, Olga Tomashevskaya, Eugene Bonte, Boston Foundation for Sight (USA); R. Daniel Ferguson, Physical Sciences Inc. (USA) . . . . . [9693-33]

9:45 am: **Setup for analysis of optical and geometrical property changes in ex vivo crystalline lenses during simulated accommodation modified with fs-laser pulses for presbyopia treatment**, Jan Hahn, Laser Zentrum Hannover e.V. (Germany); Michael Fromm, ROWIAK GmbH (Germany) and Laser Zentrum Hannover e.V. (Germany); Gabriel Kattermann, Tano Roth, Alexander Krüger, Tammo Ripken, Laser Zentrum Hannover e.V. (Germany) . . . . . [9693-34]

Coffee Break . . . . . Sun 10:00 am to 10:30 am



# CONFERENCE 9693

LOCATION: ROOM 3004 (WEST LEVEL 3)

BIOS

## SESSION 8

LOCATION: ROOM 3004 (WEST LEVEL 3) SUN 10:30 AM TO 12:00 PM

### Vision Assessment and Correction

Session Chairs: **Arthur Ho**, Brien Holden Vision Institute (Australia);  
**Ezra Maguen M.D.**, American Eye Institute (USA)

10:30 am: **A novel automated instrument designed to determine photosensitivity thresholds**, Mariela C. Aguilar, Alex Gonzalez, Cornelis Rowaan, Carolina De Freitas, Potyra R. Rosa, Karam Alawa, Byron L. Lam, Jean-Marie A. Parel, Bascom Palmer Eye Institute (USA) ..... [9693-35]

10:45 am: **Age dependent sensitivity of two-photon isomerization of rhodopsin chromophores in the human retina**, Maciej Wojtkowski, Katarzyna Komar, Nicolaus Copernicus Univ. (Poland); Grazyna Palczewska, Polgenix, Inc. (USA); Agnieszka Zielinska, Patrycjusz Stremplewski, Nicolaus Copernicus Univ. (Poland); Krzysztof Palczewski, School of Medicine, Case Western Reserve Univ. (USA) ..... [9693-36]

11:00 am: **Chromatic multifocal pupillometer for objective perimetry in patients with macular degeneration**, Ygal Rotenstreich, Daniel Ben-Ner, Mohamad Mahajna, Ron Chibel, Ifat Sher-Rosenthal, The Chaim Sheba Medical Ctr. (Israel) ..... [9693-37]

11:15 am: **Pupillary responses of healthy subjects to chromatic light stimuli at incremental intensities at central and peripheral visual field locations**, Ygal Rotenstreich, The Chaim Sheba Medical Ctr. (Israel); Soad Haj Yahia, Sheba Medical Ctr. (Israel); Ron Chibel, The Chaim Sheba Medical Ctr. (Israel); Daniel Ben-Ner, Sheba Medical Ctr. (Israel); Ifat Sher-Rosenthal, The Chaim Sheba Medical Ctr. (Israel) ..... [9693-38]

11:30 am: **Simultaneous refraction measurement and OCT axial biometry of the eye during accommodation**, Carolina De Freitas, Victor M. Hernandez, Marco Ruggeri, Heather A. Durkee, Siobhan Williams, Giovanni Gregori, Bascom Palmer Eye Institute (USA); Arthur Ho, Bascom Palmer Eye Institute (USA) and Brien Holden Vision Institute, Univ. of New South Wales (Australia); Fabrice Manns, Bascom Palmer Eye Institute (USA); Jean-Marie A. Parel, Bascom Palmer Eye Institute (USA) and Brien Holden Vision Institute, Univ. of New South Wales (Australia) ..... [9693-39]

11:45 am: **Optical extended depth of focus lens design for children myopia control**, Zeev Zalevsky, Bar-Ilan Univ. (Israel); Shai Ben Yaish, Bar Ilan Univ. (Israel) ..... [9693-40]

Lunch/Exhibition Break ..... Sun 12:00 pm to 1:30 pm

## SESSION 9

LOCATION: ROOM 3004 (WEST LEVEL 3) ... SUN 1:30 PM TO 3:15 PM

### Ophthalmic Laser and Light Therapy

Session Chairs: **Georg Schuele**, Abbott Medical Optics (USA);  
**Ralf Brinkmann**, Medizinisches Laserzentrum  
Lübeck GmbH (Germany)

1:30 pm: **Non-invasive detection of laser-induced retinal injury through the vitreous using dynamic light scattering**, Rafat R. Ansari, NASA Glenn Research Ctr. (USA); Melissa Naiman, Univ. of Illinois at Chicago (USA); Rachida Bouhenni, Jeffrey Dunmire, Summa Health System (USA); Ying Liu, Qundeel Rafiq, Deepak Edward, Johns Hopkins Univ. (USA); David Gothard, BIOSTATS, Inc. (USA) ..... [9693-41]

1:45 pm: **Developing a one-second automatic glaucoma treatment using trans-scleral laser trabeculoplasty (LTP) without a gonioscopy lens**, Michael Belkin, Tel Aviv Univ. (Israel); Noa Geffen, Meir Medical Ctr. (Israel); Modi Goldenfeld, Sheba Medical Ctr. (Israel); Shay Ofir, Avner Belkin, Ehud Assia, Meir Medical Ctr. (Israel) ..... [9693-42]

2:00 pm: **Heat shock protein expression as guidance for the therapeutic window of retinal laser therapy**, Jenny Wang, Philip Huie, Roopa Dalal, Seungjun Lee, Gavin Tan, Daeyoung Lee, Stanford Univ. (USA); Daniel Lavinsky M.D., Univ. Federal do Rio Grande do Sul (Brazil); Daniel Palanker, Stanford Univ. (USA) ..... [9693-43]

2:15 pm: **Towards real time speckle controlled retinal photocoagulation**, Katharina Bliedtner, Eric Seifert, Medizinisches Laserzentrum Lübeck GmbH (Germany); Leonil Stockmann, Ralf Brinkmann, Medizinisches Laserzentrum Lübeck GmbH (Germany) and Institute of Biomedical Optics, Univ. Lübeck (Germany) ..... [9693-44]

2:30 pm: **Effect of laser polarization and pulse energy on therapeutic, femtosecond laser-induced second harmonic generation in corneal tissue**, William R. Calhoun III, Ilko K. Ilev, U.S. Food and Drug Administration (USA) ..... [9693-45]

2:45 pm: **Investigating the effect of photodynamic therapy on Pseudomonas aeruginosa keratitis isolates**, Heather A. Durkee, Nidhi Relhan, Alejandro Arboleda, Francisco Halili Jr., Carolina De Freitas, Karam Alawa, Mariela C. Aguilar, Guillermo Amescua, Darlene Miller, Bascom Palmer Eye Institute (USA); Jean-Marie A. Parel, Bascom Palmer Eye Institute (USA) and Univ. of Liège (Belgium) ..... [9693-46]

3:00 pm: **Two-photon fluorescence microscopy for determination of the riboflavin concentration in the anterior corneal stroma when using the Dresden Protocol**, Tobias Ehmke, Laser Zentrum Hannover e.V. (Germany); Theo G. Seiler, Isaac Fischinger, Daniel Zapp, Chris P. Lohmann, Technische Univ. München (Germany); Heiko Meyer, Tammo Ripken, Laser Zentrum Hannover e.V. (Germany); Oliver Stachs, Univ. Rostock (Germany); Theo Seiler, IROC AG (Switzerland); Alexander Heisterkamp, Laser Zentrum Hannover e.V. (Germany) and Institut für Quantenoptik (Germany) ..... [9693-47]

Coffee Break ..... Sun 3:15 pm to 3:45 pm

## SESSION 10

LOCATION: ROOM 3004 (WEST LEVEL 3) ... SUN 3:45 PM TO 5:15 PM

### Adaptive Optics and Cellular Imaging

Session Chairs: **Daniel V. Palanker**, Stanford Univ. (USA);  
**Roberto Pini**, Istituto di Fisica Applicata "Nello Carrara" (Italy)

3:45 pm: **Imaging human retinal pigment epithelium cells using adaptive optics optical coherence tomography**, Zhuolin Liu, Omer P. Kocaoglu, Timothy L. Turner, Donald T. Miller, Indiana Univ. (USA) ..... [9693-48]

4:00 pm: **Computational adaptive optics of the human retina**, Fredrick A. South, Yuan-Zhi Liu, Paul S. Carney, Stephen A. Boppart, Univ. of Illinois at Urbana-Champaign (USA) ..... [9693-49]

4:15 pm: **Compact adaptive optics fundus camera/optical coherence tomography system for high resolution retinal imaging**, Matthias Salas, Wolfgang Drexler, Ctr. for Medical Physics and Biomedical Engineering, Medizinische Univ. Wien (Austria); Xavier Leveccq, Barbara Lamory, Imagine Eyes (France); Anna Ledolter, Markus Ritter, Ursula Schmidt-Erfurth M.D., Medizinische Univ. Wien (Austria); Michael Pircher, Ctr. for Medical Physics and Biomedical Engineering, Medizinische Univ. Wien (Austria) ..... [9693-50]

4:30 pm: **Axial analysis of cones and adjacent retinal structures using AOSLO**, Joel A. Papay, Kirby D Johnston, Lucie Sawides, Alberto de Castro, Stephen A. Burns, Ann E. Elsner, Indiana Univ. (USA) ..... [9693-51]

4:45 pm: **Parafoveal retinal cone mosaic imaging in children with ultra-compact switchable SLO/OCT handheld probe**, Francesco LaRocca, Derek Nankivil, Theodore B. DuBose, Cynthia A. Toth M.D., Sina Farsiou, Joseph A. Izatt, Duke Univ. (USA) ..... [9693-52]

5:00 pm: **Retinal photoreceptor imaging with high-speed line-field parallel spectral domain OCT**, Laurin Ginner, Daniel J. Fechtig, Medizinische Univ. Wien (Austria); Tilman Schmolli, Carl Zeiss Meditec, Inc. (USA); Lara M. Wurster, Michael Pircher, Rainer A. Leitgeb, Wolfgang Drexler, Medizinische Univ. Wien (Austria) ..... [9693-53]

## PASCAL ROL AWARD

LOCATION: ROOM 3004 (WEST LEVEL 3) SUN 5:15 PM TO 5:30 PM

Session Chair: **Arthur Ho**, Brien Holden Vision Institute (Australia)

Outstanding extended abstracts submitted to the Ophthalmic Technologies conference will be nominated for the Pascal Rol Award for Best Paper in Ophthalmic Technologies. The award and prize will be presented after the last scientific session of the conference to recognize the best paper and presentation. The 2015 recipient of the Pascal Rol Award was Dr. Francesco LaRocca and his colleagues from Duke University (see www.pascalrolfoundation.org).

AWARD SPONSOR:



# CONFERENCE 9693

LOCATION: ROOM 3004 (WEST LEVEL 3)

DISCUSSION ..... SUN 5:30 PM TO 5:45 PM

## POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Objective straylight assessment of the human eye with a novel device**, Stefan Schramm, Technische Univ. Ilmenau (Germany); Patrick Schikowski, GMC Systems mbH (Germany); Elena Lerm, Technische Univ. Ilmenau (Germany); André Kaeding, GMC Systems mbH (Germany); Matthias Klemm, Jens Hauelsen, Daniel Baumgarten, Technische Univ. Ilmenau (Germany) ..... [9693-54]

**Computer assisted quantification of choroidal neovascularization**, Jonathan Luisi, The Univ. of Texas Medical Branch (USA); Nick D. Motamedi, Univ. of California, Los Angeles (USA); Massoud Motamedi, The Univ. of Texas Medical Branch (USA) ..... [9693-55]

**Preliminary studies on sunglasses lenses UV protection degradation by using an automated prototype**, Leonardo M. Mariano Gomes, Artur D. Loureiro, Liliiane Ventura, Univ. de São Paulo (Brazil) ..... [9693-56]

**In vivo measurement of intraocular distances in human eyes by using Fourier domain low-coherence interferometry**, Liang Feng, Northeastern Univ. at Qinhuangdao (China); Qinghua Li, Northeastern Univ. (China); Zhenhe Ma, Yi Wang, Northeastern Univ. at Qinhuangdao (China) ..... [9693-57]

**Optical design of a novel instrument that uses the Hartmann-Shack sensor and Zernike polynomials to measure and simulate customized refraction correction surgery outcomes and patient satisfaction**, Fatima M. M. Yasuoka, Instituto de Física de São Carlos (Brazil) and BR Labs. Tecnologia Optica e Fotonica Ltda. (Brazil); Luciana de Matos, Instituto de Física de São Carlos (Brazil); Antonio F. R. Cremasco, Miriam Numajiri, Rafael Marcato, Wavetek Technologies Ltda. (Brazil); Otavio G. Oliveira, Mediphacos Ltda. (Brazil); Jarbas C. Castro Neto, Vanderlei S. Bagnato, Instituto de Física de São Carlos (Brazil); Luis Albert V. Carvalho, Wavetek Technologies Ltda. (Brazil) ..... [9693-58]

**Assessing the elasticity change of cataract lens with OCE**, Chen Wu, Chih-Hao Liu, Manmohan Singh, Zhaolong Han, Jiasong Li, Raksha Raghunathan, Univ. of Houston (USA); Kirill V. Larin, Univ. of Houston (USA) and Baylor College of Medicine (USA) ..... [9693-59]

**Improvement of glaucoma diagnosis with 3D depth measurement on stereo retinal images using novel instrumentation and algorithm for focus stacking: preliminary results on model and in vivo eyes**, Luis Albert V. Carvalho, Wavetek Technologies Ltda. (Brazil) and Univ. de São Paulo (Brazil) ..... [9693-60]

**Effects of short term changes in the blood glucose level on the autofluorescence lifetime of the human retina in healthy volunteers**, Matthias Klemm, Technische Univ. Ilmenau (Germany); Edgar Nagel, Ophthalmic Practice Ankermedicum (Germany); Dietrich Schweitzer, Universitätsklinikum Jena (Germany); Stefan Schramm, Jens Hauelsen, Technische Univ. Ilmenau (Germany) ..... [9693-61]

**Imaging choroidal neovascularization in the mouse retina using optical coherence tomography angiography**, Jang Ryul Park, Yongjoo Kim, KAIST (Korea, Democratic Peoples Republic of); Hye Kyong Hong, Gun Hwi Lee, Seoul National Univ. Bundang Hospital (Korea, Republic of); Sang Jun Park, Seoul National Univ. Bundang (Korea, Republic of); Jaeryung Kim, KAIST (Korea, Republic of); Yoonha Hwang, Pilhan Kim, Gou Young Koh, KAIST (Korea, Democratic Peoples Republic of); Se Joon Woo, Kyu Hyung Park, Seoul National Univ. Bundang Hospital (Korea, Republic of); Wang-Yuhl Oh, KAIST (Korea, Democratic Peoples Republic of) ..... [9693-62]

**A comparison study of Riboflavin/UV-A and Rose-Bengal/Green light cross-linking of the rabbit corneas using optical coherence elastography**, Jiasong Li, Manmohan Singh, Zhaolong Han, Srilatha Vantipalli, Chih-Hao Liu, Chen Wu, Raksha Raghunathan, Tina Kazemi, Univ. of Houston (USA); Michael D. Twa, The Univ. of Alabama at Birmingham (USA); Kirill V. Larin, Univ. of Houston (USA) and Baylor College of Medicine (USA) ..... [9693-63]

**Quantitative assessment of rat corneal thickness and morphology during stem cell therapy by high-speed optical coherence tomography**, Cerine Lal, James McGrath, Hrebesh M. Subhash, Martin J. Leahy, National Univ. of Ireland, Galway (Ireland) ..... [9693-64]

**Mimicking cataract-induced visual dysfunction by means of protein denaturation in egg albumen**, Biagio Mandracchia, Andrea Finizio, Pietro Ferraro, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) . [9693-65]

**Objective chromatic perimetry using a multifocal pupillometer**, Ygal Rotenstreich, Ron Chibel, Soad Haj Yahia, Daniel Ben-Ner, Mohamad Mahajna, The Chaim Sheba Medical Ctr. (Israel); Asaf Achiron, Wolfson Medical Ctr. (Israel); Yakir Berchenko, Bernice Oberman, Ofra Kalter-Leibovici, Laurence Freedman, The Gertner Institute (Israel); Ifat Sher-Rosenthal, The Chaim Sheba Medical Ctr. (Israel) . [9693-66]

**Tilt and decentration tolerance of intraocular lenses: measurements with an improved mechanical model eye**, Lukas Traxler, Bernd Reutterer, Natascha Bayer, Fachhochschule Technikum Wien (Austria); Elisabet Rank, Sylvio Krause, Erik Beckert, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Andreas Drauschke, Fachhochschule Technikum Wien (Austria) ..... [9693-67]

**Basic studies on laser-assisted phacoemulsification using diode-pumped Er:YAG laser**, Florian Hausladen, Holger Wurm, Karl Stock, Univ. Ulm (Germany) ..... [9693-68]

**Correlation of blood flow and functional changes in the rat retina during acute ocular pressure elevation**, Bingyao Tan, Akshay Gurdita, Kirsten Carter, Vivian Choh, Univ. of Waterloo (Canada); Karen M. Joos, Vanderbilt Univ. (USA); Kostadinka Bizheva, Univ. of Waterloo (Canada) ..... [9693-69]

**Public sunglasses tester: acknowledging population of UV protection**, Fernando Lahoz, Liliiane Ventura, Univ. de São Paulo (Brazil) ..... [9693-70]

**Comparison of performance of some common Hartmann-Shack centroid estimation methods**, Chandrasah Thatiparthi, Indian Institute of Technology Madras (India); Abbas Ommani, Univ. of Waterloo (Canada); Ritambhar Burman, Jadavpur Univ. (India); Damber Thapa, Univ. of Illinois at Chicago (USA); Natalie Hutchings, Vasudevan Lakshminarayanan, Univ. of Waterloo (Canada) ..... [9693-71]

**Visible-light optical coherence tomography measures oxygen metabolism in a rat model of retinopathy of prematurity**, Brian T. Soetikno, Ji Yi, Ronil Shah, Wenzhong Liu, Patryk Purta, Hao F. Zhang, Amani A. Fawzi M.D., Northwestern Univ. (USA) ..... [9693-72]

# CONFERENCE 9694

LOCATION: ROOM 3008 (WEST LEVEL 3)

Saturday–Sunday 13–14 February 2016 • Proceedings of SPIE Vol. 9694

# Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXV

Conference Chairs: **David H. Kessel**, Wayne State Univ. (USA); **Tayyaba Hasan**, Massachusetts General Hospital (USA)

Program Committee: **Imran Rizvi**, Brigham and Women's Hospital (USA); **Jonathan P. Celli**, Univ. of Massachusetts Boston (USA)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 3008 (WEST LEVEL 3) . SAT 9:00 AM TO 10:20 AM

#### Photodynamic Therapy I

Session Chair: **David H. Kessel**,  
Wayne State Univ. School of Medicine (USA)

9:00 am: **Mechanistic studies on a sequential PDT protocol** (*Invited Paper*),  
David H. Kessel, Wayne State Univ. School of Medicine (USA) . . . . . [9694-1]

9:30 am: **Spatiotemporally synchronized cancer combination therapy using photo-activated nanoparticle drug delivery systems** (*Invited Paper*),  
Tayyaba Hasan, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA) . . . . . [9694-2]

10:00 am: **Designing PDT-based combinations to overcome chemoresistance in heterocellular 3D tumor models**, Imran Rizvi, Brigham and Women's Hospital (USA) and Harvard Medical School (USA); Emma A. Briars, Massachusetts General Hospital (USA) and Wellman Ctr. for Photomedicine (USA); Anne-Laure Bulin, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Sriram R. Anbil, Wellman Ctr. for Photomedicine (USA) and Howard Hughes Medical Institute (USA); Daniela Vecchio, Ahmed Alkhateeb, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); William R. Hanna, Jonathan P. Celli, Univ. of Massachusetts Boston (USA); Tayyaba Hasan, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA) . . . . . [9694-3]

Coffee Break . . . . . Sat 10:20 am to 10:50 am

### SESSION 2

LOCATION: ROOM 3008 (WEST LEVEL 3) . SAT 10:50 AM TO 12:10 PM

#### Photodynamic Therapy II

Session Chair: **Tayyaba Hasan**, Wellman Ctr. for Photomedicine (USA)

10:50 am: **Defining a path for critical dosimetry measures and surrogate tools that can facilitate clinical success**, Brian W. Pogue, Scott C. Davis, Stephen C. Kanick, Thayer School of Engineering at Dartmouth (USA); Edward V. Maytin M.D., Cleveland Clinic Lerner Research Institute (USA); Stephen P. Pereira, Univ. College London Hospitals (United Kingdom); Akilan Palanisami, Tayyaba Hasan, Harvard Medical School (USA) . . . . . [9694-4]

11:10 am: **A feasibility study of singlet oxygen explicit dosimetry (SOED) of PDT by an intercomparison with a singlet oxygen luminescence dosimetry (SOLD) system**, Michele M. Kim, Univ. of Pennsylvania School of Medicine (USA); Rozhin Penjweini, The Univ. of Pennsylvania Health System (USA); Nathan R. Gemmill, Robert H. Hadfield, Univ. of Glasgow (United Kingdom); Israel Veilleux, Univ. of Toronto (Canada) and Princess Margaret Hospital (Canada); Brian C. Wilson, Princess Margaret Hospital (Canada) and Univ. of Toronto (Canada) and Univ. Health Network (Canada); Timothy C. Zhu, The Univ. of Pennsylvania Health System (USA) . . . . . [9694-5]

11:30 am: **Therapeutic enhancement of verteporfin-mediated photodynamic therapy with PI3K signaling pathway targeted therapy**, Bin Chen, Univ. of the Sciences in Philadelphia (USA) . . . . . [9694-6]

11:50 am: **Quantification of pancreas tumor interstitial pressure, matrix components and stiffness, as related to verteporfin perfusion**, Michael D. Nieskoski, Thayer School of Engineering at Dartmouth (USA); Marvin M. Doyley, Univ. of Rochester (USA); Jason R. Gunn, Kayla Marra, Thayer School of Engineering at Dartmouth (USA); Kimberley S. Samkoe, Geisel School of Medicine (USA); Tayyaba Hasan, Massachusetts General Hospital (USA) and Harvard Medical School (USA); B. Stuart Trembly, Brian W. Pogue, Thayer School of Engineering at Dartmouth (USA) . . . . . [9694-7]

Lunch/Exhibition Break . . . . . Sat 12:10 pm to 1:40 pm

### SESSION 3

LOCATION: ROOM 3008 (WEST LEVEL 3) . . . SAT 1:40 PM TO 3:20 PM

#### Photodynamic Therapy III

Session Chair: **Jonathan P. Celli**, Univ. of Massachusetts Boston (USA)

1:40 pm: **Photoacoustic imaging to predict photodynamic therapy efficacy**, Srivalleesha Mallidi, Zhiming Mai, Amjad P. Khan, Tayyaba Hasan, Harvard Medical School (USA) . . . . . [9694-9]

2:00 pm: **Activation of photodynamic therapy in vitro with Cerenkov luminescence generated from Yttrium-90**, Brad A. Hartl, Univ. of California, Davis (USA); Henry Hirschberg, Univ. of California, Irvine (USA); Laura Marcu, Simon R. Chery, Univ. of California, Davis (USA) . . . . . [9694-10]

2:20 pm: **Development of low-cost devices for image-guided photodynamic therapy treatment of oral cancer in global health settings**, Hui Liu, Joshua Hempstead, Dustin P. Jones, Univ. of Massachusetts Boston (USA); Srivalleesha Mallidi, Amjad P. Khan, Wellman Ctr. for Photomedicine (USA); Imran Rizvi, Wellman Ctr. for Photomedicine (USA); Grant Rudd, Liam Daly, Filip Cuckov, Stephen Arnason, Univ. of Massachusetts Boston (USA); Tayyaba Hasan, Wellman Ctr. for Photomedicine (USA); Jonathan P. Celli, Univ. of Massachusetts Boston (USA) . . . . . [9694-11]

2:40 pm: **Determination of the low concentration correction in the macroscopic singlet oxygen model for PDT**, Michele M. Kim, Univ. of Pennsylvania School of Medicine (USA); Rozhin Penjweini, Perelman Ctr. for Advanced Medicine (USA); Jarod C. Finlay, Timothy C. Zhu, The Univ. of Pennsylvania Health System (USA) . . . . . [9694-12]

3:00 pm: **Photodynamic tumor cell and microvessel damage with simultaneous inhibition of multiple molecular signaling escape pathways**, Bryan Q. Spring, R. Bryan Sears, Lei Z. Zheng, Zhiming Mai, Massachusetts General Hospital (USA); Reika Watanabe, Univ. of California, San Diego (USA); Margaret E. Sherwood, David A. Schoenfeld, Massachusetts General Hospital (USA); Brian W. Pogue, Thayer School of Engineering at Dartmouth (USA); Stephen P. Pereira, Univ. College London (United Kingdom); Elizabeth Villa, Univ. of California, San Diego (USA); Tayyaba Hasan, Massachusetts General Hospital (USA) . . . . . [9694-8]

Coffee Break . . . . . Sat 3:20 pm to 3:50 pm

### SESSION 4

LOCATION: ROOM 3008 (WEST LEVEL 3) . . SAT 3:50 PM TO 5:40 PM

#### Photodynamic Therapy IV

Session Chair: **Theresa M. Busch**, Univ. of Pennsylvania (USA)

3:50 pm: **Combination photodynamic therapy using 5-fluorouracil and aminolevulinic acid enhances tumor-selective production of protoporphyrin IX and improves treatment efficacy of squamous skin cancers** (*Invited Paper*), Edward V. Maytin M.D., Sanjay Anand, Cleveland Clinic Lerner Research Institute (USA) . . . . . [9694-18]

4:20 pm: **Combination strategy in photodynamic therapy of skin diseases**, Xia Lei M.D., Jinjin Wu, Third Military Medical Univ. (China); Zheng Huang, Fujian Normal Univ. (China) and Univ. of Colorado Denver (USA) . . . . . [9694-14]

4:40 pm: **Fluorescence image-guided photothermal therapy of human oesophageal adenocarcinoma in vivo using multifunctional gold nanorods in vivo**, Eli Nabavi, Mohan Singh, Yu Zhou, Maria Elena Gallina, Hailin Zhao, Daqing Ma, Anthony Cass, George Hanna, Daniel S. Elson, Imperial College London (United Kingdom) . . . . . [9694-15]

5:00 pm: **Detection techniques for singlet oxygen production during photodynamic therapy**, Buhong Li, Fujian Normal Univ. (China) . . . . . [9694-16]

5:20 pm: **Home-use cancer detecting plaster**, Zeev Zalevsky, Arkady Rudnitsky, Victor Sheinman, Bar-Ilan Univ. (Israel); Andrey Tzoy, Aitmatat Toktosunov, Arkady Adashov, Kyrgyz State Medical Academy (Kyrgyzstan) . . . . . [9694-17]



# CONFERENCE 9694

LOCATION: ROOM 3008 (WEST LEVEL 3)

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION V

LOCATION: ROOM 3008 (WEST LEVEL 3) . SUN 8:50 AM TO 10:10 AM

## Photodynamic Therapy V

Session Chair: **Timothy C. Zhu**,  
The Univ. of Pennsylvania Health System (USA)

8:50 am: **Photodynamic therapy for targeting extracellular biophysical regulators of tumor growth and invasive behavior in pancreatic cancer**, Gwendolyn M. Cramer, Hamid El Hamidi, Dustin P. Jones, Ljubica Petrovic, Univ. of Massachusetts Boston (USA); Imran Rizvi, Brigham and Women's Hospital (USA); Tayyaba Hasan, Massachusetts General Hospital (USA); Jonathan P. Celli, Univ. of Massachusetts Boston (USA) . . . . . [9694-13]

9:10 am: **Vitamin D for combination photodynamic therapy of skin cancer in individuals with vitamin D deficiency: Insights from a preclinical study in a mouse model of squamous cell carcinoma**, Sanjay Anand, Cleveland Clinic Lerner Research Institute (USA); Erik Thomas, The Cleveland Clinic (USA); Tayyaba Hasan, Harvard Medical School (USA); Edward V. Maytin M.D., Cleveland Clinic Lerner Research Institute (USA) . . . . . [9694-19]

9:30 am: **Modeling of the impact of initial oxygen concentration and blood flow variation on photodynamic therapy**, Rozhin Penjweini, Timothy C. Zhu, The Univ. of Pennsylvania Health System (USA) . . . . . [9694-20]

9:50 am: **Adapting biomodulatory approaches to enhance photodynamic therapy outcomes in new contexts: pancreatic and oral cancers**, Sriram R. Anbil, Harvard Medical School (USA) and Howard Hughes Medical Institute (USA) and The Univ. of Texas Health Science Ctr. at San Antonio (USA); Imran Rizvi, Brigham and Women's Hospital (USA) and Harvard Medical School (USA); Amjad P. Khan, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Jonathan P. Celli, Univ. of Massachusetts Boston (USA); Edward V. Maytin M.D., Cleveland Clinic Lerner Research Institute (USA); Tayyaba Hasan, Massachusetts General Hospital (USA) and Harvard Medical School (USA) . . . . . [9694-21]

Coffee Break . . . . . Sun 10:10 am to 10:40 am

### SESSION 6

LOCATION: ROOM 3008 (WEST LEVEL 3) SUN 10:40 AM TO 12:00 PM

## Photodynamic Therapy VI

Session Chair: **Kimberley S. Samkoe**, Geisel School of Medicine (USA)

10:40 am: **Red and blue-excited wide-field fluorescence imaging to distinguish subsurface PpIX during photodynamic therapy of the skin**, Ethan LaRochelle, Hayden H. Chun, Thayer School of Engineering at Dartmouth (USA); Tayyaba Hasan, Wellman Ctr. for Photomedicine (USA); Brian W. Pogue, Thayer School of Engineering at Dartmouth (USA); Edward V. Maytin M.D., Cleveland Clinic Lerner Research Institute (USA); Michael S. Chapman M.D., Dartmouth Hitchcock Medical Ctr. (USA); Scott C. Davis, Thayer School of Engineering at Dartmouth (USA) . . . . . [9694-22]

11:00 am: **Molecular targeted PDT with selective delivery of ICG Photo-Immunoconjugates**, Sijia Wang, Gereon Hüttmann, Univ. zu Lübeck (Germany); Tayyaba Hasan, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA) and Harvard Medical School (USA); Ramtin Rahmzadeh, Univ. zu Lübeck (Germany) . . . . . [9694-23]

11:20 am: **Reducing background noise in near-infrared medical imaging: Routes to activated fluorescing**, Mary K. Burdette, Yuriy P. Bandera, Stephen H. Foulger, Clemson Univ. (USA) . . . . . [9694-24]

11:40 am: **Efficiency of photodynamic therapy using indocyanine green and infrared light on MCF-7 breast cancer cells in vitro**, Mustafa K. Ruhi, Bogaziçi Üniv. (Turkey); Ayse Ak, Erzincan Univ. (Turkey); Murat Gülsoy, Bogaziçi Üniv. (Turkey) . . . . . [9694-25]

Lunch/Exhibition Break . . . . . Sun 12:00 pm to 1:20 pm

### SESSION 7

LOCATION: ROOM 3008 (WEST LEVEL 3) . . SUN 1:20 PM TO 3:00 PM

## Photodynamic Therapy VII

Session Chair: **Scott C. Davis**,  
Thayer School of Engineering at Dartmouth (USA)

1:20 pm: **First prospective study assessing the combination of photodynamic therapy and proton radiation therapy: safety, outcomes, and potential synergy when treating malignant pleural mesothelioma**, Charles B. Simone M.D., The Univ. of Pennsylvania Health System (USA); Yun R. Li, Theresa M. Busch, Univ. of Pennsylvania (USA); Jarod C. Finlay, The Univ. of Pennsylvania Health System (USA); Michele M. Kim, Univ. of Pennsylvania School of Medicine (USA); Sally McNulty, Univ. of Pennsylvania (USA); Andrea Dimofte, Timothy C. Zhu, The Univ. of Pennsylvania Health System (USA); Keith A. Cengel, Univ. of Pennsylvania School of Medicine (USA) . . . . . [9694-42]

1:40 pm: **Two-photon photodynamic properties of TBO-AuNR-in-shell nanoparticles**, Cheng-Han Wu, Institute of Biomedical Engineering, National Taiwan Univ. (Taiwan); Chen-Sheng Yeh, Fong-Yu Cheng, National Cheng Kung Univ. (Taiwan); Zen-Uong Tsai, Tzu-Ming Liu, National Taiwan Univ. (Taiwan) . . . . . [9694-26]

2:00 pm: **Dosimetry study of PHOTOFRIN-mediated photodynamic therapy in a mouse tumor model**, Haixia Qiu, The Univ. of Pennsylvania Health System (USA) and Chinese PLA General Hospital (China); Michele M. Kim, Univ. of Pennsylvania School of Medicine (USA); Rozhin Penjweini, Perelman Ctr. for Advanced Medicine (USA) and The Univ. of Pennsylvania Health System (USA); Timothy C. Zhu, The Univ. of Pennsylvania Health System (USA) . . . . . [9694-27]

2:20 pm: **Site-specific antibody-liposome conjugation through copper-free click chemistry: a molecular biology approach for targeted photodynamic therapy**, Girsig Obaid, Yucheng Wang, Jerrin Kuriakose, Wellman Ctr. for Photomedicine (USA); Mans Broekgaarden, Ahmed Alkhatieb, Wellman Center for Photomedicine, Massachusetts General Hospital, Harvard Medical School (USA); Anne-Laure Bulin, Wellman Ctr. for Photomedicine (USA); James Hui, Andrew Tsourkas, Univ. of Pennsylvania (USA); Tayyaba Hasan, Wellman Ctr. for Photomedicine (USA) . . . . . [9694-28]

2:40 pm: **Repurposing of tetracyclines to overcome resistance pathways associated with photochemotherapy in ovarian cancer**, Joyce Liu, Huang-Chiao Huang, Imran Rizvi, Tayyaba Hasan, Wellman Ctr. for Photomedicine (USA) . . . . . [9694-29]

Coffee Break . . . . . Sun 3:00 pm to 3:30 pm

### SESSION 8

LOCATION: ROOM 3008 (WEST LEVEL 3) . . SUN 3:30 PM TO 4:50 PM

## Photodynamic Therapy VIII

Session Chair: **Imran Rizvi**, Brigham and Women's Hospital (USA)

3:30 pm: **Mechanistic exploration of a bi-directional photochemotherapeutic combination for pancreatic cancer**, Huang-Chiao Huang, Srivalleesha Mallidi, Joyce Liu, Chun-Te Chiang, Zhiming Mai, Ruth Goldschmidt, Imran Rizvi, Neema Ebrahim-Zadeh, Tayyaba Hasan, Massachusetts General Hospital (USA) . . . . . [9694-30]

3:50 pm: **Cherenkov radiation fluence estimates in tissue for molecular imaging and therapy applications**, Adam K. Glaser, Dartmouth College (USA) and Univ. of Washington (USA); Rongxiao Zhang, Dartmouth College (USA) and Harvard Medical School (USA); Jacqueline Andreozzi, Dartmouth College (USA); David Gladstone, Dartmouth Hitchcock Medical Ctr. (USA); Brian W. Pogue, Dartmouth College (USA) . . . . . [9694-31]

4:10 pm: **PDT dose dosimeter for pleural photodynamic therapy**, Michele M. Kim, Univ. of Pennsylvania School of Medicine (USA); Arash Darafsheh, Perelman Ctr. for Advanced Medicine (USA); Mahmoud Ahmad, Univ. of Pennsylvania (USA); Jarod C. Finlay, Timothy C. Zhu, The Univ. of Pennsylvania Health System (USA) . . . . . [9694-32]

4:30 pm: **Analysis of superficial fluorescence patterns in nonmelanoma skin cancer during photodynamic therapy by a dosimetric tool**, Irene Salas-García, Félix Fanjul-Vélez, José Luis Arce-Diego, Univ. de Cantabria (Spain) . . . . . [9694-33]



MONDAY 15 FEBRUARY

POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

Conference attendees are invited to attend the BIOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Optical spectroscopy of radiotherapy and photodynamic therapy responses in normal rat skin shows vascular breakdown products.** Cintia T. Andrade, CAPES Foundation (Brazil) and Instituto de Física de São Carlos (Brazil); Stephen C. Kanick, Thayer School of Engineering at Dartmouth (USA); Kayla Marra, Jason R. Gunn, Geisel School of Medicine (USA); Jacqueline Andreozzi, Thayer School of Engineering at Dartmouth (USA); Kimberley S. Samkoe, Geisel School of Medicine (USA) and Dartmouth Hitchcock Medical Ctr. (USA); Cristina Kurachi, Instituto de Física de São Carlos (Brazil); Brian W. Pogue, Geisel School of Medicine (USA) and Thayer School of Engineering at Dartmouth (USA) and Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA) . . . . . [9694-34]

**Fluence rate effects in intrathoracic PDT of murine tumors.** Theresa M. Busch, Univ. of Pennsylvania (USA); Craig E. Grossman M.D., Univ. of Pennsylvania (USA) and Univ. of Rochester (USA); Shirron L. Carter, Mary E. Putt, The Univ. of Pennsylvania Health System (USA); Le Wang, Univ. of Pennsylvania (USA) . . . . . [9694-35]

**Synthesis and characterization of novel phthalocyanines and evaluation of photodynamic therapy properties.** Aysun Korkmaz, Yusuf Yilmaz, Mehmet Kahraman, Gaziantep Univ. (Turkey) . . . . . [9694-36]

**Synthesis and characterization of PLGA nanoparticles containing mixture of curcuminoids for optimization of photodynamic inactivation.** Isabella Suzuki, Univ. de São Paulo (Brazil); Natália M. Inada, Instituto de Física de São Carlos (Brazil); Valéria S. Marangoni, Univ. de São Paulo (Brazil); Thaila Q. Corrêa, Valtencir Zucolotto, Cristina Kurachi, Vanderlei S. Bagnato, Instituto de Física de São Carlos (Brazil) . . . . . [9694-37]

**Photodynamic inactivation of contaminated blood with Staphylococcus aureus.** Thaila Q. Corrêa, Instituto de Física de São Carlos (Brazil); Natália M. Inada, Sebastião Pratavieira, Kate C. Blanco, Univ. de São Paulo (Brazil); Cristina Kurachi, Vanderlei S. Bagnato, Instituto de Física de São Carlos (Brazil) . . . . . [9694-38]

**Photodynamic inactivation of Acanthamoeba polyphaga with curcuminoids: an in vitro study.** Thaila Q. Corrêa, Mariana C. Geralde, Instituto de Física de São Carlos (Brazil); Mariana T. Carvalho, Univ. de São Paulo (Brazil); Vanderlei S. Bagnato, Cristina Kurachi, Clovis W. O. Souza, Instituto de Física de São Carlos (Brazil) . . . . . [9694-39]

**Use of combined iron chelator and fractionated ALA-PDT to enhance treatment of skin cancer in vivo.** Ana Luiza Ribeiro de Souza, Thayer School of Engineering at Dartmouth (USA) and CAPES Foundation (Brazil); Kayla Marra, Thayer School of Engineering at Dartmouth (USA); Jason R. Gunn, Geisel School of Medicine (USA); Kimberley S. Samkoe, Geisel School of Medicine (USA) and Dartmouth Hitchcock Medical Ctr. (USA); Stephen C. Kanick, Geisel School of Medicine (USA); Edward V. Maytin M.D., Cleveland Clinic Lerner Research Institute (USA); Tayyaba Hasan, Wellman Ctr. for Photomedicine (USA); Brian W. Pogue, Thayer School of Engineering at Dartmouth (USA) and Geisel School of Medicine (USA) and Wellman Ctr. for Photomedicine (USA) . . . . . [9694-40]

**Comparison of two photosensitizers in photodynamic therapy using light pulses in femtosecond regime: an animal study.** Clovis Grecco, Sebastião Pratavieira, Univ. de São Paulo (Brazil); Vanderlei S. Bagnato, Cristina Kurachi, Instituto de Física de São Carlos (Brazil) . . . . . [9694-41]

**Intratumor photosensitizer injection for photodynamic therapy: pre-clinical experience with methylene blue, Pc 4, and Photofrin.** Timothy M. Baran, Thomas H. Foster, Univ. of Rochester Medical Ctr. (USA) . . . . . [9694-43]

# CONFERENCE 9695

LOCATION: ROOM 3003 (WEST LEVEL 3)

Saturday 13 February 2016 • Proceedings of SPIE Vol. 9695

# Mechanisms of Photobiomodulation Therapy XI

*Conference Chairs:* **Michael R. Hamblin**, Wellman Ctr. for Photomedicine (USA); **James D. Carroll**, THOR Photomedicine Ltd. (United Kingdom); **Praveen Arany**, Univ. at Buffalo (USA)

*Program Committee:* **Heidi Abrahamse**, Univ. of Johannesburg (South Africa); **Tomas Hode**, Immunophotonics, Inc. (USA); **Clark E. Tedford**, LumiThera (USA)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 3003 (WEST LEVEL 3) . SAT 8:30 AM TO 10:30 AM

### Present Status And Future Direction with PBM Therapy

Session Chair: **Michael R. Hamblin**, Wellman Ctr. for Photomedicine (USA)

8:30 am: **Photobiomodulation and the brain: a new paradigm** (*Invited Paper*), Michael R. Hamblin, Wellman Ctr. for Photomedicine (USA) . . . . . [9695-1]

9:10 am: **Blue light inhibits proliferation of melanoma cells**, Anja Becker, Elisabeth Distler, Anna Klapczynski, Fabiola Arpino, Natalia Kuch, Katja Simon-Keller, Carsten Sticht, Ruprecht-Karls-Univ. Heidelberg (Germany); Frank A. van Abeelen, Philips Research (Netherlands); Norbert Gretz, Ruprecht-Karls-Univ. Heidelberg (Germany); Gerrit Oversluizen, Philips Research (Netherlands) . . . . . [9695-2]

9:30 am: **Regulation of cellular markers modulated upon irradiation of low power laser lights in burn injured mice**, Bharath Rathnakar, School of Life Sciences, Manipal Univ. (India); Vijendra Prabhu, School of Life Sciences, Manipal Univ. (India) and Manipal Univ. (India); Satish Rao, Subhash Chandra, School of Life Sciences, Manipal Univ. (India); Pradeep K. Gupta, Mrinalini Sharma, Raja Ramanna Ctr. for Advanced Technology (India); Krishna K. Mahato, School of Life Sciences, Manipal Univ. (India) . . . . . [9695-3]

9:50 am: **Effect of interstitial low level laser stimulation for skin density change**, Seulgi Jang, Sangyeob Lee, Jihoon Park, Edalat Radfar, Myungjin Ha, Sungkon Yu, Jeonghwan Son, Byungjo Jung, Yonsei Univ. (Korea, Republic of) . . . . . [9695-4]

10:10 am: **Biochemical changes on the repair of surgical bone defects grafted with biphasic synthetic micro-granular HA + $\beta$ -tricalcium phosphate induced by laser and LED phototherapies assessed by Raman spectroscopy**, Antonio Luiz B. Pinheiro, Univ. Federal da Bahia (Brazil) and Univ. Camilo Castelo Branco (Brazil); Luiz Guilherme P. Soares, Aparecida Maria C. Marques, Ctr. of Biophotonics, Univ. Federal da Bahia (Brazil); Landulfo Silveira Jr., Univ. Camilo Castelo Branco (Brazil) . . . . . [9695-5]

Coffee Break . . . . . Sat 10:30 am to 11:00 am

### SESSION 2

LOCATION: ROOM 3003 (WEST LEVEL 3) . SAT 11:00 AM TO 12:30 PM

### Clinical Translational Research with PBM Therapy

Session Chair: **Praveen Arany D.D.S.**, Univ. at Buffalo (USA)

11:00 am: **Precision medicine: Molecular mechanisms will lead future optimizations with PBM therapy** (*Invited Paper*), Praveen Arany D.D.S., Univ. at Buffalo (USA) . . . . . [9695-6]

11:30 am: **Photobiomodulation of human dermal fibroblast pools in vitro and ex-vivo culture: rational approach towards effective light parameters and nuances of cell physiology**, Charles Mignon, Philips Research (Netherlands) and Univ. of Bradford (United Kingdom); Irene Castellano, Univ. of Bradford (United Kingdom); Natalia Uzunbajakava, Bianca Raafs, Philips Research (Netherlands); Natalia Botchkareva, Desmond Tobin, Univ. of Bradford (United Kingdom) . . . . . [9695-7]

11:50 am: **Low level laser exposure influence on calcium channels and intracellular release in cultured astrocytes** (*Invited Paper*), Thomas S. Mang, Mohammed Mehdi Maneshi, David Shucard, Susan Z. Hua, Univ. at Buffalo (USA) . . . . . [9695-8]

12:10 pm: **In vitro measurements of oxygen consumption rates in hTERT-RPE cells exposed to low levels of red light**, Jeffrey C. Wagle, Cherry C. Castellanos, U.S. Air Force (USA) . . . . . [9695-9]

Lunch/Exhibition Break . . . . . Sat 12:30 pm to 1:30 pm

### SESSION 3

LOCATION: ROOM 3003 (WEST LEVEL 3) . . . SAT 1:30 PM TO 3:00 PM

### Clinical Applications of PBM Therapy

Session Chair: **James D. Carroll**, THOR Photomedicine Ltd. (United Kingdom)

1:30 pm: **Photobiomodulation dosimetry for nerve regeneration: a systematic review**, James D. Carroll, THOR Photomedicine Ltd. (United Kingdom) . . . . . [9695-10]

2:00 pm: **Efficacy of low level laser therapy on painful diabetic peripheral neuropathy** (*Invited Paper*), Arun Maiya, Manipal Univ. (India) . . . . . [9695-11]

2:20 pm: **Effect of interstitial low level laser therapy on tibial defect**, Sangyeob Lee, Seulgi Jang, Donghyun Hwang, Jihoon Park, Myungjin Ha, Sungkon Yu, Edalat Radfar, Hansung Kim, Byungjo Jung, Yonsei Univ. (Korea, Republic of) . . . . . [9695-12]

2:40 pm: **Wearable light management system for light stimulated healing of large area chronic wounds**, David Kallweit, Jan Mayer, Sören Fricke, Marc Schnieper, Rolando Ferrini, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland) . . . . . [9695-13]

Coffee Break . . . . . Sat 3:00 pm to 3:30 pm

# CONFERENCE 9695

LOCATION: ROOM 3003 (WEST LEVEL 3)

SUNDAY 14 FEBRUARY

SESSION 4  
LOCATION: ROOM 3003 (WEST LEVEL 3) . . . SAT 3:30 PM TO 5:30 PM

## PBM Synergistic Therapies

Session Chair: **Tomas Hode**, Immunophotonics, Inc. (USA)

- 3:30 pm: **Effects of photothermal application in laser immunotherapy (LIT) for the treatment of metastatic cancer**, Tomas Hode, Siu Kit Lam, Immunophotonics, Inc. (USA), Feifan Zhou, Wei R. Chen, Univ. of Central Oklahoma (USA) . . . . . [9695-15]
- 3:50 pm: **NIR exerts a hormetic biomodulation effect on neuronal function**, Fatma Vatansever M.D., Ying-Ying Huang M.D., Michael R. Hamblin, Wellman Ctr. for Photomedicine (USA) . . . . . [9695-16]
- 4:10 pm: **Low-power laser irradiation did not stimulate breast cancer cells following ionizing radiation**, Camila R. Silva, Claudinei Francisco M. Camargo, Martha S. Ribeiro, Instituto de Pesquisas Energéticas e Nucleares (Brazil) . . . . . [9695-18]
- 4:30 pm: **Nitromedicine: a new concept**, Salaheldin Halasa M.D., Nitromedicine (USA); Praveen Arany D.D.S., Univ. at Buffalo (USA); Michael R. Hamblin, Wellman Ctr. for Photomedicine (USA) . . . . . [9695-27]
- 4:50 pm: **Biochemical responses of isolated lung CSCS after application of low intensity laser irradiation dose**, Heidi Abrahamse, Univ. of Johannesburg (South Africa) . . . . . [9695-28]
- 5:10 pm: **Photobiomodulation in retinal injury and disease**, Sandeep Gopalakrishnan, Janis T. Eells, Univ. of Wisconsin-Milwaukee (USA) . . [9695-31]

## POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BiOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

- Assessment of the influence of Laser phototherapy on the bone repair process of complete fractures in tibiae of rabbits stabilized with Semi-Rigid internal fixation treated with or without MTA implant: a histological study.**, Luiz Guilherme P. Soares, Ctr. of Biophotonics, Univ. Federal da Bahia (Brazil); Aline C. P. Silva, Institute of Health Sciences, Univ. Federal da Bahia (Brazil); Anna Paula L. T. Silva, Bruno Luiz R. C. Neves, Nicole R. S. Santos, Jean N. dos Santos, Antonio L. Pinheiro, Ctr. of Biophotonics, Univ. Federal da Bahia (Brazil) . . . . . [9695-17]
- Safety and efficacy of photo modulation therapy for weight loss**, Ambereen Ahmed M.D., A&M Assorted Therapy, LLC (USA) . . . . . [9695-19]
- Wellbeing effect of LED photobiomodulation**, Francois Michel M.D., Consultant (France); Daniel Barolet M.D., McGill Univ. (Canada) . . . . . [9695-20]
- Photodynamic antimicrobial chemotherapy (PACT) against oral microorganisms with the use of blue LED associated to curcumin**, Gustavo M. Pires Santos, Fernando J. P. Sampaio, Susana Carla P. Sampaio de Oliveira, School of Dentistry, Univ. Federal da Bahia (Brazil) and Institute of Health Sciences, Univ. Federal da Bahia (Brazil); Juliana S. C. Monteiro, School of Dentistry, Univ. Federal da Bahia (Brazil); Vanderlei S. Bagnato, Instituto de Física de São Carlos (Brazil); Antonio Luiz B. Pinheiro, School of Dentistry, Univ. Federal da Bahia (Brazil) and Institute of Health Sciences, Univ. Federal da Bahia (Brazil) and Univ. Camilo Castelo Branco (Brazil) . . . . . [9695-21]
- Interaction of low level laser therapy in candida albicans fungal proliferation**, Vanda M. Carneiro, Natália C. Araújo, Rebeca F. Menezes, Lara M. Moreno, Alexandrino P. Santos-Neto, Marley E. M. Gerbi, Univ. Federal de Pernambuco (Brazil) . . . . . [9695-22]
- Low-level laser therapy (LLLT) in Russia: history of study of biomodulation action (BMA) mechanisms of low-intensity laser irradiation (LILI) and its therapeutic application practice**, Sergey Moskvina, State Scientific Ctr. of Laser Medicine (Russian Federation) . . . . . [9695-23]
- PDT in non-surgical treatment of periodontitis in kidney transplanted patients: a split-mouth, randomized clinical trial**, Kelly C. Marinho M.D., Elcio M. Giovanni D.D.S., Univ. Paulista (Brazil) . . . . . [9695-24]
- PDT in periodontal disease of haart resistance patients**, Elcio M. Giovanni D.D.S., Gilberto A. Noro-Filho M.D., Bruno V. Caputo M.D., Renato Casarin M.D., Claudio Costa, Daniela Andrade, Camila C. Santos M.D., Univ. Paulista (Brazil) . . . . . [9695-25]
- Evaluation of laser photobiomodulation effects in peri-implant bone repair through energy dispersive x-ray fluorescence: study in dogs**, Rebeca F. Menezes, Alexandrino P. Santos Neto, Natália C. Araújo, Vanda M. Carneiro, Lara Marques, Marley E. M. Gerbi, Univ. Federal de Pernambuco (Brazil) . . . . . [9695-26]
- Photodynamic ability of gold and silver nanoparticles in mediating cell death in breast and lung cancer cell lines**, Heidi Abrahamse, Univ. of Johannesburg (South Africa) . . . . . [9695-29]
- How to market your laser phototherapy practice evidence based best practices**, Terrance L. Baker, Sollay Cosmetic Medical & Laser Ctr. (USA) . . . . . [9695-30]

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM  
LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

BIOS

# CONFERENCE 9696

LOCATION: ROOM 3006 (WEST LEVEL 3)

Saturday–Sunday 13–14 February 2016 • Proceedings of SPIE Vol. 9696

# Molecular-Guided Surgery: Molecules, Devices, and Applications II

Conference Chairs: **Brian W. Pogue**, Thayer School of Engineering at Dartmouth (USA); **Sylvain Gioux**, Univ. de Strasbourg (France)

Program Committee: **David J. Cuccia**, Modulated Imaging, Inc. (USA); **Daniel R. Draney**, LI-COR Biosciences (USA); **Hisataka Kobayashi**, National Cancer Institute (USA); **Vasilis Ntziachristos**, Helmholtz Zentrum München GmbH (Germany); **Keith D. Paulsen**, Thayer School of Engineering at Dartmouth (USA); **Jonathan M. Sogger**, Intuitive Surgical, Inc. (USA); **Tomasz S. Tkaczyk**, Rice Univ. (USA); **Alex Vahrmeijer**, Leiden Univ. Medical Ctr. (Netherlands); **Thomas D. Wang M.D.**, Univ. of Michigan (USA); **Brian C. Wilson**, Ontario Cancer Institute (Canada); **Siavash Yazdanfar**, GE Global Research (USA)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 3006 (WEST LEVEL 3) .SAT 8:00 AM TO 10:00 AM

#### Advanced Molecular Imaging Methods I

Session Chairs: **David J. Cuccia**, Modulated Imaging, Inc. (USA);  
**Sylvain Gioux**, Univ. de Strasbourg (France)

8:00 am: **Sub-diffuse structured light imaging provides macroscopic maps of microscopic tissue structure** (*Invited Paper*), Stephen C. Kanick, Thayer School of Engineering at Dartmouth (USA) . . . . . [9696-1]

8:30 am: **Imaging and modeling of collagen architecture in living tissue with polarized light transfer** (*Invited Paper*), Jessica C. Ramella-Roman, Susan Stoff, Joseph Chue-Sang, Yuqiang Bai, Florida International Univ. (USA) . . . . . [9696-2]

9:00 am: **Multi-modality spatial frequency domain imaging of tissue** (*Invited Paper*), Bruce J. Tromberg, Univ. of California, Irvine (USA) . . . . . [9696-3]

9:30 am: **Real-time endoscopic oxygenation imaging using single snapshot of optical properties (SSOP) imaging**, Joseph P. Angelo, Beth Israel Deaconess Medical Ctr. (USA); Martijn van de Giessen, Leiden Univ. Medical Ctr. (Netherlands); Sylvain Gioux, Beth Israel Deaconess Medical Ctr. (USA) . . . . . [9696-4]

9:45 am: **Single-sensor real-time multispectral fluorescence and color imaging platform for image guided surgery**, Nikolas Dimitriadis, Martin Theuring, Bartlomiej Grychtol, Lars Maertins, Fraunhofer-Institut für Produktionstechnik und Automatisierung (Germany); Matthias Kolibabka, Eric Brandhorst, Hans-Peter Hammes, Ruprecht-Karls-Univ. Heidelberg (Germany); Nikolaos C. Deliolanis, Fraunhofer-Institut für Produktionstechnik und Automatisierung (Germany) . . . . . [9696-5]

Coffee Break . . . . . Sat 10:00 am to 10:30 am

### SESSION 2

LOCATION: ROOM 3006 (WEST LEVEL 3) SAT 10:30 AM TO 12:00 PM

#### Advanced Molecular Imaging Methods II

Session Chairs: **Nicholas J. Durr**,  
Beth Israel Deaconess Medical Ctr. (USA);  
**Brian W. Pogue**, Thayer School of Engineering at Dartmouth (USA)

10:30 am: **Attenuation correction in molecular fluorescence imaging** (*Invited Paper*), Bin Yang, James W. Tunnell, The Univ. of Texas at Austin (USA) [9696-6]

11:00 am: **The benefits of paired-agent imaging in molecular-guided surgery: an update on methods and applications** (*Invited Paper*), Kenneth M. Tichauer, Illinois Institute of Technology (USA) . . . . . [9696-7]

11:30 am: **Real-time multispectral fluorescence lifetime values estimation and overlay onto tissue white-light video frames**, Dimitris S. Gorpas, Dinglong M. Ma, Julien Bec, Diego R. Yankelevich, Laura Marcu, Univ. of California, Davis (USA) . . . . . [9696-8]

11:45 am: **A compact bio-inspired visible/NIR imager for image-guided surgery**, Shengkui Gao, Missael Garcia, Chris Edmiston, Washington Univ. in St. Louis (USA); Timothy York, Southern Illinois Univ. Edwardsville (USA); Radoslav Marinov, Suman B. Mondal, Washington Univ. in St. Louis (USA); Nan Zhu, College of Optical Sciences, The Univ. of Arizona (USA); Gail P. Sudlow, Walter J. Akers, Julie A. Margenthaler, Washington Univ. School of Medicine in St. Louis (USA); Rongguang Liang, Marta Pepino, Washington Univ. in St. Louis (USA); Samuel Achilefu, Washington Univ. School of Medicine in St. Louis (USA); Viktor Gruev, Washington Univ. in St. Louis (USA) . . . . . [9696-9]

Lunch/Exhibition Break . . . . . Sat 12:00 pm to 1:30 pm

### SESSION 3

LOCATION: ROOM 3006 (WEST LEVEL 3) . . . SAT 1:30 PM TO 3:30 PM

#### Molecular Contrast Agents

Session Chairs: **Mikhail Y. Berezin**,  
Washington Univ. School of Medicine in St. Louis (USA);  
**Kenneth M. Tichauer**, Illinois Institute of Technology (USA)

1:30 pm: **Optical probes for molecular-guided surgery with photodestruction of residual microscopic tumors and controlled drug-release to suppress multiple molecular signaling pathways of treatment escape** (*Invited Paper*), Bryan Q. Spring, R. Bryan Sears, Lei Z. Zheng, Zhiming Mai, Massachusetts General Hospital (USA); Reika Watanabe, Elizabeth Villa, Univ. of California, San Diego (USA); Tayyaba Hasan, Massachusetts General Hospital (USA) . . . . . [9696-10]

2:00 pm: **Engineered antibodies for optical imaging** (*Invited Paper*), Anna M. Wu, Univ. of California, Los Angeles (USA) . . . . . [9696-11]

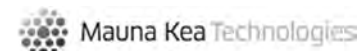
2:30 pm: **In-vivo fluorescence lifetime imaging for monitoring the efficacy of HER2 expressing tumors** (*Invited Paper*), Yasaman Ardeshirpour, Viktor V. Chernomordik, Moinuddin Hassan, Rafal Zielinski, Jacek Capala, Amir Gandjbakhche, National Institutes of Health (USA) . . . . . [9696-12]

3:00 pm: **Fluorescent probes for pancreatic cancer margin assessment in the operating room**, Dianmu Zhang, Emily Schultz, Summer L. Gibbs, Oregon Health & Science Univ. (USA) . . . . . [9696-13]

3:15 pm: **Porphyrin lipid nanoparticles for enhanced photothermal therapy (PTT) in a patient-derived orthotopic pancreas xenograft cancer model**, Christina MacLaughlin, Lili Ding, Cheng Jin, Pinjiang Cao, Juan Chen, Brian C. Wilson, Gang Zheng, David W. Hedley, Univ. Health Network (Canada) . . . . . [9696-14]

Coffee Break . . . . . Sat 3:30 pm to 4:00 pm

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# CONFERENCE 9696

LOCATION: ROOM 3006 (WEST LEVEL 3)

SUNDAY 14 FEBRUARY

SESSION 4  
LOCATION: ROOM 3006 (WEST LEVEL 3) . . SAT 4:00 PM TO 6:00 PM

## Imaging Systems

Session Chairs: **Stephen C. Kanick**,

Thayer School of Engineering at Dartmouth (USA);

**Joseph P. Angelo Jr.**, Beth Israel Deaconess Medical Ctr. (USA)

4:00 pm: **Optical surgical navigation for nodal staging: to see or not to see?** (*Invited Paper*), Eva M. Sevick-Muraca, The Univ. of Texas Health Science Ctr. at Houston (USA) . . . . . [9696-15]

4:30 pm: **Lambertian characteristic of tissue phantoms used as near infrared imaging fluorescence calibrator**, Maritoni Litorja, National Institute of Standards and Technology (USA); Simon G. Lorenzo, Louisiana State Univ. (USA); Banghe Zhu, Eva M. Sevick-Muraca, The Univ. of Texas Health Science Ctr. at Houston (USA) . . . . . [9696-16]

4:45 pm: **Goggle augmented imaging and navigation system (GAINS) for real-time fluorescence image-guided oncologic surgery**, Suman B. Mondal, Shengkui Gao, Washington Univ. in St. Louis (USA); Nan Zhu, College of Optical Sciences, The Univ. of Arizona (USA); Gail P. Sudlow, Walter J. Akers, Washington Univ. School of Medicine in St. Louis (USA); Ryan C. Fields, Washington Univ. in St. Louis (USA); Julie A. Margenthaler, Washington Univ. School of Medicine in St. Louis (USA); Rongguang Liang, College of Optical Sciences, The Univ. of Arizona (USA); Viktor Gruev, Washington Univ. in St. Louis (USA); Samuel Achilefu, Washington Univ. School of Medicine in St. Louis (USA) . . . . . [9696-17]

5:00 pm: **A projective surgical navigation system for cancer resection**, Qi Gan, Dong Wang, Jian Ye, Ze Shu Zhang, Xin R. Wang, Peng Fei Shao, Univ. of Science and Technology of China (China); Ronald X. Xu, The Ohio State Univ. (USA) . . . . . [9696-18]

5:15 pm: **Fluorescence guided lymph node biopsy in large animals using direct image projection device**, Elizabeth Ringhausen, Tylon Wang, Jonathan Pitts, Washington Univ. School of Medicine in St. Louis (USA); Pinaki Sarder, Univ. at Buffalo (USA); Walter J. Akers, Washington Univ. School of Medicine in St. Louis (USA) . . . . . [9696-19]

5:30 pm: **Intraoperative vascular imaging with augmented microscopy**, Jeffrey R. Watson, The Univ. of Arizona (USA); Nikolay Martirosyan, Banner Univ. Medical Ctr. (USA); Summer Garland, The Univ. of Arizona (USA); Michael Lemole Jr., Banner Univ. Medical Ctr. (USA); Marek Romanowski, The Univ. of Arizona (USA) . . . . . [9696-20]

5:45 pm: **A portable fluorescence microscopic imaging system for cholecystectomy**, Jian Ye, Chao Y. Yang, Qi Gan, Univ. of Science and Technology of China (China); Rong Ma, Chongqing Medical Univ. (China); Ze Shu Zhang, Peng Fei Shao, Shiwu Zhang, Univ. of Science and Technology of China (China); Ronald X. Xu, The Ohio State Univ. (USA) . . . . . [9696-21]

**BiOS Hot Topics**  
**SAT 7:00 PM TO 9:00 PM**  
**LOCATION: ROOM 3022 (WEST LEVEL 3)**  
See page 16 for complete Hot Topic Listing and Times

BIOS

SESSION 5  
LOCATION: ROOM 3006 (WEST LEVEL 3) SUN 8:00 AM TO 10:00 AM

## Preclinical Applications and Clinical Translation I

Session Chairs: **Summer L. Gibbs**,

Oregon Health & Science Univ. (USA);

**Alisha V. DSouza**, Thayer School of Engineering at Dartmouth (USA)

8:00 am: **Fluorophore-conjugated antibodies for imaging and resection of GI tumors** (*Invited Paper*), Michael Bouvet, Univ. of California, San Diego (USA); Robert M. Hoffman, Univ. of California, San Diego (USA) and AntiCancer, Inc. (USA) . . . . . [9696-22]

8:30 am: **Fluorescence-based enhanced reality (FLER) for real-time estimation of bowel perfusion in minimally-invasive surgery** (*Invited Paper*), Michele Diana, IHU Strasbourg (France) . . . . . [9696-23]

9:00 am: **Affibody in fluorescence-guided surgery of glioma to mark the extent based upon tumor receptors**, Ana Luiza Ribeiro de Souza, Thayer School of Engineering at Dartmouth (USA) and CAPES Foundation (Brazil); Kayla Marra, Jason R. Gunn, Jonathan T. Elliott, Thayer School of Engineering at Dartmouth (USA); Kimberley S. Samkoe, Keith D. Paulsen, Thayer School of Engineering at Dartmouth (USA) and Geisel School of Medicine (USA); Daniel R. Draney, LI-COR Biosciences (USA); Joachim Feldwisch, Affibody AB (Sweden) . . . . . [9696-24]

9:15 am: **Direct administration of nerve-specific fluorophores to guide nerve-sparing radical prostatectomy**, Connor Barth, Summer L. Gibbs, Oregon Health & Science Univ. (USA) . . . . . [9696-25]

9:30 am: **Detection of breast positive surgical margins with fluorescence-guided microscopy imaging**, Nicusor V. Iftimia, Dorin Preda, Jesung Park, Mitchell Antalek, Physical Sciences Inc. (USA) . . . . . [9696-26]

9:45 am: **Quantitative in vivo immunohistochemistry for tumor margin assessment in head and neck surgical resection**, Kimberley S. Samkoe, Geisel School of Medicine (USA); Kenneth M. Tichauer, Illinois Institute of Technology (USA); Eunice Chen, Geisel School of Medicine (USA); Jason R. Gunn, Thayer School of Engineering at Dartmouth (USA); P. Jack Hoopes, Wendy A. Wells, Geisel School of Medicine (USA); Tayyaba Hasan, Wellman Ctr. for Photomedicine (USA); Brian W. Pogue, Thayer School of Engineering at Dartmouth (USA) . . . . . [9696-27]

Coffee Break . . . . . Sun 10:00 am to 10:30 am

SESSION 6  
LOCATION: ROOM 3006 (WEST LEVEL 3) SUN 10:30 AM TO 12:00 PM

## Preclinical Applications and Clinical Translation II

Session Chairs: **Darren M. Roblyer**, Boston Univ. (USA);

**Adrien Ponticorvo**, Beckman Laser Institute and Medical Clinic (USA)

10:30 am: **Optical contrast agents to guide surgical ablation and pathological evaluation of resected tissues** (*Invited Paper*), Eben L. Rosenthal, Stanford Univ. (USA); Jason M. Warram, The Univ. of Alabama School of Medicine (USA) . . . . . [9696-28]

11:00 am: **BLZ-100 tumor fluorescent reporter** (*Invited Paper*), Heather Franklin, Blaze Bioscience, Inc. (USA) . . . . . [9696-29]

11:30 am: **Comparison of lymphatic uptake and active pumping patterns for small and large sized fluorescent molecules imaged in vivo**, Alisha V. DSouza, Jason R. Gunn, Kayla Marra, Jonathan T. Elliott, Thayer School of Engineering at Dartmouth (USA); Kimberley S. Samkoe, Geisel School of Medicine (USA); Brian W. Pogue, Thayer School of Engineering at Dartmouth (USA) . . . . . [9696-30]

11:45 am: **A standardized model for predicting flap failure using indocyanine green dye**, Lindsay Moore, The Univ. of Alabama School of Medicine (USA); Terence M. Zimmermann, Mayo Clinic (USA); Jason M. Warram, The Univ. of Alabama School of Medicine (USA); Benjamin Greene, The Univ. of Alabama at Birmingham School of Medicine (USA); Melissa L. Korb, The Univ. of Alabama School of Medicine (USA); Eben L. Rosenthal, Stanford Univ. (USA) . . . . . [9696-31]

Lunch/Exhibition Break . . . . . Sun 12:00 pm to 1:30 pm

# CONFERENCE 9696

LOCATION: ROOM 3006 (WEST LEVEL 3)

## SESSION 7

LOCATION: ROOM 3006 (WEST LEVEL 3) . . . SUN 1:30 PM TO 3:15 PM

### Clinical Applications

Session Chairs: **Michele Diana**, IHU, Strasbourg (France);  
**Frédéric Leblond**, Ecole Polytechnique de Montréal (Canada)

1:30 pm: **Clinical impact of NIR fluorescence guided surgery** (*Invited Paper*), Fernando Dip, Hospital de Clinicas Buenos Aires (Argentina) and Cleveland Clinic (USA) . . . . . [9696-32]

2:00 pm: **Image guided surgery using fluorescence: Road to clinical translation of novel probes** (*Invited Paper*), Alexander L. Vahrmeijer, Leiden Univ. Medical Ctr. (Netherlands) . . . . . [9696-33]

2:30 pm: **Near-infrared (NIR) fluorescence imaging of head and neck squamous cell carcinoma for fluorescence-guided surgery**, Lindsay Moore, Jason M. Warram, Esther de Boer, William R. Carroll, Anthony Morlandt, Kirk P. Withrow, The Univ. of Alabama School of Medicine (USA); Eben L. Rosenthal, Stanford Univ. (USA) . . . . . [9696-34]

2:45 pm: **Intraoperative optical imaging of peritoneal carcinomatosis of colorectal origin using a vegf-targeted fluorescent tracer: results of the hi-light study, a first in human imaging study**, Marjory Koller, Niels J. Harlaar, Steven J. de Jongh, Barbara L. van Leeuwen, P.H. J. Hemmer, Robert J. van Ginkel, Lucas B. Been, Gursah Kats-Ugurlu, Matthijs D. Linssen, Annelies Jorritsma-Smit, Wouter B. Nagengast, Univ. Medical Ctr. Groningen (Netherlands); Vasilis Ntziachristos, Helmholtz Zentrum München GmbH (Germany); Gooitzen M. van Dam, Univ. Medical Ctr. Groningen (Netherlands) . . . . . [9696-35]

3:00 pm: **Ongoing advances in quantitative PpIX fluorescence guided intracranial tumor resection**, Jonathan D. Olson, Stephen C. Kanick, Jaime J. Bravo, Thayer School of Engineering at Dartmouth (USA); David W. Roberts, Dartmouth Hitchcock Medical Ctr. (USA); Keith D. Paulsen, Thayer School of Engineering at Dartmouth (USA) . . . . . [9696-36]

Coffee Break . . . . . Sun 3:15 pm to 3:45 pm

### PANEL DISCUSSION

LOCATION: ROOM 3006 (WEST LEVEL 3) . . . 3:45 PM TO 5:30 PM

### Instrumentation for fluorescence-guided surgery: What do we need, what can we do?

Panel Moderators: **Sylvain Gioux**, Univ. de Strasbourg (France);  
**Brian W. Pogue**, Thayer School of Engineering at Dartmouth (USA)

#### PANELISTS:

**James Basilion**, Case Western Reserve Univ. (USA)

**Michael Bouvet**, Univ. of California San Diego (USA)

**Stefan Schorling**, SurgVision (Germany)

**Eben Rosenthal**, Stanford Univ. (USA)

**Philippe Rizo**, Commissariat à l'Énergie Atomique (France)

**Alex Vahrmeijer**, Leiden Univ Medical Ctr. (Netherlands)

# CONFERENCE 9697

LOCATION: ROOM 2002 (WEST LEVEL 2)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9697

# Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XX

BIOS

**Conference Chairs:** Joseph A. Izatt, Duke Univ. (USA); James G. Fujimoto, Massachusetts Institute of Technology (USA); Valery V. Tuchin, N.G. Chernyshevsky Saratov State Univ. (Russian Federation)

**Program Committee:** Peter E. Andersen, Technical Univ. of Denmark (Denmark); Kostadinka Bizheva, Univ. of Waterloo (Canada); Stephen A. Boppart M.D., Univ. of Illinois at Urbana-Champaign (USA); Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA); Johannes de Boer, Vrije Univ. Amsterdam (Netherlands); Wolfgang Drexler, Medizinische Univ. Wien (Austria); Grigory V. Gelikonov, Institute of Applied Physics (Russian Federation); Christoph K. Hitzenberger, Medizinische Univ. Wien (Austria); Robert A. Huber, Univ. zu Lübeck (Germany); Rainer A. Leitgeb, Medizinische Univ. Wien (Austria); Xingde Li, Johns Hopkins Univ. (USA); Yingtian Pan, Stony Brook Univ. (USA); Adrian Gh. Podoleanu, Univ. of Kent (United Kingdom); Andrew M. Rollins, Case Western Reserve Univ. (USA); Guillermo J. Tearney M.D., Wellman Ctr. for Photomedicine (USA); Ruikang K. Wang, Univ. of Washington (USA); Maciej Wojtkowski, Nicolaus Copernicus Univ. (Poland); Yoshiaki Yasuno, Univ. of Tsukuba (Japan)

## SUNDAY 14 FEBRUARY

### POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Degree of polarization (uniformity) and depolarization index: unambiguous depolarization contrast for optical coherence tomography.** Norman Lippok, Martin Villiger, Brett E. Bouma, Wellman Ctr. for Photomedicine (USA). [9697-85]

**Self-phase modulation induced spectral broadening in wavelength swept SOA fiber ring lasers.** Norman Lippok, Brett E. Bouma, Wellman Ctr. for Photomedicine (USA). [9697-86]

**Extended bandwidth wavelength swept laser source for high resolution optical frequency domain imaging.** Sahar Hosseinzadeh Kassani, Changsu Jun, Norman Lippok, Martin Villiger, Brett E. Bouma, Wellman Ctr. for Photomedicine (USA). [9697-87]

**Dual mode-locked swept sources for SS-OCT.** Radu F. Stancu, Adrian G. H. Podoleanu, Univ. of Kent (United Kingdom). [9697-88]

**Band multiplexing of wide-wavelength swept source based on multi-wavelength generation by filterless active mode-locking.** Gyeong Hun Kim, Hwi Don Lee, Hyung-Seok Lee, Chang-Seok Kim, Pusan National Univ. (Korea, Republic of). [9697-89]

**Computational point spread function engineering for optical coherence tomography.** Jeffrey A. Mulligan, Steven G. Adie, Cornell Univ. (USA). [9697-90]

**Wavelength dependence of penetration depth of OCT imaging for biological tissue in 0.8-1.9  $\mu\text{m}$  wavelength region.** Hiroyuki Kawagoe, Masahito Yamanaka, Norihiko Nishizawa, Nagoya Univ. (Japan). [9697-91]

**Influence of aberrations on the image quality in optical coherence microscopy.** Hinnerk Schulz-Hildebrandt, Mario Pieper, Peter König, Gereon Hüttmann, Univ. zu Lübeck (Germany). [9697-92]

**Quantitative OCT model links optical properties to microscale sample organization.** Mitra Almasian, Academisch Medisch Centrum (Netherlands); Nienke Bosschaart, Univ. Twente (Netherlands); Ton G. van Leeuwen, Dirk J. Faber, Academisch Medisch Centrum (Netherlands). [9697-93]

**Coarse-grained and fine-grained parallel optimization for real-time en-face OCT imaging.** Konstantin Kapinchev, Adrian Bradu, Frederick Barnes, Adrian G. H. Podoleanu, Univ. of Kent (United Kingdom). [9697-94]

**Acousto-optic tunable filter for dispersion characterization of optical coherence tomography systems.** Catherine Chin, Univ. of Kent (United Kingdom); Thomas Feuchter, Lasse Leick, NKT Photonics A/S (Denmark); Adrian Bradu, Adrian G. H. Podoleanu, Univ. of Kent (United Kingdom) [9697-95]

**Enhancing the dynamic range of swept source optical coherence tomography using dual level detection.** Xinyu Li, Jun Zhang, Sun Yat-Sen Univ. (China). [9697-96]

**Supercontinuum white light source used to increase sensitivity and resolution of parallel line-field spectral domain optical coherence tomography.** Jessica Barrick, The Univ. of North Carolina at Chapel Hill (USA); Michael Gardner, The Univ. of Texas at Austin (USA); Amy L. Oldenburg, The Univ. of North Carolina at Chapel Hill (USA). [9697-97]

**Broadband master/slave interferometry using a super-continuum source.** Michael Maria, Manuel J. M. Marques, Christopher Costa, Adrian Bradu, Univ. of Kent (United Kingdom); Thomas Feuchter, Lasse Leick, NKT Photonics A/S (Denmark); Adrian G. H. Podoleanu, Univ. of Kent (United Kingdom). [9697-98]

**Theory of Fourier phase within the framework of Fourier-domain optical coherence tomography.** Shikhar Uttam, Yang Liu, Univ. of Pittsburgh (USA). [9697-99]

**Narrow linewidth broadband tunable semiconductor laser at 840 nm with dual acousto-optic tunable configuration for OCT applications.** Alexander Chamorovskiy, Mikhail V. Shramenko, Andrei Lobintsov, Superlum (Ireland); Sergey Yakubovich, Moscow State Institute of Radiotechnics, Electronics and Automation (Russian Federation). [9697-101]

**Optical coherence tomography with gapped spectrum.** Nanshuo Wang, Xinyu Liu, Xiaojun Yu, Si Chen, En Bo, Yuemei Luo, Dongyao Cui, Linbo Liu, Nanyang Technological Univ. (Singapore). [9697-102]

**Depths-encoded angular compounding for speckle reduction in optical coherence tomography.** Zhaoyuan Cao, Jie Qian, Xinjian Chen, Jianhua Mo, Soochow Univ. (China). [9697-103]

**Design of a scan-lens and tube-lens for OCT applications.** Farid Atry, Ramin Pashaie, Univ. of Wisconsin-Milwaukee (USA). [9697-104]

**Extending the effective imaging depth in spectral domain optical coherence tomography by dual spatial frequency encoding.** Tong Wu, Qingqing Wang, Youwen Liu, Jiming Wang, Nanjing Univ. of Aeronautics and Astronautics (China). [9697-105]

**System calibration and optimization for swept-source optical coherence tomography.** Tan-Lin Liao, Cheng-Han Huang, Chun-Jung Huang, Chia-Wei Sun, National Chiao Tung Univ. (Taiwan). [9697-106]

**Dual scan based SD-OCT for depth enhanced investigation on leaf samples using a single spectrometer.** Naresh Kumar Ravichandran, Kibeom Park, BIO PHOTRONICS (Korea, Republic of); Seung-Yeol Lee, Kyungpook National Univ. (Korea, Republic of); Jaeyul Lee, Jaewon Song, Light Wave Lab. (Korea, Republic of); Hee-Young Jung, Kyungpook National Univ. (Korea, Republic of); Mansik Jeon, Jeehyun Kim, BIO PHOTRONICS (Korea, Republic of). [9697-107]

**Use of high NA fibers in swept source OCT for improved image quality.** Bharadwaj Muralidharan, Tianyi Wang, Thomas E. Milner, The Univ. of Texas at Austin (USA). [9697-108]

**Optical coherence tomography probe design for reduced artifact generation and manufacturability.** Daniel Staloff, Corning Tropol Corp. (USA); Lovell E. Comstock, William Miller, Horst Schreiber, Corning Incorporated (USA). [9697-109]

# CONFERENCE 9697

LOCATION: ROOM 2002 (WEST LEVEL 2)

MONDAY 15 FEBRUARY

## SESSION 1

LOCATION: ROOM 2002 (WEST LEVEL 2) MON 8:30 AM TO 10:00 AM

### Ophthalmic New Technology

Session Chair: **Joseph A. Izatt**, Duke Univ. (USA)

8:30 am: **Novel real-time volumetric tool segmentation algorithm for intraoperative microscope integrated OCT**, Christian Viehland, Brenton Keller, Oscar Carrasco-Zevallos, Duke Univ. (USA); David Cunefare, Duke Univ. School of Medicine (USA); Liangbo Shen, Duke Univ. (USA); Cynthia Toth M.D., Duke Univ. School of Medicine (USA); Sina Farsiu, Joseph A. Izatt, Duke Univ. (USA) ..... [9697-1]

8:45 am: **Megahertz FDML laser with up to 143nm sweep range for ultrahigh resolution OCT at 1050nm**, Jan Philip Kolb, Univ. zu Lübeck (Germany) and Ludwig-Maximilians-Univ. München (Germany); Thomas Klein, Optores GmbH (Germany) and Ludwig-Maximilians-Univ. München (Germany); Matthias Eibl, Tom Pfeiffer, Univ. zu Lübeck (Germany) and Ludwig-Maximilians-Univ. München (Germany); Wolfgang Wieser, Optores GmbH (Germany) and Ludwig-Maximilians-Univ. München (Germany); Robert A. Huber, Univ. zu Lübeck (Germany) ..... [9697-2]

9:00 am: **Phase stable photoreceptor imaging with line-field spectral domain OCT**, Daniel J. Fechtig, Laurin Ginner, Abhishek Kumar, Michael Pircher, Medizinische Univ. Wien (Austria); Tilman Schmoll, Carl Zeiss Meditec, Inc. (USA); Lara M. Wurster, Wolfgang Drexler, Rainer A. Leitgeb, Medizinische Univ. Wien (Austria) ..... [9697-3]

9:15 am: **A novel 1050nm handheld optical frequency domain imaging system for pediatric retinoblastoma patients: translation from laboratory bench to clinical study**, Oleg Nadiarnykh, Vrije Univ. Amsterdam (Netherlands); Annette C. Moll, Vrije Univ. Medical Ctr. (Netherlands); Johannes F. de Boer, Vrije Univ. Amsterdam (Netherlands) ..... [9697-4]

9:30 am: **In vivo tear film thickness measurement and tear film dynamics visualization using spectral domain OCT and an efficient delay estimator**, Valentin Aranha dos Santos, Medizinische Univ. Wien (Austria) and Technische Univ. Wien (Austria); René M. Werkmeister, Leopold Schmetterer, Medizinische Univ. Wien (Austria); Martin Gröschl, Technische Univ. Wien (Austria); Gerhard Garhofer, Medizinische Univ. Wien (Austria) ..... [9697-5]

9:45 am: **Anterior segment and retinal OCT imaging with simplified sample arm using focus tunable lens technology**, Ireneusz Grulkowski, Karol Karnowski, Daniel Ruminski, Maciej Wojtkowski, Nicolaus Copernicus Univ. (Poland) ..... [9697-6]

Coffee Break ..... Mon 10:00 am to 10:30 am

## SESSION 2

LOCATION: ROOM 2002 (WEST LEVEL 2) MON 10:30 AM TO 12:00 PM

### Cardiac Applications

Session Chair: **Guillermo J. Tearney**, Wellman Ctr. for Photomedicine (USA)

10:30 am: **Angiographic imaging using an 18.9 MHz swept-wavelength laser that is phase-locked to the data acquisition clock and resonant scanners**, Serhat Tozburun, Cedric Blatter, Wellman Ctr. for Photomedicine (USA); Meena Siddiqui, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA); Ahhyun S. Nam, Massachusetts Institute of Technology (USA); Benjamin J. Vakoc, Wellman Ctr. for Photomedicine (USA) ..... [9697-7]

10:45 am: **Integrated RFA/OCT catheter for real-time guidance of cardiac radio-frequency ablation therapy**, Xiaoyong Fu, Colin Blumenthal, Deniz Dosluoglu, Yves T. Wang, Michael W. Jenkins, Rakesh Souza, Christopher Snyder, Mauricio Arruda, Andrew M. Rollins, Case Western Reserve Univ. (USA) ..... [9697-8]

11:00 am: **Multi-modality intravascular imaging: first-in-human OCT and near-infrared autofluorescence (NIRAF) imaging of coronary artery disease**, Giovanni Jacopo J. Ughi, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA) and Harvard Medical School (USA); Hao Wang, Joseph A. Gardecki, Edouard Gerbaud, Ali M. Fard, Ehsan Hamidi, Paulino Vacas-Jacques, Mireille Rosenberg, Farouc A. Jaffer, Wellman Ctr. for Photomedicine (USA); Guillermo J. Tearney, Massachusetts General Hospital (USA) and Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA) ..... [9697-9]

11:15 am: **Automatic classification of atherosclerotic plaques imaged with intravascular OCT**, Jose D. Rico-Jimenez, Texas A&M Univ. (USA); Daniel U. Campos-Delgado, Univ. Autónoma de San Luis Potosí (Mexico); Martin Villiger, Brett E. Bouma, Wellman Ctr. for Photomedicine (USA); Javier A. Jo, Texas A&M Univ. (USA) ..... [9697-10]

11:30 am: **Automated tissue classification of intracardiac optical coherence tomography images**, Yu Gan, Columbia Univ. (USA); David Tsay, Columbia Univ. Medical Ctr. (USA); Syed A. Bin Amir, Columbia Univ. (USA); Charles C. Marboe, Columbia Univ. Medical Ctr. (USA); Christine P. Hendon, Columbia Univ. (USA) ..... [9697-11]

11:45 am: **Pacing-induced congenital heart defects assessed by OCT**, Stephanie M. Ford, Univ. Hospitals Rainbow Babies & Children's Hospital (USA); Matthew T. McPheeters, Yves T. Wang, Shi Gu, Yong Qiu Doughman, Case Western Reserve Univ. (USA); James P. Strainic M.D., Univ. Hospitals Rainbow Babies & Children's Hospital (USA); Andrew M. Rollins, Michiko Watanabe, Michael W. Jenkins, Case Western Reserve Univ. (USA) ..... [9697-12]

Lunch Break ..... Mon 12:00 pm to 1:30 pm

## SESSION 3

LOCATION: ROOM 2002 (WEST LEVEL 2) . . MON 1:30 PM TO 3:30 PM

### Flow and Perfusion Imaging

Session Chair: **Ruikang K. Wang**, Univ. of Washington (USA)

1:30 pm: **Imaging vascular dynamics in human retina using full-field swept-source optical coherence tomography**, Hendrik Spahr, Univ. zu Lübeck (Germany) and Medizinisches Laserzentrum Lübeck GmbH (Germany); Dierck Hillmann, Thorlabs GmbH (Germany); Carola Hain, Clara Pfäffle, Helge M. Sudkamp, Gesa L. Franke, Gereon Hüttmann, Univ. zu Lübeck (Germany) and Medizinisches Laserzentrum Lübeck GmbH (Germany) [9697-13]

1:45 pm: **Particle streak velocimetry OCT (PSV-OCT): a novel method for multi-vector component velocimetry of microscale flow physiology**, Kevin C. Zhou, Brendan K. Huang, Ute A. Gamm, Vineet Bhandari M.D., Mustafa K. Khokha, Michael A. Choma M.D., Yale Univ. (USA) ..... [9697-14]

2:00 pm: **Dynamic contrast optical coherence tomography: quantitative measurement of microvascular transit-time distributions in vivo**, Conrad W. Merkle, Vivek J. Srinivasan, Univ. of California, Davis (USA) [9697-15]

2:15 pm: **Visible light optical coherence tomography for microvascular oximetry in ocular circulation**, Siyu Chen, Ji Yi, Hao F. Zhang, Northwestern Univ. (USA) ..... [9697-16]

2:30 pm: **Visible light optical coherence tomography measure retinal oxygen metabolic response to systemic oxygenation**, Ji Yi, Boston Univ. (USA); Wenzhong Liu, Siyu Chen, Vadim Backman, Northwestern Univ. (USA); Nader Sheibani, Christine M. Sorenson, Univ. of Wisconsin-Madison (USA); Amani A. Fawzi M.D., Robert A. Linsenmeier, Hao F. Zhang, Northwestern Univ. (USA) ..... [9697-17]

2:45 pm: **Noise-immune complex correlation for vasculature imaging based on standard and Jones-matrix optical coherence tomography**, Shuichi Makita, Kazuhiro Kurokawa, Young-Joo Hong, En Li, Univ. of Tsukuba (Japan); Masahiro Miura, Tokyo Medical Univ. (Japan); Yasuno Yoshiaki, Univ. of Tsukuba (Japan) ..... [9697-18]

3:00 pm: **Depth encoded three-beam swept source Doppler optical coherence tomography**, Andreas Wartak, Richard Haindl, Wolfgang Trasischker, Bernhard Baumann, Michael Pircher, Christoph K. Hitzenberger, Medizinische Univ. Wien (Austria) ..... [9697-19]

3:15 pm: **Simultaneous and localized measurement of biofilm growth and flow in microfluidic channels using OCT**, Nicolas Weiss, Academisch Medisch Centrum (Netherlands); Khalid El Tayeb El Obied, Univ. Twente (Netherlands); Jeroen Kalkman, Technische Univ. Delft (Netherlands); Rob G. H. Lammertink, Univ. Twente (Netherlands); Ton G. van Leeuwen, Academisch Medisch Centrum (Netherlands) ..... [9697-20]

Coffee Break ..... Mon 3:30 pm to 4:00 pm



### SESSION 4

LOCATION: ROOM 2002 (WEST LEVEL 2) . MON 4:00 PM TO 6:00 PM

## OCT New Technology

Session Chair: **James G. Fujimoto**,  
Massachusetts Institute of Technology (USA)

4:00 pm: **Miniaturized silicon photonic integrated swept source OCT receiver with dual polarization, dual balanced, in-phase and quadrature detection**, Zhao Wang, Hsiang-Chieh Lee, Massachusetts Institute of Technology (USA); Long Chen, Diedrik Vermeulen, Torben Nielsen, Seo Yeon Park, Allan Ghaemi, Eric Swanson, Chris Doerr, Acacia Communications Inc. (USA); James G. Fujimoto, Massachusetts Institute of Technology (USA) . . . . . [9697-21]

4:15 pm: **Simultaneous long-range and high-speed imaging with optically subsampled OCT**, Meena Siddiqui, Massachusetts Institute of Technology (USA) and Harvard Univ. (USA) and Massachusetts General Hospital (USA); Serhat Tozburun, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA); Benjamin J. Vakoc, Massachusetts General Hospital (USA) and Harvard Medical School (USA) . . . . . [9697-22]

4:30 pm: **Electro-thermal MEMS fiber scanner for endoscopic optical coherence tomography**, Hyeon-Cheol Park, Johns Hopkins Univ. (USA); Xiaoyang Zhang, Univ. of Florida (USA); Jessica Mavadia-Shukla, Wu Yuan, Johns Hopkins Univ. (USA); Huikai Xie, Univ. of Florida (USA); Xingde Li, Johns Hopkins Univ. (USA) . . . . . [9697-23]

4:45 pm: **Noncontact phase-sensitive dynamic optical coherence elastography at megahertz rate**, Manmohan Singh, Chen Wu, Chih-Hao Liu, Jiasong Li, Alexander Schill, Achuth Nair, Univ. of Houston (USA); Yuri V. Kistenev, Tomsk State University (Russian Federation); Kirill V. Larin, Univ. of Houston (USA) . . . . . [9697-24]

5:00 pm: **Spectral estimation optical coherence tomography for axial super-resolution**, Xinyu Liu, Xiaojun Yu, Nanshuo Wang, En Bo, Yuemei Luo, Si Chen M.D., Dongyao Cui, Linbo Liu, Nanyang Technological Univ. (Singapore) . . . . . [9697-25]

5:15 pm: **SNR of swept SLEDs and swept lasers for OCT**, Bart C. Johnson, Walid Atia, Dale Flanders, Mark Kuznetsov, Brian D. Goldberg, Nate J. Kemp, Peter Whitney, AXSUN Technologies Inc. (USA) . . . . . [9697-26]

5:30 pm: **Flexible A-scan rate MHz OCT: computational downscaling by coherent averaging**, Tom Pfeiffer, Univ. zu Lübeck (Germany) and Ludwig-Maximilians-Univ. München (Germany); Thomas Klein, Optores GmbH (Germany); Wolfgang Wieser, Optores GmbH (Germany) and Ludwig-Maximilians-Univ. München (Germany); Markus Petermann, Ludwig-Maximilians-Univ. München (Germany) and Optores GmbH (Germany); Matthias Eibl, Univ. zu Lübeck (Germany); Robert A. Huber, Univ. zu Lübeck (Germany) and Optores GmbH (Germany) . . . . . [9697-27]

5:45 pm: **The how and why of a \$10 optical coherence tomography system**, Martin J. Leahy, National Univ. of Ireland, Galway (Ireland); Carol J. Wilson, Josh Hogan, Compact Imaging, Inc. (USA); Roshan I. Dsouza, National Univ. of Ireland, Galway (Ireland); Don Bogue, Compact Imaging, Inc. (USA); Kai Neuhaus, Hrebesh M. Subhash, National Univ. of Ireland, Galway (Ireland); Paul M. McNamara, Compact Imaging Ltd. (Ireland) and National Univ. of Ireland, Galway (Ireland) . . . . . [9697-28]

### POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

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**Fast subcellular optical coherence photoacoustic microscopy**, Cuixia Dai, Shanghai Institute of Technology (China) . . . . . [9697-110]

**Cerebral metabolic rate of oxygen (CMRO2) assessed by combined Doppler and spectroscopic OCT**, Shau Poh Chong, Conrad W. Merkle, Vivek J. Srinivasan, Univ. of California, Davis (USA) . . . . . [9697-111]

**Magnetic force optical coherence elastography at 1.5 million a-lines per second**, Chen Wu, Manmohan Singh, Zhaolong Han, Raksha Raghunathan, Chih-Hao Liu, Jiasong Li, Alexander Schill, Kirill V. Larin, Univ. of Houston (USA) . . . . . [9697-112]

**Development of a whole model eye tissue phantom for swept-source optical coherence tomography (SS-OCT)**, T. Scott Rowe, Rowe Technical Design (USA) . . . . . [9697-113]

**In vivo imaging of phonating larynx in awake patients using optical coherence tomography**, Li-Dek Chou, Beckman Laser Institute and Medical Clinic (USA) and OCT Medical Imaging Inc. (USA); Carolyn Coughlan, Univ. of California, Irvine (USA); Joseph C. Jing, Univ. of California, Irvine (USA) and Beckman Laser Institute and Medical Clinic, Univ. of California, Irvine (USA); Jason Chen, Beckman Laser Institute and Medical Clinic (USA); Swathi Rangarajan, Theodore H. Chang, OCT Medical Imaging Inc. (USA); Giriraj Sharma, Univ. of California, Irvine (USA); Kyoungri Cho, Donghoon Lee, Beckman Laser Institute and Medical Clinic (USA); Julie A. Goddard M.D., Univ. of California, Irvine (USA); Brian J. F. Wong, Univ. of California, Irvine (USA) and Beckman Laser Institute and Medical Clinic, Univ. of California, Irvine (USA); Zhongping Chen, Univ. of California, Irvine (USA) and Beckman Laser Institute and Medical Clinic (USA) . . . . . [9697-114]

**Study of tailing effect in OCT angiography**, Anqi Zhang, Qinqin Zhang, Univ. of Washington (USA); Philip J. Rosenfeld, Bascom Palmer Eye Institute, Univ. of Miami (USA); Ruikang K. Wang, Univ. of Washington (USA) . . . . . [9697-115]

**Optical coherence tomography for pathological analysis of thyroid**, Neda Haj-Hosseini, Pernilla Petersson, Oliver Gimm, Ivan Shabo, Linköping Univ. (Sweden) . . . . . [9697-116]

**Automated detection of inflammatory cells in whole anterior chamber of a uveitis mouse from swept-source optical coherence tomography images**, Woo June Choi, Kathryn L. Pepple M.D., Ruikang K. Wang, Univ. of Washington (USA) . . . . . [9697-117]

**Automatic three-dimensional segmentation combined with in vivo microvascular network imaging of human retina by intensity-based Doppler variance optical coherence tomography**, Zhonglie Piao, Beckman Laser Institute and Medical Clinic (USA) and Pusan National Univ. (Korea, Republic of); Shenghai Huang, Beckman Laser Institute and Medical Clinic, Univ. of California, Irvine (USA) and Wenzhou Medical College (China); Jiang Zhu, Li Qi, Beckman Laser Institute and Medical Clinic (USA); Fan Lu, Wenzhou Medical College (China); Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9697-118]

**Automatic airway wall segmentation and thickness measurement for long-range optical coherence tomography images**, Li Qi, Nanjing Univ. (China) and Beckman Laser Institute and Medical Clinic (USA); Shenghai Huang, Beckman Laser Institute and Medical Clinic, Univ. of California, Irvine (USA); Andrew E. Heidari, Beckman Laser Institute and Medical Clinic (USA) and Univ. of California, Irvine (USA); Cuixia Dai, Jiang Zhu, Beckman Laser Institute and Medical Clinic (USA); Xuping Zhang, Nanjing Univ. (China); Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA) and Univ. of California, Irvine (USA) . . . . . [9697-119]

**Optimization of modified scanning protocol based correlation mapping optical coherence tomography at 200 kHz VCSEL source for in vivo microcirculation imaging applications**, Cerine Lal, James McGrath, Hrebesh M. Subhash, Martin J. Leahy, National Univ. of Ireland, Galway (Ireland) . . . . . [9697-120]

**Ex vivo brain tumor analysis using spectroscopic optical coherence tomography**, Marcel Lenz, Ruhr-Univ. Bochum (Germany); Robin Krug, Univ. Knappschaftskrankenhaus Bochum GmbH (Germany); Hubert Welp, Technische Fachhochschule Georg Agricola zu Bochum (Germany); Kirsten Schmieder, Univ. Knappschaftskrankenhaus Bochum GmbH (Germany); Martin R. Hofmann, Ruhr-Univ. Bochum (Germany) . . . . . [9697-121]

**Comprehensive study of various amplitude-based angiography algorithms with CEECL and VCSEL based swept source optical coherence tomography systems**, James McGrath, Cerine Lal, Sean O'Gorman, Hrebesh M. Subhash, Martin J. Leahy, National Univ. of Ireland, Galway (Ireland) . . . . . [9697-122]

**OCT for blood glucose monitoring through signal attenuation**, Lucas R. De Pretto, Tania M. Yoshimura, Univ. de São Paulo (Brazil); Martha S. Ribeiro, Anderson Z. Freitas, Instituto de Pesquisas Energéticas e Nucleares (Brazil) . . . . . [9697-123]

**Profilometry of the air-tissue interface by all-semiconductor akinetic programmable swept-source with centimeters coherence length**, Zenghai Lu, Stephen J. Matcher, The Univ. of Sheffield (United Kingdom) . . . . . [9697-124]

**Nanoparticles displacement analysis using optical coherence tomography**, Marcin R. Strakowski, Maciej Kraszewski, Michal Trojanowski, Paulina Strakowska, Gdansk Univ. of Technology (Poland) . . . . . [9697-125]

**Spectroscopic low coherence interferometry using a supercontinuum source and an ultra broadband spectrometer**, Felix T. Fleischhauer, Sophie Caujolle, NKT Photonics A/S (Denmark) and Univ. of Kent (United Kingdom); Thomas Feutcher, NKT Photonics A/S (Denmark); Ranjan Rajendram, Moorfields Eye Hospital (United Kingdom) and Univ. College London (United Kingdom); Lasse Leick, NKT Photonics A/S (Denmark); Adrian G. H. Podoleanu, Univ. of Kent (United Kingdom) . . . . . [9697-126]

# CONFERENCE 9697

LOCATION: ROOM 2002 (WEST LEVEL 2)

**Quantification of microvasculature of irradiated tumor tissue with optical coherence tomography**, Valentin Demidov, Univ. of Toronto (Canada); Victoria Madge, Carleton Univ. (Canada); Azusa Maeda, Univ. of Toronto (Canada); Egor Demidov, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Ralph S. DaCosta, Princess Margaret Cancer Ctr., Univ. Health Network (Canada); I. Alex Vitkin, Univ. of Toronto (Canada) and Princess Margaret Cancer Ctr., Univ. Health Network (Canada) . . . . . [9697-127]

**Optical coherence tomography for longitudinal monitoring of tumor vascular permeability following radiation therapy**, Valentin Demidov, Univ. of Toronto (Canada); Lev A. Matveev, Institute of Applied Physics of the RAS (Russian Federation) and Nizhny Novgorod State Medical Academy (Russian Federation) and Nizhny Novgorod State Univ. (Russian Federation); Azusa Maeda, Univ. of Toronto (Canada); Victoria Madge, Carleton Univ. (Canada); Grigory V. Gelikonov, Vladimir Y. Zaitsev, Institute of Applied Physics of the RAS (Russian Federation) and Nizhny Novgorod State Medical Academy (Russian Federation) and Nizhny Novgorod State Univ. (Russian Federation); Ralph S. DaCosta, Princess Margaret Cancer Ctr., Univ. Health Network (Canada); I. Alex Vitkin, Univ. of Toronto (Canada) and Princess Margaret Cancer Ctr., Univ. Health Network (Canada) and Nizhny Novgorod State Medical Academy (Russian Federation) . . . . . [9697-128]

**In vivo imaging of melanoma tissues guided by magnetic nanoparticles augmented magneto-motive optical Doppler tomography system**, Ruchire E. Henry Wijesinghe, Seung-Yeol Lee, Kibeom Park, Muhammad Faizan Shirazi, Hee-Young Jung, Mansik Jeon, Jeehyun Kim, Kyungpook National Univ. (Korea, Republic of) . . . . . [9697-129]

**Tri-band optical coherence tomography for lipid and vessel spectroscopic imaging**, Luoqin Yu, Jiqiang Kang, Xie Wang, Xiaoming Wei, Kin Tak Chan, Nikki P. Lee, Kenneth K. Y. Wong, The Univ. of Hong Kong (Hong Kong, China) . . . . . [9697-130]

**Continuous imaging of the blood vessels in tumor mouse dorsal skin window chamber model by using SD-OCT**, Xiao Peng, Shaozhuang Yang, Bin Yu, Qi Wang, Danying Lin, Yiqun Ma, Junle Qu, Hanben Niu, Shenzhen Univ. (China) . . . . . [9697-131]

**High speed line field spectral domain optical coherence tomography for morphological inspection of industrial samples**, Muhammad Faizan Shirazi, Ruchire E. H. Wijesinghe, Kibeom Park, Kyungpook National Univ. (Korea, Republic of); Pil Un Kim, Oz-tec Co., Ltd. (Korea, Republic of); Mansik Jeon, Jeehyun Kim, Kyungpook National Univ. (Korea, Republic of) . . . . . [9697-132]

**Application of deconvolution technique in optical coherent tomography for tear film measurement**, Hui Lu, Kai Shen, Sarfaraz Baig, Michael R. Wang, Univ. of Miami (USA) . . . . . [9697-133]

**Calculus diagnosis base on real time polarization optical coherence tomography**, Shang Ruei You, Chia-Wei Sun, Cheng-Han Huang, National Chiao Tung Univ. (Taiwan) . . . . . [9697-134]

9:30 am: **Adaptive optics full-field OCT: a resolution almost insensitive to aberrations**, Peng Xiao, Mathias Fink, Claude Boccara, Institut Langevin (France) . . . . . [9697-33]

9:45 am: **3D-Spectral domain computational imaging**, Trevor B. Anderson, Armin Segref, Grant Frisken, Dirk Lorensen, Herman Ferra, Steven Frisken, Cylite Pty Ltd. (Australia) . . . . . [9697-34]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

## SESSION 6

LOCATION: ROOM 2002 (WEST LEVEL 2) TUE 10:30 AM TO 12:00 PM

### Catheter/Endoscopic/Needle Probes

Session Chair: **Andrew Rollins**, Case Western Reserve Univ. (USA)

10:30 am: **Towards low-risk in vivo diagnosis of pulmonary fibrosis with optical coherence tomography**, Lida P. Hariri M.D., David C. Adams, Massachusetts General Hospital (USA); Thomas V. Colby M.D., Mayo Clinic Arizona (USA); Andrew M. Tager M.D., Melissa J. Suter, Massachusetts General Hospital (USA) . . . . . [9697-35]

10:45 am: **Ultrahigh speed en face OCT capsule imaging for endoscopic surveillance**, Kaicheng Liang, Osman O. Ahsen, Hsiang-Chieh Lee, Zhao Wang, Massachusetts Institute of Technology (USA); Benjamin Pottsaid, Massachusetts Institute of Technology (USA) and Thorlabs, Inc. (USA); Marisa Figueiredo, VA Boston Healthcare System (USA); Michael G. Giacomelli, Massachusetts Institute of Technology (USA); Vijaysekhar Jayaraman, Praevium Research, Inc. (USA); Qin Huang, VA Boston Healthcare System (USA); Hiroshi Mashimo, VA Boston Healthcare System (USA) and Harvard Medical School (USA); James G. Fujimoto, Massachusetts Institute of Technology (USA) . . . . . [9697-36]

11:00 am: **Super-achromatic microprobe for ultrahigh-resolution endoscopic OCT imaging at 800 nm**, Wu Yuan, Milad Alemohammad, Xiaoyun Yu, Shaoyong Yu, Xingde Li, Johns Hopkins Univ. (USA) . . . . . [9697-37]

11:15 am: **Depth of focus extension for OCT by self-imaging wavefront division fiber optic probe**, Biwei Yin, Chia-pin Liang, Kengyeh K. Chu, Joseph A. Gardecki, Guillermo J. Tearney, Harvard Medical School (USA) . . . . . [9697-38]

11:30 am: **High speed, ultrahigh-resolution, distal scanning endoscopic OCT at 800 nm**, Jessica Mavadia-Shukla, Wenxuan Liang, Xiaoyun Yu, Shaoyong Yu, Xingde Li, Johns Hopkins Univ. (USA) . . . . . [9697-39]

11:45 am: **Rotational distortion and tissue deformation correction in catheter-based optical coherence tomography using a hybrid speckle-decorrelation and feature-tracking technique**, Néstor Uribe-Patarroyo, Wellman Ctr. for Photomedicine (USA); Benedikt W. Graf, David A. Vader, NinePoint Medical (USA); Brett E. Bouma, Wellman Ctr. for Photomedicine (USA) . . . . . [9697-40]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:30 pm

## TUESDAY 16 FEBRUARY

### SESSION 5

LOCATION: ROOM 2002 (WEST LEVEL 2) . TUE 8:30 AM TO 10:00 AM

### Adaptive/Computational Optics

Session Chair: **Rainer Andreas Leitgeb**, Medizinische Univ. Wien (Austria)

8:30 am: **Phase sensitive adaptive optics assisted SLO/OCT for retinal imaging**, Michael Pircher, Franz Felberer, Matthias Salas, Richard Haindl, Bernhard Baumann, Andreas Wartak, Christoph K. Hitzenberger, Medizinische Univ. Wien (Austria) . . . . . [9697-29]

8:45 am: **Wide field-of-view sensorless adaptive optics optical coherence tomography**, James M. Polans, Francesco LaRocca, Oscar Carrasco-Zevallos, Brenton Keller, Joseph A. Izatt, Duke Univ. (USA) . . . . . [9697-30]

9:00 am: **Adaptive Optics OCT using 1060nm swept source and dual deformable lenses for human retinal imaging**, Yifan Jian, Sujin Lee, Michelle Cua, Dongkai Miao, Simon Fraser Univ. (Canada); Stefano Bonora, IFN-CNR LUXOR Lab. (Italy); Robert J. Zawadzki, Univ. of California, Davis (USA); Marinko V. Sarunic, Simon Fraser Univ. (Canada) . . . . . [9697-31]

9:15 am: **Aberration-corrected high-speed full-field swept-source OCT**, Dierck Hillmann, Thorlabs GmbH (Germany); Hendrik Spahr, Institut für Biomedizinische Optik, Univ. zu Lübeck (Germany) and Medizinisches Laserzentrum Lübeck GmbH (Germany); Carola Hain, Institut für Biomedizinische Optik, Univ. zu Lübeck (Germany); Helge M. Sudkamp, Gesa L. Franke, Institut für Biomedizinische Optik, Univ. zu Lübeck (Germany) and Medizinisches Laserzentrum Lübeck GmbH (Germany); Clara Pfäffle, Institut für Biomedizinische Optik, Univ. zu Lübeck (Germany); Christian Winter, Thorlabs GmbH (Germany); Gereon Hüttmann, Institut für Biomedizinische Optik, Univ. zu Lübeck (Germany) and Medizinisches Laserzentrum Lübeck GmbH (Germany) . . . . . [9697-32]

### SESSION 7

LOCATION: ROOM 2002 (WEST LEVEL 2) . . . TUE 1:30 PM TO 3:30 PM

### Brain, Small Animal and Hand-Held OCT

Session Chair: **Maciej Wojtkowski**, Nicolaus Copernicus Univ. (Poland)

1:30 pm: **High-resolution optical polarization tractography based on polarization-sensitive optical coherence tomography**, Gang Yao, Univ. of Missouri (USA) . . . . . [9697-41]

1:45 pm: **Non-invasive, in vivo imaging of subcortical mouse brain regions with 1.7  $\mu$ m optical coherence tomography**, Chau Poh Chong, Conrad W. Merkle, Tingwei Zhang, Harsha Radhakrishnan, Dylan F. Cooke, Leah Krubitzer, Vivek J. Srinivasan, Univ. of California, Davis (USA) . . . . . [9697-42]

2:00 pm: **Imaging of the stroke-related changes in mouse brain vascular system with the use of extended focus optical coherence microscopy**, Szymon Tamborski, Hong Chou Lyu, Nicolaus Copernicus Univ. (Poland); Danuta M. Bukowska, Lion's Eye Institute (Australia); Hubert Dolezyczek, Grzegorz Wilczynski, Nencki Institute of Experimental Biology (Poland); Maciej Wojtkowski, Maciej Szkulmowski, Nicolaus Copernicus Univ. (Poland); Daniel Szlag, Theo Lasser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9697-43]

2:15 pm: **Investigating alcohol-induced congenital heart defects using optical coherence tomography**, Shi Gu, Lindsay M. Peterson, Pei Ma, Ganga Karunamuni, Michiko Watanabe, Michael W. Jenkins, Andrew M. Rollins, Case Western Reserve Univ. (USA) . . . . . [9697-44]

2:30 pm: **An integrated optical coherence microscopy imaging and optical stimulation system for optogenetic pacing in Drosophila melanogaster**, Jing Men, Chao Zhou, Lehigh Univ. (USA) . . . . . [9697-45]

# CONFERENCE 9697

LOCATION: ROOM 2002 (WEST LEVEL 2)

WEDNESDAY 17 FEBRUARY

SESSION 9

LOCATION: ROOM 2002 (WEST LEVEL 2) WED 8:30 AM TO 10:00 AM

## Elastography

Session Chair: **Zhongping Chen**,

Beckman Laser Institute and Medical Clinic (USA)

8:30 am: **Towards intraoperative assessment of tumor margins in breast surgery using optical coherence elastography**, Brendan F. Kennedy, Philip Wijesinghe, Wes M. Allen, Lixin Chin, The Univ. of Western Australia (Australia); Bruce Latham, Royal Perth Hospital (Australia); Christobel M. Saunders, David D. Sampson, The Univ. of Western Australia (Australia). . . . . [9697-57]

8:45 am: **Corneal elastic anisotropy and hysteresis as a function of IOP assessed by optical coherence elastography**, Jiasong Li, Manmohan Singh, Zhaolong Han, Chen Wu, Raksha Raghunathan, Chih-Hao Liu, Achuth Nair, Univ. of Houston (USA); Kirill V. Larin, Univ. of Houston (USA) and Baylor College of Medicine (USA) and Tomsk State Univ. (Russian Federation)[9697-58]

9:00 am: **Optical coherence elastography based on high speed imaging of single-shot laser-induced acoustic wave at 16 kHz frame rate**, Shaozhen Song, Bao-yu Hsieh, Wei Wei, Tueng Shen, Matthew O'Donnell, Ruikang K. Wang, Univ. of Washington (USA) . . . . . [9697-59]

9:15 am: **Imaging shear wave propagation for the elastic measurement using OCT Doppler variance method**, Jiang Zhu, Yueqiao Qu, Beckman Laser Institute and Medical Clinic (USA); Teng Ma, The Univ. of Southern California (USA); Rui Li, Yongzhao Du, Beckman Laser Institute and Medical Clinic (USA); Shenghai Huang, Beckman Laser Institute and Medical Clinic, Univ. of California, Irvine (USA); K. Kirk Shung, Qifa Zhou, The Univ. of Southern California (USA); Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA) and Univ. of California, Irvine (USA) . . . . . [9697-60]

9:30 am: **Ultrahigh resolution optical coherence elastography using a Bessel beam for extended depth of field**, Andrea Curatolo, The Univ. of Western Australia (Australia); Martin Villiger, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA); Dirk Lorenser, Philip Wijesinghe, Alex Fritz, Brendan F. Kennedy, David D. Sampson, The Univ. of Western Australia (Australia) . . . . . [9697-61]

9:45 am: **Single shot line-field optical coherence elastography**, Chih-Hao Liu, Alexander Schill, Manmohan Singh, Chen Wu, Jiasong Li, Zhaolong Han, Raksha Raghunathan, Tina Kazemi, Achuth Nair, Jayson VanMarter, Shezaan Noorani, Thomas Hsu, Kirill V. Larin, Univ. of Houston (USA). . . . . [9697-62]

Coffee Break . . . . . Wed 10:00 am to 10:30 am

SESSION 10

LOCATION: ROOM 2002 (WEST LEVEL 2) WED 10:30 AM TO 12:00 PM

## Image Processing

Session Chair: **Yasuno Yoshiaki**, Univ. of Tsukuba (Japan)

10:30 am: **Three-dimensional choroidal segmentation in spectral OCT volumes using optic disc prior information**, Zhihong Hu, Doheny Eye Institute (USA); Christopher Girkin, The Univ. of Alabama at Birmingham (USA); Amirhossein Hariri, Srinivas R. Sadda, Doheny Eye Institute (USA) . . . . [9697-63]

10:45 am: **Motion correction in full-field swept-source OCT**, Dierck Hillmann, Thorlabs GmbH (Germany); Hendrik Spahr, Univ. zu Lübeck (Germany) and Medizinisches Laserzentrum Lübeck GmbH (Germany); Clara Pfäffle, Univ. zu Lübeck (Germany); Helge M. Sudkamp, Medizinisches Laserzentrum Lübeck GmbH (Germany) and Univ. zu Lübeck (Germany); Carola Hain, Univ. zu Lübeck (Germany); Gesa L. Franke, Gereon Hüttmann, Univ. zu Lübeck (Germany) and Medizinisches Laserzentrum Lübeck GmbH (Germany). . . . . [9697-64]

11:00 am: **Optical coherence tomography noise modeling and fundamental bounds on human retinal layer segmentation accuracy**, Theodore B. DuBose, Duke Univ. (USA); Peyman Milanfar, Univ. of California, Santa Cruz (USA); Joseph A. Izatt, Sina Farsiu, Duke Univ. (USA) . . . . . [9697-65]

11:15 am: **Development of a new robust and accurate spectroscopic metric for scatterer size estimation in optical coherence tomography (OCT) images**, Michalis Kassinos, Costas Pitris, Univ. of Cyprus (Cyprus) . . . . . [9697-66]

11:30 am: **Quantitative optical coherence tomography by maximum a-posteriori estimation of signal intensity**, Aaron C. Chan, Kazuhiro Kurokawa, Shuichi Makita, Arata Miyazawa, Univ. of Tsukuba (Japan); Masahiro Miura, Ibaraki Medical Ctr., Tokyo Medical Univ. (Japan); Yoshiaki Yasuno, Univ. of Tsukuba (Japan). . . . . [9697-67]

2:45 pm: **Handheld OCT for longitudinal tracking of chronic middle-ear infection in response to therapeutic interventions**, Guillermo L. Monroy, Ryan L. Shelton, Ryan M. Nolan, Paritosh Pande, Darold Spillman, Univ. of Illinois at Urbana-Champaign (USA); Daniel T. McCormick, AdvancedMEMS (USA); Michael Novak M.D., Ryan Porter M.D., Malcolm Hill M.D., Carle Foundation Hospital (USA); Stephen A. Boppart M.D., Univ. of Illinois at Urbana-Champaign (USA). . . . . [9697-46]

3:00 pm: **In-vivo cutaneous burn depth assessment and wound healing process observing with multi-functional optical coherence tomography**, Bumju Kim, Yeorum Yoon, Viet-Hoan Le, Calvin J. Yoon, Ki Hean Kim, Pohang Univ. of Science and Technology (Korea, Republic of). . . . . [9697-47]

3:15 pm: **Development of a low-cost hand-held system for optical coherence tomography imaging**, Paritosh Pande, Ryan L. Shelton, Guillermo L. Monroy, Ryan M. Nolan, Stephen A. Boppart M.D., Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9697-48]

Coffee Break . . . . . Tue 3:30 pm to 4:00 pm

SESSION 8

LOCATION: ROOM 2002 (WEST LEVEL 2) . . TUE 4:00 PM TO 6:00 PM

## PS-OCT

Session Chair: **Johannes F. de Boer**, Vrije Univ. Amsterdam (Netherlands)

4:00 pm: **Needle-based polarization-sensitive OCT of breast tumor**, Martin Villiger, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Dirk Lorenser, Robert A. McLaughlin, Bryden C. Quirk, Rodney W. Kirk, The Univ. of Western Australia (Australia); Brett E. Bouma, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA) and Harvard Medical School (USA); David D. Sampson, The Univ. of Western Australia (Australia). . . . . [9697-49]

4:15 pm: **Changes in retina and sclera caused by increased intraocular pressure investigated using high resolution polarization sensitive OCT**, Stanislava Fialová, Marco Augustin, Corinna Knopf, Leopold Schmetterer, Michael Pircher, Christoph K. Hitzenberger, Bernhard Baumann, Medizinische Univ. Wien (Austria). . . . . [9697-50]

4:30 pm: **In vivo polarization sensitive optical coherence tomography of human burn scars**, Fabio Feroldi, Vrije Univ. Amsterdam (Netherlands); Mariëlle E. H. Jaspers, Thijs Bink, Paul P. M. van Zuijlen, Rode Kruis Ziekenhuis (Netherlands); Johannes F. de Boer, Vrije Univ. Amsterdam (Netherlands) . . . . . [9697-51]

4:45 pm: **Studying airway smooth muscle in vivo with PS-OCT**, David C. Adams, Lida P. Hariri M.D., Alyssa J. Miller, Martin Villiger, Jasmin Holz, Margit V. Szabari, Massachusetts General Hospital (USA); Brett E. Bouma, Wellman Ctr. for Photomedicine (USA); Andrew D. Luster, Benjamin D. Medoff, Melissa J. Suter, Massachusetts General Hospital (USA) . . . . . [9697-52]

5:00 pm: **Accurate and quantitative polarization-sensitive OCT by unbiased birefringence estimator with noise-stochastic correction**, Deepa K. Kasaragod, Univ. of Tsukuba (Japan); Satoshi Sugiyama, Tomey Corp. (Japan) and Univ. of Tsukuba (Japan); Yasushi Ikuno, Osaka Univ. (Japan); David Alonso-Caneiro, Queensland Univ. of Technology, Brisbane (Australia); Masahiro Yamanari, Tomey Corp. (Japan); Shinichi Fukuda, Tetsuro Oshika, Young-Joo Hong, En Li, Shuichi Makita, Univ. of Tsukuba (Japan); Masahiro Miura, Ibaraki Medical Ctr., Tokyo Medical Univ. (Japan); Yoshiaki Yasuno, Univ. of Tsukuba (Japan). . . . . [9697-53]

5:15 pm: **Jones-matrix estimation for quantitative birefringence analysis in polarization-sensitive OCT**, Masahiro Yamanari, Tomey Corp. (Japan); Satoru Tsuda, Tohoku Univ. School of Medicine (Japan); Taiki Kokubun, Tohoku Univ. School of Medicine (Japan) and Katta General Hospital (Japan); Kazuko Omodaka, Yu Yokoyama, Noriko Himori, Morin Ryu, Shihou Kunimatsu-Sanuki, Hidetoshi Takahashi, Kazuichi Maruyama, Hiroshi Kunikata, Toru Nakazawa, Tohoku Univ. School of Medicine (Japan) . . . . . [9697-54]

5:30 pm: **Spectral-domain, polarization-sensitive optical coherence tomography system insensitive to fiber disturbances**, Manuel J. M. Marques, Univ. of Kent (United Kingdom); Sylvain Rivet, Univ. of Kent (United Kingdom) and Univ. de Bretagne Occidentale (France); Adrian Bradu, Adrian G. H. Podoleanu, Univ. of Kent (United Kingdom) . . . . . [9697-55]

5:45 pm: **Polarization sensitive optical frequency domain imaging of plasmon-resonant nanoparticles using the depolarization index**, Norman Lippok, Martin Villiger, Wellman Ctr. for Photomedicine (USA); Alexandre Albanese, Sangeeta N. Bhatia, The David H. Koch Institute for Integrative Cancer Research (USA); Brett E. Bouma, Wellman Ctr. for Photomedicine (USA) . . . . . [9697-56]

BIOS



# CONFERENCE 9697

LOCATION: ROOM 2002 (WEST LEVEL 2)

11:45 am: **Rigorous simulation of OCT image formation using Maxwell's equations in three dimensions**, Peter R. T. Munro, Univ. College London (United Kingdom); Andrea Curatolo, David D. Sampson, The Univ. of Western Australia (Australia) . . . . . [9697-68]  
Lunch/Exhibition Break . . . . . Wed 12:00 pm to 1:30 pm

## SESSION 11

LOCATION: ROOM 2002 (WEST LEVEL 2) . . WED 1:30 PM TO 3:30 PM

### Novel Contrast Mechanisms

Session Chair: **Christoph K. Hitzberger**,  
Medizinische Univ. Wien (Austria)

1:30 pm: **Three dimensional time lapse imaging of live cell mitochondria with photothermal optical lock-in optical coherence microscopy**, Miguel Sison, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Sabyasachi Chakraborty, Univ. Ulm (Germany); Jerome Extermann, Amir Nahas, Christophe Pache, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Tanja Weil, Univ. Ulm (Germany); Theo Lasser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9697-69]

1:45 pm: **In vivo photothermal optical coherence tomography in the mouse eye**, Maryse Lapiere-Landry, Andrew Y. Gordon, Jason R. Craft, Melissa C. Skala, Vanderbilt Univ. (USA) . . . . . [9697-70]

2:00 pm: **Rhodopsin molecular contrast imaging by optical coherence tomography for functional assessment of photoreceptors**, Zahra Nafra, Tan Liu, Shuliang Jiao, Florida International Univ. (USA) . . . . . [9697-71]

2:15 pm: **Visible-light OCT to quantify retinal oxygen metabolism**, Hao F. Zhang, Ji Yi, Siyu Chen, Wenzhong Liu, Brian T. Soetikno, Northwestern Univ. (USA) . . . . . [9697-72]

2:30 pm: **Pump-probe optical coherence tomography using microencapsulated methylene blue as a contrast agent**, Wihan Kim, Erin Zebrowski, Hazel C. Lopez, Brian E. Applegate, Phapanin Charoenphol, Javier A. Jo, Texas A&M Univ. (USA) . . . . . [9697-73]

2:45 pm: **Interferometric near-infrared spectroscopy**, Dawid Borycki, Oybek Kholiqov, Shau Poh Chong, Vivek J. Srinivasan, Univ. of California, Davis (USA) . . . . . [9697-74]

3:00 pm: **Diffusion-sensitive optical coherence tomography for real-time monitoring of mucus thinning treatments**, Richard L. Blackmon, Patrick R. Sears, Lawrence E. Ostrowski, David B. Hill, The Univ. of North Carolina at Chapel Hill (USA); Brian S. Chapman, Joseph B. Tracy, North Carolina State Univ. (USA); Silvia M. Kreda, Amy L. Oldenburg, The Univ. of North Carolina at Chapel Hill (USA) . . . . . [9697-75]

3:15 pm: **OCT based in vivo tissue injury mapping**, Utku Baran, Yuandong Li, Ruikang K. Wang, Univ. of Washington (USA) . . . . . [9697-76]  
Coffee Break . . . . . Wed 3:30 pm to 4:00 pm

## SESSION 12

LOCATION: ROOM 2002 (WEST LEVEL 2) . WED 4:00 PM TO 6:00 PM

### Novel Microscopy

Session Chair: **Valery V. Tuchin**,

N.G. Chernyshevsky Saratov State Univ. (Russian Federation)

4:00 pm: **Dynamic full field OCT: metabolic contrast at subcellular level**, Clement Apelian, Institut Langevin (France); Fabrice Harms, LLTech SAS (France); Olivier Thouvenin, Claude Boccard, Institut Langevin (France) [9697-77]

4:15 pm: **Longitudinal, 3D visualization of diabetes by functional optical coherence imaging**, Corinne Berclaz, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Anja Schmidt-Christensen, Lund Univ. (Sweden); Daniel Szig, Ecole Polytechnique Fédérale de Lausanne (Switzerland) and Nicolaus Copernicus Univ. (Poland); Jerome Extermann, Ecole Polytechnique Fédérale de Lausanne (Switzerland) and Univ. of Applied Science of Western Switzerland (Switzerland); Lisbeth Hansen, Lund Univ. (Sweden); Arno Bouwens, Martin Villiger, Joan Gouley, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Frans Schuit, KU Leuven (Belgium); Anne Grapin-Botton, Univ. of Copenhagen (Denmark); Dan Holmberg, Lund Univ. (Sweden); Theo Lasser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9697-78]

4:30 pm: **Depth-resolved nanoscale nuclear architecture mapping for early prediction of cancer progression**, Shikhar Uttam, Hoa V. Pham, Justin LaFace, Univ. of Pittsburgh (USA); Douglas J. Hartman, Univ. of Pittsburgh School of Medicine (USA); Yang Liu, Univ. of Pittsburgh (USA) . . . . . [9697-79]

4:45 pm: **OCT-based quantification of flow velocity, shear force, and power generated by a biological ciliated surface**, Brendan K. Huang, Mustafa K. Khokha, Michael Loewenberg, Michael A. Choma M.D., Yale Univ. (USA) . . . . . [9697-80]

5:00 pm: **Label-free three-dimensional imaging of C. elegans with visible wavelength extended-focus optical coherence microscopy**, Séverine Coquoz, Laurent Mouchiroud, Miguel Sison, Daniel Szig, Paul J. Marchand, Arno Bouwens, Johan Auwerx, Theo Lasser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9697-81]

5:15 pm: **Structural and functional measurements of fertilized mouse oocytes with combined high-resolution OCT and inverted microscope**, Karol Karnowski, Nicolaus Copernicus Univ. (Poland); Anna Ajduk, Univ. of Warsaw (Poland); Maciej Wojtkowski, Maciej Szkulmowski, Nicolaus Copernicus Univ. (Poland) . . . . . [9697-82]

5:30 pm: **Synchronous multimodal combination of full-field OCT and structured illumination fluorescence microscopy**, Olivier Thouvenin, Mathias Fink, Claude Boccard, Institut Langevin (France) . . . . . [9697-83]

5:45 pm: **2 μm axial resolution, fiber-optic SD-OCT operating at ~1300 nm for cellular resolution imaging of biological tissue**, Kostadinka Bizheva, Bingyao Tan, Tyler Monahan, Julia Zangoulos, Mungo Marsden, Mojtaba Hajjalamdari, Univ. of Waterloo (Canada) . . . . . [9697-84]



# CONFERENCE 9698

LOCATION: ROOM 2006 (WEST LEVEL 2)

Sunday–Tuesday 14–16 February 2016 • Proceedings of SPIE Vol. 9698

# Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV

Conference Chairs: **Tuan Vo-Dinh**, Fitzpatrick Institute For Photonics, Duke Univ. (USA); **Anita Mahadevan-Jansen**, Vanderbilt Univ. (USA); **Warren S. Grundfest M.D.**, Univ. of California, Los Angeles (USA)

Program Committee: **Maurice C. Aalders**, Forensic Technical Solutions (Netherlands); **Francesco Baldini**, Istituto di Fisica Applicata “Nello Carrara” (Italy); **Jennifer K. Barton**, The Univ. of Arizona (USA); **Stephen A. Boppart M.D.**, Univ. of Illinois at Urbana-Champaign (USA); **Gerald Grant**, Duke Univ. (USA); **Daniel C. Gray**, Lighthouse Imaging LLC (USA); **Cristina Kurachi D.D.S.**, Univ. de São Paulo (Brazil); **Hong Liu**, The Univ. of Oklahoma (USA); **Laura Marcu**, Univ. of California, Davis (USA); **Mary-Ann Mycek**, Univ. of Michigan (USA); **Jianan Y. Qu**, Hong Kong Univ. of Science and Technology (Hong Kong, China); **Urs Utzinger**, The Univ. of Arizona (USA)

## SUNDAY 14 FEBRUARY

### SESSION 1

LOCATION: ROOM 2006 (WEST LEVEL 2) . SUN 9:10 AM TO 10:10 AM

### Fluorescence and Raman Detection Systems I

Session Chair: **Tuan Vo-Dinh**, Duke Univ. (USA)

9:10 am: **Time-resolved fluorescence spectroscopy for intraoperative assistance of thyroid surgery**, Luciano Bachmann, Mariana P. Brandão, Kaique Haleplian, Amando S. Ito, Ricardo Iwakura, Fagner S. Basilio, Luiz Carlos Conti de Freitas, Univ. de São Paulo (Brazil) . . . . . [9698-1]

9:30 am: **Design and validation of a near-infrared fluorescence endoscope for detection of early oesophageal malignancy using a targeted imaging probe**, Dale J. Waterhouse, James Joseph, Univ. of Cambridge (United Kingdom) and Cancer Research UK Cambridge Institute (United Kingdom); Andre A. Neves, Cancer Research UK Cambridge Institute (United Kingdom); Massimiliano di Pietro, MRC Cancer Unit, Univ. of Cambridge (United Kingdom); Kevin M. Brindle, Cancer Research UK Cambridge Institute (United Kingdom) and Univ. of Cambridge (United Kingdom); Rebecca C. Fitzgerald, MRC Cancer Unit, Univ. of Cambridge (United Kingdom); Sarah E. Bohndiek, Univ. of Cambridge (United Kingdom) and Cancer Research UK Cambridge Institute (United Kingdom). . . . . [9698-2]

9:50 am: **Real-time intraoperative multispectral fluorescence and color imaging platform for the visible and near infra-red region**, Nikolas Dimitriadis, Bartłomiej Grychtol, Martin Theuring, Tobias Behr, Nikolaos C. Deliolanis, Fraunhofer-Institut für Produktionstechnik und Automatisierung (Germany). . . . . [9698-3]

Coffee Break . . . . . Sun 10:10 am to 10:40 am

### SESSION 2

LOCATION: ROOM 2006 (WEST LEVEL 2) SUN 10:40 AM TO 12:00 PM

### Fluorescence and Raman Detection Systems II

Session Chair: **Tuan Vo-Dinh**, Duke Univ. (USA)

10:40 am: **In vivo detection of oral epithelial cancer using endogenous fluorescence lifetime imaging: a pilot human study**, Javier A. Jo, Dae Yon Hwang, Jorge Palma, Shuna Cheng, Rodrigo Cuenca Martinez, Bilal H. Malik, Joey M. Jabbour, Yi-Shing L. Cheng, John Wright, Kristen C. Maitland, Texas A&M Univ. (USA) . . . . . [9698-4]

11:00 am: **Combined fiber probe for fluorescence lifetime and Raman spectroscopy**, Sebastian Dochow, Leibniz-Institut für Photonische Technologien e.V. (Germany) and Friedrich-Schiller-Univ. Jena (Germany); Dinglong M. Ma, Univ. of California, Davis (USA); Ines Latka, Leibniz-Institut für Photonische Technologien e.V. (Germany); Thomas W. Bocklitz, Friedrich-Schiller-Univ. Jena (Germany); Brad A. Hartl, Julien Bec, Hussain Fatakdawala, Univ. of California, Davis (USA); Sebastian Wachsmann-Hogiu, Ctr. for Biophotonics, Univ. of California, Davis (USA); Eric T. Marple, Kirk Urmey, EmVision, LLC (USA); Michael Schmitt, Friedrich-Schiller-Univ. Jena (Germany); Laura Marcu, Univ. of California, Davis (USA); Jürgen Popp, Friedrich-Schiller-Univ. Jena (Germany) and Leibniz-Institut für Photonische Technologien e.V. (Germany) . . . . . [9698-5]

11:20 am: **Optical fiber Raman-based spectroscopy for oral lesions characterization: a pilot study**, Luis Felipe C. S. Carvalho D.D.S., Lázaro P. Medeiros Neto, Inajara P. Oliveira, João Lucas Rangel, Univ. do Vale do Paraíba (Brazil); Dárcio Kitakawa, Prefeitura Municipal de São Paulo (Brazil); Airon A. Martin D.D.S., Univ. do Vale do Paraíba (Brazil) . . . . . [9698-6]

11:40 am: **SERS molecular probes for early detection of disease biomarkers**, H. N. Wang, Duke Univ. (USA); B. M. Crawford, Tuan Vo-Dinh, Duke Univ. (USA) . . . . . [9698-7]

Lunch Break . . . . . Sun 12:00 pm to 1:40 pm

### SESSION 3

LOCATION: ROOM 2006 (WEST LEVEL 2) . . SUN 1:40 PM TO 3:00 PM

### Optical Detection and Sensing Technologies

Session Chair: **Cristina Kurachi**, Instituto de Física de São Carlos (Brazil)

1:40 pm: **Diffuse optical measurements of head and neck tumor hemodynamics for early prediction of radiation therapy**, Lixin Dong, Mahesh Kudrimoti, Daniel Irwin, Li Chen, Yu Shang, Xingzhe Li, Scott D. Stevens, Brent J. Shelton, Guoqiang Yu, Univ. of Kentucky (USA) . . . . . [9698-8]

2:00 pm: **Optical elastic scattering for early label-free identification of clinical pathogens**, Valentin Genuer, Olivier Gal, Jeremy Meteau, Pierre R. Marcoux, Emmanuelle Schultz, Commissariat à l'Énergie Atomique (France); Eric Lacot, Univ. Grenoble Alpes (France); Max Maurin, CHU Grenoble (France); Jean-Marc Dinten, Commissariat à l'Énergie Atomique (France) . . . . . [9698-9]

2:20 pm: **Non-invasive monitoring of cytokine-based regenerative treatment of cartilage by hyperspectral unmixing**, Saabah B. Mahbub, Peter Succer, Martin E. Gosnell, Ayad G. Anwer, Macquarie Univ. (Australia); Benjamin Herbert, The Univ. of Sydney (Australia); Graham Vesey, Regeneus Ltd. (Australia); Ewa M. Goldys, Macquarie Univ. (Australia) . . . . . [9698-10]

2:40 pm: **Near infrared fluorescent image based evaluation of gastric tube perfusion after esophagectomy in preclinical model**, Minji Kim, Korea Univ. (Korea, Republic of); Yuhua Quan, Kook Nam Han, Byeong Hyun Choi, Korea Univ. Guro Hospital (Korea, Republic of); Yeonho Choi, Korea Univ. Guro Hospital (Korea, Republic of) and Korea Univ. (Korea, Republic of); Hyun Koo Kim, Korea Univ. Guro Hospital (Korea, Republic of); Beop-Min Kim, Korea Univ. (Korea, Republic of) . . . . . [9698-11]

Coffee Break . . . . . Sun 3:00 pm to 3:30 pm

# CONFERENCE 9698

LOCATION: ROOM 2006 (WEST LEVEL 2)

## SESSION 4

LOCATION: ROOM 2006 (WEST LEVEL 2) . . SUN 3:30 PM TO 4:30 PM

### Microscopy and Imaging Technologies

Session Chairs: **Laura Marcu**, Univ. of California, Davis (USA);  
**Mary-Ann Mycek**, Univ. of Michigan (USA)

3:30 pm: **Rapid diagnostic imaging and pathologic evaluation of surgical tissue using video rate structured illumination microscopy (VR-SIM)**, Mei Wang, David B. Tulman, Katherine N. Elfer, Andrew B. Sholl, Jonathon Q. Brown, Tulane Univ. (USA) . . . . . [9698-12]

3:50 pm: **Clinical use of a portable dual microscope system for smartphone**, Cristina Kurachi D.D.S., Gabriel Brognara, Pablo A. Gómez-García, Fernanda M. Carbinatto, Univ. de São Paulo (Brazil); Eduardo V. da Silva, Wellington Lombardi, UNIARA (Brazil); Natália M. Inada, Vanderlei S. Bagnato, Univ. de São Paulo (Brazil) . . . . . [9698-13]

4:10 pm: **Wide-field optical assessment of wounds using spatial frequency domain imaging (SFDI)**, Amaan Mazhar, Pierre Khoury, David J. Cuccia, Modulated Imaging, Inc. (USA) . . . . . [9698-14]

## POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Development of single-channel stereoscopic imaging modality for real time retinal imaging**, Edalat Radfar, Byungjo Jung, Jihoon Park, Sangyeob Lee, Myungjin Ha, Sungkon Yu, Seulgi Jang, Yonsei Univ. (Korea, Republic of) . . . . . [9698-37]

**A 2-axis Polydimethylsiloxane (PDMS) based electromagnetic MEMS scanning mirror for optical coherence tomography**, Sehui Kim, Changho Lee, Jin Young Kim, Pohang Univ. of Science and Technology (Korea, Republic of); Jeehyun Kim, Kyungpook National Univ. (Korea, Republic of); Chulhong Kim, Pohang Univ. of Science and Technology (Korea, Republic of) . . . [9698-39]

**Detection of ictal and interictal migraine by using near-infrared spectroscopy**, Chao-Che Lee, Chia-Wei Sun, National Chiao Tung Univ. (Taiwan); Wei-Ta Chen, Neurological Institute, Taipei Veterans General Hospital (Taiwan) . . . . . [9698-40]

**Signal of prefrontal cortex with fibromyalgia based on NIRS method**, Chen Yu Lin, Chia Wei Sun, National Chiao Tung Univ. (Taiwan); Wei Ta Chen, Neurological Institute, Taipei Veterans General Hospital (Taiwan) . . . . [9698-41]

**Application of the advanced technologies of laser diodes, LEDs and OLEDs for total jaundice management of newborn infants**, Mostafa Hamza, Mansoura Univ. (Egypt); Mohammad H. Sayed Elahl, Military Medical Academy (Egypt); Ahmad M. Hamza, National Research Ctr. (Egypt); Aya M. Hamza, Yahya M. Hamza, Tabarak Children's Hospital (Egypt) . . . . . [9698-42]

**A scalable correlator for multichannel diffuse correlation spectroscopy**, Christopher J. Stapels, Noah J. Kolodziejski, Daniel McAdams, Matthew J. Podolsky, Daniel E. Fernandez, Radiation Monitoring Devices, Inc. (USA); Dana Farkas, Radiation Monitoring Devices, Inc. (USA) and Northeastern Univ. (USA); James F. Christian, Radiation Monitoring Devices, Inc. (USA) . . [9698-43]

**Raman spectroscopy and immunohistochemistry analysis for schwannoma characterization: a case study**, Lázaro P. Medeiros Neto, Maurílio J. das Chagas, Luís Felipe C. Carvalho, Isabella Ferreira, Laurita dos Santos, Univ. do Vale do Paraíba (Brazil); Marcello H. Ribas, Instituto de Assistência Médica ao Servidor Público (Brazil); Vinicius de Almeida Loddi, Chagas Serviços Médicos (Brazil); Airton A. Martin D.D.S., Univ. do Vale do Paraíba (Brazil) . . . . [9698-44]

**Intraoperative autofluorescence imaging of parathyroid gland using DSLR camera**, Yeh-Chan Ahn, Pukyong National Univ. (Korea, Republic of) and Ctr. for Marine-Integrated Biomedical Technology (Korea, Republic of) and Innovative Biomedical Technology Research Ctr., Kosin Univ. (Korea, Republic of); Kang Dae Lee, Sung Won Kim, Hyoung Shin Lee, College of Medicine, Kosin Univ. (Korea, Republic of) and Innovative Biomedical Technology Research Ctr. (Korea, Republic of); Seo Hyun Song, Pukyong National Univ. (Korea, Republic of) and Ctr. for Marine-Integrated Biomedical Technology (Korea, Republic of) and Innovative Biomedical Technology Research Ctr., Kosin Univ. (Korea, Republic of); Chulho Oak, Kosin Univ. (Korea, Republic of) and Innovative Biomedical Technology Research Ctr. (Korea, Republic of) . [9698-45]

**Evaluation of motion compensation method for assessing the gastrointestinal motility using three dimensional endoscope**, Kayo Yoshimoto, Osaka City Univ. (Japan); Kenji Yamada, Kenji Watabe, Tetsuji Fujinaga, Michiko Kido, Osaka Univ. (Japan); Toshiaki Nagakura, Osaka Electro-Communication Univ. (Japan); Hideya Takahashi, Osaka City Univ. (Japan); Hideki Iijima, Masahiko Tsujii, Tetsuo Takehara, Yuko Ohno, Osaka Univ. (Japan) . . . . . [9698-46]

**Imaging of the median nerve neuropathy by optical coherence tomography in rabbits**, Yeh-Chan Ahn, Pukyong National Univ. (Korea, Republic of) and Ctr. for Marine Integrated Biomedical Technology (Korea, Republic of) and Innovative Biomedical Technology Research Ctr. (Korea, Republic of); Yu-Gyeong Chae, Ctr. for Marine Integrated Biomedical Technology (Korea, Republic of) and Pukyong National Univ. (Korea, Republic of) and Innovative Biomedical Technology Research Ctr. (Korea, Republic of); Young-Sik Kim, Innovative Biomedical Technology Research Ctr. (Korea, Republic of); Dong-Kyu Kim, Innovative Biomedical Technology Research Ctr. (Korea, Republic of) and Kosin Univ. College of Medicine (Korea, Republic of); Eun-Kee Park, Kosin Univ. College of Medicine (Korea, Republic of) and Innovative Biomedical Technology Research Ctr. (Korea, Republic of); Sae Hyun Kim, Kosin Univ. College of Medicine (Korea, Republic of) . . . . . [9698-47]

**Spectral aspects of noninvasive diagnostic melanoma imaging**, Daniel S. Gareau, The Rockefeller Univ. (USA) . . . . . [9698-48]

**A finger-free wrist-worn pulse oximeter for the monitoring of chronic obstructive pulmonary disease**, Jyh-Chern Chen, Taiwan Biophotonic Corp (Taiwan) . . . . . [9698-49]

## MONDAY 15 FEBRUARY

### SESSION 5

LOCATION: ROOM 2006 (WEST LEVEL 2) .MON 8:50 AM TO 10:10 AM

### Visualization and Image-Guided Systems I

Session Chair: **Anita Mahadevan-Jansen**, Vanderbilt Univ. (USA)

8:50 am: **Three-dimensional ultrasonic needle tracking with a fiber-optic hydrophone and a custom 1.5D ultrasound imaging probe**, Wenfeng Xia, Univ. College London (United Kingdom); Simeon J. West, Yuval Ginsberg, Univ. College Hospital (United Kingdom); Jean M. Mari, Univ. de la Polynésie Française (French Polynesia); Anna L. David, Univ. College Hospital (United Kingdom); Adrien E. Desjardins, Univ. College London (United Kingdom) . . . . . [9698-15]

9:10 am: **Image-guided dynamic laser coagulation using a double-clad fiber-based system**, Kathy Beaudette, Ecole Polytechnique de Montréal (Canada) and Massachusetts General Hospital (USA); William Lo, Martin Villiger, Milen Shishkov, Harvard Medical School (USA) and Massachusetts General Hospital (USA); Nicolas Godbout, Ecole Polytechnique de Montréal (Canada); Brett E. Bouma, Harvard Medical School (USA) and Massachusetts General Hospital (USA); Caroline Boudoux, Ecole Polytechnique de Montréal (Canada) . . . . . [9698-16]

9:30 am: **A goggle navigation system for ultrasound and fluorescence dual-mode image-guided surgery**, Ze Shu Zhang, Jin Pei, Dong Wang, Jian Ye, Qi Gan, Peng Liu, Jian Yue, Ben Zhong Wang, Peng Fei Shao, Univ. of Science and Technology of China (China); Ronald X. Xu, The Ohio State Univ. (USA) . . . . . [9698-17]

9:50 am: **A portable near-infrared fluorescence image overlay device for surgical navigation**, Melanie A. McWade, Vanderbilt Univ. (USA) . . . [9698-50]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

### SESSION 6

LOCATION: ROOM 2006 (WEST LEVEL 2) . . . MON 10:40 AM TO 12:00 PM

### Visualization and Image-Guided Systems II

Session Chairs: **Warren S. Grundfest**, Univ. of California, Los Angeles (USA); **Urs Utzinger**, The Univ. of Arizona (USA)

10:40 am: **Image-guided cold atmosphere plasma (CAP) therapy for chronic wound**, Zelin Yu, Wenqi Ren, Qi Gan, Cheng Cheng, Shiwu Zhang, Univ. of Science and Technology of China (China); Ronald X. Xu, The Ohio State Univ. (USA) . . . . . [9698-18]

11:00 am: **Development of a safe ultraviolet camera system to enhance awareness by showing effects of UV radiation and UV protection of the skin**, Rudolf M. Verdaasdonk, Rosaline Wedzinga, Bibi van Montfrans, Mirte Stok, John H. Klaessens, Albert J. van der Veen, Vrije Univ. Medical Ctr. (Netherlands) . . . . . [9698-19]

# CONFERENCE 9698

LOCATION: ROOM 2006 (WEST LEVEL 2)

BIOS

11:20 am: **Rapid Mueller matrix polarimetry imaging based on four photoelastic modulators with no moving parts**, Adam Gribble, Univ. of Toronto (Canada) and Ontario Cancer Institute (Canada); Sanaz Alali, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Alex Vitkin, Univ. of Toronto (Canada) and Ontario Cancer Institute (Canada) . . . . . [9698-20]

11:40 am: **Optimal injection time of indocyanine green for intraoperative fluorescence image-guided thoracoscopic resection in rabbit model**, Minji Kim, Korea Univ. (Korea, Republic of); Yuhua Quan, Korea Univ. Guro Hospital (Korea, Republic of); Byeong Hyun Choi, Korea Univ. (Korea, Republic of) and Korea Univ. Guro Hospital (Korea, Republic of); Yeonho Choi, Korea Univ. (Korea, Republic of); Hyun Koo Kim, Korea Univ. Guro Hospital (Korea, Republic of); Beop-Min Kim, Korea Univ. (Korea, Republic of) . . . . . [9698-21]

Lunch Break . . . . . Mon 12:00 pm to 1:30 pm

## SESSION 7

LOCATION: ROOM 2006 (WEST LEVEL 2) . . MON 1:30 PM TO 3:10 PM

### Optical Coherence Techniques

Session Chairs: **Stephen A. Boppart**, Beckman Institute for Advanced Science and Technology (USA); **Jennifer K. Barton**, The Univ. of Arizona (USA)

1:30 pm: **Comparison of perfusion diagnostics with optical coherence tomography, sidestream-darkfield, incident darkfield and laser speckle contrast imaging in a tissue-like phantom**, Sanne M. A. Jansen M.D., Daniel M. de Bruin, Dirk J. Faber, Ton G. van Leeuwen, Academisch Medisch Centrum (Netherlands) . . . . . [9698-22]

1:50 pm: **Fast ex-vivo wide-field OCT system for diagnostic and surgical guidance**, Eugénie Dalimier, LLTech SAS (France); Fabrice Harms, Institut Langevin, ESPCI ParisTech (France); Charles Brossolet, Emilie Benoit, Franck Martins, LLTech SAS (France); Claude Boccara, Institut Langevin, ESPCI ParisTech (France) . . . . . [9698-23]

2:10 pm: **Quantification of NA-dependence of OCT signal attenuation**, Liliana M. Peinado, Academisch Medisch Centrum (Netherlands); Paul R. Bloemen, Mitra Almasian, Ton G. van Leeuwen, Dirk J. Faber, Academisch Medisch Centrum (Netherlands) . . . . . [9698-24]

2:30 pm: **Automated 3D segmentation of oral mucosa from wide-field OCT images**, Ryan N. Goldan, BC Cancer Agency Research Ctr. (Canada) and Simon Fraser Univ. (Canada); Anthony Lee, Lucas C. Cahill, BC Cancer Agency Research Ctr. (Canada); Kelly Y. Liu, Calum E. MacAulay, BC Cancer Agency Research Ctr. (Canada); Catherine F. Poh D.D.S., Pierre M. Lane, BC Cancer Agency Research Ctr. (Canada) . . . . . [9698-25]

2:50 pm: **Fully automatic segmentation and characterization of in vivo esophageal tissue by optical coherence tomography**, Giovanni Jacopo J. Ughi, Wellman Ctr. for Photomedicine (USA); Michalina J. Gora, CNRS (France) and Massachusetts General Hospital (USA); Anne-Fre Swager, Academisch Medisch Centrum (Netherlands); Mireille Rosenberg, Wellman Ctr. for Photomedicine (USA); Jenny S. Sauk, Massachusetts General Hospital (USA); Norman S. Nishioka, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Guillermo J. Tearney, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA) and Harvard Medical School (USA) . . . . . [9698-26]

Coffee Break . . . . . Mon 3:10 pm to 3:40 pm

## SESSION 8

LOCATION: ROOM 2006 (WEST LEVEL 2) . MON 3:40 PM TO 5:00 PM

### Optical Diagnostic Devices

Session Chair: **Francesco Baldini**, Istituto di Fisica Applicata "Nello Carrara" (Italy)

3:40 pm: **A thermal-magnetic biosensor for point of care applications**, Maria E. Castagna, Salvatore Petralia, Sabrina Conoci, Maria Grazia Amore, Giuseppe Tosto, STMicroelectronics (Italy); Salvatore Baglio, Angela Beninato, Valentina Sinatra, Univ. degli Studi di Catania (Italy) . . . . . [9698-27]

4:00 pm: **Multimodal optical biopsy probe to improve the safety and diagnostic yield of brain needle biopsies**, Joannie Desroches, Julien Pichette, Andréanne Goyette, Marie-Andrée Tremblay, Ecole Polytechnique de Montréal (Canada); Michael Jermyn, Kevin Petrecca, Brain Tumour Research Ctr., Montreal Neurological Hospital and Institute (Canada); Frédéric Leblond, Ecole Polytechnique de Montréal (Canada) . . . . . [9698-28]

4:20 pm: **An optical spectroscopy instrument designed for in-vivo use in a primary care clinical setting**, Adam Eshein, The-Quyen Nguyen, Andrew J. Radosevich, Bradley Gould, Wenli Wu, Northwestern Univ. (USA); Vani Konda, Leslie W. Yang, Ann Koons, The Univ. of Chicago (USA); Seth Feder, Northwestern Univ. (USA); Vesta Valuckaite, The Univ. of Chicago (USA); Hemant K. Roy, Boston Univ. (USA); Vadim Backman, Northwestern Univ. (USA) . . . . . [9698-29]

4:40 pm: **High definition Mueller polarimetric endoscope**, Ji Qi, Daniel S. Elson, Imperial College London (United Kingdom) . . . . . [9698-30]

## TUESDAY 16 FEBRUARY

### SESSION 9

LOCATION: ROOM 2006 (WEST LEVEL 2) . TUE 8:50 AM TO 10:10 AM

### Near Infrared Spectroscopy Sensing Methods

Session Chair: **Zhiwei Huang**, National Univ. of Singapore (Singapore)

8:50 am: **Which blood oxygen index by NIRS is sensitive to shock severity?**, Ting Li, Kai Li, Univ. of Electronic Science and Technology of China (China) . . . . . [9698-31]

9:10 am: **Diagnosis potential of near infrared Mueller Matrix imaging for colonic adenocarcinoma**, Jianfeng Wang, Kan Lin, Wei Zheng, Zhiwei Huang, National Univ. of Singapore (Singapore) . . . . . [9698-32]

9:30 am: **Investigation of oxygenation dynamics of sepsis patient using far-infrared intervention with NIRS measurement**, Kuei Hung Chuang, Chia-Wei Sun, National Chiao Tung Univ. (Taiwan) . . . . . [9698-33]

9:50 am: **A novel method to estimate oxygen saturation of the internal jugular vein blood**, Ting Li, Kai Li, Univ. of Electronic Science and Technology of China (China); ZhengShang Ruan, Shanghai Xin Hua Hospital (China) . . . . . [9698-34]

Coffee Break . . . . . Tue 10:10 am to 10:40 am

### SESSION 10

LOCATION: ROOM 2006 (WEST LEVEL 2) TUE 10:40 AM TO 11:40 AM

### Imaging and Detection Methods

Session Chair: **Quan Liu**, Nanyang Technological Univ. (Singapore)

10:40 am: **3D shape reconstruction for minimally invasive surgical interventions using OFDR in optical fibers**, François Parent, Koushik Kanti Mandal, Sébastien Loranger, Ecole Polytechnique de Montréal (Canada); Eric Hideki Watanabe Fernandes, Univ. Federal de São Paulo (Brazil); Samuel Kadoury, Raman Kashyap, Ecole Polytechnique de Montréal (Canada) . . . . . [9698-35]

11:00 am: **The joint analysis of perfusion and coenzymes NADH and FAD in diabetes**, Victor V. Dremin, State Univ. Education-Science-Production Complex (Russian Federation); Victor V. Sidorov, SPE LAZMA Ltd. (Russian Federation); Alexander I. Krupatkin, Priorov Central Research Institute of Traumatology and Orthopaedics (Russian Federation); Gagik R. Galstyan, Endocrinology Research Ctr. of the Ministry of Health of the Russian Federation (Russian Federation); Irina N. Novikova, Angelina I. Zhrebtsova, Evgeny A. Zhrebtsov, Andrey V. Dunaev, State Univ. Education-Science-Production Complex (Russian Federation); Zera N. Abdulvapova, Endocrinology Research Ctr. of the Ministry of Health of the Russian Federation (Russian Federation); Karina S. Litvinova, Ilya E. Rafailov, Sergei G. Sokolovsky, Edik U. Rafailov, Aston Univ. (United Kingdom) . . . . . [9698-36]

11:20 am: **Real-time wide-field metabolic imaging achieved through coherent spatial frequency domain imaging (cSFDI)**, Michael T. Ghjisen, Anthony J. Durkin, Univ. of California, Irvine (USA); Sylvain Gioux, Beth Israel Deaconess Medical Ctr. (USA); Bruce J. Tromberg, Univ. of California, Irvine (USA) . . . . . [9698-38]



# CONFERENCE 9699

LOCATION: ROOM 2004 (WEST LEVEL 2)

Saturday–Sunday 13–14 February 2016 • Proceedings of SPIE Vol. 9699

# Optics and Biophotonics in Low-Resource Settings II

Conference Chairs: **David Levitz**, MobileODT (Israel); **Aydogan Ozcan**, Univ. of California, Los Angeles (USA); **David Erickson**, Cornell Univ. (USA)

Program Committee: **Gerard L. Coté**, Texas A&M Univ. (USA); **Wolfgang Drexler**, Medizinische Univ. Wien (Austria); **Frances S. Ligler**, North Carolina State Univ. (USA); **Anita Mahadevan-Jansen**, Vanderbilt Univ. (USA); **Chetan A. Patil**, Vanderbilt Univ. (USA); **Nirmala Ramanujam**, Duke Univ. (USA); **Avi Rasooly**, National Institutes of Health (USA); **Eric A. Swanson**, OCT News (USA); **Sebastian Wachsmann-Hogiu**, NSF Ctr. for Biophotonics Science and Technology (USA); **Ian M. White**, Univ. of Maryland, College Park (USA)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 2004 (WEST LEVEL 2) . SAT 8:30 AM TO 10:10 AM

### Lab-On-a-Chip Methods

Session Chair: **David Levitz**, MobileODT Ltd. (Israel)

8:30 am: **Digital detection of biomarkers for high-sensitivity diagnostics at low-cost** (*Invited Paper*), M. Selim Ünlü, John H. Connor, Steve Scherr, Boston Univ. (USA); George G. Daaboul, Nanoview (USA); Elif Ç. Seymour, Boston Univ. (USA); Nese Lortlar Unlu, Bahçesehir Univ. (Turkey) and Boston Univ. (USA); Jacob Trueb, Derin D. Sevenler, Oguzhan Avci, Boston Univ. (USA) . . . [9699-1]

9:10 am: **Single DNA imaging and length quantification through a mobile-phone microscope**, Qingshan Wei, Wei Luo, Samuel Chiang, Tara Kappel, Crystal Mejia, Derek Tseng, Raymond Y. Chan, Eddie Yan, Hangfei Qi, Faizan Shabbir, Haydar Ozkan, Steve W. Feng, Aydogan Ozcan, Univ. of California, Los Angeles (USA) . . . [9699-2]

9:30 am: **NutriPhone: smartphone platform for vitamin B12 quantification in point-of-care settings**, Seoho Lee, Dakota O'Dell, Jessica Hohenstein, Susannah Colt, Saurabh Mehta, David Erickson, Cornell Univ. (USA) . . . [9699-3]

9:50 am: **Cellphone-based colorimetric microplate reader for point-of-care testing**, Brandon Berg, Bingen Cortazar, Derek Tseng, Haydar Ozkan, Steve W. Feng, Qingshan Wei, Raymond Y. Chan, Jordi Burbano, Qamar Farooqui, Univ. of California, Los Angeles (USA); Michael Lewinski, Roche Molecular Systems (USA); Dino Di Carlo, Omai B. Garner, Aydogan Ozcan, Univ. of California, Los Angeles (USA) . . . [9699-4]

Coffee Break . . . Sat 10:10 am to 10:40 am

### SESSION 2

LOCATION: ROOM 2004 (WEST LEVEL 2) SAT 10:40 AM TO 12:20 PM

### Fabrication and 3D Printing in Optical Systems

Session Chair: **Aydogan Ozcan**, Univ. of California, Los Angeles (USA)

10:40 am: **Low-cost flatbed scanner label-free biosensor**, Ugur Aygun, Koç Univ. (Turkey); Oguzhan Avci, Derin D. Sevenler, Elif Ç. Seymour, Boston Univ. (USA); Hakan Urey, Koç Univ. (Turkey); M. Selim Ünlü, Boston Univ. (USA); Ayca Yalcin Ozkumur, Bahçesehir Univ. (Turkey) . . . [9699-5]

11:00 am: **Development and bench testing of a multi-spectral imaging technology built on a smartphone platform**, Frank J. Bolton, Ronit Slyper, Reuven Weiser, Ben Friedman, Alexander J. Kass, Donny Rose, Amit Safir, David Levitz, MobileODT Ltd. (Israel) . . . [9699-6]

11:20 am: **Mechanical and optical behavior of a tunable liquid lens using a variable cross section membrane**, Mario Flores-Bustamante, Sergio Calixto-Carrera, Ctr. de Investigaciones en Óptica, A.C. (Mexico); Martha Rosete-Aguilar, Univ. Nacional Autónoma de México (Mexico) . . . [9699-7]

11:40 am: **Development of a miniature multiple reference optical coherence tomography imaging device**, Paul M. McNamara, National Univ. of Ireland, Galway (Ireland) and Compact Imaging Ireland, Ltd. (Ireland) . . . [9699-8]

12:00 pm: **Wavelength scanning achieves pixel super-resolution in holographic on-chip microscopy**, Wei Luo, Yibo Zhang, Alborz Feizi, Zoltán Göröcs, Alon Greenbaum, Aydogan Ozcan, Univ. of California, Los Angeles (USA) . . . [9699-9]

Lunch/Exhibition Break . . . Sat 12:20 pm to 1:50 pm

### SESSION 3

LOCATION: ROOM 2004 (WEST LEVEL 2) . . . SAT 1:50 PM TO 3:30 PM

### Fluorescence and Polarization Methods

Session Chair: **David Erickson**, Cornell Univ. (USA)

1:50 pm: **Design of miniature mobile phone based cell incubator microscope for real-time fluorescence detection**, Taerim Yoon, Kyujung Kim, Pusan National Univ. (Korea, Republic of) . . . [9699-10]

2:10 pm: **Difference among human normal, Barrett's Dysplasia and Adenocarcinoma revealed by autofluorescence spectroscopy**, Kenneth J. Zhou, Stony Brook Univ. (USA); Jun Chen, Tianjin Medical Univ. General Hospital (China) . . . [9699-11]

2:30 pm: **Monitoring bacterial metabolic activity for food hygiene detection using NADH fluorescence**, Kenneth J. Zhou, Stony Brook Univ. (USA); Jun Chen, Tianjin Medical Univ. General Hospital (China) . . . [9699-12]

2:50 pm: **Evaluation of a polarization sensitive multiple reference optical coherence tomography system**, Sean O'Gorman, Paul M. McNamara, Roshan I. Dsouza, Kai Neuhaus, Hrebesh M. Subhash, National Univ. of Ireland, Galway (Ireland); Josh Hogan, Carol J. Wilson, Compact Imaging, Inc. (USA); Martin J. Leahy, National Univ. of Ireland, Galway (Ireland) . . . [9699-13]

3:10 pm: **Wide-field synovial fluid imaging using polarized lens-free on-chip microscopy for point-of-care diagnostics of gout and pseudogout**, Yibo Zhang, Seung Yoon Lee, Yun Zhang, Daniel Furst, John Fitzgerald, Aydogan Ozcan, Univ. of California, Los Angeles (USA) . . . [9699-14]

Coffee Break . . . Sat 3:30 pm to 4:00 pm

### SESSION 4

LOCATION: ROOM 2004 (WEST LEVEL 2) . . . SAT 4:00 PM TO 5:40 PM

### Blood Diagnostics

Session Chair: **David Levitz**, MobileODT Ltd. (Israel)

4:00 pm: **Portable point-of-care blood analysis system for global health**, James J. Dou, Stewart J. Aitchison, Univ. of Toronto (Canada); Lu Chen, Rakesh Nayyar, ChipCare Corp. (Canada) . . . [9699-15]

4:20 pm: **Thumb-size ultrasonic-assisted spectroscopic imager for in-situ glucose monitoring as optional sensor of conventional dialyzers**, Kosuke Nogo, Keita Mori, Wei Qi, Satsuki Hosono, Natsumi Kawashima, Akira Nishiyama, Kenji Wada, Ichiro Ishimaru, Kagawa Univ. (Japan) . . . [9699-16]

4:40 pm: **Phase-sensitive multiple reference optical coherence tomography**, Roshan I. Dsouza, Hrebesh M. Subhash, Kai Neuhaus, National Univ. of Ireland, Galway (Ireland); Josh Hogan, Carol J. Wilson, Compact Imaging, Inc. (USA); Martin J. Leahy, National Univ. of Ireland, Galway (Ireland) . . . [9699-17]

5:00 pm: **Multiple reference optical coherence tomography noise analysis for chip on submount superluminescent light emitting diode**, Kai Neuhaus, Hrebesh M. Subhash, Roshan I. Dsouza, National Univ. of Ireland, Galway (Ireland); Josh Hogan, Carol J. Wilson, Compact Imaging, Inc. (USA); Martin J. Leahy, National Univ. of Ireland, Galway (Ireland) . . . [9699-18]

5:20 pm: **Flat lensless phase imager**, Manon Rostykus, Christophe Moser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . [9699-19]



# CONFERENCE 9699

LOCATION: ROOM 2004 (WEST LEVEL 2)

BIOS

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM  
LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 5

LOCATION: ROOM 2004 (WEST LEVEL 2) .SUN 8:30 AM TO 10:20 AM

## Translational Research I: Microscopy Plus White Light Imaging

Session Chair: **Anita Mahadevan-Jansen**, Vanderbilt Univ. (USA)

8:30 am: **A mobile telemedicine approach for early diagnosis of oral cancer in resource limited settings** (*Invited Paper*), Radhika Chigurupati D.D.S., Boston Univ. (USA) ..... [9699-20]

9:00 am: **Comparison of performance of mobile and traditional colposcopy in high- and low-resource settings**, Octavio A. Villalobos-Méndez, Centro Médico Pro Salud (Mexico); Bruce Kahn M.D., Scripps Clinic Medical Group (USA); Sonia Contreras, International Community Foundation (USA); Marta M. Madiedo-Camargo, Centro Médico Pro Salud (Mexico); David Levitz, MobileODT Ltd. (Israel) ..... [9699-22]

9:20 am: **Field-testing of a cost-effective mobile-phone based microscope for screening of Schistosoma haematobium**, Hatice Ceylan Koydemir, Univ. of California, Los Angeles (USA); Isaac I. Bogoch, Univ. of Toronto (Canada) and Toronto General Hospital (Canada); Derek Tseng, Univ. of California, Los Angeles (USA); Richard K. D. Ephraim, Evans Duah, Univ. of Cape Coast (Ghana); Joseph Tee, Volta River Authority (Ghana); Jason R. Andrews, Stanford Univ. (USA) and Stanford School of Medicine (USA); Aydogan Ozcan, Univ. of California, Los Angeles (USA) and California NanoSystems Institute (USA) ..... [9699-23]

9:40 am: **Versatile medical diagnostics kit based on customized tablet platform**, Jung Kweon Bae, Sungwon Shin, Andrey Vavilin, Ulsan National Institute of Science and Technology (Korea, Republic of); Jae Hyeok Shin, Adic Co., Ltd (Korea, Republic of); Joon You, PraxisBio Science, Inc. (USA) and Ulsan National Institute of Science and Technology (Korea, Republic of); Hyeongeun Kim, Ulsan National Institute of Science and Technology (Korea, Republic of); Woonggyu Jung, Ulsan National Institute of Science and Technology (Korea, Republic of) and Institute for Basic Science (Korea, Republic of) ..... [9699-24]

10:00 am: **Custom field-of-view optofluidic imaging by synthetic digital holography**, Vittorio Bianco, Melania Paturzo, Valentina Marchesano, Pietro Ferraro, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) and Consiglio Nazionale delle Ricerche (Italy) ..... [9699-25]

Coffee Break ..... Sun 10:20 am to 10:50 am

### SESSION 6

LOCATION: ROOM 2004 (WEST LEVEL 2) .SUN 10:50 AM TO 12:10 PM

## Translational Research II: New Technologies and Implementations

Session Chair: **Euan McLeod**, The Univ. of Arizona (USA)

10:50 am: **Initial clinical testing of a multi-spectral imaging system built on a smartphone platform**, Jonah Mink, MobileODT Ltd. (Israel) and Univ. of Pennsylvania (USA); Bruce Kahn M.D., Scripps Clinic Medical Group (USA); Charles Hummel, Danielle Burkland, Univ. of Pennsylvania (USA); Leigh Cataldo, Scripps Clinic Medical Group (USA); David Levitz, MobileODT Ltd. (Israel) ..... [9699-26]

11:10 am: **Quantitative wound healing studies using a portable, low-cost, hand-held near-infrared optical scanner: preliminary sensitivity and specificity analysis**, Jiali Lei, Suset Rodriguez, Maanasa Jayachandran, Elizabeth Solis, Stephanie Gonzalez, Florida International Univ. (USA); Francesco Pere-Clavijo, Podiatry Care Partners (USA); Stephen Wigley, Wigley Foot and Ankle Inc. (USA); Anuradha Godavarty, Florida International Univ. (USA) ..... [9699-27]

11:30 am: **A game-based crowd-sourcing platform for rapidly training middle and high school students to perform biomedical image analysis**, Steve W. Feng, Min-jae Woo, Hannah Kim, So Jung Ki, Lei Shao, Aydogan Ozcan, Univ. of California, Los Angeles (USA) ..... [9699-28]

11:50 am: **StressPhone: smartphone enabled detection of stress related salivary biomarkers**, Aadhar Jain, Elizabeth Rey, Seoho Lee, Dakota O'Dell, David Erickson, Cornell Univ. (USA) ..... [9699-29]

### POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BiOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Evaluation of PpIX formation in Cervical Intraepithelial Neoplasia I (CIN) using widefield fluorescence images**, Fernanda M. Carbinatto, Natália M. Inada, Thereza C. Fortunato, Sebastião Prataveira, José D. Vollet-Filho, Univ. de São Paulo (Brazil); Wellington Lombardi M.D., Eduardo V. da Silva, UNIARA (Brazil); Cristina Kurachi, Vanderlei S. Bagnato, Univ. de São Paulo (Brazil) ..... [9699-21]

**Melanoma detection using a mobile phone app**, Luciano Elias-Diniz, Karin M. Enns, Swansea Univ. (United Kingdom) ..... [9699-30]

**Shed a light of wireless technology on portable/mobile design of NIRS**, Ting Li, Yunlong Sun, Univ. of Electronic Science and Technology of China (China) ..... [9699-31]

**Image processing framework for evaluation of image quality for multiple reference optical coherence tomography**, Kai Neuhaus, National Univ. of Ireland, Galway (Ireland); Hreesh M. Subhash, National Univ. of Ireland, Galway (Ireland); Roshan I. Dsouza, National Univ. of Ireland, Galway (Ireland); Josh Hogan, Carol J. Wilson, Compact Imaging, Inc. (USA); Martin J. Leahy, National Univ. of Ireland, Galway (Ireland) ..... [9699-32]

**Potential applications of Near Infrared auto-fluorescence spectral polarized imaging for assessment of food quality and safety**, Kenneth J Zhou, Stony Brook Univ. (USA); Jun Chen, Tianjin Medical Univ. General Hospital (China) ..... [9699-33]

# CONFERENCE 9700

LOCATION: ROOM 2001 (WEST LEVEL 2)

Saturday–Sunday 13–14 February 2016 • Proceedings of SPIE Vol. 9700

# Design and Quality for Biomedical Technologies IX

*Conference Chairs:* **Ramesh Raghavachari**, U.S. Food and Drug Administration (USA); **Rongguang Liang**, College of Optical Sciences, The Univ. of Arizona (USA)

*Conference Co-Chair:* **T. Joshua Pfefer**, U.S. Food and Drug Administration (USA)

*Program Committee:* **David W. Allen**, National Institute of Standards and Technology (USA); **Anthony J. Durkin**, Beckman Laser Institute and Medical Clinic (USA); **Jeeseong Hwang**, National Institute of Standards and Technology (USA); **Stephen P. Morgan**, The Univ. of Nottingham (United Kingdom); **Robert J. Nordstrom**, National Institutes of Health (USA); **Jannick P. Rolland**, Univ. of Rochester (USA); **Eric J. Seibel**, Univ. of Washington (USA); **Behrouz Shabestari**, National Institutes of Health (USA); **Kenji Taira**, Olympus Corp. (USA); **Tomasz S. Tkaczyk**, Rice Univ. (USA); **Gracie Vargas**, The Univ. of Texas Medical Branch (USA); **Rudolf M. Verdaasdonk**, Vrije Univ. Medical Ctr. (Netherlands)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 2001 (WEST LEVEL 2) .. SAT 8:30 AM TO 10:00 AM

### Phantom Development and Characterization

Session Chairs: **Ramesh Raghavachari**, U.S. Food and Drug Administration (USA); **Rongguang Liang**, College of Optical Sciences, The Univ. of Arizona (USA)

8:30 am: **Development of a reference platform for the characterization of liquid phantoms** (*Invited Paper*), Paul Lemaillet, David W. Allen, Jeeseong C. Hwang, National Institute of Standards and Technology (USA) . . . . . [9700-1]

9:00 am: **Development of breast cancer tissue phantoms for terahertz imaging**, Alec Walter, Tyler Bowman, Magda El-Shenawee, Univ. of Arkansas (USA) . . . . . [9700-2]

9:20 am: **Low-cost tissue simulating phantoms with tunable, wavelength-dependent scattering properties**, Rolf B. Saager, Alan Quach, Rebecca A. Rowland, Melissa L. Baldado, Adrien Ponticorvo, Anthony J. Durkin, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9700-17]

9:40 am: **Characterization of homogeneous tissue phantoms for performance tests in diffuse optics**, Heidrun Wabnitz, Dieter Richard Taubert, Physikalisch-Technische Bundesanstalt (Germany); Tsukasa Funane, Masashi Kiguchi, Hitachi, Ltd. (Japan); Hideo Eda, The Graduate School for the Creation of New Photonics Industries (Japan); Antonio Pifferi, Politecnico di Milano (Italy) and CNR-Istituto di Fotonica e Nanotecnologie (Italy); Alessandro Torricelli, Politecnico di Milano (Italy); Rainer Macdonald, Physikalisch-Technische Bundesanstalt (Germany) . . . . . [9700-4]

Coffee Break . . . . . Sat 10:00 am to 10:30 am

### SESSION 2

LOCATION: ROOM 2001 (WEST LEVEL 2) .. SAT 10:30 AM TO 12:10 PM

### Printed Phantoms

Session Chair: **T. Joshua Pfefer**, U.S. Food and Drug Administration (USA)

10:30 am: **Performance evaluation of CCD- and mobile-phone-based near-infrared fluorescence imaging systems with molded and 3D-printed phantoms**, Bohan Wang, Univ. of Maryland, College Park (USA); Pejman Ghassemi, Quanzeng Wang, Kejing Chen, U.S. Food and Drug Administration (USA); Yu Chen, Univ. of Maryland, College Park (USA); T. Joshua Pfefer, U.S. Food and Drug Administration (USA) . . . . . [9700-5]

10:50 am: **3D-printed phantom for the characterization of non-uniform rotational distortion**, Geoffrey Hohert, Hamid Pahlevaninezhad, Anthony Lee M.D., Pierre M. Lane, BC Cancer Agency Research Ctr. (Canada) . . . . . [9700-6]

11:10 am: **Customized three-dimensional printed optical phantoms with user-defined absorption and scattering**, Sanjana Pannem, Jordan Sweer, Phuong Diep, Justine Lo, Michael Snyder, Gabriella Stueber, Yanyu Zhao, Syeda Tabassum, Raef Istfan, Junjie Wu, Shyamsunder Erramilli, Darren M. Roblyer, Boston Univ. (USA) . . . . . [9700-7]

11:30 am: **A three-dimensional printed phantom for conjoined twins separation surgery**, Shuwei Shen, Zhu Hua Zhao, Yilin Han, Guang Li Liu, Erbao Zhang, Univ. of Science and Technology of China (China); Ronald X. Xu, The Ohio State Univ. (USA) . . . . . [9700-8]

11:50 am: **A vertical double integrating sphere system for optical characterization of phantom materials in 3D printing**, Yilin Han, Shuwei Shen, Qiuming Jia, Guang Li Liu, Zhu Hua Zhao, Gang Zhao, Erbao Dong, Univ. of Science and Technology of China (China); Ronald X. Xu, The Ohio State Univ. (USA); David W. Allen, Paul Lemaillet, National Institute of Standards and Technology (USA) . . . . . [9700-9]

Lunch/Exhibition Break . . . . . Sat 12:10 pm to 1:30 pm

### SESSION 3

LOCATION: ROOM 2001 (WEST LEVEL 2) . . . . SAT 1:30 PM TO 3:10 PM

### Quality of Biomedical Technologies

Session Chair: **William C. Vogt**, U.S. Food and Drug Administration (USA)

1:30 pm: **Eye safety analysis for non-uniform retinal scanning laser trajectories**, Uwe Schelinski, Hans-Georg Dallmann, Heinrich Grüger, Jens Knobbe, Tino Pügner, Peter Reinig, Franziska Woittennek, Fraunhofer-Institut für Photonische Mikrosysteme (Germany) . . . . . [9700-10]

1:50 pm: **New solutions for standardization, monitoring and quality management of fluorescence-based imaging systems**, Arnaud Royon, Gautier Papon, Argolight (France) . . . . . [9700-11]

2:10 pm: **Quantitative assessment of hyperspectral imaging in detection of plasmonic nanoparticles: a modified contrast-detail analysis approach**, Jianting Wang, U.S. Food and Drug Administration (USA); Yu Chen, Univ. of Maryland, College Park (USA); T. Joshua Pfefer, U.S. Food and Drug Administration (USA) . . . . . [9700-12]

2:30 pm: **Component validation of direct diode 488nm lasers in BD Accuri™ flow cytometers**, Wei P. Chen, BD Biosciences (USA); Ningyi D. Luo, Pavilion Integration Corp. (USA) . . . . . [9700-13]

2:50 pm: **Dynamic thermal effects of epidermal melanin and plasmonic nanoparticles during photoacoustic breast imaging**, Pejman Ghassemi, Quanzeng Wang, T. Joshua Pfefer, U.S. Food and Drug Administration (USA) . . . . . [9700-14]

Coffee Break . . . . . Sat 3:10 pm to 3:40 pm

# CONFERENCE 9700

## LOCATION: ROOM 2001 (WEST LEVEL 2)

### SESSION 4

LOCATION: ROOM 2001 (WEST LEVEL 2) . . . . SAT 3:40 PM TO 5:10 PM

## Phantom Technologies

Session Chair: **David W. Allen**,  
National Institute of Standards and Technology (USA)

3:40 pm: **From theory to practice: the broadening role of polydimethylsiloxane phantoms as an intermediary between model validation and instrument performance testing** (*Invited Paper*), Rolf B. Saager, Alan Quach, Gordon T. Kennedy, Bruce J. Tromberg, Anthony J. Durkin, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9700-15]

4:10 pm: **Tissue-simulating phantoms for testing pretreatment planning of photodynamic therapy with optical flap**, Gal Shafirstein, Emily Oakley, Brian Wrazen, Juliann Lajoie, Tyger Howell, David A. Bellnier, Roswell Park Cancer Institute (USA) . . . . . [9700-16]

4:30 pm: **Margin assessment of three-dimensional breast cancer phantoms using terahertz imaging**, Tyler Bowman, Alec Walter, Magda El-Shenawee, Univ. of Arkansas (USA) . . . . . [9700-3]

4:50 pm: **Novel organosilicon phantoms as testing material for photoacoustic imaging**, Cinzia Avigo, Istituto di Fisiologia Clinica (Italy); Nicole Di Lascio, Istituto di Fisiologia Clinica (Italy) and Scuola Superiore Sant'Anna (Italy); Paolo Armanetti, Univ. di Pisa (Italy); Claudia Kusmic, Istituto di Fisiologia Clinica (Italy); Lucia Cavigli, Fulvio Ratto, Istituto di Fisica Applicata "Nello Carrara" (Italy); Sandro Meucci, Scuola Normale Superiore (Italy) and Istituto Italiano di Tecnologia (Italy); Cecilia Masciullo, NEST (Italy) and Istituto Nanoscienze (Italy) and Scuola Normale Superiore (Italy); Marco Cecchini, NEST (Italy); Roberto Pini, Istituto di Fisica Applicata "Nello Carrara" (Italy); Francesco Faita, Luca Menichetti, Istituto di Fisiologia Clinica (Italy). . . . . [9700-18]

## BiOS Hot Topics

**SAT 7:00 PM TO 9:00 PM**  
**LOCATION: ROOM 3022 (WEST LEVEL 3)**

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 5

LOCATION: ROOM 2001 (WEST LEVEL 2) . . SUN 8:10 AM TO 10:00 AM

## Biomedical Imaging Technologies I

Session Chair: **Gracie Vargas**,  
The Univ. of Texas Medical Branch (USA)

8:10 am: **Biological lasers for BIOS** (*Invited Paper*), Seok-Hyun Yun, Harvard University (USA). . . . . [9700-20]

8:40 am: **Label-free hyperspectral microscopy for scatter imaging of biological processes in cells**, Jeeseong C. Hwang, Aniruddha Ray, Phillip P. Cheney, Bonghwan Chon, Ji Youn Lee, Kimberly A. Briggman, National Institute of Standards and Technology (USA). . . . . [9700-21]

9:00 am: **Hyperspectral scatter microscopy of tissue optical properties in support of quantitative clinical applications**, Phillip P. Cheney, National Institute of Standards and Technology (USA); David M. McClatchy III, Stephen C. Kanick, Dartmouth College (USA); Bonghwan Chon, National Institute of Standards and Technology (USA); Brian W. Pogue, Dartmouth College (USA); Jeeseong C. Hwang, National Institute of Standards and Technology (USA) . . . . . [9700-22]

9:20 am: **Spectral analysis of different bacteria and yeast colonies**, S. P. Arjunan, B. Aliahmad, RMIT Univ. (Australia); R. Viswanathan, R. Shukla, RMIT University (Australia); D. K. Kumar, RMIT Univ. (Australia) . . . . . [9700-23]

9:40 am: **Spatially resolved diffuse reflectance spectroscopy of two-layer turbid media using a densely packed multi-pixel photodiode probe**, Ozlem Senlik, Duke Univ. (USA); Gage J. Greening, Timothy J. Muldoon, Univ. of Arkansas (USA); Nan M. Jokerst, Duke Univ. (USA) . . . . . [9700-24]

Coffee Break . . . . . Sun 10:00 am to 10:30 am

### SESSION 6

LOCATION: ROOM 2001 (WEST LEVEL 2) . . SUN 10:30 AM TO 12:10 PM

## Design of Biomedical Imaging Technologies

Session Chair: **Jeeseong C. Hwang**,  
National Institute of Standards and Technology (USA)

10:30 am: **Fiber optic microprobes with rare-earth-based phosphor tips for proton beam characterization**, Arash Darafsheh, Andrew Soldner, Alireza Kassaei, Jarod C. Finlay, Univ. of Pennsylvania (USA) . . . . . [9700-25]

10:50 am: **A wearable infrared videopupillometry with multi-stimulation of consistent illumination for binocular pupil response**, Ou-Yang Mang, National Chiao Tung Univ. (Taiwan); Yi-Chun Tsai, Jin-Chern Chiou, Ting-Wei Huang, National Chiao Tung Univ. (Taiwan); Mei-Lan Ko, National Taiwan Univ. Hospital, Hsin-Chu Branch (Taiwan) . . . . . [9700-26]

11:10 am: **Illumination-parameter adjustable and illumination-distribution visible LED helmet for low-level light therapy on brain injury**, Ting Li, Yuan Gao, Pengbo Wang, Univ. of Electronic Science and Technology of China (China); Xiao Chen, Huazhong Univ. Of Science And Technology (China) . . . . . [9700-27]

11:30 am: **Modelling and design of modified Wollaston prisms and the application in differential interference contrast microscopy**, Site Zhang, Huiying Zhong, Frank Wyrowski, Friedrich-Schiller-Univ. Jena (Germany) . . . . . [9700-28]

11:50 am: **Bessel beam scanning-laser optical projection tomography for 3D extended-depth cellular imaging**, Dongli Xu, Leilei Peng, The Univ. of Arizona (USA) . . . . . [9700-29]

Lunch/Exhibition Break . . . . . Sun 12:10 pm to 1:10 pm

### SESSION 7

LOCATION: ROOM 2001 (WEST LEVEL 2) . . . . SUN 1:10 PM TO 3:40 PM

## Biomedical Imaging Technologies II

Session Chair: **Behrouz Shabestari**, National Institutes of Health (USA)

1:10 pm: **Programs and funding opportunities at the National Institute of Biomedical Imaging and Bioengineering**, Behrouz Shabestari, National Institutes of Health (USA) . . . . . [9700-47]

1:50 pm: **Handheld reflectance confocal endomicroscope for imaging of the oral cavity** (*Invited Paper*), Kristen Carlson Maitland, Texas A&M University (USA) . . . . . [9700-30]

2:20 pm: **LED induced autofluorescence (LIAF) imager with eight multi-filters for oral cancer diagnosis**, Ting-Wei Huang, Nai-Lun Cheng, National Chiao Tung Univ. (Taiwan); Ming-Hsui Tsai, China Medical Univ. (Taiwan); Jin-Chern Chiou, China Medical Univ. (Taiwan) and National Chiao Tung Univ. (Taiwan); Mang Ou-Yang, National Chiao Tung Univ. (Taiwan) . . . . . [9700-31]

2:40 pm: **Excitation-resolved wide-field fluorescence imaging of indocyanine green visualizes the microenvironment properties in vivo via solvatochromic shift**, Jaedu Cho, Univ. of California, Irvine (USA); Chang-Seok Kim, Pusan National Univ. (Korea, Republic of); Gultekin Gulsen, Univ. of California, Irvine (USA). . . . . [9700-32]

3:00 pm: **Design and validation of a research spatial frequency domain imaging (SFDI) platform**, Amaan Mazhar, Pierre Khoury, Chris Campbell, David J. Cuccia, Modulated Imaging, Inc. (USA) . . . . . [9700-33]

3:20 pm: **Real-time processing and visualization of spatial frequency domain images**, Mohammad Torabzadeh, Kyle P. Nadeau, Anthony J. Durkin, Bruce J. Tromberg, Beckman Laser Institute and Medical Clinic (USA). [9700-34]

Coffee Break . . . . . Sun 3:40 pm to 4:00 pm

# CONFERENCE 9700

LOCATION: ROOM 2001 (WEST LEVEL 2)

## SESSION 8

LOCATION: ROOM 2001 (WEST LEVEL 2) . . .SUN 4:00 PM TO 6:00 PM

### Translational Technology

Session Chair: **Rongguang Liang**,  
College of Optical Sciences, The Univ. of Arizona (USA)

4:00 pm: **Translation of integrated OCT/US system for cardiovascular imaging** (*Invited Paper*), Zhongping Chen, University of California, Irvine (USA) . . . . . [9700-35]

4:30 pm: **Clinical utility of endoscopic OCT: recent advances and future directions** (*Invited Paper*), Melissa Suter, Harvard University (USA) . . . [9700-36]

5:00 pm: **Spectral domain optical coherence tomography with dual-balanced detection for auto-correlation artifacts reduction**, En Bo, Linbo Liu, Nanyang Technological Univ. (Singapore) . . . . . [9700-37]

5:20 pm: **Single-channel stereoscopic video imaging ophthalmology surgical microscopes based on TRD**, Edalat Radfar, Byungjo Jung, Jihoon Park, Sangyeob Lee, Myungjin Ha, Sungkon Yu, Seulgi Jang, Yonsei Univ. (Korea, Republic of) . . . . . [9700-38]

5:40 pm: **Fast full 4x4 Mueller polarimeter for endoscopic applications**, Sylvain Rivet, Univ. de Bretagne Occidentale (France) and Univ. of Kent (United Kingdom); Adrian Bradu, Adrian G. H. Podoleanu, Univ. of Kent (United Kingdom) . . . . . [9700-39]

## POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BiOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**The role of cerebral spinal fluid in light propagation through the mouse head: improving fluorescence tomography with Monte Carlo modeling**, Daniele Ancora, Athanasios Zacharopoulos, Foundation for Research and Technology-Hellas (Greece); Jorge Ripoll, Univ. Carlos III de Madrid (Spain); Giannis Zacharakis, Foundation for Research and Technology-Hellas (Greece) . . . . . [9700-40]

**Towards improved image reconstruction in breast diffuse optical tomography using compressed sensing: a comparative study among  $l_1$  ( $0 \leq p \leq 2$ ) sparsity regularizations**, Bingyuan Wang, Yihan Wang, Yanqi Zhang, Huijuan Zhao, Feng Gao, Tianjin Univ. (China) . . . . . [9700-41]

**Validation of MTF measurement for CBCT system using Monte Carlo simulations**, Ting Hao, Tianjin Univ. (China); Feng Gao, Huijuan Zhao, Tianjin University (China) and School of Precision Instrument and Optoelectronics Engineering, Tianjin University (China) and Tianjin Key Laboratory of Biomedical Detecting Techniques and Instruments (China); Zhongxing Zhou, Tianjin Univ. (China) . . . . . [9700-42]

**Non-contact ECG monitoring**, Aleksei Smirnov, Vadim Erlikh, Vladimir Kodkin, Andrei Keller, Vitaly Epishev, South Ural State Univ. (Russian Federation) . . . . . [9700-43]

**Embedded infrared imaging system for detection of vein pattern**, Mustafa Z. Yildiz, Hyun Soo Lim, Özdemir Çetin, Ömer F. Boyraz, Volkan Seymen, Sakarya Univ. (Turkey) . . . . . [9700-44]

**Multi-wavelength fluorescence tomography**, Tiffany C. Kwong, Jaedu Cho, Farouk Nouizi, Ctr. for Functional Onco-Imaging (USA); Chang-Seok Kim, Pusan National Univ. (Korea, Republic of); Gultekin Gulsen, Ctr. for Functional Onco-Imaging (USA) . . . . . [9700-45]

**A modified laminar optical tomography system and initial validation**, Huijuan Zhao, Shuang Wang, Mengyu Jia, Feng Gao, Tianjin Univ. (China) . . . . . [9700-46]



# CONFERENCE 9701

LOCATION: ROOM 2003 (WEST LEVEL 2)

Saturday 13 February 2016 • Proceedings of SPIE Vol. 9701

# Multimodal Biomedical Imaging XI

BIOS

Conference Chairs: **Fred S. Azar**, Philips Medical Systems (USA); **Xavier Intes**, Rensselaer Polytechnic Institute (USA)

Program Committee: **Caroline Boudoux**, Ecole Polytechnique de Montréal (Canada); **Christophe Chéd'hotel**, Ventana Medical Systems, Inc. (USA); **Yu Chen**, Univ. of Maryland, College Park (USA); **Qianqian Fang**, Massachusetts General Hospital (USA); **Sergio Fantini**, Tufts Univ. (USA); **Gultekin Gulsen**, Univ. of California, Irvine (USA); **Theodore J. Huppert**, Univ. of Pittsburgh (USA); **Tim Nielsen**, Philips Research (Germany); **Vasilis Ntziachristos**, Helmholtz Zentrum München GmbH (Germany); **Brian W. Pogue**, Thayer School of Engineering at Dartmouth (USA); **Siavash Yazdanfar**, GE Global Research (USA); **Arjun G. Yodh**, Univ. of Pennsylvania (USA)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 2003 (WEST LEVEL 2) . SAT 8:30 AM TO 10:30 AM

### Instrument/Algorithms

Session Chairs: **Xavier Intes**, Rensselaer Polytechnic Institute (USA); **Guoqiang Yu**, Univ. of Kentucky (USA)

- 8:30 am: **Quantum yield imaging: a new method for imaging quantum yield in diffusive media**, Yanyu Zhao, Darren M. Roblyer, Boston Univ. (USA) [9701-1]
- 8:50 am: **A quad-modality molecular small animal imaging system for both optical and radioactive molecular probes**, Changhui Li, Yanye Lu, Qiushi Ren, Peking Univ. (China) ..... [9701-2]
- 9:10 am: **Common reduced spaces of representation applied to multispectral texture analysis in cosmetology**, Joris Corvo, MINES ParisTech (France) and SILAB (France); Jesus Lopez-Angulo, MINES ParisTech (France); Josselin Breugnot, SILAB (France); Sylvie Borbes, SILAB (France) . . . . [9701-3]
- 9:30 am: **A combined diffuse correlation spectroscopy and time-resolved near-infrared spectroscopy instrument for calculating absolute cerebral blood flow and cerebral metabolic rate for oxygen**, Venkaiah C. Kavuri, Wesley B. Baker, Ashwin B. Parthasarathy, Univ. of Pennsylvania (USA); Ramani Balu, W. Andrew Kofke, Univ. of Pennsylvania School of Medicine (USA); Arjun G. Yodh, Univ. of Pennsylvania (USA) ..... [9701-4]
- 9:50 am: **Deformable medical image registration of pleural cavity for photodynamic therapy by using finite-element based method**, Rozhin Penjweini, The Univ. of Pennsylvania Health System (USA); Michele M. Kim, Univ. of Pennsylvania School of Medicine (USA); Andrea Dimofte, Jarod C. Finlay, Timothy C. Zhu, The Univ. of Pennsylvania Health System (USA) [9701-5]
- 10:10 am: **Correction of reference image distortion in adaptive optics scanning light ophthalmoscopy**, Qiang Yang, Ethan Rossi, Univ. of Rochester Medical Ctr. (USA); David R. Williams, Univ. of Rochester (USA) . . . . . [9701-6]
- Coffee Break ..... Sat 10:30 am to 11:00 am

### SESSION 2

LOCATION: ROOM 2003 (WEST LEVEL 2) . SAT 11:00 AM TO 12:30 PM

### Multimodality Microscopy

Session Chairs: **Caroline Boudoux**, Castor Optics (Canada); **Fred S. Azar**, Philips Healthcare (USA)

- 11:00 am: **Acute and long-term effects of neural implants examined with two-photon and optical coherence microscopy (Invited Paper)**, Daniel X. Hammer, U.S. Food and Drug Administration (USA) ..... [9701-7]
- 11:30 am: **Combining large area fluorescence with multiphoton microscopy for improved detection of oral epithelial neoplasia**, Rahul Pal, Jinping Yang, Suimin Qiu, Susan McCammon, Vicente Resto, Gracie Vargas, The Univ. of Texas Medical Branch (USA) ..... [9701-8]
- 11:50 am: **Dual Raman-Brillouin microscope for chemical and mechanical characterization and imaging**, Vladislav V. Yakovlev, Texas A&M Univ. (USA) ..... [9701-9]
- 12:10 pm: **Towards in vivo laser coagulation and concurrent optical coherence tomography through double-clad fiber devices**, Kathy Beaudette, Ecole Polytechnique de Montréal (Canada) and Massachusetts General Hospital (USA); William Lo, Martin Villiger, Milen Shishkov, Harvard Medical School (USA) and Massachusetts General Hospital (USA); Nicolas Godbout, Ecole Polytechnique de Montréal (Canada); Brett E. Bouma, Harvard Medical School (USA) and Massachusetts General Hospital (USA); Caroline Boudoux, Ecole Polytechnique de Montréal (Canada) ..... [9701-10]
- Lunch/Exhibition Break ..... Sat 12:30 pm to 1:30 pm

### SESSION 3

LOCATION: ROOM 2003 (WEST LEVEL 2) . . . SAT 1:30 PM TO 3:40 PM

### Clinical Applications

Session Chairs: **Yu Chen**, Univ. of Maryland, College Park (USA); **Fred S. Azar**, Philips Healthcare (USA)

- 1:30 pm: **Surgical applications of probe based confocal endomicroscopy: the benefit of immaterial biopsies (Invited Paper)**, Christof Schäfer, Sophie Clade, Francois Lacombe, Mauna Kea Technologies (France) . . . . . [9701-11]
- 2:00 pm: **In vivo multimodal imaging of peripheral airways using an endoscopic co-registered optical coherence tomography and autofluorescence imaging system**, Hamid Pahlevaninezhad, Anthony Lee, Geoffrey Hohert, Carley Schwartz, Tawimas Shaipanich, Alexander J. Ritchie, Wei Zhang, Calum E. MacAulay, Stephen Lam, Pierre M. Lane, BC Cancer Research Ctr. (Canada) ..... [9701-12]
- 2:20 pm: **Multimodal colposcopy for in vivo detection of cervical intraepithelial neoplasia**, Wenqi Ren, Yingjie Qu, Univ. of Science and Technology of China (China); JiaoJiao Pei, LinLin Xiao, Chongqing Medical Univ. (China); Shiwu Zhang, Univ. of Science and Technology of China (China); Shufang Chang, Chongqing Medical Univ. (China); Ronald X. Xu, The Ohio State Univ. (USA) ..... [9701-13]
- 2:40 pm: **Towards multimodal detection of melanoma thickness based on optical coherence tomography and optoacoustics**, Maik Rahlves, Arthur Varkentin, Maya Otte, Jenny Stritzel, Elias Blumenroether, Mikhail Mazurenka, Merve Meinhardt-Wollweber, Bernhard Roth, Leibniz Univ. Hannover (Germany) ..... [9701-14]
- 3:00 pm: **Identification of early cancerous lesion of esophagus with endoscopic images by hyperspectral image technique**, Shih-Wei Huang, Shih-Hua Chen, National Chung Cheng Univ. (Taiwan); Weichung Chen, I-Chen Wu, Ming Tsang Wu, Kaohsiung Medical Univ. (Taiwan); Chie-Tong Kuo, National Sun Yat-Sen Univ. (Taiwan); Hsiang-Chen Wang, National Chung Cheng Univ. (Taiwan) ..... [9701-15]
- 3:20 pm: **Multimodal imaging of ocular surface of dry eye subjects**, Aizhong Zhang, Univ. of Rochester (USA) ..... [9701-16]

### SESSION 4

LOCATION: ROOM 2003 (WEST LEVEL 2) . . SAT 4:00 PM TO 6:00 PM

### Preclinical/Hybrid Imaging

Session Chairs: **Gultekin Gulsen**, Ctr. for Functional Onco-Imaging (USA); **Xavier Intes**, Rensselaer Polytechnic Institute (USA)

- 4:00 pm: **Depth-resolved imaging of colon tumor using optical coherence tomography and fluorescence laminar optical tomography**, Qinggong Tang, Aaron Frank, Jianting Wang, Chao-Wei Chen, Lily Jin, Jon Lin, Joanne M. Chan, Yu Chen, Univ. of Maryland, College Park (USA) ..... [9701-17]
- 4:20 pm: **Bioluminescence tomography-guided system for preclinical radiation research**, Ken Kang-Hsin Wang, Bin Zhang, Phuoc T. Tran, Julian I. Iordachita, Johns Hopkins Univ. (USA); Michael S. Patterson, McMaster Univ. (Canada); John W. Wong, Johns Hopkins Univ. (USA) ..... [9701-18]
- 4:40 pm: **Intravascular diagnosis by a dual modality imaging system combining optical frequency domain imaging (OFDI) and intravascular ultrasound imaging (IVUS)**, Jian Ren, Milen Shishkov, Martin Villiger, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Brett E. Bouma, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA) and Harvard-MIT Health Sciences and Technology (USA) ..... [9701-19]
- 5:00 pm: **Thermal outlining using focused ultrasound (TOFU) with reversible temperature sensitive fluorescent probes**, Tiffany C. Kwong, Farouk Nouizi, Univ. of California, Irvine (USA); Yuting Lin, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Yue Zhu, Uma Sampathkumaran, InnoSense LLC (USA); Gultekin Gulsen, Univ. of California, Irvine (USA) [9701-20]

# CONFERENCE 9701

LOCATION: ROOM 2003 (WEST LEVEL 2)

5:20 pm: **Characterization of early-stage ionizing radiation induced skin injury in a mouse model by two-photon microscopy and optical coherence tomography**, Won Hyuk Jang, Pohang Univ. of Science and Technology (Korea, Republic of); Sehwan Shim, Korea Institute of Radiological & Medical Sciences (Korea, Republic of); Yeoreum Yoon, Taejun Wang, Pohang Univ. of Science and Technology (Korea, Republic of); Won-Suk Jang, Sunhoo Park, Korea Institute of Radiological & Medical Sciences (Korea, Republic of); Ki Hean Kim, Pohang Univ. of Science and Technology (Korea, Republic of) . . . . . [9701-21]

5:40 pm: **Multimodal OCT for visualization of animal model tumor response during PDT**, Marina A. Sirotkina, Natalia L. Buyanova, Nizhny Novgorod State Medical Academy (Russian Federation); Lev A. Matveev, Institute of Applied Physics of the RAS (Russian Federation) and Nizhny Novgorod State Medical Academy (Russian Federation); Aleksander A. Moiseev, Institute of Applied Physics of the RAS (Russian Federation); Maria Karabut, Tatiana I. Kalganova, Vadim V. Elagin, Sergey Gamayunov, Marina V. Shirmanova, Nizhny Novgorod State Medical Academy (Russian Federation); Vladimir Y. Zaytsev, Institute of Applied Physics of the RAS (Russian Federation) and Nizhny Novgorod State Medical Academy (Russian Federation); Anton I. Pavlikov, Sergey S. Kuznetsov, Ludmila B. Snopova, Nizhny Novgorod State Medical Academy (Russian Federation); Grigory V. Gelikonov, Institute of Applied Physics of the RAS (Russian Federation) and Nizhny Novgorod State Medical Academy (Russian Federation); Elena V. Zagaynova, Nizhny Novgorod State Medical Academy (Russian Federation); Alex Vitkin, Ontario Cancer Institute (Canada) and Nizhny Novgorod State Medical Academy (Russian Federation); Natalia D. Gladkova, Nizhny Novgorod State Medical Academy (Russian Federation) . . . . . [9701-22]

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BiOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Speckle contrast diffuse correlation tomography for flow contrast imaging of complex turbid media**, Chong Huang, Daniel Irwin, Yu Lin, Yu Shang, Lian He, Weikai Kong, Jia Luo, Guoqiang Yu, Univ. of Kentucky (USA) . . . . . [9701-23]

**Noncontact diffuse correlation tomography of human breast tumor**, Lian He, Chong Huang, Daniel Irwin, Margaret M. Szabunio, Guoqiang Yu, Univ. of Kentucky (USA) . . . . . [9701-24]

**Random laser illumination: an ideal source for biomedical polarization imaging?**, Mariana T. Carvalho, Durham Univ. (United Kingdom) and Univ. Federal de Pernambuco (Brazil); Amrit S. Lotay, Fiona M. Kenny, John M. Girkin, Durham Univ. (United Kingdom); Anderson S. L. Gomes, Univ. Federal de Pernambuco (Brazil) . . . . . [9701-25]

**Acceleration of direct reconstruction of pharmacokinetic parameters in dynamic fluorescence molecular tomography by augmented Lagrangian method**, Dianwen Zhu, Changqing Li, Univ. of California, Merced (USA) . . . . . [9701-26]

**Advancing a smart air cushion system for preventing pressure ulcer using electronic speckle pattern interferometry for deformation and strain/stress measurements**, Sheng-Lin Cheng, Tsung-Heng Tsai, Jean-Tien Lee, Yu-Hsiang Hsu, Chih-Kung Lee, National Taiwan Univ. (Taiwan) . . . . . [9701-27]

**Ultrasound-guided diffuse optical tomography with microbubbles enhancement for functional imaging of advanced breast tumors**, Ronald X. Xu, The Ohio State Univ. (USA) . . . . . [9701-28]

**Cross-calibrating interferon- $\gamma$  detection by using electrochemical impedance spectroscopy and paraboloidal mirror enabled surface plasmon resonance interferometer**, Meng-Wei Liu, Chih-Kung Lee, National Taiwan Univ. (Taiwan) . . . . . [9701-29]

**Adaptive selection of minimally correlated data for optimization of source-detector configuration in diffuse optical tomography**, Sohail Sabir, Seungryong Cho, KAIST (Korea, Republic of); Duchang Heo, Keehyun Kim, Korea Electrotechnology Research Institute (Korea, Republic of) . . . . . [9701-30]

**A hybrid diffuse optical tomography system for concurrent optical and MR imaging of breast cancer**, Jeffrey M. Cochran, Univ. of Pennsylvania (USA); David R. Busch, The Children's Hospital of Philadelphia (USA); Venkaiah C. Kavuri, Univ. of Pennsylvania (USA); Martin Schweiger, Univ. College London (United Kingdom); Han Y. Ban, Univ. of Pennsylvania (USA); Simon R. Arridge, Univ. College London (United Kingdom); Arjun G. Yodh, Univ. of Pennsylvania (USA) . . . . . [9701-31]

**A 1060nm double clad fiber coupler for combined optical coherence tomography and endoscopy**, Robin Guay Lord, Ecole Polytechnique de Montréal (Canada); Kristen L. Lurie, Stanford Univ. (USA); Mathias Strupler, Lucas Majeau, Ecole Polytechnique de Montréal (Canada); Audrey K. Ellerbee, Stanford Univ. (USA); Caroline Boudoux, Ecole Polytechnique de Montréal (Canada) . . . . . [9701-32]

**Quantitative modulated imaging of turbid media in the high spatial frequency domain**, Weihao Lin, Zili Cao, Bixin Zeng, Wenzhou Medical Univ. (China); Min Xu, Fairfield Univ. (USA) . . . . . [9701-33]

**Frequency domain diffuse optical tomography using wavelength-swept laser**, Hansol Jang, Chang-Seok Kim, Gukbin Lim, Pusan National Univ. (Korea, Republic of); Jaedu Cho, Univ. of California Irvine (USA) . . . . . [9701-34]

**Multi-spectral, heterodyne frequency-domain diffuse optical tomography with surface profilometry for breast cancer imaging**, Han Y. Ban, Venkaiah C. Kavuri, Univ. of Pennsylvania (USA); Martin Schweiger, Univ. College London (United Kingdom); Jeffrey M. Cochran, Univ. of Pennsylvania (USA); David R. Busch, The Children's Hospital of Philadelphia (USA); Long Xie, Univ. of Pennsylvania (USA); Brian J. Czerniecki, Hospital of the Univ. of Pennsylvania (USA); Mitchell D. Schnall, The Univ. of Pennsylvania Health System (USA); Simon R. Arridge, Univ. College London (United Kingdom); Arjun G. Yodh, Univ. of Pennsylvania (USA) . . . . . [9701-35]

**Photoplethysmographic imaging via spectrally demultiplexed erythema fluctuation analysis for remote heart rate monitoring**, Jason Deglint, Audrey G. Chung, Brendan Chwyl, Robert Amelard, Farnoud Kazemzadeh, Xiao Yu Wang, David A. Clausi, Alexander Wong, Univ. of Waterloo (Canada) . . . . . [9701-36]

**Non-contact hematoma damage and healing assessment using reflectance photoplethysmographic imaging**, Robert Amelard, Kaylen J. Pfisterer, David A. Clausi, Alexander Wong, Univ. of Waterloo (Canada) . . . . . [9701-37]

**Spectral photoplethysmographic imaging sensor fusion for enhanced heart rate detection**, Robert Amelard, David A. Clausi, Alexander Wong, Univ. of Waterloo (Canada) . . . . . [9701-38]

**Integrated polarization-sensitive optical coherence tomography and Stokes imaging polarimeter for birefringent tissues**, Yuqiang Bai, Joseph Chue-Sang, Jessica C. Ramella-Roman, Florida International Univ. (USA) . . . . . [9701-39]

**Time-resolved hyperspectral single-pixel camera implementation for compressive wide-field fluorescence lifetime imaging**, Qi Pian, Ruoyang Yao, Xavier Intes, Rensselaer Polytechnic Institute (USA) . . . . . [9701-40]

**Sparse temporal sampling for fast time-domain wide-field fluorescence molecular tomography**, Ruoyang Yao, Lingling Zhao, Xavier Intes, Rensselaer Polytechnic Institute (USA) . . . . . [9701-41]

**Gate-width impact on NIR FRET lifetime fitting using gated ICCD**, Sez-Jade Chen, Xavier Intes, Rensselaer Polytechnic Institute (USA) . . . . . [9701-42]

# CONFERENCE 9702

LOCATION: ROOM 2005 (WEST LEVEL 2)

Saturday–Sunday 13–14 February 2016 • Proceedings of SPIE Vol. 9702

# Optical Fibers and Sensors for Medical Diagnostics and Treatment Applications XVI

BIOS

Conference Chair: **Israel Gannot**, Johns Hopkins Univ. (USA), Tel Aviv Univ. (Israel)

Program Committee: **James P. Clarkin**, Polymicro Technologies, A Subsidiary of Molex Incorporated (USA); **Ilko Ilev**, U.S. Food and Drug Administration (USA); **Jin U. Kang**, Johns Hopkins Univ. (USA); **Abraham Katzir**, Tel Aviv Univ. (Israel); **Karl-Friedrich Klein**, Technische Hochschule Mittelhessen (Germany); **Pierre Lucas**, The Univ. of Arizona (USA); **Yuji Matsuura**, Tohoku Univ. (Japan); **Angela B. Seddon**, The Univ. of Nottingham (United Kingdom)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 2005 (WEST LEVEL 2) . SAT 8:40 AM TO 10:00 AM

### Devices and Systems

Session Chair: **Yuji Matsuura**, Tohoku Univ. (Japan)

8:40 am: **Towards mid-infrared fiber-optic devices and systems for sensing, mapping and imaging**, Dinuka Jayasuriya, David Furniss, Zhuoqi Tang, Emma Barney, Trevor M. Benson, Angela B. Seddon, The Univ. of Nottingham (United Kingdom) . . . . . [9702-1]

9:00 am: **Fiber-optic Fourier transform infrared (FO-FTIR) spectroscopy for detecting endotoxin contamination in ophthalmic viscosurgical devices (OVDS)**, Moinuddin Hassan, Ilko K. Ilev, U.S. Food and Drug Administration (USA) . . . . . [9702-2]

9:20 am: **Photoacoustic imaging by using a bundle of thin hollow-optical fibers**, Atsushi Seki, Tohoku Univ. (Japan); Katsumasa Iwai, Sendai National College of Technology (Japan); Takashi Katagiri, Yuji Matsuura, Tohoku Univ. (Japan) . . . . . [9702-3]

9:40 am: **Manufacture of micro-fluidic devices by laser welding using thermal transfer printing techniques**, Karl-Friedrich Klein, Rolf Klein, Daniel Thölken, Tim Tobisch, Technische Hochschule Mittelhessen (Germany); Mathias Belz, World Precision Instruments (Germany) . . . . . [9702-4]

Coffee Break . . . . . Sat 10:00 am to 10:30 am

### KEYNOTE I

LOCATION: ROOM 2005 (WEST LEVEL 2) . SAT 10:30 TO 11:10 AM

Session Chair: **Pierre Lucas**, The Univ. of Arizona (USA)

10:30 am: **Exploring the nanoscale dynamics of biomolecules with optical microcavities (Keynote Presentation)**, Frank Vollmer, Max-Planck-Institut für die Physik des Lichts (Germany) . . . . . [9702-5]

### SESSION 2

LOCATION: ROOM 2005 (WEST LEVEL 2) . . SAT 11:10 AM TO 12:10 PM

### Physiological Sensing I

Session Chair: **Pierre Lucas**, The Univ. of Arizona (USA)

11:10 am: **Ultra-sensitive near-infrared fiber-optic gas sensors enhanced by metal-organic frameworks**, Xinyuan Chong, Ki-Joong Kim, Erwen Li, Oregon State Univ. (USA); Paul R. Ohodnicki, National Energy Technology Lab. (USA); Chih-Hung Chang, Alan X. Wang, Oregon State Univ. (USA) . . . . . [9702-6]

11:30 am: **Label-free tracking of single extracellular vesicles in a nano-fluidic optical fiber**, Edwin van der Pol, Univ. van Amsterdam (Netherlands); Stefan Weidlich, Heraeus Quarzglas GmbH & Co. KG (Germany) and Leibniz-Institut für Photonische Technologien e.V. (Germany); Yoav Lahini, Massachusetts Institute of Technology (USA) and Harvard Univ. (USA); Frank A. W. Coumans, Auguste Sturk, Rienk Nieuwland, Univ. van Amsterdam (Netherlands); Markus A. Schmidt, Leibniz-Institut für Photonische Technologien e.V. (Germany) and Otto Schott Institute of Material Research, Friedrich-Schiller-Universität Jena (Germany); Sanli Faez, Leiden Univ. (Netherlands) and Utrecht Univ. (Netherlands); Ton G. van Leeuwen, Univ. van Amsterdam (Netherlands) [9702-7]

11:50 am: **Blood glucose measurement in vivo using hollow-fiber based, mid-infrared ATR probe with multi-reflection prism**, Saiko Kino, Suguru Omori, Yuji Matsuura, Tohoku Univ. (Japan) . . . . . [9702-8]

Lunch/Exhibition Break . . . . . Sat 12:10 pm to 1:40 pm

### SESSION 3

LOCATION: ROOM 2005 (WEST LEVEL 2) . . . SAT 1:40 PM TO 3:30 PM

### Surgical Applications

Session Chair: **Ilko K. Ilev**, U.S. Food and Drug Administration (USA)

1:40 pm: **Current progress and perspectives in laser-assisted tissue repair of vascular tissue (Invited Paper)**, Paolo Matteini, Francesca P. Rossi, Martina Banchelli, Istituto di Fisica Applicata “Nello Carrara” (Italy); Stefano Frosini, Luca Giannoni, El.En. S.p.A. (Italy); Giancarlo Lupi, Univ. di Pisa (Italy); Guido Giachi, Ecopol S.p.A. (Italy); Federica Chiellini, Univ. di Pisa (Italy); Dario Puppi, Ecopol S.p.A. (Italy); Janis Spigulis, Ilze Lihacova, Univ. of Latvia (Latvia); Israel Gannot, Optical Diagnostics (USA); Roberto Pini, Istituto di Fisica Applicata “Nello Carrara” (Italy) . . . . . [9702-9]

2:10 pm: **Closure of incisions in cataract surgery, using a temperature controlled system based on a 1.9µm semiconductor laser and on AgClBr fibers**, Svetlana Basov, Ilan Gabay, Tel Aviv Univ. (Israel); David Varsano M.D., Tel-Aviv Sourasky Medical Ctr. (Israel); Irina S. Barequet, Mordechai Rosner M.D., Sheba Medical Ctr. (Israel); Marcel Rattunde, Joachim Wagner, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); Abraham Katzir, Tel Aviv Univ. (Israel) . . . . . [9702-10]

2:30 pm: **Active depth-guding handheld micro-forceps for membranectomy based on CP-SSOCT**, Gyeong Woo Cheon, Phillip Lee, Berk Gonenc, Johns Hopkins Univ. (USA); Peter L. Gehlbach, Wilmer Eye Institute (USA); Jin U. Kang, Johns Hopkins Univ. (USA) . . . . . [9702-11]

2:50 pm: **A simply way to establish a dual-core hollow fiber for medical laser surgery applications**, Chengbin Jing, East China Normal Univ (China); Wesley Kendall, James A Harrington, Rutgers University (USA) . . . . . [9702-12]

3:10 pm: **Endoluminal non-contact soft tissue ablation using fiber-based Er:YAG laser delivery**, Dennis Kundrat, Alexander Fuchs, Andreas Schoob, Lueder A. Kahrs, Tobias Ortmaier, Leibniz Univ. Hannover (Germany) . [9702-13]

Coffee Break . . . . . Sat 3:30 pm to 4:00 pm

### SESSION 4

LOCATION: ROOM 2005 (WEST LEVEL 2) . . SAT 4:00 PM TO 5:20 PM

### Temperature Sensing

Session Chair: **James P. Clarkin**, Polymicro Technologies, A Subsidiary of Molex Incorporated (USA)

4:00 pm: **Improvement of bimanual SMART micro-surgical system**, Hyun-cheol Park, Cheol Song, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of) . . . . . [9702-14]

4:20 pm: **Improved fiber probe for laser tissue ablation with integrated distributed temperature sensor**, Yu Liu, Riccardo Gassino, Hao Yu, Politecnico di Torino (Italy); Andrea Braglia, Politecnico di Torino (Italy) and OPI Photonics s.r.l. (Italy); Alberto Vallan, Guido Perrone, Politecnico di Torino (Italy); Daniele Tosi, Nazarbayev Univ. (Kazakhstan) . . . . . [9702-15]

4:40 pm: **A sphere-taper cascaded microfiber for temperature sensing**, Pei Xian, Guoying Feng, Hong Zhang, Shouhuan Zhou, Sichuan Univ. (China) . . . . . [9702-16]



# CONFERENCE 9702

LOCATION: ROOM 2005 (WEST LEVEL 2)

5:00 pm: **Comparison of surface micro-structured and plasmonic all-fiber delivery probes for laser-induced thermotherapy of tumor cells**, Riccardo Gassino, Politecnico di Torino (Italy); Papiya Dhara, Politecnico di Torino (Italy) and Indian School of Mines (India); Yu Liu, Hao Yu, Politecnico di Torino (Italy); Andrea Braglia, Politecnico di Torino (Italy) and OPI Photonics s.r.l. (Italy); Massimo Olivero, Alberto Vallan, Guido Perrone, Politecnico di Torino (Italy) . . . . . [9702-17]

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM  
LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 5

LOCATION: ROOM 2005 (WEST LEVEL 2) .SUN 8:20 AM TO 10:00 AM

### Fibers and Sensors: Theory, Design and Realization

Session Chair: **James A. Harrington**,  
Rutgers, The State Univ. of New Jersey (USA)

8:20 am: **High-index-contrast multilayer hollow waveguides for mid-IR laser delivery**, Jeffrey E. Melzer, Rutgers, The State Univ. of New Jersey (USA) and The Univ. of Arizona, College of Optical Sciences (USA); Wesley Y. Kendall, James A. Harrington, Rutgers, The State Univ. of New Jersey (USA) . . [9702-18]

8:40 am: **Improved uniformity of meter long continuous sensor gratings in offset core fibers through correction of fiber lensing aberrations**, Paul S. Westbrook, Kenneth S. Feder, Tristan Kremp, Thierry F. Taunay, Eric M. Monberg, Gabe S. Puc, OFS Fitel LLC (USA) . . . . . [9702-19]

9:00 am: **Novel localized surface plasmon resonance based optical fiber sensor**, Harald Ian Damm I. Muri, Dag R. Hjelm, Hogskolen i Sor-Trondelag (Norway) and Norwegian Univ. of Science and Technology (Norway) . . [9702-20]

9:20 am: **Wavelength and intensity dispersion analysis of Si Av LEDs for futuristic biosensor applications**, Timothy A. Okhai, Tshwane Univ. of Technology (South Africa) and Univ. Paris-Est Marne-la-Vallée (France); Lukas W. Snyman, Univ. of South Africa (South Africa); Jean-Luc Polleux, ESIEE Paris (France) . . . . . [9702-21]

9:40 am: **Electric field Monte Carlo simulation for studying the backscattering coherence phenomenon with diverging beam illumination from fiber**, Wenli Wu, Andrew J. Radosevich, Adam Eshein, The-Quyen Nguyen, Vadim Backman, Northwestern Univ. (USA) . . . . . [9702-22]

Coffee Break . . . . . Sun 10:00 am to 10:30 am

### SESSION KEY2

LOCATION: ROOM 2005 (WEST LEVEL 2) .SUN 10:30 TO 11:10 AM

### Keynote II

Session Chair: **Israel Gannot**, Tel Aviv Univ. (Israel)

10:30 am: **Advanced biosensing methodologies developed for evaluating performance quality and safety of emerging biophotonics technologies and medical devices (Keynote Presentation)**, Ilko K. Ilev, Bennett Walker, William Calhoun, Moinuddin Hassan, U.S. Food and Drug Administration (USA) . . . . . [9702-23]

### SESSION 6

LOCATION: ROOM 2005 (WEST LEVEL 2) . SUN 11:10 AM TO 11:50 PM

### Physiological Sensing II

Session Chair: **Angela B. Seddon**,  
The Univ. of Nottingham (United Kingdom)

11:10 am: **Fiber optic biofluorometer for physiological research on muscle slices**, Mathias Belz, World Precision Instruments (Germany); Andreas Dendorfer, Walter Brendel Zentrum für experimentelle Medizin, Ludwig-Maximilians-Univ. München (Germany); Jan Werner, Karl-Friedrich Klein, Technische Hochschule Mittelhessen (Germany) . . . . . [9702-25]

11:30 am: **Biophotonic Low-coherence sensors with the use of boron-doped diamond thin layer**, Katarzyna Karpieko, Daria Milewska, Michal Sobaszek, Pawel Wierzbza, Matgorzata Jędrzejewska-Szczerska, Gdansk Univ. of Technology (Poland) . . . . . [9702-26]

Lunch/Exhibition Break . . . . . Sun 11:50 am to 1:30 pm

### SESSION 7

LOCATION: ROOM 2005 (WEST LEVEL 2) . . SUN 1:30 PM TO 2:30 PM

### Sensors: Grating

Session Chair: **Moinuddin Hassan**,  
U.S. Food and Drug Administration (USA)

1:30 pm: **Simultaneous monitoring the real and imaginary parts of the analyte refractive index using liquid-core photonic bandgap Bragg fibers**, Jingwen Li, Ecole Polytechnique de Montréal (Canada) . . . . . [9702-27]

1:50 pm: **Label-free oligonucleotide biosensor based on dual-peak long period fiber grating**, Xianfeng Chen, Chen Liu, Bangor Univ. (United Kingdom); Marcos R. Cardoso, Cleber R. Mendonça, Univ. de São Paulo (Brazil); David A. Nagel, Anna V. Hine, Lin Zhang, Aston Univ. (United Kingdom) . . . . . [9702-28]

2:10 pm: **Estimating needle-tissue interaction forces for hollow needles using fiber Bragg grating sensors**, Saurabh Kumar, Indian Institute of Science (India) and Bosch Research and Technology Ctr. (India); Sundarajan Asokan, Bharadwaj Amrutur, V. Shrikanth, M. S. Bobji, Indian Institute of Science (India) . . . . . [9702-29]

### SESSION 8

LOCATION: ROOM 2005 (WEST LEVEL 2) . . SUN 2:30 PM TO 3:30 PM

### Sensors: Physical I

Session Chair: **Jin U. Kang**, Johns Hopkins Univ. (USA)

2:30 pm: **Sensorization of a surgical robotic instrument for force sensing**, Kaspar S. Shahzada, Aaron Yurkewich, Ran Xu, Rajni V. Patel, Western Univ. (Canada) and Canadian Surgical Technologies and Advanced Robotics (Canada) . . . . . [9702-30]

2:50 pm: **Curvature and torsion sensing for pre-curved continuum robots**, Ran Xu, Aaron Yurkewich, Rajni V. Patel, Western Univ. (Canada) and Canadian Surgical Technologies and Advanced Robotics, London Health Sciences Ctr. (Canada) . . . . . [9702-31]

3:10 pm: **Fiber-optic quantitative optical coherence elastography based on integrated Feby-Perot force sensor**, Yi Qiu, New Jersey Institute of Technology (USA); Yiqing Xu, The Univ. of Hong Kong (Hong Kong, China); Shameeza Mohamed, Science Park High School (USA); Divyaansh Raj, Livingston High School (USA); Xuan Liu, New Jersey Institute of Technology (USA) . . . . . [9702-32]

Coffee Break . . . . . Sun 3:30 pm to 4:00 pm



**SESSION 9**

**LOCATION: ROOM 2005 (WEST LEVEL 2) . . SUN 4:00 PM TO 5:20 PM**

**Sensors: Physical II**

Session Chair: **Karl-Friedrich Klein**, Technische Hochschule  
Mittelhessen (Germany)

4:00 pm: **Development of nanomaterials-based strain sensor for OCT sensor-guided SMART surgical tool**, Phillip Lee, Gyeong Woo Cheon, Peter L. Gehlbach, Jin U. Kang, Johns Hopkins Univ. (USA) . . . . . [9702-33]

4:20 pm: **Mechanical properties of polyimide coated optical fiber at elevated temperatures**, Lei Huang, OFS Fitel LLC (USA) . . . . . [9702-34]

4:40 pm: **Silver hollow optical fibers with acrylic silicone resin coating as buffer layer for sturdy structure**, Katsumasa Iwai, Hiroyuki Takaku, Sendai National College of Technology (Japan); Mitsunobu Miyagi, Tohoku Institute of Technology (Japan); Yi-Wei Shi, Fudan Univ. (China); Yuji Matsuura, Tohoku Univ. (Japan) . . . . . [9702-35]

5:00 pm: **Fiber optic probes based on silver-only coated hollow glass waveguides for ionizing beam radiation dosimetry**, Arash Darafsheh, Haoyang Liu, Univ. of Pennsylvania (USA); Jeffrey E. Melzer, James A. Harrington, Rutgers, The State Univ. of New Jersey (USA); Timothy C. Zhu, Jarod C. Finlay, Univ. of Pennsylvania (USA) . . . . . [9702-36]

**MONDAY 15 FEBRUARY**

**POSTERS-MONDAY**

**LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM**

Conference attendees are invited to attend the BIOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Time resolved based fiber optic FRET sensor: a potential lead in medical diagnostic and remote sensing applications**, Nabarun Polley, Samir K. Pal, S.N. Bose National Ctr. for Basic Sciences (India) . . . . . [9702-37]

**Spectral characterization of tracheal and esophageal tissues using a hyperspectral camera and fiber optic sensors**, Corinne D. Nawn, U.S. Army Institute of Surgical Research (USA); Brian B. Souhan, U.S. Military Academy (USA); Robert Carter III, U.S. Army Institute of Surgical Research (USA); Caitlin Kneapler, Nicholas F. Fell, U.S. Military Academy (USA); Jing Yong Ye, The Univ. of Texas at San Antonio (USA) . . . . . [9702-38]

**Bowel perforation detection using metabolic fluorescent chlorophylls**, Jung Hyun Han, Gwangju Institute of Science and Technology (Korea, Republic of); Young Goun Jo, Chonnam National Univ. Hospital (Korea, Republic of); Yong-Chul Kim, In-Wook Hwang, Gwangju Institute of Science and Technology (Korea, Republic of) . . . . . [9702-39]

**A study on the efficiency improvement of a single fiber guided illumination system for disposable flexible endoscope (DFE)**, Hyeon Jin Bang, Byung Jun Park, Young Jae Won, Seung Rag Lee, Osong Medical Innovation Foundation (Korea, Republic of) . . . . . [9702-40]

**Black-glass optical-fiber preform preparation for a high resolution endoscope**, Soichi Kobayashi, Kaoru Fukuda, Chitose Institute of Science and Technology (Japan); Yusuke Fujii, Photonic Science and Technology, Inc. (Japan) . . . . . [9702-41]

**Optical coherence tomography application by using optical phase shift based on fiber optic sensor**, Seung Suk Lee, Joo Ha Kim, Chosun Univ. (Korea, Republic of); Tae Joong Eom, Gwangju Institute of Science and Technology (Korea, Republic of) and Advanced Photonics Research Institute (Korea, Republic of); Eun-Seo Choi, Chosun Univ. (Korea, Republic of) [9702-42]

**Fiber optic pH-sensor with fast response time, broad operating range and simple readout system**, Krister Hammarling, Magnus Engholm, Mid Sweden Univ. (Sweden); Beatrice Fiorini, Università degli studi di Modena e Reggio Emilia (Italy) . . . . . [9702-43]

**Novel light diffusing fiber for use in medical applications**, W. Spencer S. Klubben III, Stephan L. Logunov, Edward J. Fewkes, Jeff Mooney, Paul M. Then, Horst Schreiber, Cynthia J. Wilson, Kaitlyn Matias, Manuela Ocampo, Corning Incorporated (USA) . . . . . [9702-44]

# CONFERENCE 9703

LOCATION: ROOM 2001 (WEST LEVEL 2)

Monday–Wednesday 15–17 February 2016  
Proceedings of SPIE Vol. 9703

# Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis

Conference Chairs: **Robert R. Alfano**, The City College of New York (USA); **Stavros G. Demos**, Lawrence Livermore National Lab. (USA)

Program Committee: **Irving J. Bigio**, Boston Univ. (USA); **Nicole J. Crane**, Naval Medical Research Ctr. (USA); **Zhiwei Huang**, National Univ. of Singapore (Singapore); **Amir Gandjbakhche**, National Institutes of Health (USA); **Israel Gannot**, Tel Aviv Univ. (Israel); **Igor V. Meglinski**, Univ. of Otago (New Zealand); **Yang Pu**, George Mason Univ. (USA); **Lingyan Shi**, The City College of New York (USA); **Milind Rajadhyaksha**, Memorial Sloan-Kettering Cancer Ctr. (USA); **Angela B. Seddon**, The Univ. of Nottingham (United Kingdom); **Kestutis Sutkus**, The City College of New York (USA); **Siavash Yazdanfar**, GE Global Research (USA)

## MONDAY 15 FEBRUARY

### WELCOME AND INTRODUCTION

LOCATION: ROOM 2001 (WEST LEVEL 2) . . MON 8:00 AM TO 8:05 AM

Session Chair: **Robert R. Alfano**, The City College of New York (USA)

### INTRODUCTION

LOCATION: ROOM 2001 (WEST LEVEL 2) . . MON 8:05 AM TO 8:10 AM

Session Chair: **Bruce Napier**, Vivid Components Ltd. (Germany)

### SESSION 1

LOCATION: ROOM 2001 (WEST LEVEL 2) . . MON 8:10 AM TO 10:10 AM

## Towards the Mid-Infrared Optical Biopsy: MINERVA-I

Session Chair: **Bruce Napier**, Vivid Components Ltd. (Germany)

8:10 am: **Towards the mid-infrared optical biopsy** (*Invited Paper*), Angela B. Seddon, Trevor M. Benson, Slawomir Sujecki, Nabil S. Abdel-Moneim, Zhuoqi Tang, David Furniss, Lukasz Sojka, The Univ. of Nottingham (United Kingdom); Ian Lindsay, Jon D. Ward, Gooch & Housego PLC (United Kingdom); Mark Farries, Gooch & Housego (Torquay) Ltd. (United Kingdom); Peter M. Moselund, NKT Photonics A/S (Denmark); Bruce Napier, Vivid Components Ltd. (Germany); Samir Lamrini, LISA Laser Products OHG (Germany); Christian R. Petersen, Uffe V. Møller, DTU Fotonik (Denmark); Irnis Kubat, Technical Univ. of Denmark (Denmark); Ole Bang, DTU Fotonik (Denmark) . . . . . [9703-1]

8:30 am: **Identification of GI cancers utilising rapid mid-infrared spectral imaging** (*Invited Paper*), Nick Stone, Jayakrupakar Nallala, Univ. of Exeter (United Kingdom); Gavin R. Lloyd, Rebecca Griggs, Oliver Old, Neil A. Shepherd, Hugh Barr M.D., Gloucestershire Hospitals NHS Foundation Trust (United Kingdom) . . . . . [9703-2]

8:50 am: **Towards supercontinuum-driven hyperspectral microscopy in the mid-infrared**, Ian Lindsay, Stefano Valle, Jon D. Ward, Gooch & Housego PLC (United Kingdom); Gary Stevens, Mark Farries, Gooch & Housego (Torquay) Ltd. (United Kingdom); Laurent Huot, Christopher D. Brooks, Peter M. Moselund, NKT Photonics A/S (Denmark); Rosa M. Vinella, Munir Abdalla, Danny De Gaspari, Xenics NV (Belgium); Sergiy Smuk, Rickard Marcks von Württemberg, Henk Martijn, IRnova AB (Sweden); Jayakrupakar Nallala, Nick Stone, Univ. of Exeter (United Kingdom); Cestmir Barta, Radek Hasal, BBT-Materials Processing, s.r.o. Ltd. (Czech Republic); Uffe V. Møller, Ole Bang, DTU Fotonik (Denmark); Slawomir Sujecki, Angela B. Seddon, The Univ. of Nottingham (United Kingdom) . . . . . [9703-3]

## SPONSORS:



CORNING



9:10 am: **A two-step framework for the registration of HE stained and FTIR images**, Francisco Peñaranda, Valery Naranjo, Univ. Politècnica de València (Spain); Rafael Verdú, Univ. Politècnica de Cartagena (Spain); Gavin R. Lloyd, Gloucestershire Hospitals NHS Foundation Trust (United Kingdom); Jayakrupakar Nallala, Nick Stone, Univ. of Exeter (United Kingdom) . . . . . [9703-4]

9:30 am: **Investigating the effect of pixel size on of high spatial resolution FTIR imaging for detection of colorectal cancer**, Gavin R. Lloyd, Gloucestershire Hospitals NHS Foundation Trust (United Kingdom); Jayakrupakar Nallala, Nick Stone, Univ. of Exeter (United Kingdom) . . . . . [9703-5]

9:50 am: **Potential of mid IR spectroscopy in the rapid label free identification of skin malignancies**, Jürgen Schneckeburger, Lena Kastl, Björn Kemper, Westfälische Wilhelms-Univ. Münster (Germany) . . . . . [9703-6]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

### SESSION 2

LOCATION: ROOM 2001 (WEST LEVEL 2) MON 10:40 AM TO 12:00 PM

## Towards the Mid-Infrared Optical Biopsy: MINERVA-II

Session Chair: **Angela B. Seddon**, The Univ. of Nottingham (United Kingdom)

10:40 am: **Sensing applications of silver halide mid-IR fibers** (*Invited Paper*), Abraham Katzir, Tel Aviv Univ. (Israel) . . . . . [9703-7]

11:00 am: **Ge-Sb-Se glass fiber-optics for the mid-infrared optical biopsy**, Harriet A. Parnell, David Furniss, Trevor M. Benson, Colin Scotchford, Hesham Sakr, Zhuoqi Tang, Jessica H. Butterworth, Angela B. Seddon, The Univ. of Nottingham (United Kingdom) . . . . . [9703-8]

# CONFERENCE 9703

## LOCATION: ROOM 2001 (WEST LEVEL 2)

11:20 am: **Mid-IR supercontinuum generation beyond 7  $\mu\text{m}$  using a silica-fluoride-chalcogenide fiber cascade**, Christian R. Petersen, DTU Fotonik (Denmark); Peter M. Moselund, NKT Photonics A/S (Denmark); Laurent Huot, NKT Photonics A/S (Denmark) and DTU Fotonik (Denmark); Christopher D. Brooks, NKT Photonics A/S (Denmark) ..... [9703-9]

11:40 am: **All-fiber mid-IR supercontinuum: a powerful new tool for IR-spectroscopy**, Peter M. Moselund, NKT Photonics A/S (Denmark); Laurent Huot, NKT Photonics A/S (Denmark) and DTU Fotonik (Denmark); Christopher D. Brooks, NKT Photonics A/S (Denmark) ..... [9703-10]

Lunch Break ..... Mon 12:00 pm to 1:30 pm

### SESSION 3

LOCATION: ROOM 2001 (WEST LEVEL 2) . . . MON 1:30 PM TO 3:10 PM

## Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment I

Session Chairs: **Michael G. Giacomelli**, Massachusetts Institute of Technology (USA);  
**Richard M. Levenson M.D.**, Univ. of California, Davis (USA)

Part of the special sessions on  
**Optical Biopsy Methods for Rapid Ex-Vivo Tissue Assessment: Towards Supplementing Conventional Histology**

1:30 pm: **Spectrally encoded confocal microscopy (SECM) for rapid assessment of breast excision specimens** (*Invited Paper*), Elena F. Brachtel, Massachusetts General Hospital (USA); Nicole B. Johnson, Beth Israel Deaconess Medical Ctr. (USA); Amelia E. Huck, Travis L. Rice-Stitt, Mark G. Vangel, Barbara L. Smith, Guillermo J. Tearney M.D., DongKyun Kang, Massachusetts General Hospital (USA) ..... [9703-11]

1:55 pm: **Rapid full-field OCT assessment of clinical tissue specimens** (*Invited Paper*), Eugénie Dalimier, LLTech SAS (France); Fabrice Harms, Institut Langevin (France) and LLTech SAS (France) and Ecole Supérieure de Physique et de Chimie Industrielles de la Ville de Paris (France); Charles Brossollet, Emilie Benoit, Franck Martins, LLTech SAS (France); Claude A. Boccara, Institut Langevin (France) and LLTech SAS (France) and Ecole Supérieure de Physique et de Chimie Industrielles de la Ville de Paris (France) ..... [9703-12]

2:20 pm: **Rapid breast cancer assessment using a high resolution microendoscope system with structured illumination** (*Invited Paper*), Jessica Dobbs, Rice Univ. (USA); Matthew Kyrish, Fresnel Technologies Inc. (USA) and Rice Univ. (USA); Savitri Krishnamurthy M.D., The Univ. of Texas M.D. Anderson Cancer Ctr. (USA); Noah Bedard, Univ of California, San Francisco (USA); Ben Grant, Rice Univ. (USA); Wei T. Yang M.D., The Univ. of Texas M.D. Anderson Cancer Ctr. (USA); Tomasz Tkaczyk, Rebecca Richards-Kortum, Rice Univ. (USA) ..... [9703-13]

2:45 pm: **Line-scanning, stage scanning confocal microscope** (*Invited Paper*), Daniel S. Gareau, The Rockefeller Univ. (USA); John Carucci, New York Univ. (USA) ..... [9703-14]

Coffee Break ..... Mon 3:10 pm to 3:40 pm

### SESSION 4

LOCATION: ROOM 2001 (WEST LEVEL 2) . . . MON 3:40 PM TO 5:20 PM

## Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment II

Session Chairs: **Elizabeth A. Munro**, Perimeter Medical Imaging (Canada); **Farzad Fereidouni**, Univ. of California, Davis (USA)

Part of the mini-symposium on  
**Optical Biopsy Methods for Rapid Ex-Vivo Tissue Assessment: Towards Supplementing Conventional Histology**

3:40 pm: **Nonlinear microscopy for rapid assessment of breast surgical specimens** (*Invited Paper*), Michael G. Giacomelli, Tadayuki Yoshitake, Lucas C. Cahill, Osman O. Ahsen, Massachusetts Institute of Technology (USA); Yuri Sheykin, Hilde Vardeh, Beth Israel Deaconess Medical Ctr. (USA); Jeffrey Brooker, Thorlabs Imaging Systems (USA); Lennart A. Husvogt, Joachim Hornegger, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); James L. Connolly M.D., Massachusetts Institute of Technology (USA); Alex E. Cable, Thorlabs, Inc. (USA); James G. Fujimoto, Massachusetts Institute of Technology (USA) ..... [9703-15]

4:05 pm: **Core needle biopsy guidance based on EMOCT imaging** (*Invited Paper*), Nicusor V. Iftimia, Jesung Park, Gopi N. Maguluri, Physical Sciences Inc. (USA) ..... [9703-16]

4:30 pm: **Ex vivo applications of multiphoton microscopy in urology** (*Invited Paper*), Manu Jain M.D., Memorial Sloan-Kettering Cancer Ctr. (USA); Sushmita Mukherjee, Weill Cornell Medical College (USA) ..... [9703-17]

4:55 pm: **Slide-free histology via MUSE: UV surface excitation microscopy for imaging unsectioned tissue** (*Invited Paper*), Richard M. Levenson M.D., Zachary Harmany, Univ. of California, Davis (USA); Stavros G. Demos, Lawrence Livermore National Lab. (USA); Farzad Fereidouni, Univ. of California, Davis (USA) ..... [9703-18]

## TUESDAY 16 FEBRUARY

### SESSION 5

LOCATION: ROOM 2001 (WEST LEVEL 2) . . . TUE 8:05 AM TO 10:10 AM

## Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment III

Session Chairs: **Elena F. Brachtel**, Massachusetts General Hospital (USA); **Nicusor V. Iftimia**, Physical Sciences Inc. (USA)

Part of the mini-symposium on  
**Optical Biopsy Methods for Rapid Ex-Vivo Tissue Assessment: Towards Supplementing Conventional Histology**

8:05 am: **Fluorescence lifetime spectroscopy and imaging of tissue specimens: applications in oncology and cardiovascular pathology** (*Invited Paper*), Laura Marcu, Univ. of California, Davis (USA) ..... [9703-20]

8:30 am: **Development and clinical translation of OTIS: a wide-field OCT imaging device for ex-vivo tissue characterization** (*Invited Paper*), Elizabeth A. Munro, David Rempel, Christine Danner, Yaaseen Atchia, Michael S. Valic, Andrew Berkeley, Bahar Davoudi, Paul A. Magnin, Perimeter Medical Imaging (Canada); Susan J. Done, Supriya Kulkarni, Wey-Liang Leong, Brian C. Wilson, Univ. Health Network (Canada) ..... [9703-21]

8:55 am: **Parametric approaches to micro-scale characterization of tissue volumes in vivo and ex vivo: Imaging microvasculature, attenuation, birefringence, and stiffness** (*Invited Paper*), David D. Sampson, Lixin Chin, Peijun Gong, Philip Wijesinghe, Shaghayegh Es'haghian, Wesley M. Allen, Blake R. Klyen, Rodney W. Kirk, Brendan F. Kennedy, Robert A. McLaughlin, The Univ. of Western Australia (Australia) ..... [9703-22]

9:20 am: **Fluorescein as a contrast agent for confocal intra-operative imaging of basal cell carcinomas: a preliminary ex vivo study** (*Invited Paper*), Heidi Sierra, Memorial Sloan-Kettering Cancer Ctr. (USA); Qiaochu Qi, Weill Cornell Medical College (USA); Nikash Taskar, Edgemont Jr. / Sr. High School (USA); Anthony Rossi, Milind Rajadhyaksha, Memorial Sloan-Kettering Cancer Ctr. (USA) ..... [9703-23]

9:45 am: **Real-time digital signal processing in multiphoton and time-resolved microscopy** (*Invited Paper*), Jesse W. Wilson, Colorado State Univ. (USA); Martin C. Fischer, Warren S. Warren, Duke Univ. (USA) ..... [9703-24]

Coffee Break ..... Tue 10:10 am to 10:40 am

# CONFERENCE 9703

LOCATION: ROOM 2001 (WEST LEVEL 2)

## SESSION 6

LOCATION: ROOM 2001 (WEST LEVEL 2) TUE 10:40 AM TO 12:00 PM

### Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment IV

Session Chairs: **Heidy Sierra, Milind Rajadhyaksha,**  
Memorial Sloan-Kettering Cancer Ctr. (USA)

Part of the mini-symposium on

#### Optical Biopsy Methods for Rapid Ex-Vivo Tissue Assessment: Towards Supplementing Conventional Histology

10:40 am: **Implementation of fluorescence confocal mosaicing microscopy by "early adopter" Mohs surgeons: a review of recent progress in five settings** (*Invited Paper*), Manu Jain M.D., Memorial Sloan-Kettering Cancer Ctr. (USA) . . . . . [9703-25]

11:00 am: **Differentiation of cancerous and normal brain tissue using label free fluorescence and Stokes shift spectroscopies**, Yan Zhou M.D., The General Hospital of the Air Force, PLA (China); Leana Wang, Columbia Univ. (USA); Cheng-Hui Liu, The City College of New York (USA); Yong He, Beijing Normal Univ. (China); Xinguang Yu M.D., Gangge Cheng M.D., Peng Wang M.D., Cheng Shu M.D., The General Hospital of the Air Force, PLA (China); Robert R. Alfano, The City College of New York (USA) . . . . . [9703-26]

11:20 am: **Deconstructing native fluorescence: non-invasive detection and monitoring of biochemistry in cells and tissues**, Ewa M. Goldys, Martin E. Gosnell, Ayad G. Anwer, Macquarie Univ. (Australia); Juan C. Cassano, Carolyn M. Sue, The Univ. of Sydney (Australia); Saabah B. Mahbub, Sandeep M. Perinchery, David W. Inglis, Macquarie Univ. (Australia); Partho P. Adhikary, Jalal A. Jazayeri, Michael A. Cahill, Charles Sturt Univ. (Australia); Sonia Saad, Carol Pollock, The Univ. of Sydney (Australia); Melanie L. Sutton-McDowall, Jeremy G. Thompson, The Univ. of Adelaide (Australia) . . . . . [9703-27]

11:40 am: **Raman spectroscopy of hamster buccal pouch tissues: investigating suitability of ex vivo models to evaluate in vivo spectra**, Piyush Kumar, C. Murali Krishna, Advanced Ctr. for Treatment, Research & Education in Cancer (India) . . . . . [9703-28]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:30 pm

## SESSION 7

LOCATION: ROOM 2001 (WEST LEVEL 2) . . . . TUE 1:30 PM TO 3:10 PM

### Label-Free Advanced Optics Tissue Assessment

Session Chairs: **Israel Gannot, Tel Aviv Univ. (Israel); Amir Gandjbakhche, National Institutes of Health (USA)**

1:30 pm: **Label-free fluorescence spectroscopy detecting Alzheimer disease in brain tissue of a mouse model**, Lingyan Shi, The City College of New York (USA); George Harvey, Thomas Harvey, Riverdale Country School (USA); Paulo Marques, City College of New York (USA); Robert R. Alfano, The City College of New York (USA); Adrián Rodríguez-Contreras, The City Univ. of New York (USA) . . . . . [9703-29]

1:50 pm: **Rapid spatial frequency domain inverse problem solutions using look-up tables for real-time processing**, Joseph P. Angelo, Beth Israel Deaconess Medical Ctr. (USA); Irving J. Bigio, Boston Univ. (USA); Sylvain Gioux, Beth Israel Deaconess Medical Ctr. (USA) . . . . . [9703-30]

2:10 pm: **Measuring sampling depth of lens-based single fiber reflectance spectroscopy with optical coherence tomography**, Abel Swaan, Anouk L. Post, Daniel M. de Bruin, Henricus J. C. M. Sterenborg, Jean J. M. C. H. de la Rosette, Ton G. van Leeuwen, Dirk J. Faber, Academisch Medisch Centrum (Netherlands) . . . . . [9703-31]

2:30 pm: **Label-free pathological evaluation of grade 3 cancer using Stokes shift spectroscopy**, Laura A. Sordillo, Peter P. Sordillo M.D., Robert R. Alfano, The City College of New York (USA) . . . . . [9703-32]

2:50 pm: **Tryptophan as a biomarker for cancer detection in terahertz (THz) sensing**, Hakan Altan, Middle East Technical Univ. (Turkey) . . . . . [9703-33]

Coffee Break . . . . . Tue 3:10 pm to 3:40 pm

## SESSION 8

LOCATION: ROOM 2001 (WEST LEVEL 2) . . . TUE 3:40 PM TO 5:00 PM

### Applications of Raman Scattering

Session Chairs: **Lingyan Shi, The City College of New York (USA); Laura A. Sordillo, The City College of New York (USA)**

3:40 pm: **Resonance Raman spectroscopy detection of vulnerable atherosclerotic plaque**, Cheng-Hui Liu, The City College of New York (USA); Susie Boydston-White, Borough of Manhattan Community College (USA); Arel Weisberg, Energy Research Co. (USA); Wubao B. Wang, Laura A. Sordillo, Yury Budansky, The City College of New York (USA); Adler Perotte, Vincent P. Tomaselli, Columbia Univ. (USA); Stephanie S. Lubicz M.D., Peter P. Sordillo M.D., Robert R. Alfano, The City College of New York (USA) . . . . . [9703-34]

4:00 pm: **Shedding light inside middle ear: discerning the differential molecular pathology of proliferative middle ear lesions**, Rishikesh Pandey, Massachusetts Institute of Technology (USA); Tulio A. Valdez, Connecticut Children's Medical Ctr. (USA); Nicolas Spegazzini, Niyom Lue, Luis Galindo, Massachusetts Institute of Technology (USA); Ishan Barman, Johns Hopkins Univ. (USA); Ramachandra Rao Dasari, Peter T. C. So, Massachusetts Institute of Technology (USA) . . . . . [9703-35]

4:20 pm: **Assessing the effects of antihistamines in rodents with Raman and Brillouin spectroscopy**, Maria A. Troyanova-Wood, Zhaokai Meng, Andrew J. Traverso, Cassidy Gobbell, Vladislav V. Yakovlev, Texas A&M Univ. (USA) . . . . . [9703-36]

4:40 pm: **The Raman spectrum character of Skin tumor process induced by UVB**, Shulian Wu, Yunxia Wang, Liangjun Hu, Fujian Normal Univ. (China) . . . . . [9703-37]

## POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the poster session on Tuesday evening (select BiOS conferences and LASE). Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines> .

**Tissue slides analysis using red, green and blue LEDs as microscope light source**, Sebastião Pratavieira, Felipe F. Navascues, Ramon G. Teixeira Rosa, Cristina Kurachi, Vanderlei S. Bagnato, Univ. de São Paulo (Brazil) . . . [9703-19]

**Assessing the photoaging process at sun exposed and non-exposed skin using fluorescence lifetime spectroscopy**, Marcelo Saito Nogueira, Sebastião Pratavieira, Cristina Kurachi, Instituto de Física de São Carlos (Brazil) . [9703-52]

**Evaluation of actinic cheilitis using fluorescence lifetime spectroscopy**, Marcelo Saito Nogueira, Alessandro Cosci, Instituto de Física de São Carlos (Brazil); Ademar Takahama, Rebeca Souza Azevedo, Univ. Federal Fluminense (Brazil); Sebastião Pratavieira, Cristina Kurachi, Instituto de Física de São Carlos (Brazil) . . . . . [9703-54]

**Imaging using a supercontinuum laser to assess tumor margins in patients with breast carcinoma**, Laura A. Sordillo, Peter P. Sordillo M.D., Robert R. Alfano, The City College of New York (USA) . . . . . [9703-57]

**Optical pathology: real time evaluation of disease**, Laura A. Sordillo, Peter P. Sordillo M.D., Robert R. Alfano, The City College of New York (USA) . . . . . [9703-58]

**Evaluation of algorithmic methods for analyzing fluorescence spectra of cancerous and normal human tissues**, Yang Pu, Wubao B. Wang, Robert R. Alfano, The City College of New York (USA) . . . . . [9703-59]

**Transcutaneous in vivo Raman spectroscopy: discrimination of benign from malignant breast lesions in animal models**, Tanmoy Bhattacharjee, Sandeep Panicker, Arvind Ingle, Girish B. Maru, C. Murali Krishna, Advanced Ctr. for Treatment, Research & Education in Cancer (India) . . . . . [9703-60]

**Transcutaneous in vivo Raman spectroscopy: study of pre-adenocarcinoma condition for early breast cancer detection in animal models**, Tanmoy Bhattacharjee, Mahazabeen Sayyed, Arvind Ingle, Girish B. Maru, C. Murali Krishna, Advanced Ctr. for Treatment, Research & Education in Cancer (India) . . . . . [9703-61]

**Fluorescence anisotropy characterization of urine in the diagnosis of cancer**, Ramu Rajasekaran, Brindha Elumalai, Aruna Prakasa Rao, Anna Univ. Chennai (India); Dornadula Koteeswaran, Meenakshi Univ. (India); Singaravelu Ganesan, Anna Univ. Chennai (India) . . . . . [9703-62]



# CONFERENCE 9703

## LOCATION: ROOM 2001 (WEST LEVEL 2)

BIOS

**The effect of Stokes shift in the discrimination of urine of cervical cancer from normal subjects**, Ramu Rajasekaran, Brindha Elumalai, Aruna Prakasa Rao, Anna Univ. Chennai (India); Dornadula Koteeswaran, Meenakshi Univ. (India); Singaravelu Ganesan, Anna Univ. Chennai (India) . . . . . [9703-63]

**Optical pathology of human brain metastasis of lung cancer using combined resonance Raman and spatial frequency spectroscopies**, Yan Zhou M.D., The General Hospital of the Air Force, PLA (China); Cheng-Hui Liu, Yang Pu, The City College of New York (USA); Gangge Cheng M.D., The General Hospital of the Air Force, PLA (China); Lixin Zhou M.D., Beijing Cancer Hospital (China); Jun Chen M.D., Tianjin Medical Univ. General Hospital (China); Ke Zhu, Institute of Physics (China); Robert R. Alfano, The City College of New York (USA) . . . . . [9703-64]

**Optical pathology study of human abdominal aorta tissues using confocal micro resonance Raman spectroscopy: vibrational fingerprints**, Cheng-Hui Liu, The City College of New York (USA); Susie Boydston-White, The City College of New York (USA) and Borough of Manhattan Community College (USA); Wubao B. Wang, Laura A. Sordillo, Institute of Ultrafast Spectroscopy and Lasers, The City College of New York (USA); Lingyan Shi, Institute of Ultrafast Spectroscopy and Lasers, The City College of New York (USA) and The City Univ. of New York (USA); Arel Weisberg, Energy Research Co. (USA); Vincent P. Tomaselli, Columbia Univ. (USA); Robert R. Alfano, Institute of Ultrafast Spectroscopy and Lasers, The City College of New York (USA) . . . . . [9703-65]

**Raman spectroscopy of bio fluids: an exploratory study for oral cancer detection**, Brindha Elumalai, Ramu Rajasekaran, Aruna Prakasa Rao, Anna Univ. Chennai (India); Dornadula Koteeswaran, Meenakshi Univ. (India); Singaravelu Ganesan, Anna Univ. Chennai (India) . . . . . [9703-66]

**An empirical formula based on Monte Carlo simulation for diffuse reflectance from turbid media**, Einstein Gnanatheepam, Aruna Prakasa Rao, Singaravelu Ganesan, Anna Univ. Chennai (India) . . . . . [9703-67]

## WEDNESDAY 17 FEBRUARY

### SESSION 9

LOCATION: ROOM 2001 (WEST LEVEL 2) . . WED 8:10 AM TO 10:10 AM

### Applications of Spectral Imaging

Session Chairs: **Zhiwei Huang**, National Univ. of Singapore (Singapore); **Wubao B. Wang**, The City College of New York (USA)

8:10 am: **Nanosecond coherent anti-Stokes Raman scattering for particle size characterization**, Farid El Bassri, XLIM Institut de Recherche (France) and CILAS (France); Claire Lefort, Erwan Capitaine, Christophe Louot, Dominique Pagnoux, Vincent Couderc, Philippe Leproux, XLIM Institut de Recherche (France) . . . . . [9703-38]

8:30 am: **Penetration depth in biological tissues from hyperspectral imaging in SWIR in transmission and reflection geometry**, Hairong Zhang, David M. Kim, Daniel C. Salo, Mikhail Y. Berezin, Washington Univ. School of Medicine in St. Louis (USA) . . . . . [9703-39]

8:50 am: **Upconversion imaging using an all-fiber supercontinuum source**, Laurent Huot, NKT Photonics A/S (Denmark) and DTU Fotonik (Denmark); Christian Pedersen, Peter Tidemand-Lichtenberg, Jeppe S. Dam, DTU Fotonik (Denmark); Peter M. Moselund, Christopher D. Brooks, NKT Photonics A/S (Denmark) . . . . . [9703-40]

9:10 am: **Measuring the scattering anisotropy by combining SFR spectroscopy and OCT: accounting for the phase function dependence**, Anouk L. Post, Xu U. Zhang, Academisch Medisch Centrum (Netherlands); Nienke Bosschaart, Univ. Twente (Netherlands); Ton G. Van Leeuwen, Henricus J. C. M. Sterenberg, Dirk J. Faber, Academisch Medisch Centrum (Netherlands) . . . . . [9703-41]

9:30 am: **Label-free vascular imaging in a spontaneous hamster cheek pouch carcinogen model for pre-cancer detection**, Fangyao Hu, Robert Morhard, Heather Liu, Helen Murphy, Sina Farsiu, Nimmi Ramanujam, Duke Univ. (USA) . . . . . [9703-42]

9:50 am: **Hyperspectral imaging fluorescence excitation scanning for detecting colorectal cancer: pilot study**, Silas J. Leavesley, Mikayla Wheeler, Carmen Lopez, Thomas Baker, Peter F. Favreau, Thomas C. Rich, Paul F. Rider, Carole W. Boudreaux, Univ. of South Alabama (USA) . . . . . [9703-43]

Coffee Break . . . . . Wed 10:10 am to 10:40 am

### SESSION 10

LOCATION: ROOM 2001 (WEST LEVEL 2) WED 10:40 AM TO 12:00 PM

### Tissue Assessment with Light Scattering

Session Chairs: **Laura Marcu**, Univ. of California, Davis (USA); **Igor Meglinski**, Univ. of Oulu (Finland)

10:40 am: **A fiber optic probe to measure spatially resolved diffuse reflectance in the sub-diffusion regime for in-vivo use**, Adam Eshein, Wenli Wu, The-Guyen Nguyen, Andrew J. Radosevich, Vadim Backman, Northwestern Univ. (USA) . . . . . [9703-44]

11:00 am: **Near-infrared Mueller matrix imaging for colonic cancer detection**, Jianfeng Wang, Kan Lin, Wei Zheng, Zhiwei Huang, National Univ. of Singapore (Singapore) . . . . . [9703-45]

11:20 am: **Protocol using elliptically polarized light for enhanced contrast in polarization gating imaging of biological tissues**, Susmita Sridhar, Anabela da Silva, Institut Fresnel (France) and Aix-Marseille Univ. (France); Ivo Vanzetta, Institut des Neurosciences de la Timone, Aix-Marseille Univ. (France) . [9703-46]

11:40 am: **Characterizing microstructural changes of skeletal muscle tissues using spectral transformed Mueller matrix polarization parameters**, Chao He, Honghui He, Jintao Chang, Hui Ma, Graduate School at Shenzhen, Tsinghua Univ. (China) . . . . . [9703-47]

Lunch/Exhibition Break . . . . . Wed 12:00 pm to 1:50 pm

### SESSION 11

LOCATION: ROOM 2001 (WEST LEVEL 2) . . . WED 1:50 PM TO 3:10 PM

### Assessment of Cell and Tissue Function

Session Chairs: **Yang Pu**, George Madison Univ. (USA); **Siavash Yazdanfar**, GE Global Research (USA)

1:50 pm: **Preliminary investigation of intrinsic UV fluorescence spectroscopic changes associated with proteolytic digestion of bovine articular cartilage**, William Lewis, Walfre Franco, Juan Pablo Padilla-Martinez, Antonio Ortega-Martinez, Wellman Ctr. for Photomedicine (USA) . . . . . [9703-48]

2:10 pm: **In vivo detection of apoptosis with cellular level resolution using fluorescence lifetime imaging**, Andrew J. Bower, Marina Marjanovic, Youbo Zhao, Joanne Li, Eric J. Chaney, Stephen A. Boppart M.D., Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9703-49]

2:30 pm: **Wound size measurement of diabetic foot ulcers using region growing algorithm**, Arash Dadkhah, Elizabeth Solis, Ruogo Fang, Anuradha Godavarty, Florida International Univ. (USA) . . . . . [9703-50]

2:50 pm: **Monitoring combat wound healing by IR hyperspectral imaging**, Christopher R. Howle, Abigail M. Spear, Ehsan Gazi, Defence Science and Technology Lab. (United Kingdom); Nicole J. Crane, Naval Medical Research Ctr. (USA) and Uniformed Services Univ. of the Health Sciences (USA) [9703-51]

Coffee Break . . . . . Wed 3:10 pm to 3:40 pm

### SESSION 12

LOCATION: ROOM 2001 (WEST LEVEL 2) . . WED 3:40 PM TO 5:20 PM

### Label-Free Spectroscopy Methods

Session Chairs: **Stavros G. Demos**, Lawrence Livermore National Lab. (USA); **Hakan Altan**, Middle East Technical Univ. (Turkey)

3:40 pm: **LED-based endoscopic light source for spectral imaging**, Craig Browning, Samuel Mayes, Silas J. Leavesley, Univ. of South Alabama (USA) . . . . . [9703-53]

4:00 pm: **Time resolved fluorescence spectroscopy with multi-photon or single-photon excitation of label free molecules in brain tissue of an Alzheimer's mouse model**, Bidyut Das, Lingyan Shi, The City College of New York (USA); Adrian Rodriguez-Contreras, The City Univ. of New York (USA); Robert R. Alfano, The City College of New York (USA) . . . . . [9703-68]

4:20 pm: **Study on discrimination of oral cancer from normal using blood plasma based on fluorescence steady and excited state at excitation wavelength 280 nm**, Rekha Pachaiappan, Aruna Prakasa Rao, Singaravelu Ganesan, Anna Univ. Chennai (India) . . . . . [9703-55]

4:40 pm: **Serum-based Raman spectroscopy: discrimination of benign from malignant lesions and identification of pre-tumor condition**, Tanmoy Bhattacharjee, Sneha Tawde, Aarif Khan, Piyush Kumar, Arvind Ingle, Girish B. Maru, C. Murali Krishna, Advanced Ctr. for Treatment, Research & Education in Cancer (India) . . . . . [9703-56]

5:00 pm: **Steady state fluorescence spectroscopic characterization of normal and diabetic urine at 280 nm excitation**, Anjana Kesavan, Rekha Pachaiappan, Aruna Prakasa Rao, Singaravelu Ganesan, Anna Univ. Chennai (India) . . . . . [9703-57]

# CONFERENCE 9704

LOCATION: ROOM 2002 (WEST LEVEL 2)

Saturday–Sunday 13–14 February 2016 • Proceedings of SPIE Vol. 9704

# Biomedical Vibrational Spectroscopy 2016: Advances in Research and Industry

Conference Chairs: **Anita Mahadevan-Jansen**, Vanderbilt Univ. (USA); **Wolfgang Petrich**, Roche Diagnostics GmbH (Germany)

Program Committee: **Andrew J. Berger**, Univ. of Rochester (USA); **Rohit Bhargava**, Univ. of Illinois at Urbana-Champaign (USA); **Airton Abrahão Martin**, Univ. do Vale do Paraíba (Brazil); **Michael D. Morris**, Univ. of Michigan (USA); **Dieter Naumann**, Robert Koch-Institut (Germany); **Jürgen Popp**, Institut für Photonische Technologien e.V. (Germany); **Nicholas Stone**, Gloucestershire Royal Hospital (United Kingdom)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 2002 (WEST LEVEL 2) . SAT 8:30 AM TO 10:10 AM

#### Analysis Methods

Session Chair: **Wolfgang Petrich**, Roche Diagnostics GmbH (Germany)

8:30 am: **Discrete frequency infrared imaging using quantum cascade lasers for biological tissue analysis**, Kevin L. Yeh, Univ. of Illinois at Urbana-Champaign (USA); **Rohit Bhargava**, Beckman Institute for Advanced Science and Technology (USA). . . . . [9704-37]

8:50 am: **Functionalized plasmonic nanostructure arrays for direct and accurate mapping extracellular pH of living cells using SERS**, Fang Sun, Shaoyi Jiang, Qiuming Yu, Univ. of Washington (USA). . . . . [9704-2]

9:10 am: **Determination of optical properties of porcine skin in the mid-infrared regime**, Arthur Schönhals, Niels Kröger-Lui, Annemarie Pucci, Wolfgang Petrich, Ruprecht-Karls-Univ. Heidelberg (Germany). . . . . [9704-3]

9:30 am: **UV-resonance Raman spectroscopy of amino acids**, Martin Höhl, Merve Meinhardt-Wollweber, Uwe Morgner, Leibniz Univ. Hannover (Germany); Heike Schmitt, Thomas Lenarz, Medizinische Hochschule Hannover (Germany). . . . . [9704-4]

9:50 am: **Raman spectroscopy for highly accurate estimation of the age of refrigerated porcine muscle**, Constantinos Timinis, Costas Pitris, Univ. of Cyprus (Cyprus). . . . . [9704-5]

Coffee Break . . . . . Sat 10:10 am to 10:30 am

### SESSION 2

LOCATION: ROOM 2002 (WEST LEVEL 2) . SAT 10:30 AM TO 12:10 PM

#### Cancer Applications I

Session Chair: **Zachary J. Smith**,  
Univ. of Science and Technology of China (China)

10:30 am: **Serum Raman spectroscopic classification of buccal mucosa and tongue cancers**, Aditi Sahu, Sharada Sawant, C. Murali Krishna, Advanced Ctr. for Treatment, Research & Education in Cancer (India). . . . . [9704-6]

10:50 am: **Raman-based identification of circulating tumor cells for cancer diagnostics**, Christoph Krafft, Claudia Beleites, Iwan Schie, Leibniz-Institut für Photonische Technologien e.V. (Germany); Joachim H. Clement, Universitätsklinikum Jena (Germany); Jürgen Popp, Leibniz-Institut für Photonische Technologien e.V. (Germany). . . . . [9704-7]

11:10 am: **Prealanalytical considerations in detection of colorectal cancer in blood serum using Raman molecular imaging**, Patrick J. Treado, Shona D. Stewart, Aaron Smith, Heather Kirschner, Christopher Post, ChemImage Corp. (USA); Bergein F. Overholt M.D., Gastrointestinal Associates, P.C. (USA) [9704-8]

11:30 am: **Blood test using surface-enhanced Raman spectroscopy with colloidal silver nanoparticle substrate to detect polyps and colorectal cancer**, Wenbo Wang, BC Cancer Agency Research Ctr. (Canada); Shangyuan Feng, BC Cancer Agency Research Ctr. (Canada) and Fujian Normal Univ. (China); Isabella T. Tai, Canada's Michael Smith Genome Sciences Ctr. (Canada) and The Univ. of British Columbia (Canada); Guannan Chen, Rong Chen, Fujian Normal Univ. (China); Haishan Zeng, BC Cancer Agency Research Ctr. (Canada). . . . . [9704-9]

11:50 am: **The road map to providing a robust Raman spectroscopy-based cancer diagnostic platform and integration into clinic**, Katherine Lau, Ian Bell, Renishaw plc (United Kingdom); Martin E. Isabelle, Gavin R. Lloyd, Oliver Old, Gloucestershire Hospitals NHS Foundation Trust (United Kingdom); Jennifer Dorney, Univ. of Exeter (United Kingdom); Aaran Lewis, Riana Gaifulina, Manuel Rodriguez-Justo, Univ. College London (United Kingdom); Catherine A. Kendall, Gloucestershire Hospitals NHS Foundation Trust (United Kingdom); Nick Stone, Univ. of Exeter (United Kingdom); Geraint Thomas, Univ. College London (United Kingdom); David M. Reece, Renishaw plc (United Kingdom). . . . . [9704-40]

Lunch/Exhibition Break . . . . . Sat 12:10 pm to 1:30 pm

### SESSION 3

LOCATION: ROOM 2002 (WEST LEVEL 2) . . . SAT 1:30 PM TO 3:10 PM

#### Cancer Applications II

Session Chair: **Christoph Krafft**,  
Leibniz-Institut für Photonische Technologien e.V. (Germany)

1:30 pm: **Biophysical basis for noninvasive skin cancer detection using Raman spectroscopy**, Xu Feng, Austin J. Moy, Jason Zhang, Mia K. Markey, Jason S. Reichenberg, James W. Tunnell, The Univ. of Texas at Austin (USA). . . . . [9704-10]

1:50 pm: **Endoscope-based beveled and volume fiber-optic Raman probes for the diagnosis of gastric dysplasia in vivo at endoscopy: a comparative study**, Jianfeng Wang, Kan Lin, Wei Zheng, Zhiwei Huang, National Univ. of Singapore (Singapore). . . . . [9704-11]

2:10 pm: **Evaluation of a multi-fibre needle Raman probe for tissue analysis**, Leanne Fullwood, Univ. of Exeter (United Kingdom) and Gloucestershire Hospitals NHS Foundation Trust (United Kingdom); Ingeborg Iping-Petterson, Univ. of Exeter (United Kingdom); Catherine A. Kendall, Gloucestershire Hospitals NHS Foundation Trust (United Kingdom); Charlie Hall, Gloucestershire Hospitals NHS Foundation Trust (United Kingdom); John Day, Univ. of Bristol (United Kingdom); Nick Stone, Univ. of Exeter (United Kingdom). . . . . [9704-39]

2:30 pm: **Raman spectroscopy of oral cancer: investigations in pet canines**, Piyush Kumar, Tanmoy Bhattacharjee, Pradeep Chaudhary, C. Murali Krishna, Advanced Ctr. for Treatment, Research & Education in Cancer (India). . . . . [9704-12]

2:50 pm: **Intra-operative on-line discrimination of kidney cancer from normal tissue by IR ATR spectroscopy of extra cellular fluid**, Valdas Sablinskas, Vidita Urboniene, Martynas Velicka, Milda Pucetaite, Justinas Ceponkus, Feliksas Jankevicius M.D., Vilnius Univ. (Lithuania); Gerald Steiner, TU Dresden (Germany). . . . . [9704-13]

Coffee Break . . . . . Sat 3:10 pm to 3:30 pm

# CONFERENCE 9704

## LOCATION: ROOM 2002 (WEST LEVEL 2)

### SESSION 4

LOCATION: ROOM 2002 (WEST LEVEL 2) . . SAT 3:30 PM TO 6:00 PM

## Novel Methodologies

Session Chair: **Airton Abrahão Martin D.D.S.**,  
Univ. do Vale do Paraíba (Brazil)

3:30 pm: **In vivo vibrational imaging: emerging platform for biology and medicine**, Ji-Xin Cheng, Vibronix Inc. (USA) and Purdue Univ. (USA) . [9704-41]

4:00 pm: **Multimodal nonlinear microscopy of biopsy specimen: towards intraoperative diagnostics**, Michael Schmitt, Friedrich-Schiller-Univ. Jena (Germany); Sandro Heuke, Tobias Meyer, Friedrich-Schiller-Univ. Jena (Germany); Leibniz-Institut für Photonische Technologien e.V. (Germany); Olga Chernavskaia, Leibniz-Institut für Photonische Technologien e.V. (Germany); Thomas W. Bocklitz, Friedrich-Schiller-Univ. Jena (Germany); Jürgen Popp, Friedrich-Schiller-Univ. Jena (Germany) and Leibniz-Institut für Photonische Technologien e.V. (Germany) . . . . . [9704-14]

4:20 pm: **Hyperspectral imaging of cartilage by using multiplex CARS**, Manabu Shiozawa, Hitachi, Ltd. (Japan) . . . . . [9704-15]

4:40 pm: **Dental caries imaging using hyperspectral stimulated Raman scattering and multiphoton microscopy**, Zi Wang, Wei Zheng, Jian Lin, Zhiwei Huang, National Univ. of Singapore (Singapore) . . . . . [9704-16]

5:00 pm: **Raman imaging analysis reveals native-like bone repair of defects induced by porous strontium-loaded bioactive glass**, Charalambos Kallepitis, Helene Autefage, Imperial College London (United Kingdom); Felix Allen, Allen E. Goodship, Univ. College London (United Kingdom); Julian R. Jones, Imperial College London (United Kingdom); Gordon Blunn, Univ. College London (United Kingdom); Molly M. Stevens, Imperial College London (United Kingdom) . . . . . [9704-17]

5:20 pm: **Fast quantum cascade laser-based real-time infrared microspectroscopy in-vivo**, Niels Kröger-Lui, Katharina Haase, Arthur Schönhals, Annemarie Pucci, Ruprecht-Karls-Univ. Heidelberg (Germany); Wolfgang Petrich, Roche Diagnostics GmbH (Germany) and Ruprecht-Karls-Univ. Heidelberg (Germany) . . . . . [9704-18]

5:40 pm: **Rigorous comparison of the spectral SNR of FTIR and EC-QCL spectroscopy**, David T. D. Childs, Richard A. Hogg, Kristian M. Groom, Dmitry G. Revin, Ihtesham U. Rehman, John W. Cockburn, Stephen J. Matcher, The Univ. of Sheffield (United Kingdom) . . . . . [9704-19]

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 5

LOCATION: ROOM 2002 (WEST LEVEL 2) SUN 8:40 AM TO 10:00 AM

## Non-Cancer Applications I

Session Chair: **Wolfgang Petrich**, Roche Diagnostics GmbH (Germany)

8:40 am: **In vivo confocal Raman spectroscopy study of the vitamin A derivative perfusion through human skin**, Laurita dos Santos, Claudio A. S. Tellez, Priscila P. Fávero, Airton A. Martin, Univ. do Vale do Paraíba (Brazil) . . . . . [9704-20]

9:00 am: **Raman spectroscopy of single extracellular vesicles reveals subpopulations with varying membrane content**, Zachary J. Smith, Changwon Lee, Tatu Rojalín, Randy P. Carney, Sidhartha Hazari, Alisha Knudson, Kit S. Lam, NSF Ctr. for Biophotonics Science and Technology, UC Davis Medical Ctr. (USA); Heikki Saari, Elisa Lazaro Ibañez, Tapani Viitala, Timo Laaksonen, Marjo Yliperttula, Univ. of Helsinki (Finland); Sebastian Wachsmann-Hogiu, NSF Ctr. for Biophotonics Science and Technology (USA) . . . . . [9704-21]

9:20 am: **Detection of advanced glycation end products (AGEs) on human skin by in vivo confocal Raman spectroscopy**, Airton A. Martin, Liliane P. Pereira, Syed M. Ali, Claudio A. Tellez, Priscila P. Fávero, Laurita dos Santos, Univ. do Vale do Paraíba (Brazil) . . . . . [9704-23]

9:40 am: **Combination of micro-dialysis and infrared spectroscopy: a multi-analyte assay for accurate biofluid analysis and patient monitoring**, Sven Delbeck, Janpeter Buddé, Lars Cocchieri, Thorsten Vahlsing, Dieter Ihrig, Herbert M. Heise, Fachhochschule Südwestfalen (Germany) . . . . . [9704-1]

Coffee Break . . . . . Sun 10:00 am to 10:30 am

### SESSION 6

LOCATION: ROOM 2002 (WEST LEVEL 2) .SUN 10:30 AM TO 12:10 PM

## Non-Cancer Applications II

Session Chair: **Zhiwei Huang**, National Univ. of Singapore (Singapore)

10:30 am: **Translation of infrared chemical imaging for cardiovascular evaluation**, Saumya Tiwari, Jai Raman, Vijaya Reddy, Rohit Bhargava, Beckman Institute for Advanced Science and Technology (USA) . . . . . [9704-38]

10:50 am: **Development of multivariate analysis methods for improved discrimination of inflammatory bowel disease in vivo**, Hao Ding, Andrew Dupont, Larry D. Scott, Sushovan Guha, Shashideep Singhal, Mamoun Younes, Jingqing Wang, Hua Xu, The Univ. of Texas Health Science Ctr. at Houston (USA); Isaac J. Pence, Alan J. Herline M.D., David Schwartz, Anita Mahadevan-Jansen, Vanderbilt Univ. (USA); Xiaohong Bi, The Univ. of Texas Health Science Ctr. at Houston (USA) . . . . . [9704-24]

11:10 am: **Raman and surface-enhanced Raman spectroscopy for renal condition monitoring**, Jingting Li, Ming Li, Yong Du, Greggory M. Santos, Chandra Mohan, Wei-Chuan Shih, Univ. of Houston (USA) . . . . . [9704-25]

11:30 am: **Identification of bacteria causing acute otitis media using Raman microspectroscopy**, Oscar D. Ayala, Catherine A. Wakeman, Eric Skaar, Anita Mahadevan-Jansen, Vanderbilt Univ. (USA) . . . . . [9704-26]

11:50 am: **Discerning the differential molecular pathology of serous and mucoid fluids using Raman spectroscopy**, Rishikesh Pandey, Massachusetts Institute of Technology (USA); Tulio A. Valdez, Connecticut Children's Medical Ctr. (USA); Nicolas Spegazzini, Jeon Woong Kang, Ramachandra R. Dasari, Peter T. C. So, Massachusetts Institute of Technology (USA) . . . . . [9704-27]

## MONDAY 15 FEBRUARY

### POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

Conference attendees are invited to attend the BiOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/IPWPosterGuidelines>.

**Towards optical fibre based Raman spectroscopy for the detection of surgical site infection**, Alex J. Thompson, Huw Williams, Daniel S. Elson, Guang-Zhong Yang, Imperial College London (United Kingdom) . . . . . [9704-22]

**Raman spectroscopy of cell lines: distinguishing oral dysplastic and squamous cell carcinoma cell lines**, Piyush Kumar, Crismita Dmello, Milind M. Vaidya, C. Murali Krishna, Advanced Ctr. for Treatment, Research & Education in Cancer (India) . . . . . [9704-28]

**Raman spectroscopic analysis of amide I band resulting from collagen glycation process**, Liliane P. Pereira, Claudio A. S. Tellez, Syed M. Ali, Laurita dos Santos, Michely Glenda P. da Silva, João Lucas Rangel, Larissa Vanessa Machado Viana, Priscila P. Fávero, Airton A. Martin, Univ. do Vale do Paraíba (Brazil) . . . . . [9704-29]

**FT-IR spectroscopy characterization of schwannoma: a case study**, Isabelle Ferreira, Lazaro P. Medeiros Neto, Maurilio José das Chagas, Luis Felipe C. S. Carvalho D.D.S., Univ. do Vale do Paraíba (Brazil); Marcelo Ribas, Instituto de Assistência Médica ao Servidor Público (Brazil); Vinicius de Almeida Lodzi, Chagas Serviços Médicos (Brazil); Airton A. Martin, Univ. do Vale do Paraíba (Brazil) . . . . . [9704-32]

**Raman spectroscopy of hamster buccal pouch carcinogenesis: investigating precancer changes due to confounding factors**, Piyush Kumar, Mahazabeen Sayyed, C. Murali Krishna, Advanced Ctr. for Treatment, Research & Education in Cancer (India) . . . . . [9704-33]

**Biomarkers of chronic kidney disease in the urine of diabetic/hypertensive patients by means of Raman spectroscopy**, Elzo E. S. Vieira, Jeyse A. M. Bispo, Adriana Barrinha Fernandes Moretti, Landulfo Silveira Jr., Univ. Camilo Castelo Branco (Brazil) . . . . . [9704-34]

**Development of an optical biosensor based on surface-enhanced Raman scattering for DNA analysis**, Tugce Yigit, Ebru Akdogan, Isik Didem Karagoz, Mehmet Kahraman, Gaziantep Univ. (Turkey) . . . . . [9704-35]

**Quantitative Raman characterization of cross-linked collagen thin films as a model system for diagnosing early osteoarthritis**, Chao Wang, Columbia Univ. (USA); Krista Durney, Gregory Fomovsky, Gerard A. Ateshian, Sinisa Vukelic, Columbia Univ. (USA) . . . . . [9704-36]



# CONFERENCE 9705

## LOCATION: ROOM 2000 (WEST LEVEL 2)

Saturday–Monday 13–15 February 2016 • Proceedings of SPIE Vol. 9705

# Microfluidics, BioMEMS, and Medical Microsystems XIV

Conference Chairs: **Bonnie L. Gray**, Simon Fraser Univ. (Canada); **Holger Becker**, microfluidic ChipShop GmbH (Germany)

Program Committee: **Brian W. Anthony**, Massachusetts Institute of Technology (USA); **Yolanda Fintschenko**, LabSmith, Inc. (USA); **Bruce K. Gale**, The Univ. of Utah (USA); **Albert K. Henning**, Aquarian Microsystems (USA); **Yu-Cheng Lin**, National Cheng Kung Univ. (Taiwan); **Yuehe Lin**, Pacific Northwest National Lab. (USA); **Ciara K. O'Sullivan**, Univ. Rovira i Virgili (Spain); **Ian Papautsky**, Univ. of Cincinnati (USA); **Bastian E. Rapp**, Karlsruhe Institut für Technologie (Germany); **Thomas Stieglitz**, Albert-Ludwigs-Universität Freiburg (Germany); **Sindy Kam-Yan Tang**, Stanford Univ. (USA); **Albert van den Berg**, MESA+ Institute for Nanotechnology (Netherlands); **WanJun Wang**, Louisiana State Univ. (USA); **Bernhard H. Weigl**, PATH (USA)

SPONSORS:



## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 2000 (WEST LEVEL 2) . . . SAT 1:30 PM TO 3:20 PM

### Microfluidic Devices I

Session Chairs: **Bonnie L. Gray**, Simon Fraser Univ. (Canada); **Holger Becker**, microfluidic ChipShop GmbH (Germany)

1:30 pm: **Microfluidic approaches to separation of challenging biological particles and cells** (*Invited Paper*), Bruce K. Gale, Kevin Petersen, Jiyoung Son, Matthew Hockin, John Nelson, Haidong Feng, Himanshu J. Sant, The Univ. of Utah (USA). . . . . [9705-1]

2:00 pm: **A latchable thermally activated phase change actuator for microfluidic systems**, Christiane Richter, Kai Sachsenheimer, Bastian E. Rapp, Karlsruhe Institut für Technologie (Germany). . . . . [9705-2]

2:20 pm: **A focus-tunable liquid lens encapsulated by a membrane with aspherical cross-section for field curvature reduction at high dioptries**, Hanyang Huang, Kang Wei, Yi Zhao, The Ohio State Univ. (USA) . . . . . [9705-3]

2:40 pm: **One-layer microfluidic device for hydrodynamic 3D self-flow-focusing operating in low flow speed**, Yasaman Daghighi, Vaskar Gnyawali, Eric M. Strohm, Scott S. H. Tsai, Mickael C. Kolios, Ryerson Univ. (Canada) . . . . . [9705-4]

3:00 pm: **A two-fold control on both pressure and flow-rate for flow control and quality management in fluidic processes**, Thibaut Thupnot, Benjamin Rouffet, Anne Le Nel, Fluigent (France); Nicolas Petit, ARMINES-ENSMP (France) . . . . . [9705-5]

Coffee Break . . . . . Sat 3:20 pm to 3:50 pm

### SESSION 2

LOCATION: ROOM 2000 (WEST LEVEL 2) . . . SAT 3:50 PM TO 5:40 PM

### Manufacturing I

Session Chair: **Himanshu J. Sant**, The Univ. of Utah (USA)

3:50 pm: **Tacky COC: a solvent bonding technique for fabrication microfluidic systems**, Nico Keller, Tobias M. Nargang, Bastian E. Rapp, Karlsruhe Institut für Technologie (Germany). . . . . [9705-6]

4:10 pm: **Electrowetting liquid lens array on curved substrates for wide field of view image sensor**, Yousung Bang, Muyeoung Lee, Yong Hyub Won, KAIST (Korea, Republic of). . . . . [9705-7]

4:30 pm: **Transfer molding processes for nano scale patterning of poly-L-lactic acid (PLLA) films**, Rabin Dhakal, Akshit Peer, Rana Biswas, Jaeyoun Kim, Iowa State Univ. of Science and Technology (USA) . . . . . [9705-8]

4:50 pm: **Improvement of mixing efficiency by using two sides of chip for inlets in a hybrid micromixer**, Meisam Zaferani, Hamid Latifi, Zahra Saeedian, Jalal Sadeghi, Shahid Beheshti Univ. (Iran, Islamic Republic of) . . . . . [9705-9]

5:10 pm: **Revolutionary 3-D printing systems of designable gels to develop novel applications and markets** (*Invited Paper*), Hidemitsu Furukawa, Yamagata Univ (Japan); Masaru Kawakami, Azusa Saito, Kazuyuki Sakai, Taizo Hayashida, Kei Toba, Yamagata Univ. (Japan) . . . . . [9705-10]

### BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 3

LOCATION: ROOM 2000 (WEST LEVEL 2) .SUN 8:30 AM TO 10:00 AM

### Microfluidic Devices II

Session Chair: **P. Ravi Selvaganapathy**, McMaster Univ. (Canada)

8:30 am: **Low-cost implementation of acoustophoretic devices** (*Invited Paper*), John Yeow, University of Waterloo (Canada). . . . . [9705-11]

9:00 am: **Photothermal generation of microbubbles on plasmonic nanostructures for flow manipulation inside microfluidic channels**, Jingting Li, Ming Li, Gregory M. Santos, Fusheng Zhao, Wei-Chuan Shih, Univ. of Houston (USA). . . . . [9705-12]

9:20 am: **The use of microfluidics and dielectrophoresis for separation, concentration, and identification of bacteria**, Cynthia Hanson, Elizabeth Vargis, Karen Tew, Annelise Dykes, Michaela Salisbury, Utah State Univ. (USA) . . . . . [9705-13]

9:40 am: **Blister technology for the storage of liquid reagents in microfluidic devices**, Suzanne Smith, Council for Scientific and Industrial Research (South Africa); René Sewart, microfluidic ChipShop GmbH (Germany); Kevin Land, Pieter Roux, Council for Scientific and Industrial Research (South Africa); Holger Becker, microfluidic ChipShop GmbH (Germany). . . . . [9705-14]

Coffee Break . . . . . Sun 10:00 am to 10:30 am

### SESSION 4

LOCATION: ROOM 2000 (WEST LEVEL 2) SUN 10:30 AM TO 11:40 AM

### Medical Devices I

Session Chair: **Swapnajit Chakravarty**, Omega Optics, Inc. (USA)

10:30 am: **Advances towards reliable identification and concentration determination of rare cells in peripheral blood** (*Invited Paper*), Daniel Hill, Univ. de València (Spain). . . . . [9705-15]

11:00 am: **Novel microfluidic system for online monitoring of biofilm dynamics by electrical impedance spectroscopy and amperometry**, Julia Bruchmann, Kai Sachsenheimer, Thomas Schwartz, Bastian E. Rapp, Karlsruhe Institut für Technologie (Germany) . . . . . [9705-16]

11:20 am: **Rapidly reconfigurable monolithic laser/detector arrays with capillary fill microfluidics for chip-based flow cytometry**, Robert Thomas, Cardiff Univ. (United Kingdom) . . . . . [9705-17]

Lunch/Exhibition Break . . . . . Sun 11:40 am to 1:40 pm



# CONFERENCE 9705

LOCATION: ROOM 2000 (WEST LEVEL 2)

**SESSION 5**  
LOCATION: ROOM 2000 (WEST LEVEL 2) . . SUN 1:40 PM TO 3:30 PM

## Manufacturing II

Session Chair: **John Yeow**

1:40 pm: **3D printing of microfluidic vascular channels in gels using commercial 3D printers** (*Invited Paper*), P. Ravi Selvaganapathy, Rana Attala, McMaster Univ. (Canada) . . . . . [9705-19]

2:10 pm: **Femtosecond laser fabricated integrated chip for manipulation of single cells**, Anusha Keloth, Melanie Jimenez, Helen Bridle, Lynn Paterson, Gerard H. Markx, Ajoy K. Kar, Heriot-Watt Univ. (United Kingdom) . . . . . [9705-20]

2:30 pm: **Maskless fabrication of a microfluidic device with interdigitated electrodes on PCB using laser ablation**, Michael Contreras-Saenz, Christian Hassard, Rafael Vargas-Chacon, Jose Luis Gordillo, Sergio Camacho-León, Tecnológico de Monterrey (Mexico) . . . . . [9705-21]

2:50 pm: **Pyro-EHD ink-jet printing for direct functionalization of 3D lab-on-chip devices**, Sara Coppola, Veronica Vespini, Vittorio Bianco, Laura Mecozzi, Michele Todino, Melania Paturzo, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) and Consiglio Nazionale delle Ricerche (Italy); Pietro Ferraro, Istituto di Cibernetica Eduardo Caianiello (Italy) and Consiglio Nazionale delle Ricerche (Italy); Simonetta Grilli, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) and Consiglio Nazionale delle Ricerche (Italy) . . . . . [9705-22]

3:10 pm: **Enhancing defect tolerance in periodic post microfluidic channels**, Glenn H Chapman, Bonnie L. Grey, Simon Fraser Univ (Canada) . . . . . [9705-23]

Coffee Break . . . . . Sun 3:30 pm to 4:00 pm

**SESSION 6**  
LOCATION: ROOM 2000 (WEST LEVEL 2) . . SUN 4:00 PM TO 5:30 PM

## Optofluidics

Session Chair: **Daniel Hill**, Univ. de València (Spain)

4:00 pm: **Silicon chip integrated photonic sensors for biological and chemical sensing** (*Invited Paper*), Swapnajit Chakravarty, Omega Optics, Inc. (USA); Ray T. Chen, The Univ. of Texas at Austin (USA); Naime Tang, Omega Optics, Inc. (USA); Yi Zou, Wei-Cheng Lai, Hai Yan, Chun-Ju Yang, The Univ. of Texas at Austin (USA) . . . . . [9705-24]

4:30 pm: **Optofluidic lens(es) for switchable 2D and 3D imaging**, Hanyang Huang, Kang Wei, Yi Zhao, The Ohio State Univ. (USA) . . . . . [9705-25]

4:50 pm: **Integrating opto-piezoelectric actuators and a two-mode excited linear ultrasonic motor for microfluidics transport of a biochip**, Tsun-Hsu Chen, Hsin-Hu Wang, Yu-Hsiang Hsu, Chih-Kung Lee, National Taiwan Univ. (Taiwan) . . . . . [9705-26]

5:10 pm: **Development of microfluidic devices for in situ investigation of cells using surface-enhanced Raman spectroscopy**, Yu-Han Ho, Daniel D. Galvan, Qiuming Yu, Univ. of Washington (USA) . . . . . [9705-27]

**POSTERS-SUNDAY**  
LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Electromagnetic simulation of on-chip optofluidic devices: liquid core/liquid cladding waveguides**, Mohammadreza Oraie, Hamid Latifi, Hamed Ghazvini, Jalal Sadeghi, Shahid Beheshti Univ. (Iran, Islamic Republic of) . . . . . [9705-44]

**A label free opto-fluidic micro flow cytometer based on optical fiber Fabry-Perot interrogation**, Jalal Sadeghi, Hamid Latifi, Farnood Mirkhosravi, Mohsen Jamshidi, Hesamodin Khashei, Shahid Beheshti Univ. (Iran, Islamic Republic of) . . . . . [9705-45]

**Development of microfluidic-based cell collection devices for in vitro and in vivo use**, Logan Butt, SUNY CNSE/SUNYIT (USA); Dave Entenberg, Albert Einstein College of Medicine (USA) and Gruss Lipper Biophotonics Ctr. (USA); Madhubhani Hemachandra, Matthew Strohmayer, SUNY CNSE/SUNYIT (USA); Patricia Keely, Univ. of Wisconsin-Madison (USA); Julio Aguirre-Ghiso, Icahn School of Medicine at Mount Sinai (USA); John S. Condeelis, Albert Einstein College of Medicine (USA) and Gruss Lipper Biophotonics Ctr. (USA); James Castracane, SUNY CNSE/SUNYIT (USA) . . . . . [9705-47]

**Using 3d-bio-printer make micro pattern**, Sang Mok Kim, Pusan National Univ. (Korea, Republic of) . . . . . [9705-48]

**Decomplexification of positive blood cultures by acoustophoresis for rapid diagnosis of bloodstream infections**, Emilie Bisceglia, Lucien Talvard, M. H. Charles, J. Blaze, Fredric Pinston, Patrick Broyer, bioMérieux SA (France) . . . . . [9705-49]

## MONDAY 15 FEBRUARY

**SESSION 7**  
LOCATION: ROOM 2000 (WEST LEVEL 2) MON 8:30 AM TO 10:00 AM

## Applications I

Session Chair: **Holger Becker**, microfluidic ChipShop GmbH (Germany)

8:30 am: **Rapid and label-free collection and analysis of circulating tumor cells using Vortex technology** (*Invited Paper*), Elodie Sollier, Vortex BioSciences, Inc. (USA); J. Che, Vortex BioSciences, Inc. (USA) and Univ. of California, Los Angeles (USA); C. Renier, Vortex BioSciences, Inc. (USA); E. Pao, Univ. of California, Los Angeles (USA); M. Dhar, E. Liu, S. Liu, M. Kochersperger, S. Jeffrey, Vortex BioSciences, Inc. (USA); D. Di Carlo, Univ. of California, Los Angeles (USA) . . . . . [9705-28]

9:00 am: **Nanoimprinted nanopillar array chip for procalcitonin detection**, Ling Ling Sun, Temasek Polytechnic (Singapore); Xiaodong Zhou, A\*STAR Institute of Materials Research and Engineering (Singapore) . . . . . [9705-29]

9:20 am: **Piezo-microfluidic transport system for multi-targets biochip detections**, Chia-Chin Li, Chih-Kung Lee, National Taiwan Univ. (Taiwan) . . . . . [9705-30]

9:40 am: **Dielectrophoresis assisted trapping of food pathogens in high conductive juice medium using microfluidic lab-on-chip device**, Sekar Harikrishnan, Narjes Allahrabbi, Suhanya Duraiswamy, Kian Meng Lim, Lin Yue Lanry Yung, Heow Pueh Lee, National Univ. of Singapore (Singapore) . [9705-31]

Coffee Break . . . . . Mon 10:00 am to 10:30 am

**SESSION 8**  
LOCATION: ROOM 2000 (WEST LEVEL 2) . . . MON 10:30 AM TO 12:00 PM

## Applications II

Session Chair: **Amy Shen**,

Okinawa Institute of Science and Technology (Japan)

10:30 am: **Micro-dissected tumors on-chip: using microfluidics and fluorescence imaging for personalized drug response assays** (*Invited Paper*), Mélina Astolfi, Ecole Polytechnique de Montréal (Canada) and Ctr. de recherche du Ctr. hospitalier de l'Univ. de Montréal (Canada); Amélie St-Georges-Robillard, Nassim Rousset, Ecole Polytechnique de Montréal (Canada); Muhammad A. Lateef, Ctr. de recherche du Ctr. hospitalier de l'Univ. de Montréal (Canada); Benjamin Péant, Ctr. de recherche du Ctr. hospitalier de l'Univ. de Montréal (Canada) and Institut du Cancer de Montréal (Canada); Mohana Marimuthu, Ecole Polytechnique de Montréal (Canada); Jennifer Kendall-Dupont, Ctr. de recherche du Ctr. hospitalier de l'Univ. de Montréal (Canada); Bishnubrata Patra, Ecole Polytechnique de Montréal (Canada); Euridice Carmona, Ctr. de recherche du Ctr. hospitalier de l'Univ. de Montréal (Canada) and Institut du Cancer de Montréal (Canada); Fred Saad, Ctr. de recherche du Ctr. hospitalier de l'Univ. de Montréal (Canada) and Institut du Cancer de Montréal (Canada); Diane Provencher M.D., Ctr. de recherche du Ctr. Hospitalier de l'Univ. de Montréal (Canada) and Institut du Cancer de Montréal (Canada) and Univ. de Montréal (Canada); Anne-Marie Mes-Masson, Ctr. de recherche du Ctr. hospitalier de l'Univ. de Montréal (Canada) and Institut du cancer de Montréal (Canada) and Univ. de Montréal (Canada); Frédéric Leblond, Ecole Polytechnique de Montréal (Canada) and Ctr. de recherche du Ctr. hospitalier de l'Univ. de Montréal (Canada); Thomas Gervais, Ecole Polytechnique de Montréal (Canada) and Ctr. de recherche du Ctr. hospitalier de l'Univ. de Montréal (Canada) and Institut du Cancer de Montréal (Canada) . . . . . [9705-32]

11:00 am: **Microfluidics in-channel electrochemical imaging platform for neurotransmitter sensing**, Amine Miled, Jesse Greener, Adnane Kara, Jessy Mathault, Arnaud Reitz, Martin Boisvert, Univ. Laval (Canada) . . [9705-33]

11:20 am: **Label-free detection and sizing of biomolecules using a UV-LED microfluidic platform**, Pavan Kumar Challa, Yuewen Zhang, Jackie Carozza, Tuomas P. J. Knowles, Univ. of Cambridge (United Kingdom) . . . . . [9705-34]

11:40 am: **Single-bead arrays for fluorescence-based immunoassays on capillary-driven microfluidic chips**, Yuksel Temiz, Michel Lim, Emmanuel Delamarche, IBM Research-Zürich (Switzerland) . . . . . [9705-35]

Lunch Break . . . . . Mon 12:00 pm to 1:30 pm

BIOS

# CONFERENCE 9705

LOCATION: ROOM 2000 (WEST LEVEL 2)

## SESSION 9

LOCATION: ROOM 2000 (WEST LEVEL 2) . . MON 1:30 PM TO 3:00 PM

### Applications III

Session Chair: **Thomas Gervais**

1:30 pm: **Getting the most from microfluidic platforms in biomedical applications** (*Invited Paper*), Amy Shen, Okinawa Institute of Science and Technology (Japan) . . . . . [9705-36]

2:00 pm: **Development of automated high throughput single molecular microfluidic detection platform for signal transduction analysis**, Po-Jung Huang, Jun Kameoka, Texas A&M Univ. (USA); Hirohito Yamaguchi, Chao-Kai Chou, Mien-Chie Hung, The Univ. of Texas M.D. Anderson Cancer Ctr. (USA); Sina Baghbani-Kordmahale, Texas A&M Univ. (USA). . . . . [9705-37]

2:20 pm: **Cell analysis and sorting with Raman-tweezers in microfluidic system**, Zdeněk Pilát, Institute of Scientific Instruments of the ASCR, v.v.i. (Czech Republic) . . . . . [9705-38]

2:40 pm: **High-speed cell cytometry using nonlinear Brillouin imaging/sensing via time-resolved optical (BISTRO) measurements**, Zhaokai Meng, Charles Ballman, Georgi I. Petrov, Vladislav V. Yakovlev, Texas A&M Univ. (USA) . . . . . [9705-39]

Coffee Break . . . . . Mon 3:00 pm to 3:30 pm

## SESSION 10

LOCATION: ROOM 2000 (WEST LEVEL 2) . . MON 3:30 PM TO 4:50 PM

### Applications IV

Session Chair: **Bonnie L. Gray**, Simon Fraser Univ. (Canada)

3:30 pm: **Modular microfluidic cartridge-based universal diagnostic system for global health applications**, Holger Becker, microfluidic ChipShop GmbH (Germany) . . . . . [9705-40]

3:50 pm: **Aqueous gradient by balancing diffusive and convective mass transport**, Mohammed-Baker I. Habhab, Tania Ismail, Joe F. Lo, Arefa Haque, Univ. of Michigan-Dearborn (USA) . . . . . [9705-41]

4:10 pm: **Universal lab-on-a-chip platform for complex, perfused 3D cell cultures**, Frank Sonntag, Florian Schmieder, Joachim Ströbel, Stefan Grünzner, Mathias Busek, Udo Klotzbach, Fraunhofer IWS Dresden (Germany) . . [9705-42]

4:30 pm: **Micro-fluidic system for measuring of the single cell viability**, Mojmir Sery, Silvie Bernatová, Petr Ják, Jan Kanka, Milan Matějka, Ota Samek, Institute of Scientific Instruments of the ASCR, v.v.i. (Czech Republic); Filip Ružicka, Masaryk Univ. (Czech Republic), St. Anne's Univ. Hospital Brno (Czech Republic); Pavel Zemánek, Institute of Scientific Instruments of the ASCR, v.v.i. (Czech Republic) . . . . . [9705-43]

## PANEL DISCUSSION

LOCATION: ROOM 2000 (WEST LEVEL 2) . MON 5:00 TO 6:30 PM

### Prospects and Future of Microfluidics

Moderator: **Holger Becker**, microfluidic ChipShop GmbH (Germany)

The commercialization of microfluidic devices and systems is rapidly progressing. However not all promising approaches have become an economic success and investor's payback often has not met initial expectations. The discussion will look upon experiences made in the product development and market introduction phase of microfluidics enabled devices and will present lessons learned from various perspectives, from device performance to commercial organization. It tries to identify trends and will present case studies from different applications.

## BEST STUDENT PAPER AWARD

LOCATION: ROOM 2000 (WEST LEVEL 2) . MON 6:30 TO 6:35 PM

We are pleased to announce that a cash prize will be awarded to the best student paper in this conference. Qualifying papers and presentations will be evaluated by the awards committee and the winner will be notified at the end of or after the meeting.

AWARD SPONSORS:

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# CONFERENCE 9706

LOCATION: ROOM 2009 (WEST LEVEL 2)

Sunday–Wednesday 14–17 February 2016 • Proceedings of SPIE Vol. 9706

# Optical Interactions with Tissue and Cells XXVII

Conference Chair: **E. Duco Jansen**, Vanderbilt Univ. (USA)

Program Committee: **Hope Thomas Beier**, Air Force Research Lab. (USA); **Randolph Glickman**, The Univ. of Texas Health Science Ctr. at San Antonio (USA); **Steven L. Jacques**, Oregon Health & Science Univ. (USA); **Bennett L. Ibey**, Tri Service Research Lab. (USA); **Beop-Min Kim**, Korea Univ. (Korea, Republic of); **Alexander J. Makowski**, Prozess Technologie (USA); **Jessica C. Ramella-Roman**, Florida International Univ. (USA); **Marissa Nicole Rylander**, Virginia Polytechnic Institute and State Univ. (USA); **Zachary D. Taylor**, Univ. of California, Los Angeles (USA); **Robert J. Thomas**, Air Force Research Lab. (USA); **Alfred Vogel**, Univ. zu Lübeck (Germany); **Gerald J. Wilmink**, WiseWear Corp. (USA)

## SUNDAY 14 FEBRUARY

### SESSION 1

LOCATION: ROOM 2009 (WEST LEVEL 2) .. SUN 1:30 PM TO 5:40 PM

### THz Sensing and Imaging

Session Chair: **Zachary D. Taylor**, Univ. of California, Los Angeles (USA)

1:30 pm: **Adaptive enhancement and visualization techniques for 3D THz images of breast cancer tumors** (*Invited Paper*), Yuhao Wu, Tyler Bowman, John M. Gauch, Magda El-Shenawee, Univ. of Arkansas (USA) . . . . . [9706-1]

1:50 pm: **Breast cancer margin detection with a single frequency terahertz imaging system** (*Invited Paper*), Sigfrid K. Yngvesson, Univ. of Massachusetts Amherst (USA); Andrew Karellas, Univ. of Massachusetts Medical School (USA); Stephen Glick, U.S. Dept. of Health & Human Services (USA) and U.S. Food and Drug Administration (USA); Ashraf Khan, Univ. of Massachusetts Medical School (USA); Paul R. Siqueira, Patrick A. Kelly, Univ. of Massachusetts Amherst (USA); Benjamin St. Peter, Spectral Sciences, Inc. (USA) . . . . . [9706-2]

2:10 pm: **GaAs THz photoconductive sources with laser boresight alignment** (*Invited Paper*), Elliott R. Brown, Weidong Zhang, Wright State Univ. (USA) . . . . . [9706-3]

2:30 pm: **Quasioptical imaging system design for THz medical imaging application**, Shijun Sung, Zachary D. Taylor, Univ. of California, Los Angeles (USA) . . . . . [9706-4]

2:50 pm: **Design and analysis of a handheld galvanoscanner for terahertz time-domain spectroscopic imaging in clinical settings** (*Invited Paper*), M. Hassan Arbab, Univ. of Washington (USA); Stefan Katletz, Research Ctr. for Non Destructive Testing GmbH (Austria); Zac Harris, Univ. of Washington (USA) . . . . . [9706-5]

Coffee Break . . . . . Sun 3:10 pm to 3:40 pm

3:40 pm: **A millimeter-wave reflectometer for whole-body hydration sensing**, Weidong Zhang, Elliott R. Brown, Wright State Univ. (USA) . . . [9706-6]

4:00 pm: **Surface roughness limited contrast to clutter ratios THz medical imaging**, Shijun Sung, Neha Bajwa, Jacob Goell, Zachary D. Taylor, Univ. of California, Los Angeles (USA) . . . . . [9706-7]

4:20 pm: **Morphological study of human sweat ducts for the investigation of THz-wave interaction** (*Invited Paper*), Kodo Kawase, Saroj R. Tripathi, Nagoya Univ. (Japan) . . . . . [9706-8]

4:40 pm: **In situ monitoring of surgical flap viability using THz imaging**, Neha Bajwa, Shijun Sung, Warren S. Grundfest, Zachary D. Taylor, Ctr. for Advanced Surgical and Interventional Technology (USA) . . . . . [9706-9]

5:00 pm: **Corneal tissue water content mapping with THz imaging: preliminary clinical results**, Shijun Sung, Neha Bajwa, Sophie X. Deng, Zachary D. Taylor, Warren S. Grundfest, Univ. of California, Los Angeles (USA) . . . . . [9706-10]

5:20 pm: **Visualization of vasodynamics using THz imaging with applications to allergy testing**, Shijun Sung, Neha Bajwa, Warren S. Grundfest, Zachary Grundfest, Ctr. for Advanced Surgical and Interventional Technology (USA) . . . . . [9706-11]

## MONDAY 15 FEBRUARY

### SESSION 2

LOCATION: ROOM 2009 (WEST LEVEL 2) MON 8:00 AM TO 10:10 AM

### Photothermal Interactions I

Session Chair: **E. Duco Jansen**, Vanderbilt Univ. (USA)

8:00 am: **Understanding the tissue interaction of new treatment modalities in laparoscopic surgery in view of safe and effective application** (*Invited Paper*), Matthijs C. M. Grimbergen, John H. Klaessens, Albert J. van der Veen, Rudolf M. Verdaasdonk, Vrije Univ. Medical Ctr. (Netherlands) . . [9706-12]

8:30 am: **Low-cost 420nm blue laser diode for tissue cutting and hemostasis**, Kurt J. Linden, N2 Biomedical (USA) . . . . . [9706-13]

8:50 am: **Light-assisted drying (LAD) of small volume biologics: a comparison of two IR light sources**, Madison A. Young, Matthew P. Van Vorst, Gloria D. Elliott, Susan R. Trammell, The Univ. of North Carolina at Charlotte (USA) . . . . . [9706-14]

9:10 am: **Heating drug delivery to vascular wall with Rhodamine B and fluorescence labeled paclitaxel ranging 50 to 70°C: ex vivo study**, Rie Homma, Machiko Shinozuka, Natsumi Shimazaki, Tsunenori Arai, Keio Univ. (Japan) . . . . . [9706-15]

9:30 am: **Influence of temperature on the myocardial cells death by an extracellular talaporfin sodium-induced photosensitization reaction**, Emiyu Ogawa, Hiromi Takenoya, Tsunenori Arai, Keio Univ. (Japan) . . . . . [9706-16]

9:50 am: **Development of 2-micron nonlinear frequency conversion laser system and tissue interaction monitoring using optical coherence tomography**, Bongkyun Kim, Jin-Chul Ahn M.D., Phil-Sang Chung, Dae Yu Kim, Dankook Univ. (Korea, Republic of) . . . . . [9706-17]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

### SESSION 3

LOCATION: ROOM 2009 (WEST LEVEL 2) . . . MON 10:40 AM TO 12:00 PM

### Photothermal Interactions II

Session Chair: **Bennett L. Ibey**, Tri Service Research Lab. (USA)

10:40 am: **Selective ablation of rabbit atherosclerotic plaque with less thermal effect by the control of pulse structure of a quantum cascade laser in the 5.7 μm wavelength range**, Keisuke Hashimura, Osaka Univ. (Japan) and Japan Society for the Promotion of Science (Japan); Katsunori Ishii, Osaka Univ. (Japan); Kunio Awazu, Osaka Univ. (Japan) and Graduate School of Frontier Biosciences, Osaka Univ. (Japan) and Global Ctr. for Medical Engineering and Informatics, Osaka Univ. (Japan) . . . . . [9706-18]

11:00 am: **A non-contact temperature measurement system for controlling photothermal medical laser treatments**, Özgür Kaya, Murat Gülsoy, Bogaziçi Univ. (Turkey) . . . . . [9706-19]

11:20 am: **A new analytical approach for heat generation in tissue due to laser excitation**, Hakan Erkol, Farouk Nouzi, Alex T. Luk, Univ. of California, Irvine (USA); Mehmet B. Unlu, Bogaziçi Univ. (Turkey); Gultekin Gulsen, Univ. of California, Irvine (USA) . . . . . [9706-20]

11:40 am: **Monitoring gold nanoparticle distribution in vivo with high resolution using photomagnetic imaging**, Alex T. Luk, Farouk Nouzi, Univ. of California, Irvine (USA); Yuting Lin, Harvard Medical School (USA); David Thayer, Washington Univ. in St Louis (USA) and Mallinckrodt Institute of Radiology (USA); Gultekin Gulsen, Univ. of California, Irvine (USA) . . . . . [9706-21]

Lunch Break . . . . . Mon 12:00 pm to 1:30 pm

# CONFERENCE 9706

LOCATION: ROOM 2009 (WEST LEVEL 2)

## SESSION 4

LOCATION: ROOM 2009 (WEST LEVEL 2) . . MON 1:30 PM TO 3:10 PM

### Ultrafast Laser-Tissue Interactions

Session Chair: **Robert J. Thomas**, Air Force Research Lab. (USA)

1:30 pm: **Femtosecond laser subsurface scleral treatment in cadaver human sclera and evaluation using two-photon and confocal microscopy**, Hui Sun, Zhongwei Fan, Ying Yan, Fuqiang Lian, Academy of Opto-Electronics (China); Ron Kurtz, Tibor Juhasz, Univ. of California, Irvine (USA) . . . . . [9706-22]

1:50 pm: **Laser assisted bioprinting using a femtosecond laser with and without a gold transductive layer: a parametric study**, Helene Desrus, ALPhANOV (France) and Bioingénierie Tissulaire (France); Catherine Artigues, Aquitaine Science Transfert (France); Bruno Chassagne, ALPhANOV (France); Raphael Devillard, Bioingénierie Tissulaire (France) and ALPhANOV (France); Stéphane Petit, Ctr. Lasers Intenses et Applications (France); Jean-Christophe Fricain, Bioingénierie Tissulaire (France); Florent Deloison, ALPhANOV (France); Fabien Guillemot, Poietis (France); Sylvain Catros, Bioingénierie Tissulaire (France); Rainer Kling, ALPhANOV (France) . . . . . [9706-23]

2:10 pm: **Precision resection of intestine using ultrashort laser pulses**, Rainer J. Beck, Wojciech S. Góra, Heriot-Watt Univ. (United Kingdom); Neil MacIntyre, The Univ. of Edinburgh (United Kingdom); Sonny Gunadi, David G. Jayne, Univ. of Leeds (United Kingdom); Duncan P. Hand, Jonathan D. Shephard, Heriot-Watt Univ. (United Kingdom) . . . . . [9706-24]

2:30 pm: **Time resolved digital-holographic analysis of femtosecond laser-induced photodisruption**, Emanuel Saerchen, Rowiak GmbH (Germany) and Laser Zentrum Hannover e.V. (Germany); Johannes Wenzel, Rowiak GmbH (Germany); Alexander Krüger, Laser Zentrum Hannover e.V. (Germany); Holger Lubatschowski, Rowiak GmbH (Germany); Tammo Ripken, Laser Zentrum Hannover e.V. (Germany) . . . . . [9706-25]

2:50 pm: **Chromatically encoded high-speed photography of cavitation bubble dynamics inside inhomogeneous ophthalmic tissue**, Nadine Tinne, Fabian Kranert, Christoph Wetzler, Ben Matthias, Alexander Krüger, Tammo Ripken, Laser Zentrum Hannover e.V. (Germany) . . . . . [9706-26]

Coffee Break . . . . . Mon 3:10 pm to 3:40 pm

## SESSION 5

LOCATION: ROOM 2009 (WEST LEVEL 2) . . MON 3:40 PM TO 5:20 PM

### Photomechanical Interactions

Session Chair: **Alexander J. Makowski**, Prozess Technologie (USA)

3:40 pm: **A route to laser angioplasty in the presence of fluoroscopy contrast media using a nanosecond-pulsed 355nm laser**, Amir Herzog, Ben-Gurion Univ. of the Negev (Israel); Idan Steinberg, Tel Aviv Univ. (Israel); Elad Geinsberg, Reut Nomberg, Amiel Ishaaya, Ben-Gurion Univ. of the Negev (Israel) . . . . . [9706-27]

4:00 pm: **Lead extraction by selective operation of a nanosecond-pulsed 355nm laser**, Amir Herzog, Ben-Gurion Univ. of the Negev (Israel); Stefan Bogdan, Michael Glikson, Sheba Medical Ctr. (Israel) and Leviev Heart Ctr. (Israel); Amiel Ishaaya, Ben-Gurion Univ. of the Negev (Israel); Charles Love, New York Univ. Langone Heart Rhythm Ctr. (USA) . . . . . [9706-28]

4:20 pm: **Laser dosimetry for disabling anopheles stephensi mosquitoes in-flight**, Matthew D. Keller, Bryan J. Norton, Phil Rutschman, David J. Farrar, Maclen Marvit, Artyom Makagon, Intellectual Ventures Lab. (USA) . . . . . [9706-29]

4:40 pm: **Exposure to nanosecond duration electrical pulses can induce electrodeformation**, Caleb C. Roth, The Univ. of Texas Health Science Ctr. at San Antonio (USA); Ronald A. Barnes Jr., National Research Council (USA) and Oak Ridge Institute for Science & Education (USA); Bennett L. Ibey, Tri Service Research Lab. (USA); Hope T. Beier, Air Force Research Lab. (USA); Randolph D. Glickman, The Univ. of Texas Health Science Ctr. at San Antonio (USA) . . . . . [9706-30]

5:00 pm: **High frequency application of nanosecond pulsed electric fields alters cellular membrane disruption and fluorescent dye uptake**, Zachary A. Steelman, Duke Univ. (USA); Gleb P. Tolstykh, Bennett L. Ibey, Air Force Research Lab. (USA) . . . . . [9706-31]

## POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

Conference attendees are invited to attend the BIOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Multi-channel photon migration study in visible Chinese human muscle for optical detection of deep vein thrombosis**, Ting Li, Yunlong Sun, Univ. of Electronic Science and Technology of China (China) . . . . . [9706-57]

**Biophysical mechanism of transient retinal phototropism in rod photoreceptors**, Xiaohui Zhao, Univ. of Illinois at Chicago (China) and Hebei Univ. (USA); Damber Thapa, Benquan Wang, Univ. of Illinois at Chicago (USA); Shaoyan Gai, Univ. of Illinois at Chicago (USA) and University of Illinois at Chicago (USA); Xincheng Yao, Univ. of Illinois at Chicago (USA) . . . . . [9706-58]

**Effects of snap freezing and formalin fixation on tissues during multimodal spectroscopic measurements**, Suresh Anand, European Lab. for Non-linear Spectroscopy (Italy); Riccardo Cicchi, Istituto Nazionale di Ottica (Italy) and European Lab. for Non-Linear Spectroscopy (Italy) and Consiglio Nazionale delle Ricerche (Italy); Francesco S. Pavone, European Lab. for Non-linear Spectroscopy (Italy) and Consiglio Nazionale delle Ricerche (Italy) . . . . . [9706-59]

**Simulation of the dependence of spatial fluence profiles on tissue optical properties**, Stephanie Miller, Kunal Mitra, Florida Institute of Technology (USA) . . . . . [9706-60]

**Laser photoactivation gibberellin molecules in the surface tissues of plants**, Aleksandr S. Grishkanich, Sergey V. Kascheev, Aleksandr P. Zhevlakov, Julia Ruzankina, ITMO Univ. (Russian Federation); Igor S. Sidorov, Univ. of Eastern Finland (Finland); Alexey Yakovlev, St. Petersburg State Forest-Technical Univ. (Russian Federation) . . . . . [9706-61]

**Determination of the effects of terahertz radiation on mitochondrial activity**, Cesario Z. Cerna, Bridget Endler, JBSA Fort Sam Houston (USA); Hope T. Beier, Bennett L. Ibey, Ibtissam Echchgadda, Air Force Research Lab. (USA) . . . . . [9706-63]

**Impact of terahertz frequencies on microtubule polymerization and dynamics**, Alexis Catalá, Air Force Research Lab. (USA); Cesario Z. Cerna, General Dynamics Information Technology (USA); Brady McMicken, Gary L. Thompson, Bennett L. Ibey, Ibtissam Echchgadda, Air Force Research Lab. (USA) . . . . . [9706-64]

**Sensor structure concepts for the analysis or local radiation exposure of biological samples at terahertz and millimeter wave frequencies**, Fabian Dornuf, Goethe Univ. (Germany); Roland Dörr, David Lämmle, Helmut F. Schlaak, Technische Univ. Darmstadt (Germany); Viktor Krozer, Goethe Univ. (Germany) . . . . . [9706-65]

**Time of flight estimation for breast cancer margin thickness using embedded tumors**, Tyler Bowman, Magda El-Shenawee, Univ. of Arkansas (USA); Lucas Campbell, Northwest Arkansas Pathology Associates, P.A. (USA) . . . . . [9706-66]

**Regional spectroscopy of paraffin-embedded breast cancer tissue using pulsed terahertz transmission imaging**, Tyler Bowman, Magda El-Shenawee, Univ. of Arkansas (USA); Lucas Campbell, Northwest Arkansas Pathology Associates, P.A. (USA) . . . . . [9706-67]

**Analytical terahertz spectroscopy and imaging of pharmaceutical crystals and cocrystals**, Katsuhiro Ajito, Nippon Telegraph and Telephone Corp. | (Japan) . . . . . [9706-68]

**Investigation of superparamagnetic (Fe<sub>3</sub>O<sub>4</sub>) nanoparticle and magnetic field exposures on CHO-K1 cell line**, Zachary Coker, Air Force Research Lab. (USA) and Univ. of North Texas (USA); Larry E. Estlack, General Dynamics Information Technology (USA); Tae-Youl Choi, Univ. of North Texas (USA); Saber M. Hussain, Bennett L. Ibey, Air Force Research Lab. (USA) . . . . . [9706-69]

# TUESDAY 16 FEBRUARY

## SESSION 6

LOCATION: ROOM 2009 (WEST LEVEL 2) . TUE 8:30 AM TO 10:10 AM

### Tissue Optics and Optical Properties of Tissue I

Session Chair: **Hope Thomas Beier**, Air Force Research Lab. (USA)

8:30 am: **A Monte Carlo simulator of PS-OCT local birefringence imaging**, Ellen Z. Zhang, Alzbeta E. Hartinger, Benjamin J. Vakoc, Massachusetts General Hospital (USA) . . . . . [9706-32]



# CONFERENCE 9706

LOCATION: ROOM 2009 (WEST LEVEL 2)

8:50 am: **Laser dosimetry planning tool for colonoscopic tumor resection**, María Luisa Pelayo-Fernández, Félix Fanjul-Vélez, Irene Salas-García, Mihail Zverev, José Luis Arce-Diego, Univ. de Cantabria (Spain) . . . . . [9706-33]

9:10 am: **Influence of the scattering phase function in numerical modelling of hyperspectral imaging**, Matija Milanič, Univ. of Ljubljana (Slovenia), Jožef Stefan Institute (Slovenia), Norwegian Univ. of Science and Technology (Slovenia); Boris Majaron, Jožef Stefan Institute (Slovenia) . . . . . [9706-34]

9:30 am: **Light pattern preservation in rodent's cortical tissue during optogenetic neuro-stimulation**, Mehdi Azimipour, Farid Atry, Ramin Pashaie, Univ. of Wisconsin-Milwaukee (USA) . . . . . [9706-35]

9:50 am: **Coherent-wave Monte Carlo method for simulating light propagation in tissue**, Maciej Kraszewski, Jerzy Pluciński, Gdansk Univ. of Technology (Poland) . . . . . [9706-36]

Coffee Break . . . . . Tue 10:10 am to 10:40 am

## SESSION 7

LOCATION: ROOM 2009 (WEST LEVEL 2) TUE 10:40 AM TO 12:00 PM

### Tissue Optics and Optical Properties of Tissue II

Session Chair: **Bennett L. Ibey**, Tri Service Research Lab. (USA)

10:40 am: **Methods for focusing beams and variance reduction in Monte Carlo simulations**, Joel N. Bixler, Robert J. Thomas, Air Force Research Lab. (USA) . . . . . [9706-37]

11:00 am: **Modeling intra-vital illumination of the lung**, Madeleine S. Durkee, Patrick J. Griffin, Landon D. Nash, Duncan J. Maitland, Texas A&M Univ. (USA); Jeffrey D. Cirillo, Texas A&M Health Science Ctr. (USA); Kristen C. Maitland, Texas A&M Univ. (USA) . . . . . [9706-38]

11:20 am: **Accurately modeling Gaussian beam propagation in the context of Monte Carlo techniques**, Brett H. Hokr, Texas A&M Univ. (USA) and TASC, Inc. (USA); Joel N. Bixler, Texas A&M Univ. (USA) and Air Force Research Lab. (USA); Gabriel Elpers, Byron Zollars, Nanohmics, Inc. (USA); Robert J. Thomas, Air Force Research Lab. (USA); Vladislav V. Yakovlev, Texas A&M Univ. (USA); Marlan O. Scully, Texas A&M Univ. (USA) and Princeton Univ. (USA) and Baylor Univ. (USA) . . . . . [9706-39]

11:40 am: **Noninvasive optical measurement of bone marrow lesions: a Monte Carlo study on visible human dataset**, Yu Su, Ting Li, Univ. of Electronic Science and Technology of China (China) . . . . . [9706-40]

Lunch Break . . . . . Tue 12:00 pm to 1:30 pm

## SESSION 8

LOCATION: ROOM 2009 (WEST LEVEL 2) . . . TUE 1:30 PM TO 3:10 PM

### Tissue Optics and Optical Properties of Tissue III

Session Chair: **E. Duco Jansen**, Vanderbilt Univ. (USA)

1:30 pm: **A time-resolved subtraction method for evaluating the optical properties of layered turbid media**, Daniel Milej, Western Univ. (Canada) and Lawson Health Research Institute (Canada); Androu Abdalmalak, Mamadou Diop, Lawson Health Research Institute (Canada) and Western Univ. (Canada); Adam Liebert, Nalecz Institute of Biocybernetics and Biomedical Engineering PAS (Poland); Keith St. Lawrence, Lawson Health Research Institute (Canada) and Western Univ. (Canada) . . . . . [9706-41]

1:50 pm: **Quantification and analysis of tissue back-scattering in the sub-diffusive regime**, Nico Bodenschatz, Institut für Lasertechnologien in der Medizin und Messtechnik (Germany) and BC Cancer Research Ctr. (Canada); André Liemert, Institut für Lasertechnologien in der Medizin und Messtechnik (Germany); Calum E. MacAulay, BC Cancer Research Ctr. (Canada); Alwin Kienle, Institut für Lasertechnologien in der Medizin und Messtechnik (Germany) . . . . . [9706-42]

2:10 pm: **Radiation absorption in different kinds of tissue analysis: ex vivo study with supercontinuum laser source**, Carlo Fornaini, Elisabetta Merigo, Stefano Selleri, Annamaria Cucinotta, Univ. degli Studi di Parma (Italy) [9706-43]

2:30 pm: **Transmittance of MCF-7 cancer cell line through visible spectrum**, Hasim Özgür Tabakoglu, Fatih Univ. (Turkey) . . . . . [9706-44]

2:50 pm: **Extraction of optical properties from hyperspectral images by Monte Carlo light propagation model**, Matic Ivancic, Peter Naglic, Peter Usenik, Aleš Fidler, Univ. of Ljubljana (Slovenia); Franjo Pernuš, Boštjan Likar, Univ. of Ljubljana (Slovenia), Sensum d.o.o. (Slovenia); Miran Bürmen, Univ. of Ljubljana (Slovenia) . . . . . [9706-45]

Coffee Break . . . . . Tue 3:10 pm to 3:40 pm

## SESSION 9

LOCATION: ROOM 2009 (WEST LEVEL 2) . . TUE 3:40 PM TO 5:20 PM

### Tissue Optics and Optical Properties of Tissue IV

Session Chair: **Jessica C. Ramella-Roman**, Florida International Univ. (USA)

3:40 pm: **Transcranial light-tissue interaction analysis**, Kavleen Aulakh, Scott Zakaib, Winnie N. Ye, Carleton Univ. (Canada) . . . . . [9706-46]

4:00 pm: **Extraction of optical properties in the sub-diffuse regime by spatially resolved reflectance spectroscopy**, Peter Naglic, Franjo Pernuš, Boštjan Likar, Miran Bürmen, Univ. of Ljubljana (Slovenia) . . . . . [9706-47]

4:20 pm: **An improved analytic function for predicting light fluence rate in circular fields on a semi-infinite geometry**, Amy D. Lu, Timothy C. Zhu, Univ. of Pennsylvania (USA) . . . . . [9706-48]

4:40 pm: **Increased epidermal laser fluence through simultaneous ultrasonic microporation**, Paul J. D. Whiteside, Jeff A. Chininis, Mason W. Schellenberg, Heather K. Hunt, Univ. of Missouri (USA) . . . . . [9706-49]

5:00 pm: **Parameterized source term in the diffusion approximation for enhanced near-field modeling of collimated light**, Mengyu Jia, Shuang Wang, Xueying Chen, Feng Gao, Huijuan Zhao, Tianjin Univ. (China) . . [9706-62]

## WEDNESDAY 17 FEBRUARY

## SESSION 10

LOCATION: ROOM 2009 (WEST LEVEL 2) . WED 8:30 AM TO 11:30 AM

### Photochemical and Cellular Bio-response

Session Chair: **Randolph D. Glickman**, The Univ. of Texas Health Science Ctr. at San Antonio (USA)

8:30 am: **Photothermal damage is correlated to the delivery rate of time-integrated temperature (Invited Paper)**, Michael L. Denton, Gary D. Noojin, Betsy Gamboa, Elharith Ahmed, Engility Corp. (USA); Benjamin A. Rockwell, Air Force Research Lab. (USA) . . . . . [9706-70]

9:00 am: **Optical imaging of mitochondrial redox state in irradiated vs. non-irradiated rat hearts during ischemia and reperfusion**, Stephanie Bolin, Guanchu Chen, Univ. of Wisconsin-Milwaukee (USA); Meetha M. Medhora, Amadou K. S. Camara, Medical College of Wisconsin (USA); Mahsa Ranji, Univ. of Wisconsin-Milwaukee (USA) . . . . . [9706-50]

9:20 am: **Patency of heart blood vessels under photosensitization reaction shortly after intravenous injection of talaporfin sodium in canine model**, Risa Hamada, Ryota Matsuzaki, Emiyu Ogawa, Tsunenori Arai, Keio Univ. (Japan) . . . . . [9706-51]

9:40 am: **Action spectrum for photochemical retinal pigment epithelium (RPE) disruption in an in vivo monkey model**, Jie Zhang, Ranjani Sabarinathan, Tracy Bubel, David R. Williams, Jennifer J. Hunter, Univ. of Rochester (USA) . . . . . [9706-52]

Coffee Break . . . . . Wed 10:00 am to 10:30 am

10:30 am: **Quantification of protein-protein binding before and after photo-modification of albumin**, Sarah C. Rozinek, The Univ. of Texas at San Antonio (USA) and 711th HPW, Human Effectiveness Directorate (USA); Robert J. Thomas, Air Force Research Lab. (USA) and 711th HPW, Human Effectiveness Directorate (USA); Lorenzo Brancalione, The Univ. of Texas at San Antonio (USA) . . . . . [9706-53]

10:50 am: **Quantification of the effect of toxicants on the motility of mammary organoids by OCT fluctuation spectroscopy**, Xiao Yu, Richard L. Blackmon, Patricia Carabas-Hernandez, Ashley Fuller, Melissa A. Troester, Amy L. Oldenburg, The Univ. of North Carolina at Chapel Hill (USA) . . . . . [9706-54]

11:10 am: **Multi-scale analysis of engineered skin using serial optical coherence microscopy**, Yujin An, Songye Baek, Andrey Vavilin, Ulsan National Institute of Science and Technology (Korea, Republic of); Pil Un Kim, Oz-tec Co., Ltd. (Korea, Republic of); Haekwang Lee, AmorePacific Corp. (Korea, Republic of); Woonggyu Jung, Ulsan National Institute of Science and Technology (Korea, Republic of) and Institute of Basic Science (Korea, Republic of) . . . . . [9706-55]

BIOS

# CONFERENCE 9707

LOCATION: ROOM 3003 (WEST LEVEL 3)

Sunday–Monday 14–15 February 2016 • Proceedings of SPIE Vol. 9707

# Dynamics and Fluctuations in Biomedical Photonics XIII

*Conference Chairs:* **Valery V. Tuchin**, N.G. Chernyshevsky Saratov State Univ. (Russian Federation), Univ. of Oulu (Finland); **Kirill V. Larin**, Univ. of Houston (USA); **Martin J. Leahy**, National Univ. of Ireland, Galway (Ireland); **Ruikang K. Wang**, Univ. of Washington (USA)

*Program Committee:* **Pierre O. Bagnaninchi**, The Univ. of Edinburgh (United Kingdom); **Wei R. Chen**, Univ. of Central Oklahoma (USA); **Joseph P. Culver**, Washington Univ. School of Medicine in St. Louis (USA); **Ekaterina I. Galanzha**, Univ. of Arkansas for Medical Sciences (USA); **Miya Ishihara**, National Defense Medical College (Japan); **Jingying Jiang**, Tianjin Univ. (China); **Sean J. Kirkpatrick**, Michigan Technological Univ. (USA); **Jürgen M. Lademann**, Charité Universitätsmedizin Berlin (Germany); **Hong Liu**, The Univ. of Oklahoma (USA); **Qingming Luo**, Huazhong Univ. of Science and Technology (China); **Igor V. Meglinski**, Univ. of Oulu (Finland); **Brian S. Sorg**, National Cancer Institute (USA); **Vladislav Toronov**, Ryerson Univ. (Canada); **Lihong V. Wang**, Washington Univ. in St. Louis (USA); **Ying Yang**, Keele Univ. (United Kingdom); **Anna N. Yaroslavsky**, Univ. of Massachusetts Lowell (USA); **Vladimir P. Zharov**, Univ. of Arkansas for Medical Sciences (USA); **Dan Zhu**, Huazhong Univ. of Science and Technology (China)

## SUNDAY 14 FEBRUARY

### SESSION 1

LOCATION: ROOM 3003 (WEST LEVEL 3) . SUN 8:20 AM TO 10:10 AM

### Speckle Technologies

Session Chairs: **Sean J. Kirkpatrick**, Michigan Technological Univ. (USA); **Igor Meglinski**, Univ. of Oulu (Finland)

8:20 am: **Laser speckle micro rheology for micro-mechanical mapping of bio-materials** (*Invited Paper*), Zeinab Hajjarian Kashany, Harvard Medical School (USA); Shawn Ahn, Univ. of Illinois at Urbana-Champaign (USA); Hadi Tavakoli Nia, Harvard Medical School (USA); Diane M. Tshikudi, Massachusetts General Hospital (USA); Alan Grodzinsky, Massachusetts Institute of Technology (USA); Rakesh K. Jain, Seemantini K. Nadkarni, Harvard Medical School (USA) . . . . . [9707-1]

8:50 am: **Momentum transfer Monte Carlo model for the simulation of laser speckle contrast imaging**, Caitlin Regan, Carole K. Hayakawa, Bernard Choi, Univ. of California, Irvine (USA) . . . . . [9707-3]

9:10 am: **Effects of incident intensity on laser speckle contrast imaging**, Mitchell A. Kirby, Kosar Khaksari, Sean J. Kirkpatrick, Michigan Technological Univ. (USA) . . . . . [9707-4]

9:30 am: **New sensor for the stress measurement based on blood flow fluctuations analysis**, Ilya Fine, Alexander V. Kaminsky, Elfi-Tech Ltd. (Israel) . . . . . [9707-5]

9:50 am: **Instrument to detect syncope and the onset of shock**, Daniel R. McAdams, Noah J. Kolodziejcki, Christopher J. Stapels, Daniel E. Fernandez, Matthew J. Podolsky, Dana Farkas, James F. Christian, Radiation Monitoring Devices, Inc. (USA); Michael J. Joyner, Christopher P. Johnson, Mayo Clinic (USA) . . . . . [9707-6]

Coffee Break . . . . . Sun 10:10 am to 11:00 am

### SESSION 2

LOCATION: ROOM 3003 (WEST LEVEL 3) . SUN 11:00 AM TO 12:30 PM

### OCT Plus Speckle Imaging

Session Chair: **Martin J. Leahy**, National Univ. of Ireland, Galway (Ireland)

11:00 am: **Mapping transverse capillary flow speed using time-varying OCT speckle signals** (*Invited Paper*), Woo June Choi, Ruikang K. Wang, Univ. of Washington (USA) . . . . . [9707-7]

11:30 am: **Visualization and characterization of the acoustic radiation force assisted displacement of particles using an OCT technique**, Marjan Razani, Azhar Zam, Nico J. J. Arezza, Yan J. Wang, Michael C. Kolios, Ryerson Univ. (Canada) . . . . . [9707-8]

11:50 am: **Towards understanding speckle pattern formation in optical coherence tomography**, Valentin Demidov, Univ. of Toronto (Canada); Igor Meglinski, Univ. of Oulu (Finland); Alexander Doronin, Yale Univ. (USA); I. Alex Vitkin, Univ. of Toronto (Canada) and Ontario Cancer Institute (Canada). [9707-9]

12:10 pm: **Comprehensive analysis of factors influencing the shadow-artifact in microcirculation imaging with optical coherence tomography**, James McGrath, Hrebesh M. Subhash, Cerine Lal, Martin J. Leahy, National Univ. of Ireland, Galway (Ireland). . . . . [9707-10]

Lunch/Exhibition Break . . . . . Sun 12:30 pm to 1:40 pm

### SESSION 3

LOCATION: ROOM 3003 (WEST LEVEL 3) . . SUN 1:40 PM TO 3:20 PM

### Functional Imaging

Session Chairs: **Ruikang K. Wang**, Univ. of Washington (USA); **Ekaterina I. Galanzha**, Univ. of Arkansas for Medical Sciences (USA)

1:40 pm: **Capillary flux measurement using OCT microangiography**, Utku Baran, Ruikang K. Wang, Univ. of Washington (USA). . . . . [9707-11]

2:00 pm: **Blood flow changes after unilateral carotid artery ligation monitored by optical coherence tomography**, Yushu Ma, Northeastern Univ. (China); Chengbo Liang, Yanyan Suo, Shenzhen Entry-Exit Inspection and Quarantine Bureau (China); Yuqian Zhao, Yi Wang, Northeastern Univ. (China); Tao Xu, Shenzhen Academy of Metrology and Quality Inspection (China); Ruikang K. Wang, Univ. of Washington (USA); Zhenhe Ma, Northeastern Univ. (China) . . . . . [9707-12]

2:20 pm: **Quantitative Mueller matrix microscope: theory, equipment, calibration, and applications** (*Invited Paper*), Hui Ma, Graduate School at Shenzhen, Tsinghua Univ. (China). . . . . [9707-13]

2:50 pm: **Quantification of volumetric cerebral blood flow using hybrid laser speckle contrast and optical coherence tomography** (*Invited Paper*), Niksa Valim, Andrew K. Dunn, The Univ. of Texas at Austin (USA) . . . . . [9707-14]

Coffee Break . . . . . Sun 3:20 pm to 3:50 pm

### SESSION 4

LOCATION: ROOM 3003 (WEST LEVEL 3) . . SUN 3:50 PM TO 5:00 PM

### Keynote Session

Session Chair: **Martin J. Leahy**, National Univ. of Ireland, Galway (Ireland)

3:50 pm: **Functional monitoring of blood flow dynamics in brain** (*Invited Paper*), Arjun G. Yodh, Univ. of Pennsylvania (USA) . . . . . [9707-51]

4:20 pm: **Speckle fluctuations to probe dynamics on the macroscopic to microscopic scales** (*Keynote Presentation*), David A. Boas, Athinoula A. Martinos Ctr. for Biomedical Imaging (USA) . . . . . [9707-15]

# CONFERENCE 9707

LOCATION: ROOM 3003 (WEST LEVEL 3)

BIOS

## PANEL DISCUSSION

LOCATION: ROOM 3003 (WEST LEVEL 3) . . . 5:00 PM TO 6:00 PM

### Speckle in Biomedical Optics

*Moderators:* **Seán Kirkpatrick**, Michigan Technological Univ. (USA) and **Martin J. Leahy**, National Univ. of Ireland, Galway (Ireland)

*Panelists:* **Ruikang Wang**, Univ. of Washington (USA); **Kirill Larin**, Univ. of Houston (USA); **Valery Tuchin**, Saratov State Univ. (Russia); **Jessica Ramella Roman**, Florida International Univ. (USA); **David Sampson**, The Univ. of Western Australia (Australia); **Sergey Alexandrov**, National Univ. of Ireland, Galway (Ireland); **David Boas**, Harvard Univ. (USA); **Arjun Yodh**, Univ. of Pennsylvania (USA); **Igor Meglinski**, Univ. of Oulu (Finland)

Our understanding of speckle generated by laser light interaction with tissue has advanced across a broad range of biophotonics and so this is a good time to gather what has been learned with a view to cross-fertilizing the various applications for which speckle is an important feature. Advances have been made both in the suppression of speckle noise and in the extraction of key information relating to structure (e.g. type of plaque in the coronary artery) and function (microcirculatory blood flow). This panel will discuss the latest developments and explore the most exciting future directions in speckle research. The discussion will follow lectures from scientists who have made seminal contributions to our understanding of speckle in biomedical optics and be seeded by one introductory slide from each panellist.

## POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BiOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/IPWPosterGuidelines>.*

**Quantitative assessment of reactive hyperemia using laser speckle contrast imaging at multiple wavelengths**, Anthony Young, Karthik Vishwanath, Miami Univ. (USA) . . . . . [9707-20]

**Demonstration of brain noise on human EEG signals in perception of bistable images**, Vadim V. Grubov, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Anastasiya E. Runnova, Saratov State Technical Univ. (Russian Federation); Maria K. Kurovskaja, Alexey A. Koronovskii, Alexey N. Pavlov, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Alexander E. Hramov, Saratov State Technical Univ. (Russian Federation) . . . . . [9707-33]

**Estimation of degree of synchronization in epileptic brain**, Olga I. Moskalenko, Alexey A. Koronovskii, Alexey N. Pavlov, Alexander E. Hramov, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Maksim O Zhuravlev, Saratov State University (Russian Federation) and Saratov State Technical University (Russian Federation) . . . . . [9707-34]

**Multilayer structure formation via homophily and homeostasis**, Vladimir V. Makarov, Alexey A. Koronovskii, Olga I. Moskalenko, Vladimir A. Maksimenko, Marina V. Khramova, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Javier Buldu, Univ. Politécnic de Madrid (Spain); Alexey N. Pavlov, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Stefano Boccaletti, Italian Embassy in Israel (Israel); Alexander E. Hramov, Saratov State Technical Univ. (Russian Federation) . . . . . [9707-35]

**Analysis of the establishment of the global synchronization in complex networks with different topologies of links**, Alexander A. Kharchenko, N.G. Chernyshevsky Saratov State Univ (Russian Federation); Vladimir V. Makarov, Olga I. Moskalenko, Alexey A. Koronovskii, Alexey N. Pavlov, Marina V. Khramova, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Syamal Dana, Indian Institute of Chemical Biology (India); Alexander E. Hramov, Saratov State Technical Univ. (Russian Federation) . . . . . [9707-36]

**THz-range generation frequency growth in semiconductor superlattice coupled to external high-quality resonator**, Vladimir V. Makarov, Alexey A. Koronovskii, Vladimir A. Maksimenko, Alexey N. Pavlov, Marina V. Khramova, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Alexander E. Hramov, Saratov State Technical Univ. (Russian Federation) . . . . . [9707-37]

**Experimental study on synergistic effects of reflectance and transmittance for near infrared spectroscopy**, Jingying Jiang, Jiajia Liu, Congcong Ma, Lin Li, Junsheng Lu, Kexin Xu, Tianjin Univ. (China) . . . . . [9707-38]

**Monte Carlo simulation study on the availability of the floating-reference theory to diffused transmittance spectra**, Jingying Jiang, Lin Li, Congcong Ma, Jiajia Liu, Junsheng Lu, Kexin Xu, Tianjin Univ. (China) . . . . . [9707-39]

**Quantitative relationship-established between skin optical properties and imaging performance using spectral domain optical coherence tomography**, Rui Shi, Huazhong Univ. of Science and Technology (China); Li Guo, Zhejiang Univ. (China); Chao Zhang, Huazhong Univ. of Science and Technology (China); Peng Li, Zhihua Ding, Zhejiang Univ. (China); Dan Zhu, Huazhong Univ. of Science and Technology (China) . . . . . [9707-40]

**A rapid and reversible skull optical clearing method for monitoring cortical blood flow**, Chao Zhang, Yanjie Zhao, Rui Shi, Dan Zhu, Huazhong Univ. of Science and Technology (China) . . . . . [9707-41]

**Recognition of short-term changes in physiological signals with the wavelet-based multifractal formalism**, Alexey N. Pavlov, Olga S. Sindeeva, Sergey S. Sindeev, Olga N. Pavlova, Elena V Rybalova, Oxana V. Semyachkina-Glushkovskaya, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) . . . . . [9707-42]

**Speech signal denoising with wavelet-transforms and the mean opinion score characterizing the filtering quality**, Alauldeen S. Yaseen, Alexey N. Pavlov, Alexander E. Hramov, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) . . . . . [9707-43]

**Full-field tracking and measurement of the motion of particles in capillary vessels by using time-varying laser speckle**, Hongxian Zhou, Zhenhe Ma, Yi Wang, Northeastern Univ. at Qinhuangdao (China) . . . . . [9707-44]

**Quantitative measurement of particle concentration by using optical coherence tomography**, Luying Zhang, Foshan Univ. (China); Zhenhe Ma, Yi Wang, Northeastern Univ. at Qinhuangdao (China) . . . . . [9707-45]

**OCT as the convenient tool to assess the quality and application of the organotypic retinal samples**, Ying Yang, Nicholas Khoshnaw, Rachel Gater, Keele Univ. (United Kingdom) . . . . . [9707-46]

**Measurement of cerebral blood flow rate and its relationship with brain function using optical coherence tomography**, Jian Liu, Zhenhe Ma, Yi Wang, Yuqian Zhao, Northeastern Univ. at Qinhuangdao (China); Shidan Dou, Northeastern Univ. (China); Yushu Ma, Northeastern Univ. at Qinhuangdao (China) . . . . . [9707-47]

**Phototoxicity of cationic porphyrins and nanocomposites of anisotropic silver**, Grigor V. Gyulkhandanyan, Institute of Biochemistry (Armenia); Robert K. Ghazaryan, Yerevan State Medical Univ. (Armenia); Anna G. Gyulkhandanyan, Institute of Biochemistry (Armenia); Marina H. Paronyan, Scientific and Production Ctr. Armbiotechnology (Armenia); Marina A. Sheyranyan, Yerevan State Univ. (Armenia); Aram G. Gyulkhandanyan, Institute of Biochemistry (Armenia); Elena S. Tuchina, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Valery V. Tuchin, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) and Institute of Precision Mechanics and Control (Russian Federation) and National Research Tomsk State Univ. (Russian Federation) . . . . . [9707-48]

**Photodynamic damages of red blood cells membranes**, Natalia V. Tkachenko, Alexander B. Pravdin, Valery V. Tuchin, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Nikita A. Navolokin, Natalia V. Polukonova, Saratov State Medical Univ. (Russian Federation); Alexander A. Serov, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) . . [9707-49]

**Direct photobleaching of glycated dentine**, Natalia I. Kazadaeva, Alexander B. Pravdin, Valery V. Tuchin, Leonid E. Dolotov, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) . . . . . [9707-50]

## MONDAY 15 FEBRUARY

### SESSION 5

LOCATION: ROOM 3003 (WEST LEVEL 3) . MON 8:20 AM TO 10:10 AM

### Functional and Clinical Imaging I

Session Chairs: **Kirill V. Larin**, Univ. of Houston (USA); **Igor Meglinski**, Univ. of Oulu (Finland)

8:20 am: **Topical application of nanoparticles: prospects and safety aspects (Invited Paper)**, Jürgen M. Lademann, Heike Richter, Sora Jung, Martina C. Meinke, Charité Universitätsmedizin Berlin (Germany); Eckart Rühl, Ulrike Alexiev, Marcelo Calderon, Freie Univ. Berlin (Germany); Alexa Patzelt, Charité Universitätsmedizin Berlin (Germany) . . . . . [9707-16]

8:50 am: **Detection of dermal systemic sclerosis using noncontact optical coherence elastography**, Chih-Hao Liu, Yong Du, Manmohan Singh, Jiasong Li, Chen Wu, Zhaolong Han, Raksha Raghunathan, Thomas Hsu, Shezaan Noorani, Anthony Chang, Chandra Mohan, Kirill V. Larin, Univ. of Houston (USA) . . . . . [9707-17]

# CONFERENCE 9707

LOCATION: ROOM 3003 (WEST LEVEL 3)

9:10 am: **Transformation of full  $4 \times 4$  Mueller matrices: a quantitative technique for biomedical diagnosis**, Jintao Chang, Chao He, Hui Ma, Graduate School at Shenzhen, Tsinghua Univ. (China). . . . . [9707-18]

9:30 am: **Noncontact imaging of plethysmographic pulsation and spontaneous low-frequency oscillation in skin perfusion with a digital red-green-blue camera**, Izumi Nishidate, Akira Hoshi, Yuta Aoki, Tokyo Univ. of Agriculture and Technology (Japan); Kazuya Nakano, Tokyo Univ. of Science (Japan); Kyuichi Niizeki, Yamagata Univ. (Japan); Yoshihisa Aizu, Muroran Institute of Technology (Japan). . . . . [9707-19]

9:50 am: **Breath air measurement using wide-band frequency tuning IR laser photo-acoustic spectroscopy**, Yury V. Kistenev, Alexey V. Borisov, National Research Tomsk State Univ. (Russian Federation); Dmitry A. Kuzmin, Siberian State Medical Univ. (Russian Federation); Andrey A. Boyko, Nadezhda Y. Kostyukova, Alexey A. Karapuzikov, Special Technologies, Ltd. (Russian Federation); Anna A. Bulanova, Siberian State Medical Univ. (Russian Federation) . . . . . [9707-21]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

## SESSION 6

LOCATION: ROOM 3003 (WEST LEVEL 3) MON 10:40 AM TO 12:20 PM

### Functional and Clinical Imaging II

Session Chair: **Dan Zhu**,  
Huazhong Univ. of Science and Technology (China)

10:40 am: **3D tissue engineered micro-tumors for optical-based therapeutic screening platform**, Michael B. Fenn Jr., Eric Mason, Joseph Spano, Florida Institute of Technology (USA); Sudipta Seal, Soumen Das, Univ. of Central Florida (USA); Timothy Hannon, Guochang Ye, Florida Institute of Technology (USA) . . . . . [9707-22]

11:00 am: **Imaging pulse wave velocity in mouse retina using swept-source optical coherence tomography**, Shaozhen Song, Wei Wei, Ruikang K. Wang, Univ. of Washington (USA) . . . . . [9707-23]

11:20 am: **Wavelet-based multifractal analysis of dynamic infrared thermograms and x-ray mammograms to assist in early breast cancer diagnosis**, Alain Arneodo, Ecole Normale Supérieure de Lyon (France) [9707-24]

11:40 am: **Reflectance light signal processing methods for intraoperative blood vessel detection and quantification in real time**, Amal Chaturvedi, Shetha A. Shukair, Paul Le Rolland, Mayank Vijayvergia, Hariharan Subramanian, Jonathan W. Gunn, BriteSeed, LLC (USA). . . . . [9707-25]

12:00 pm: **Fluorescence polarization imaging for detecting breast cancer at cellular level**, Anna N. Yaroslavsky, Xin Feng, Univ. of Massachusetts Lowell (USA) . . . . . [9707-52]

Lunch Break . . . . . Mon 12:20 pm to 1:30 pm

## SESSION 7

LOCATION: ROOM 3003 (WEST LEVEL 3) . . MON 1:30 PM TO 4:00 PM

### Tissue and Cell Dynamics

Session Chairs: **Valery V. Tuchin**, N.G. Chernyshevsky Saratov State Univ. (Russian Federation), Univ. of Oulu (Finland);  
**Anna N. Yaroslavsky**, Univ. of Massachusetts Lowell (USA)

1:30 pm: **Biodynamic profiling of three-dimensional tissue growth techniques** (*Invited Paper*), Hao Sun, Daniel A. Merrill, David D. Nolte, John J. Turek, Purdue Univ. (USA) . . . . . [9707-26]

2:00 pm: **Subcellular metabolic contrast in living tissue using dynamic full field OCT (D-FFOCT)**, Clement Apelian, Institut Langevin (France) and LLTech SAS (France); Fabrice Harms, LLTech SAS (France); Olivier Thouvenin, Claude A. Boccara, Institut Langevin (France) . . . . . [9707-27]

2:20 pm: **The relationship between decorrelation time and sample thickness in brain tissue**, Joshua Brake, Mooseok Jang, Changhui Yang, California Institute of Technology (USA) . . . . . [9707-28]

2:40 pm: **Measuring intracellular motion in cancer cell using optical coherence tomography**, Azhar Zam, Michael C. Kolios, Ryerson Univ. (Canada) . . . . . [9707-29]

3:00 pm: **DoFP polarimeter based polarization microscope for biomedical applications**, Jintao Chang, Honghui He, Chao He, Hui Ma, Graduate School at Shenzhen, Tsinghua Univ. (China). . . . . [9707-30]

3:20 pm: **Deep tissue ablation using ultrafast laser with optical clearing**, Ilan Gabay, Kaushik G. Subramanian, Christopher Martin, Murat Yildirim, The Univ. of Texas at Austin (USA); Valery V. Tuchin, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) and Institute of Precision Mechanics and Control (Russian Federation) and National Research Tomsk State Univ. (Russian Federation); Adela Ben-Yakar, The Univ. of Texas at Austin (USA) . . . . [9707-31]

3:40 pm: **Longitudinal optical characterization of bacterial biofilm growth and dynamics**, Guillermo L. Monroy, Veronika Sowers, Eric J. Chaney, Stephen A. Boppart, Univ. of Illinois at Urbana-Champaign (USA) . . . . [9707-32]



# CONFERENCE 9708

LOCATION: ROOM 2010 (WEST LEVEL 2)

Sunday–Wednesday 14–17 February 2016 • Proceedings of SPIE Vol. 9708

# Photons Plus Ultrasound: Imaging and Sensing 2016

BIOS

Conference Chairs: **Alexander A. Oraevsky**, TomoWave Laboratories, Inc. (USA); **Lihong V. Wang**, Washington Univ. in St. Louis (USA)

Program Committee: **Mark A. Anastasio**, Washington Univ. in St. Louis (USA); **Paul C. Beard**, Univ. College London (United Kingdom); **A. Claude Boccara**, Institut Langevin (France); **Peter Burgholzer**, Research Ctr. for Non Destructive Testing GmbH (Austria); **Stanislav Y. Emelianov**, The Univ. of Texas at Austin (USA); **Rinat O. Esenaliev**, The Univ. of Texas Medical Branch (USA); **Martin Frenz**, Univ. Bern (Switzerland); **Miya Ishihara**, National Defense Medical College (Japan); **Chulhong Kim**, Pohang Univ. of Science and Technology (Korea, Republic of); **Changhui Li**, Peking Univ. (China); **Pai-Chi Li**, National Taiwan Univ. (Taiwan); **Andreas Mandelis**, Univ. of Toronto (Canada); **Srirang Manohar**, Univ. Twente (Netherlands); **Vasilis Ntziachristos**, Helmholtz Zentrum München GmbH (Germany); **Matthew O'Donnell**, Univ. of Washington (USA); **Günther Paltauf**, Karl-Franzens-Univ. Graz (Austria); **Wiendelt Steenbergen**, Univ. Twente (Netherlands); **William M. Whelan**, Univ. of Prince Edward Island (Canada); **Vladimir P. Zharov**, Univ. of Arkansas for Medical Sciences (USA); **Qifa Zhou**, The Univ. of Southern California (USA); **Quing Zhu**, Univ. of Connecticut (USA)

## SUNDAY 14 FEBRUARY

### OPENING REMARKS

LOCATION: ROOM 2010 (WEST LEVEL 2) . . . . . 8:00 AM TO 8:15 AM

Conference Chairs: **Alexander A. Oraevsky**, TomoWave Laboratories, Inc. (USA); **Lihong V. Wang**, Washington Univ. in St. Louis (USA)

### SESSION 1

LOCATION: ROOM 2010 (WEST LEVEL 2) . . SUN 8:15 AM TO 10:00 AM

#### Clinical Applications of Imaging

Session Chairs: **Alexander A. Oraevsky**, TomoWave Labs, Inc. (USA); **Lihong V. Wang**, Washington Univ. in St. Louis (USA)

8:15 am: **Vascular elastic photoacoustic tomography in humans**, Pengfei Hai, Yong Zhou, Jinyang Liang, Chiye Li, Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . . . [9708-1]

8:30 am: **High-speed intravascular photoacoustic imaging at 1.7  $\mu\text{m}$** , Jie Hui, Purdue Univ. (USA); Qianhuan Yu, Shanghai Institute of Optics and Fine Mechanics (China); Teng Ma, The Univ. of Southern California (USA); Pu Wang, Yingchun Cao, Purdue Univ. (USA); Rebecca Bruning, Indiana Univ. (USA); Yueqiao Qu, Zhongping Chen, Univ. of California, Irvine (USA); Qifa Zhou, The Univ. of Southern California (USA); Michael Sturek, Indiana Univ.-Purdue Univ. Indianapolis (USA); Weibiao Chen, Shanghai Institute of Optics and Fine Mechanics (China); Ji-Xin Cheng, Purdue Univ. (USA) . . . . . [9708-2]

8:45 am: **Clinical real-time photoacoustic/ultrasound imaging system at POSTECH**, Jeeseu Kim, Sara Park, Yuhan Jung, Pohang Univ. of Science and Technology (Korea, Republic of); Yumiao Zhang, Jonathan Lovell, The State Univ. of New York (USA); Chulhong Kim, Pohang Univ. of Science and Technology (Korea, Republic of) . . . . . [9708-3]

9:00 am: **Detecting both melanoma depth and volume in vivo with a handheld photoacoustic microscope**, Yong Zhou, Guo Li, Liren Zhu, Chiye Li, Washington Univ. in St. Louis (USA); Lynn A. Cornelius, Washington Univ. School of Medicine in St. Louis (USA); Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . . . [9708-4]

9:15 am: **Photoacoustic imaging system for small-vessel imaging based on clinical ultrasound technology**, Kaku Irisawa, Kazuhiro Hirota, Atsushi Hashimoto, Dai Murakoshi, Hiroyasu Ishii, Takuji Tada, Takatsugu Wada, FUJIFILM Corp. (Japan) . . . . . [9708-5]

9:30 am: **The application of differential frequency-domain photoacoustics for characterizing arterial vessels**, Bahman Lashkari, Andreas Mandelis, Univ. of Toronto (Canada) . . . . . [9708-6]

9:45 am: **An automated breast ultrasound scanner with integrated multispectral photoacoustic tomography**, Corey Kelly, Hamid Moradi, Tim E. Salcudean, The Univ. of British Columbia (Canada) . . . . . [9708-7]

Coffee Break . . . . . Sun 10:00 am to 10:30 am

### SESSION 2

LOCATION: ROOM 2010 (WEST LEVEL 2) . . SUN 10:30 AM TO 12:15 PM

#### Image Guidance for Surgery, Therapy and Biopsy

Session Chairs: **Matthew O'Donnell**, Univ. of Washington (USA); **Wiendelt Steenbergen**, Univ. Twente (Netherlands)

10:30 am: **Integrated transrectal probe for translational ultrasound-photoacoustic imaging**, Kevan Bell, Tyler Harrison, Roger J. Zemp, Univ. of Alberta (Canada) . . . . . [9708-8]

10:45 am: **Interventional multi-spectral photoacoustic imaging in laparoscopic surgery**, Emma R. Hill, Wenfeng Xia, Daniil I. Nikitichev, Matthew J. Clarkson, Crispin Schneider, Univ. College London (United Kingdom); Kurinchi Gurusamy, Univ. College London (United Kingdom); Paul C. Beard, David J. Hawkes, Brian R. Davidson, Adrien E. Desjardins, Univ. College London (United Kingdom) . . . . . [9708-9]

11:00 am: **Interventional multispectral photoacoustic imaging with a clinical linear array ultrasound probe for guiding nerve blocks**, Wenfeng Xia, Univ. College London (United Kingdom); Simeon J. West, Univ. College London (United Kingdom); Daniil I. Nikitichev, Paul C. Beard, Adrien E. Desjardins, Univ. College London (United Kingdom) . . . . . [9708-10]

11:15 am: **Minimum energy and fiber diameter requirements for safe photoacoustic guidance of endonasal neurosurgeries**, Muyinatu A. Lediju Bell, Johns Hopkins Univ. (USA); Alicia B. Dagle, Clark Univ. (USA); Peter Kazanzides, Emad M. Boctor, Johns Hopkins Univ. (USA) . . . . . [9708-11]

11:30 am: **VHF-induced thermoacoustic imaging of fresh human prostates using a clinical ultrasound transducer array**, Sarah K. Patch, Univ. of Wisconsin-Milwaukee (USA); William A. See, Medical College of Wisconsin (USA) . . . . . [9708-12]

11:45 am: **Volumetric optoacoustic monitoring of endovenous laser treatments**, Thomas F. Fehm, Technische Univ. München (Germany); Xosé Luis Deán-Ben, Helmholtz Zentrum München GmbH (Germany); Peter Schaur, Ronald Sroka, Ludwig-Maximilians-Univ. München (Germany); Daniel Razansky, Technische Univ. München (Germany) . . . . . [9708-13]

12:00 pm: **In vivo cryoablation of prostate tissue with real-time optoacoustic monitoring**, Elena V. Petrova, TomoWave Labs, Inc. (USA); Massoud Motamedi, The Univ. of Texas Medical Branch (USA); Alexander A. Oraevsky, Sergey A. Ermilov, TomoWave Labs, Inc. (USA) . . . . . [9708-14]

Lunch/Exhibition Break . . . . . Sun 12:15 pm to 1:45 pm

# CONFERENCE 9708

LOCATION: ROOM 2010 (WEST LEVEL 2)

## SESSION 3

LOCATION: ROOM 2010 (WEST LEVEL 2) . . . . SUN 1:45 PM TO 3:15 PM

### Endoscopy and High Resolution Imaging

Session Chairs: **Stanislav Emelianov**, The Univ. of Texas at Austin (USA); **Qifa Zhou**, The Univ. of Southern California (USA)

1:45 pm: **A full-field illumination approach with multiple speckle for optical-resolution photoacoustic endoscopy**, Florian Poisson, Emmanuel Bossy, Institut Langevin (France) . . . . . [9708-15]

2:00 pm: **Prostate cancer characterization by optical contrast enhanced photoacoustics**, Guan Xu, Univ. of Michigan Medical School (USA); Ming Qin, Univ. of Michigan (USA); Javed Siddiqui, Scott A. Tomlins, Univ. of Michigan Medical School (USA); Raoul Kopelman, Univ. of Michigan (USA); Xueding Wang, Univ. of Michigan Medical School (USA) . . . . . [9708-16]

2:15 pm: **Optoacoustic endoscopy in curved scanning mode**, Hailong He, Andreas Buehler, Vasilis Ntziachristos, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany) . . . . . [9708-17]

2:30 pm: **Characterizing intestinal strictures with acoustic resolution photoacoustic microscopy**, Guan Xu, Univ. of Michigan Medical School (USA); Hao Lei, Univ. of Michigan (USA); Shengchun Liu, Laura A. Johnson, Peter D. R. Higgins, Michael D. Rice, Univ. of Michigan Medical School (USA); Jun Ni, Univ. of Michigan (USA); Xueding Wang, Univ. of Michigan Medical School (USA) . . . . . [9708-18]

2:45 pm: **Photoacoustic endoscopy probe using a coherent fibre-optic bundle and Fabry-Pérot ultrasound sensor**, Rehman Ansari, Paul C. Beard, Edward Z. Zhang, Adrien E. Desjardins, Univ. College London (United Kingdom) . . . . . [9708-19]

3:00 pm: **Estimation of the skull insertion loss using an optoacoustic point source**, Héctor Andrés Estrada Beltrán, Helmholtz Zentrum München GmbH (Germany); Johannes Rebling, Jake Turner, Moritz Kneipp, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany); Shy Shoham, Technion-Israel Institute of Technology (Israel); Daniel Razansky, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany) . . . . . [9708-20]

Coffee Break . . . . . Sun 3:15 pm to 3:45 pm

## SESSION 4

LOCATION: ROOM 2010 (WEST LEVEL 2) . . . . SUN 3:45 PM TO 5:45 PM

### Preclinical Applications

Session Chair: **William M. Whelan**, Univ. of Prince Edward Island (Canada)

3:45 pm: **Optoacoustic measurements of human placenta and umbilical cord blood oxygenation**, Tatiana Nanovskaya, Mahmoud Ahmed, Irene Y. Petrov, Yuriy Y. Petrov, Svetlana Patrikeeva, Gary D. Hankins, Donald S. Prough, Rinat O. Esenaliev, The Univ. of Texas Medical Branch (USA) . [9708-21]

4:00 pm: **Photoacoustic sensing of erythrocyte programmed cell death (eryptosis) for monitor cancer response to treatment**, Muhannad Fadhel, Michael C. Kolios, Ryerson Univ. (Canada) . . . . . [9708-22]

4:15 pm: **Targeted therapy of animal eyes by laser generated focused ultrasound**, Taehwa Lee, Wei Luo, Hakan Demirci, L. Jay Guo, Univ. of Michigan (USA) . . . . . [9708-23]

4:30 pm: **Photoacoustic imaging of angiogenesis in subdermal islet transplant sites**, Wei Shi, Rena Pawlick, Andrew Pepper, Boris Gala Lopez, Antonio Bruni, Min Choi, Roger J. Zemp, James Shapiro, Univ. of Alberta (Canada) . . . . . [9708-24]

4:45 pm: **Imaging melanin cancer growth in vivo using raster scan optoacoustic mesoscopy (RSOM) at 50 MHz and 100 MHz**, Murad Omar, Mathias Schwarz, Dominik Soliman, Panagiotis Symvoulidis, Vasilis Ntziachristos, Technische Univ. München (Germany) . . . . . [9708-25]

5:00 pm: **To assess the reparative ability of differentiated mesenchymal stem cells (MSCs) in a rat critical size bone repair defect model using high frequency co-registered photoacoustics/ultrasound imaging and micro computed tomography**, Haroon Zafar, Sean Gaynard, Cathal O'Flatharta, Tatiana Doroshenkova, National Univ. of Ireland, Galway (Ireland); Declan Devine, Athlone Institute of Technology (Ireland); Faisal Sharif, Frank Barry, Jessica Hayes, Mary Murphy, Martin J. Leahy, National Univ. of Ireland, Galway (Ireland) . . . . . [9708-26]

5:15 pm: **Characterizing intraocular tumors with physio-chemical photoacoustics**, Guan Xu, Hakan Demirci, Zeynep Gursel, Xueding Wang, Univ. of Michigan Medical School (USA) . . . . . [9708-27]

5:30 pm: **In vivo microwave-based thermoacoustic tomography in rats**, Li Lin, Yong Zhou, Lihong V. Wang, Washington Univ. in St. Louis (USA) . [9708-28]

## POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**In vivo photoacoustic imaging in rabbit tumor models**, Yeh-Chan Ahn, Pukyong National Univ. (Korea, Republic of) and Innovative Biomedical Technology Research Ctr. (Korea, Republic of); Jung-Eun Park, Yu-Gyeong Chae, Pukyong National Univ. (Korea, Republic of); Chul-Ho Oak, Eun-Kee Park, Jee-Yeong Jeong, Kosin Univ. (Korea, Republic of); Van Phuc Phuc, Hyun Wook Kang, Junghwan Oh, Pukyong National Univ. (Korea, Republic of); Sung Won Kim, Kosin Univ. (Korea, Republic of) . . . . . [9708-101]

**Photoacoustic detection of blood in dental pulp by using short-time Fourier transform**, Azusa Yamada, Tohoku Univ. (Japan); Satoko Kakino, Tokyo Medical and Dental Univ. (Japan); Yuji Matsuura, Tohoku Univ. (Japan) . . . . . [9708-102]

**Fast and compact optical-resolution photoacoustic microscopy using a water-proofing 2-axis MEMS scanner, and a step forward to clinical applications**, Jin Young Kim, Changho Lee, Geunbae Lim, Chulhong Kim, Pohang Univ. of Science and Technology (Korea, Republic of) . . . . . [9708-103]

**Imaging of matrix metalloproteinases activity by using a photoacoustic microscopy system**, Esra Aytac-Kiperçil, Nasire Uluc, Aytac Demirkiran, Bogaziçi Univ. (Turkey); Hakan Erkol, Univ. of California, Irvine (USA); Mehmet Burcin Unlu, Bogaziçi Univ. (Turkey) . . . . . [9708-104]

**Combined label-free optical and optoacoustic imaging of model organisms at mesoscopy and microscopy resolutions**, Dominik Soliman, Helmholtz Zentrum München GmbH (Germany); George J. Tservelakis, Foundation for Research and Technology-Hellas (Greece); Murad Omar, Helmholtz Zentrum München GmbH (Germany); Vasilis Ntziachristos, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany) . . . . . [9708-105]

**Photoacoustic microscopy based on polydimethylsiloxane thin film Fabry-Perot optical interferometer**, Soongho Park, Jonghyun Eom, Jun Geun Shin, Sunghwan Rim, Byeong Ha Lee, Gwangju Institute of Science and Technology (Korea, Republic of) . . . . . [9708-106]

**Bessel beam Grueneisen relaxation photoacoustic microscopy with extended depth of field**, Junhui Shi, Lidai Wang, Lihong V. Wang, Washington Univ. in St. Louis (USA); Cedric Noordam, Univ. Twente (Netherlands) [9708-107]

**A broadband PVDF-based hydrophone with integrated readout circuit for intravascular photoacoustic imaging**, Verya Daeichin, Erasmus MC (Netherlands); Chao Chen, Delft Univ. of Technology (Netherlands); Qing Ding, Technische Univ. Delft (Netherlands); Min Wu, Robert Beurskens, Geert Springeling, Erasmus MC (Netherlands); Emile Noothout, Martin Verweij, K. W. A. van Dongen, Johan G. Bosch, Technische Univ. Delft (Netherlands); Antonius F. W. van der Steen, Erasmus MC (Netherlands) and Delft Univ. of Technology (Netherlands); Nico de Jong, Erasmus MC (Netherlands) and Technische Univ. Delft (Netherlands); Michiel Pertijs, Technische Univ. Delft (Netherlands); Gijs van Soest, Erasmus MC (Netherlands) . . . . . [9708-108]

**Optoacoustic response from carbon nanotubes embedded in a soft tissue-like phantom by using high-power diode-laser assemblies**, Luca Leggio, Daniel C. Gallego, Sandeep Babu Gawali, Ehsan Dadransia, Univ. Carlos III de Madrid (Spain); Marek Osinski, The Univ. of New Mexico (USA) and Univ. Carlos III de Madrid (Spain); Guillermo Carpintero del Barrio, Horacio Lamela, Univ. Carlos III de Madrid (Spain) . . . . . [9708-109]

**Planar waveguide light transmission modality for backward-mode photoacoustic tomography**, Mason W. Schellenberg, Paul J. D. Whiteside, Heather K. Hunt, Univ. of Missouri (USA) . . . . . [9708-110]

**Photoacoustic signal detection via atomic force microscopy cantilevers: a theoretical study**, Aytac Demirkiran, Esra Aytac-Kiperçil, Nasire Uluc, Bogaziçi Univ. (Turkey); Hakan Erkol, Univ. of California, Irvine (USA); Mehmet Burcin Unlu, Bogaziçi Univ. (Turkey) . . . . . [9708-111]

**Photoacoustic imaging of clinical metal needle by a LED light source integrated transducer**, Toshitaka Agano, Naoto Sato, PreXion Corp. (Japan) . . . . . [9708-112]

**Resonance effect of the laser generated ultrasound due to the reflection at the soft boundary**, Wei Luo, Taehwa Lee, Univ. of Michigan (USA); Qiuyun Fu, Huazhong Univ. of Science and Technology (China); L. Jay Guo, Univ. of Michigan (USA) . . . . . [9708-113]

# CONFERENCE 9708

## LOCATION: ROOM 2010 (WEST LEVEL 2)

### MONDAY 15 FEBRUARY

#### SESSION 5

LOCATION: ROOM 2010 (WEST LEVEL 2) . MON 8:15 AM TO 10:00 AM

## Laser Sources and All-Optical Systems for Imaging

Session Chairs: **Martin Frenz**, Univ. Bern (Switzerland);  
**Claude Boccara**, Institut Langevin (France)

8:15 am: **An ultra compact laser diode source for integration in a hand held point-of-care photoacoustic scanner**, Andreas Kohl, Celine Canal, Arnaud Laugustin, Olivier Rabot, Quantel (France) . . . . . [9708-29]

8:30 am: **Advanced laser system for 3D optoacoustic tomography of the breast**, Marc Klosner, Gary Chan, Chunbai Wu, Donald F. Heller, Light Age, Inc. (USA); Richard Su, Sergey A. Ermilov, Hans-Peter Brecht, Vassili Ivanov, Pratik Talole, TomoWave Labs, Inc. (USA); Yang Lou, Mark A. Anastasio, Washington Univ. in St. Louis (USA); Alexander A. Oraevsky, TomoWave Labs, Inc. (USA) . . . . . [9708-30]

8:45 am: **Novel fibre lasers as excitation sources for photoacoustic tomography and microscopy**, Thomas J. Allen, Univ. College London (United Kingdom); Martin Berendt, Univ. of Southampton (United Kingdom); Edward Z. Zhang, Univ. College London (United Kingdom); Shaiful Alam, Univ. of Southampton (United Kingdom); David J. Richardson, Optoelectronics Research Ctr. (United Kingdom); Paul C. Beard, Univ. College London (United Kingdom) . . . . . [9708-31]

9:00 am: **An optical resolution photoacoustic microscopy system with unique supercontinuum fiber laser and detection of several cancer cells**, Esra Aytac-Kipergil, Nasire Uluc, Aytac Demirkiran, Sirin Yonucu, Defne Yilmaz, Bogaziçi Univ. (Turkey); Hakan Erkol, Univ. of California, Irvine (USA); Mehmet Burcin Unlu, Bogaziçi Univ. (Turkey) . . . . . [9708-32]

9:15 am: **Limited -view multi-source quantitative photoacoustic tomography with a circular transducer of finite-dimension**, Jing Feng, Hao Gao, Shanghai Jiao Tong Univ. (China) . . . . . [9708-33]

9:30 am: **Thin metal film-polymer composite for efficient photoacoustic generation**, Taehwa Lee, L. Jay Guo, Univ. of Michigan (USA) . . . . . [9708-34]

9:45 am: **Multimodal system for non-contact photoacoustic imaging, optical coherence tomography, and mid-infrared photoacoustic spectroscopy**, Elisabeth Leiss-Holzinger, Markus Brandstetter, Gregor Langer, Andreas Buchsbaum, Peter Burgholzer, Research Ctr. for Non Destructive Testing GmbH (Austria); Bernhard Lendl, Technische Univ. Wien (Austria); Thomas Berer, Research Ctr. for Non Destructive Testing GmbH (Austria) . . . . . [9708-35]

Coffee Break . . . . . Mon 10:00 am to 10:30 am

#### SESSION 6

LOCATION: ROOM 2010 (WEST LEVEL 2) MON 10:30 AM TO 12:15 PM

## Optical Detectors for Imaging

Session Chair: **Paul C. Beard**, Univ. College London (United Kingdom)

10:30 am: **Photoacoustic spectrum analysis of tissue microstructure using an optical micro-ring resonator**, Qiaochu Li, Univ. of Michigan (USA) [9708-36]

10:45 am: **A compact polymer optical fibre ultrasound detector**, Christian F. B. Broadway, Univ. Carlos III de Madrid (Spain); Andreas Pospori, Michal G. Zubeł, Aston Univ. (United Kingdom); Daniel C. Gallego, Univ. Carlos III de Madrid (Spain); Getinet T. Woyessa, DTU Fotonik (Denmark); David J. Webb, Kate Sugden, Aston Univ. (United Kingdom); Ole Bang, DTU Fotonik (Denmark); Guillermo Carpintero del Barrio, Horacio Lamela, Univ. Carlos III de Madrid (Spain) . . . . . [9708-37]

11:00 am: **Photoacoustic and ultrasound imaging with a gas-coupled laser acoustic line detector**, Jami L. Johnson, Kasper van Wijk, The Univ. of Auckland (New Zealand); James N. Caron, Quarktet (USA) and Research Support Instruments (USA); Miriam Timmerman, Univ. Twente (Netherlands) . . . . . [9708-38]

11:15 am: **All-optical highly sensitive broadband ultrasound sensor without any deformable parts for photoacoustic imaging**, Wolfgang Rohringer, Stefan Preisser, Medizinische Univ. Wien (Austria) and XARION Laser Acoustics GmbH (Austria); Mengyang Liu, Zhe Chen, Boris Hermann, Harald Sattmann, Medizinische Univ. Wien (Austria); Nicole Schmitner, Univ. of Innsbruck (Austria); Stefan Zotter, XARION Laser Acoustics GmbH (Austria); Dirk Meyer, Leopold-Franzens-Univ. Innsbruck (Austria); Balthasar Fischer, XARION Laser Acoustics GmbH (Austria); Wolfgang Drexler, Medizinische Univ. Wien (Austria) . . [9708-39]

**Optimization of the image reconstruction procedure in multi-focal photoacoustic computed tomography**, Hongying Wan, Depeng Wang, Univ. at Buffalo (USA); Jing Meng, College of Information Science and Engineering (China); Liang Song, Shenzhen Institute of Advanced Technology (China); Leslie Ying, Jun Xia, Univ. at Buffalo (USA) . . . . . [9708-114]

**Optoacoustic processing algorithms for intravascular imaging using optical interferometric ultrasonic sensors**, Sandeep Babu Gawali, Ehsan Dadransnia, Daniel C. Gallego, Guillermo Carpintero del Barrio, Luca Leggio, Horacio Lamela, Christian F. B. Broadway, Univ. Carlos III de Madrid (Spain) . . . . . [9708-115]

**In vivo switchable optical-resolution and acoustic-resolution photoacoustic microscopy**, Seungwan Jeon, Jaewoo Kim, Chulhong Kim, Pohang Univ. of Science and Technology (Korea, Republic of) . . . . . [9708-116]

**Photoacoustic imaging probe to expand imaging range**, Yong-Jae Lee, Eun-Ju Jeong, Hyun-Woo Song, Chang-Geun Ahn, Hyung-Wook Noh, Electronics and Telecommunications Research Institute (Korea, Republic of); Min-Yong Jeon, Chungnam National Univ. (Korea, Republic of); Bong-Kyu Kim, Electronics and Telecommunications Research Institute (Korea, Republic of) . . . . . [9708-117]

**Noncontact photoacoustic imaging by using a modified optical-fiber Michelson interferometer**, Jiao Lu, Yingzhe Gao, Zhenhe Ma, Yi Wang, Northeastern Univ. at Qinhuangdao (China) . . . . . [9708-118]

**High frame rate photoacoustic imaging using multiple wave-length LED array light source**, Toshitaka Agano, Naoto Sato, PreXion Corp. (Japan) . . . . . [9708-119]

**High energy laser pulse coupling in a multimode fiber for photoacoustic tomography**, Min Min Ai, Weihang Shu, Tim E. Salcudean, Robert N. Rohling, Purang Abolmaesumi, Shuo Tang, The Univ. of British Columbia (Canada) . . . . . [9708-120]

**Photoacoustic radiation force on a microbubble**, Hakan Erkol, Univ. of California, Irvine (USA); Esra Aytac-Kipergil, Nasire Uluc, Aytac Demirkiran, Mehmet Burcin Unlu, Bogaziçi Univ. (Turkey) . . . . . [9708-121]

**Numerical and experimental analysis of high frequency acoustic microscopy and infrared reflectance system design for early detection of melanoma**, Georgios T. Karagiannis, Univ. of Thessaly (Greece); Georgios K. Apostolidis, Ormylia Art Diagnosis Ctr. (Greece); Panagiotis Georgoulas, Univ. of Thessaly (Greece) . . . . . [9708-122]

**High frame rate photoacoustic imaging using clinical ultrasound system**, Kathyayini Sivasubramanian, Manojit Pramanik, Nanyang Technological Univ. (Singapore) . . . . . [9708-123]

**A practical optical-resolution photoacoustic microscopy prototype using a 300 mW visible laser diode**, Lvming Zeng, Jiangxi Science and Technology Normal Univ. (China) and Beckman Laser Institute and Medical Clinic (USA); Zhonglie Piao, Shenghai Huang, Wangcun Jia, Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9708-124]

**Laser-scanning optical-resolution photoacoustic microscopy using a virtual point detector concept**, Che-Chang Yang, Shun-Jen Hsiao, Meng-Lin Li, National Tsing Hua Univ. (Taiwan) . . . . . [9708-125]

**Simultaneous photoacoustic and optical attenuation imaging of single cells using photoacoustic microscopy**, Michael Moore, Eric M. Strohm, Michael C. Kolios, Ryerson Univ. (Canada) . . . . . [9708-126]

**Fast integrated intravascular photoacoustic/ultrasound catheter**, Changhoon Choi, Seunghee Cho, Sungjo Park, Pohang Univ. of Science and Technology (Korea, Republic of); Hyeon Park, Kiyuk Jang, The Catholic Univ. of Korea (Korea, Republic of); Chulhong Kim, Pohang Univ. of Science and Technology (Korea, Republic of) . . . . . [9708-127]

**Evaluation of intracellular delivery efficiency of gold nanoparticles by integrated photoacoustic microscopy and confocal fluorescence microscopy**, Chao Tian, Zhixing Xie, Xia S. Shao, Xueding Wang, Univ. of Michigan (USA); Wei Qian, IMRA America, Inc. (USA) . . . . . [9708-128]



# CONFERENCE 9708

LOCATION: ROOM 2010 (WEST LEVEL 2)

11:30 am: **Air-coupled ultrasound optical detector based on optofluidic ring resonator**, Kyu Hyun Kim, Wei Luo, Cheng Zhang, L. Jay Guo, Xudong Fan, Univ. of Michigan (USA) . . . . . [9708-40]

11:45 am: **Articulated dual modality photoacoustic and optical coherence tomography probe for preclinical and clinical imaging**, Mengyang Liu, Behrooz Zabihian, Jessika Weingast, Boris Hermann, Zhe Chen, Medizinische Univ. Wien (Austria); Edward Z. Zhang, Paul C. Beard, Univ. College London (United Kingdom); Hubert Pehamberger, Wolfgang Drexler, Medizinische Univ. Wien (Austria) . . . . . [9708-41]

12:00 pm: **All-optical optoacoustic microscopy system based on probe beam deflection technique**, Saher Maswadi, Oak Ridge Institute for Science and Education (USA) and EchoLase Inc. (USA); Dmitri Tsyboulskic, TomoWave Labs, Inc. (USA); Caleb C. Roth, The Univ. of Texas Health Science Ctr. at San Antonio (USA); Randolph Glickman, The Univ. of Texas Health Science Ctr. at San Antonio (USA) and EchoLase Inc. (USA); Hope T. Beier, Air Force Research Lab. (USA); Alexander A. Oraevsky, TomoWave Labs, Inc. (USA); Bennett L. Ibey, Air Force Research Lab. (USA) . . . . . [9708-42]

Lunch Break . . . . . Mon 12:15 pm to 1:45 pm

## SESSION 7

LOCATION: ROOM 2010 (WEST LEVEL 2) . . . MON 1:45 PM TO 3:30 PM

### Quantitative and Functional Imaging

Session Chairs: **Benjamin T. Cox**, Univ. College London (United Kingdom); **Quing Zhu**, Univ. of Connecticut (USA)

1:45 pm: **Analysis of photoacoustic response from plasmonic nanostructures irradiated by ultrafast laser in water**, Ali Hatf, Behafarid Darvish, Nipissing Univ. (Canada); Adrien Dagallier, École Polytechnique de Montréal (Canada); Christos Boutopoulos, Michel Meunier, Ecole Polytechnique de Montréal (Canada) . . . . . [9708-43]

2:00 pm: **Classification of biological cells using a sound wave based flow cytometer**, Eric M. Strohm, Vaskar Gnyawali, Mia Van De Vondervoort, Yasaman Daghighi, Scott S. H. Tsai, Michael C. Kolios, Ryerson Univ. (Canada) . . . . . [9708-44]

2:15 pm: **Photoacoustic simulations of micro-vessels bleeding: spectral analysis and its implication for monitoring vascular-targeted treatments**, Muhannad Fadhel, Jason Zalev, Eno Hysi, Michael C. Kolios, Ryerson Univ. (Canada) . . . . . [9708-45]

2:30 pm: **Pulsed photoacoustic flow imaging of whole blood with low-frequency detection**, Pim J. van den Berg, Khalid Daoudi, Wiendelt Steenbergen, Univ. Twente (Netherlands) . . . . . [9708-46]

2:45 pm: **Microvascular pressure estimation using compression and vessel-tracking photoacoustic microscopy**, Min Choi, Roger J. Zemp, Univ. of Alberta (Canada) . . . . . [9708-47]

3:00 pm: **Spectral correction of OA signals based on multiple irradiation sensing: experimental validation**, K. Gerrit Held, Michael Jaeger, Martin Frenz, Jaroslav Ricka, H. Günhan Akarçay, Univ. Bern (Switzerland) . . . . . [9708-48]

3:15 pm: **Measurement of changes in blood oxygenation using multispectral optoacoustic tomography (MSOT) allows assessment of tumor development**, Michal R. Tomaszewski, Univ. of Cambridge (United Kingdom) and Cancer Research UK (United Kingdom) and EPSRC-CRUK Cancer Imaging Ctr. in Cambridge and Manchester (United Kingdom); Isabel Quirós-Gonzalez, Cancer Research UK (United Kingdom); James Joseph, Univ. of Cambridge (United Kingdom) and Cancer Research UK (United Kingdom); Sarah E. Bohndiek, Univ. of Cambridge (United Kingdom) and Cancer Research UK (United Kingdom) and CRUK & EPSRC Cancer Imaging Ctr. in Cambridge & Manchester (United Kingdom) . . . . . [9708-49]

Coffee Break . . . . . Mon 3:30 pm to 4:00 pm

## SESSION 8

LOCATION: ROOM 2010 (WEST LEVEL 2) . . MON 4:00 PM TO 5:45 PM

### Spectroscopy and Analytic Sensing

Session Chairs: **Andreas Mandelis**, Univ. of Toronto (Canada); **Rinat O. Esenaliev**, The Univ. of Texas Medical Branch (USA)

4:00 pm: **Bayesian parameter estimation in spectral quantitative photoacoustic tomography**, Aki Pulkkinen, Univ. of Eastern Finland (Finland); Ben T. Cox, Simon R. Arridge, Univ. College London (United Kingdom); Jari P. Kaipio, Univ. of Eastern Finland (Finland) and The Univ. of Auckland (New Zealand); Tanja Tarvainen, Univ. of Eastern Finland (Finland) . . . . . [9708-50]

4:15 pm: **Nanoparticle-enhanced spectral photoacoustic tomography: effect of oxygen saturation and tissue heterogeneity**, William C. Vogt, Congxian Jia, Keith A. Wear, Brian S. Garra, T. Joshua Pfefer, U.S. Food and Drug Administration (USA) . . . . . [9708-51]

4:30 pm: **Combined photoacoustic and acousto-optic tomography setup for quantitative spectroscopy**, Altaf Hussain, Jacob W. Staley, Erwin Hondebrink, Khalid Daoudi, Wiendelt Steenbergen, Univ. Twente (Netherlands) . . . . [9708-52]

4:45 pm: **Photoacoustic spectroscopy using linear frequency modulation chirp**, Bahman Lashkari, Sung soo (Sean) Choi, Edem Dovlo, Andreas Mandelis, Univ. of Toronto (Canada) . . . . . [9708-53]

5:00 pm: **Photoacoustic physio-chemical analysis of liver conditions in human subjects**, Guan Xu, Chao Tian, Shanshan Wan, Theodore H. Welling, Anna S. F. Lok, Jonathan M. Rubin, Xueding Wang, Univ. of Michigan Medical School (USA) . . . . . [9708-54]

5:15 pm: **Lifetime-resolved photoacoustic (LPA) spectroscopy for monitoring oxygen change and photodynamic therapy (PDT)**, Janggun Jo, Chang Heon Lee, Raoul Kopelman, Xueding Wang, Univ. of Michigan (USA) . . . . . [9708-55]

5:30 pm: **Effect of optical wavelength on photoacoustic investigations of pulsatile blood flow**, Tae-Hoon Bok, Eno Hysi, Michael C. Kolios, Ryerson Univ. (Canada) . . . . . [9708-56]

## POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

Conference attendees are invited to attend the BIOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Comparison of spectral fitting and spectral differential as unmixing methods in multispectral photoacoustic imaging to visualize enzymatically activatable photoacoustic probe**, Takeshi Hirasawa, Shinpei Okawa, National Defense Medical College (Japan); Ryu J. Iwatate, Mako Kamiya, Yasuteru Urano, The Univ. of Tokyo (Japan); Miya Ishihara, National Defense Medical College (Japan) . . . . . [9708-130]

**Effects of the optical properties of gold nanoparticles on photoacoustic signals**, Shinpei Okawa, Takeshi Hirasawa, National Defense Medical College (Japan); Ryota Sato, Kyoto Univ. (Japan); Toshihiro Kushibiki, Miya Ishihara, National Defense Medical College (Japan); Toshiharu Teranishi, Kyoto Univ. (Japan) . . . . . [9708-131]

**Photoacoustic imaging and surface-enhanced Raman spectroscopy using dual modal contrast agents**, Sungjo Park, Seunghyun lee, Chulhong Kim, Pohang Univ. of Science and Technology (Korea, Republic of); Myeonggeun Cha, Dae-Hong Jeong, Seoul National Univ. (Korea, Republic of) . . . . [9708-132]

**Magnetic nanoparticles for thermal lysis and application in cancer treatment**, Sumana Das, Brahmanandam Javvaji, Sarath Chandra Veerla, D. Roy Mahapatra, Indian Institute of Science (India) . . . . . [9708-133]

**Depth discrimination in acousto-optic cerebral blood flow measurement simulation**, Adi Tsalach, Zeev Schiffer, Eliahu Ratner, Ilan Breskin, Reuven Zeitak, Revital Shechter, Michal Balberg, Ornim Medical Ltd. (Israel) . [9708-134]

**Improvement and evaluation of a low-cost laser diode photoacoustic microscopy system for ovarian tissue imaging**, Mohsen Erfanzadeh, Hassan S. Salehi, Patrick D. Kumavor, Quing Zhu, Univ. of Connecticut (USA) [9708-135]

**Acoustic characterization of a highly sensitive broadband all-optical ultrasound sensor without any deformable parts**, Stefan Preisser, Wolfgang Rohringer, Medizinische Univ. Wien (Austria) and XARION Laser Acoustics GmbH (Austria); Mengyang Liu, Zhe Chen, Boris Hermann, Christian Kollmann, Harald Sattmann, Behrooz Zabihian, Medizinische Univ. Wien (Austria); Stefan Zotter, Balthasar Fischer, XARION Laser Acoustics GmbH (Austria); Wolfgang Drexler, Medizinische Univ. Wien (Austria) . . . . . [9708-136]



# CONFERENCE 9708

## LOCATION: ROOM 2010 (WEST LEVEL 2)

BIOS

**Multi-wavelength source at 300 kHz pulse repetition rates using stimulated Raman scattering effect for photoacoustic imaging**, Soon-Woo Cho, Pusan National Univ. (Korea, Republic of); Sang-Won Lee, Heesung Kang, Korea Research Institute of Standards and Science (Korea, Republic of); Chang-Seok Kim, Pusan National Univ. (Korea, Republic of); Tae Geol Lee, Korea Research Institute of Standards and Science (Korea, Republic of) . . . [9708-137]

**Higher energy supercontinuum source suitable for photoacoustic microscopy**, Magalie M. Bondu, NKT Photonics A/S (Denmark) and Univ. of Kent (United Kingdom); Christopher D. Brooks, Peter M. Moselund, Lasse Leick, NKT Photonics A/S (Denmark); Adrian G. H. Podoleanu, Univ. of Kent (United Kingdom) . . . [9708-138]

**Optimization of light delivery for an intravascular photoacoustic array using Monte Carlo simulations**, Robin F. Castelino, Solomon Grant, Univ. of Toronto (Canada) and Sunnybrook Research Institute (Canada); F. Stuart Foster, Univ. of Toronto (Canada) and Sunnybrook Health Sciences Ctr. (Canada) . . . [9708-139]

**Label-free quantitative evaluation of atherosclerotic lipid by spectral-coded intravascular photoacoustic imaging**, Sihua Yang, South China Normal Univ. (China) . . . [9708-140]

**Acoustic resolution photoacoustic Doppler velocimetry: the heterogeneity requirement**, Joanna Bruncker, Paul C. Beard, Univ. College London (United Kingdom) . . . [9708-141]

**Experimental evaluation of cMUT and PZT transducers in receive only mode for photoacoustic imaging**, Omri Warshavski, Cyril Meynier, Nicolas Sénégond, Pascal Chatain, An Nguyen Dinh, Vermon S.A. (France) . . . [9708-142]

**Dual modality photoacoustic and optical coherence tomography imaging with angiographic extension**, Behrooz Zabihian, Laurin Ginner, Daniel J. Fechtig, Zhe Chen, Boris Hermann, Mengyang Liu, Rainer Andreas Leitgeb, Wolfgang Drexler, Medizinische Univ. Wien (Austria) . . . [9708-143]

**Investigation of breast cancer cell lines at different risk level using photoacoustic microscopic (PAM) technique**, Kenneth J. Zhou, Stony Brook Univ. (USA); Jun Chen, Tianjin Medical Univ. General Hospital (China) . . . [9708-144]

**Optically induced microbubbles around gold nanorods: the influence of particle parameters and environment on cavitation threshold**, Lucia Cavigli, Fulvio Ratto, Marella de Angelis, Sonia Centi, Sarah Lai, Alberto Cini, Istituto di Fisica Applicata "Nello Carrara" (Italy); Claudia Borri, Istituto di Fisica Applicata "Nello Carrara" (Italy) and Univ. degli Studi di Firenze (Italy); Stefano Colagrande, Univ. degli Studi di Firenze (Italy); Roberto Pini, Istituto di Fisica Applicata "Nello Carrara" (Italy) . . . [9708-145]

**Dynamics of double-pulse photoacoustic excitation**, Maxim N. Cherkashin, Carsten Brenner, Lena Göring, Benjamin Döpke, Nils C. Gerhardt, Martin R. Hofmann, Ruhr-Univ. Bochum (Germany) . . . [9708-146]

**All fiber sensor array for ultrasound sensing**, Haniel Gabai, Idan Steinberg, Avishay Eyal, Tel Aviv Univ. (Israel) . . . [9708-147]

**Photoacoustic imaging using lock-in amplification and tunable-repetition-rate pulsed fiber lasers**, Wei Shi, Roger J. Zemp, Univ. of Alberta (Canada) . . . [9708-148]

**Photoacoustic tomography of inflammatory arthritis based on a FDA-approved macrophage-targeted contrast agent clofazimine**, Chao Tian, Rahul K. Keswani, Gustavo Rosania, Xueding Wang, Univ. of Michigan (USA) . . . [9708-149]

**Numerical phantom for 3D optoacoustic breast imaging**, Yang Lou, Mark A. Anastasio, Catherine Appleton, Kenji Mitsuhashi, Washington Univ. in St. Louis (USA); Alexander A. Oraevsky, TomoWave Labs, Inc. (USA) . [9708-150]

**High-speed pre-clinical brain imaging using pulsed laser diode based photoacoustic tomography (PLD-PAT) system**, Paul Kumar Upputuri, Manojit Pramanik, Nanyang Technological Univ. (Singapore) . . . [9708-151]

**In vivo photoacoustic flowmetry in the optical diffusive regime based on saline injection**, Yong Zhou, Joemini Poudel, Guo Li, Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . [9708-152]

**Accuracy and feasibility of quantitative photoacoustic tomography inversion schemes: from simulation to experiment**, Martina B. Fonseca, Univ. College London (United Kingdom); Bajram Zeqiri, National Physical Lab. (United Kingdom); Paul C. Beard, Benjamin T. Cox, Univ. College London (United Kingdom) . . . [9708-153]

**Constrained independent component analysis for multiwavelength photoacoustic imaging**, Lu An, Paul C. Beard, Benjamin T. Cox, Univ. College London (United Kingdom) . . . [9708-154]

**Unmixing chromophores in human skin with a 3D multispectral optoacoustic mesoscopy system**, Mathias Schwarz, Juan Aguirre, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany); Dominik Soliman, Helmholtz Zentrum München GmbH (Germany) and Technische Universität München (Germany); Andreas Buehler, Vasilis Ntziachristos, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany) . . . [9708-155]

**Spectral correction of OA signals based on multiple irradiation sensing: theoretical considerations**, H. Günhan Akarçay, K. Gerrit Held, Jaroslav Ricka, Martin Frenz, Michael Jaeger, Univ. Bern (Switzerland) . . . [9708-156]

**Study of resting-state functional connectivity in the mouse brain using photoacoustic microscopy**, Ali Hariri, Nicholas Bely, Chen Chen, Mohammadreza Nasirivanaki, Wayne State Univ. (USA) . . . [9708-183]

## TUESDAY 16 FEBRUARY

### SESSION 9

LOCATION: ROOM 2010 (WEST LEVEL 2) . . TUE 8:15 AM TO 10:00 AM

### Novel Methods and Systems

Session Chairs: **Alexander A. Oraevsky**, TomoWave Labs, Inc. (USA); **Claude Boccara**, Institut Langevin (France)

8:15 am: **Dual-wavelength optical-resolution photoacoustic microscopy for cells with gold nanoparticle bioconjugates in three-dimensional cultures**, Po-Yi Lee, Wei-Wen Liu, Shu-Ching Chen, Pai-Chi Li, National Taiwan Univ. (Taiwan) . . . [9708-57]

8:30 am: **Cost-effective design of a concurrent photoacoustic-ultrasound microscope using single laser pulses**, Wen Shao Wu, Wei-Wen Liu, Pai-Chi Li, National Taiwan Univ. (Taiwan) . . . [9708-58]

8:45 am: **Photoacoustic imaging with multiple speckle illumination: towards deep tissue imaging below acoustic resolution**, Thomas Chaigne, Institut Langevin (France) and Lab. Kastler-Brossel (France); Jérôme Gateau, Institut Langevin (France); Marc Allain, Institut Fresnel (France); Ori Katz, Institut Langevin (France); Sylvain Gigan, Lab. Kastler-Brossel (France); Anne Sentenac, Institut Fresnel Equipe SEMO (France); Emmanuel Bossy, Institut Langevin (France) . . . [9708-59]

9:00 am: **Multi-acoustic lens design methodology for a low cost C-scan photoacoustic imaging camera**, Bhargava Kumar Chinni, Univ. of Rochester Medical Ctr. (USA); Zichao Han, Rochester Institute of Technology (USA); Nicholas Brown, Pedro P. Vallejo, Univ. of Rochester (USA); Tess Jacobs, Univ. of Rochester (USA); Wayne H. Knox, Univ. of Rochester (USA); Vikram S. Dogra, Univ. of Rochester Medical Ctr. (USA); Navalgund A. Rao, Rochester Institute of Technology (USA) . . . [9708-60]

9:15 am: **Reflection-artifact-free photoacoustic imaging using PAFUSion (photoacoustic-guided focused ultrasound)**, Mithun Kuniyil Ajith Singh, Univ. Twente (Netherlands); Michael Jaeger, Martin Frenz, Univ. Bern (Switzerland); Wiendelt Steenbergen, Univ. Twente (Netherlands) . . . [9708-61]

9:30 am: **Design and development of an endovaginal ultrasound and photoacoustic imaging system**, Yan Yan, Vishal Srivastava, Bhargava Saripalli, Sirisha Kondle, Mohammad Mehrmohammadi, Wayne State Univ. (USA) . . . [9708-62]

9:45 am: **3D optoacoustic tomography system for molecular imaging of contrast agents in small animals**, Richard Su, Anton Liopo, Sergey A. Ermilov, Alexander A. Oraevsky, TomoWave Labs, Inc. (USA) . . . [9708-63]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

### SESSION 10

LOCATION: ROOM 2010 (WEST LEVEL 2) . . TUE 10:30 AM TO 12:15 PM

### Novel Technologies and Applications

Session Chairs: **Srirang Manohar**, Univ. Twente (Netherlands); **Wiendelt Steenbergen**, Univ. Twente (Netherlands)

10:30 am: **Developing a slip-ring based multi-transducer photoacoustic tomography system**, Changhui Li, Zijian Deng, Peking Univ. (China) . . [9708-64]

10:45 am: **In vivo photoacoustic imaging of mouse brain voltage signals**, Bin Rao, Ruiying Zhang, Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . [9708-65]

11:00 am: **Solution-processed CNT-PDMS optoacoustic lens for long-range high-precision treatment**, Jeong Min Heo, Sungkyunkwan Univ. (Korea, Republic of); Ujwal Thakur, Hui Joon Park, Ajou Univ. (Korea, Republic of); Hyoung Won Baac, Sungkyunkwan Univ. (Korea, Republic of) . . . [9708-66]

# CONFERENCE 9708

## LOCATION: ROOM 2010 (WEST LEVEL 2)

11:15 am: **Non-contact optoacoustic imaging by raster scanning a piezoelectric air-coupled transducer**, Xosé Luis Deán-Ben, Helmholtz Zentrum München GmbH (Germany); Genny A. Pang, Technische Univ. München (Germany); Francisco Montero de Espinosa, Consejo Superior de Investigaciones Científicas (Spain); Daniel Razansky, Helmholtz Zentrum München GmbH (Germany) . . . . . [9708-67]

11:30 am: **A novel two-axis micromechanical scanning transducer for handheld 3D ultrasound and photoacoustic imaging**, Chih-Hsien Huang, Jun Zou, Texas A&M Univ. (USA) . . . . . [9708-68]

11:45 am: **Wavelength-modulated differential photoacoustic (WM-DPA) imaging towards noninvasive diagnosis of cancer**, Edem Dovlo, Bahman Lashkari, Andreas Mandelis, Univ. of Toronto (Canada) . . . . . [9708-69]

12:00 pm: **Engineering a near-infrared dark chromoprotein as a probe for photoacoustic imaging**, Yan Li, Quinn Barber, Robert J. Paproski, Jhon R. Enterina, Univ. of Alberta (Canada); Erik A. Rodriguez, Roger Y. Tsien, Univ. of California, San Diego (USA); Robert E. Campbell, Roger J. Zemp, Univ. of Alberta (Canada) . . . . . [9708-70]

Lunch Break . . . . . Tue 12:15 pm to 1:45 pm

### SESSION 11

## LOCATION: ROOM 2010 (WEST LEVEL 2) . . . . TUE 1:45 PM TO 3:30 PM

### Molecular Imaging with Contrast Agents

Session Chairs: **Pai-Chi Li**, National Taiwan Univ. (Taiwan); **Vladimir P. Zharov**, Univ. of Arkansas for Medical Sciences (USA)

1:45 pm: **Dual-wavelength photoacoustic imaging of a photoswitchable reporter protein**, Julia Märk, Hakan Dortay, Technische Univ. Berlin (Germany); Carsten Grötzinger, Charité Universitätsmedizin Berlin (Germany); Peter Hildebrandt, Thomas Friedrich, Technische Univ. Berlin (Germany); Jan Laufer, Technische Univ. Berlin (Germany) and Charité Universitätsmedizin Berlin (Germany) . . . . . [9708-71]

2:00 pm: **Motion corrected photoacoustic difference imaging of fluorescent contrast agents in vivo**, Julia Märk, Technische Univ. Berlin (Germany); Sarah Pönick, Carsten Grötzinger, Charité Universitätsmedizin Berlin (Germany); Edward Z. Zhang, Univ. College London (United Kingdom); Jan Laufer, Technische Univ. Berlin (Germany) and Charité Universitätsmedizin Berlin (Germany) . . . . . [9708-72]

2:15 pm: **Four dimensional optoacoustic imaging of perfusion in preclinical breast tumor model in vivo**, Xosé Luis Deán-Ben, Vladimir Ermolayev, Helmholtz Zentrum München GmbH (Germany); Subhamoy Mandal, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany); Vasilis Ntziachristos, Technische Univ. München (Germany) and Helmholtz Zentrum München GmbH (Germany); Daniel Razansky, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany) [9708-73]

2:30 pm: **Photoacoustic imaging and photothermal therapy using biodegradable melanoidin**, Changho Lee, Pohang Univ. of Science and Technology (Korea, Republic of); Min-Young Lee, Medical Device Research Ctr. (Korea, Republic of) and Samsung Advanced Institute of Technology (Korea, Republic of); Ho Sang Jung, Pohang Univ. of Science and Technology (Korea, Republic of); Mansik Jeon, Kyungpook National Univ. (Korea, Republic of); Sei Kwang Hahn, Chulhong Kim, Pohang Univ. of Science and Technology (Korea, Republic of) . . . . . [9708-74]

2:45 pm: **Monitoring cancer treatment response using photoacoustic and ultrasound spectral analysis in combination with oxygenation and perfusion measurements**, Eno Hysi, Ryerson Univ. (Canada); Jonathan P. May, The Univ. of British Columbia (Canada); Lauren Wirtzfeld, Ryerson Univ. (Canada); Eljuz Undzys, Ontario Institute for Cancer Research (Canada); Shyh-Dar Li, The Univ. of British Columbia (Canada); Michael C. Kolios, Ryerson Univ. (Canada) . . . . . [9708-75]

3:00 pm: **Imaging the distribution of photoswitchable probes with temporally-unmixed multispectral optoacoustic tomography**, Xosé Luis Deán-Ben, Helmholtz Zentrum München GmbH (Germany); Andre C. Stiel, Max-Planck-Gesellschaft (Germany); Yuanyuan Jiang, Vasilis Ntziachristos, Gil Westmeyer, Daniel Razansky, Helmholtz Zentrum München GmbH (Germany) . . . . . [9708-76]

3:15 pm: **Biodegradable polymer based theranostic agents for photoacoustic imaging and cancer therapy**, Yan J. Wang, Eric M. Strohm, Michael C. Kolios, Ryerson Univ. (Canada) . . . . . [9708-77]

Coffee Break . . . . . Tue 3:30 pm to 4:00 pm

### SESSION 12

## LOCATION: ROOM 2010 (WEST LEVEL 2) . . . TUE 4:00 PM TO 5:45 PM

### Signal Processing and Image Reconstruction

Session Chairs: **Mark A. Anastasio**, Washington Univ. in St. Louis (USA); **Andreas Mandelis**, Univ. of Toronto (Canada)

4:00 pm: **Multispectral reconstruction methods for quantitative photoacoustic tomography**, Emma Malone, Benjamin T. Cox, Simon R. Arridge, Univ. College London (United Kingdom) . . . . . [9708-78]

4:15 pm: **Sparsifying transformations of photoacoustic signals enabling compressed sensing algorithms**, Peter Burgholzer, Research Ctr. for Non Destructive Testing GmbH (Austria); Markus Sandbichler, Univ. of Innsbruck (Austria); Felix Kramer, Georg-August-Univ. Göttingen (Germany); Thomas Berer, Research Ctr. for Non Destructive Testing GmbH (Austria); Markus Haltmeier, Univ. of Innsbruck (Austria) . . . . . [9708-79]

4:30 pm: **In vivo light fluence correction for determination of tissue absorption coefficient using multispectral optoacoustic tomography**, Frederic M. Brochu, James Joseph, Michal R. Tomaszewski, Sarah E. Bohndiek, Univ. of Cambridge (United Kingdom) . . . . . [9708-80]

4:45 pm: **Optoacoustic imaging quality enhancement based on geometrical super-resolution method**, Hailong He, Subhamoy Mandal, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany); Andreas Buehler, Xosé Luis Deán-Ben, Helmholtz Zentrum München GmbH (Germany); Daniel Razansky, Vasilis Ntziachristos, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany) . . . . . [9708-81]

5:00 pm: **Taking advantage of acoustic inhomogeneities in photoacoustic measurements**, Anabela da Silva, Institut Fresnel (France); Charles Handschin, Institut Fresnel (France) and SATT PACA Corse SAS (France); Christophe Riedinger, Institut Fresnel (France) and SATT PACA Corse SAS (France); Julien Piasecki, SATT PACA Corse SAS (France); Serge Mensah, Ctr. National de la Recherche Scientifique (France); Amelie Litman, Institut Fresnel Equipe HIPE (France); Hassan Akhouyari, Institut Fresnel (France) . . . . . [9708-82]

5:15 pm: **Multi-view Hilbert transform on full-ring photoacoustic computed tomography**, Lei Li, Guo Li, Liren Zhu, Washington Univ. in St. Louis (USA); Jun Xia, Univ. at Buffalo (USA); Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . . . [9708-83]

5:30 pm: **Deconvolution based photoacoustic reconstruction for directional transducer with sparsity regularization**, Hamid Moradi, Shuo Tang, Tim E. Salcudean, The Univ. of British Columbia (Canada) . . . . . [9708-84]

### POSTERS-TUESDAY

## LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the BIOS and LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Axial-resolution improved optical resolution photoacoustic microscopy using convex optimization based deconvolution**, Ke-Cian Li, Chung-Yi Tsao, Meng-Lin Li, National Tsing Hua Univ. (Taiwan) . . . . . [9708-157]

**Photoacoustic image reconstruction utilizing ultrasound post-beamformed B-mode image**, Haichong K. Zhang, Xiaoyu Guo, Hyun Jae Kang, Emad M. Boctor, Johns Hopkins Univ. (USA) . . . . . [9708-159]

**Variational image reconstruction for dynamic high resolution photoacoustic tomography**, Felix Lucka, Marta M. Betcke, Nam Trung Huynh, Edward Z. Zhang, Paul C. Beard, Benjamin T. Cox, Simon R. Arridge, Univ. College London (United Kingdom) . . . . . [9708-160]

**Automatic speed of sound correction with photoacoustic image reconstruction**, Meng Ye, Nanjing Univ. (China); Meng Cao, Nanjing Univ (China); Ting Feng, Jie Yuan, Nanjing Univ. (China); Qian Cheng, Tongji University (China); Xiaojun Liu, Nanjing Univ (China); Guan Xu, Xueding Wang, Univ. of Michigan Medical School (USA) . . . . . [9708-161]

**Freehand photoacoustic tomography for 3D angiography using local gradient information**, Thomas Kirchner, Esther Wild, Klaus H. Maier-Hein, Lena Maier-Hein, Deutsches Krebsforschungszentrum (Germany) . . . . . [9708-162]

# CONFERENCE 9708

LOCATION: ROOM 2010 (WEST LEVEL 2)

BIOS

**Correction of light attenuation using segmentation prior in multispectral optoacoustic tomography**, Subhamoy Mandal, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany); Xosé Luis Deán-Ben, Helmholtz Zentrum München GmbH (Germany); Daniel Razansky, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany) . . . . . [9708-163]

**Differential phase photoacoustic imaging for enhanced lateral and axial resolution imaging**, Sophine Iskander-Rizk, Pieter Kruizinga, Gijs van Soest, Erasmus MC (Netherlands); Antonius F. W. van der Steen, Erasmus MC (Netherlands) and Interuniversity Cardiology Institute (Netherlands) and Technische Univ. Delft (Netherlands) . . . . . [9708-165]

**Image reconstruction with noise and error modelling in quantitative photoacoustic tomography**, Tanja Tarvainen, Univ. of Eastern Finland (Finland) and Univ. College London (United Kingdom); Aki Pulkkinen, Univ. of Eastern Finland (Finland); Ben T. Cox, Univ. College London (United Kingdom); Jari P. Kaipio, Univ. of Eastern Finland (Finland) and The Univ. of Auckland (New Zealand); Simon R. Arridge, Univ. College London (United Kingdom) . [9708-166]

**High-frequency linear-array photoacoustic tomography image reconstruction based on multi-view image restoration**, Liren Zhu, Guo Li, Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . . . [9708-167]

**Compensation of acoustic heterogeneities in photoacoustic computed tomography via a temporal data truncation reconstruction method**, Joemini Poudel, Thomas Paul Matthews, Lei Li, Mark A. Anastasio, Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . . . [9708-168]

**Application of signal detection theory to assess imaging depth in photoacoustic imaging of the breast**, Yang Lou, Mark A. Anastasio, Washington Univ. in St. Louis (USA); Alexander A. Oraevsky, TomoWave Labs, Inc. (USA). . . . . [9708-169]

**Compensation for the effect of air voids in photoacoustic computed tomography image reconstruction**, Thomas P. Matthews, Lei Li, Lihong V. Wang, Mark A. Anastasio, Washington Univ. in St. Louis (USA). . . . . [9708-170]

**In vivo photoacoustic tomography of myoglobin oxygen saturation**, Li Lin, Junjie Yao, Lei Li, Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . . . [9708-171]

**Cuffing-based photoacoustic flowmetry in humans at depths in the diffusive regime**, Yong Zhou, Jinyang Liang, Lihong V. Wang, Washington Univ. in St. Louis (USA). . . . . [9708-172]

**Non-traveling wave approach of the photoacoustic Z-scan measurements on biomaterials**, Rafael Perez-Solano, Gerardo Gutiérrez-Juárez, Univ. de Guanajuato (Mexico); Luis Polo-Parada, Univ. of Missouri (USA); Alejandro Martinez, Bartolome Reyes-Ramirez, Univ. de Guanajuato (Mexico) . . [9708-173]

**All optical fiber combined imaging system of photoacoustic and optical coherence tomography**, Jonghyun Eom, Jun Geun Shin, Soongho Park, Byeong Ha Lee, Gwangju Institute of Science and Technology (Korea, Republic of) . . . . . [9708-174]

**Multiple-illumination photoacoustic-ultrasound tomography**, Quinn Barber, Roger J. Zemp, Univ. of Alberta (Canada) . . . . . [9708-175]

**Simulated microsurgery monitoring using intraoperative multimodal surgical microscopy**, Donghyun Lee, Changho Lee, Sehui Kim, Pohang Univ. of Science and Technology (Korea, Republic of); Jeehyun Kim, Kyungpook National Univ. (Korea, Republic of); Chulhong Kim, Pohang Univ. of Science and Technology (Korea, Republic of) . . . . . [9708-176]

**Optoacoustic monitoring of cerebral, central, and peripheral blood oxygenation with multi-wavelength, fiber-coupled, high-power, compact laser diode-based system**, Yuriy Y. Petrov, Irene Y. Petrov, Donald S. Prough, Andrey Petrov, Rinat O. Esenaliev, The Univ. of Texas Medical Branch (USA) . . . . . [9708-177]

**Transmission (forward) mode, transcranial, noninvasive optoacoustic measurements for brain monitoring, imaging, and sensing**, Irene Y. Petrov, Yuriy Y. Petrov, Donald S. Prough, C. Joan Richardson, Rafael A. Fonseca, The Univ. of Texas Medical Branch (USA); Claudia S. Robertson, Vasantha Asokan, Adaeze Agbor, Baylor College of Medicine (USA); Rinat O. Esenaliev, The Univ. of Texas Medical Branch (USA). . . . . [9708-178]

**Intravascular imaging of ex-vivo atherosclerotic rabbit vessels using ultrasound and frequency domain photoacoustics**, Robin F. Castellino, Univ. of Toronto (Canada) and Sunnybrook Research Institute (Canada); Hyunggyun Lee, Sunnybrook Research Institute (Canada); F. Stuart Foster, Univ. of Toronto (Canada) and Sunnybrook Research Institute (Canada) . . . . . [9708-179]

**Ability of combined NIRS-IVUS imaging to detect lipid core plaques and estimate cap thickness in human autopsy coronary arteries**, Stephanie Grainger, Jimmy Su, Cherry A. Greiner, InfraReDx, Inc. (USA); Matthew D. Saybolt, Robert L. Wilensky, Hospital of the Univ. of Pennsylvania (USA); Joel S. Raichlen, AstraZeneca Pharmaceuticals LP (USA); Sean P. Madden, James E. Muller, InfraReDx, Inc. (USA) . . . . . [9708-180]

**Aortic atherosclerotic plaque detection using a multiwavelength handheld optoacoustic imaging system**, Susumu Hirano, Takeshi Namita, Kengo Kondo, Makoto Yamakawa, Tsuyoshi Shiina, Kyoto Univ. (Japan) . . . [9708-181]

**Comparison between transrectal photoacoustic, Doppler and magnetic resonance imaging for prostate cancer detection**, Miya Ishihara, Akio Horiguchi, Hiroshi Shinmoto, Hitoshi Tsuda, National Defense Medical College (Japan); Kaku Irisawa, Takatsugu Wada, FUJIFILM Corp. (Japan); Tomohiko Asano, National Defense Medical College (Japan) . . . . . [9708-182]

**Evaluation of Fabry-Perot polymer film sensors made using hard dielectric mirror deposition**, Jens Buchmann, Technische Univ. Berlin (Germany); Edward Z. Zhang, Univ. College London (United Kingdom); Chris Scharfenorth, Bastian Spannekrebs, Technische Univ. Berlin (Germany); Claus Villringer, Technische Hochschule Wildau (Germany); Jan Laufer, Technische Univ. Berlin (Germany) and Charité Universitätsmedizin Berlin (Germany) . . . . . [9708-185]

## WEDNESDAY 17 FEBRUARY

### SESSION 13

LOCATION: ROOM 2010 (WEST LEVEL 2) WED 8:15 AM TO 10:00 AM

### Microscopy

Session Chairs: **Lihong V. Wang**, Washington Univ. in St. Louis (USA); **Jonathan Pollock**, National Institutes of Health (USA)

8:15 am: **Light-sheet photoacoustic microscopy (LIS-PAM) with optical ultrasound detection**, Robert Nuster, Karl-Franzens-Univ. Graz (Austria); Paul Slezak, Ludwig Boltzmann Institut (Austria); Guenther Paltauf, Karl-Franzens-Univ. Graz (Austria) . . . . . [9708-85]

8:30 am: **Functional multi-scale photoacoustic remote sensing microscopy**, Parsin Haji Reza, Kevan Bell, Wei Shi, Roger J. Zemp, Univ. of Alberta (Canada) . . . . . [9708-86]

8:45 am: **Acoustic and photoacoustic microscopy imaging of single leukocytes**, Eric M. Strohm, Michael Moore, Michael C. Kolios, Ryerson Univ. (Canada) . . . . . [9708-87]

9:00 am: **Fully integrated reflection-mode photoacoustic/two-photon microscopy in vivo**, Liang Song, Wei Song, Yang Zhang, Wei Zheng, Shenzhen Institute of Advanced Technology (China) . . . . . [9708-88]

9:15 am: **Mechanisms and models for photoacoustic remote sensing microscopy**, Roger J. Zemp, W. Shi, Parsin Haji Reza, Univ. of Alberta (Canada) . . . . . [9708-89]

9:30 am: **Super-resolution photoacoustic imaging of single gold nanoparticles**, Seunghyun Lee, Pohang Univ. of Science and Technology (Korea, Republic of); Owoong Kwon, Sungkyunkwan Univ. (Korea, Republic of); Mansik Jeon, Kyungpook National Univ. (Korea, Republic of); Jaejung Song, Minguk Jo, Junwoo Son, Sungjee Kim, Pohang Univ. of Science and Technology (Korea, Republic of); Yunseok Kim, Sungkyunkwan Univ. (Korea, Republic of); Chulhong Kim, Pohang Univ. of Science and Technology (Korea, Republic of) . . . . . [9708-90]

9:45 am: **Non-linear photoacoustic and fluorescence microscopy using a modulated laser diode**, Gregor Langer, Thomas Berer, Research Ctr. for Non Destructive Testing GmbH (Austria) . . . . . [9708-91]

Coffee Break . . . . . Wed 10:00 am to 10:30 am

### SESSION 14

LOCATION: ROOM 2010 (WEST LEVEL 2) WED 10:30 AM TO 12:15 PM

### Tomography with Optical Interferometry Detection

Session Chair: **Peter Burgholzer**, Research Ctr. for Non Destructive Testing GmbH (Austria)

10:30 am: **Multibeam Fabry Perot photoacoustic scanner for fast 2D and 3D imaging**, Nam Trung Huynh, Olumide Ogunlade, Edward Z. Zhang, Benjamin T. Cox, Paul C. Beard, Univ. College London (United Kingdom) . . . . . [9708-92]

10:45 am: **Photoacoustic imaging with ultra-sensitive plano-concave optical microresonator detectors**, James A. Guggenheim, Edward Z. Zhang, Paul C. Beard, Univ. College London (United Kingdom). . . . . [9708-93]

11:00 am: **Enhanced field of view in-vivo photoacoustic tomography using orthogonal Fabry-Pérot planar sensor arrays**, Robert J. Ellwood, Edward Z. Zhang, Paul C. Beard, Benjamin T. Cox, Univ. College London (United Kingdom) . . . . . [9708-94]



# CONFERENCE 9708

## LOCATION: ROOM 2010 (WEST LEVEL 2)

11:15 am: **Resolution and contrast of an optical full-field holographic system for fast non-contact photoacoustic tomography**, Michael M $\ddot{u}$ nter, Jens Horstmann, Christian Buj, Benedikt Schmarbeck, Univ. zu L $\ddot{u}$ beck (Germany); Ralf Brinkmann, Univ. zu L $\ddot{u}$ beck (Germany) and Medizinisches Laserzentrum L $\ddot{u}$ beck GmbH (Germany). . . . . [9708-95]

11:30 am: **Grüneisen relaxation photoacoustic microscopy in vivo**, Jun Ma, Junhui Shi, Pengfei Hai, Yong Zhou, Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . . . [9708-97]

11:45 am: **Miniature fiber optic probe for minimally invasive photoacoustic sensing**, Sunish J. Mathews, Edward Z. Zhang, Adrien E. Desjardins, Paul C. Beard, Univ. College London (United Kingdom) . . . . . [9708-98]

12:00 pm: **Advanced photoacoustic image reconstruction using the k-Wave toolbox**, Bradley E. Treeby, Edward Z. Zhang, Paul C. Beard, Ben T. Cox, Univ. College London (United Kingdom) . . . . . [9708-158]

Lunch Break . . . . .Wed 12:15 pm to 1:45 pm

### SESSION 15

#### LOCATION: ROOM 2010 (WEST LEVEL 2) . . . WED 1:45 PM TO 2:30 PM

### Hot Topics and Latest Results

Session Chairs: **Changhui Li**, Peking Univ. (China); **Qifa Zhou**, The Univ. of Southern California (USA)

1:45 pm: **A Monte Carlo investigation on quantifying the retinal pigment epithelium melanin concentration by photoacoustic ophthalmoscopy**, Xiao Shu, Hao F. Zhang, Wenzhong Liu, Northwestern Univ. (USA) . . . . . [9708-99]

2:00 pm: **High speed photoacoustic imaging with fast OPO laser at 1.7  $\mu$ m**, Zhonglie Piao, Beckman Laser Institute and Medical Clinic (USA) and Pusan National Univ. (Korea, Republic of); Ma Teng, The Univ. of Southern California (USA); Jiawen Li, Yueqiao Qu, Beckman Laser Institute and Medical Clinic (USA); Mingyue Yu, K. Kirk Shung, Qifa Zhou, The Univ. of Southern California (USA); Chang-Seok Kim, Pusan National Univ. (Korea, Republic of); Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9708-100]

2:15 pm: **Reversibly switchable photoacoustic tomography using a genetically-encoded near-infrared phytochrome**, Junjie Yao, Washington Univ. in St. Louis (USA); Andrii A. Kaberniuk, Albert Einstein College of Medicine (USA); Lei Li, Washington Univ. in St. Louis (USA); Daria M. Shcherbakova, Albert Einstein College of Medicine (USA); Ruiying Zhang, Lidai Wang, Guo Li, Washington Univ. in St. Louis (USA); Vladislav V. Verkhusha, Albert Einstein College of Medicine (USA); Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . . . [9708-184]

### Seno Medical Best Paper Award

2:30 PM TO 3:00 PM

LOCATION: ROOM 2010 (WEST LEVEL 2)

Session Chairs: **Alexander A. Oraevsky**, TomoWave Laboratories, Inc. (USA); **Lihong V. Wang**, Washington Univ. in St. Louis (USA)

Seno Medical Instruments of San Antonio, Texas, will sponsor the "Best Paper Award" at this conference (Certificate of recognition to all coauthors and \$3,000). To qualify for the Award authors must present their papers at the conference (oral or poster) and submit proceedings manuscripts (4 to 12 pages) by no later than midnight, Saturday, 27 February 2016. Awards will be announced on the SPIE website and by email no later than 1 June 2016 and officially presented at the opening ceremony of next year's conference.

PRIZE DONATED BY:





# CONFERENCE 9709

LOCATION: ROOM 3005 (WEST LEVEL 3)

Monday 15 February 2016 • Proceedings of SPIE Vol. 9709

# Biophotonics and Immune Responses XI

BIOS

Conference Chair: **Wei R. Chen**, Univ. of Central Oklahoma (USA)

Program Committee: **Gianfranco L. Canti**, Univ. degli Studi di Milano (Italy); **Sandra O. Gollnick**, Roswell Park Cancer Institute (USA); **Yueqing Gu**, China Pharmaceutical Univ. (China); **Michael R. Hamblin**, Wellman Ctr. for Photomedicine (USA); **Tomas Hode**, Immunophotonics, Inc. (USA); **Yih-Chih Hsu**, Chung Yuan Christian Univ. (Taiwan); **Zheng Huang**, Univ. of Colorado Denver (USA); **Vyacheslav Kalchenko**, Weizmann Institute of Science (Israel); **Mladen Korbelik**, BC Cancer Research Ctr. (Canada); **Mark F. Naylor**, Dermatology Associates of San Antonio (USA); **Karl-Goran Tranberg**, CLS Ltd. (Sweden); **Valery V. Tuchin**, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); **Xunbin Wei**, Shanghai Jiao Tong Univ. (China); **Da Xing**, South China Normal Univ. (China); **Zhihong Zhang**, Huazhong Univ. of Science and Technology (China); **Vladimir P. Zharov**, Univ. of Arkansas for Medical Sciences (USA)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: ROOM 3005 (WEST LEVEL 3) MON 8:00 AM TO 10:00 AM

#### PDT and Immune Responses

Session Chairs: **Yih-Chih Hsu**, Chung Yuan Christian Univ. (Taiwan); **Mladen Korbelik**, BC Cancer Research Ctr. (Canada)

8:00 am: **Cancer cell killing and immunotolerance reversal by PDT and PTT: role of ER stress** (*Invited Paper*), Mladen Korbelik, BC Cancer Research Ctr. (Canada) . . . . . [9709-1]

8:25 am: **Photodynamic therapy and anti-tumor immune response** (*Invited Paper*), Michael R. Hamblin, Wellman Ctr. for Photomedicine (USA) . . . . . [9709-2]

8:50 am: **Therapeutic effect of photodynamic therapy combined with targeted delivery of silencing vascular endothelial growth factor** (*Invited Paper*), Yih-Chih Hsu, Chung Yuan Christian Univ. (Taiwan) . . . . . [9709-3]

9:15 am: **Anti-tumor immune response in glioblastoma induced by 5-ALA-based PDT?** (*Invited Paper*), Ronald Sroka, Laser-Forschungslabor (Germany) and Klinikum der Univ. München (Germany); Herbert Stepp, LIFE Ctr. (Germany) and Klinikum der Univ. München (Germany); Heike Pohla, Klinikum der Univ. München (Germany); Robert Kammerer, Friedrich-Loeffler-Institut (Germany); Alexander Buchner, Patricia Müller, LIFE Ctr. (Germany) and Klinikum der Univ. München (Germany); Sara Abdel Hamid, LIFE Ctr. (Germany) and The German Univ. in Cairo (Egypt) and Klinikum der Univ. München (Germany); Wolfgang Zimmermann, LIFE Ctr. (Germany) and Klinikum der Univ. München (Germany) . . . . . [9709-4]

9:40 am: **The role of DAMPS in ALA-PDT for skin squamous cell carcinoma**, Xiuli Wang, Xiaojie Wang, Jie Ji, Haiyan Zhang, Lei Shi, Shanghai Skin Disease Hospital (China) . . . . . [9709-5]

Coffee Break . . . . . Mon 10:00 am to 10:30 am

### SESSION 2

LOCATION: ROOM 3005 (WEST LEVEL 3) MON 10:30 AM TO 12:20 PM

#### Laser-Nanotechnology and Immune Responses

Session Chairs: **Feifan Zhou**, Univ. of Central Oklahoma (USA); **Zhihong Zhang**, Huazhong Univ. of Science and Technology (China)

10:30 am: **Photo-nano immunotherapy for metastatic cancer using synergistic nano-particle** (*Invited Paper*), Feifan Zhou, Univ. of Central Oklahoma (USA) . . . . . [9709-6]

10:55 am: **Peptide-lipid nanoparticle-based vaccine for tumor immunotherapy** (*Invited Paper*), Zhihong Zhang, Huazhong Univ. of Science and Technology (China) . . . . . [9709-7]

11:20 am: **Fast, accurate and sensitive detection of anti-PEG using surface plasmon resonance sensor**, Fang Sun, Shaoyi Jiang, Qiuming Yu, Univ. of Washington (USA) . . . . . [9709-8]

11:40 am: **In vitro photothermal effects of 808nm gold nanorods and indocyanine green on metastatic pancreatic tumor model using an 805nm diode laser**, Aamr M. Hasanjee, Eliviva Layton, Kegan Silk, Cody F. Bahavar, Connor L. West, Austin Doughty, Feifan Zhou, Wei R. Chen, Univ. of Central Oklahoma (USA) . . . . . [9709-9]

12:00 pm: **Size-dependent cytotoxicity of gold nanoparticles to rabbit articular chondrocytes**, Xiao-Ping Wang, The First Affiliated Hospital of Jinan Univ. (China) . . . . . [9709-10]

Lunch Break . . . . . Mon 12:20 pm to 1:50 pm

### SESSION 3

LOCATION: ROOM 3005 (WEST LEVEL 3) . . MON 1:50 PM TO 3:45 PM

#### In vivo Detection of Immune Responses

Session Chairs: **Xunbin Wei**, Shanghai Jiao Tong Univ. (China); **Ekaterina I. Galanzha**, Univ. of Arkansas for Medical Sciences (USA)

1:50 pm: **Label-free detection of circulating melanoma cells by in vivo photoacoustic flow cytometry** (*Invited Paper*), Xunbin Wei, Shanghai Jiao Tong Univ. (China) . . . . . [9709-11]

2:15 pm: **New insight in quantitative analysis of vascular permeability during immune reaction** (*Invited Paper*), Vyacheslav Kalchenko, Weizmann Institute of Science (Israel); Guillaume Molodij, Weizmann Institute of Science (Israel) and Observatoire de Paris à Meudon (France); Yuri Kuznetsov, Weizmann Institute of Science (Israel); Yuri Smolyakov, Chita State Medical Academy (Russian Federation); David Israeli, Jerusalem Mental Health Ctr., The Hebrew Univ. Hadassah Medical School (Israel); Igor Meglinski, Univ. of Oulu (Finland); Alon Harmelin, Weizmann Institute of Science (Israel) . . . . . [9709-12]

2:40 pm: **In vivo single cell analysis: detection of circulating platelets for assessment of thrombosis and immunity** (*Invited Paper*), Ekaterina I. Galanzha, Vladimir P. Zharov, Univ. of Arkansas for Medical Sciences (USA) . . . . . [9709-13]

3:05 pm: **Two-photon flow cytometer with laser scanning Bessel beams**, Yongdong Wang, Kevin M. Honsaker, Chunqiang Li, The Univ. of Texas at El Paso (USA) . . . . . [9709-14]

3:25 pm: **Imaging neutrophil migration dynamics using micro-optical coherence tomography**, Kengyeh K. Chu, Lael Yonker, Massachusetts General Hospital (USA); Avira Som, Massachusetts Institute of Technology (USA); Michael Pazos, Mark E. Kusek, Bryan P. Hurley, Guillermo J. Tearney, Massachusetts General Hospital (USA) . . . . . [9709-15]

Coffee Break . . . . . Mon 3:45 pm to 4:15 pm

### SESSION 4

LOCATION: ROOM 3005 (WEST LEVEL 3) . . . MON 4:15 PM TO 5:15 PM

#### inCVAX and Immune Responses

Session Chairs: **Mark F. Naylor**, Dermatology Associates of San Antonio (USA); **Siu Kit Lam**, Immunophotonics, Inc. (USA)

4:15 pm: **The importance of logical application of immunotherapy techniques: ISPI followed by checkpoint inhibitors**, Mark F. Naylor, Dermatology Associates of San Antonio (USA); Feifan Zhou, Univ. of Central Oklahoma (USA); Robert E. Nordquist, Wound Healing of Oklahoma, Inc. (USA); Aamr M. Hasanjee, Wei R. Chen, Univ. of Central Oklahoma (USA) . . . [9709-16]

4:35 pm: **Development of inCVAX for treatment of metastatic cancers: milestones of a biotech company**, Tomas Hode, Luciano Alleruzzo, Joseph Raker, Samuel Siu Kit Lam, Robert E. Nordquist, Immunophotonics, Inc. (USA); Wei R. Chen, Univ. of Central Oklahoma (USA) . . . . . [9709-17]

4:55 pm: **inCVAX, a novel in situ autologous cancer vaccine**, Siu Kit Lam, Immunophotonics, Inc. (USA); Feifan Zhou, Univ. of Central Oklahoma (USA); Tomas Hode, Immunophotonics, Inc. (USA); Robert E. Nordquist, Wound Healing of Oklahoma, Inc. (USA); Luciano Alleruzzo, Joseph Raker, Immunophotonics, Inc. (USA); Wei R. Chen, Univ. of Central Oklahoma (USA) . . . . . [9709-18]

# CONFERENCE 9709

LOCATION: ROOM 3005 (WEST LEVEL 3)

## SESSION 5

LOCATION: ROOM 3005 (WEST LEVEL 3) . . . MON 5:15 PM TO 6:15 PM

### Novel Detection Techniques

Session Chairs: **Vyacheslav Kalchenko**, Weizmann Institute of Science (Israel); **Yuchen Qiu**, The Univ. of Oklahoma (USA)

5:15 pm: Applying deep learning technology to automatically identify metaphase chromosomes using scanning microscopic images: an initial investigation, Yuchen Qiu, The Univ. of Oklahoma (USA); Xianglan Lu, The Univ. of Oklahoma Health Sciences Ctr. (USA); Shiju Yan, Univ. of Shanghai for Science and Technology (China); Maxine Tan, The Univ. of Oklahoma (USA); Samuel Cheng, The Univ. of Oklahoma–Tulsa (USA); Shibo Li, The Univ. of Oklahoma Health Sciences Ctr. (USA); Hong Liu, Bin Zheng, The Univ. of Oklahoma (USA) . . . . . [9709-19]

5:35 pm: **Photoacoustic image-guided drug delivery in prostate**, Shanshan Tang, Jian Chen, Pratik Samant, Liangzhong Xiang, The Univ. of Oklahoma (USA) . . . . . [9709-20]

5:55 pm: **Phantom characterization of a micro computed tomography system**, Muhammad U. Ghani, Liqiang Ren, Zheng Li, The Univ. of Oklahoma (USA); Kai Yang, Massachusetts General Hospital (USA); Wei Chen, Univ. of Central Oklahoma (USA); Hong Liu, The Univ. of Oklahoma (USA) . . . . . [9709-21]

## POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

Conference attendees are invited to attend the BIOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Tracking tumor metastases using molecularly-targeted contrast agent assisted MRI**, Austin Doughty, Aamr Hasanjee, Blake Young, Univ. of Central Oklahoma (USA); Nataliya Smith, Debra Saunders, Rheel A. Towner, Oklahoma Medical Research Foundation (USA); Wei R. Chen, Univ. of Central Oklahoma (USA) . . . . . [9709-22]

**Studying infrared light therapy for treating Alzheimer's disease**, Xunbin Wei, Shanghai Jiao Tong Univ. (China) . . . . . [9709-23]

**CT/ FMT dual-modal imaging of breast cancer based on peptide-lipid nanoparticles**, Zhihong Zhang, Guoqiang Xu, Huazhong Univ. of Science and Technology (China) . . . . . [9709-24]

**Laser inactivation of pathogenic viruses in water**, Aleksandr S. Grishkanich, Aleksandr P. Zhevlakov, ITMO Univ. (Russian Federation); Igor S. Sidorov, Univ. of Eastern Finland (Finland); Sergey V. Kascheev, Julia Ruzankina, ITMO Univ. (Russian Federation) . . . . . [9709-25]

**The effects of laser immunotherapy on cancer cell migration**, Cody F. Bahavar, Feifan Zhou, Aamr M. Hasanjee, Wei R. Chen, Melville B. Vaughan, Univ. of Central Oklahoma (USA) . . . . . [9709-26]

**Artesunate induces ROS-independent apoptosis in HepG2 cells**, Tongsheng Chen, South China Normal Univ. (China) . . . . . [9709-27]

**Clearance pathways and tumor targeting of nanomedicines**, Jie Zheng, Mengxiao Yu, The Univ. of Texas at Dallas (USA) . . . . . [9709-28]

**The interaction between Beclin 1 and Bax in Alzheimer's disease**, Lan Zhang, Guangzhou Medical Univ. (China) . . . . . [9709-29]

**Temperature distribution in target tumor tissue and photothermal tissue destruction during laser immunotherapy**, Austin Doughty, Aamr M. Hasanjee, Connor West, Kegan Silk, Feifan Zhou, Wei R. Chen, Univ. of Central Oklahoma (USA) . . . . . [9709-30]

**Optimized acquisition time of spectra in quantitative x-ray fluorescence (XRF) analysis of gold nanoparticles (GNPs)**, Liqiang Ren, Di Wu, Yuhua Li, The Univ. of Oklahoma (USA); Wei R. Chen, Univ. of Central Oklahoma (USA); Bin Zheng, Hong Liu, The Univ. of Oklahoma (USA) . . . . . [9709-31]

**The synergistic effects of radiofrequency ablation (RFA) with glycated chitosan (GC) for inhibiting the metastasis of breast cancer**, Hsin-Yu Chiu, Yi-Jang Lee, National Yang-Ming Univ. (Taiwan); Jyh-Der Leu, Taipei City Hospital (Taiwan); Wei R. Chen, Univ. of Central Oklahoma (USA) . . . . . [9709-32]

**Cisplatin encapsulated nanoparticle as a therapeutic agent for anticancer treatment**, Yih-Chih Hsu, Chung Yuan Christian Univ. (Taiwan); Leaf Huang, Chung Yuan Christian Univ. (Taiwan) and The Univ. of North Carolina at Chapel Hill (USA); Eka Putra Gusti Ngurah Putu, Chung Yuan Christian Univ. (Taiwan) . . . . . [9709-33]

**Alterations of morphology of immune organs and peripheral blood indicators under the influence of gold nanoparticles in rats**, Alla B. Bucharskaya, Svetlana S. Pakhomiy, Olga V. Zlobina, Galina N. Maslyakova, Olga V. Matveeva, Irina O. Bugaeva, Nikita A. Navolokin, Saratov State Medical Univ. (Russian Federation); Boris N. Khlebtsov, Vladimir A. Bogatyrev, Nikolai G. Khlebtsov, Institute of Biochemistry and Physiology of Plants and Microorganisms (Russian Federation); Valery V. Tuchin, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) . . . . . [9709-34]

**DC vaccine generated by photodynamic therapy for squamous cell carcinoma**, Xiuli Wang, Haiyan Zhang, Jie Ji, Shanghai Skin Disease Hospital (China) . . . . . [9709-35]

**Regulatory T cell effects in antitumor laser immunotherapy: a mathematical model and analysis**, Sean M. Lavery, Bryan A. Dawkins, Univ. of Central Oklahoma (USA) . . . . . [9709-36]

**Distinguishing oxygenated and deoxygenated fetal blood using fluorescence lifetime imaging on stained placental sections**, Teng Luo, Xiao Peng, Danying Lin, Junle Qu, Shenzhen Univ. (China) . . . . . [9709-37]

**Toxicity induced by upconversion nanoparticles in mouse macrophages**, Xiao Peng, Shuai Ye, Guangsheng Wang, Yuliang Tian, Maozhen Xiong, Wei Yan, Dong Wang, Jun Song, Junle Qu, Shenzhen Univ. (China) . . . . . [9709-38]

# Optical Elastography and Tissue Biomechanics III

Conference Chairs: **Kirill V. Larin**, Univ. of Houston (USA); **David D. Sampson**, The Univ. of Western Australia (Australia)

Program Committee: **Jeffrey C. Bamber**, The Royal Marsden NHS Foundation Trust (United Kingdom); **Claude Boccara**, Institut Langevin (France); **Stephen A. Boppart**, Univ. of Illinois at Urbana-Champaign (USA); **Brett E. Bouma**, Wellman Ctr. for Photomedicine (USA); **Zhongping Chen**, Beckman Laser Institute and Medical Clinic (USA); **Donald D. Duncan**, Portland State Univ. (USA); **Kishan Dholakia**, Univ. of St. Andrews (United Kingdom); **Daniel S. Elson**, Imperial College London (United Kingdom); **Mathias Fink**, Institut Langevin (France); **Brendan F. Kennedy**, The Univ. of Western Australia (Australia); **Sean J. Kirkpatrick**, Michigan Technological Univ. (USA); **Seemantini K. Nadkarni**, Harvard Medical School (USA); **Kentaro Nakamura**, Tokyo Institute of Technology (Japan); **Amy L. Oldenburg**, The Univ. of North Carolina at Chapel Hill (USA); **Francesco S. Pavone**, European Lab. for Non-linear Spectroscopy (Italy); **Andrew Pelling**, Univ. of Ottawa (Canada); **Gabriel Popescu**, Univ. of Illinois at Urbana-Champaign (USA); **Giuliano Scarcelli**, Harvard Medical School (USA); **Gijs van Soest**, Erasmus MC (Netherlands); **Victor X. D. Yang**, Ryerson Univ. (Canada); **Seok Hyun A. Yun**, Wellman Ctr. for Photomedicine (USA); **Ruikang K. Wang**, Univ. of Washington (USA); **Qifa Zhou**, The Univ. of Southern California (USA)

## SATURDAY 13 FEBRUARY

### WELCOME

LOCATION: ROOM 2011 (WEST LEVEL 2) . . . . . 9:00 AM TO 9:10 AM

Conference Chairs: **Kirill V. Larin**, Univ. of Houston (USA);  
**David D. Sampson**, The Univ. of Western Australia (Australia)

### SESSION 1

LOCATION: ROOM 2011 (WEST LEVEL 2) . . SAT 9:10 AM TO 10:30 AM

#### Novel Methods I

Session Chairs: **Stephen A. Boppart**,  
Univ. of Illinois at Urbana-Champaign (USA);

**Kishan Dholakia**, Univ. of St. Andrews (United Kingdom)

9:10 am: **Laser speckle rheology** (*Invited Paper*), Seemantini K. Nadkarni, Harvard Medical School (USA) . . . . . [9710-1]

9:40 am: **Ex vivo multiscale quantitation of skin biomechanics in wild-type and genetically-modified mice using multiphoton microscopy**, Stéphane Bancelin, Institut National de la Recherche Scientifique (Canada) and Ecole Polytechnique (France); Barbara Lynch, Ecole Polytechnique (France); Christelle Bonod-Bidaud, Institut de Génétique Fonctionnelle de Lyon (France); Guillaume Ducourthial, Sotiris Psilodimitrakopoulos, Lab. d'Optique et Biosciences (France) and Ecole Polytechnique (France); Petr Dokladal, Ctr. de Morphologie Mathématique (France); Jean-Marc Allain, Ecole Polytechnique (France); Marie-Claire Schanne-Klein, Lab. d'Optique et Biosciences (France) and Ecole Polytechnique (France); Florence Ruggiero, Institut de Génétique Fonctionnelle de Lyon (France) . . . . . [9710-2]

10:00 am: **Compression optical coherence elastography for improved diagnosis of disease** (*Invited Paper*), Brendan F. Kennedy, Phillip Wijesinghe, Lixin Chin, Andrea Curatolo, Shaghayegh Es'haghian, Wes M. Allen, Luke Frewer, Arash Arabshahi, Karol Karnowski, David D. Sampson, The Univ. of Western Australia (Australia) . . . . . [9710-18]

Coffee Break . . . . . Sat 10:30 am to 11:00 am

### SESSION 2

LOCATION: ROOM 2011 (WEST LEVEL 2) . . SAT 11:00 AM TO 12:20 PM

#### Cellular and Extracellular Mechanics

Session Chairs: **Seok-Hyun Yun**, Wellman Ctr. for Photomedicine (USA); **Gabriel Popescu**, Univ. of Illinois at Urbana-Champaign (USA)

11:00 am: **The endogenous fluorescence of fibroblasts in collagen gels as indicator of stiffness of the extracellular matrix**, Juan Pablo Padilla-Martinez, Antonio Ortega-Martinez, Walfre Franco, Wellman Ctr. for Photomedicine (USA) . . . . . [9710-4]

11:20 am: **Mapping ECM nanotopology via PS-OCT measurements of gold nanorod diffusion**, Richard L. Blackmon, The Univ. of North Carolina at Chapel Hill (USA); Brian S. Chapman, Joseph B. Tracy, North Carolina State Univ. (USA); Patricia Casbas-Hernandez, Rupinder Sandhu, Melissa Troester, Amy L. Oldenburg, The Univ. of North Carolina at Chapel Hill (USA) . . . [9710-5]

11:40 am: **Online monitoring of mechanical properties of three-dimensional tissue engineered constructs for quality assessment**, Yvonne Reinwald, Keele Univ. (United Kingdom); Pierre O. Bagnaninchi, The Univ. of Edinburgh (United Kingdom); Ying Yang, Yanny Baba Ismail, Alicia J. El Haj, Keele Univ. (United Kingdom) . . . . . [9710-6]

12:00 pm: **Laser speckle micro-rheology for biomechanical evaluation of breast tumors**, Zeinab Hajjarian Kashany, Seemantini K. Nadkarni, Harvard Medical School (USA) . . . . . [9710-7]

Lunch/Exhibition Break . . . . . Sat 12:20 pm to 1:40 pm

### SESSION 3

LOCATION: ROOM 2011 (WEST LEVEL 2) . . . SAT 1:40 PM TO 3:30 PM

#### Novel Methods II

Session Chair: **Amy L. Oldenburg**,  
The Univ. of North Carolina at Chapel Hill (USA)

1:40 pm: **Acoustic radiation force optical coherence elastography** (*Invited Paper*), Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9710-8]

2:10 pm: **Dynamic phase-sensitive optical coherence elastography at a true kilohertz frame-rate**, Manmohan Singh, Zhaolong Han, Thomas Hsu, Jiasong Li, Alexander Schill, Chih-Hao Liu, Chen Wu, Raksha Raghunathan, Achuth Nair, Kirill V. Larin, Univ. of Houston (USA) . . . . . [9710-9]

2:30 pm: **Ultra-high speed all optical shear wave imaging optical coherence elastography**, Shaozhen Song, Bao-Yu Hsieh, Wei Wei, Tueng Shen, Matthew O'Donnell, Ruikang K. Wang, Univ. of Washington (USA) . . . [9710-10]

2:50 pm: **High speed optical coherence elastography for human skin deformation studies**, Xuesong Hu, Raman Maiti, Robert A. Byers, The Univ. of Sheffield (United Kingdom); Lutz Gerhardt, Philips Research (Netherlands); Matt J. Carré, Roger Lewis, The Univ. of Sheffield (United Kingdom); Steven E. Franklin, Philips Research (Netherlands) and The Univ. of Sheffield (United Kingdom); Stephen J. Matcher, The Univ. of Sheffield (United Kingdom) . . . . . [9710-11]

# CONFERENCE 9710

LOCATION: ROOM 2011 (WEST LEVEL 2)

3:30 pm: **Lorentz force megahertz optical coherence elastography**, Chen Wu, Manmohan Singh, Zhaolong Han, Raksha Raghunathan, Chih-Hao Liu, Jiasong Li, Alexander Schill, Kirill V. Larin, Univ. of Houston (USA) . . . . [9710-12]

Coffee Break . . . . . Sat 3:30 pm to 4:00 pm

## SESSION 4

LOCATION: ROOM 2011 (WEST LEVEL 2) . . . SAT 4:00 PM TO 6:00 PM

### Brillouin Elastography

Session Chairs: **Claude Boccara**, Institut Langevin (France);  
**Ruikang K. Wang**, Univ. of Washington (USA)

4:00 pm: **Continuous-wave stimulated Brillouin spectroscopy in scattering media at 780 nm**, Itay Remer, Alberto Billenca, Ben-Gurion Univ. of the Negev (Israel) . . . . . [9710-13]

4:20 pm: **Ultra-high spectral extinction Brillouin spectroscopy for turbid tissue measurements**, Jitao Zhang, Antonio Fiore, Univ. of Maryland, College Park (USA); Peng Shao, Seok-Hyun Yun, Wellman Ctr. for Photomedicine (USA); Giuliano Scarcelli, Univ. of Maryland, College Park (USA) . . . . . [9710-14]

4:40 pm: **High-speed elasticity-specific nonlinear Brillouin imaging/sensing via time-resolved optical (BISTRO) measurements**, Zhaokai Meng, Charles Ballman, Georgi I. Petrov, Vladislav V. Yakovlev, Texas A&M Univ. (USA) . . . . . [9710-15]

5:00 pm: **A Fabry-Perot etalon-based notch filter for background cleaning in Brillouin microscopy**, Peng Shao, Sebastien Besner, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA) and Harvard Medical School (USA); Giuliano Scarcelli, Univ. of Maryland, College Park (USA); Seok-Hyun Yun, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA) and Harvard Medical School (USA) . . . . . [9710-16]

5:20 pm: **Cell biomechanical properties in 2D and 3D with Brillouin microscopy**, Giuliano Scarcelli, Univ. of Maryland, College Park (USA); Seok Hyun Yun, Harvard Medical School (USA) . . . . . [9710-17]

5:40 pm: **Quantification of plaque stiffness by Brillouin microscopy**, Giuseppe Antonacci, Ryan Pedrigi, Rob Krams, Peter Török, Imperial College London (United Kingdom) . . . . . [9710-15]

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 5

LOCATION: ROOM 2011 (WEST LEVEL 2) . . SUN 8:30 AM TO 10:10 AM

### Elastography Methods and Applications I

Session Chairs: **Qifa Zhou**, The Univ. of Southern California (USA);  
**Giuliano Scarcelli**, Harvard Medical School (USA)

8:30 am: **Acoustic radiation force optical coherence elastography in a small front-facing probe**, Yueqiao Qu, Univ. of California, Irvine (USA); Teng Ma, The Univ. of Southern California (USA); Youmin He, Univ. of California, Irvine (USA); Mingyue Yu, The Univ. of Southern California (USA); Rui Li, Jiang Zhu, Cuixia Dai, Zhonglie Piao, Univ. of California, Irvine (USA); K. Kirk Shung, Qifa Zhou, The Univ. of Southern California (USA); Zhongping Chen, Univ. of California, Irvine (USA) . . . . . [9710-19]

8:50 am: **Combined optical coherence tomography and optical coherence elastography for glomerulonephritis classification**, Chih-Hao Liu, Yong Du, Manmohan Singh, Chen Wu, Zhaolong Han, Jiasong Li, Qais Mohammadzai, Raksha Raghunathan, Thomas Hsu, Shezaan Noorani, Anthony Chang, Chandra Mohan, Univ. of Houston (USA); Kirill V. Larin, Univ. of Houston (USA) and Baylor College of Medicine (USA) and Samara State Aerospace Univ. (Russian Federation) . . . . . [9710-20]

9:10 am: **Depth dependent displacement sensitivity analysis and the influence of Doppler angle for quantitative assessment of the mechanical properties of tissue-mimicking phantoms with phase sensitive dynamic optical coherence tomography**, Gillian M. Lynch, Hreesh M. Subhash, Martin J. Leahy, National Univ. of Ireland, Galway (Ireland) . . . . . [9710-21]

9:30 am: **Robust strain mapping in optical coherence elastography by combining local phase-resolved and cumulative displacement measurements**, Vladimir Y. Zaitsev, Alexander L. Matveyev, Lev A. Matveev, Grigory V. Gelikonov, Institute of Applied Physics of the RAS (Russian Federation); Ekaterina Gubar'kova, Natalia D. Gladkova, Nizhny Novgorod State Medical Academy (Russian Federation); Alex Vitkin, Univ. of Toronto (Canada) . . . . . [9710-22]

9:50 am: **Mechanical characterization of mouse diaphragm with optical coherence elastography reveals fibrosis-related change of muscle stiffness**, Shang Wang, James A. Loehr, Irina V. Larina, George G. Rodney Jr., Baylor College of Medicine (USA); Kirill V. Larin, Univ. of Houston (USA) and Baylor College of Medicine (USA) and Samara State Aerospace Univ. (Russian Federation) . . . . . [9710-23]

Coffee Break . . . . . Sun 10:10 am to 10:40 am

### SESSION 6

LOCATION: ROOM 2011 (WEST LEVEL 2) . SUN 10:40 AM TO 12:00 PM

### Elastography Methods and Applications II

Session Chairs: **Gijs van Soest**, Erasmus MC (Netherlands);  
**Francesco S. Pavone**, European Lab. for Non-linear Spectroscopy (Italy); **Kentaro Nakamura**, Tokyo Institute of Technology (Japan)

10:40 am: **Alterations in microstructure of cornea under thermo-mechanical effect of 1.56 microns laser radiation**, Olga I. Baum, Emil N. Sobol, Institute on Laser and Information Technologies (Russian Federation); Andrey V. Bolshunov, Vladimir I. Siplivy, Research Institute of Eye Diseases (Russian Federation) . . . . . [9710-24]

11:00 am: **Magnetomotive optical coherence elastography for thermal therapy dosimetry**, Pin-Chieh Huang, Marina Marjanovic, Darold R. Spillman Jr., Boris M. Odintsov, Stephen A. Boppart, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9710-26]

11:20 am: **Intra-luminal mapping of tissue viscoelastic properties using laser speckle rheology**, Jing Wang, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA); Masaki Hosoda, Canon U.S.A., Inc. (USA); Diane M. Tshikudi, Seemantini K. Nadkarni, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA) . . . . [9710-27]

11:40 am: **Revealing anisotropic properties of cornea at different intraocular pressures using optical coherence elastography**, Jiasong Li, Manmohan Singh, Zhaolong Han, Chen Wu, Chih-Hao Liu, Raksha Raghunathan, Achuth Nair, Univ. of Houston (USA); Kirill V. Larin, Univ. of Houston (USA) and Baylor College of Medicine (USA) and National Research Tomsk State Univ. (Russian Federation) . . . . . [9710-28]

Lunch/Exhibition Break . . . . . Sun 12:00 pm to 1:20 pm

### SESSION 7

LOCATION: ROOM 2011 (WEST LEVEL 2) . . . SUN 1:20 TO 2:00 PM

### Keynote Session

Session Chair: **David D. Sampson**,  
The Univ. of Western Australia (Australia)

10:30 am: **Cells might not see where they are but they certainly feel the mechanics of their microenvironment!** (Keynote Presentation), Dennis E. Discher, Univ. of Pennsylvania (USA) . . . . . [9710-3]

### SESSION 8

LOCATION: ROOM 2011 (WEST LEVEL 2) . . . SUN 2:00 PM TO 3:10 PM

### Computation and Modeling in Elastography I

Session Chairs: **Brendan F. Kennedy**, The Univ. of Western Australia (Australia); **Mathias Fink**, Institut Langevin (France)

2:00 pm: **Inverse problems in biomechanical imaging** (Invited Paper), Assad A. Oberai, Rensselaer Polytechnic Institute (USA) . . . . . [9710-29]

2:30 pm: **Effect of curvature and thickness on elastic wave velocity in cornea-like structures by FEM and OCE**, Zhaolong Han, Jiasong Li, Manmohan Singh, Univ. of Houston (USA); Salavat R. Aglyamov, The Univ. of Texas at Austin (USA); Chen Wu, Chih-Hao Liu, Kirill V. Larin, Univ. of Houston (USA) . . . . . [9710-30]

2:50 pm: **A comparative study of shear wave speed estimation techniques in optical coherence elastography applications**, Fernando Zvietcovich, Jianing Yao, Ying-Ju Chu, Univ. of Rochester (USA); Panomsak Meemon, Suranaree Univ. of Technology (Thailand); Jannick P. Rolland, Kevin J. Parker, Univ. of Rochester (USA) . . . . . [9710-31]

Coffee Break . . . . . Sun 3:10 pm to 4:00 pm



# CONFERENCE 9710

LOCATION: ROOM 2011 (WEST LEVEL 2)

MONDAY 15 FEBRUARY

SESSION 9  
LOCATION: ROOM 2011 (WEST LEVEL 2) . . . SUN 4:00 PM TO 5:20 PM

## Computation and Modeling in Elastography II

Session Chairs: **Zhongping Chen**, Beckman Laser Institute and Medical Clinic (USA); **Victor X. D. Yang**, Ryerson Univ. (Canada)

4:00 pm: **Experimental classification of surface waves in optical coherence elastography**, Fernando Zvietcovich, Jianing Yao, Jannick P. Rolland, Kevin J. Parker, Univ. of Rochester (USA) . . . . . [9710-32]

4:20 pm: **A three dimensional solution for laser-induced thermoelastic deformation of the viscoelastic medium**, Salavat R. Aglyamov, The Univ. of Texas at Austin (USA); Shang Wang, Univ. of Houston (USA) and Baylor College of Medicine (USA); Stanislav Y. Emelianov, Georgia Institute of Technology (USA); Kirill V. Larin, Univ. of Houston (USA) and Baylor College of Medicine (USA) . . . . . [9710-33]

4:40 pm: **Quantitative optical coherence elastography as an inverse elasticity problem**, Li Dong, Rensselaer Polytechnic Institute (USA); Philip Wijesinghe, The Univ. of Western Australia (Australia); James T. Dantuono, Rensselaer Polytechnic Institute (USA); David D. Sampson, The Univ. of Western Australia (Australia); Peter R. T. Munro, Univ. College London (United Kingdom); Brendan F. Kennedy, The Univ. of Western Australia (Australia); Assad A. Oberai, Rensselaer Polytechnic Institute (USA) . . . . . [9710-34]

5:00 pm: **Computational optical palpation: micro-scale force mapping using finite-element methods**, Philip Wijesinghe, David D. Sampson, Brendan F. Kennedy, The Univ. of Western Australia (Australia) . . . . . [9710-35]

## POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**The morphology and biomechanics of the human heart**, Anastasiya Golyadkina, Irina V. Kirillova, Nataliya Chelnokova, Asel V. Polienko, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) . . . . . [9710-45]

**Patient-specific modeling of the elements of the cardiovascular system**, Anastasiya Golyadkina, Leonid Kossovich, Irina V. Kirillova, Asel V. Polienko, Nataliya Chelnokova, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Vladimir Murylev, I.M. Sechenov Moscow Medical Academy (Russian Federation) . . . . . [9710-46]

**Measurement of strain and strain rate in embryonic chick heart using spectral domain optical coherence tomography**, Shidan Dou, Northeastern Univ. (China); Yanyan Suo, Chengbo Liang, Shenzhen Entry-Exit Inspection and Quarantine Bureau (China); Yi Wang, Yuqian Zhao, Jian Liu, Northeastern Univ. at Qinhuangdao (China); Tao Xu, Shenzhen Academy of Metrology and Quality Inspection (China); Ruikang K. Wang, Univ. of Washington (USA); Zhenhe Ma, Northeastern Univ. at Qinhuangdao (China) . . . . . [9710-47]

**Skin surface and sub-surface strain and deformation imaging using OCT and DIC**, Xuesong Hu, Raman Maiti, Zing S. Lee, Robert A. Byers, The Univ. of Sheffield (United Kingdom); Lutz Gerhardt, Philips Research (Netherlands); Matt J. Carré, Roger Lewis, The Univ. of Sheffield (United Kingdom); Steven E. Franklin, Philips Research (Netherlands) and The Univ. of Sheffield (United Kingdom); Stephen J. Matcher, The Univ. of Sheffield (United Kingdom) . . . . . [9710-48]

**Micromotor OCT enables catheter-based assessment of vascular elasticity**, Tianshi Wang, Erasmus MC (Netherlands); Tom Pfeiffer, Univ. zu Lübeck (Germany) and Ludwig-Maximilians-Univ. München (Germany); Wolfgang Wieser, Ludwig-Maximilians-Univ. München (Germany); Charles T. Lancee, Erasmus MC (Netherlands); Antonius F. W. van der Steen, Erasmus MC (Netherlands) and Shenzhen Institute of Advanced Technology (China); Robert A. Huber, Univ. zu Lübeck (Germany) and Ludwig-Maximilians-Univ. München (Germany); Gijs van Soest, Erasmus MC (Netherlands) . . . . . [9710-49]

**Phase-sensitive optical coherence elastography with acoustic radiation force impulse excitation**, Cheol Song, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of); Dae-Gab Gweon, KAIST (Korea, Republic of); Jae Youn Hwang, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of) . . . . . [9710-50]

## SESSION 10

LOCATION: ROOM 2011 (WEST LEVEL 2) . . . MON 8:30 AM TO 10:10 AM

## Tissue Mechanical Contrast

Session Chairs: **Sean J. Kirkpatrick**, Michigan Technological Univ. (USA); **Andrew E. Pelling**, Univ. of Ottawa (Canada)

8:30 am: **A study on the relation between tissue deformation and optical properties measured by multi-diameter fiber reflectance spectroscopy on an optical phantom**, Xu U. Zhang, Anouk L. Post, Ton G. van Leeuwen, Dirk J. Faber, Academisch Medisch Centrum (Netherlands); Henricus J. C. M. Sterenberg, Academisch Medisch Centrum (Netherlands) and The Netherlands Cancer Institute (Netherlands) . . . . . [9710-36]

8:50 am: **Polarized spatial frequency domain imaging of heart valve fiber structure**, Will Goth, Bin Yang, John Lesicko, Reece Stevens, Michael S. Sacks, James W. Tunnell, The Univ. of Texas at Austin (USA) . . . . . [9710-37]

9:10 am: **A comparison study of optical coherence elastography and laser Michelson vibrometry**, Jiasong Li, Chih-Hao Liu, Manmohan Singh, Alexander Schill, Univ. of Houston (USA); Kirill V. Larin, Univ. of Houston (USA) and Baylor College of Medicine (USA) and National Research Tomsk State Univ. (Russian Federation) . . . . . [9710-38]

9:30 am: **Wide-field optical coherence elastography for intraoperative assessment of tumour margins in breast cancer**, Wes M. Allen, Lixin Chin, David D. Sampson, Brendan F. Kennedy, The Univ. of Western Australia (Australia) . . . . . [9710-39]

9:50 am: **Mechanisms of laser-induced stress relaxation for temporal and permanent reshaping of cartilage**, Emil N. Sobol, Institute on Laser and Information Technologies (Russian Federation) . . . . . [9710-40]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

## SESSION 11

LOCATION: ROOM 2011 (WEST LEVEL 2) MON 10:40 AM TO 12:00 PM

## Novel Methods III

Session Chairs: **Donald D. Duncan**, Portland State Univ. (USA); **Seemantini K. Nadkarni**, Harvard Medical School (USA)

10:40 am: **Depth-resolved photothermal optical coherence tomography by local optical path length change measurement**, Shuichi Makita, Young-Joo Hong, En Li, Yasuno Yoshiaki, Univ. of Tsukuba (Japan) . . [9710-41]

11:00 am: **Three-dimensional mapping of shear modulus using acoustic radiation force orthogonal excitation optical coherence elastography (ARFOE-OCE)**, Jiang Zhu, Li Qi, Beckman Laser Institute and Medical Clinic (USA); Teng Ma, The Univ. of Southern California (USA); Cuixia Dai, Yueqiao Qu, Youmin He, Beckman Laser Institute and Medical Clinic (USA); Qifa Zhou, The Univ. of Southern California (USA); Zhongping Chen, Beckman Laser Institute and Medical Clinic (USA) and Univ. of California, Irvine (USA) . . . . . [9710-42]

11:20 am: **Speckle-free elasticity imaging with moving acoustic radiation force and phase-sensitive optical coherence tomography**, Bao-Yu Hsieh, Shaozhen Song, Thu-Mai Nguyen, Soon Joon Yoon, Tueng Shen, Ruikang K. Wang, Matthew O'Donnell, Univ. of Washington (USA) . . . . . [9710-43]

11:40 am: **Characterizing tissue stiffness at the tip of a rigid needle using an all-optical force sensor**, Steven V. Beekmans, Davide Iannuzzi, Vrije Univ. Amsterdam (Netherlands); John J. van den Dobbelaar, Technische Univ. Delft (Netherlands) . . . . . [9710-44]

# CONFERENCE 9711

LOCATION: ROOM 2018 (WEST LEVEL 2)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9711

# Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX

*Conference Chairs:* **Daniel L. Farkas**, Univ. of Southern California (USA), SMI (United States); **Dan V. Nicolau**, McGill Univ. (Canada); **Robert C. Leif**, Newport Instruments (USA)

*Conference Co-Chairs:* **James F. Leary**, Purdue Univ. (USA); **Attila Tarnok**, Univ. Leipzig (Germany)

*Program Committee:* **Vadim Backman**, Northwestern Univ. (USA); **Christopher H. Contag**, Stanford Univ. School of Medicine (USA); **Paul M. W. French**, Imperial College London (United Kingdom); **Yuval Garini**, Bar-Ilan Univ. (Israel); **DaeGab Gweon**, KAIST (Korea, Republic of); **Charles P. Lin**, Wellman Ctr. for Photomedicine (USA); **Sacha Loiseau**, Mauna Kea Technologies (France); **Ramesh Raghavachari**, U.S. Food and Drug Administration (USA); **Sebastian Wachsmann-Hogiu**, Univ. of California, Davis (USA); **Warren S. Warren**, Duke Univ. (USA)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: ROOM 2018 (WEST LEVEL 2) . MON 8:00 AM TO 11:40 AM

### Functional Imaging

Session Chair: **Daniel L. Farkas**, Univ. of Southern California (USA), Spectral Molecular Imaging, Inc. (United States)

8:00 am: **Quantitative long term measurements of burns in a rat model using spatial frequency domain imaging and laser speckle imaging** (*Invited Paper*), Adrien Ponticorvo, Rebecca A. Rowland, Melissa L. Baldado, Gordon T. Kennedy, Rolf B. Saager, Bernard Choi, Anthony J. Durkin, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9711-1]

8:30 am: **Lasng within live cells for barcode-type cell tagging and tracking**, Marcel Schubert, Anja Steude, Philipp Liehm, Nils M. Kronenberg, Markus Karl, Klara C. R. Volckaert, Elaine C. Campbell, Simon J. Powis, Malte C. Gather, Univ. of St. Andrews (United Kingdom) . . . . . [9711-2]

8:50 am: **Time evolution of trapped single cell microorganism**, Silvie Bernatová, Ota Samek, Institute of Scientific Instruments of the ASCR, v.v.i. (Czech Republic); Stanislav Obruca, Brno Univ. of Technology (Czech Republic); Mojmir Sery, Pavel Zemánek, Institute of Scientific Instruments of the ASCR, v.v.i. (Czech Republic); Ivana Márová, Brno Univ. of Technology (Czech Republic) . . . . . [9711-3]

9:10 am: **Live cell phase imaging under whole blood shear flow using oblique back-illumination**, Diana Mojahed, Wellman Ctr. for Photomedicine (USA); Paul H. Dannenberg, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Alexander Q. Anderson, Univ. of Rochester (USA); Timothy N. Ford, Wellman Ctr. for Photomedicine (USA); Guillermo J. Tearney, Massachusetts General Hospital (USA) . . . . . [9711-4]

9:30 am: **Investigation of cell-matrix interactions in ovarian cancer via multiphoton excited fabrication of 3D image-based biomimetic stromal models**, Paul J. Campagnola, Visar Ajeti, Jorge Lara, Kevin W. Eliceiri, Mansh Patankar, Univ. of Wisconsin-Madison (USA) . . . . . [9711-5]

9:50 am: **Quantitative imaging of light-triggered DOXorubicin release using spatial frequency domain imaging**, Ulas Sunar, Wright State Univ. (USA); Jeremy Kress, Wayne State Univ. (USA); Daniel J. Rohrbach, Wright State Univ. (USA); Kevin A. Carter, Dandan Luo, Shuai Shao, Univ. at Buffalo (USA); Shashikant Lele M.D., Roswell Park Cancer Institute (USA); Jonathan F. Lovell, Univ. at Buffalo (USA) . . . . . [9711-6]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

10:40 am: **Fluorescence lifetime imaging of NAD(P)H measures metabolic enzyme activity in cells**, Joe T. Sharick, Melissa C. Skala, Vanderbilt Univ. (USA) . . . . . [9711-7]

11:00 am: **Detection of particle flow patterns in tumor by directional spatial frequency analysis**, Stewart Russell, Hawa Camara, Lingyan Shi, The City College of New York (USA); P. Jack Hoopes, Geisel School of Medicine (USA); Peter A. Kaufman, Dartmouth Hitchcock Medical Ctr. (USA); Brian W. Pogue, Thayer School of Engineering at Dartmouth (USA); Robert R. Alfano, The City College of New York (USA) . . . . . [9711-8]

11:20 am: **Forensic applications of in vivo Raman spectroscopy: determination of post-mortem interval in animal models**, Tanmoy Bhattacharjee, Piyush Kumar, C. Murali Krishna, Arvind Ingle, Advanced Ctr. for Treatment, Research & Education in Cancer (India) . . . . . [9711-9]

### SESSION 2

LOCATION: ROOM 2018 (WEST LEVEL 2) . MON 11:40 AM TO 12:20 PM

### Optical Manipulation

Session Chair: **Daniel L. Farkas**, Univ. of Southern California (USA), Spectral Molecular Imaging, Inc. (United States)

11:40 am: **An integrated optofluidic platform for assessing biologics**, Perry Schein, Dakota O'Dell, David Erickson, Cornell Univ. (USA) . . . . . [9711-10]

12:00 pm: **Elasticity measurements to evaluate optical damages induced in red blood cells optically trapped using near-infrared lasers**, Marcos A. S. de Oliveira, Diogenes S. Moura, Adriana Fontes, Renato E. de Araujo, Univ. Federal de Pernambuco (Brazil) . . . . . [9711-11]

Lunch Break . . . . . Mon 12:20 pm to 1:50 pm

### SESSION 3

LOCATION: ROOM 2018 (WEST LEVEL 2) . . . MON 1:50 PM TO 4:40 PM

### Regenerative, Pilot and Industrial Cell and Tissue Growth

Session Chairs: **Attila Tarnok**, Univ. Leipzig (Germany); **Daniel L. Farkas**, Univ. of Southern California (USA), Spectral Molecular Imaging, Inc. (United States)

1:50 pm: **Evaluation of local MSC therapeutic impact in osteogenesis imperfecta using deep tissue single cell ablation with a multicolor femtosecond fiber laser source**, Kayvan F. Tehrani, The Univ. of Georgia (USA); Charles P. Lin, Wellman Ctr. for Photomedicine (USA); Luke J. Mortensen, The Univ. of Georgia (USA) . . . . . [9711-12]

2:10 pm: **Monitoring stem cell differentiation in phase contrast imaging**, Katherine P. Dempsey, KP Lam, Keele Univ. (United Kingdom) . . . . . [9711-13]

2:30 pm: **Cell sheets image validation of phase-diversity homodyne OCT and effect of the light irradiation on cells**, Naoko Senda, Kentaro Osawa, Hitachi, Ltd. (Japan) . . . . . [9711-14]

2:50 pm: **Non-disruptive measurement system of cell viability in bioreactors containing artificial vascular networks**, Florian Rudek, Bryan L. Nelsen, Westsächsische Hochschule Zwickau (Germany); Tobias Baselt, Westsächsische Hochschule Zwickau (Germany) and Fraunhofer IWS Dresden (Germany); Alexander Kabardiadi, Westsächsische Hochschule Zwickau (Germany); Peter Hartmann, Westsächsische Hochschule Zwickau (Germany) and Fraunhofer IWS Dresden (Germany) . . . . . [9711-15]

Coffee Break . . . . . Mon 3:10 pm to 3:40 pm

3:40 pm: **Confocal microscopy and electrophysiological study of single patient corneal endothelium cell cultures**, Francesca Tatini, Francesca Rossi, Istituto di Fisica Applicata "Nello Carrara" (Italy); Elisabetta Coppi, Giada Magni, Univ. degli Studi di Firenze (Italy); Fulvio Ratto, Istituto di Fisica Applicata "Nello Carrara" (Italy); Irene Fusco, Univ. degli Studi di Firenze (Italy); Luca Menabuoni, Azienda USL 4 (Italy); Felicità Pedata, Anna Maria Pugliese, Univ. degli Studi di Firenze (Italy); Roberto Pini, Istituto di Fisica Applicata "Nello Carrara" (Italy) . . . . . [9711-16]

### Spectral Imaging

Session Chair: **Dan V. Nicolau**, McGill Univ. (Canada)

8:30 am: **Excitation-scanning hyperspectral imaging system for microscopic and endoscopic applications**, Sam Mayes, Thomas C. Rich, Silas J. Leavesley, Univ. of South Alabama (USA) . . . . . [9711-20]

8:50 am: **Multimode optical dermoscopy (SkinSpect) for skin with mole analysis (Invited Paper)**, Fartash Vasefi, Nicholas B. MacKinnon, Spectral Molecular Imaging, Inc. (USA); Rolf B. Saager, Anthony J. Durkin, Kristen M. Kelly M.D., Beckman Laser Institute and Medical Clinic (USA); Daniel L. Farkas, Spectral Molecular Imaging, Inc. (USA) . . . . . [9711-22]

9:20 am: **Hyperspectral in vivo fluorescence imaging with multi wavelength LED excitation**, Siri Luthman, Isabel Quirós-Gonzalez, Sarah E. Bohndiek, Univ. of Cambridge (United Kingdom) and Cancer Research UK (United Kingdom) . . . . . [9711-23]

9:40 am: **In vivo perfusion assessment of an anastomosis surgery on porcine intestinal model**, Hanh N. D. Le, Johns Hopkins Univ. (USA); Justin Opferman, Ryan Decker, Children's National Health System (USA); Gyeong W. Cheon, Johns Hopkins Univ. (USA); Peter C. W. Kim, Children's National Health System (USA); Jin U. Kang, Johns Hopkins Univ. (USA); Axel Krieger, Children's National Health System (USA) . . . . . [9711-24]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

10:30 am: **Feasibility for detection of autofluorescent signatures in rat organs using a novel excitation-scanning hyperspectral imaging system**, Peter F. Favreau, Joshua A. Deal, David S. Weber, Thomas C. Rich, Silas J. Leavesley, Univ. of South Alabama (USA) . . . . . [9711-25]

10:50 am: **Investigate the variation in optical redox ratio of epicardial adipose tissue in patients with CAD or DM through auto-fluorescence metabolic molecular image**, Lun-Zhang Guo, National Taiwan Univ. (Taiwan); Tzung-Dau Wang, Cardiovascular Ctr., National Taiwan Univ. Hospital (Taiwan) and National Taiwan Univ. (Taiwan); Jong-Wei Lin, Cardiovascular Ctr., National Taiwan Univ. Hospital (Taiwan); Tzu-Ming Liu, National Taiwan Univ. (Taiwan) . . . . . [9711-26]

11:10 am: **Light labeling with temporal intensity modulations for hyperspectral imaging**, Scott R. Domingue, David G. Winters, Randy A. Bartels, Colorado State Univ. (USA) . . . . . [9711-27]

Lunch Break . . . . . Tue 11:30 am to 1:30 pm

### Biomedical Imaging using a DMD or Other Light Structuring Devices

Joint Session with Conferences 9711 and 9761

Session Chairs: **Michael R. Douglass**, Texas Instruments Inc. (USA); **Robert C. Leif**, Newport Instruments (USA)

1:30 pm: **Wavefront shaping optical coherence tomography using a digital micromirror device for enhancing penetration depth in biological tissues (Invited Paper)**, YongKeun Park, KAIST (Korea, Republic of) . . . . . [9761-4]

2:00 pm: **Digital micromirror device (DMD) based fast digital optical phase conjugation (DOPC) system**, Haojiang Zhou, California Institute of Technology (USA); Daifa Wang, California Institute of Technology (USA) and BeiHang Univ. (China); Joshua Brake, Changhui Yang, California Institute of Technology (USA) . . . . . [9761-5]

2:20 pm: **Digital micromirror device based multispectral retinal imaging using optimized illumination schemes**, Mathi Damodaran, Vrije Univ. Amsterdam (Netherlands); Kari V. Vienola, Vrije Univ. Amsterdam (Netherlands) and Rotterdam Ophthalmic Institute (Netherlands); Boy Braaf, Vrije Univ. Amsterdam (Netherlands); Koenraad A. Vermeer, Rotterdam Ophthalmic Institute (Netherlands); Johannes F. de Boer, Vrije Univ. Amsterdam (Netherlands) . . . . . [9761-6]

2:40 pm: **Contrast enhancement using differential spinning disc structured illumination in high resolution microendoscopy for imaging nuclear morphology in tissue (Invited Paper)**, Pelham Keahey, Rebecca Richards-Kortum, Rice Univ. (USA) . . . . . [9711-28]

3:10 pm: **Melanoma detection using smartphone and multimode hyperspectral imaging**, Nicholas B. MacKinnon, Fartash Vasefi, Spectral Molecular Imaging Inc. (USA); Daniel L. Farkas, Spectral Molecular Imaging, Inc. (USA) and Univ. of Southern California, Los Angeles (USA) . . . . . [9711-29]

Coffee Break . . . . . Tue 3:30 pm to 4:00 pm

4:00 pm: **Filamentation and spatiotemporal distribution of extracellular polymeric substances: role on X.fastidiosa single cell adhesion and biofilm formation**, Richard Janissen, Duber M. Murillo, Univ. Estadual de Campinas (Brazil); Barbara Niza, Instituto Agronômico (Brazil); Prasana K. Sahoo, Moniellen P. Monteiro, Carlos L. César, Hernandes F. Carvalho, Univ. Estadual de Campinas (Brazil); Alessandra A. de Souza, Ctr. APTA Citros Sylvio Moreira (Brazil) and Instituto Agronômico (Brazil); Monica A. Cotta, Univ. Estadual de Campinas (Brazil) . . . . . [9711-17]

4:20 pm: **Movement of bacteria in urban microfluidics: a method for biosimulation of complex traffic**, Viola Tokarova, McGill Univ. (Canada); Ben Libberton, Univ. of Liverpool (United Kingdom); Ondrej Kaspar, McGill Univ. (Canada); Sylvain Martel, Ecole Polytechnique de Montréal (Canada); Dan V. Nicolau, McGill Univ. (Canada) . . . . . [9711-19]

### POSTERS-MONDAY

Conference attendees are invited to attend the BIOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Measurement of muscle food spoilage using fluorescence imaging**, Binlin Wu, Southern Connecticut State Univ. (USA) . . . . . [9711-18]

**Enhancement of trastuzumab penetration using atorvastatin and cyclophosphamide to Her2+ NCI N87 xenograft mouse model**, Jin Su Kim, Kyung Deuk Cho, Kook-Hyun Yu, Korea Institute of Radiological & Medical Sciences (Korea, Republic of) . . . . . [9711-53]

**PCA-HOG symmetrical feature based diseased cell detection**, Min-jie Wan, Nanjing Univ. of Science and Technology (China) . . . . . [9711-54]

**Turn-and-run of crawling cells mediated by membrane ruffling with two different time scales**, Taeseok D. Yang, Youngwoon Choi, Kyoung-Jin Lee, Korea Univ. (Korea, Republic of) . . . . . [9711-55]

**Automated particle identification through regression analysis of size, shape and colour**, Juan Carlos Rodriguez Luna, Jonathan Cooper, Steven Neale, Univ. of Glasgow (United Kingdom) . . . . . [9711-56]

**Label-free separation of arteries and veins using two-photon excitation autofluorescence microscopy**, Wei Zheng, Shenzhen Institute of Advanced Technology (China) . . . . . [9711-57]

**Fourier spatial frequency analysis for image classification: training the training set**, Timothy H. Johnson, Yigah Lhamo, Lingyan Shi, Robert R. Alfano, Stewart Russell, The City College of New York (USA) . . . . . [9711-58]

**Characterization of red blood cells using Brillouin spectroscopy**, Sandra C. Bustamante-Lopez, Swansea Univ. (United Kingdom) and Texas A&M Univ. (USA); Zhaokai Meng, Vladislav V. Yakovlev, Texas A&M Univ. (USA); Kenith E. Meissner II, Swansea Univ. (United Kingdom) . . . . . [9711-59]

**Plasmonic enhanced whispering gallery mode biosensor using nanostructure**, Seunghun Lee, Pusan National Univ. (Korea, Republic of) . . . . . [9711-60]

**Analysis of cancer cell morphology in fluorescence microscopy image exploiting shape descriptor**, Misun Kang, Hye-Ryun Kim, Ewha Womans Univ. (Korea, Republic of); Sudong Kim, Samsung Advanced Institute of Technology (Korea, Republic of); Gyu Ha Ryu, Sungkyunkwan Univ. (Korea, Republic of); Myoung-Hee Kim, Ewha Womans Univ. (Korea, Republic of) . . . . . [9711-61]

**Brillouin spectroscopy as a mechanical-specific probing tool for stem cell and nanoparticle reinforced GeIMA nanocomposite**, Zhaokai Meng, Vladislav V. Yakovlev, Texas A&M Univ. (USA) . . . . . [9711-62]

**Dielectrophoresis measurement of red blood cells (RBCs) exposed to oxidative stress using optical tweezer and microfluidic chip**, HeeJae Jeon, Jong Jin Kim, Dae Sung Yoon, Beop-Min Kim, Korea Univ. (Korea, Republic of) . . . . . [9711-63]

**Diagnosis and management of hand arthritis using a mobile medical application**, Fartash Vasefi, eTreat Medical Diagnostics Inc. (Canada); Farhad Akhbardeh, Univ. of North Dakota (USA); Nicholas B. MacKinnon, eTreat Medical Diagnostics Inc. (Canada); Kouhyar Tavakolian, David Bradley, Reza Fazel-Rezai, Univ. of North Dakota (USA) . . . . . [9711-64]

**Vanishing point: a smartphone application that classifies pimples and estimates prognosis**, Nicholas B. MacKinnon, eTreat Medical Diagnostics Inc. (Canada); Fartash Vasefi, eTreat Medical Diagnostics Inc. (USA) . . . . . [9711-65]

**Embryonic stem cell counting on fluorescence images**, Ali Furkan Kamanli, Sakarya Univ. (Turkey); Gökçen Çetinel, Sakarya Üniv. (Turkey); Hyun Soo Lim, Sakarya Univ. (Turkey) . . . . . [9711-66]



# CONFERENCE 9711

LOCATION: ROOM 2018 (WEST LEVEL 2)

## SESSION 6

LOCATION: ROOM 2018 (WEST LEVEL 2) . . . TUE 4:00 PM TO 6:00 PM

### Data Analysis

Session Chair: **Robert C. Leif**, Newport Instruments (USA)

4:00 pm: **Cytometry metadata in XML**, Robert C. Leif, Stephanie H. Leif, Newport Instruments (USA). . . . . [9711-30]

4:20 pm: **Comprehensive guide to modern methods for processing and analyzing single molecule fluorescence data**, Mélodie C. A. S. Hadzic, Danny Kowerko, Richard Börner, Sebastian L. B. König, Univ. Zürich (Switzerland); Mario Heidernätsch, Technische Univ. Chemnitz (Germany); Roland K. O. Sigel, Univ. Zürich (Switzerland) . . . . . [9711-31]

4:40 pm: **Directional spatial frequency analysis of lipid distribution in atherosclerotic plaque**, Clyde R. Korn, Eric Reese, Lingyan Shi, Robert R. Alfano, Stewart Russell, The City College of New York (USA) . . . . . [9711-32]

5:00 pm: **Brain vascular image enhancement based on gradient adjust with split Bregman**, Xiao Liang, Di Dong, Hui Hui, Liwen Zhang, Mengjie Fang, Jie Tian, Institute of Automation (China) . . . . . [9711-33]

5:20 pm: **Statistical image segmentation for the detection of skin lesion borders in UV fluorescence excitation**, Antonio Ortega-Martinez, Juan Pablo Padilla-Martinez, Walfre Franco, Wellman Ctr. for Photomedicine (USA) . . . . . [9711-34]

5:40 pm: **Limitations of fitting angular scattering from single cells**, Xing Fan, Ashley E. Cannaday, Andrew J. Berger, Univ. of Rochester (USA) . . . . [9711-35]

10:40 am: **Vitamin C for stabilising biological lasers**, Mark D. Mackenzie, Katarzyna I. Cialowicz, Rebecca S. Saleeb, Rory R. Duncan, Ajoy K. Kar, Heriot-Watt Univ. (United Kingdom) . . . . . [9711-42]

11:00 am: **Whole slide imaging of unstained tissue using lensfree microscopy**, Sophie Nhu An Morel, Lionel Hervé, Thomas Bordy, Olivier Cioni, CEA-LETI (France); Antoine Delon, Univ. Grenoble Alpes (France) and Lab. Interdisciplinaire de Physique (France); Catherine Fromentin, LENS-Ctr. Hospitalier Dr. Schaffner (France); Jean-Marc Dinten, Cédric Allier, CEA-LETI (France) . . . . . [9711-43]

11:20 am: **Mapping molecular orientational distributions for biological sample in 3D**, Wei He, Institut Fresnel (France) and Karlsruhe Institute of Technology (Germany); Patrick F. Ferrand, Institute Fresnel (France); Benjamin Richter, Karlsruhe Institute of Technology (Germany); Martin Bastmeyer, Karlsruhe Institute of Technology (Germany); Sophie Brasselet, Institute Fresnel (France) . . . . . [9711-44]

11:40 am: **Analysis of forward/backward second harmonic generation images reveals the nanoscale structure of collagen within bone and cartilage**, Marie-Andrée Houle, Charles-André Couture, Stéphane Bancelin, Institut National de la Recherche Scientifique (Canada); Jarno N. Van der Kolk, Univ. of Ottawa (Canada); Etienne Auger, Institut National de la Recherche Scientifique (Canada); Cameron Brown, Univ. of Oxford (United Kingdom); Konstantin Popov, Lora Ramunno, Univ. of Ottawa (Canada); François Légaré, Institut National de la Recherche Scientifique (Canada) . . . . . [9711-45]

Lunch Break . . . . . Wed 12:00 pm to 1:30 pm

## SESSION 8

LOCATION: ROOM 2018 (WEST LEVEL 2) . . . WED 1:30 PM TO 4:00 PM

### Instrumentation II

Session Chair: **Robert C. Leif**, Newport Instruments (USA)

1:30 pm: **Multispectral excitation based multiple fluorescent targets resolving in fluorescence molecular tomography**, Yuan Zhou, Huihui Guang, Tsinghua Univ. (China); Huangsheng Pu, Jiulou Zhang, Jing Bai, Tsinghua Univ. School of Medicine (China); Jianwen Luo, Tsinghua Univ. (China) . . . . [9711-46]

1:50 pm: **Robust organelle size extractions from elastic scattering measurements of single cells**, Ashley E. Cannaday, Robert Draham, Andrew J. Berger, Univ. of Rochester (USA) . . . . . [9711-47]

2:10 pm: **Development of a smartphone-based multispectral imaging system for mobile skin-care**, Sewoong Kim, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of); Dongrae Cho, Gwangju Institute of Science and Technology (Korea, Republic of); Jin Man Park, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of); Boreom Lee, Gwangju Institute of Science and Technology (Korea, Republic of); Daniel L. Farkas, Spectral Molecular Imaging, Inc. (USA) and The Univ. of Southern California (USA); Jae Youn Hwang, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of) . . . . . [9711-48]

2:30 pm: **A method to compensate for the underestimation of collagen with polarized picrosirius red imaging in human artery atherosclerotic plaques**, Cherry Anne Greiner, Stephanie J. Grainger, Jimmy L. Su, Sean P. Madden, James E. Muller, InfraReDx, Inc. (USA) . . . . . [9711-49]

2:50 pm: **Intraoperative optical biopsy for brain tumors using spectro-lifetime properties of intrinsic fluorophores (Invited Paper)**, Fartash Vasefi, David S. Kittle, Chirag G. Patil M.D., Ray M. Chu M.D., Adam N. Mamelak M.D., Keith L. Black M.D., Pramod V. Butte, Cedars-Sinai Medical Ctr. (USA) [9711-50]

3:20 pm: **3D fabricated microoptic system for multispectral tissue fluorescence lifetime measurements**, Luwei Zou, Univ. of Michigan-Dearborn (USA); Mohamad Mahmoud, Mehdi Fahs, Fadl Choughari, Kai Duan, Univ. of Michigan-Dearborn (USA); Joe F. Lo, Univ. of Michigan-Dearborn (USA) . . . . . [9711-51]

3:40 pm: **Quantitative image cytometry measurements of lipids, DNA, CD45 and cytokeratin for circulating tumor cell identification in a model system**, Gregory Louis Futia, Lubna Qamar, Kian Behbakht, Emily A. Gibson, Univ. of Colorado Denver (USA) . . . . . [9711-52]

## WEDNESDAY 17 FEBRUARY

## SESSION 7

LOCATION: ROOM 2018 (WEST LEVEL 2) . WED 8:00 AM TO 12:00 PM

### Instrumentation I

Session Chairs: **Robert C. Leif**, Newport Instruments (USA); **James F. Leary**, Purdue Univ. (USA)

8:00 am: **True 3D imaging method-holographic 3D display for future biomedical imaging (Invited Paper)**, Hongyue Gao, Jicheng Liu, Shanghai Univ. (China) . . . . . [9711-36]

8:30 am: **One-step fabrication of multi-layered microcapsules by a tri-axial flow focusing device for microencapsulation of soluble drugs and imaging agents**, Shuai Yuan, Ting Si, Univ. of Science and Technology of China (China); Ronald X. Xu, The Ohio State Univ. (USA) . . . . . [9711-37]

8:50 am: **Tracking corneal epithelium stem cells using optical coherence tomography**, Joseph Boadi, Stephen J. Matcher, Sheila MacNeil, The Univ. of Sheffield (United Kingdom); Virender S. Sangwan, LV Prasad Eye Institute (India) . . . . . [9711-38]

9:10 am: **Fiber based imaging in bioengineered construct**, Etai Sapoznik, Wake Forest Institute for Regenerative Medicine (USA) and Virginia Tech-Wake Forest Univ. School of Biomedical Engineering and Sciences (USA); Guoguang Niu, Wake Forest Institute for Regenerative Medicine (USA); Peng Lu, Virginia Polytechnic Institute and State Univ. (USA); Yu Zhou, Wake Forest Institute for Regenerative Medicine (USA); Yong Xu, Virginia Polytechnic Institute and State Univ. (USA); Tracy L. Criswell, Wake Forest Institute for Regenerative Medicine (USA); Shay Soker, Wake Forest Institute for Regenerative Medicine (USA) and Virginia Tech-Wake Forest Univ. School of Biomedical Engineering and Sciences (USA) . . . . . [9711-39]

9:30 am: **Multi-contrast volumetric cell imaging based on optical projection tomography**, Sungbea Ban, Nam Hyun Cho, Yongjae Ryu, Sunwoo Jung, Andrey Vavilin, Eunjung Min, Woongyu Jung, Ulsan National Institute of Science and Technology (Korea, Republic of) . . . . . [9711-40]

9:50 am: **Light-guide tunable snapshot spectrometer for biomedical applications**, Ye Wang, Tomasz Tkaczyk, Michal E. Pawlowski, Rice Univ. (USA) . . . . . [9711-41]

Coffee Break . . . . . Wed 10:10 am to 10:40 am



# CONFERENCE 9712

LOCATION: ROOM 2014 (WEST LEVEL 2)

Sunday-Tuesday 14-16 February 2016 • Proceedings of SPIE Vol. 9712

# Multiphoton Microscopy in the Biomedical Sciences XVI

Conference Chairs: **Ammasi Periasamy**, Univ. of Virginia (USA); **Peter T. C. So**, Massachusetts Institute of Technology (USA); **Karsten König**, Univ. des Saarlandes (Germany)

Program Committee: **Wolfgang Becker**, Becker & Hickl GmbH (Germany); **Alberto Diaspro**, Istituto Italiano di Tecnologia (Italy); **Chen-Yuan Dong**, National Taiwan Univ. (Taiwan); **Kevin W. Eliceiri**, Univ. of Wisconsin-Madison (USA); **Scott Fraser**, The Univ. of Southern California (USA); **Paul M. W. French**, Imperial College London (United Kingdom); **Hans C. Gerritsen**, Utrecht Univ. (Netherlands); **Enrico Gratton**, Univ. of California, Irvine (USA); **Min Gu**, Swinburne Univ. of Technology (Australia); **Stefan W. Hell**, Max-Planck-Institut für Biophysikalische Chemie (Germany); **Paul J. Campagnola**, Univ. of Wisconsin-Madison (USA); **Satoshi Kawata**, Osaka Univ. (Japan); **Fu-Jen Kao**, National Yang-Ming Univ. (Taiwan); **Arnd K. Krueger**, Spectra-Physics (USA); **Joseph R. Lakowicz**, Univ. of Maryland School of Medicine (USA); **Steve M. McDonald**, Coherent, Inc. (USA); **Angelika C. Rueck**, Univ. Ulm (Germany); **Junle Qu**, Shenzhen Univ. (China); **Steven S. Vogel**, National Institutes of Health (USA); **Paul W. Wiseman**, McGill Univ. (Canada); **X. Sunney Xie**, Harvard Univ. (USA); **Chris Xu**, Cornell Univ. (USA); **Bernhard Zimmermann**, Carl Zeiss Jena GmbH (Germany); **Warren R. Zipfel**, Cornell Univ. (USA)

## SUNDAY 14 FEBRUARY

### OPENING REMARKS

LOCATION: ROOM 2014 (WEST LEVEL 2) . . . . . 8:15 AM TO 8:30 AM

Conference Chair: Ammasi Periasamy, Univ. of Virginia (USA)

### SESSION 1

LOCATION: ROOM 2014 (WEST LEVEL 2) . . SUN 8:30 TO 10:00 AM

#### Keynote Session

Session Chair: **Ammasi Periasamy**, Univ. of Virginia (USA)

8:30 am: **Correlated phosphorescence and fluorescence lifetime imaging for cell metabolism** (*Keynote Presentation*), Angelika C. Rueck, Jasmin Breymayer, P. Schäfer, Bjorn von Einem, Christine A. F. von Arnim, Sviatlana Kalinina, Univ. Ulm (Germany) . . . . . [9712-1]

9:00 am: **Depth-resolved incoherent and coherent wide-field high-content imaging** (*Keynote Presentation*), Peter T. C. So, Massachusetts Institute of Technology (USA) . . . . . [9712-2]

9:30 am: **Biomedical applications of SRS microscopy** (*Keynote Presentation*), Xiaoliang S. Xie, Harvard Univ. (USA) . . . . . [9712-3]

Coffee Break . . . . . Sun 10:00 am to 10:30 am

### SESSION 2

LOCATION: ROOM 2014 (WEST LEVEL 2) . . SUN 10:30 AM TO 11:55 AM

#### Biomedical Applications of Coherent Raman I

Session Chair: **X. Sunney Xie**, Harvard Univ. (USA)

10:30 am: **Label-free vibrational stark imaging of neuronal membrane potential** (*Invited Paper*), Ji-Xin Cheng, Purdue Univ. (USA) . . . . . [9712-4]

10:50 am: **Phenotype classification of single cells using coherent Raman microscopy and RNA sequencing**, Aaron M. Streets, Chen Cao, Xiannian Zhang, Yanyi Huang, Peking Univ. (China) . . . . . [9712-5]

11:05 am: **Biological application of stimulated Raman scattering microscopy in modeling lipid dynamics** (*Invited Paper*), Yong Yu, Baylor College of Medicine (USA); Dan Fu, Univ. of Washington (USA); Harrison Liu, Univ. of California, San Francisco (USA); Xiaoliang S. Xie, Harvard Univ. (USA); Bo Huang, Univ. of California, San Francisco (USA); Meng Wang, Baylor College of Medicine (USA) . . . . . [9712-6]

11:25 am: **In vivo lipid saturation study of C. elegans using quantitative broadband coherent anti-stokes Raman imaging**, Bradley Littleton, Thomas Kavanagh, Yu Nie, Vincenzo Abbate, Peter Hylands, Stephen Sturzenbaum, David R. Richards, King's College London (United Kingdom) . . . . . [9712-7]

SPONSORS:



11:40 am: **Limitations and solutions for polarization resolved in-depth nonlinear vibrational imaging in biological tissues**, Sophie Brasselet, Hilton B. de Aguiar, Paulina Gasecka, Julien Duboisset, Hervé Rigneault, Institut Fresnel (France) . . . . . [9712-8]

Lunch/Exhibition Break . . . . . Sun 11:55 am to 1:25 pm

### SESSION 3

LOCATION: ROOM 2014 (WEST LEVEL 2) . . . SUN 1:25 PM TO 3:05 PM

#### Biomedical Applications of Coherent Raman II

Session Chair: **Ji-Xin Cheng**, Purdue Univ. (USA)

1:25 pm: **Broadband CARS: instrumentation, quantitation, and application** (*Invited Paper*), Marcus T. Cicerone, Charles H. Camp Jr., National Institute of Standards and Technology (USA) . . . . . [9712-9]

1:45 pm: **Intraoperative stimulated Raman scattering microscopy for guidance during brain tumor surgery**, Spencer Lewis, Univ. of Michigan Medical School (USA); Mia Garrard, Univ. of Michigan Health System (USA); Sunney S. Xie, Harvard Univ. (USA); Daniel A. Orringer, Univ. of Michigan Health System (USA) . . . . . [9712-10]

2:00 pm: **Histological reconstruction, guided micro-dissection, and sequencing of cancer tissue using stimulated Raman scattering (SRS) microscopy**, Tao Chen, Chen Cao, Biodynamic Optical Imaging Ctr. (China); Jianyun Zhang, Peking Univ. School of Stomatology (China); Yanyi Huang, Biodynamic Optical Imaging Ctr. (China); Tiejun Li, Peking Univ. School of Stomatology (China) . . . . . [9712-11]

2:15 pm: **Stimulated Raman scattering imaging of metabolic activities of mammalian brain tissue** (*Invited Paper*), Fanghao Hu, Lu Wei, Michael R. Lamprecht, Barclay Morisson, Wei Min, Columbia Univ. (USA) . . . . . [9712-12]

2:35 pm: **Hyperspectral stimulated Raman scattering and multiphoton imaging for label-free colonic diseases diagnosis and characterization**, Zi Wang, Wei Zheng, Jian Lin, Zhiwei Huang, National Univ. of Singapore (Singapore) . . . . . [9712-13]

2:50 pm: **Biomedical lipid imaging in zebrafish with stimulated Raman scattering microscopy**, Miriam J. Moester, Marjo J. den Broeder, Freek Ariese, Juliette Legler, Johannes F. de Boer, Vrije Univ. Amsterdam (Netherlands) . . . . . [9712-14]

Coffee Break . . . . . Sun 3:05 pm to 3:35 pm

# CONFERENCE 9712

LOCATION: ROOM 2014 (WEST LEVEL 2)

## SESSION 4

LOCATION: ROOM 2014 (WEST LEVEL 2) . . . . SUN 3:35 PM TO 5:10 PM

### Coherent Raman Technical Development

Session Chair: **Marcus T. Cicerone**,  
National Institute of Standards and Technology (USA)

3:35 pm: **Surface-sensitive coherent Raman scattering microscopy with total internal reflection illumination** (*Invited Paper*), Eric O. Potma, Alex Fast, Univ. of California, Irvine (USA); Christopher D. Syme, Univ. of Glasgow (United Kingdom) . . . . . [9712-15]

3:55 pm: **Dispersion-based stimulated Raman scattering spectroscopy, holography, and optical coherence tomography**, Francisco E. Robles, Martin C. Fischer, Warren S. Warren, Duke Univ. (USA) . . . . . [9712-16]

4:10 pm: **Polarization modulated background-free hyperspectral stimulated Raman scattering microscopy**, Marie-Andrée Houle, Institut National de la Recherche Scientifique (Canada); Marco Andreana, National Research Council Canada (Canada) and Univ. of Ottawa (Canada); Andrew Ridsdale, Douglas J. Moffatt, Rune Lausten, National Research Council Canada (Canada); François Légaré, Institut National de la Recherche Scientifique (Canada); Albert Stolow, National Research Council Canada (Canada) and Univ. of Ottawa (Canada) . . . . . [9712-17]

4:25 pm: **Resonant artefacts in broadband cars microspectroscopy**, Bradley Littleton, Thomas Kavanagh, David R. Richards, King's College London (United Kingdom) . . . . . [9712-18]

4:40 pm: **Electric field mapping and dosimetry by means of spontaneous and coherent Raman microspectroscopy**, Erwan Capitaine, Christophe Louot, Claire Lefort, Dominique Pagnoux, Vincent Couderc, Philippe Leproux, XLIM Institut de Recherche (France) . . . . . [9712-19]

4:55 pm: **Synchronized and timing-stabilized pulse generation from a gain-switched laser diode for stimulated Raman scattering microscopy**, Kyoya Tokunaga, The Univ. of Tokyo (Japan); Yi-Cheng Fang, Hiroyuki Yokoyama, Tohoku Univ. (Japan); Yasuyuki Ozeki, The Univ. of Tokyo (Japan) . . . . . [9712-20]

## POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Multiphoton fluorescence lifetime imaging of metabolic status in mesenchymal stem cell during differentiation**, Aleksandra V. Meleshina, N.I. Lobachevsky State Univ. of Nizhni Novgorod (Russian Federation) and Nizhny Novgorod State Medical Academy (Russian Federation); Varvara V. Dudenkova, Alena S. Bystrova, Elena I. Cherkasova, N.I. Lobachevsky State Univ. of Nizhni Novgorod (Russian Federation); Elena V. Zagaynova, Nizhny Novgorod State Medical Academy (Russian Federation) and N.I. Lobachevsky State Univ. of Nizhni Novgorod (Russian Federation) . . . . . [9712-28]

**Evaluation of collagen by second-harmonic generation microscopy support the heterogeneity of luminal breast cancer**, Rodrigo de Andrade Natal, Vitor B. Pelegati, Caroline Bondarik, Luis O. Z. Sarian, Sophie F. M. Derchain, Carlos L. César, José Vassallo, Univ. Estadual de Campinas (Brazil) . . . [9712-58]

**In vivo imaging flow cytometry based on two-photon microscopy at kHz cross-sectional frame rate**, Lingjie Kong, Meng Cui, Purdue Univ. (USA) . . . . . [9712-59]

**Comparison of in vivo-ex vivo imaging of the microvasculature with 2-photon fluorescence microscopy**, Joe Steinman, Univ. of Toronto (Canada) and The Hospital for Sick Children (Canada); Margaret Koletar, Sunnybrook Research Institute (Canada); Bojana Stefanovic, Sunnybrook Research Institute (Canada) and Univ. of Toronto (Canada); John G. Sled, Univ. of Toronto (Canada) and The Hospital for Sick Children (Canada) . . . . . [9712-60]

**Four-wave mixing based light sources for real-world biomedical applications of coherent anti-stokes Raman scattering microscopy**, Thomas Gottschall, Tobias Meyer, Michael Schmitt, Friedrich-Schiller-Univ. Jena (Germany); Jürgen Popp, Friedrich-Schiller-Univ. Jena (Germany) and Leibniz-Institut für Photonische Technologien e.V. (Germany); Jens Limpert, Friedrich-Schiller-Univ. Jena (Germany); Andreas Tünnermann, Friedrich-Schiller-Univ. Jena (Germany) and Fraunhofer Institute for Applied Optics and Precision Engineering (Germany) . . . . . [9712-61]

**Noninvasive visualization of pheomelanin using coherent Raman scattering microscopy**, Hequn Wang, Massachusetts General Hospital (USA); Sam Osseiran, Massachusetts Institute of Technology (USA) and Harvard-MIT Health Sciences and Technology (HST) Program (USA); Elisabeth Roider, David E. Fisher, Massachusetts General Hospital (USA); Conor L. Evans, Massachusetts General Hospital (USA) and Harvard Medical School (USA) . . . . . [9712-62]

**The nature of multiphoton fluorescence from red blood cells**, Ilyas Saytashev, Michigan State Univ. (USA); Michael Murphy, Wellman Ctr. for Photomedicine (USA); Sam Osseiran, Massachusetts Institute of Technology (USA); Dana M. Spence, Michigan State Univ. (USA); Conor L. Evans, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Marcos Dantus, Michigan State Univ. (USA) . . . . . [9712-63]

**Evaluation of oxidative stress in human skin exposed to common sun filters by two-photon excitation fluorescence (2PEF) and fluorescence lifetime imaging microscopy (FLIM)**, Sam Osseiran, Yusuke Suita, Elisabeth Roider, Hequn Wang, David E. Fisher, Conor L. Evans, Massachusetts General Hospital (USA) . . . . . [9712-64]

**Two-photon endomicroscopic metabolic imaging via simultaneous autofluorescence lifetime and redox ratio measurement**, Wenxuan Liang, Guanghan Meng, Israel Gannot, Johns Hopkins Univ. (USA); Ming-Jun Li, Corning Incorporated (USA); Xingde Li, Johns Hopkins Univ. (USA) . . . [9712-65]

**In vivo multiphoton imaging measurement of blood-brain barrier permeability during early postnatal brain development in rats**, Lingyan Shi, Bingmei Fu, Adrian Rodriguez-Conteras, The City College of New York (USA) . . . . . [9712-66]

**Coherent Raman scattering microscopy for probing longitudinal molecular orientations using spirally polarized light**, Jian Lin, Zhiwei Huang, National Univ. of Singapore (Singapore) . . . . . [9712-67]

**Monitoring and mapping intracellular concentrations of macromolecules by two-photon excited fluorescence lifetime imaging**, Lixin Liu, Xidian Univ. (China); Artem Pliss, Andrey N. Kuzmin, Univ. at Buffalo (USA); Xiao Peng, Junle Qu, Shenzhen Univ. (China); Paras N. Prasad, Univ. at Buffalo (USA) . . [9712-69]

**Observation of tendon repair in animal model using second-harmonic-generation microscopy**, Eiji Hase, Takeo Minamikawa, Katsuya Sato, The Univ. of Tokushima (Japan); Mitsuhiko Takahashi, Takamatsu Red Cross Hospital (Japan); Takeshi Yasui, The Univ. of Tokushima (Japan) . . . . . [9712-70]

**In situ quantitative evaluation of osteoblastic collagen synthesis under cyclic strain by using second-harmonic-generation microscope**, Oki Matsubara, Eiji Hase, Takeo Minamikawa, Takeshi Yasui, Katsuya Sato, The Univ. of Tokushima (Japan) . . . . . [9712-71]

**Imaging of three-photon induced fluorescence from graphene oxides on the biomimetic phantom**, Seung Won Jun, Sang Min Park, Jin Soo Choi, Seok Hee Kang, Suck Won Hong, Chang-Seok Kim, Pusan National Univ. (Korea, Republic of) . . . . . [9712-72]

**Multi-modal optical microscopy with multiphoton, second-harmonic generation and optical coherence microscopy using supercontinuum generation**, Jaehun Kim, Daekeun Kim, Dankook Univ. (Korea, Republic of) . . . . . [9712-73]

**Observation of two-photon fluorescence spectrum in cellular and tissue structures**, Sung-Ho Lee, Bo Ram Kim, Yumee Jeong, Hong-Gyu Ahn, Seung-Han Park, Yonsei Univ. (Korea, Republic of) . . . . . [9712-74]

**Real time imaging of live cell membrane using laser trapping, reflectance confocal microscopy, and multiphoton fluorescence microscopy**, Yunxian Tian, Haishan Zeng, Shangyuan Feng, Yimei Huang, Yimei Huang, Jianhua Zhao, Eddie Shen, Wenbo Wang, BC Cancer Research Ctr. (Canada); Caigan Du, The Univ. of British Columbia (Canada) . . . . . [9712-75]

**Stimulated Raman imaging of newly synthesized proteome response under cellular stress**, Lixue Shi, Lu Wei, Yihui Shen, Wei Min, Columbia Univ. (USA) . . . . . [9712-76]

**Second harmonic generation stokes ellipsometric microscopy for the imaging of the local tensors of collagen tissues**, Ximeng You, Emma L. DeWalt, Paul D. Schmitt, Garth J. Simpson, Purdue Univ. (USA) . . . . [9712-77]

**High speed wide field stimulated Raman scattering microscopy with an extreme high full well capacity camera and selective attenuation of background field**, Yang-Hyo Kim, Massachusetts Institute of Technology (USA); Jeon Woong Kang, Ramachandra R. Dasari, Laser Biomedical Research Ctr. (USA) and Massachusetts Institute of Technology (USA); Shyamsunder Erramilli, Boston Univ. (USA); Peter T. C. So, Massachusetts Institute of Technology (USA) . . . . . [9712-78]

**Novel pattern matching based fluorophore identification for advanced FLIM analysis**, Uwe Ortmann, Benedikt Kraemer, PicoQuant GmbH (Germany); Thomas Niehoerster, Anna Loeschberger, Julius-Maximilians-Univ. Würzburg (Germany); Volker Buschmann, Marcelle Koenig, Paja Reisch, Matthias Patting, Felix Koberling, PicoQuant GmbH (Germany); Ingo Gregor, Georg-August-Univ. Göttingen (Germany); Sandra Orthaus-Müller, Olaf Schulz, Rainer Erdmann, PicoQuant GmbH (Germany) . . . . . [9712-79]

# CONFERENCE 9712

## LOCATION: ROOM 2014 (WEST LEVEL 2)

BIOS

**Clustering and tracking of single membrane proteins in living bacteria by multi-dimensional microscopy**, Daniela Hellwig, Friedrich-Schiller-Univ. Jena (Germany); Gabriele Deckers-Hebestreit, Univ. Osnabrück (Germany); Michael Börsch, Friedrich-Schiller-Univ. Jena (Germany) . . . . . [9712-80]

**Line-scanning two-photon microscope for in vivo imaging of brain activity**, Marie-Pierre Adam, European Lab. for Non-linear Spectroscopy (Italy); Domenico Alfieri, Light4Tech Firenze S.r.l. (Italy); Leonardo Sacconi, Francesco S. Pavone, European Lab. for Non-linear Spectroscopy (Italy). . . . . [9712-81]

**Time-gated FLIM microscope for corneal metabolic imaging**, Susana Silva, Ana Batista, José Paulo Domingues, Univ. de Coimbra (Portugal); Maria João Quadrado, Univ. de Coimbra (Portugal) and Coimbra Hospital and Univ. Ctr. (Portugal); António Miguel Morgado, Univ. de Coimbra (Portugal) . . . . [9712-82]

**Higher harmonic generation microscopy of human brain tumors and temporal lobe epilepsy**, Nikolay Kuzmin, Vrije Univ. Amsterdam (Netherlands); P. Wesseling, Vrije Univ. Amsterdam (Netherlands) and Radboud Univ. Medical Ctr. (Netherlands); P. C. de Witt Hamer, D. P. Noske, Vrije Univ. Medical Ctr. (Netherlands) and VUmc Cancer Ctr. Amsterdam (Netherlands); A. J. Rozemuller, Vrije Univ. Medical Ctr. (Netherlands); E. Aronica, Vrije Univ. Medical Ctr. (Netherlands) and Stichting Epilepsie Instellingen Nederland-Heemstede (Netherlands); S. Idema, Vrije Univ. Medical Ctr. (Netherlands) and VUmc Cancer Ctr. Amsterdam (Netherlands); Giovanni D. Galgano, H. D. Mansvelder, Vrije Univ. Amsterdam (Netherlands); J. C. Baayen, Vrije Univ. Medical Ctr. (Netherlands) and Vrije Univ. Amsterdam (Netherlands) and VUmc Cancer Ctr. Amsterdam (Netherlands); Marloes L. Groot, Vrije Univ. Amsterdam (Netherlands) . . . . . [9712-83]

**FLIM data analysis of NADH and tryptophan autofluorescence in prostate cancer cells**, Meghan J. O'Melia, Horst K. Wallrabe, Zdenek Svindrych, Shagufta Rehman, Ammasi Periasamy, Univ. of Virginia (USA) . . . . . [9712-84]

**In-vivo dynamical analysis zonal difference of hepatobiliary metabolism in chronic hepatic diseases by multiphoton microscopy**, Chen-Yuan Dong, Chih-Ju Lin, National Taiwan Univ. (Taiwan); Hsuan-Shu Lee, National Taiwan Univ. Hospital (Taiwan) . . . . . [9712-85]

10:55 am: **Tunable PIE and synchronized gating detections by FastFLIM for quantitative microscopy measurements of fast dynamics of single molecules** (*Invited Paper*), Yuansheng Sun, Ulas Coskun, Beniamino B. Barbieri, Shih-Chu Liao, ISS, Inc. (USA) . . . . . [9712-25]

11:20 am: **Ns-time resolution for multispecies STED-FLIM and artifact free STED-FCS** (*Invited Paper*), Felix Koberling, Paja Reisch, Rhys Dowler, Benedikt Kraemer, Sebastian Tannert, Matthias Patting, Marcelle Koenig, Rainer Erdmann, PicoQuant GmbH (Germany). . . . . [9712-26]

11:45 am: **Live-tracking drug delivery in skin: multiphoton FLIM FRET**, Hanna Thomsen, Johan Borglin, Danni Wang, Marica B. Ericson, Univ. of Gothenburg (Sweden) . . . . . [9712-27]

Lunch Break . . . . . Mon 12:00 pm to 1:45 pm

### SESSION 8

LOCATION: ROOM 2014 (WEST LEVEL 2) . . . MON 1:45 PM TO 2:30 PM

## Technology Development I

Session Chair: **Peter T. C. So**,  
Massachusetts Institute of Technology (USA)

1:45 pm: **Multiphoton fluorescence lifetime microscopy quantifies in vivo tumor heterogeneity**, Amy T. Shah, Kirsten E. Diggins, Alex J. Walsh, Jonathan M. Irish, Melissa C. Skala, Vanderbilt Univ. (USA) . . . . . [9712-29]

2:00 pm: **STED FLIM: fluorescence lifetime imaging with 30nm resolution**, Christian A. Wurm, Abberior GmbH (Germany); Wolfgang Becker, Becker & Hickl GmbH (Germany); Andreas Schönle, Abberior GmbH (Germany) . [9712-30]

2:15 pm: **A phasor approach analysis of multiphoton FLIM measurements recorded from three-dimensional Caco-2 models to detect changes in NAD(P)H characteristics**, Pirmin Lakner, Universitätsklinikum Tübingen (Germany); Yvonne Möller, Monilola Olayoye, Univ. Stuttgart (Germany); Michael G. Monaghan, Universitätsklinikum Tübingen (Germany); Katja Schenke-Layland, Universitätsklinikum Tübingen (Germany) and Fraunhofer-Institut für Grenzflächen- und Bioverfahrenstechnik (Germany) . . . . . [9712-31]

## MONDAY 15 FEBRUARY

### SESSION 5

LOCATION: ROOM 2014 (WEST LEVEL 2) . . MON 8:30 AM TO 9:35 AM

## FLIM/FRET/FCS I

Session Chair: **Yuansheng Sun**, ISS, Inc. (USA)

8:30 am: **Imaging of calcium transients in cultured neurons by TCSPC FLIM** (*Invited Paper*), Wolfgang Becker, Becker & Hickl GmbH (Germany); Samuel Frere, Tel Aviv Univ. (Israel) . . . . . [9712-21]

8:55 am: **Binding of the immunomodulatory drug Bz-423 to mitochondrial FoF1-ATP synthase in living cells by FLIM-FRET and FRET acceptor photobleaching** (*Invited Paper*), Ilka Starke, Friedrich-Schiller-Univ. Jena (Germany); Gary D. Glick, Univ. of Michigan (USA); Michael Börsch, Friedrich-Schiller-Univ. Jena (Germany) . . . . . [9712-22]

9:20 am: **Investigation of prostate cancer cells using NADH and Tryptophan as biomarker: multiphoton FLIM-FRET microscopy**, Shagufta Rehman, Meghan J. O'Melia, Univ. of Virginia (USA); Horst Wallrabe, Univ. of Virginia (USA); Zdenek Svindrych, Univ. of Virginia (USA); Dhyan Chandra, Roswell Park Cancer Institute (USA); Ammasi Periasamy, Univ. of Virginia (USA) . . . . [9712-23]

### SESSION 6

LOCATION: ROOM 2014 (WEST LEVEL 2) . MON 9:35 TO 10:05 AM

## JenLab Young Investigator Award Papers Presentation

Session Chair: **Ammas Periasamy**, Univ. of Virginia (USA)

Coffee Break . . . . . Mon 10:05 am to 10:30 am

### SESSION 7

LOCATION: ROOM 2014 (WEST LEVEL 2) MON 10:30 AM TO 12:00 PM

## FLIM/FRET/FCS II

Session Chair: **Michael Börsch**,  
Friedrich-Schiller-Univ. Jena (Germany)

10:30 am: **Temporal binning of TCSPC data to improve exponential decay fits and improve imaging speed** (*Invited Paper*), Alex J. Walsh, National Research Council (USA) and Air Force Research Lab. (USA); Melissa C. Skala, Vanderbilt Univ. (USA); Hope T. Beier, Air Force Research Lab. (USA) . [9712-24]

## Award Presentation

2:30 PM TO 3:00 PM

LOCATION: ROOM 2014 (WEST LEVEL 2)

Session Chair: **Ammas Periasamy**, Univ. of Virginia (USA)

## Student Poster Session Competition

Graduate students and postdoctoral fellows are welcome to participate in the poster session competition of the conference on Multiphoton Microscopy in the Biomedical Sciences. There is a cash award for the winner(s). The winner(s) will be informed in person or by email and must receive the award in person in the conference hall. Participants should follow the rules and regulations of SPIE for submission of their abstract and manuscript. Participants should also register their names for the competition with the Conference Chairs during the first day of the conference.

PRIZE DONATED BY:

**Becker and Hickl, Carl Zeiss Microscopy, LLC, Chroma Tech, Coherent Inc., ISS Inc., Leica Microsystems, Newport Corporation, Princeton Instruments, Semrock, Veroptics**

## JenLab Young Investigator Award

We are pleased to announce that a prize in the amount of \$2000.00 will be awarded to a graduate student, postdoc, scientist, or junior faculty under the age of 32. To be eligible to receive the award, participants must 1) be both the primary author and presenter of an accepted abstract, 2) submit the proceedings paper by the due date, prior to the meeting, for review by the selection committee, 3) submit their paper for consideration.

PRIZE DONATED BY:



Coffee Break . . . . . Mon 3:00 pm to 3:30 pm



# CONFERENCE 9712

LOCATION: ROOM 2014 (WEST LEVEL 2)

## SESSION 9

LOCATION: ROOM 2014 (WEST LEVEL 2) . . . MON 3:30 PM TO 5:05 PM

### Technology Development II

Session Chair: **Peter T. C. So**,  
Massachusetts Institute of Technology (USA)

3:30 pm: **High-throughput 3D super-resolution imaging by volumetric parallel STED microscopy** (*Invited Paper*), Yi Xue, Christopher J. Rowlands, Peter T. C. So, Massachusetts Institute of Technology (USA). . . . . [9712-32]

3:55 pm: **SearchLight: a freely available web-based quantitative spectral analysis tool** (*Invited Paper*), Prashant Prabhat, Michael Peet, Turan Erdogan, Semrock, Inc. (USA) . . . . . [9712-33]

4:20 pm: **Recent developments in widely tunable and high peak power ultrafast laser sources and their adoption in biological imaging**, Julien Klein, Spectra-Physics (USA) . . . . . [9712-34]

4:35 pm: **Advanced femtosecond lasers enable new developments in non-linear imaging and fundamental studies in neuroscience, biology and medical applications**, Marco Arrigoni, Coherent, Inc. (USA); Darryl McCoy, Coherent Scotland Ltd. (United Kingdom) . . . . . [9712-35]

4:50 pm: **Airyscan detection combined with two-photon excitation improves imaging signal-to-noise and resolution in thick scattering samples**, Joseph Huff, Carl Zeiss Microscopy, LLC (USA); Ingo Kleppe, Carl Zeiss Microscopy GmbH (Germany). . . . . [9712-36]

## TUESDAY 16 FEBRUARY

### SESSION 10

LOCATION: ROOM 2014 (WEST LEVEL 2) . . . TUE 8:30 AM TO 9:55 AM

### Second/Third Harmonic Generation I

Session Chair: **Aisada Uchugonova**, Univ. des Saarlandes (Germany)

8:30 am: **Analysis of stromal alterations in ovarian cancers via wavelength dependent second harmonic generation microscopy and optical scattering** (*Invited Paper*), Paul J. Campagnola, Karissa B. Tilbury, Kirby R. Campbell, Kevin W. Eliceiri, Mansih Patankar, Univ. of Wisconsin-Madison (USA). [9712-37]

8:55 am: **Volumetric imaging of oral epithelial neoplasia by MPM-SHGM: epithelial connective tissue interface**, Rahul Pal, Jinping Yang, Suimin Qiu, Vicente Resto, Susan McCammon, Gracie Vargas, The Univ. of Texas Medical Branch (USA). . . . . [9712-38]

9:10 am: **Characterization of human arterial tissue affected by atherosclerosis using multimodal nonlinear optical microscopy**, Enrico Baria, European Lab. for Non-linear Spectroscopy (Italy); Riccardo Cicchi, European Lab. for Non-linear Spectroscopy (Italy) and Istituto Nazionale di Ottica (Italy); Matteo Rotellini, Daniela Massi, Univ. degli Studi di Firenze (Italy); Francesco S. Pavone, European Lab. for Non-linear Spectroscopy (Italy) and Istituto Nazionale di Ottica (Italy) and Univ. degli Studi di Firenze (Italy) [9712-39]

9:25 am: **Forward versus backward polarization-resolved SHG imaging of collagen structure in tissues**, Claire Teulon, Ecole Polytechnique (France) and Consiglio Nazionale delle Ricerche-Inserm U1182 (France); Ivan Gusachenko, Ecole Polytechnique (France) and Consiglio Nazionale delle Ricerche-Inserm U1182 (France) and Okinawa Institute of Science and Technology Graduate Univ. (Japan); Gaël Latour, Ecole Polytechnique (France) and Consiglio Nazionale delle Ricerche-Inserm U1182 (France) and Univ. Paris-Sud 11 (France); Marie-Claire Schanne-Klein, Lab. d'Optique et Biosciences (France) and Consiglio Nazionale delle Ricerche-Inserm U1182 (France) . . . . . [9712-40]

9:40 am: **Impact of relative collagen fibril polarity in determining the signal intensity in second harmonic generation microscopy**, Charles-André Couture, Stéphane Bancelin, Institut National de la Recherche Scientifique (Canada); Jarno N. Van der Kolk, Konstantin Popov, Univ. of Ottawa (Canada); Maxime Rivard, Katherine Légaré, Institut National de la Recherche Scientifique (Canada); Gabrielle Martel, Univ. de Montréal (Canada); Hélène Richard, Univ. of Ottawa (Canada); Cameron Brown, Univ. of Oxford (United Kingdom); Sheila Laverty, Univ. de Montréal (Canada); Lora Ramunno, Univ. of Ottawa (Canada); François Légaré, Institut National de la Recherche Scientifique (Canada) . . . . . [9712-41]

Coffee Break . . . . . Tue 9:55 am to 10:25 am

## SESSION 11

LOCATION: ROOM 2014 (WEST LEVEL 2) . TUE 10:25 AM TO 12:00 PM

### Second/Third Harmonic Generation II

Session Chair: **Paul J. Campagnola**, Univ. of Wisconsin-Madison (USA)

10:25 am: **Two-photon imaging during brain surgery: first clinical study using a certified multiphoton tomograph** (*Invited Paper*), Karsten König, Univ. des Saarlandes (Germany) and JenLab GmbH (Germany); Martin Weinigel, JenLab GmbH (Germany); Sven R. Kandelhardt, Alf Giese, Universitätsmedizin der Johannes Gutenberg-Univ. Mainz (Germany). . . . . [9712-42]

10:50 am: **Biocompatibility of novel ultracompact femtosecond laser oscillators for multiphoton imaging** (*Invited Paper*), Aisada Uchugonova, Univ. des Saarlandes (Germany) and JenLab GmbH (Germany); Hans G. Breunig, JenLab GmbH (Germany); Tuan Li, FEMTOLASERS Produktions GmbH (Austria); Karsten König, Univ. des Saarlandes (Germany) and JenLab GmbH (Germany) . . . . . [9712-43]

11:15 am: **Multimodal imaging platform to study cancer progression in zebrafish**, Angelika Unterhuber, Marco Andreana, Aart J. Verhoef, Medizinische Univ. Wien (Austria); Martin Distel, St. Anna Kinderkrebsforschung e.V. (Austria); Alma del Carmen Fernandez Gonzalez, Technische Univ. Wien (Austria); René M. Werkmeister, Wolfgang Drexler, Medizinische Univ. Wien (Austria) . [9712-44]

11:30 am: **Multiphoton imaging with a nanosecond supercontinuum source**, Claire Lefort, XLIM Institut de Recherche (France) and Univ. de Limoges (France) and Consiglio Nazionale delle Ricerche (France); Rodney P. O'Connor, XLIM Institut de Recherche (France); Véronique Blanquet, Fabienne Baraige, Unité de Génétique Moléculaire Animale (France); Vincent Tombelaire, LEUKOS (France); Philippe Leveque, Vincent Couderc, Philippe Leproux, XLIM Institut de Recherche (France) . . . . . [9712-45]

11:45 am: **Coherence gated wavefront sensorless adaptive optics for two photon imaging**, Yifan Jian, Michelle Cua, Simon Fraser Univ. (Canada); Stefano Bonora, IFN-CNR LUXOR Lab. (Italy); Edward N. Pugh Jr., Robert J. Zawadzki, Univ. of California, Davis (USA); Marinko V. Sarunic, Simon Fraser Univ. (Canada). . . . . [9712-46]

Lunch Break . . . . . Tue 12:00 pm to 1:30 pm

## SESSION 12

LOCATION: ROOM 2014 (WEST LEVEL 2) . . . . TUE 1:30 PM TO 3:05 PM

### Technology Development III

Session Chair: **Francesco S. Pavone**,  
European Lab. for Non-linear Spectroscopy (Italy)

1:30 pm: **Large field of view in vivo multiphoton microscopy of human skin** (*Invited Paper*), Mihaela Balu, Beckman Laser Institute and Medical Clinic (USA); Hideharu Mikami, The Univ. of Tokyo (Japan) and Univ. of California, Irvine (USA); Jue Hou, Beckman Laser Institute and Medical Clinic (USA); Eric O. Potma, Univ. of California, Irvine (USA); Bruce J. Tromberg, Beckman Laser Institute and Medical Clinic (USA). . . . . [9712-47]

1:55 pm: **Design of a portable, wide field of view, GPU-accelerated multiphoton imaging system for real-time imaging of breast surgical specimens** (*Invited Paper*), Michael G. Giacomelli, Tadayuki Yoshitake, Osman O. Ahsen, Massachusetts Institute of Technology (USA); Lennart A. Husvogt, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); Yury Sheykin, Hilde Vardeh, Beth Israel Deaconess Medical Ctr. (USA); Jeffrey Brooker, Thorlabs, Inc. (USA); James L. Connolly, Beth Israel Deaconess Medical Ctr. (USA); Joachim Hornegger, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); Alex E. Cable, Thorlabs, Inc. (USA); James G. Fujimoto, Massachusetts Institute of Technology (USA) . . . . . [9712-48]

2:20 pm: **Compact fixed wavelength femtosecond oscillators as an add-on for tunable titanium sapphire lasers extend the range of applications towards multimodal imaging and optogenetics**, Tommi Hakulinen, Spectra-Physics (Austria); Julien Klein, Spectra-Physics (USA) . . . . . [9712-49]

2:35 pm: **Advanced multiphoton methods for in vitro and in vivo functional imaging of mouse retinal neurons**, Noam Cohen, Adi Schejter, Nairouz Farah, Shy Shoham, Technion-Israel Institute of Technology (Israel) . . . . . [9712-50]

2:50 pm: **Widefield three-photon excitation: excitation of quantum dots and optogenetic opsins using 1300nm excitation**, Christopher J. Rowlands, Demian Park, Kiryl Piatkevich, Oliver T. Bruns, Mouni G. Bawendi, Edward S. Boyden, Peter T. C. So, Massachusetts Institute of Technology (USA) . [9712-51]

Coffee Break . . . . . Tue 3:05 pm to 3:30 pm



**SESSION 13**

**LOCATION: ROOM 2014 (WEST LEVEL 2) . . . . TUE 3:30 PM TO 5:10 PM**

**Technology Development IV**

Session Chair: **Karsten König**, Univ. des Saarlandes (Germany)

3:30 pm: **Label-free NIR reflectance imaging as a complimentary tool for two-photon fluorescence microscopy** (*Invited Paper*), Anna Letizia Allegra Mascaro, European Lab. for Non-linear Spectroscopy (Italy) and Consiglio Nazionale delle Ricerche (Italy) and Istituto Nazionale di Ottica (Italy); Irene Costantini, Emilia Margoni, European Lab. for Non-linear Spectroscopy (Italy); Giulio Iannello, Alessandro Bria, Univ. Campus Bio-Medico (Italy); Leonardo Sacconi, European Lab. for Non-linear Spectroscopy (Italy) and Consiglio Nazionale delle Ricerche (Italy) and Istituto Nazionale di Ottica (Italy); Francesco S. Pavone, European Lab. for Non-linear Spectroscopy (Italy) and Univ. degli Studi di Firenze (Italy) . . . . . [9712-52]

3:55 pm: **Brillouin imaging/sensing via time-resolved optical (BISTRO) measurements**, Zhaokai Meng, Charles Ballman, Georgi I. Petrov, Vladislav V. Yakovlev, Texas A&M Univ. (USA) . . . . . [9712-53]

4:10 pm: **Multiphoton microscope driven by novel green laser pump**, Dominik Marti, Anders K. Hansen, Mathias Christensen, Ole B. Jensen, Peter E. Andersen, DTU Risø Campus (Denmark) . . . . . [9712-54]

4:25 pm: **Ratiometric detection of O<sub>2</sub> sensing probe in tumor model via two photon microscopy**, Calvin J. Yoon, Bumju Kim, Junhwa Lee, Seoyeon Bok, Joonhyuck Park, Seunghun Lee, Viet Hoan Le, Sungjee Kim, G-One Ahn, Ki Hean Kim, Pohang Univ. of Science and Technology (Korea, Republic of) . . . . . [9712-55]

4:40 pm: **A new method using multiphoton imaging and morphometric analysis for differentiating chromophobe renal cell carcinoma and oncocytoma kidney cancers**, Binlin Wu, Southern Connecticut State Univ. (USA); Sushmita Mukherjee, Manu Jain, Weill Cornell Medical College (USA) . . . . . [9712-56]

4:55 pm: **Quantitative structural markers of colorectal dysplasia progression in a cross sectional study of the APC/min mouse using label-free multiphoton microscopy**, Sandra P. Prieto, Gage J. Greening, Cassandra Reed, Timothy J. Muldoon, Univ. of Arkansas (USA) . . . . . [9712-57]

# CONFERENCE 9713

LOCATION: ROOM 2022 (WEST LEVEL 2)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9713

# Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XXIII

Conference Chairs: **Thomas G. Brown**, Univ. of Rochester (USA); **Carol J. Cogswell**, Univ. of Colorado at Boulder (USA); **Tony Wilson**, Univ. of Oxford (United Kingdom)

Program Committee: **Martin Booth**, Univ. of Oxford (United Kingdom); **Charles A. DiMarzio**, Northeastern Univ. (USA); **Raimund J. Ober**, Texas A&M Univ. (USA); **Chrysanthe Preza**, Univ. of Memphis (USA); **Monika Ritsch-Marte**, Innsbruck Medical Univ. (Austria); **Laura Waller**, Univ. of California, Berkeley (USA)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: ROOM 2022 (WEST LEVEL 2) . MON 8:20 AM TO 10:10 AM

### Imaging and Reconstruction Beyond the Diffraction Limit

Session Chair: **Thomas G. Brown**, Univ. of Rochester (USA)

8:20 am: **Microscopy using source and detector arrays** (*Invited Paper*), Colin J. Sheppard, Marco Castello, Giuseppe Vicidomini, Marti Duocastella, Alberto Diaspro, Istituto Italiano di Tecnologia (Italy) . . . . . [9713-1]

8:50 am: **Novel contrast mechanism for label free super-resolution imaging**, Sergey A. Alexandrov, James McGrath, Hrebesh M. Subhash, National Univ. of Ireland, Galway (Ireland); Cinzia Giannini, Consiglio Nazionale delle Ricerche (Italy); Francesca Boccafroschi, Univ. degli Studi del Piemonte Orientale Amedeo Avogadro (Italy); Martin J. Leahy, National Univ. of Ireland, Galway (Ireland) . . . . . [9713-2]

9:10 am: **Super-resolved nonlinear microscopy with spatial frequency modulated imaging**, Keith Wernsing, Jeffrey J. Field, Randy A. Bartels, Scott R. Domingue, Colorado State Univ. (USA); Jeffrey A. Squier, Alyssa Allende Motz, Colorado School of Mines (USA); Dean H. Levi, Darius Kuciauskas, National Renewable Energy Lab. (USA); Jennifer DeLuca, Keith DeLuca, Colorado State Univ. (USA) . . . . . [9713-3]

9:30 am: **Investigating the performance of reconstruction methods used in structured illumination microscopy as a function of the illumination pattern's modulation frequency**, Hasti Shabani, The Univ. of Memphis (USA); Emilio Sánchez-Ortiga, Univ. de València (Spain); Chrysanthe Preza, The Univ. of Memphis (USA) . . . . . [9713-4]

9:50 am: **Super-resolution through broadband random speckle patterns**, Zachary Hoffman, Charles A. DiMarzio, Northeastern Univ. (USA) . . . . . [9713-5]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

### SESSION 2

LOCATION: ROOM 2022 (WEST LEVEL 2) MON 10:40 AM TO 12:00 PM

### Instrumental Methods I

Session Chair: **Carol J. Cogswell**, Univ. of Colorado at Boulder (USA)

10:40 am: **Volumetric real-time wide-field microscopy with tunable acoustic gradient lens**, Ting Hsuan Chen, Craig B. Arnold, Princeton Univ. (USA) . . . . . [9713-6]

11:00 am: **Line-scan focal modulation microscopy: a comparison study**, Nanguang Chen, Shilpa Pant, National Univ. of Singapore (Singapore) . . [9713-7]

11:20 am: **Speckle pattern analysis to provide displacement profile induced by acoustic radiation force**, Ali Vakili, Northeastern Univ. (USA); Joseph L. Hollmann, ICFO–Institut de Ciències Fotòniques (Spain); Ray Glynn Holt, Boston Univ. (USA); Charles A. DiMarzio, Northeastern Univ. (USA) . . . . . [9713-8]

11:40 am: **Fluorescence microscopy with isotropic resolution using three objectives**, Thomas Huelsnitz, Peter Kner, The Univ. of Georgia (USA) . [9713-9]

Lunch Break . . . . . Mon 12:00 pm to 1:30 pm

### SESSION 3

LOCATION: ROOM 2022 (WEST LEVEL 2) . . MON 1:30 PM TO 3:10 PM

### Holographic Microscopy I

Session Chair: **Monika Ritsch-Marte**, Medizinische Univ. Innsbruck (Austria)

1:30 pm: **Coherent image reconstruction of incoherent contrast light**, Jeffrey J. Field, David G. Winters, Randy A. Bartels, Colorado State Univ. (USA) . . . . . [9713-10]

1:50 pm: **Multimodal interferometric microscopy for label-free 3D imaging of live cells during flow**, Natan T. Shaked, Tel Aviv Univ. (Israel) . . . [9713-11]

2:10 pm: **New approaches for the analysis of confluent cell layers with quantitative phase digital holographic microscopy**, Luisa Pohl, Mathias Kaiser, Steffi Ketelhut, Eva Doecker, Suzana Pereira, Jürgen Schnekenburger, Francisco Goycoolea, Björn Kemper, Westfälische Wilhelms-Univ. Münster (Germany) . . . . . [9713-12]

2:30 pm: **Imaging macroscopic targets hidden behind a scattering layer using a low-coherence and wide-field interferometry**, Sungsoo Woo, Sungsam Kang, Changhyeong Yoon, Wonshik Choi, Korea Univ. (Korea, Republic of) . . . . . [9713-13]

2:50 pm: **Dual detection confocal microscopy: high-speed surface profiling without depth scanning**, Dong-Ryoung Lee, KAIST (Korea, Republic of); Hongki Yoo, Hanyang Univ. (Korea, Republic of); Dae-Gab Gweon, KAIST (Korea, Republic of) . . . . . [9713-14]

Coffee Break . . . . . Mon 3:10 pm to 3:40 pm

### SESSION 4

LOCATION: ROOM 2022 (WEST LEVEL 2) . . MON 3:40 PM TO 5:20 PM

### Instrumental Methods II

Session Chair: **Charles A. DiMarzio**, Northeastern Univ. (USA)

3:40 pm: **Increasing spatial resolution in confocal Raman microscopy**, Clemens Roeder, Alexander Jesacher, Medizinische Univ. Innsbruck (Austria) . . . . . [9713-64]

4:00 pm: **Optical axial scanning in structured illumination imaging enabled by a tunable lens**, Taylor Hinsdale, Bilal H. Malik, Cory A. Olsovsky, Javier A. Jo, Kristen C. Maitland, Texas A&M Univ. (USA) . . . . . [9713-16]

4:20 pm: **Confocal fluorometer for diffusion tracking in 3D engineered tissue constructs**, Daniel J. Daly, Lein Applied Diagnostics Ltd. (United Kingdom); Andrea Zilioli, Univ. degli Studi di Genova (Italy); Noah S. Tan, Univ. College London (United Kingdom); Kim K. Buttenschoen, Durham Univ. (United Kingdom) and Lein Applied Diagnostics Ltd. (United Kingdom); Bhaskar Chikkanna, James Reynolds, Ben Marsden, Chris Hughes, Lein Applied Diagnostics Ltd. (United Kingdom) . . . . . [9713-17]

4:40 pm: **Simultaneous fluorescence and high-resolution bright-field imaging with aberration-correction over a wide field-of-view with Fourier ptychographic microscopy**, Jaebum Chung, Jinho Kim, Xiaozhe Ou, Roarke Horstmeyer, Changhui Yang, California Institute of Technology (USA) . . . . . [9713-18]

# CONFERENCE 9713

## LOCATION: ROOM 2022 (WEST LEVEL 2)

5:00 pm: **The impact of absorption coefficient on polarimetric determination of berry phase based depth resolved characterization of biomedical scattering samples: a polarized Monte Carlo investigation**, Justin S. Baba, Oak Ridge National Lab. (USA); Vijay Koju, Univ. of Tennessee (USA) and Middle Tennessee State Univ. (USA); Dwayne John, The Univ. of Tennessee Knoxville (USA) and Middle Tennessee State Univ. (USA) . . . [9713-19]

### POSTERS-MONDAY

**LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM**

Conference attendees are invited to attend the BIOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Motion correction of full-field swept-source optical coherence tomography integrated with surgical microscope**, Chang-Soo Kim, Hyeong Soo Nam, Hanyang Univ. (Korea, Republic of); Hyung-Ki Lee, Koh Young Technology, Inc. (Korea, Republic of); Hongki Yoo, Hanyang Univ. (Korea, Republic of) . . . [9713-56]

**Application of linear-scale differential analysis in phase correlation method of image stitching**, Vitalii V. Bezzubik, Nikolai R. Belashenkov, Sergei V. Losev, ITMO Univ. (Russian Federation) . . . [9713-57]

**Improving the lateral resolution of optical coherence tomography for imaging of skins**, Kai Shen, Hui Lu, Michael R. Wang, Univ. of Miami (USA) . . . [9713-58]

**Three dimensional measurement of camp gradients using hyperspectral confocal microscopy**, Thomas C. Rich, Naga Annamdevula, Rachel Sweat, Andrea L. Britain, Samuel Mayes, Peter F. Favreau, Silas J. Leavesley, Univ. of South Alabama (USA) . . . [9713-59]

**Three-dimensional dental scanning method based on structured illumination microscopy**, Jae Sung Ahn, Joo Beom Eom, Anjin Park, Byeong-il Lee, Korea Photonics Technology Institute (Korea, Republic of) . . . [9713-60]

**The cubic protocol adapted for 3D imaging of the intact murine colon with light sheet microscopy**, Alicia Arranz, Ctr. de Biología Molecular "Severo Ochoa" (Spain) and Consejo Superior de Investigaciones Científicas (Spain) . . . [9713-61]

**Hologram encoding strategies for non-Bayesian noise suppression in digital holography reconstructions and optical display**, Vittorio Bianco, Pasquale Memmolo, Andrea Finizio, Melania Paturzo, Pietro Ferraro, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) and Consiglio Nazionale delle Ricerche (Italy) . . . [9713-62]

**Live cell 3D super-localization imaging from a single plane of focus using EPIC microscopy**, Simeng Chen, Jiun-Yann Yu, Ramzi N. Zahreddine, Jian Xing, Jolien Tyler, Mark Winey, Carol J. Cogswell, Univ. of Colorado at Boulder (USA) . . . [9713-65]

## TUESDAY 16 FEBRUARY

### SESSION 5

**LOCATION: ROOM 2022 (WEST LEVEL 2) . TUE 8:20 AM TO 10:10 AM**

### Innovations in Optical Modes

Session Chair: **Thomas G. Brown**, Univ. of Rochester (USA)

8:20 am: **High-speed gigapixel and 3D phase microscopy using coded illumination** (*Invited Paper*), Lei Tian, Laura Waller, Univ. of California, Berkeley (USA) . . . [9713-20]

8:50 am: **Super-resolution optical microscopy by using dielectric microspheres and microwires**, Arash Darafsheh, Gaoxiang Wu, Shu Yang, Jarod C. Finlay, Univ. of Pennsylvania (USA) . . . [9713-21]

9:10 am: **EPIC microscopy generates high-speed 3D images of continuous structures without changing focus**, Carol J. Cogswell, Univ. of Colorado at Boulder (USA) . . . [9713-22]

9:30 am: **Lensfree on-chip high-resolution imaging using two-way lighting, and its limitations**, Yasuhiko Adachi, Tokuhiko Tamaki, Motomura Hideto, Yoshihisa Kato, Panasonic Corp. (Japan) . . . [9713-23]

9:50 am: **Optically sectioned widefield fluorescence lifetime imaging endoscopy enabled by structured illumination**, Taylor Hinsdale, Bilal H. Malik, Jose Jesus Rico-Jimenez, Javier A. Jo, Kristen C. Maitland, Texas A&M Univ. (USA) . . . [9713-24]

Coffee Break . . . Tue 10:10 am to 10:40 am

### SESSION 6

**LOCATION: ROOM 2022 (WEST LEVEL 2) TUE 10:40 AM TO 12:00 PM**

### Image Reconstruction and Analysis I

Session Chair: **Laura Waller**, Univ. of California, Berkeley (USA)

10:40 am: **Three-dimensional imaging using phase retrieval with two focus planes**, Tali Ilovitsh, Asaf Ilovitsh, Aryeh M. Weiss, Rinat Meir, Zeev Zalevsky, Bar-Ilan Univ. (Israel) . . . [9713-25]

11:00 am: **Compressive sensing in reflectance confocal microscopy of skin images: a preliminary comparative study**, Fernando X. Arias, Univ. de Puerto Rico Mayagüez (USA); Heidi Sierra, Milind Rajadhyaksha, Memorial Sloan-Kettering Cancer Ctr. (USA); Emmanuel Arzuaga, Univ. de Puerto Rico Mayagüez (USA) . . . [9713-26]

11:20 am: **A superresolution algorithm in fluorescence microscopy with limited artefacts for conical diffraction microscopy**, Julien Caron, Bioaxial (France); Anne-Sophie Mace, Bioaxial (France) and Univ. Paris Descartes (France); Stephane Oddos, Clément Fallet, Gabriel Y. Sirat, Bioaxial (France); Lionel Moisan, René Descartes Univ. (France) . . . [9713-27]

11:40 am: **Fabrication of two-color annular hybrid wave plate for three-dimensional super-resolution microscopy**, Hiroshi Kumagai, Kitasato Univ. (Japan); Yoshinori Iketaki, Olympus Corp. (Japan); Kornel Jahn, Nador Bokor, Budapest Univ. of Technology and Economics (Hungary) . . . [9713-28]

Lunch Break . . . Tue 12:00 pm to 1:10 pm

### SESSION 7

**LOCATION: ROOM 2022 (WEST LEVEL 2) . . . TUE 1:10 PM TO 3:10 PM**

### Instrumental Methods III

Session Chair: **Tony Wilson**, Univ. of Oxford (United Kingdom)

1:10 pm: **Development of a temporal multiplexed 3D beam-scanning Lissajous trajectory microscope for rapid, multimodal volumetric imaging**, Justin A. Newman, Shane Z. Sullivan, Janny Dinh, Sreya Sarkar, Garth J. Simpson, Purdue Univ. (USA) . . . [9713-29]

1:30 pm: **Deformable mirror based remote focusing for fast three-dimensional microscopy**, Mantas Zurauskas, Maria Frade Rodriguez, Martin J. Booth, Univ. of Oxford (United Kingdom) . . . [9713-30]

1:50 pm: **Design of adaptive objective lens for ultrabroad near infrared imaging**, Gongpu Lan, Thomas F. Mauger, Guoqiang Li, The Ohio State Univ. (USA) . . . [9713-31]

2:10 pm: **Optical transfer function characterization using a weak diffuser**, Gautam Gunjala, Aamod Shanker, Nick Antipa, Laura Waller, Univ. of California, Berkeley (USA) . . . [9713-32]

2:30 pm: **Confocal imaging with orthogonally polarized illumination beams**, Bosanta R. Boruah, Ranjan Kalita, Indian Institute of Technology Guwahati (India) . . . [9713-33]

2:50 pm: **A linear algorithm for quantitative measure of corneal collagen fiber orientation using second harmonic generation microscopy**, James McLean, Charles A. DiMarzio, Northeastern Univ. (USA) . . . [9713-66]

Coffee Break . . . Tue 3:10 pm to 3:40 pm

### SESSION 8

**LOCATION: ROOM 2022 (WEST LEVEL 2) . . TUE 3:40 PM TO 5:20 PM**

### Light Sheet and Extended Depth of Focus Microscopy

Session Chair: **Chrysanthe Preza**, The Univ. of Memphis (USA)

3:40 pm: **Three-dimensional fluorescence imaging by stage-scanning oblique plane microscopy**, Vincent Maioli, Frederik Görlitz, Sean Warren, Sunil Kumar, Paul M. W. French, George Chennell, Alessandro Sardini, David Carling, Imperial College London (United Kingdom); Frederike Alwes, Ecole Normale Supérieure de Lyon (France); Christopher W. Dunsby, Imperial College London (United Kingdom) . . . [9713-34]

4:00 pm: **Increasing the imaging depth through computational scattering correction**, Benno Koberstein-Schwarz, Helmholtz Zentrum München GmbH (Germany) and Carl Zeiss AG (Germany); Lars Omlor, Tobias Schmitt-Manderbach, Timo Mappes, Carl Zeiss AG (Germany); Vasilis Ntziachristos, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany) . . . [9713-35]

# CONFERENCE 9713

LOCATION: ROOM 2022 (WEST LEVEL 2)

4:20 pm: **Volumetric high resolution imaging of live cancer cell spheroids using light sheet fluorescence microscopy**, Stylianos Psycharakis, Evangelos Liapis, Ilias Kyparissidis-Kokkinidis, Athanasios Zacharopoulos, Joseph Papamatheakis, Foundation for Research and Technology-Hellas (Greece); Jorge Ripoll, Univ. Carlos III de Madrid (Spain); Giannis Zacharakis, Foundation for Research and Technology-Hellas (Greece) . . . . . [9713-36]

4:40 pm: **Light sheet polarimetric imaging**, Thomas G. Brown, Univ. of Rochester (USA) . . . . . [9713-37]

5:00 pm: **Volumetric retinal fluorescence imaging with extended depth of field microscope**, Zengzhuo Li, The Ohio State Univ. (USA); Wei Li, National Eye Institute (USA); Guoqing Li, The Ohio State Univ. (USA) . . . . . [9713-63]

## WEDNESDAY 17 FEBRUARY

### SESSION 9

LOCATION: ROOM 2022 (WEST LEVEL 2) WED 8:30 AM TO 10:10 AM

#### Holographic Microscopy II

Session Chair: **Martin J. Booth**, Univ. of Oxford (United Kingdom)

8:30 am: **Joint imaging and trapping by 2-color synthetic holography**, Monika Ritsch-Marte, Medizinische Univ. Innsbruck (Austria) . . . . . [9713-38]

8:50 am: **High resolution image plane digital holographic microscopy**, Mandeep Singh, Kedar B. Khare, Indian Institute of Technology Delhi (India) . . . . . [9713-39]

9:10 am: **Optimized numerical dynamic DIC by digital holography**, Vittorio Bianco, Melania Paturzo, Valentina Marchesano, Pietro Ferraro, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) and Consiglio Nazionale delle Ricerche (Italy) . . . . . [9713-40]

9:30 am: **Dynamic photothermal interferometric phase microscopy**, Nir A. Turko, Omry Blum, Natan T. Shaked, Tel Aviv Univ. (Israel) . . . . . [9713-41]

9:50 am: **Swept-source holographic phase microscopy**, Yizheng Zhu, Shichao Chen, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9713-42]

Coffee Break . . . . . Wed 10:10 am to 10:40 am

### SESSION 10

LOCATION: ROOM 2022 (WEST LEVEL 2) WED 10:40 AM TO 12:00 PM

#### Quantitative Phase Imaging

Session Chair: **Raimund J. Ober**, Texas A&M Univ. (USA)

10:40 am: **Integrated quantitative phase and polarization imaging using spectral multiplexing interferometry**, Chengshuai Li, Yizheng Zhu, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9713-43]

11:00 am: **Multiplexed fluorescence and phase microscopy for simultaneous, single-camera, one-shot, multimodal imaging**, Shwetadwip Chowdhury, Joseph A. Izatt, Duke Univ. (USA) . . . . . [9713-44]

11:20 am: **A novel phase shifting structured illumination microscopy**, Veena Singh, Vishesh Dubey, Azeem Ahmad, Gyanendra Singh, Dalip Singh Mehta, Indian Institute of Technology Delhi (India) . . . . . [9713-45]

11:40 am: **Label-free three dimensional reconstruction of biological samples**, Sherazade Aknoun, PHASICS S.A. (France); Pierre Bon, Institut d'Optique Graduate School (France); Julien Savatier, Serge Monneret, Institut Fresnel (France) and Aix-Marseille Univ. (France); Benoit F. Wattellier, PHASICS S.A. (France) . . . . . [9713-46]

Lunch Break . . . . . Wed 12:00 pm to 1:30 pm

### SESSION 11

LOCATION: ROOM 2022 (WEST LEVEL 2) . . WED 1:30 PM TO 3:10 PM

#### Innovative Methods in Microscopy

Session Chair: **Carol J. Cogswell**, Univ. of Colorado at Boulder (USA)

1:30 pm: **Investigating the usage of point spread functions in point source and microsphere localization**, Jerry Chao, Texas A&M Univ. (USA); Sripad Ram, Univ. of Texas at Dallas (USA); Elizabeth S. Ward, Texas A&M Health Science Ctr. (USA); Raimund J. Ober, Texas A&M Univ. (USA) . . . . . [9713-47]

1:50 pm: **High-speed volumetric STED-like microscopy with focus extension**, Kai-Ping Yang, Wei-Kuan Lin, Kuo-Jen Hsu, Shi-Wei Chu, National Taiwan Univ. (Taiwan) . . . . . [9713-48]

2:10 pm: **Spectral reconstruction strategies toward generalized-domain optical coherence tomography with a broadband source and a bucket detector**, Pui-Chuen Hui, Néstor Uribe-Patarroyo, Martin Villiger, Brett E. Bouma, Harvard Medical School (USA) . . . . . [9713-49]

2:30 pm: **Data driven 3D high resolution structure illuminated fluorescent microscopy based on Bayesian estimation**, Hsi-Hsun Chen, Yuan Luo, National Taiwan Univ. (Taiwan); Vijay R. Singh, SMART-Singapore MIT Alliance for Research & Technology (Singapore) . . . . . [9713-50]

2:50 pm: **Nonlinear complex diffusion approaches based on a novel noise estimation for noise reduction in phase-resolved optical coherence tomography**, Shaoyan Xia, Yong Huang, Xiaodi Tan, Beijing Institute of Technology (China) . . . . . [9713-51]

Coffee Break . . . . . Wed 3:10 pm to 3:40 pm

### SESSION 12

LOCATION: ROOM 2022 (WEST LEVEL 2) . WED 3:40 PM TO 5:00 PM

#### Image Reconstruction and Analysis II

Session Chair: **Thomas G. Brown**, Univ. of Rochester (USA)

3:40 pm: **Modified K-factor image decomposition for three-dimensional super resolution microscopy**, Tali Ilovitsh, Aryeh M. Weiss, Bar-Ilan Univ. (Israel); Amihai Meiri, Carl G. Ebeling, The Univ. of Utah (USA); Aliza Amiel, Hila Katz, Batya Mannasse Green, Bar-Ilan Univ. (Israel) and Meir Medical Ctr. (Israel); Zeev Zalevsky, Bar-Ilan Univ. (Israel) . . . . . [9713-52]

4:00 pm: **Scale-up through sparse representation in chemical imaging of infected RBC cell components**, Nicolas Spegazzini, Rishikesh Pandey, Jeon Woong Kang, Massachusetts Institute of Technology (USA); Ishan Barman, Johns Hopkins Univ. (USA); Ramachandra R. Dasari, Peter T. C. So, Massachusetts Institute of Technology (USA) . . . . . [9713-53]

4:20 pm: **A computational hyperspectral imaging technique**, Nasim Habibi, Mohammad Azari, The Univ. of North Carolina at Charlotte (USA); Mehrdad Abolbashiari, Optoniks, Inc. (USA); Faramarz Farahi, The Univ. of North Carolina at Charlotte (USA) . . . . . [9713-54]

4:40 pm: **A quantitative framework for the analysis of multimodal optical microscopy images**, Andrew J. Bower, Benjamin Chidester, Youbo Zhao, Marina Marjanovic, Eric J. Chaney, Minh N. Do, Stephen A. Boppart, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9713-55]



# CONFERENCE 9714

LOCATION: ROOM 2022 (WEST LEVEL 2)

Saturday–Sunday 13–14 February 2016 • Proceedings of SPIE Vol. 9714

# Single Molecule Spectroscopy and Superresolution Imaging IX

BIOS

**Conference Chairs:** Jörg Enderlein, Georg-August-Univ. Göttingen (Germany); Ingo Gregor, Georg-August-Univ. Göttingen (Germany); Zygmunt Karol Gryczynski, Univ. of North Texas Health Science Ctr. at Fort Worth (USA), Texas Christian Univ. at Fort Worth (United States); Rainer Erdmann, PicoQuant GmbH Berlin (Germany); Felix Koberling, PicoQuant GmbH (Germany)

**Program Committee:** Sohail Ahmed, A\*STAR Institute of Medical Biology (Singapore); Michael Börsch, Friedrich-Schiller-Univ. Jena (Germany); Christian Eggeling, Univ. of Oxford (United Kingdom); Paul M. W. French, Imperial College London (United Kingdom); Ewa M. Goldys, Macquarie Univ. (Australia); Johan Hofkens, Katholieke Univ. Leuven (Belgium); Zhen-Li Huang, Huazhong Univ. of Science and Technology (China); Thomas R. Huser, Univ. Bielefeld (Germany); Maria Teresa Neves-Petersen, International Iberian Nanotechnology Lab. (Portugal); Markus Sauer, Univ. Bielefeld (Germany); Shimon Weiss, Univ. of California, Los Angeles (USA); Andong Xia, Institute of Chemistry (China)

## SATURDAY 13 FEBRUARY

### WELCOME AND INTRODUCTION

LOCATION: ROOM 2022 (WEST LEVEL 2) . . . . . 9:10 AM TO 9:15 AM

Conference Chair: Rainer Erdmann, PicoQuant GmbH Berlin (Germany)

### SESSION 1

LOCATION: ROOM 2022 (WEST LEVEL 2) . . . . . SAT 9:15 AM TO 10:15 AM

### FLIM, FRET and FCS I

Session Chair: Rainer Erdmann, PicoQuant GmbH (Germany)

9:15 am: **Heterogeneity and restricted state selection in FRET with fluorescent proteins**, Angus J. Bain, Thomas S. Blacker, Michael R. Duchon, Univ. College London (United Kingdom) . . . . . [9714-1]

9:35 am: **Optimizing enhanced green fluorescent proteins fused to membrane transporters for single-molecule FRET using a fast anti-Brownian electrokinetic trap**, Maria Dienerowitz, Mykhailo Ilchenko, Bertram Su, Friedrich-Schiller-Univ. Jena (Germany); Günter Mayer, Thomas Henkel, Leibniz-Institut für Photonische Technologien e.V. (Germany); Monika Düser, Nawid Zarrabi, ATINA Ingenieurbüro (Germany); Michael Börsch, Friedrich-Schiller-Univ. Jena (Germany) . . . . . [9714-2]

9:55 am: **Viscoelastic properties of the bacterial chromosome measured by fluorescence correlation spectroscopy**, Rudra P. Kafle, Molly R. Liebeskind, Jens-Christian D. Meiners, Univ. of Michigan (USA) . . . . . [9714-3]

Coffee Break . . . . . Sat 10:15 am to 10:50 am

### SESSION 2

LOCATION: ROOM 2022 (WEST LEVEL 2) .SAT 10:50 AM TO 12:30 PM

### FLIM, FRET and FCS II

Session Chair: Felix Koberling, PicoQuant GmbH (Germany)

10:50 am: **Study of the conformational dynamics of intrinsically disordered protein by PET-FCS**, Joerg Enderlein, Man Zhou, Qui Van, Ingo Gregor, Georg-August-Univ. Göttingen (Germany) . . . . . [9714-4]

11:10 am: **Photon-HDF5: open data format and computational tools for timestamp-based single-molecule fluorescence experiments**, Antonino Ingargiola, Univ. of California, Los Angeles (USA); Ted A. Laurence, Lawrence Livermore National Lab. (USA); Shimon Weiss, Xavier Michalet, Univ. of California, Los Angeles (USA) . . . . . [9714-5]

11:30 am: **Analyzing blinking effects in super resolution localization microscopy with single-photon SPAD imagers**, Ivan Michel Antolovic, Technische Univ. Delft (Netherlands); Samuel Burri, Claudio E. Bruschini, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Ron A. Hoebe, Academisch Medisch Centrum (Netherlands); Edoardo Charbon, Technische Univ. Delft (Netherlands) . . . . . [9714-6]

11:50 am: **Pile-up correction for high-throughput fluorescence lifetime imaging microscopy (FLIM)**, Joerg Enderlein, Daja Ruhlandt, Anna Chithik, René Ebrecht, Fred S. Wouters, Ingo Gregor, Georg-August-Univ. Göttingen (Germany) . . . . . [9714-7]

12:10 pm: **Carbocyanines in an RNA environment: experiment meets simulation**, Richard Boerner, Fabio Steffen, Roland K. O. Sigel, Univ. Zürich (Switzerland) . . . . . [9714-8]

Lunch/Exhibition Break . . . . . Sat 12:30 pm to 2:00 pm

### SESSION 3

LOCATION: ROOM 2022 (WEST LEVEL 2) . . . . . SAT 2:00 PM TO 3:30 PM

### Biological Applications of Single Molecule Detection Techniques

Session Chair: Joerg Enderlein, Georg-August-Univ. Göttingen (Germany)

2:00 pm: **PhotoGate: tracking single molecules in crowded environments (Invited Paper)**, Ahmet Yildiz, Univ. of California, Berkeley (USA) . . . . . [9714-9]

2:30 pm: **Single light-harvesting complexes: from detergent to a lipid membrane environment**, J. Michael Gruber, Vrije Univ. Amsterdam (Netherlands); Stefan Scheidelaar, J. Antoinette Killian, Utrecht Univ. (Netherlands); Rienk van Grondelle, Vrije Univ. Amsterdam (Netherlands) . . . . . [9714-10]

2:50 pm: **Observing the proton-translocating motor of single FoF1-ATP synthase at work using an improved fluorescent protein mNeonGreen as novel FRET donor**, Thomas Heitkamp, Friedrich-Schiller-Univ. Jena (Germany); Gabriele Deckers-Hebestreit, Univ. Osnabrück (Germany); Michael Börsch, Friedrich-Schiller-Univ. Jena (Germany) . . . . . [9714-11]

3:10 pm: **Adhesion of living cells revealed by variable-angle total internal reflection fluorescence microscopy**, Marcelina Cardoso Dos Santos, Cyrille Vézy, Rodolphe Jaffiol, Univ. de Technologie Troyes (France) . . [9714-12]

Coffee Break . . . . . Sat 3:30 pm to 4:05 pm

### SESSION 4

LOCATION: ROOM 2022 (WEST LEVEL 2) . . . . . SAT 4:05 PM TO 5:35 PM

### Nanoscopy and Superresolution Microscopy I

Session Chair: Ingo Gregor, Georg-August-Univ. Göttingen (Germany)

4:05 pm: **Development and application of 2-color live-cell STED nanoscopy (Invited Paper)**, Edward S. Allgeyer, Francesca Bottanelli, Emil B. Kromann, Xiang Hao, Joerg Bewersdorf, Yale School of Medicine (USA) . . . . . [9714-13]

4:35 pm: **Super resolution imaging of HER2 gene amplification**, Masaya Okada, Takuya Kubo, Kanako Masumoto, Shigeki Iwanaga, Sysmex Corp. (Japan) . . . . . [9714-14]

4:55 pm: **Multi-pulse pumping for far-field super-resolution imaging**, Sebastian Requena, Texas Christian Univ. (USA); Sangram Raut, Texas Christian Univ. (USA) and Univ. of North Texas Health Science Ctr. at Fort Worth (USA); Hung Doan, Joseph D. Kimball, Texas Christian Univ. (USA); Rafal Fudala, Julian Borejdo, Ignacy Gryczynski, Univ. of North Texas Health Science Ctr. at Fort Worth (USA); Yuri Strzhemechny, Zygmunt K. Gryczynski, Texas Christian Univ. (USA) . . . . . [9714-15]

5:15 pm: **Fast and precise 3D fluorophore localization by gradient fitting**, Hongqiang Ma, Jianquan Xu, Jingyi Jin, Ying Gao, Li Lan, Yang Liu, Univ. of Pittsburgh (USA) . . . . . [9714-17]

# CONFERENCE 9714

LOCATION: ROOM 2022 (WEST LEVEL 2)

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 5

LOCATION: ROOM 2022 (WEST LEVEL 2) SUN 9:00 AM TO 10:20 AM

### New Developments in Methods and Systems I

Session Chair: **Felix Koberling**, PicoQuant GmbH (Germany)

9:00 am: **Custom field-of-view quantitative label-free microscopy by optofluidic space-time digital holography**, Vittorio Bianco, Melania Paturzo, Valentina Marchesano, Pietro Ferraro, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) . . . . . [9714-20]

9:20 am: **Nanopore integrated with Au cluster formation for single molecule analysis**, Seong Soo Choi, Myoung Jin Park, Chul Hee Han, Tokutaro Yamaguchi, Sun Moon Univ. (Korea, Republic of); Sung In Kim, Kyoung Jin Park, Jung Ho Yoo, National Nanofab Ctr. (Korea, Republic of); Namkyoo Park, Seoul National Univ. (Korea, Republic of) . . . . . [9714-19]

9:40 am: **Generating 3D depletion distribution in an achromatic, single-channel, monolithic system**, Clément Fallet, Arvid Lindberg, Gabriel Y. Sirat, Bioaxial (France) . . . . . [9714-18]

10:00 am: **Fourier-interpolation stochastic optical fluctuation imaging (SOFI)**, Joerg Enderlein, Simon C. Stein, Anja Huss, Dirk Hähnel, Ingo Gregor, Georg-August-Univ. Göttingen (Germany) . . . . . [9714-21]

Coffee Break . . . . . Sun 10:20 am to 10:55 am

### SESSION 6

LOCATION: ROOM 2022 (WEST LEVEL 2) . SUN 10:55 AM TO 12:15 PM

### New Developments in Methods and Systems II

Session Chair: **Ingo Gregor**, Georg-August-Univ. Göttingen (Germany)

10:55 am: **Multicolor single-molecule imaging by spectral point-spread-function engineering**, Yoav Shechtman, Lucien E. Weiss, Adam S. Backer, William E. Moerner, Stanford Univ. (USA) . . . . . [9714-22]

11:15 am: **Advanced pulse pattern generation and fine tuning for STED microscopy**, Felix Koberling, Rhys Dowler, Marcelle Koenig, Paja Reisch, Alexander Glatz, Sebastian Tannert, Thomas Schoenau, Romano Haertel, Tino Roehlicke, Marcus Sackrow, Matthias Patting, Rainer Erdmann, PicoQuant GmbH (Germany) . . . . . [9714-23]

11:35 am: **Video-rate super-resolution fluorescence microscopy using all-optical two-photon image scanning microscopy**, Ingo Gregor, Martin Spiecker, Joerg Enderlein, Georg-August-Univ. Göttingen (Germany). . [9714-24]

11:55 am: **Restoration of STORM images from sparse subset of localizations**, Alexander A. Moiseev, Grigory V. Gelikonov, Institute of Applied Physics of the RAS (Russian Federation); Valentine M. Gelikonov, Institute of Applied Physics of the RAS (Russian Federation) and Nizhny Novgorod State Technical Univ. (Russian Federation) . . . . . [9714-25]

Lunch/Exhibition Break . . . . . Sun 12:15 pm to 1:45 pm

### SESSION 7

LOCATION: ROOM 2022 (WEST LEVEL 2) . . . SUN 1:45 PM TO 3:15 PM

### Nanoscopy and Superresolution Microscopy II

Session Chair: **Rainer Erdmann**, PicoQuant GmbH (Germany)

1:45 pm: **Investigating the molecular basis of muscular dystrophy diseases by single molecule imaging in cells and live animal models (Invited Paper)**, Anthony Fernandez, Ramunas Stanciauskas, Fabien Pinaud, The Univ. of Southern California (USA) . . . . . [9714-26]

2:15 pm: **Molecular orientational order imaging by polarized super resolution localization microscopy**, Sophie Brasselet, Cesar A. Valades Cruz, Haitham A. Shaban, Nicolas Bertaux, Julien Savatier, Institut Fresnel (France) . . . . . [9714-27]

2:35 pm: **Novel 3D single marker switching microscope with isotropic resolution over large axial range**, Haugen Grefe, Claudia Geisler, Alexander Egner, Laser-Lab. Göttingen e.V. (Germany) . . . . . [9714-28]

2:55 pm: **Screening photoswitching properties of synthesized BODIPY-based fluorophores for multispectral superresolution microscopy (MSSRM)**, Amy M. Bittel, Isaac S. Saldivar, Oregon Health & Science Univ. (USA); Xiaolin Nan, Summer L. Gibbs, Oregon Health & Science Univ. (USA) and Knight Cancer Institute (USA) and Oregon Ctr. for Spatial Systems Biology (USA) . . . . . [9714-29]

### TRIBUTE AND PRESENTATION

LOCATION: ROOM 2022 (WEST LEVEL 2) . . . 3:15 PM TO 3:30 PM

### Tribute to Dick Keller and Presentation of the PicoQuant Young Investigator Award

Conference Chair: **Zygmunt Karol Gryczynski**, Univ. of North Texas Health Science Ctr. at Fort Worth (USA), Texas Christian Univ. at Fort Worth (USA)

### PicoQuant Young Investigator Award

Young scientists (age 32 or below and not yet full faculty members) are encouraged to participate in this best paper competition, which offers a \$1000 USD cash award. Participants must be both the primary author and presenter of an accepted abstract to be eligible. Please note in your abstract submission to this conference "Young Investigator best paper competition BO403" to be considered. This award is sponsored by PicoQuant GmbH Berlin and presented Sunday afternoon.

AWARD SPONSOR:



Coffee Break . . . . . Sun 3:30 pm to 4:00 pm

### SESSION 8

LOCATION: ROOM 2022 (WEST LEVEL 2) . SUN 4:00 PM TO 5:40 PM

## Nanoscopy and Superresolution Microscopy III

Session Chair: **Zygmunt K. Gryczynski**,  
Univ. of North Texas Health Science Ctr. at Fort Worth (USA),  
Texas Christian Univ. at Fort Worth (USA)

4:00 pm: **Correlating structure and fluorescence dynamics of quantum dot clusters using super-resolution imaging**, Duncan P. Ryan, Colorado State Univ. (USA); Peter M. Goodwin, Chris Sheehan, Los Alamos National Lab. (USA); Kevin J. Whitcomb, Alan K. Van Orden, Martin Gelfand, Colorado State Univ. (USA) . . . . . [9714-30]

4:20 pm: **Superresolution imaging with enhanced axial section by STED structured illumination microscopy**, Yu Li, Leilei Peng, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9714-31]

4:40 pm: **Optimization of super-resolution parameters for imaging of the cell cytoskeleton during C2C12 differentiation**, Xiao Peng, Shuyi Yuan, Danying Lin, Qianqian Wu, Jing Qi, Junle Qu, Shenzhen Univ. (China) . [9714-32]

5:00 pm: **Multi-color joint tagging localization nanoscopy with ultra-high density molecule tracking**, Peng Xi, Zhiping Zeng, Xuanze Chen, Ning Huang, Yujie Sun, Peking Univ. (China) . . . . . [9714-33]

5:20 pm: **Multi-scale imaging approach identifies novel roles for the scaffold protein IQGAP1 in epithelial cell development**, Volker Schweikhard, Rice Univ. (USA) . . . . . [9714-46]

### POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**STED add-on for a standard time-resolved confocal microscope**, Felix Koberling, Marcelle Koenig, Rhys Dowler, Benedikt Kraemer, Sebastian Tannert, Matthias Patting, Rainer Erdmann, PicoQuant GmbH (Germany) . . . . . [9714-34]

**Effortless adaptive optics correction enabling deep SMLM imaging**, Grégory Clouvel, Audrius Jasaitis Jr., Xavier Levecq, Imagine Optic SA (France) . . . . . [9714-35]

**Super-resolved image acquisition with full-field localization based microscopy: theoretical analysis and evaluation**, Taehwang Son, Wonju Lee, Donghyun Kim, Yonsei Univ. (Korea, Republic of) . . . . . [9714-36]

**Conventional fluorescence microscopy below the diffraction limit with simultaneous capture of two fluorophores**, Ben Glasgow, Lie Ma, Univ. of California, Los Angeles (USA) . . . . . [9714-37]

**A user-friendly two-color super-resolution localization microscope**, Teng Zhao, Ying Wang, Yuanliang Zhai, Aifang Cheng, Xiaoxuan Qu, Shengwang Du, Michael M. T. Loy, Hong Kong Univ. of Science and Technology (Hong Kong, China) . . . . . [9714-38]

**Simultaneous fluorescence imaging of multiple fluorophores using wide-field epi-fluorescence microscopy**, Kwan Seob Park, Dong Uk Kim, Jooran Lee, Ki-Soo Chang, Korea Basic Science Institute (Korea, Republic of) . . . . . [9714-39]

**Accurate axial localization by conical diffraction beam shaping generating a dark-helix PSF**, Clément Fallet, Bioaxial (France); Astrid Lassalle, Bioaxial (France) and Institut d'Optique Graduate School (France); Gabriel Y. Sirat, Bioaxial (France) . . . . . [9714-40]

**A bi-functional bolometer with sensitivity to IR radiation and hot air induced temperature variation**, Evgenia Vaganova, The Hebrew Univ. of Jerusalem (Israel) . . . . . [9714-41]

**Localization-based superresolution microscopy reveals tapering and asynchronous axonemal growths of primary cilia**, Tony Yang, Yi-De Chen, Jung-Chi Liao, Academia Sinica (Taiwan) . . . . . [9714-42]

**Quantitative protein labeling of the HER2 cancer signaling pathway for high-resolution microscopy**, Allison Solanki, Xiaolin Nan, Summer L. Gibbs, Oregon Health & Science Univ. (USA) . . . . . [9714-43]

**Single-wavelength-controlled dynamic optical nanoimaging based on fluorescence molecular switches**, Ming-Qiang Zhu, Wen-Liang Gong, Chong Li, Zhen-Li Huang, Huazhong Univ. of Science and Technology (China) . . . . . [9714-44]

**Novel plasmonic platform for ultra-sensitive detection and diagnostics**, Sangram Raut, Texas Christian Univ. (USA); Ryan M. Rich, Univ. of North Texas Health Science Ctr. at Fort Worth (USA); Tanya Shtoyko, The Univ. of Texas at Tyler (USA); Ilkay Bora, Bo W. Laursen, Thomas Just Sorensen, Univ. of Copenhagen (Denmark); Julian Borejdo, Univ. of North Texas Health Science Ctr. at Fort Worth (USA); Zygmunt K. Gryczynski, Texas Christian Univ. (USA); Ignacy Gryczynski, Univ. of North Texas Health Science Ctr. at Fort Worth (USA) . . . . . [9714-45]

# CONFERENCE 9715

LOCATION: ROOM 2016 (WEST LEVEL 2)

Monday–Tuesday 15–16 February 2016 • Proceedings of SPIE Vol. 9715

# Optical Diagnostics and Sensing XVI: Toward Point-of-Care Diagnostics

Conference Chair: **Gerard L. Coté**, Texas A&M Univ. (USA)

Program Committee: **Brent D. Cameron**, The Univ. of Toledo (USA); **Werner Gellermann**, The Univ. of Utah (USA); **H. Michael Heise**, Univ. of Applied Sciences of South-Westphalia, Iserlohn (Germany); **Jürgen M. Lademann**, Charité Universitätsmedizin Berlin (Germany); **Kristen C. Maitland**, Texas A&M Univ. (USA); **Michael J. McShane**, Texas A&M Univ. (USA); **Kenith E. Meissner**, Swansea Univ. (United Kingdom); **Timothy J. Muldoon**, Univ. of Arkansas (USA); **Aydogan Ozcan**, Univ. of California, Los Angeles (USA); **Babak Shadgan**, The Univ. of British Columbia (Canada); **Kexin Xu**, Tianjin Univ. (China); **Shaoqun Zeng**, Britton Chance Ctr. for Biomedical Photonics (China)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: ROOM 2016 (WEST LEVEL 2) . MON 8:20 AM TO 10:00 AM

### Point-of-Care Diagnostics I

Session Chair: **Brent D. Cameron**, The Univ. of Toledo (USA)

8:20 am: **A point of care real time PCR platform based on silicon technology**, Maria E. Castagna, Sabrina Conoci, Salvatore Petralia, Maria Grazia Amore, Massimo Spata, STMicroelectronics (Italy) . . . . . [9715-1]

8:40 am: **The use of reverse iontophoresis based surface plasmon resonance for the development of a noninvasive real time transdermal biomarker sensor**, Niraj K. Gupta, Yongsoon Hwang, Brent D. Cameron, The Univ. of Toledo (USA) . . . . . [9715-2]

9:00 am: **Optical thromboelastography (OTEG) for diagnosis of hyperfibrinolysis in patients**, Markandey M. Tripathi, Wellman Ctr. for Photomedicine (USA) and Harvard Medical School (USA); Diane M. Tshikudi, Seemantini K. Nadkarni, Wellman Ctr. for Photomedicine (USA) . . . . . [9715-3]

9:20 am: **Fluorescent detection of C-reactive protein from blood plasma on a 3D-printed device**, Shreesh Jagadeesh, Stewart J. Aitchison, Univ. of Toronto (Canada); Lu Chen, ChipCare Corp. (Canada) . . . . . [9715-4]

9:40 am: **Point-of-care porphyria screening by fluorescence spectroscopy of blood plasma**, Alexander Lang, Laser-Forschungslabor (Germany) and Klinikum der Univ. München (Germany); Georg Hennig, Christian Homann, Klinikum der Univ. München (Germany) and Laser-Forschungslabor (Germany); Herbert Stepp, Laser-Forschungslabor (Germany) and Klinikum der Univ. München (Germany); Gary M. Brittenham, Columbia Univ. (USA); Michael Vogeser, Klinikum der Univ. München (Germany) . . . . . [9715-5]

Coffee Break . . . . . Mon 10:00 am to 10:30 am

### SESSION 2

LOCATION: ROOM 2016 (WEST LEVEL 2) . MON 10:30 AM TO 11:50 AM

### Point-of-Care Diagnostics II: Cell Phone Based Systems

Session Chair: **Timothy J. Muldoon**, Univ. of Arkansas (USA)

10:30 am: **Diffraction interference optical analyzer (DiOPTER)**, Harish Sasikumar, Vishnu Prasad, Parama Pal, Manoj M. Varma, Indian Institute of Science (India) . . . . . [9715-6]

10:50 am: **Smart-phone based point-of-care detector of urine albumin**, Vratislav Cmiel, Brno Univ. of Technology (Czech Republic) and St. Anne's Univ. Hospital Brno (Czech Republic) and International Clinical Research Ctr. (ICRC) (Czech Republic); Ondrej Svoboda, Brno Univ. of Technology (Czech Republic) and International Clinical Research Ctr. (ICRC) (Czech Republic); Pavlina Koscova, Brno Univ. of Technology (Czech Republic); Ivo Provaznik, Brno Univ. of Technology (Czech Republic) and St. Anne's Univ. Hospital Brno (Czech Republic) and International Clinical Research Ctr. (ICRC) (Czech Republic) . . . . . [9715-7]

11:10 am: **All-in-one detector of circulating mRNA based on a smartphone**, Vratislav Cmiel, St. Anne's Univ. Hospital in Brno (Czech Republic) and Brno Univ. of Technology (Czech Republic); Jaromir Gumulec, Masaryk Univ. (Czech Republic); Ondrej Svoboda, Brno Univ. of Technology (Czech Republic); Martina Raudenska, Kristyna Hudcova, Masaryk Univ. (Czech Republic); Jaroslav Balogh, Brno Univ. of Technology (Czech Republic); Michal Masarik, Masaryk Univ. (Czech Republic); Ivo Provaznik, Brno Univ. of Technology (Czech Republic) and St. Anne's Univ. Hospital Brno (Czech Republic) . . . . . [9715-8]

11:30 am: **Low-cost computing and network communication for a point-of-care device to perform a 3-part leukocyte differential**, Amy J. Powless, Lauren E. Feekin, Joshua A. Hutcheson, Univ. of Arkansas (USA); Daisy V. Alapat, Univ. of Arkansas for Medical Sciences (USA); Timothy J. Muldoon, Univ. of Arkansas (USA) . . . . . [9715-9]

Lunch Break . . . . . Mon 11:50 am to 1:40 pm

### SESSION 3

LOCATION: ROOM 2016 (WEST LEVEL 2) . . MON 1:40 PM TO 3:00 PM

### Point-of-Care Diagnostics III: Raman Spectroscopy Approaches

Session Chair: **Katherine E. Cilwa**, Naval Medical Research Ctr. (USA)

1:40 pm: **Surface enhanced Raman spectroscopy as a point-of-care diagnostic for infection in wound effluent**, Meron Y. Ghebremedhin, Naval Medical Research Ctr. (USA); Shubha Yesupriya, The Geneva Foundation (USA) and Naval Medical Research Ctr. (USA); Nicole J. Crane, Naval Medical Research Ctr. (USA) . . . . . [9715-10]

2:00 pm: **Raman spectroscopy for predicting wound healing outcome: towards in vivo application**, Adam G. Berger, Univ. of Maryland, College Park (USA) and Naval Medical Research Ctr. (USA); Nicole J. Crane, Naval Medical Research Ctr. (USA) and Uniformed Services Univ. of the Health Sciences (USA) and Henry M. Jackson Foundation for the Advancement of Military Medicine (USA) . . . . . [9715-11]

2:20 pm: **Development of an optofluidic SERS-based biomedical sensor**, Brian M. Walton, Po-Jung Huang, Jun Kameoka, Nicolaas Deutz, Gerard L. Cote, Texas A&M Univ. (USA) . . . . . [9715-12]

2:40 pm: **Effectiveness of surface enhanced Raman spectroscopy of tear fluid with soft substrate for point-of-care therapeutic drug monitoring**, Kenji Yamada, Osaka Univ. (Japan) . . . . . [9715-13]

Coffee Break . . . . . Mon 3:00 pm to 3:30 pm



### SESSION 4

LOCATION: ROOM 2016 (WEST LEVEL 2) . . . MON 3:30 PM TO 5:10 PM

## Optical Diagnostics for Developing Countries

Session Chair: **Gerard L. Cote**, Texas A&M Univ. (USA)

3:30 pm: **Investigation of surface enhanced Raman spectroscopy for hemozoin detection in single malaria parasites of ring stage**, Keren Chen, Aoli Xiong, Peter Preiser, Quan Liu, Nanyang Technological Univ. (Singapore) . . . . . [9715-14]

3:50 pm: **An embedded point-of-care malaria screening device for low-resource regions**, Sayantan Das, Indian institute of Technology Kharagpur (India); Subhamoy Mandal, Helmholtz Zentrum München GmbH (Germany) and Technische Univ. München (Germany) and Indian Institute of Technology Kharagpur (India); Debnath Das, Richa Malviya, Indian Institute of Technology Kharagpur (India); Hrushikesh T. Garud, Indian institute of Technology Kharagpur (India) and Texas Instruments Inc. (India); Ajoy K. Ray, Indian Institute of Technology Kharagpur (India) and Indian Institute of Engineering Science and Technology, Shibpur (India) . . . . . [9715-15]

4:10 pm: **Whole-animal imaging of bacterial infection using endoscopic excitation of  $\beta$ -lactamase (BlaC)-specific fluorogenic probe**, Fatemeh Nooshabadi, Texas A&M Univ. (USA); Hee-jeong Yang, Texas A&M Health Science Ctr. (USA); Yunfeng Cheng, Hexin Xie, Jianghong Rao, Stanford Univ. (USA); Jeffrey D. Cirillo, Texas A&M Health Science Ctr. (USA); Kristen C. Maitland, Texas A&M Univ. (USA) . . . . . [9715-16]

4:30 pm: **Non-invasive detection of iron deficiency by fluorescence spectroscopic quantitation of erythrocyte zinc protoporphyrin in the lower lip**, Christian Homann, Georg Hennig, Klinikum der Univ. München (Germany) and Laser-Forschungslabor (Germany); Ilknur Teksan, Uwe Hasbargen, Stephan Hasmüller, Lesca M. Holdt, Klinikum der Univ. München (Germany); Nadia Khaled, Nestlé Research Ctr. (Switzerland) and Nestec Ltd. (Switzerland); Ronald Sroka, Laser-Forschungslabor (Germany) and Klinikum der Univ. München (Germany); Thomas Stauch, Medizinisches Versorgungszentrum Labor PD Dr. Volkman and Kollegen GbR (Germany); Herbert Stepp, Laser-Forschungslabor (Germany) and Klinikum der Univ. München (Germany); Michael Vogeser, Klinikum der Univ. München (Germany); Gary M. Brittenham, Columbia Univ. (USA) . . . . . [9715-17]

4:50 pm: **A simple, portable cytometry system for cell counts in blood and other body fluids in humans and animals**, Zachary J. Smith, Tingjuan Gao, NSF Ctr. for Biophotonics Science and Technology, UC Davis Medical Ctr. (USA); Tzu-Yin Lin, UC Davis Medical Ctr. (USA); Danielle Carrade-Holt, William R. Pritchard Veterinary Medical Teaching Hospital (USA); Stephen M. Lane, Dennis L. Matthews, NSF Ctr. for Biophotonics Science and Technology, UC Davis Medical Ctr. (USA); Denis M. Dwyre, Univ. of California, Davis (USA); Sebastian Wachsmann-Hogiu, NSF Ctr. for Biophotonics Science and Technology, UC Davis Medical Ctr. (USA) . . . . . [9715-18]

### POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

Conference attendees are invited to attend the BIOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Thermography: a potential tool in detecting exercise induced muscle damage (EIMD)**, Nicolas P. Avdelicis, Chara K. Deli, Univ. of Thessaly (Greece); Panagiotis Theodorakeas, National Technical Univ. of Athens (Greece); Giannis Giakas, Athanasios Tsiokanos, Univ. of Thessaly (Greece); Maria Kouli, National Technical Univ. of Athens (Greece); Athanasios Z. Jamurtas, Univ. of Thessaly (Greece) . . . . . [9715-37]

**Long range non-contact imaging photoplethysmography**, Ethan Blackford, Ball Aerospace & Technologies Corp. (USA); Justin R. Estep, Air Force Research Lab. (USA) . . . . . [9715-39]

**Biomedical imaging with wearable smart eyeglasses**, Dino Carpentras, Christophe Moser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9715-40]

**Low-dose intrathecal fluorescein for diagnosis of cerebrospinal fluid rhinorrhea using the scanning fiber endoscope in the human nasal cavities**, Vivian W. Hou, Calvin G. Davis, Greg E. Davis, Eric J. Seibel, Univ. of Washington (USA) . . . . . [9715-41]

**Non-contact measurement of pulse wave velocity using RGB cameras**, Kazuya Nakano, Tokyo Univ. of Science (Japan); Yuta Aoki, Ryota Satoh, Akira Hoshi, Tokyo Univ. of Agriculture and Technology (Japan); Hiroyuki Suzuki, Tokyo Institute of Technology (Japan); Izumi Nishidate, Tokyo Univ. of Agriculture and Technology (Japan) . . . . . [9715-42]

**Dramatic reduction of tracer concentration in renal function monitoring through time-resolved fluorescence detection**, Uwe Ortmann, Volker Buschmann, PicoQuant GmbH (Germany); Cathleen Fichtner, Ruprecht-Karls- Univ. Heidelberg (Germany); Deborah Herdt, Institute for Process Control and Innovative Energy Conversion (Germany); Felix Koberling, PicoQuant GmbH (Germany); Daniel Schock-Kusch, Institute for Process Control and Innovative Energy Conversion (Germany); Sabine Neudecker, Ruprecht-Karls- Univ. Heidelberg (Germany); Anatoli Shmarlouki, Yury Shulhevich, Dzmity Stsepankou, Jürgen Hesser, Experimental Radiation Oncology (Germany); Matthias Raedle, Institute for Process Control and Innovative Energy Conversion (Germany); Rainer Erdmann, PicoQuant GmbH (Germany) . . . . . [9715-43]

**Performance testing of a mid-infrared spectroscopic system for clinical chemistry applications utilising an ultra-broadband tunable EC-QCL radiation source**, Markus Grafen, Konstantinos Nalpantidis, Andreas Ostendorf, Ruhr-Univ. Bochum (Germany); Dieter Ihrig, Herbert M. Heise, Fachhochschule Südwestfalen (Germany) . . . . . [9715-44]

**Single chip AWG-based Raman spectroscopy for continuous glucose monitoring**, Sheng Yang, Yen-Chun Yeh, Dominik J. Schmidt, International Technological Univ. (USA) and Ardency Bionics (USA) . . . . . [9715-45]

**An optical fiber probe based on quantum-dots integrated cavity fabricated by femtosecond laser micromachining for single cell level temperature measurement**, Qi Zhang, Lei Yuan, Clemson Univ. (USA); Jie Huang, Missouri Univ. of Science and Technology (USA); Hai Xiao, Clemson Univ. (USA) . . . . . [9715-46]

**Single chip GMR-filter based self emission glucose monitoring system**, Yen-Chun Yeh, Sheng Yang, International Technological Univ. (USA) and Ardency Bionics (USA); Dominik J. Schmidt, Ardency Bionics (USA) and International Technological Univ. (USA) . . . . . [9715-47]

**Raman-spectroscopy based multiplexed detection of alternate glycemic marker panel**, Rishikesh Pandey, Nicolas Spezzazzini, Niyom Lue, Luis Galindo, Massachusetts Institute of Technology (USA); Ishan Barman, Johns Hopkins Univ. (USA); Gary L. Horowitz, Beth Israel Deaconess Medical Ctr. (USA) and Harvard Medical School (USA); Ramachandra R. Dasari, Peter T. C. So, Massachusetts Institute of Technology (USA) . . . . . [9715-48]

**Comparison of production methods of a spiral inertial microfluidic cell separation device**, Mitchell Robinson, Haley L. Marks, Gerard L. Cote, Texas A&M Univ. (USA) . . . . . [9715-49]

**Probing focal cortical dysplasia in formalin fixed samples using tissue optical coherence spectroscopy**, Suresh Anand, European Lab. for Non-linear Spectroscopy (Italy); Riccardo Cicchi, Istituto Nazionale di Ottica (Italy) and European Lab. for Non-linear Spectroscopy (Italy); Flavio Giordano, Anna Maria Buccoliero, Valerio Conti, Renzo Guerrini, Azienda Ospedaliera Univ. Anna Meyer (Italy); Francesco S. Pavone, European Lab. for Non-linear Spectroscopy (Italy) and Istituto Nazionale di Ottica (Italy) . . . . . [9715-50]

**Application of spectroscopic techniques for the analysis of kidney stones: a pilot study**, Unnikrishnan V. K., Muhammed Shameem K. M., Arun Chawla, Aseefhali Bankapur, Santhosh Chidangil, Manipal Univ. (India) . . . . . [9715-51]

**Microvascular contrast enhancement in optical coherence tomography using microbubbles**, Homa Assadi, Ryerson Univ. (Canada); Valentin Demidov, Univ. of Toronto (Canada); Raffi Karshafian, Ryerson Univ. (Canada); I. Alex Vitkin, Univ. of Toronto (Canada); Alexandre Douplik, Ryerson Univ. (Canada) . . . . . [9715-52]

**Inter-and intra-individual differences in skin hydration and surface lipids measured with mid-infrared spectroscopy**, Anna Ezerskaia, Philips Research (Netherlands); Silvania F. Pereira, H. Paul Urbach, Technische Univ. Delft (Netherlands); Babu Varghese, Philips Research (Netherlands) . . . . . [9715-53]

**A disposable, flexible skin patch for clinical optical perfusion monitoring at multiple depths**, Dana Farkas, Northeastern Univ. (USA); Noah J. Kolodziejki, Christopher J. Stapels, Daniel R. McAdams, Daniel E. Fernandez, Matthew J. Podolsky, James F. Christian, Radiation Monitoring Devices, Inc. (USA); Brent B. Ward, Mark Vartarian, Stephen E. Feinberg, Seung Yup Lee, Urmi Parikh, Mary-Ann Mycek, Univ. of Michigan (USA); Michael J. Joyner, Christopher P. Johnson, Mayo Clinic (USA); Norman A. Paradis, Dartmouth Hitchcock Medical Ctr. (USA) . . . . . [9715-54]

# CONFERENCE 9715

LOCATION: ROOM 2016 (WEST LEVEL 2)

TUESDAY 16 FEBRUARY

## SESSION 5

LOCATION: ROOM 2016 (WEST LEVEL 2) . . . TUE 8:20 AM TO 10:00 AM

### Optical Monitoring of Blood Perfusion and Flow

Session Chair: **Patrick O'Neal**, Louisiana Tech Univ. (USA)

8:20 am: **Assessment of phantom replicated cochlear blood flow changes with laser speckle system**, Sungkon Yu, Jihoon Park, Myungjin Ha, Sangyeob Lee, Seulgi Jang, Edalat Radfar, Byungjo Jung, Yonsei Univ. (Korea, Republic of) . . . . . [9715-19]

8:40 am: **A compact instrument to measure perfusion of vasculature in transplanted maxillofacial free flaps**, Noah J. Kolodziejski, Christopher J. Stapels, Daniel R. McAdams, Daniel E. Fernandez, Matthew J. Podolsky, Radiation Monitoring Devices, Inc. (USA); Dana Farkas, Radiation Monitoring Devices, Inc. (USA) and Northeastern Univ. (USA); James F. Christian, Radiation Monitoring Devices, Inc. (USA); Brent B. Ward, Mark Vartarian, Stephen E. Feinberg, Seung Yup Lee, Urmi Parikh, Mary-Ann Mycek, Univ. of Michigan (USA) . . . . . [9715-20]

9:00 am: **Assessment of sacrococcygeal pressure ulcers using diffuse correlation spectroscopy**, David Diaz, Drexel Univ. (USA); Michael T. Neidrauer, Drexel Univ. (USA); Michael S. Weingarten, Drexel Univ. College of Medicine (USA); Alec Lafontant, Drexel Univ. (USA); Rose Ann DiMaria Ghalili, Drexel Univ. (USA); Guy W. Fried, Magee Rehabilitation Hospital (USA); Peter A. Lewin, Leonid A. Zubkov, Drexel Univ. (USA) . . . . . [9715-21]

9:20 am: **In vivo quantification with OCT of vascular changes in humans in response to heating**, Rodney W. Kirk, Peijun Gong, Shaghayegh Es'haghian, Howard H. Carter, Ceri L. Atkinson, David D. Sampson, Daniel J. Green, Robert A. McLaughlin, The Univ. of Western Australia (Australia) . . . . . [9715-22]

9:40 am: **Assessment of multi-wavelength pulse photometry for non-invasive dose estimation of circulating drugs and nanoparticles**, Pratik Adhikari, Louisiana Tech Univ. (USA); Wakako M. Eklund, Louisiana Tech Univ. (USA) and Pediatric Medical Group of Tennessee, P.C. (USA); Eric Sherer, D. Patrick O'Neal, Louisiana Tech Univ. (USA) . . . . . [9715-23]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

## SESSION 6

LOCATION: ROOM 2016 (WEST LEVEL 2) . . . TUE 10:30 AM TO 11:50 AM

### Optical Blood Oxygenation Measurements

Session Chair: **Darren M. Roblyer**, Boston Univ. (USA)

10:30 am: **A wearable continuous-wave optical device for continuous monitoring during neoadjuvant chemotherapy infusions**, Fei Teng, Boston Univ. (USA); Timothy Cormier, Alexis Sauer-Budge, Fraunhofer USA, Inc. (USA); Darren M. Roblyer, Boston Univ. (USA) . . . . . [9715-24]

10:50 am: **Multispectral imaging system for in vivo detection and therapeutic assessment of vulvar lichen sclerosis**, YingJie Qu, Wenqi Ren, Univ. of Science and Technology of China (China); JiaoJiao Pei, LinLin Xiao, Chongqing Medical Univ. (China); Shiwu Zhang, Univ. of Science and Technology of China (China); Shufang Chang, Chongqing Medical Univ. (China); Peng Fei Shao, Univ. of Science and Technology of China (China); Ronald X. Xu, The Ohio State Univ. (USA) . . . . . [9715-25]

11:10 am: **A wearable, conformal bandage for non-invasive, two-dimensional imaging of skin oxygenation**, Zongxi Li, Emmanuel Roussakis, Massachusetts General Hospital (USA); Emily Keeley, Massachusetts Institute of Technology (USA); Gabriela Apiou-Sbirlea, Massachusetts General Hospital (USA); Reginald Birngruber, Univ. zu Lübeck (Germany); Christene Huang, Conor L. Evans, Massachusetts General Hospital (USA) . . . . . [9715-26]

11:30 am: **Novel multi wavelength sensor concept to measure carboxy- and methemoglobin concentration non-invasively**, Ulrich Timm, Jens Kraittl, Helge Gewiss, Hartmut Ewald, Univ. Rostock (Germany) . . . . . [9715-27]

Lunch Break . . . . . Tue 11:50 am to 1:20 pm

## SESSION 7

LOCATION: ROOM 2016 (WEST LEVEL 2) . . . TUE 1:20 PM TO 3:00 PM

### Optical Glucose Monitoring

Session Chair: **Herbert Michael Heise**, Fachhochschule Südwestfalen (Germany)

1:20 pm: **Characterization of a multi-module tunable EC-QCL system for mid-infrared biofluid spectroscopy for hospital use and personalized diabetes technology**, Herbert M. Heise, Thorsten Vahlsing, Fachhochschule Südwestfalen (Germany); Markus Grafen, Konstantinos Nalpantidis, Andreas Ostendorf, Ruhr-Univ. Bochum (Germany); Dieter Ihrig, Fachhochschule Südwestfalen (Germany) . . . . . [9715-28]

1:40 pm: **A closed-loop dual modulation two wavelength polarimeter for glucose monitoring**, Zhenfang Yu, Univ. of Electronic Science and Technology of China (China) and Texas A&M Univ. (USA); Casey W. Pirstill, Gerard L. Cote, Texas A&M Univ. (USA) . . . . . [9715-29]

2:00 pm: **Glucose sensing through Fano resonances in mesoscale silica core-gold shell particles arrays**, Francesca Pincella, Zhiwei Huang, National Univ. of Singapore (Singapore) . . . . . [9715-30]

2:20 pm: **Single strand, fiber optic glucose and pH sensor**, Krister Hammarling, Mid Sweden Univ. (Sweden); Dag R. Hjelle, Hogskolen i Sor-Trondelag (Norway) and Norwegian Univ. of Science and Technology (Norway) . . . . . [9715-31]

2:40 pm: **Fresh calibration-free framework for continuous spectroscopic sensing of blood analytes: single prick glucose detection**, Nicolas Spagazzini, Jeon Woong Kang, Rishikesh Pandey, Massachusetts Institute of Technology (USA); Ishan Barman, Johns Hopkins Univ. (USA); Ramachandra R. Dasari, Peter T. C. So, Massachusetts Institute of Technology (USA) . . . [9715-32]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

## SESSION 8

LOCATION: ROOM 2016 (WEST LEVEL 2) . . . TUE 3:30 PM TO 4:30 PM

### Optical Imaging for Cancer

Session Chair: **Walter J. Akers**, Washington Univ. School of Medicine in St. Louis (USA)

3:30 pm: **Enhancing contrast and quantitation by spatial frequency domain fluorescence molecular imaging**, Jessica Sun, Deep Hathi, Monica Shokeen, Walter J. Akers, Washington Univ. School of Medicine in St. Louis (USA) . . . . . [9715-33]

3:50 pm: **Multimodal microendoscopic imaging of adenoma development in ApcMin/+ mice**, Gage J. Greening, Haley M. James, Nontapoth Vongkittiarom, Samantha Osterholm, Timothy J. Muldoon, Univ. of Arkansas (USA) . . . . . [9715-34]

4:10 pm: **Choice of spectroscopy method for tumor margin detection**, Viacheslav Artyushenko, Andrey Bogomolov, art photonics GmbH (Germany); Hans-Peter Berlien, Evangelische Elisabeth Klinik (Germany); Franziska Schulte, Iskander Usenov, Ursula Zabarylo, art photonics GmbH (Germany) . . . [9715-36]

# CONFERENCE 9716

LOCATION: ROOM 2020 (WEST LEVEL 2)

Saturday–Sunday 13–14 February 2016 • Proceedings of SPIE Vol. 9716

# Optical Methods in Developmental Biology IV

BIOS

Conference Chairs: **Andrew M. Rollins**, Case Western Reserve Univ. (USA); **Scott E. Fraser**, The Univ. of Southern California (USA); **Michael A. Choma**, Yale School of Medicine (USA)

Program Committee: **Anjul M. Davis**, Thorlabs Inc. (USA); **Mary E. Dickinson**, Baylor College of Medicine (USA); **Robert G. Gourdie**, Virginia Polytechnic Institute and State Univ. (USA); **Michael W. Jenkins**, Case Western Reserve Univ. (USA); **Bradley B. Keller**, Univ. of Louisville (USA); **Kirill V. Larin**, Univ. of Houston (USA); **Kersti K. Linask**, Univ. of South Florida (USA); **Charles D. Little**, The Univ. of Kansas Medical Ctr. (USA); **Cecilia W. Lo**, Univ. of Pittsburgh (USA); **David Sedmera M.D.**, Charles Univ. in Prague (Czech Republic); **Lars Thrane**, Technical Univ. of Denmark (Denmark); **Ruikang K. Wang**, Univ. of Washington (USA); **Michiko Watanabe**, Case Western Reserve Univ. (USA); **Talât Mesud Yelbuz**, Medizinische Hochschule Hannover (Germany)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 2020 (WEST LEVEL 2) . SAT 8:20 AM TO 10:00 AM

### Cardiovascular I

Session Chair: **Michael A. Choma**, Yale School of Medicine (USA)

8:20 am: **Betaine supplementation reduces congenital defects after prenatal alcohol exposure**, Ganga Karunamuni, Shi Gu, Yong Qiu Doughman, Megan M. Sheehan, Pei Ma, Lindsay M. Peterson, Case Western Reserve Univ. (USA); Kersti K. Linask, Univ. of South Florida (USA); Michael W. Jenkins, Andrew M. Rollins, Case Western Reserve Univ. (USA); Michiko Watanabe, Case Western Reserve Univ (USA) . . . . . [9716-1]

8:40 am: **Effect of high fat diet on heart development in wild-type and clock-mutant drosophila**, Jing Men, Chao Zhou, Lehigh Univ. (USA) . . . [9716-2]

9:00 am: **Live dynamic OCT imaging of mouse embryonic cardiovascular structure and function with direct volumetric data acquisition at 1.5 MHz A-line rate**, Shang Wang, Baylor College of Medicine (USA); Manmohan Singh, Univ. of Houston (USA); Andrew L. Lopez III, Baylor College of Medicine (USA); Chen Wu, Raksha Raghunathan, Alexander W. Schill, Jiasong Li, Univ. of Houston (USA); Kirill V. Larin, Univ. of Houston (USA) and Baylor College of Medicine (USA) and Samara State Aerospace Univ. (Russian Federation); Irina V. Larina, Baylor College of Medicine (USA) . . . . . [9716-3]

9:20 am: **Imaging of murine embryonic cardiovascular development using optical coherence tomography**, Yongyang Huang, Lehigh Univ. (USA); Karl R. Degenhardt, The Children's Hospital of Philadelphia (USA); Sophie Astrof, Thomas Jefferson Univ. (USA); Chao Zhou, Lehigh Univ. (USA) . . . . . [9716-4]

9:40 am: **Optical mapping of conduction in early embryonic quail hearts with light-sheet microscopy**, Pei Ma, Shi Gu, Yves T. Wang, Michael W. Jenkins, Andrew M. Rollins, Case Western Reserve Univ. (USA) . . . . . [9716-5]

Coffee Break . . . . . Sat 10:00 am to 10:30 am

### SESSION 2

LOCATION: ROOM 2020 (WEST LEVEL 2) . SAT 10:30 AM TO 12:10 PM

### Cardiovascular II

Session Chair: **Chao Zhou**, Lehigh Univ. (USA)

10:30 am: **Optogenetic control of drosophila heart rhythm at different developmental stages**, Aneesh Alex, Jing Men, Chao Zhou, Lehigh Univ. (USA) . . . . . [9716-6]

10:50 am: **Altering hemodynamics leads to congenital heart defects**, Stephanie M. Ford, Univ. Hospitals Rainbow Babies & Children's Hospital (USA); Matthew T. McPheeters, Yves T. Wang, Shi Gu, Yong Qiu Doughman, Case Western Reserve Univ. (USA); James P. Strainic, Univ. Hospitals Rainbow Babies & Children's Hospital (USA); Andrew M. Rollins, Michiko Watanabe, Michael W. Jenkins, Case Western Reserve Univ. (USA) . . . . . [9716-7]

11:10 am: **Comparison of rotational imaging optical coherence tomography and selective plane illumination microscopy for embryonic study**, Chen Wu, Manmohan Singh, David Mayerich, Univ. of Houston (USA); Irina V. Larina, Mary E. Dickinson, Baylor College of Medicine (USA); Kirill V. Larin, Univ. of Houston (USA) . . . . . [9716-8]

11:30 am: **Live 4D optical coherence tomography for early embryonic mouse cardiac phenotyping**, Andrew L. Lopez III, Shang Wang, Baylor College of Medicine (USA); Kirill V. Larin, Univ. of Houston (USA); Paul A. Overbeek, Irina V. Larina, Baylor College of Medicine (USA) . . . . . [9716-9]

11:50 am: **Label-free imaging of developing vasculature in zebrafish with phase variance optical coherence microscopy**, Yu Chen, Jeff Fingler, Le A. Trinh, Scott E. Fraser, The Univ. of Southern California (USA) . . . . . [9716-10]

Lunch/Exhibition Break . . . . . Sat 12:10 pm to 1:20 pm

### SESSION 3

LOCATION: ROOM 2020 (WEST LEVEL 2) . . . SAT 1:20 PM TO 3:00 PM

### Anatomical, Functional and Molecular Imaging

Session Chair: **Irina V. Larina**, Baylor College of Medicine (USA)

1:20 pm: **OCT imaging of craniofacial anatomy in xenopus embryos**, Engin Deniz, Yale Univ. (USA); Stephan M. Jonas, RWTH Aachen Univ. (Germany); John Griffin, Michael C. Hooper, Yale Univ. (USA); Michael A. Choma, Mustafa K. Khokha, Yale School of Medicine (USA) . . . . . [9716-14]

1:40 pm: **An OCT-based approach to quantifying shear force and power dissipation in xenopus embryo cilia-driven fluid flow fields**, Brendan K. Huang, Mustafa K. Khokha, Michael Loewenberg, Yale Univ. (USA); Michael A. Choma, Yale School of Medicine (USA) . . . . . [9716-12]

2:00 pm: **Three-dimensional imaging of the developing mouse female reproductive organs with optical coherence tomography**, Jason C. Burton, Shang Wang, Baylor College of Medicine (USA); Richard R. Behringer, The Univ. of Texas M.D. Anderson Cancer Ctr. (USA); Irina V. Larina, Baylor College of Medicine (USA) . . . . . [9716-13]

2:20 pm: **Use of a highly transparent zebrafish mutant for investigations in the development of the vertebrate auditory system**, Anna M. Wisniowiecki, Scott P. Mattison, Sangmin Kim, Bruce Riley, Brian E. Applegate, Texas A&M Univ. (USA) . . . . . [9716-11]

2:40 pm: **Omega-6 polyunsaturated fatty acids modulate lipid delivery into oocytes and oogenesis in Caenorhabditis elegans examined by CARS microscopy**, Wei-Wen Chen, National Tsing-Hua Univ. (Taiwan) and TIGP Academia Sinica (Taiwan); Yung-Hsiang Yi, Tian-Hsiang Ma, Szecheng J. Lo, Chang Gung Univ. (Taiwan); Cheng-Hao Chien, Ta-Chau Chang, Institute of Atomic and Molecular Sciences–Academia Sinica (Taiwan) . . . . . [9716-15]

Coffee Break . . . . . Sat 3:00 pm to 3:30 pm

# CONFERENCE 9716

LOCATION: ROOM 2020 (WEST LEVEL 2)

## SESSION 4

LOCATION: ROOM 2020 (WEST LEVEL 2) . . . SAT 3:30 PM TO 5:10 PM

### Novel Optical Imaging Methods

Session Chairs: **Audrey K. Ellerbee**, Stanford Univ. (USA);  
**Zeev Zalevsky**, Bar-Ilan Univ. (Israel)

3:30 pm: **Bessel beam fluorescence lifetime tomography of live embryos**, Dongli Xu, Leilei Peng, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9716-16]

3:50 pm: **OCT-based three-dimensional, three vector component imaging of cilia-driven fluid flow for developmental biology**, Brendan K. Huang, Yale School of Medicine (USA); Kevin C. Zhou, Yale Univ. (USA); Ute A. Gamm, Yale School of Medicine (USA); Vineet Bhandari, Yale Univ. (USA); Mustafa K. Khokha, Michael A. Choma, Yale School of Medicine (USA) . . . . . [9716-17]

4:10 pm: **Time multiplexing super resolution using a 2D Barker-based array**, Asaf Ilovitsh, Tali Ilovitsh, Eyal Preter, Bar-Ilan Univ. (Israel); Nadav Levanon, Tel Aviv Univ. (Israel); Zeev Zalevsky, Bar-Ilan Univ. (Israel) . . . . . [9716-18]

4:30 pm: **Super resolved optical system using circular gratings for objects with finite sizes**, Asaf Ilovitsh, Bar-Ilan Univ. (Israel); Vicente Mico, Univ. de València (Spain); Zeev Zalevsky, Bar-Ilan Univ. (Israel) . . . . . [9716-21]

4:50 pm: **Watching embryonic development in a new light: elasticity specific imaging with dual Brillouin/Raman microspectroscopy**, Zhaokai Meng, Jessica Hanson, Vladislav V. Yakovlev, Texas A&M Univ. (USA) . . . . . [9716-19]

## SUNDAY 14 FEBRUARY

### POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.*

**Blood flowing state analysis in outflow tract of chick embryonic heart based on spectral domain optical coherence tomography**, Yuqian Zhao, Zhenhe Ma, Yi Wang, Shidan Dou, Northeastern Univ. (China) . . . . . [9716-22]

### BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times



# CONFERENCE 9717

LOCATION: ROOM 2024 (WEST LEVEL 2)

Saturday–Monday 13–15 February 2016 • Proceedings of SPIE Vol. 9717

# Adaptive Optics and Wavefront Control for Biological Systems II

BIOS

Conference Chairs: **Thomas G. Bifano**, Boston Univ. (USA); **Joel Kubby**, Univ. of California, Santa Cruz (USA); **Sylvain Gigan**, Lab. Kastler Brüssel (France)

Program Committee: **Jacopo Bertolotti**, Univ. of Exeter (United Kingdom); **Martin J. Booth**, Univ. of Oxford (United Kingdom); **Wonshik Choi**, Korea Univ. (Korea, Republic of); **Meng Cui**, Purdue Univ. (USA); **John M. Girkin**, Durham Univ. (United Kingdom); **Na Ji**, Howard Hughes Medical Institute (USA); **Benjamin Judkewitz**, Charité Universitätsmedizin Berlin (Germany); **Ori Katz**, Univ. Pierre et Marie Curie (France); **Peter A. Kner**, The Univ. of Georgia (USA); **Pablo Loza-Alvarez**, ICFO - Institut de Ciències Fotòniques (Spain); **Allard P. Mosk**, Univ. Twente (Netherlands); **Rafael Piestun**, Univ. of Colorado at Boulder (USA); **Laura Waller**, Univ. of California, Berkeley (USA); **Monika Ritsch-Marte**, Medizinische Univ. Innsbruck (Austria)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 2024 (WEST LEVEL 2) . SAT 8:00 AM TO 8:40 AM

### Wavefront Shaping Devices

Session Chair: **Thomas G. Bifano**, Boston Univ. (USA)

8:00 am: **Multi-actuator adaptive lens for wavefront correction in optical coherence tomography and two-photon excitation fluorescence microscopy**, Stefano Bonora, IFN-CNR LUXOR Lab. (Italy); Sujin Lee, Yifan Jian, Michelle Cua, Simon Fraser Univ. (Canada); Edward N. Pugh, Robert J. Zawadzki, Univ. of California, Davis (USA); Marinko V. Sarunic, Simon Fraser Univ. (Canada) . . . . . [9717-1]

8:20 am: **Stand-alone scattering optical device using photopolymer**, Jongchan Park, KyeoReh Lee, YongKeun Park, KAIST (Korea, Republic of) . . . . . [9717-2]

### SESSION 2

LOCATION: ROOM 2024 (WEST LEVEL 2) . SAT 8:40 AM TO 10:00 AM

### AO for Microscopy and Optical Coherence Tomography I

Session Chair: **Thomas G. Bifano**, Boston Univ. (USA)

8:40 am: **Adaptive aberration correction for single molecule switching nanoscopy**, Martin J. Booth, Univ. of Oxford (United Kingdom); Debora Andrade, Jacopo Antonello, Daniel Burke, Brian Patton, Univ. of Oxford (United Kingdom); Fang Huang, Joerg Bewersdorf, Yale School of Medicine (USA) . . . . . [9717-3]

9:00 am: **Adaptive optics in digital micromirror based confocal microscopy**, Paolo Pozzi, Dean Wilding, Oleg A. Soloviev, Gleb V. Vdovin, Michel Verhaegen, Technische Univ. Delft (Netherlands) . . . . . [9717-4]

9:20 am: **Wavelet-based denoising of the Fourier metric for real-time sensorless adaptive optics single molecule localization microscopy**, Kayvan F. Tehrani, Peter Kner, The Univ. of Georgia (USA) . . . . . [9717-5]

9:40 am: **Overcoming the resolution limit in retinal imaging using the scattering properties of the eye**, Dino Carpentras, Timothé Laforest, Demetri Psaltis, Christophe Moser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9717-6]

Coffee Break . . . . . Sat 10:00 am to 10:30 am

### SESSION 3

LOCATION: ROOM 2024 (WEST LEVEL 2) . SAT 10:30 AM TO 12:30 PM

### AO for Microscopy and Optical Coherence Tomography II

Session Chair: **Martin J. Booth**, Univ. of Oxford (United Kingdom)

10:30 am: **Strategies for aberration control in dual-objective lens nanoscopy (Invited Paper)**, Xiang Hao, Edward S. Allgeyer, Mary Grace M. Velasco, Yale School of Medicine (USA); Martin J. Booth, Univ. of Oxford (United Kingdom); Joerg Bewersdorf, Yale School of Medicine (USA) . . . [9717-7]

11:00 am: **Fast method of cross-talk effect reduction in biomedical imaging**, Maciej Nowakowski, Sylwia M. Kolenderska, Dawid Borycki, Maciej Wojtkowski, Nicolaus Copernicus Univ. (Poland) . . . . . [9717-8]

11:20 am: **Wavefront sensorless approaches to adaptive optics for in vivo fluorescence imaging of mouse retina**, Daniel J. Wahl, Bengt K. Haunerland, Oscar Sánchez Mata, Simon Fraser Univ. (Canada); Stefano Bonora, CNR-Istituto di Fotonica e Nanotecnologie (Italy); Robert J. Zawadzki, Univ. of California, Davis (USA); Marinko V. Sarunic, Yifan Jian, Simon Fraser Univ. (Canada) . . . . . [9717-9]

11:40 am: **Pulse front adaptive optics in multiphoton microscopy**, Patrick S. Salter, Bangshan Sun, Martin J. Booth, Univ. of Oxford (United Kingdom) . . . . . [9717-10]

12:00 pm: **Adaptive stimulated emission depletion (STED) microscopy for 3D super-resolution imaging of thick specimens (Invited Paper)**, Brian R. Patton, Univ. of Oxford (United Kingdom); Debora Andrade, Daniel Burke, Univ. of Oxford (United Kingdom); Joerg Bewersdorf, Yale School of Medicine (USA); Martin J. Booth, Univ. of Oxford (United Kingdom) . . . . . [9717-11]

Lunch/Exhibition Break . . . . . Sat 12:30 pm to 1:30 pm

### SESSION 4

LOCATION: ROOM 2024 (WEST LEVEL 2) . . . SAT 1:30 PM TO 3:00 PM

### AO for Microscopy and Optical Coherence Tomography III

Session Chair: **Pablo Loza-Alvarez**, ICFO - Institut de Ciències Fotòniques (Spain)

1:30 pm: **What advances in microscopy are required for functional brain imaging? (Keynote Presentation)**, David Kleinfeld, Univ. of California, San Diego (USA) . . . . . [9717-12]

2:30 pm: **Large field-of-view wavefront control for high resolution in vivo neuroimaging (Invited Paper)**, Jung-Hoon Park, Meng Cui, Howard Hughes Medical Institute (USA) . . . . . [9717-13]

Coffee Break . . . . . Sat 3:00 pm to 3:30 pm

### SESSION 5

LOCATION: ROOM 2024 (WEST LEVEL 2) . . SAT 3:30 PM TO 5:00 PM

### AO for Microscopy and Optical Coherence Tomography IV

Session Chair: **Meng Cui**, Purdue Univ. (USA)

3:30 pm: **Adaptive optics without guide stars (Invited Paper)**, Jerome Mertz, Jiang Li, Devin Beaulieu, Hari P. Paudel, Roman Barankov, Thomas G. Bifano, Boston Univ. (USA) . . . . . [9717-14]

4:00 pm: **Dynamic performance of MEMS deformable mirrors for use in an active/adaptive two-photon microscope**, Christian C. Zhang, Warren B. Foster, David L. Dickensheets, Montana State Univ. (USA) . . . . . [9717-15]

4:20 pm: **Depth-enhanced in vivo imaging using wavefront shaping optical coherence tomography**, HyeonSeung Yu, Jaehyun P. Lee, KyeoReh Lee, Yong Jeong, YongKeun Park, KAIST (Korea, Republic of) . . . . . [9717-16]

4:40 pm: **An optical tomography PSF almost insensitive to aberrations: the benefit of a spatial incoherent illumination**, Peng Xiao, Mathias Fink, Claude Boccara, Institut Langevin (France) . . . . . [9717-17]

# CONFERENCE 9717

LOCATION: ROOM 2024 (WEST LEVEL 2)

## SESSION 6

LOCATION: ROOM 2024 (WEST LEVEL 2) . . SAT 5:00 PM TO 5:50 PM

### Coherent Optical Adaptive Techniques

Session Chair: Meng Cui, Purdue Univ. (USA)

5:00 pm: **Volumetric imaging of fast biological dynamics in deep tissue via wavefront engineering** (*Invited Paper*), Lingjie Kong, Meng Cui, Purdue Univ. (USA) . . . . . [9717-18]

5:30 pm: **Aberrations correction for stimulated emission depletion microscopes with coherent optical adaptive technique**, Wei Yan, Shenzhen Univ. (China) and Clemson Univ. (USA); Tong Ye, Clemson Univ. (USA); Xiao Peng, Junle Qu, Shenzhen Univ. (China) . . . . . [9717-19]

### BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 7

LOCATION: ROOM 2024 (WEST LEVEL 2) . SUN 8:00 AM TO 10:10 AM

### Focusing Light Through Scattering Tissues I

Session Chair: Sylvain Gigan, Lab. Kastler Brossel (France)

8:00 am: **Effects of absorption on light transmission channels in random media** (*Invited Paper*), Hui Cao, Yale Univ. (USA) . . . . . [9717-20]

8:30 am: **Optical wavefront shaping for the enhancement of Raman signal in scattering media**, Vladislav V. Yakovlev, Texas A&M Univ. (USA); Graham Throckmorton, Baylor Univ. (USA); Jonathan Thompson, Brett H. Hokr, Texas A&M Univ. (USA) . . . . . [9717-21]

8:50 am: **Enhanced second-harmonic-generation imaging of collagen by means of optical wavefront shaping**, Vladislav V. Yakovlev, Texas A&M Univ. (USA); Graham Throckmorton, Baylor Univ. (USA); Jonathan Thompson, Texas A&M Univ. (USA) . . . . . [9717-22]

9:10 am: **Second-harmonic generation imaging enhancement through scattering media via wavefront shaping**, Sophie Brasselet, Hilton B. Barbosa de Aguiar, Institut Fresnel (France); Sylvain Gigan, Lab. Kastler Brossel (France) . . . . . [9717-23]

9:30 am: **Energy leakage in highly scattering media due to the limited numerical aperture and its effects on wavefront shaping techniques**, HyeonSeung Yu, KyeoReh Lee, YongKeun Park, KAIST (Korea, Republic of) . . . . . [9717-24]

9:50 am: **Accelerated wavefront determination technique for optical imaging through scattering medium**, Hexiang He, Kam Sing Wong, Hong Kong Univ. of Science and Technology (Hong Kong, China) . . . . . [9717-25]

Coffee Break . . . . . Sun 10:10 am to 10:40 am

### SESSION 8

LOCATION: ROOM 2024 (WEST LEVEL 2) SUN 10:40 AM TO 11:40 AM

### Focusing Light Through Scattering Tissues II

Session Chair: Sylvain Gigan, Lab. Kastler Brossel (France)

10:40 am: **Biophotonic applications of eigenchannels in a scattering medium** (*Invited Paper*), Moonseok Kim, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA) and Harvard Medical School (USA); Wonjun Choi, Univ. of Exeter (United Kingdom); Youngwoon Choi, Changhyeong Yoon, Wonshik Choi, Korea Univ. (Korea, Republic of) . . . . . [9717-27]

11:10 am: **Towards deep focusing in scattering tissues using the angular memory effect of scattered light and ultrafast wavefront shaping** (*Invited Paper*), Laurent Bourdieu, Ecole Normale Supérieure (France); Sam Schott, Ecole Normale Supérieure (France) and Univ. of Cambridge (United Kingdom); Jacopo Bertolotti, Ecole Normale Supérieure (France) and Univ. of Exeter (United Kingdom); Baptiste Blochet, Walther Akemann, Jean-François Léger, Cathie Ventalon, Stéphane Dieudonné, Benjamin Mathieu, Ecole Normale Supérieure (France); Sylvain Gigan, Ecole Normale Supérieure (France) . . . . . [9717-28]

Lunch/Exhibition Break . . . . . Sun 11:40 am to 1:20 pm

### SESSION 9

LOCATION: ROOM 2024 (WEST LEVEL 2) . . SUN 1:20 PM TO 3:00 PM

### Focusing Light Through Scattering Tissues III

Session Chair: Joel Kubby, Univ. of California, Santa Cruz (USA)

1:20 pm: **Biological elements carry out optical tasks in coherent imaging systems** (*Invited Paper*), Pietro Ferraro, Vittorio Bianco, Melania Paturzo, Lisa Miccio, Pasquale Memmolo, Francesco Merola, Valentina Marchesano, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) . . . . . [9717-29]

1:50 pm: **Imaging of biological objects using spatio-temporal optical coherence (STOC) modulation**, Sylwia M. Kolenderska, Maciej Nowakowski, Nicolaus Copernicus Univ. (Poland); Grzegorz Wilczynski, Nencki Institute of Experimental Biology (Poland); Maciej Wojtkowski, Dawid Borycki, Nicolaus Copernicus Univ. (Poland) . . . . . [9717-30]

2:10 pm: **Hybrid iterative wavefront shaping for high-speed focusing through scattering media**, Ashton S. Hemphill, Washington Univ. in St. Louis (USA); Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . . . [9717-31]

2:30 pm: **Overcoming multiple scattering for detection and imaging in strongly scattering media** (*Invited Paper*), Amaury Badon, Dayan Li, Geoffroy Lerosey, Claude Boccara, Mathias Fink, Alexandre Aubry, Institut Langevin (France) . . . . . [9717-32]

Coffee Break . . . . . Sun 3:00 pm to 3:30 pm

### SESSION 10

LOCATION: ROOM 2024 (WEST LEVEL 2) . . SUN 3:30 PM TO 5:40 PM

### Focusing Light Through Scattering Tissues IV

Session Chair: Joel Kubby, Univ. of California, Santa Cruz (USA)

3:30 pm: **High-speed channel demixing by scanning interferometric focusing with binary transmission matrix** (*Invited Paper*), Xiaodong Tao, Univ. of California, Santa Cruz (USA); Dare Bodington, Univ. of Rochester (USA); Marc R. Reinig, Joel Kubby, Univ. of California, Santa Cruz (USA) . . . . . [9717-33]

4:00 pm: **Optogenetic control of cell signaling pathway through scattering skull using wavefront shaping** (*Invited Paper*), YongKeun Park, KAIST (Korea, Republic of) . . . . . [9717-34]

4:30 pm: **Adaptive wave-front shaping for flow-field measurements**, Nektarios Koukourakis, Bob Fregin, Lars Büttner, Jürgen W. Czarske, TU Dresden (Germany) . . . . . [9717-35]

4:50 pm: **Universal structures of transmission eigenchannels inside random media** (*Invited Paper*), Zhou Shi, Azriel Z. Genack, Queens College (USA) . . . . . [9717-36]

5:20 pm: **Selective coupling of optical energy into the fundamental diffusion mode of a scattering medium using of optical wavefront shaping**, Oluwafemi S. Ojambati, Hasan Yilmaz, Univ. Twente (Netherlands); Ad Lagendijk, Allard P. Mosk, Willem L. Vos, Univ. Twente (Netherlands) . . . . . [9717-37]

## MONDAY 15 FEBRUARY

### SESSION 11

LOCATION: ROOM 2024 (WEST LEVEL 2) MON 8:00 AM TO 10:00 AM

### Computed Optical Imaging Techniques

Session Chair: Laura Waller, Univ. of California, Berkeley (USA)

8:00 am: **Deep-tissue, high-resolution imaging with collective accumulation of single-scattered waves** (*Invited Paper*), Sungsam Kang, Seungwon Jeong, Wonshik Choi, Korea Univ. (Korea, Republic of) . . . . . [9717-38]

8:30 am: **Retrieving time-dependent Green's functions in optics with low-coherence interferometry: application to diffuse optical imaging**, Amaury Badon, Dayan Li, Geoffroy Lerosey, Claude Boccara, Mathias Fink, Alexandre Aubry, Institut Langevin (France) . . . . . [9717-39]

8:50 am: **Dense sampled transmission matrix for high resolution angular spectrum imaging through turbid media via compressed sensing**, Hwanchol Jang, Gwangju Institute of Science and Technology (Korea, Republic of); Changhyeong Yoon, Wonshik Choi, Korea Univ. (Korea, Republic of); Tae Joong Eom, Heung-No Lee, Gwangju Institute of Science and Technology (Korea, Republic of) . . . . . [9717-40]

# CONFERENCE 9717

LOCATION: ROOM 2024 (WEST LEVEL 2)

9:10 am: **Effects of aberrations in vortex-beams generated with amplitude diffraction gratings**, Carlos Cuartas-Vélez, René Restrepo, Santiago Echeverri Chacón, Univ. EAFIT (Colombia) . . . . . [9717-41]

9:30 am: **Computational adaptive optics for broadband interferometric tomography of tissues and cells** (*Invited Paper*), Steven G. Adie, Jeffrey A. Mulligan, Cornell Univ. (USA) . . . . . [9717-42]

Coffee Break . . . . . Mon 10:00 am to 10:30 am

## SESSION 12

LOCATION: ROOM 2024 (WEST LEVEL 2) MON 10:30 AM TO 12:10 PM

### Shaped Beams for Light Sheet And Structured Illumination Microscopy

Session Chair: **Monika Ritsch-Marte**, Medizinische Univ. Innsbruck (Austria)

10:30 am: **Dynamic focusing in the beating zebrafish heart** (*Invited Paper*), Jorge Ripoll, Univ. Carlos III de Madrid (Spain) and Instituto de Investigación Sanitaria del Hospital Gregorio Marañón (Spain); Laura Andrés, Nadia Mercader, Ctr. Nacional de Investigaciones Cardiovasculares (Spain) . . . . . [9717-43]

11:00 am: **Light-sheet optimization for microscopy**, Dean Wilding, Paolo Pozzi, Technische Univ. Delft (Netherlands); Oleg A. Soloviev, Delft Univ. of Technology (Netherlands) and Flexible Optical B.V. (Netherlands); Gleb V. Vdovin, Technische Univ. Delft (Netherlands) and Flexible Optical B.V. (Netherlands); Michel Verhaegen, Technische Univ. Delft (Netherlands) [9717-44]

11:20 am: **Structured adaptive focusing through reconfigurable scattering media**, Diego Di Battista, Daniele Ancora, Haisu Zhang, Krystalia Lemonaki, Stella Avtzi, Stelios Tzortzakis, Foundation for Research and Technology-Hellas (Greece); Marco Leonetti, Sapienza Univ. di Roma (Italy); Giannis Zacharakis, Foundation for Research and Technology-Hellas (Greece) . . . . . [9717-45]

11:40 am: **Speckle correlation resolution enhancement of wide-field fluorescence imaging** (*Invited Paper*), Hasan Yilmaz, Yale Univ. (USA) and Univ. Twente (Netherlands) . . . . . [9717-46]

Lunch Break . . . . . Mon 12:10 pm to 1:10 pm

## SESSION 13

LOCATION: ROOM 2024 (WEST LEVEL 2) . . MON 1:10 PM TO 3:40 PM

### Channel De-Mixing for Endoscopy/Fibers

Session Chair: **Peter Kner**, The Univ. of Georgia (USA)

1:10 pm: **Wavefront shaping for single fiber fluorescence endoscopy** (*Invited Paper*), Antonio M. Caravaca-Aguirre, Rafael Piestun, Univ. of Colorado at Boulder (USA) . . . . . [9717-47]

1:40 pm: **Confocal microscopy through a multimode fiber**, Damien Loterie, Salma Farahi, Ioannis N. Papadopoulos, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Sebastianus A. Goorden, Univ. Twente (Netherlands); Alexandre Goy, Princeton Univ. (USA); Demetri Psaltis, Christophe Moser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9717-48]

2:00 pm: **Ultrathin endoscopes: nonlinear imaging at the tip of a multimode fiber**, Siddharth Sivankutty, Esben R. Andresen, Institut Fresnel (France); Géraud Bouwmans, Lab. de Physique des Lasers, Atomes et Molécules (France); Serge Monneret, Hervé Rigneault, Institut Fresnel (France) . . . [9717-49]

2:20 pm: **Two-photon excitation endoscopy through a multimode optical fiber**, Edgar E. Morales Delgado, Demetri Psaltis, Christophe Moser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9717-50]

2:40 pm: **Two-photon fluorescence imaging through multicore fiber with digital phase conjugation**, Nicolino Stasio, Donald Conkey, Christophe Moser, Demetri Psaltis, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9717-51]

3:00 pm: **Label free imaging system for measuring blood flow speeds using a single multi-mode optical fiber**, Iliya Sigal, Univ. of Toronto (Canada); Antonio M. Caravaca Aguirre, Univ. of Colorado at Boulder (USA); Raanan Gad, Univ. of Toronto (Canada); Rafael Piestun, Univ. of Colorado at Boulder (USA); Ofer Levi, Univ. of Toronto (Canada) . . . . . [9717-52]

3:20 pm: **Fluorescence and optical-resolution photoacoustic imaging through capillary waveguides**, Nicolino Stasio, Atsushi Shibukawa, Ioannis N. Papadopoulos, Salma Farahi, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Olivier Simandoux, Jean-Pierre Huignard, Emmanuel Bossy, Institut Langevin (France); Christophe Moser, Demetri Psaltis, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9717-53]

Coffee Break . . . . . Mon 3:40 pm to 4:10 pm

## SESSION 14

LOCATION: ROOM 2024 (WEST LEVEL 2) . . MON 4:10 PM TO 5:30 PM

### Wavefront Shaping For Photoacoustic and Acousto-Optical Imaging/TRUE

Session Chairs: **Lihong V. Wang**, Washington Univ. in St. Louis (USA); **Emmanuel Bossy**, Institut Langevin (France)

4:10 pm: **Time-reversed ultrasonically encoded (TRUE) optical focusing inside scattering media with high power gain**, Cheng Ma, Washington Univ. in St. Louis (USA); Xiao Xu, Washington Univ. in St. Louis (USA); Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . . . [9717-54]

4:30 pm: **High-speed wavefront measurement using a lock-in camera for time-reversal based optical focusing inside scattering media**, Yan Liu, Cheng Ma, Yuecheng Shen, Washington Univ. in St. Louis (USA); Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . . . [9717-55]

4:50 pm: **Focusing light in deep tissue with time-reversed ultrasound microbubble encoded light**, Haowen Ruan, Mooseok Jang, Changhui Yang, California Institute of Technology (USA) . . . . . [9717-56]

5:10 pm: **Controlling the light distribution through turbid media with wavefront shaping based on volumetric photoacoustic feedback**, Xosé L. Deán-Ben, Héctor Estrada, Ali Özbek, Daniel Razansky, Helmholtz Zentrum München GmbH (Germany) . . . . . [9717-57]

## POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

Conference attendees are invited to attend the BiOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Iterative calibration of a digital optical phase conjugation system**, Mehdi Azimipour, Farid Atry, Ramin Pashaie, Univ. of Wisconsin-Milwaukee (USA) . . . . . [9717-58]

**Transmissive liquid-crystal device correcting primary coma aberration and astigmatism in laser scanning microscopy**, Ayano Tanabe, Citizen Holdings Co., Ltd. (Japan) and Hokkaido Univ. (Japan); Terumasa Hibi, Sari Ipponjima, Hokkaido Univ. (Japan); Kenji Matsumoto, Masafumi Yokoyama, Makoto Kurihara, Nobuyuki Hashimoto, Citizen Holdings Co., Ltd. (Japan); Tomomi Nemoto, Hokkaido Univ. (Japan) . . . . . [9717-59]

**Use of a GPU for fast deconvolution in wavefront coding light sheet imaging**, Jacob Licea-Rodriguez, David Castillo-Andreo, Omar E. Olarte, Pablo Loza-Alvarez, ICFO - Institut de Ciències Fotòniques (Spain) . . . [9717-60]

**Analysis of design for Hartmann-Shack measurements under usage of Fourier-iteration and Zernike approximation wavefront reconstruction methods**, Alexander Kabardiadi, Westsächsische Hochschule Zwickau (Germany); Tobias Baselt, Christopher Taudt, Peter Hartmann, Westsächsische Hochschule Zwickau (Germany) and Fraunhofer-Institut für Werkstoff- und Strahltechnik IWS (Germany) . . . . . [9717-61]

**Spatially resolving the optical energy density inside a scattering medium**, Oluwafemi S. Ojambati, Ad Lagendijk, Allard P. Mosk, Willem L. Vos, Univ. Twente (Netherlands) . . . . . [9717-62]

BIOS

# CONFERENCE 9718

LOCATION: ROOM 2020 (WEST LEVEL 2)

Sunday–Wednesday 14–17 February 2016 • Proceedings of SPIE Vol. 9718

## Quantitative Phase Imaging II

Conference Chairs: **Gabriel Popescu**, Univ. of Illinois at Urbana-Champaign (USA); **YongKeun Park**, KAIST (Korea, Republic of)

Program Committee: **George Barbastathis**, Massachusetts Institute of Technology (USA); **Audrey K. Ellerbee**, Stanford Univ. (USA); **Pietro Ferraro**, Istituto di Scienze applicata e Sistemi Intelligenti (Italy); **Björn Kemper**, Westfälische Wilhelms-Universität Münster (Germany); **Myung K. Kim**, Univ. of South Florida (USA); **Theo Lasser**, Ecole Polytechnique Fédérale de Lausanne (Switzerland); **Jerome Mertz**, Boston Univ. (USA); **Aydogan Ozcan**, Univ. of California, Los Angeles (USA); **Demetri Psaltis**, Ecole Polytechnique Fédérale de Lausanne (Switzerland); **Colin James Richard Sheppard**, Istituto Italiano di Tecnologia (Italy); **Peter T. C. So**, Massachusetts Institute of Technology (USA); **Laura Waller**, Univ. of California, Berkeley (USA); **Changhuei Yang**, California Institute of Technology (USA)

### SUNDAY 14 FEBRUARY

#### WELCOME

LOCATION: ROOM 2020 (WEST LEVEL 2) . . . . . 8:00 AM TO 8:10 AM

Conference Chairs: **Gabriel Popescu**, Univ. of Illinois at Urbana-Champaign (USA); **YongKeun Park**, KAIST (Korea, Republic of)

#### SESSION 1

LOCATION: ROOM 2020 (WEST LEVEL 2) . SUN 8:30 AM TO 12:20 PM

#### QPI Methodologies I

Session Chairs: **Gabriel Popescu**, Univ. of Illinois at Urbana-Champaign (USA); **YongKeun Park**, KAIST (Korea, Republic of)

8:30 am: **The evolution of interferometry from metrology to biomedical applications** (*Keynote Presentation*), James C. Wyant, The Univ. of Arizona (USA) . . . . . [9718-1]

9:10 am: **Non-iterative adaptive optical microscopy using wavefront sensing** (*Invited Paper*), Joel Kubby, Xiaodong Tao, Oscar A. Azucena Jr., Marc R. Reinig, Qingge Li, Univ. of California, Santa Cruz (USA); Dare Bodington, Univ. of Rochester (USA) . . . . . [9718-2]

9:40 am: **High resolution quantitative phase imaging of live cells with constrained optimization approach**, Vimal Prabhu Pandiyan, Indian Institute of Technology Hyderabad (India); Kedar B. Khare, Indian Institute of Technology Delhi (India); Renu John, Indian Institute of Technology Hyderabad (India) and Indian Institute of Technology Delhi (India) . . . . . [9718-3]

10:00 am: **Label-free three-dimensional refractive-index acquisition by micro-manipulations of cells in suspension**, Natan T. Shaked, Tel Aviv Univ. (Israel) . . . . . [9718-4]

Coffee Break . . . . . Sun 10:20 am to 10:50 am

10:50 am: **Holographic microscopy in low coherence**, Radim Chmelik, Jiri Petracek, Vera Kollarova, Michala Slaba, CEITEC Brno Univ. of Technology (Czech Republic) . . . . . [9718-5]

11:10 am: **Computational illumination for real-time gigapixel phase microscopy** (*Invited Paper*), Laura Waller, Univ. of California, Berkeley (USA) . . . . . [9718-6]

11:40 am: **Coherent label-free imaging through turbidity: a holographic approach**, Vittorio Bianco, Melania Paturzo, Valentina Marchesano, Lisa Miccio, Pasquale Memmolo, Pietro Ferraro, Istituto di Scienze applicate e Sistemi Intelligenti (Italy) . . . . . [9718-8]

12:00 pm: **Three-axes digital holographic microscopy for studying bacteria hydrodynamics**, Silvio Bianchi, Filippo Saglimbeni, Roberto Di Leonardo, Sapienza Univ. di Roma (Italy) . . . . . [9718-9]

Lunch/Exhibition Break . . . . . Sun 12:20 pm to 1:50 pm

#### SESSION 2

LOCATION: ROOM 2020 (WEST LEVEL 2) . . SUN 1:50 PM TO 6:00 PM

#### QPI Algorithms and Image Processing

Session Chairs: **George Barbastathis**, Massachusetts Institute of Technology (USA); **Colin J. Sheppard**, Istituto Italiano di Tecnologia (Italy)

1:50 pm: **Phase microscope imaging in phase space** (*Invited Paper*), Colin J. Sheppard, Istituto Italiano di Tecnologia (Italy); Shalin B. Mehta, Marine Biological Lab. (USA) . . . . . [9718-10]

2:20 pm: **Study the effect of resolution on focusing process via optical phase conjugation**, Te-Jen Kung, Chia-Ta Tseng, Snow H. Tseng, National Taiwan Univ. (Taiwan) . . . . . [9718-11]

2:40 pm: **Propagating light through a scattering medium with specific amplitude and phase**, Snow H. Tseng, Te-Jen Kung, Min-Lun Yu, National Taiwan Univ. (Taiwan) . . . . . [9718-12]

3:00 pm: **Single shot recovery of hologram from speckle field**, Vinu R. V., Indian Institute of Space Science and Technology (India); Kyoohyun Kim, KAIST (Korea, Republic of); Atul S. Somkuwar, Indian Institute of Space Science and Technology (India); YongKeun Park, KAIST (Korea, Republic of); Rakesh K. Singh, Indian Institute of Space Science and Technology (India) . . . . . [9718-13]

Coffee Break . . . . . Sun 3:20 pm to 3:50 pm

3:50 pm: **Reversibility of scattered fields**, Renjie Zhou, Massachusetts Institute of Technology (USA); Taewoo Kim, Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9718-14]

4:10 pm: **Quantitative phase imaging with a hybrid diffractive-refractive optical lens doublet** (*Invited Paper*), Alexander Jesacher, Walter H. Harm, Stefan Bernet, Monika Ritsch-Marte, Medizinische Univ. Innsbruck (Austria) . . . . . [9718-15]

4:40 pm: **Spectral interferometric techniques for high-sensitivity measurement of sperm morphology**, Yizheng Zhu, Chengshuai Li, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9718-16]

5:00 pm: **GPU-based rapid reconstruction of cellular 3D refractive index maps from tomographic phase microscopy**, Gili Dardikman, Natan T. Shaked, Tel Aviv Univ. (Israel) . . . . . [9718-17]

5:20 pm: **Enhanced resolution phase retrieval transport of intensity equation techniques based on inclined illumination**, Juan Martínez-Carranza, Konstantinos Falaggis, Tomasz Kozacki, Warsaw Univ. of Technology (Poland) . . . . . [9718-18]

5:40 pm: **Tomographic wavefront retrieval using the geometric sensor**, José Manuel Rodríguez Ramos, Juan Manuel Trujillo-Sevilla, Juan José Fernández-Valdivia, Univ. de La Laguna (Spain) . . . . . [9718-19]



### MONDAY 15 FEBRUARY

#### SESSION 3

LOCATION: ROOM 2020 (WEST LEVEL 2) MON 8:00 AM TO 12:00 PM

### QPI of Cells and Tissues I

Session Chairs: **Björn Kemper**,  
Westfälische Wilhelms-Univ. Münster (Germany);  
**Peter T. C. So**, Massachusetts Institute of Technology (USA)

8:00 am: **Quantitative phase-digital holographic microscopy: a new imaging modality to identify original cellular biomarkers of diseases** (*Invited Paper*), Pierre Marquet, Institut Univ. en Santé Mentale de Québec, Univ. Laval (Canada) and Ctr. Hospitalier Univ. Vaudois (Switzerland) and Brain and Mind Institute, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Pascal Jourdain, Ctr. Hospitalier Univ. Vaudois (Switzerland) and Brain Mind Institute, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Christian Depeursinge, Pierre J. Magistretti, Brain Mind Institute, Ecole Polytechnique Fédérale de Lausanne (Switzerland) and King Abdullah Univ. of Science and Technology (Saudi Arabia) . . . . . [9718-20]

8:30 am: **Quantification of neurotoxic effects on individual neuron cells using optical diffraction tomography**, Jonghee Yoon, Su-a Yang, Kyoohyun Kim, YongKeun Park, KAIST (Korea, Republic of) . . . . . [9718-21]

8:50 am: **Monitoring in-vitro bovine embryo development during the first days after fertilization**, Mikhail E. Kandel, Marcello Rubessa, Daniel Fernandes, Tan H. Nguyen, Matthew B. Wheeler, Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9718-22]

9:10 am: **Prospects and challenges of quantitative phase imaging in tumor cell biology**, Björn Kemper, Westfälische Wilhelms-Univ. Münster (Germany) . . . . . [9718-23]

9:30 am: **Quantitative label-free sperm imaging by means of transport of intensity**, Praveen Kumar Poola, Vimal P. Pandiyan, Renu John, Indian Institute of Technology Hyderabad (India); Varshini Jayaraman, Univ. of Hyderabad (India) . . . . . [9718-24]

9:50 am: **Phase correlation imaging for cell dynamics investigation**, Lihong Ma, Univ. of Illinois at Urbana-Champaign (USA) and Zhejiang Normal Univ. (China); Rajshekhar Gannavarpu, Ru Wang, Basanta Bhaduri, Shamira Sridharan, Mustafa A. Mir, Arindam Chakraborty, Supriya G. Prasanth, Univ. of Illinois at Urbana-Champaign (USA); Larry Millet, Oak Ridge National Lab. (USA); Martha U. Gillette, Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9718-25]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

10:40 am: **Quantitative characterization of wave correlations in biological tissue**, Gerwin Osnabrugge, Ivo M. Vellekoop, Univ. Twente (Netherlands) . . . . . [9718-26]

11:00 am: **Analyzing the texture changes in the quantitative phase maps of sperm cells and adipocytes**, Darina Roitshtain, Natan T. Shaked, Tel Aviv Univ. (Israel) . . . . . [9718-27]

11:20 am: **Detecting neuronal activity using two new QPI systems**, Olivier Thouvenin, Mathias Fink, Claude Boccara, Institut Langevin (France) . . . . . [9718-28]

11:40 am: **Highly sensitive kinesin-microtubule motility assays using quantitative phase imaging**, Mikhail E. Kandel, Univ. of Illinois at Urbana-Champaign (USA); Kai Wen Teng, Paul R. Selvin, Univ. of Illinois (USA); Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9718-29]

Lunch Break . . . . . Mon 12:00 pm to 1:30 pm

#### SESSION 4

LOCATION: ROOM 2020 (WEST LEVEL 2) . . MON 1:30 PM TO 3:30 PM

### QPI Clinical Applications

Session Chair: **Aydogan Ozcan**, Univ. of California, Los Angeles (USA)

1:30 pm: **Online quantitative phase imaging of vascular endothelia cells under continuous flow utilizing digital holographic microscopy**, Maria Odenthal-Schnittler, Westfälische Wilhelms-Univ. Münster (Germany) and MOS Technologies (Germany); Angelika Vollmer, Hans Joachim Schnittler, Björn Kemper, Westfälische Wilhelms-Univ. Münster (Germany) . . . . . [9718-30]

1:50 pm: **Label-free classification of white blood cell population using optical diffraction tomography**, Jonghee Yoon, Kyoohyun Kim, Min-hyeok Kim, Suk-Jo Kang, YongKeun Park, KAIST (Korea, Republic of) . . . . . [9718-31]

2:10 pm: **Using quantitative interference phase microscopy for sperm acrosome evaluation**, Michal Balberg, Ksawery Kalinowski, Mattan Levi, Natan T. Shaked, Tel Aviv Univ. (Israel) . . . . . [9718-32]

2:30 pm: **Characterizations of individual human red blood cells from patients with diabetes mellitus**, SangYun Lee, KAIST (Korea, Republic of); Seongsoo Jang, Univ. of Ulsan (Korea, Republic of) and Asan Medical Ctr. (Korea, Republic of); HyunJoo Park, YongKeun Park, KAIST (Korea, Republic of) . . . . . [9718-33]

2:50 pm: **Automatic diagnosis system for prostate cancer using quantitative phase images and machine learning**, Tan H. Nguyen, Shamira Sridharan, Univ. of Illinois at Urbana-Champaign (USA); Virgilia Macias, Andre Balla, Univ. of Illinois at Chicago (USA); Minh N. Do, Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9718-34]

3:10 pm: **Investigation of CD4 (helpers) and CD8 (killers) T-lymphocytes with coherent phase microscopy**, Anastasiya A. Bolotova, Tatiana V. Vyshenskaya, Vladislav D. Zverzhkhovskiy, Moscow State Univ. of Information Technologies, Radioengineering and Electronics (Russian Federation); I. V. Vasilenko, Russian Medical Academy of Post-Graduate Education (Russian Federation) . . . . . [9718-107]

Coffee Break . . . . . Mon 3:30 pm to 3:50 pm

#### SESSION 5

LOCATION: ROOM 2020 (WEST LEVEL 2) . . MON 3:50 PM TO 6:30 PM

### QPI from Lab to Market

Session Chair: **Gabriel Popescu**,  
Univ. of Illinois at Urbana-Champaign (USA)

3:50 pm: **Modern microscopy and “crossing the chasm” with new technologies** (*Keynote Presentation*), Jim Sharp, Carl Zeiss Microscopy, LLC (USA) . . . . . [9718-35]

4:30 pm: **Phi optics: from image to knowledge** (*Invited Paper*), Catalin Chirutescu, Phi Optics, Inc. (USA) . . . . . [9718-36]

4:50 pm: **Taking laser research results to quantitative phase imaging and beyond** (*Invited Paper*), Benoit F. Wattellier, Marie-Begoña Lebrun, PHASICS S.A. (France) . . . . . [9718-37]

5:10 pm: **Holomonitor M4: holographic imaging cytometer for real-time kinetic label-free live-cell analysis of adherent cells** (*Invited Paper*), Mikael Sebesta, Peter J. Egelberg, Anders Langberg, Jens-Henrik Lindskov, Kersti Alm, Birgit Janicke, Phase Holographic Imaging AB (Sweden) . . . . . [9718-38]

5:30 pm: **Optical diffraction tomography using a digital micromirror device** (*Invited Paper*), Seungwoo Shin, Kyoohyun Kim, Sangchan Na, Taehong Kim, Kihyun Hong, Tomocube (Korea, Republic of) . . . . . [9718-39]

5:50 pm: **From university research to commercial product** (*Invited Paper*), Philip Mathuis, Ovizio Imaging Systems (Belgium) . . . . . [9718-40]

6:10 pm: **Coherence-controlled holographic microscopy principle embodiment into Q-PHASE microscope: story of a successful technology transfer** (*Invited Paper*), Martin Lostak, TESCAN, a.s. (Czech Republic) . . . . . [9718-106]

#### POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

Conference attendees are invited to attend the BIOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PVWPosterGuidelines>.

**Automatic tissue segmentation of breast biopsies imaged by QPI**, Hassaan Majeed, Tan H. Nguyen, Mikhail E. Kandel, Univ. of Illinois at Urbana-Champaign (USA); Virgilia Macias, Univ. of Illinois at Chicago (USA); Minh N. Do, Univ. of Illinois at Urbana-Champaign (USA); Andre Kajdacsy-Balla, Univ. of Illinois at Chicago (USA); Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9718-78]

**Study of erythrocyte membrane fluctuation using light scattering analysis**, Hoyoon Lee, Korea Univ. (Korea, Republic of); Sangyun Lee, YongKeun Park, KAIST (Korea, Republic of); Sehyun Shin, Korea Univ. (Korea, Republic of) . . . . . [9718-79]

**The study on RBC characteristic in paroxysmal nocturnal hemoglobinuria (PNH) patients using common path interferometric quantitative phase microscopy (CPIQPM)**, Byung Jun Park, Youngjae Won, Byungyeon Kim, Seungrag Lee, Osong Medical Innovation Foundation (Korea, Republic of) . . . . . [9718-80]

# CONFERENCE 9718

LOCATION: ROOM 2020 (WEST LEVEL 2)

**Digital-micromirror device-based quantitative phase imaging**, Renjie Zhou, Massachusetts Institute of Technology (USA); Cuifang Kuang, Zhejiang Univ. (China); Zahid Yaqoob, Peter T. C. So, Massachusetts Institute of Technology (USA) . . . . . [9718-81]

**Phase retrieved optical projection tomography for 3D imaging through scattering layers**, Daniele Ancora, Foundation for Research and Technology-Hellas (Greece) and Univ. of Crete (Greece); Diego Di Battista, Stylianos Psycharakis, Foundation for Research and Technology-Hellas (Greece); Georgia Giasafaki, Foundation for Research and Technology-Hellas (Greece) and Univ. of Crete (Greece); Athanasios Zacharopoulos, Giannis Zacharakis, Foundation for Research and Technology-Hellas (Greece) . . . . . [9718-82]

**Quantitative measurement of displacement in photopolymer layers during holographic recording using phase shifting electronic speckle pattern interferometry**, Mohesh Moothanchery, Nanyang Technological Univ. (Singapore); Viswanath Bavigadda, Dublin Institute of Technology (Ireland); Paul Kumar Upputuri, Manojit Pramanik, Nanyang Technological Univ. (Singapore); Vincent Toal, Izabela Naydenova, Dublin Institute of Technology (Ireland) . . . . . [9718-83]

**Single-shot and 4-step phase shifting digital holographic microscopy using a 2D grating**, Taeseok D. Yang, Hyung-Jin Kim, Beop-Min Kim, Kyoung-Jin Lee, Youngwoon Choi, Korea Univ. (Korea, Republic of) . . . . . [9718-84]

**Color-coded LED microscopy for multi-contrast and quantitative phase imaging**, Donghak Lee, DaeSeong Jung, Socheol Kim, Chulmin Joo, Yonsei Univ. (Korea, Republic of) . . . . . [9718-85]

**White light phase shifting interferometry and color fringe analysis for the detection of contaminants in water**, Vishesh Dubey, Veena Singh, Azeem Ahmad, Gyanendra Singh, Dalip Singh Mehta, Indian Institute of Technology Delhi (India) . . . . . [9718-86]

**Intravital quantitative phase imaging for quantitative analysis of blood flow in live mouse mesentery**, Kyoohyun Kim, Kibaek Choe, Pilhan Kim, YongKeun Park, KAIST (Korea, Republic of) . . . . . [9718-87]

**Optical diffraction tomography for inspection of mobile phone lenses**, Kyoohyun Kim, Jonghee Yoon, YongKeun Park, KAIST (Korea, Republic of) . . . . . [9718-88]

**Non-invasive optical detection method for food spoilage using light speckle correlation**, Jonghee Yoon, KyeoReh Lee, YongKeun Park, KAIST (Korea, Republic of) . . . . . [9718-89]

**High-speed quantitative phase imaging with line-field swept-source phase microscopy using a 1D array detector**, Soon-Woo Cho, Hyung-Seok Lee, Gyeong Hun Kim, Nam-Soo Park, Chang-Seok Kim, Pusan National Univ. (Korea, Republic of) . . . . . [9718-90]

**Measurements of the membrane fluctuations of sickle cell trait red blood cells by a quantitative phase imaging unit in Tanzania**, JaeHwang Jung, KAIST (Korea, Republic of); Lucas E. Matemba, National Institute for Medical Research (Tanzania, United Republic of); Dong-Jin Kim, Nelson Mandela African Institute of Science and Technology (Tanzania, United Republic of); YongKeun Park, KAIST (Korea, Republic of) . . . . . [9718-91]

**Investigation of ethanol effects on morphological and biochemical properties of human red blood cells**, SangYun Lee, HyunJoo Park, KAIST (Korea, Republic of); Catherine Best-Popescu, Univ. of Illinois at Urbana-Champaign (USA); Seongsoo Jang, Univ. of Ulsan (Korea, Republic of) and Asan Medical Ctr. (Korea, Republic of); YongKeun Park, KAIST (Korea, Republic of) . . . . . [9718-92]

**Quantitative morphological and biochemical studies on human downy hairs using 3D quantitative phase imaging**, SangYun Lee, Kyoohyun Kim, KAIST (Korea, Republic of); Yuhyun Lee, Sungjin Park, Heejae Shin, Jongwon Yang, Kwanhong Ko, Daejeon Dongsin Science High School (Korea, Republic of); HyunJoo Park, YongKeun Park, KAIST (Korea, Republic of) . . . . . [9718-93]

**Field of view extension in quantitative phase microscopy with broadband illumination**, Pinhas Girshovitz, Irena Frenklach, Natan T. Shaked, Tel Aviv Univ. (Israel) . . . . . [9718-94]

**Substrate stiffness influence on melanoma cell growth studied by QPI**, Shamira Sridharan, Yanfen Li, Mikhail E. Kandel, Natalya Bapst, Kristopher A. Killian, Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . [9718-95]

**Validation of stromal optical anisotropy as marker for prostate cancer recurrence**, Shamira Sridharan, Univ. of Illinois at Urbana-Champaign (USA); Virgilia Macias, Univ. of Illinois at Chicago (USA); Krishnarao V. Tangella, Presence Covenant Medical Ctr. (USA); Jonathan Melamed, New York Univ. Langone Medical Ctr. (USA); Andre Kajdacsy-Balla, Univ. of Illinois at Chicago (USA); Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . [9718-96]

**Morphological evaluation of sperm cells using quantitative phase microscopy**, Pinhas Girshovitz, Tel Aviv Univ. (Israel); Miki Haifler, Tel-Aviv Univ. (Israel); Gili Band, The Chaim Sheba Medical Ctr. (Israel); Gili Dardikman, Tel Aviv Univ. (Israel); Igal Madjar, The Chaim Sheba Medical Ctr. (Israel); Natan T. Shaked, Tel Aviv Univ. (Israel) . . . . . [9718-97]

**Improvement of reconstructed phase distribution of fast moving phase object in digital holographic microscope**, Peng Xia, Kouichi Nitta, Osamu Matoba, Kobe Univ. (Japan); Yasuhiro Awatsuji, Kyoto Institute of Technology (Japan) . . . . . [9718-98]

**Optical phase analysis in cortical drilled porcine bones using digital holographic interferometry**, Cesar G. Tavera, Manuel H. De la Torre-Ibarra, Jorge M. Flores-Moreno, Juan M. Luna, Manuel de Jesus Briones Reyes, Fernando Mendoza Santoyo, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [9718-99]

**Study of inhomogeneity within PMMA samples using a 3D-SOCT system**, Manuel de Jesus Briones Reyes, Manuel H. De la Torre-Ibarra, Jorge M. Flores-Moreno, Cesar G. Tavera, Juan M. Luna Hernandez, Fernando Mendoza Santoyo, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [9718-100]

**The substructure imaging method of a multimediuem cell based on two orthogonal phase images**, Yawei Wang, Yuanyuan Xu, Zhiduo Xin, Ying Ji, Cui-Hong Lv, Hao Han, Jiangsu Univ. (China) . . . . . [9718-101]

**Portable Hilbert phase profilometry (HPP) for imaging dynamic mesoscopic objects**, Lihong Ma, Univ. of Illinois at Urbana-Champaign (USA) and Zhejiang Normal Univ. (China); Mikhail E. Kandel, Amr Martini, Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9718-102]

**Osmolality modulation to decouple erythrocyte measurements by diffraction phase microscopy**, Silvia Ceballos, Univ. Nacional de Colombia (Colombia); Lihong Ma, Mikhail E. Kandel, Hassaan Majeed, Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA); Freddy Monroy, Univ. Nacional de Colombia (Colombia) . . . . . [9718-103]

**Quantitative study of the effects of spatiotemporal coherence of illumination to speckle noise reduction**, SeungWoo Shin, Kyoohyun Kim, KyeoReh Lee, JaeHwang Jung, SangYun Lee, YongKeun Park, KAIST (Korea, Republic of) . . . . . [9718-104]

**Coherence-controlled holographic microscopy for live-cell quantitative phase imaging in turbid media**, Martin Lostak, TESCAN, a.s. (Czech Republic); Jana Colláková, Brno Univ. of Technology (Czech Republic); Tomas Slaby, TESCAN, a.s. (Czech Republic); Aneta Krizova, TESCAN, a.s. (Czech Republic) and Brno Univ. of Technology (Czech Republic) and CEITEC Brno Univ. of Technology (Czech Republic); Pavel Vesely, CEITEC Brno Univ. of Technology (Czech Republic); Radim Chmelik, Brno Univ. of Technology (Czech Republic) and CEITEC Brno Univ. of Technology (Czech Republic) . . . . . [9718-105]

## TUESDAY 16 FEBRUARY

SESSION 6

LOCATION: ROOM 2020 (WEST LEVEL 2) . . TUE 8:30 AM TO 12:10 PM

### QPI Methodologies II

Session Chairs: **Jerome Mertz**, Boston Univ. (USA); **Demetri Psaltis**, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

8:30 am: **Learning from examples in optical tomography** (*Invited Paper*), Demetri Psaltis, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9718-41]

9:00 am: **High-speed, off-axis, line-scanning reflectance confocal interference microscope for quantitative phase imaging**, Changgeng Liu, Yale School of Medicine (USA); Sebastian Knitter, Yale Univ. (USA); Zhilong Cong, Ikbal Sencan, Yale School of Medicine (USA); Hui Cao, Yale Univ. (USA); Michael A. Choma, Yale School of Medicine (USA) . . . . . [9718-42]

9:20 am: **Multi-modal digital holographic microscopy for wide-field fluorescence and 3D phase imaging**, Xiangyu Quan, Peng Xia, Osamu Matoba, Kouichi Nitta, Kobe Univ. (Japan); Yasuhiro Awatsuji, Kyoto Institute of Technology (Japan) . . . . . [9718-43]

9:40 am: **Lens-free synthetic optical holography**, Andrea Di Donato, Simone Torquati, Univ. Politecnica delle Marche (Italy); Tiziana Pietrangolo, Univ. degli Studi G. d'Annunzio Chieti Pescara (Italy); Marco Farina, Univ. Politecnica delle Marche (Italy) . . . . . [9718-44]

Coffee Break . . . . . Tue 10:00 am to 10:20 am

10:20 am: **High-throughput nanoparticle sizing using lensfree holographic microscopy and liquid nanolenses** (*Invited Paper*), Euan McLeod, The Univ. of Arizona (USA) . . . . . [9718-45]

10:50 am: **Synthetic aperture imaging of objects embedded within scattering media**, Pilsung Kang, Wonshik Choi, Korea Univ. (Korea, Republic of) . . . . . [9718-46]

# CONFERENCE 9718

## LOCATION: ROOM 2020 (WEST LEVEL 2)

### WEDNESDAY 17 FEBRUARY

#### SESSION 8

LOCATION: ROOM 2020 (WEST LEVEL 2) WED 8:00 AM TO 11:20 AM

### QPI Methodologies III

Session Chairs: **YongKeun Park**, KAIST (Korea, Republic of);  
**David Clark**, Univ. of South Florida (USA)

8:00 am: **Resolving the depth of fluorescent light by shearing interferometry**, Johannes Schindler, Univ. Stuttgart (Germany) and Institut für Technische Optik (Germany); Ahmed Elmaklizi, Florian Voit, Ansgar Hohmann, Institut für Lasertechnologien in der Medizin und Messtechnik (Germany) and Univ. Ulm (Germany); Philipp Schau, Nicole Brodhag, Karsten Frenner, Institut für Technische Optik (Germany) and Univ. Stuttgart (Germany); Alwin Kienle, Institut für Lasertechnologien in der Medizin und Messtechnik (Germany) and Univ. Ulm (Germany); Wolfgang Osten, Institut für Technische Optik (Germany) and Univ. Stuttgart (Germany) . . . . . [9718-60]

8:20 am: **Quantitative phase contrast imaging using a Nomarski microscope with variable shear distance**, Claas Falldorf, Bremer Institut für angewandte Strahltechnik GmbH (Germany); Mostafa Agour, Bremer Institut für angewandte Strahltechnik GmbH (Germany) and Aswan Univ. (Egypt); Ralf B. Bergmann, Bremer Institut für angewandte Strahltechnik GmbH (Germany) and Univ. Bremen (Germany) . . . . . [9718-61]

8:40 am: **Dual wavelength digital holographic imaging of embedded layered structures**, Jun Yong Park, Sean Norbury, Xinzhong Chen, Anna V. Sharikova, Alexander T. Khmaladze, Univ. at Albany (USA) . . . . . [9718-62]

9:00 am: **Shape measurement of microscopic objects using computational shear interferometry**, Mostafa Agour, Claas Falldorf, Ralf B. Bergmann, Bremer Institut für angewandte Strahltechnik GmbH (Germany) . . . . . [9718-67]

9:20 am: **Computational optical imaging by correcting wavefronts and aberrations in phase-resolved optical coherence tomography systems (Invited Paper)**, Stephen A. Boppert, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9718-65]

9:50 am: **Fast quantitative retardance imaging of biological samples using quadri-wave interferometry**, Sherazade Aknoun, PHASICS S.A. (France); Pierre Bon, Institut d'Optique Graduate School (France); Julien Savatier, Serge Monneret, Institut Fresnel (France) and Aix-Marseille Univ. (France); Benoit F. Wattellier, PHASICS S.A. (France) . . . . . [9718-66]

Coffee Break . . . . . Wed 10:10 am to 10:40 am

10:40 am: **Unlimited field-of-view optofluidic quantitative phase imaging**, Vittorio Bianco, Melania Paturzo, Valentina Marchesano, Pietro Ferraro, Istituto di Scienze applicate e Sistemi Intelligenti (Italy) . . . . . [9718-63]

11:00 am: **High-sensitivity quantitative phase microscopy**, Renjie Zhou, Massachusetts Institute of Technology (USA); Cuifang Kuang, Zhejiang Univ. (China); Poorya Hosseini, Massachusetts Institute of Technology (USA); Ravi Chowdhary, Univ. of Illinois at Urbana-Champaign (USA); Zahid Yaqoob, Peter T. C. So, Massachusetts Institute of Technology (USA) . . . . . [9718-68]

Lunch Break . . . . . Wed 11:20 am to 1:20 pm

#### SESSION 9

LOCATION: ROOM 2020 (WEST LEVEL 2) . . WED 1:20 PM TO 3:30 PM

### QPI Methodologies IV

Session Chairs: **Audrey K. Ellerbee**, Stanford Univ. (USA);  
**Pietro Ferraro**, Istituto di Scienze applicata e Sistemi Intelligenti (Italy)

1:20 pm: **GPC for QPI (Invited Paper)**, Jesper Glückstad, Technical Univ. of Denmark (Denmark) . . . . . [9718-69]

1:50 pm: **Extended synthetic wavelength phase imaging by multiwavelength digital holography**, David C. Clark, Myung K. Kim, Univ. of South Florida (USA) . . . . . [9718-70]

2:10 pm: **Gradient light interference microscopy (GLIM) for imaging thick specimens**, Tan H. Nguyen, Mikhail E. Kandel, Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9718-71]

2:30 pm: **Single-shot phase retrieval with blind Fourier holography**, Ben Leshem, Weizmann Institute of Science (Israel); Rui Xu, Jianwei Miao, Univ. of California, Los Angeles (USA); Boaz Nadler, Dan Oron, Nirit Dudovich, Weizmann Institute of Science (Israel); Oren Raz, Univ. of Maryland, College Park (USA) . . . . . [9718-72]

2:50 pm: **Magnified object spectrum interference microscopy**, Hassaan Majeed, Eun Jung Min, Sumin Kim, Univ. of Illinois at Urbana-Champaign (USA); Woonggyu Jung, Ulsan National Institute of Science and Technology (Korea, Republic of); Catherine Best-Popescu, Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9718-73]

11:10 am: **Some advances in design and calibration of limited angle optical diffraction tomography system for biological applications**, Arkadiusz Kus, Piotr L. Makowski, Malgorzata Kujawinska, Warsaw Univ. of Technology (Poland) . . . . . [9718-47]

11:30 am: **3D differential phase contrast microscopy**, Michael Chen, Lei Tian, Laura Waller, Univ. of California, Berkeley (USA) . . . . . [9718-48]

11:50 am: **Wavelength shifting interferometry in digital holographic microscopy**, Shichao Chen, Virginia Tech Ctr. for Photonics Technology (USA); Yizheng Zhu, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9718-49]

Lunch Break . . . . . Tue 12:10 pm to 1:40 pm

#### SESSION 7

LOCATION: ROOM 2020 (WEST LEVEL 2) . . . TUE 1:40 PM TO 5:10 PM

### QPI of Cells and Tissues II

Session Chair: **Gabriel Popescu**,  
Univ. of Illinois at Urbana-Champaign (USA)

1:40 pm: **Quantitative phase imaging of biological cells and tissues using single-shot white light interference microscopy and phase subtraction method for extended range of measurement**, Dalip Singh Mehta, Anuradha Sharma, Vishesh Dubey, Veena Singh, Azeem Ahmad, Indian Institute of Technology Delhi (India) . . . . . [9718-51]

2:00 pm: **Studying the relationship between redox and cell growth using quantitative phase imaging**, Shamira Sridharan, Matthew T. Leslie, Natalya Bapst, John Smith, H. Rex Gaskins, Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9718-52]

2:20 pm: **Label-free three dimensional reconstruction of biological samples**, Sherazade Aknoun, PHASICS S.A. (France); Pierre Bon, Institut d'Optique Graduate School (France); Julien Savatier, Serge Monneret, Institut Fresnel (France) and Aix-Marseille Univ. (France); Benoit F. Wattellier, PHASICS S.A. (France) . . . . . [9718-53]

2:40 pm: **Holographic microscopy for 3D tracking of bacteria**, Jay L. Nadeau, California Institute of Technology (USA) and McGill Univ. (Canada); Yong Bin Cho, California Institute of Technology (USA); Marwan El-Kholy, McGill Univ. (Canada); Manuel Bedrossian, Stephanie Rider, California Institute of Technology (USA); Christian A. Lindensmith, James K. Wallace, Jet Propulsion Lab. (USA) and California Institute of Technology (USA) . . . . . [9718-54]

3:00 pm: **Deciphering the internal complexity of living cells with quantitative phase microscopy: a multi-scale approach**, Cristina E. Martinez-Torres, Bastien Laperrousaz, Lotfi Berguiga, Elise Boyer-Provera, Ecole Normale Supérieure de Lyon (France); Juan Elezgaray, Institut European de Chimie et Biologie (France); Franck E. Nicolini, Ctr. Hospitalier Univ. de Lyon (France); Véronique Maguer-Satta, Institut de Recherche en Cancérologie de Lyon (France); Alain Arneodo, Françoise Argoul, Ecole Normale Supérieure de Lyon (France) . . . . . [9718-55]

Coffee Break . . . . . Tue 3:20 pm to 3:50 pm

3:50 pm: **3D measurements of live cells via digital holographic microscopy and terahertz spectroscopy**, Sean Norbury, Dorian Oser, Jun Yong Park, Alexander T. Khmaladze, Anna V. Sharikova, Univ. at Albany (USA) . . . [9718-56]

4:10 pm: **Multi-color phase imaging and sickle cell anemia**, Poorya Hosseini, Renjie Zhou, Zahid Yaqoob, Peter T. C. So, Massachusetts Institute of Technology (USA) . . . . . [9718-57]

4:30 pm: **Hilbert phase dynamometry (HPD) for real-time measurement of cell generated forces**, Shamira Sridharan, Yanfen Li, Basanta Bhaduri, Hassaan Majeed, Univ. of Illinois at Urbana-Champaign (USA); Paul Dupenloup, Alex Levine, Univ. of California, Los Angeles (USA); Kristopher A. Kilian, Gabriel Popescu, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9718-58]

4:50 pm: **Research of chromatin conformation in interphase nuclei using quantitative phase imaging**, Irina Vasilenko, Maimonides State Classical Academy (Russian Federation); Vladislav Metelin, Maimonides State Classical Academy (Russian Federation) and Russian Medical Academy of Postgraduate Education (Russian Federation); Aleksandr Kuznetsov, Pirogov Russian National Research Medical Univ. (Russian Federation); Vladimir K. Belyakov, West Trade LLC (Russian Federation) . . . . . [9718-59]

BIOS



# CONFERENCE 9718

**LOCATION: ROOM 2020 (WEST LEVEL 2)**

3:10 pm: **Confocal reflectance quantitative phase microscopy system for 3D refractive index mapping**, Vijay Raj Singh, SMART-Singapore MIT Alliance for Research & Technology (Singapore); Peter T. C. So, Massachusetts Institute of Technology (USA) . . . . . [9718-74]

Coffee Break . . . . .Wed 3:30 pm to 4:00 pm

## SESSION 10

**LOCATION: ROOM 2020 (WEST LEVEL 2) . WED 4:00 PM TO 5:00 PM**

### **QPI Material Applications**

Session Chair: **Pietro Ferraro**,  
Istituto di Scienze applicata e Sistemi Intelligenti (Italy)

4:00 pm: **Quantitative thermal phase imaging with a low-coherence illumination**, Jaeduck Jang, Taeho Shin, Changhoon Jung, Soohwan Sul, Samsung Advanced Institute of Technology (Korea, Republic of) . . . . . [9718-75]

4:20 pm: **Through-the-objective holographic surface plasmon resonance imaging for quantitative measurement of thin film thickness**, Biagio Mandracchia, Vito Pagliarulo, Melania Paturzo, Pietro Ferraro, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) . . . . . [9718-76]

4:40 pm: **Lorenz-Mie digital holographic microscopy on complex colloids and at extreme pressure conditions**, Filippo Saglimbeni, Silvio Bianchi, Roberto Di Leonardo, Sapienza Univ. di Roma (Italy); Miles J. Padgett, Graham Gibson, Univ. of Glasgow (United Kingdom); Richard W. Bowman, Queens' College (United Kingdom); Gaio Paradossi, Univ. degli Studi di Roma "Tor Vergata" (Italy) . . . . . [9718-77]



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# CONFERENCE 9719

LOCATION: ROOM 2009 (WEST LEVEL 2)

Saturday–Sunday 13–14 February 2016 • Proceedings of SPIE Vol. 9719

# Biophysics, Biology and Biophotonics: the Crossroads

BIOS

Conference Chairs: **Adam Wax**, Duke Univ. (USA); **Vadim Backman**, Northwestern Univ. (USA)

Program Committee: **Nada N. Boustany**, Rutgers, The State Univ. of New Jersey (USA); **Kishan Dholakia**, Univ. of St. Andrews (United Kingdom); **Jochen R. Guck**, Technische Univ. Dresden (Germany); **Elizabeth M. Hillman**, Columbia Univ. (USA); **Roger D. Kamm**, Massachusetts Institute of Technology (USA); **Miles J. Padgett**, Univ. of Glasgow (United Kingdom); **Igal Szeleifer**, Northwestern Univ. (USA); **Bruce J. Tromberg**, Beckman Laser Institute and Medical Clinic (USA); **David A. Weitz**, Harvard Univ. (USA)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 2009 (WEST LEVEL 2) . . . SAT 9:10 AM TO 12:00 PM

### Bioinspired Photonics and Novel Photonics Methods in Biology

Session Chair: **Adam Wax**, Duke Univ. (USA)

9:10 am: **Photo-induced binding studies on human serum albumin and protoporphyrins: ZnPIX and hemin**, Jie Hu, Ryan Allen, Lorenzo Brancalione, The Univ. of Texas at San Antonio (USA) . . . . . [9719-2]

9:30 am: **Biological inspiration in optics and photonics: harnessing nature's light manipulation strategies for multifunctional optical materials** (*Invited Paper*), Mathias Kolle, Joseph D. Sandt, Sara N. Nagelberg, Lauren D. Zarzar, Massachusetts Institute of Technology (USA); Moritz Kreysing, Max-Planck-Institut für molekulare Zellbiologie und Genetik (Germany); Peter Vukusic, Univ. of Exeter (United Kingdom) . . . . . [9719-3]

Coffee Break . . . . . Sat 10:00 am to 10:40 am

10:40 am: **Near-real time monitoring of live to dead bacterial cell ratios**, Fang Ou, Rachel Guo, Cushla McGoverin, The Univ. of Auckland (New Zealand) and The Dodd-Walls Ctr. for Photonic and Quantum Technologies (New Zealand); Simon Swift, The Univ. of Auckland (New Zealand); Frédérique Vanholsbeeck, The Univ. of Auckland (New Zealand) and The Dodd-Walls Ctr. for Photonic and Quantum Technologies (New Zealand) . . . . . [9719-4]

11:00 am: **Cherenkov imaging during volumetric modulated arc radiation therapy for real-time beam tracking and treatment response monitoring**, Jacqueline M. Andreozzi, Dartmouth College (USA); Rongxiao Zhang, Harvard Medical School (USA); David J. Gladstone, Lesley A. Jarvis, Dartmouth Hitchcock Medical Ctr. (USA); Brian W. Pogue, Dartmouth College (USA) . . . . . [9719-5]

11:20 am: **Optical trapping for optogenetics: otoliths manipulation**, Itia A. Favre-Bulle, Ethan Scott, Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia) . . . . . [9719-6]

11:40 am: **Phase sensitive signal analysis for bi-tapered optical fibers**, Amit Ben Harush Negari, Univ. of Dayton (USA); Daniel Jauregui Vazquez, Juan M. Sierra-Hernandez, Univ. of Dayton (USA) and Univ. de Guanajuato (Mexico); Diego F. Garcia Mina, Branden J. King, Ighodalo U. Idehenre, Peter E. Powers, Karolyn M. Hansen, Joseph W. Haus, Univ. of Dayton (USA) . . . [9719-7]

Lunch/Exhibition Break . . . . . Sat 12:00 pm to 1:30 pm

### SESSION 2

LOCATION: ROOM 2009 (WEST LEVEL 2) . . . SAT 1:30 PM TO 3:00 PM

### Macromolecular Crowding: A Crucial but Underappreciated Biological Phenomenon

Session Chair: **Vadim Backman**, Northwestern Univ. (USA)

1:30 pm: **Crowding, dynamics and transcription** (*Invited Paper*), Igal Szeleifer, Northwestern Univ. (USA) . . . . . [9719-8]

2:00 pm: **A macromolecular crowding study of RNA folding and activity: polymer pore size matters!**, Richard Börner, Erica Fiorini, Univ. Zürich (Switzerland); Bishnu Paudel, David Rueda, MRC Clinical Sciences Ctr. (United Kingdom); Roland K. O. Sigel, Univ. Zürich (Switzerland) . . . . . [9719-9]

2:20 pm: **Fluorescence based assessment of SDS induced hydrophobic collapse in globular proteins**, Manjunath Siddaramaiah, Venkata K. Makani, Kapaettu Satyamoorthy, Bola Sadashiva S. Rao, Gopalkrishna Bhat, Krishna Kishore Mahato, Manipal Univ. (India) . . . . . [9719-10]

2:40 pm: **The application of low angle light scattering to evaluate qualitatively and quantitatively the dynamics of formation of oligomers in heme protein sensors**, Luis G. Sabino, Wellinson G. Guimarães, Pedro M. Costa, Marta S. P. Carepo, Ana C. S. Gondim, Luiz G. F. Lopes, Eduardo H. S. Sousa, Univ. Federal do Ceará (Brazil) . . . . . [9719-11]

Coffee Break . . . . . Sat 3:00 pm to 3:30 pm

### SESSION 3

LOCATION: ROOM 2009 (WEST LEVEL 2) . . SAT 3:30 PM TO 5:00 PM

### Biological Principles of Optical Diagnostic and Therapeutic Technologies

Session Chair: **Elizabeth M. Hillman**, Columbia Univ. (USA)

3:30 pm: **Recovering refractive index correlation function from measurement of tissue scattering phase function** (*Invited Paper*), Jeremy D. Rogers, Univ. of Wisconsin-Madison (USA) . . . . . [9719-12]

4:00 pm: **Modelling refractive index changes due to molecular interactions**, Manoj M. Varma, Indian Institute of Science (India) . . . . . [9719-13]

4:20 pm: **The role of membrane dynamics in electrical and infrared neural stimulation**, Erick K. Moen, The Univ. of Southern California (USA); Hope T. Beier, Bennett L. Ibey, Air Force Research Lab. (USA); Andrea M. Armani, The Univ. of Southern California (USA) . . . . . [9719-14]

4:40 pm: **Cloud-based Monte Carlo modelling of BSSRDF for the rendering of human skin appearance**, Alexander Doronin, Holly E. Rushmeier, Yale Univ. (USA); Igor Meglinski, Alexander V. Bykov, Univ. of Oulu (Finland) . . . . [9719-15]

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

# CONFERENCE 9719

LOCATION: ROOM 2009 (WEST LEVEL 2)

## SUNDAY 14 FEBRUARY

### SESSION 4

LOCATION: ROOM 2009 (WEST LEVEL 2) SUN 8:00 AM TO 10:00 AM

#### Nanoscale Imaging of Living Cells

Session Chair: **Vadim Backman**, Northwestern Univ. (USA)

8:00 am: **New directions in light sheet imaging** (*Invited Paper*), Kishan Dholakia, Univ. of St. Andrews (United Kingdom) . . . . . [9719-16]

8:30 am: **Biomechanical cell analysis using quantitative phase imaging** (*Invited Paper*), Adam Wax, Han Sang Park, William J. Eldridge, Duke Univ. (USA) . . . . . [9719-17]

9:00 am: **Nanoscale characterization of vesicle adhesion by normalized total internal reflection fluorescence microscopy**, Marcelina Cardoso Dos Santos, Cyrille Vézzy, Rodolphe Jaffiol, Univ. de Technologie Troyes (France) . . . . . [9719-18]

9:20 am: **Novel optical approaches for label-free quantification of nano-cytotoxic effects**, Sarah Mues, Jan Antunovic, Steffi Ketelhut, Björn Kemper, Jürgen Schnekeburger, Westfälische Wilhelms-Univ. Münster (Germany) . . . . . [9719-19]

9:40 am: **2D light scattering label-free cytometry using light-sheet illumination**, Meiai Lin, Xuantao Su, Shandong Univ. (China) . . . . . [9719-20]

Coffee Break . . . . . Sun 10:00 am to 10:30 am

### SESSION 5

LOCATION: ROOM 2009 (WEST LEVEL 2) .SUN 10:30 AM TO 12:10 PM

#### Optical Methods to Study Cancer Microenvironment

Session Chair: **Nada N. Boustany**, Rutgers, The State Univ. of New Jersey (USA)

10:30 am: **Identifying quiescent cancer cell populations in heterogeneous samples with fluorescence lifetime imaging**, Tiffany Heaster, Vanderbilt Univ. (USA); Alex J. Walsh, Vanderbilt Univ. (USA) and Air Force Research Lab. (USA); Melissa C. Skala, Vanderbilt Univ. (USA) . . . . . [9719-21]

10:50 am: **ISOCT study of effects of enzymatic crosslinking of collagen in field carcinogenesis**, Graham Spicer, Scott T. Young, Ji Yi, Northwestern Univ. (USA); Lonnie D. Shea, Univ. of Michigan (USA); Vadim Backman, Northwestern Univ. (USA) . . . . . [9719-22]

11:10 am: **A model for oxygen-dependent backscattering spectroscopic contrast from single red blood cells**, Rongrong Liu, Ji Yi, Siyu Chen, Hao F. Zhang, Vadim Backman, Northwestern Univ. (USA) . . . . . [9719-23]

11:30 am: **Label-free in-vivo measurement of lymph flow velocity using Doppler optical coherence tomography**, Cedric Blatter, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA); Eelco F. J. Meijer, Massachusetts General Hospital (USA); Ahhyun S. Nam, Wellman Ctr. for Photomedicine (USA) and Massachusetts General Hospital (USA); Dennis Jones, Timothy P. Padera, Massachusetts General Hospital (USA); Benjamin J. Vakoc, Massachusetts General Hospital (USA) and Wellman Ctr. for Photomedicine (USA) . . . . . [9719-24]

11:50 am: **Elasticity-based identification of tumor margins using Brillouin spectroscopy**, Maria A. Troyanova-Wood, Zhaokai Meng, Andrew J. Traverso, Omar Yusufzai, Vladislav V. Yakovlev, Texas A&M Univ. (USA) . . . . . [9719-25]

### POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BiOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Study of reversible color change of elytron of *Aspidimorpha santaecrucis* beetle**, Ekata H. Ghate, Gauri R. Kulkarni, Savitribai Phule Pune Univ. (India) . . . . . [9719-26]

# CONFERENCE 9720

LOCATION: ROOM 2018 (WEST LEVEL 2)

Saturday–Sunday 13–14 February 2016  
Proceedings of SPIE Vol. 9720

# High-Speed Biomedical Imaging and Spectroscopy: Toward Big Data Instrumentation and Management

Conference Chairs: **Kevin K. Tsia**, The Univ. of Hong Kong (Hong Kong, China); **Keisuke Goda**, The Univ. of Tokyo (Japan)

Conference Co-Chairs: **Bahram Jalali**, Univ. of California, Los Angeles (USA); **Edmund Y. Lam**, The Univ. of Hong Kong (Hong Kong, China); **Kenneth Y. Wong**, The Univ. of Hong Kong (Hong Kong, China)

Program Committee: **Steven G. Adie**, Cornell Univ. (USA); **Mohammad Hossein Asghari**, Univ. of California, Los Angeles (USA); **Hongwei Chen**, Tsinghua Univ. (China); **Mark Foster**, Johns Hopkins Univ. (USA); **Yasuyuki Ozeki**, The Univ. of Tokyo (Japan); **Tomoyoshi Shimobaba**, Chiba Univ. (Japan); **Peter T. C. So**, Massachusetts Institute of Technology (USA); **Lei Tian**, Univ. of California, Berkeley (USA); **Chao Wang**, Univ. of Kent (United Kingdom); **Lihong V. Wang**, Washington Univ. in St. Louis (USA); **Zeev Zalevsky**, Bar-Ilan Univ. (Israel)

## SATURDAY 13 FEBRUARY

### SESSION 1

LOCATION: ROOM 2018 (WEST LEVEL 2) . . . SAT 8:00 AM TO 10:00 AM

#### Ultrafast Imaging

Session Chair: **Kevin K. Tsia**,

The Univ. of Hong Kong (Hong Kong, China)

8:00 am: **Compressed ultrafast photography at 100 billion frames per second** (*Invited Paper*), Liang S. Gao, Ricoh Innovations, Inc. (USA) . . . [9720-1]

8:30 am: **Multi-aperture ultra-high-speed imaging with lateral electric field charge modulators** (*Invited Paper*), Keiichiro Kagawa, Futa Mochizuki, Min-Woong Seo, Keita Yasutomi, Shoji Kawahito, Shizuoka Univ. (Japan) . . . [9720-2]

9:00 am: **Pixel super-resolution of time-stretch imaging by an equivalent-time sampling concept**, Antony C. S. Chan, Edmund Y. Lam, Kevin K. Tsia, The Univ. of Hong Kong (Hong Kong, China) . . . [9720-3]

9:20 am: **High speed imaging of physiology in freely moving mice with short-wavelength infrared (SWIR) quantum dots**, Oliver T. Bruns, Thomas S. Bruns, Mounqi G. Bawendi, Massachusetts Institute of Technology (USA) . . . [9720-4]

9:40 am: **Scan-less, line-field confocal microscopy by combination of wavelength/space conversion with dual optical comb**, Takeshi Yasui, Eiji Hase, Shuji Miyamoto, Yi-Da Hsieh, Takeo Minamikawa, The Univ. of Tokushima (Japan); Hirotsugu Yamamoto, Utsunomiya Univ. (Japan) . . . [9720-5]

Coffee Break . . . Sat 10:00 am to 10:30 am

### SESSION 2

LOCATION: ROOM 2018 (WEST LEVEL 2) . . . SAT 10:30 AM TO 12:00 PM

#### Computational Imaging

Session Chair: **Mark A. Foster**, Johns Hopkins Univ. (USA)

10:30 am: **Parallel phase-shifting digital holography and its application to high-speed 3D imaging of dynamic object** (*Invited Paper*), Yasuhiro Awatsuki, Peng Xia, Yexin Wang, Kyoto Institute of Technology (Japan); Osamu Matoba, Kobe Univ. (Japan) . . . [9720-6]

11:00 am: **A mask-aided shrinkage/thresholding (MAST) algorithm to improve reconstructed image quality in compressed ultrafast photography**, Yujia Chen, Liren Zhu, Jinyang Liang, Liang S. Gao, Cheng Ma, Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . [9720-7]

11:20 am: **Three-wavelength digital holography using spatial frequency-division multiplexing and dual reference arms**, Tatsuki Tahara, Shingo Takeshita, Kenta Morimoto, Toru Kaku, Yasuhiko Arai, Kansai Univ. (Japan) . . . [9720-8]

11:40 am: **4D phase-space multiplexing acquisitions for fluorescent light source**, Hsiou-Yuan Liu, Jingshan Zhong, Laura Waller, Univ. of California, Berkeley (USA) . . . [9720-9]

Lunch/Exhibition Break . . . Sat 12:00 pm to 1:30 pm

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### SESSION 3

LOCATION: ROOM 2018 (WEST LEVEL 2) . . . SAT 1:30 PM TO 3:00 PM

#### Big Data Instrumentation and Management

Session Chair: **Yasuyuki Ozeki**, The Univ. of Tokyo (Japan)

1:30 pm: **3D imaging through scattering with light field datasets** (*Invited Paper*), Laura Waller, Univ. of California, Berkeley (USA) . . . [9720-10]

2:00 pm: **Gigapixel imaging with microlens arrays**, Antony Orth, RMIT Univ. (Australia); Ethan F. Schonbrun, The Rowland Institute at Harvard (USA) . . . [9720-11]

2:20 pm: **All-IP-Ethernet architecture for real-time sensor-fusion processing**, Kei Hiraki, Mary Inaba, Hiroshi Tezuka, Hisanobu Tomari, Kenichi Koizumi, Shuya Kondo, The Univ. of Tokyo (Japan) . . . [9720-12]

2:40 pm: **A computational approach to real-time image processing for serial time-encoded amplified microscopy**, Minoru Oikawa, Daisuke Hiayama, Ryuji Hirayama, Satoki Hasegawa, Yutaka Endo, Takahisa Sugie, Norimichi Tsumura, Mai Kuroshima, Masanori Maki, Genki Okada, Chiba Univ. (Japan); Cheng Lei, Yasuyuki Ozeki, Keisuke Goda, The Univ. of Tokyo (Japan); Tomoyoshi Shimobaba, Chiba Univ. (Japan) . . . [9720-13]

Coffee Break . . . Sat 3:00 pm to 3:30 pm

### SESSION 4

LOCATION: ROOM 2018 (WEST LEVEL 2) . . . SAT 3:30 PM TO 5:50 PM

#### High-Speed Nonlinear Imaging

Session Chair: **Hideharu Mikami**, The Univ. of Tokyo (Japan)

3:30 pm: **Mapping biological tissues with hyperspectral coherent Raman scattering microscopy** (*Invited Paper*), Eric O. Potma, Alba Alfonso Garcia, Univ. of California, Irvine (USA) . . . [9720-14]

4:00 pm: **Instrumentation and data management for high-speed spectroscopic coherent Raman imaging** (*Invited Paper*), Marcus T. Cicerone, Charles H. Camp Jr., Young J. Lee, Peter Bajcsy, Petru S. Manescu, National Institute of Standards and Technology (USA) . . . [9720-15]

4:30 pm: **Label-free chemical imaging of live euglena gracilis by high-speed stimulated Raman scattering spectral microscopy**, Yoshifumi Wakisaka, Yuta Suzuki, Kyoya Tokunaga, The Univ. of Tokyo (Japan); Misa Hirose, Ryota Domon, Rina Akaho, Mai Kuroshima, Norimichi Tsumura, Tomoyoshi Shimobaba, Chiba Univ. (Japan); Osamu Iwata, Kengo Suzuki, Ayaka Nakashima, euglena Co., Ltd. (Japan); Keisuke Goda, The Univ. of Tokyo (Japan) and Univ. of California (USA) and Japan Science and Technology Agency (Japan); Yasuyuki Ozeki, The Univ. of Tokyo (Japan) . . . [9720-16]

4:50 pm: **High-throughput light-sheet Raman microscope based on full field Fourier transform spectrometry**, Dushan N. Wadduwage, Vijay R. Singh, SMART-Singapore MIT Alliance for Research & Technology (Singapore); Paul T. Matsudaira, National Univ. of Singapore (Singapore); Peter T. C. So, Massachusetts Institute of Technology (USA) . . . [9720-17]

# CONFERENCE 9720

LOCATION: ROOM 2018 (WEST LEVEL 2)

5:10 pm: **A CMOS image sensor using high-speed lock-in pixels for stimulated Raman scattering spectroscopy**, De Xing Lioe, Kamel Mars, Taishi Takasawa, Keita Yasutomi, Keiichiro Kagawa, Shizuoka Univ. (Japan); Mamoru Hashimoto, Osaka Univ. (Japan); Shoji Kawahito, Shizuoka Univ. (Japan) . . . . . [9720-18]

5:30 pm: **Fast wide-field Raman imaging system based on and multi-channel detection and Wiener estimation**, Dong Wei, Shuo Chen, Yi Hong Ong, Quan Liu, Nanyang Technological Univ. (Singapore) . . . . . [9720-50]

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM

LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

## SUNDAY 14 FEBRUARY

### SESSION 5

LOCATION: ROOM 2018 (WEST LEVEL 2) . SUN 8:00 AM TO 10:00 AM

#### 4D Imaging

Session Chair: **Steven G. Adie**, Cornell Univ. (USA)

8:00 am: **Optical coherence imaging instrumentation as big data generators** (*Invited Paper*), Stephen A. Boppart, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9720-19]

8:30 am: **4D megahertz optical coherence tomography: imaging and live display beyond 1 gigavoxel/sec** (*Invited Paper*), Robert A. Huber, Univ. zu Lübeck (Germany); Wolfgang Draxinger, Wolfgang Wieser, Ludwig-Maximilians-Univ. München (Germany) and Optores GmbH (Germany); Jan Philip Kolb, Univ. zu Lübeck (Germany); Tom Pfeiffer, Univ. zu Lübeck (Germany); Sebastian N. Karpf, Ludwig-Maximilians-Univ. München (Germany); Matthias Eibl, Univ. zu Lübeck (Germany); Thomas Klein, Optores GmbH (Germany) . . . . . [9720-20]

9:00 am: **Fiber-Bragg-grating-array MHz range optical coherence tomography**, Roman V. Kuranov, Joseph Price, Nishant Mohan, Vincente Valdez, Jeffrey Soohoo, Michael Sullivan, Wasatch Photonics, Inc. (USA) . . . . . [9720-21]

9:20 am: **GPU-based computational adaptive optics for volumetric optical coherence microscopy**, Han Tang, Jeffrey A. Mulligan, Gavielle R. Untracht, Xihao Zhang, Steven G. Adie, Cornell Univ. (USA) . . . . . [9720-22]

9:40 am: **Selective-plane illumination microscopy for high-content volumetric biological imaging**, Ryan McGorty, Univ. of San Diego (USA); Bo Huang, Univ. of California, San Francisco (USA) . . . . . [9720-23]

Coffee Break . . . . . Sun 10:00 am to 10:30 am

### SESSION 6

LOCATION: ROOM 2018 (WEST LEVEL 2) . SUN 10:30 AM TO 12:00 PM

#### Light-Sheet Microscopy

Session Chair: **Kenneth K. Wong**, The Univ. of Hong Kong (Hong Kong, China)

10:30 am: **High-speed light sheet imaging of in-vivo brain function with scape microscopy** (*Invited Paper*), Elizabeth M. Hillman, Columbia Univ. (USA) . . . . . [9720-24]

11:00 am: **Whole-animal imaging with high spatio-temporal resolution** (*Invited Paper*), Philipp Keller, Howard Hughes Medical Institute (USA) . [9720-25]

11:30 am: **Towards organisms-level systems biology** (*Invited Paper*), Hiroki R. Ueda, The Univ. of Tokyo (Japan) . . . . . [9720-26]

Lunch/Exhibition Break . . . . . Sun 12:00 pm to 1:30 pm

### SESSION 7

LOCATION: ROOM 2018 (WEST LEVEL 2) . . . SUN 1:30 PM TO 3:00 PM

#### Instrumentation for High-Speed Imaging and Spectroscopy

Session Chair: **Cheng Lei**, The Univ. of Tokyo (Japan)

1:30 pm: **Enhanced speed in fluorescence imaging using beat frequency multiplexing** (*Invited Paper*), Hirofumi Kobayashi, Hideharu Mikami, The Univ. of Tokyo (Japan); Yisen Wang, The Univ. of Tokyo (Japan) and Tianjin Univ. (China); Syed Hamad, Yasuyuki Ozeki, The Univ. of Tokyo (Japan); Keisuke Goda, The Univ. of Tokyo (Japan) and Univ. of California, Los Angeles (USA) . . . . . [9720-27]

2:00 pm: **A light sheet confocal microscope for image cytometry with a variable linear slit detector**, Joshua A. Hutcheson, Foysal Z. Khan, Amy J. Powless, Devin Benson, Courtney J. Hunter, Ingrid Fritsch, Timothy J. Muldoon, Univ. of Arkansas (USA) . . . . . [9720-28]

2:20 pm: **High-speed, high-sensitivity infrared spectroscopy using mid-infrared swept lasers**, David T. D. Childs, Kristian M. Groom, Richard A. Hogg, Dmitry G. Revin, John W. Cockburn, Ihtesham U. Rehman, Stephen J. Matcher, The Univ. of Sheffield (United Kingdom) . . . . . [9720-29]

2:40 pm: **Ultra-wideband fiber optical parametric amplifier for spectrally-encoded microscopy**, Xiaoming Wei, The Univ. of Hong Kong (Hong Kong, China); Sisi Tan, The Univ. of Hong Kong (China); Arnaud Mussot, Alexandre Kudlinski, Lab. de Physique des Lasers, Atomes et Molécules, Univ. des Sciences et Technologies de Lille (France); Kevin K. Tsia, Kenneth K. Wong, The Univ. of Hong Kong (China) . . . . . [9720-30]

Coffee Break . . . . . Sun 3:00 pm to 3:30 pm

### SESSION 8

LOCATION: ROOM 2018 (WEST LEVEL 2) . . . .SUN 3:30 PM TO 5:10 PM

#### Imaging Flow Cytometry

Session Chair: **Keisuke Goda**, The Univ. of Tokyo (Japan)

3:30 pm: **High-throughput time-stretch microscopy with morphological and chemical specificity**, Cheng Lei, Masashi Ugawa, Taisuke Nozawa, Takuro Ideguchi, The Univ. of Tokyo (Japan); Dino Di Carlo, Univ. of California, Los Angeles (USA); Sadao Ota, Yasuyuki Ozeki, Keisuke Goda, The Univ. of Tokyo (Japan) . . . . . [9720-31]

3:50 pm: **Compressive high speed flow microscopy with motion contrast**, Bryan Bosworth, Jasper R. Stroud, Dung N. Tran, Trac D. Tran, Johns Hopkins Univ. (USA); Sang Chin, Johns Hopkins Univ. (USA) and Boston Univ. (USA) and Draper Lab. (USA); Mark A. Foster, Johns Hopkins Univ. (USA) . . . . . [9720-32]

4:10 pm: **Quantitative asymmetric-detection time-stretch optical microscopy (Q-ATOM) for ultrafast quantitative phase imaging flow cytometry**, Andy K. S. Lau, Anson H. L. Tang, Bob M. F. Chung, Kwok Yeung Tsang, Antony C. S. Chan, Xiaoming Wei, Kenneth K. Wong, Edmund Y. Lam, Kathryn S. E. Cheah, Anderson H. C. Shum, Kevin K. Tsia, The Univ. of Hong Kong (Hong Kong, China) . . . . . [9720-33]

4:30 pm: **Imaging cells in flow cytometer using spatial-temporal transformation**, Yuanyuan Han, Yu-Hwa Lo, Univ. of California, San Diego (USA) . . . . . [9720-34]

4:50 pm: **Ultrafast quantitative time-stretch imaging flow cytometry of phytoplankton**, Queenie T. K. Lai, Andy K. S. Lau, Anson H. L. Tang, Kenneth K. Wong, Kevin K. Tsia, The Univ. of Hong Kong (Hong Kong, China) . . [9720-35]



**POSTERS-SUNDAY**

**LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM**

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**A programmable Raman spectroscopic imaging technique**, Shuo Chen, Quan Liu, Nanyang Technological Univ. (Singapore) . . . . . [9720-36]

**Analysis of bandwidth limitation in time-stretch compressive sampling imaging system**, Hongwei Chen, Zhiliang Weng, Qiang Guo, Minghua Chen, Sigang Yang, Shizhong Xie, Tsinghua Univ. (China) . . . . . [9720-37]

**A study on the characteristics of the analog mean-delay (AMD) method for high-speed fluorescence lifetime imaging microscopy (FLIM)**, Byungyeon Kim, Byungjun Park, Seungrak Lee, Youngjae Won, Osong Medical Innovation Foundation (Korea, Republic of) . . . . . [9720-38]

**Novel bi-exponential deconvolution for real-time fluorescence lifetime imaging data processing**, Rodrigo Cuenca Martinez, Javier A. Jo, Kristen C. Maitland, Shuna Cheng, Joey M. Jabbour, Bilal H. Malik, Texas A&M Univ. (USA) . . . . . [9720-39]

**Multispectral spatial frequency domain imaging for quantitative and accurate separation of absorption and scattering by utilizing analytical solutions of the RTE**, Steffen Nothelfer, Nico Bodenschatz, Philipp Krauter, Florian Foschum, André Liemert, Alwin Kienle, Institut für Lasertechnologien in der Medizin und Messtechnik (Germany) . . . . . [9720-40]

**Acquiring a two-dimensional cross-sectional image in two nanoseconds**, Nanguang Chen, Zaineb A. T. Al-Qazwini, Kalpesh Mehta, National Univ. of Singapore (Singapore) . . . . . [9720-41]

**Entropy analysis of OCT signal for automatic tissue characterization**, Yahui Wang, New Jersey Institute of Technology (USA); Basil Hubbi, New Jersey Medical School, Rutgers, The State Univ. of New Jersey (USA); Kevin D. Belfield, Xuan Liu, New Jersey Institute of Technology (USA) . . . . . [9720-42]

**Development of an intravital multi-plane multiphoton microscopy platform for functional cellular imaging in living mice**, Erik Bélanger, Feng Wang, Ctr. de Recherche de l'Institut Univ. en Santé Mentale de Québec (Canada); Sylvain Côté, Daniel C. Côté, Yves De Koninck, Pierre Marquet, Ctr. de Recherche de l'Institut Univ. en Santé Mentale de Québec (Canada) . . . . . [9720-43]

**Fluorescent Talbot microscopy using incoherent illumination**, Yangyang Sun, Shuo Pang, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9720-45]

**Continuous high-speed compressed sensing OCT**, Jasper R. Stroud, Bryan Bosworth, Dung N. Tran, Sang Chin, Trac D. Tran, Mark A. Foster, Johns Hopkins Univ. (USA) . . . . . [9720-46]

**Scanless, full-field confocal microscopy by combination of wavelength/1D-space conversion with line-imaging configuration**, Shuji Miyamoto, Eiji Hase, Ryuji Ichikawa, Takeo Mnamikawa, Takeshi Yasui, The Univ. of Tokushima (Japan); Hirotsugu Yamamoto, Utsunomiya Univ. (Japan) . . . . . [9720-47]

**Wide-band and fast wavelength-swept optical parametric oscillator with a photonic crystal fiber based on dispersion tuning technology at 1  $\mu$ m**, Jin Chen, Sigang Yang, Hongwei Chen, Minghua Chen, Shizhong Xie, Tsinghua Univ. (China) . . . . . [9720-48]

**Rapid spontaneous Raman light sheet microscopy using cw-lasers and tunable filters**, Israel Rocha, Ctr. de Investigación Científica y de Educación Superior de Ensenada B.C. (Mexico); Jacob Licea-Rodríguez, Omar E. Olarte, Mónica Marro Sánchez, Pablo Loza-Alvarez, ICFO-Institut de Ciències Fotòniques (Spain) . . . . . [9720-49]

**In vivo particle image velocimetry of blood cell flow using high-speed laser scanning confocal microscopy**, Richard M. Boutilier, Sung-hoon Bae, Yoon-joon Ahn, Sang-hoon Choi, Ho Lee, Yong-joong Lee, Kyungpook National Univ. (Korea, Republic of) . . . . . [9720-65]

**The High-Speed Biomedical Imaging and Spectroscopy Conference**  
**Best Paper Awards**

We are pleased to announce that Hamamatsu, PiPhotonics, and Hitachi High-Tech will sponsor six Best Paper Awards for this Conference, with a total cash prize of \$3000: two Hamamatsu Best Paper Awards (\$500 each), two PiPhotonics Best Paper Awards (\$500 each), and two Hitachi High-Tech Best Paper Awards (\$500 each). Participants must be both the primary author and presenter of an accepted abstract to be eligible. Qualifying papers and presentations will be evaluated by the awards committee. The winners will be notified at the end of, or after, the meeting.

AWARD SPONSORS:



# CONFERENCE 9721

LOCATION: ROOM 3000 (WEST LEVEL 3)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9721

# Nanoscale Imaging, Sensing, and Actuation for Biomedical Applications XIII

Conference Chairs: **Alexander N. Cartwright**, Univ. at Buffalo (USA); **Dan V. Nicolau**, McGill Univ. (Canada)

Conference Co-Chair: **Dror Fixler**, Bar-Ilan Univ. (Israel)

Program Committee: **Lorena Betancor**, Univ. ORT Uruguay (Uruguay); **Stefan Diez**, Technical Univ. Dresden (Germany); **Henry Hess**, Columbia Univ. (USA); **Sung Jin Kim**, Univ. of Miami (USA); **Armagan Kocer**, Academisch Ziekenhuis Groningen (Netherlands); **Abraham Lee**, Univ. of California, Irvine (USA); **Heiner Linke**, Lund Univ. (Sweden); **Brian D. MacCraith**, Dublin City Univ. (Ireland); **Alf Mansson**, Linnaeus Univ. (Sweden); **Paras N. Prasad**, Univ. at Buffalo (USA); **Frantisek Stepanek**, Institute of Chemical Technology, Prague (Czech Republic); **Henrique Toma**, Univ. de São Paulo (Brazil); **Sharon M. Weiss**, Vanderbilt Univ. (USA)

## MONDAY 15 FEBRUARY

### POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

Conference attendees are invited to attend the BiOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Simulation of enhanced intensity and area of plasmon field using trapezoidal nanowire structure**, Tae Young Kang, Pusan National Univ. (Korea, Republic of) . . . . . [9721-32]

**Experimental system of the full scattering profile of circular phantoms**, Idit Feder, Hamootal Duadi, Dror Fixler, Bar-Ilan Univ. (Israel) . . . . . [9721-33]

**Quantification of gold nanoparticles in tissue simulating media using spatial frequency domain imaging**, Adamo F. G. Monte, Maaikie K. Pronda, Rolf B. Saager, Anthony J. Durkin, Beckman Laser Institute and Medical Clinic (USA) . . . . . [9721-34]

**Conjugated polymer based nanoparticles with enhanced NIR CL for biomedical imaging of hydrogen peroxide**, Young Hun Seo, Korea Institute of Science and Technology (Korea, Republic of); Woo-Dong Jang, Yonsei Univ. (Korea, Republic of); Sehoon Kim, Korea Institute of Science and Technology (Korea, Republic of) . . . . . [9721-35]

## TUESDAY 16 FEBRUARY

### Nano/Biophotonics Plenary Session

TUE 10:30 AM TO 11:30 AM

LOCATION: ROOM 3002 (WEST LEVEL 3)

### Welcome and Introduction

Dan Nicolau, McGill Univ. (Canada)

### Light moves life

**Halina Rubinsztein-Dunlop**, Univ. of Queensland (Australia)

Light can be made to do the work. Imagine tweezers made out of light. Such optical tweezers can trap and move materials noninvasively at length scales ranging from tens of nanometers to tens of micrometers, and so have provided unprecedented access to physical, chemical and biological processes on a microscale. Since a light beam can carry angular momentum it is possible to use optical tweezers to exert torques to twist or rotate nano and microscopic objects. These optical rotors can be used to map the mechanical properties of cells. They can also be used in biotechnology and optomechanics.

Professor Rubinsztein-Dunlop is a Director of the Quantum Science Laboratory in the School of Mathematics and Physics at the University of Queensland. She obtained her PhD degree at the University of Gothenburg in Sweden. Halina's research interests are in quantum atom optics, laser micromanipulation, laser physics, linear and nonlinear high resolution spectroscopy, and nano-optics.

Lunch Break . . . . . Tue 11:30 am to 1:30 pm

### SESSION 1

LOCATION: ROOM 3000 (WEST LEVEL 3) . . . TUE 1:30 PM TO 5:50 PM

### Biosensing Nano-structures/Particles I

Session Chair: **Dan V. Nicolau**, McGill Univ. (Canada)

1:30 pm: **Innovative nanostructures for highly sensitive vibrational biosensing** (*Invited Paper*), Juergen Popp, Leibniz-Institut für Photonische Technologien e.V. (Germany) and Friedrich-Schiller-Univ. Jena (Germany); Thomas Mayerhöfer, Leibniz-Institut für Photonische Technologien e.V. (Germany); Dana Cialla-May, Karina Weber, Leibniz-Institut für Photonische Technologien e.V. (Germany) and Friedrich-Schiller-Univ. Jena (Germany); Uwe Hübner, Leibniz-Institut für Photonische Technologien e.V. (Germany) . [9721-1]

2:00 pm: **Highly sensitive protein detection using a plasmonic field effect transistor** (*Invited Paper*), Hossein Shokri-Kojori, Yiwen Ji, Xu Han, Younghun Paik, Adam Braunschweig, Sung Jin Kim, Univ. of Miami (USA) . . . . . [9721-2]

2:30 pm: **Engineering molecularly-active plasmonic surfaces for disease detection via colorimetry and Raman scattering**, Alasdair W. Clark, Esmaeil Heydari, Jonathan M. Cooper, Univ. of Glasgow (United Kingdom) . . . . . [9721-3]

2:50 pm: **Extremely sensitive dual imaging system in solid phantoms**, Eran Barnoy, Dror Fixler, Rachela Popovtzer, Tsviya Nayhoz, Bar-Ilan Univ. (Israel); Krishanu Ray, Univ. of Maryland School of Medicine (USA) . . . . . [9721-4]

3:10 pm: **Plasmonic nanohole-based sub-diffraction-limited fluorescence microscopy for imaging of gliding biomolecules**, Wonju Lee, Youngjin Oh, Yonsei Univ. (Korea, Republic of); Kyujung Kim, Pusan National Univ. (Korea, Republic of); Yoshiaki Kinoshita, Nagisa Mikami, Takayuki Nishizaka, Gakushuin Univ. (Japan); Donghyun Kim, Yonsei Univ. (Korea, Republic of) . . . . . [9721-5]

Coffee Break . . . . . Tue 3:30 pm to 4:00 pm

4:00 pm: **Spectrometer sensor using patterned nano-structure plasmon resonance grating** (*Invited Paper*), Hong Guo, Xueli Tian, Junpeng Guo, The Univ. of Alabama in Huntsville (USA) . . . . . [9721-6]

4:30 pm: **Array of reconfigurable diffractive lens on flexible substrate**, Mohammad J. Moghimi, Hongrui Jiang, Univ. of Wisconsin-Madison (USA) . . . . . [9721-7]

4:50 pm: **Surface plasmon enhanced cell microscopy with blocked random spatial activation**, Taehwang Son, Youngjin Oh, Wonju Lee, Heejin Yang, Donghyun Kim, Yonsei Univ. (Korea, Republic of) . . . . . [9721-8]

5:10 pm: **An optical sensing approach for the noninvasive transdermal monitoring of cortisol**, Yongsoon Hwang, Niraj K. Gupta, Yagya R. Ojha, Brent D. Cameron, The Univ. of Toledo (USA) . . . . . [9721-9]

5:30 pm: **A force sensor using nanowire arrays to understand bacterial cell motility and biofilm formation**, Prasana K. Sahoo, Univ. Estadual de Campinas (Brazil); Alessandro Cavalli, Technische Univ. Eindhoven (Netherlands); Vitor B. Pelegati, Duher M. Murillo, Univ. Estadual de Campinas (Brazil); Alessandra A. de Souza, Instituto Agronômico de Campinas (Brazil); Carlos L. César, Univ. Estadual de Campinas (Brazil); Erik P. A. M. Bakkers, Technische Univ. Eindhoven (Netherlands); Monica A. Cotta, Univ. Estadual de Campinas (Brazil) . . . . . [9721-10]

11:30 am: **Fundamental limits of super-resolution microscopy by dielectric microspheres and microfibers**, Vasily N. Astratov, The Univ. of North Carolina at Charlotte (USA); Alexey V. Maslov, N.I. Lobachevsky State Univ. of Nizhni Novgorod (Russian Federation); Kenneth W. Allen, Navid Farahi, Yangcheng Li, Aaron M. Brettn, The Univ. of North Carolina at Charlotte (USA); Nicholas I. Limberopoulos, Dennis E. Walker Jr., Augustine M. Urbas, Air Force Research Lab. (USA); Vladimir Liberman, Mordechai Rothschild, MIT Lincoln Lab. (USA) . . . . . [9721-13]

11:50 am: **Broadband energy-entangled photon for high resolution temporal sensing**, André Stefanov, Stefan Lerch, Manuel Unternährer, Univ. Bern (Switzerland); Jos Kohn, Univ. Bern (Switzerland) and Univ. de Fribourg (Switzerland) . . . . . [9721-14]

Lunch Break . . . . . Wed 12:10 pm to 1:20 pm

### SESSION 4

LOCATION: ROOM 2006 (WEST LEVEL 2) . . WED 1:20 PM TO 5:50 PM

## Nanoscale Imaging and Spectroscopy II

Session Chair: **Alexander N. Cartwright**, Univ. at Buffalo (USA)

1:20 pm: **Water nanodroplets on micro/nano-arrays: visualization by AFM and simulation**, Ondrej Kaspar, McGill Univ. (Canada); Hailong Zhang, Monash Univ. (Australia); Viola Tokarova, McGill Univ. (Canada); Reinhard I. Boysen, Milton T. W. Hearn, Monash Univ. (Australia); Dan V. Nicolau, McGill Univ. (Canada) . . . . . [9721-15]

1:40 pm: **Near infrared hyperspectral microscopy of carbon nanotube photoluminescence enables 17-color imaging**, Daniel A. Heller, Memorial Sloan-Kettering Cancer Ctr. (USA) and Weill Cornell Medical College (USA); Daniel Roxbury, Prakrit V. Jena, Ryan M. Williams, Balázs Enyedi, Philipp Niethammer, Memorial Sloan-Kettering Cancer Ctr. (USA); Stéphane Marcet, Francesca Mangiarini, Marc Verhaegen, Sébastien Blais-Ouellette, Photon etc. Inc. (Canada) . . . . . [9721-16]

2:00 pm: **Cross slit-grooves grid structure for surface plasmon resonant sensor**, Joo ho Lee, Bikash Nakarmi, Bong Ho Kim, Wonjae Jang, Yong Hyub Won, KAIST (Korea, Republic of) . . . . . [9721-17]

2:20 pm: **Detection of organic nanoparticles within tissues using optical iterative method**, Inbar Yariv, Dror Fixler, Rachel Lubart, Hamootal Duadi, Anat Lipovsky, Bar-Ilan Univ. (Israel) . . . . . [9721-18]

2:40 pm: **New confocal microscopy hyperspectral imager for NIR-emitting bioprobes: high spectral resolution for a wide spectral range**, Stéphane Marcet, Photon etc. Inc. (Canada); Antonio Benayas, Marta Quintanilla, Institut National de la Recherche Scientifique (Canada); Francesca Mangiarini, Marc Verhaegen, Photon etc. Inc. (Canada); Fiorenzo Vetrone, Institut National de la Recherche Scientifique (Canada); Sébastien Blais-Ouellette, Photon etc. Inc. (Canada) . . . . . [9721-19]

3:00 pm: **Non-radiative excitation fluorescence microscopy**, Lina Riachy, Cyrille Vézy, Rodolphe Jaffiol, Univ. de Technologie Troyes (France) . . [9721-20]

Coffee Break . . . . . Wed 3:20 pm to 3:50 pm

3:50 pm: **Non-contact optical sensor for detection of glucose concentration using a magneto-optic effect**, Nisan Ozana, Yevgeny Beiderman, Bar-Ilan Univ. (Israel); Arun Anand, The Maharaja Sayajirao Univ. of Baroda (India); Baharam Javidi, Univ. of Connecticut (USA); Javier Garcia-Monreal, Univ. de València (Spain); Zeev Zalevsky, Bar-Ilan Univ. (Israel) . . . . . [9721-21]

4:10 pm: **A novel method for sensing metastatic cells in the CSF of pediatric population with medulloblastoma by frequency domain FLIM system**, Gilad Yahav, Dror Fixler, Sivan Gershanov, Helen Toledano, Shalom Michowiz, Nitzza Goldenberg-Cohen, Bar-Ilan Univ. (Israel) . . . . . [9721-22]

4:30 pm: **Seeing the unseen with localized optical contrast**, Swathi Suran, Krishna Bharadwaj, Srinivasan Raghavan, Manoj M. Varma, Indian Institute of Science (India) . . . . . [9721-23]

4:50 pm: **Temporally flickering nanoparticles for compound cellular imaging and super resolution**, Tali Ilovitsh, Yossef Danan, Rinat Meir, Bar-Ilan Univ. (Israel); Amihai Meiri, The Univ. of Utah (USA); Zeev Zalevsky, Bar-Ilan Univ. (Israel) . . . . . [9721-24]

5:10 pm: **Optimization of imaging parameters for high sensitivity detection of skin cancer at the THz**, Michael Ney, Ibrahim Abdulhalim, Ben-Gurion Univ. of the Negev (Israel) . . . . . [9721-25]

5:30 pm: **Characterizing single molecule dynamics on surfaces**, Siheng He, Megan Armstrong, Corina Curschellas, Henry Hess, Columbia Univ. (USA) . . . . . [9721-26]

## WEDNESDAY 17 FEBRUARY

### SESSION 2

LOCATION: ROOM 2006 (WEST LEVEL 2) WED 8:20 AM TO 10:00 AM

#### NOTE ROOM CHANGE

## Biosensing Nano-structures/Particles II

Session Chair: **Dror Fixler**, Bar-Ilan Univ. (Israel)

8:20 am: **Live cell Raman imaging using subcellular organelle-targeting SERS-sensitive gold nanoparticles**, Jeon Woong Kang, Massachusetts Institute of Technology (USA); Dong-Kwon Lim, Korea Univ. (Korea, Republic of); Ramachandra R. Dasari, Peter T. C. So, Massachusetts Institute of Technology (USA) . . . . . [9721-27]

8:40 am: **Direct measurement of nanoparticle interactions using near-field photonics**, Perry Schein, Dakota O'Dell, David Erickson, Cornell Univ. (USA) . . . . . [9721-28]

9:00 am: **Gold nanoparticle based imaging technique and drug delivery for the detection and treatment of atherosclerotic vascular disease**, Rinat Ankri, Bar-Ilan Univ. (Israel); Dorit Leshem-Lev, Eli Lev, Rabin Medical Ctr. (Israel); Menachem Motiel, Bar-Ilan Univ. (Israel); Edith Hochhauser, Felsenstein Medical Research Ctr. (Israel); Dror Fixler, Bar-Ilan Univ. (Israel) . . . . . [9721-29]

9:20 am: **Geminal cross-coupling of 1,1-dibromoolefins facilitating multiple topological  $\pi$ -conjugated tetraarylethenes for optical sensing**, Ming-Qiang Zhu, Tao Chen, Ze-Qiang Chen, Huazhong Univ. of Science and Technology (China) . . . . . [9721-30]

9:40 am: **Optoelectronic investigation of nanodiamond interactions with human blood**, Mateusz Ficek, Maciej S. Wróbel, Gdansk Univ. of Technology (Poland); Michal Wasowicz, Warsaw Univ. of Life Sciences (Poland); Malgorzata Jedrzejewska-Szczerska, Gdansk Univ. of Technology (Poland) . . . . . [9721-31]

Coffee Break . . . . . Wed 10:00 am to 10:30 am

### SESSION 3

LOCATION: ROOM 2006 (WEST LEVEL 2) WED 10:30 AM TO 12:10 PM

## Nanoscale Imaging and Spectroscopy I

Session Chair: **Dror Fixler**, Bar-Ilan Univ. (Israel)

10:30 am: **Image and flow cytometric analysis of gold nanoparticle uptake by macrophages** (*Invited Paper*), Susanne Melzer, Univ. Leipzig (Germany); Rinat Ankri, Dror Fixler, Bar-Ilan Univ. (Israel); Attila Tárnok, Univ. Leipzig (Germany) . . . . . [9721-11]

11:00 am: **Plasma dispersion effect assisted nanoscopy based on tuning of absorption and scattering resonances of nanoparticles** (*Invited Paper*), Zeev Zalevsky, Yossef Danan, Tali Ilovitsh, Bar-Ilan Univ. (Israel); Danping Liu, Chongqing Univ. (China); Hadar Pinhas, Moshe Sinvani, Yehonatan Ramon, Jonathan Azougi, Bar-Ilan Univ. (Israel); Alexandre Douplik, Ryerson Univ. (Canada) . . . . . [9721-12]

# CONFERENCE 9722

## LOCATION: ROOM 3002 (WEST LEVEL 3)

Saturday–Monday 13–15 February 2016 • Proceedings of SPIE Vol. 9722

SPONSOR:



# Colloidal Nanoparticles for Biomedical Applications XI

*Conference Chairs:* **Wolfgang J. Parak**, Philipps-Univ. Marburg (Germany); **Marek Osinski**, The Univ. of New Mexico (USA); **Xing-Jie Liang**, National Ctr. for Nanoscience and Technology of China (China)

*Program Committee:* **Antigoni Alexandrou**, Ecole Polytechnique (France); **Ramón Alvarez-Puebla**, Univ. de Vigo (Spain); **Jacob M. Berlin**, City of Hope Beckman Research Institute (USA); **Jesus M. de la Fuente**, Univ. de Zaragoza (Spain); **James B. Delehanty III**, U.S. Naval Research Lab. (USA); **Pablo del Pino**, CIC BiomaGUNE (Spain); **Niko Hildebrandt**, Institut d'Électronique Fondamentale (France); **Jennifer A. Hollingsworth**, Los Alamos National Lab. (USA); **Thomas M. Jovin**, Max-Planck-Institut für Biophysikalische Chemie (Germany); **Antonios G. Kanaras**, Univ. of Southampton (United Kingdom); **Hedi Mattoussi**, The Florida State Univ. (USA); **Igor Medintz**, U.S. Naval Research Lab. (USA); **Jay L. Nadeau**, McGill Univ. (Canada); **Subramanian Tamil Selvan**, A\*STAR Institute of Materials Research and Engineering (Singapore); **Konstantin V. Sokolov**, The Univ. of Texas M.D. Anderson Cancer Ctr. (USA); **Claudia Tortiglione**, Istituto di Cibernetica Eduardo Caianiello (Italy); **Kenji I. Yamamoto**, National Ctr. for Global Health and Medicine (Japan); **Chih-Chung Yang**, National Taiwan Univ. (Taiwan); **Junjie Zhu**, Nanjing Univ. (China)

## SATURDAY 13 FEBRUARY

### WELCOME REMARKS

LOCATION: ROOM 3002 (WEST LEVEL 3) . . . . . 8:10 AM TO 8:20 AM

Conference Chairs: **Wolfgang J. Parak**, Philipps-Univ. Marburg (Germany); **Marek Osinski**, The Univ. of New Mexico (USA); **Xing-Jie Liang**, National Ctr. for Nanoscience and Technology, China (China)

### SESSION 1

LOCATION: ROOM 3002 (WEST LEVEL 3) . . SAT 8:20 AM TO 12:20 PM

## Nanoparticle Development and Characterization

Session Chair: **Marek Osinski**, The Univ. of New Mexico (USA)

8:20 am: **Luminescent rare earth vanadate nanoparticles doped with Eu<sup>3+</sup> and Bi<sup>3+</sup> for sensing and imaging applications**, Alberto Escudero Belmonte, Carolina Carrillo-Carrión, Mikhail Zyuzin, Raimo Hartmann, Sumaira Ashraf, Wolfgang J. Parak, Philipps-Univ. Marburg (Germany) . . . . . [9722-1]

8:40 am: **Design of a multi-coordinating polymer as a platform for functionalizing metal, metal oxide and semiconductor nanocrystals**, Wentao Wang, Anshika Kapur, Florida State Univ. (USA); Xin Ji, Florida State Univ. (USA) and Ocean Nanotech, LLC (USA); Hedi Mattoussi, Florida State Univ. (USA) . . . . . [9722-2]

9:00 am: **Colloidal core-seeded semiconductor nanorods as fluorescent labels for in-vitro diagnostics** (*Invited Paper*), Yin Thai Chan, National Univ. of Singapore (Singapore) . . . . . [9722-3]

9:30 am: **Formation of upconversion nanoparticles of Ce:YAG, Eu:KYW and 18%Yb:1%Er:NaYF<sub>4</sub> by ultra-short pulse laser ablation in water** (*Invited Paper*), Laura Gemini, Marie Caroline Hernandez, Rainer Kling, ALPhANOV (France) . . . . . [9722-4]

10:00 am: **Hollow metal nanostructures for enhanced plasmonics** (*Invited Paper*), Aziz Genç, Institut de Ciència de Materials de Barcelona (Spain); Javier Patarroyo, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain); Jordi Sancho-Parramon, Institut Ruder Boškovic (Croatia); Martial Duchamp, Forschungszentrum Jülich GmbH (Germany); Edgar Gonzalez, Instituto Geofísico, Pontificia Univ. Javeriana Bogotá (Colombia); Neus G. Bastus, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain); Lothar Houben, Rafal Dunin-Borkowski, Forschungszentrum Jülich GmbH (Germany); Victor F. Puntes, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain) and Institució Catalana de Recerca i Estudis Avançats (Spain) and Vall d'Hebron Institut de Recerca (Spain); Jordi Arbiol, Institut de Ciència de Materials de Barcelona (Spain) and Institució Catalana de Recerca i Estudis Avançats (Spain) . . . . . [9722-5]

Coffee Break . . . . . Sat 10:30 am to 11:00 am

11:00 am: **Growth of fluorescence-tunable gold clusters using photochemically activated ligands** (*Invited Paper*), Dinesh Mishra, Fadi Aldeek, Goutam Palui, Hedi Mattoussi, Florida State Univ. (USA) . . . . . [9722-6]

11:30 am: **A facile method to prepare NaMnF<sub>3</sub>:Yb,Er/Tm upconversion nanoparticles with single band**, Xiao Peng, Shuai Ye, Yuliang Tian, Jun Song, Guangsheng Wang, Maozhen Xiong, Dong Wang, Hanben Niu, Junle Qu, Shenzhen Univ. (China) . . . . . [9722-7]

11:50 am: **Simple method for the quantification of PEG ligands and guidelines to the spectroscopic characterization of upconversion nanoparticles** (*Invited Paper*), Ute Resch-Genger, Marko Moser, Marco Kraft, Thomas Behnke, Jana Falkenhagen, Martin Kaiser, Bundesanstalt für Materialforschung und -prüfung (Germany); Verena Muhr, Institut für Analytische Chemie-und Biosensorik (Germany); Thomas Hirsch, Univ. Regensburg (Germany) . . . . . [9722-8]

Lunch/Exhibition Break . . . . . Sat 12:20 pm to 1:50 pm

### SESSION 2

LOCATION: ROOM 3002 (WEST LEVEL 3) . . . SAT 1:50 PM TO 5:40 PM

## Nanoparticle Assemblies and Their Applications

Session Chair: **Ute Resch-Genger**, Bundesanstalt für Materialforschung und -prüfung (Germany)

1:50 pm: **Controlled assembly of biocompatible metallic nanoaggregates using a small molecule crosslinker** (*Invited Paper*), Desiree Van Haute, Alice Liu, Jacob M. Berlin, City of Hope Beckman Research Institute (USA) . . [9722-9]

2:20 pm: **Preparation of cellular vehicles for delivery of gold nanorods to tumors**, Sara Lai, Sonia Centi, Istituto di Fisica Applicata "Nello Carrara" (Italy); Claudia Borri, Univ. degli Studi di Firenze (Italy); Francesca Tatini, Istituto di Fisica Applicata "Nello Carrara" (Italy); Marisa Benaglio, Chiara Della Bella, Alessia Grassi, Stefano Colagrande, Mario M. D'Elios, Univ. degli Studi di Firenze (Italy); Fulvio Ratto, Roberto Pini, Istituto di Fisica Applicata "Nello Carrara" (Italy) . . . . . [9722-10]

2:40 pm: **Supramolecular nanocarriers with photoresponsive cargo** (*Invited Paper*), Francisco Raymo, Univ. of Miami (USA) . . . . . [9722-11]

Coffee Break . . . . . Sat 3:10 pm to 3:40 pm

3:40 pm: **Dielectric platforms for surface enhanced spectroscopies** (*Invited Paper*), Stefan A. Maier, Imperial College London (United Kingdom) . . [9722-12]

4:10 pm: **Biomedical applications of magneto-plasmonic nanoclusters** (*Invited Paper*), Konstantin V. Sokolov, Chun-Hsien Wu, The Univ. of Texas M.D. Anderson Cancer Ctr. (USA); Jason Cook, The Univ. of Texas at Austin (USA); Tomasz Zal, The Univ. of Texas M.D. Anderson Cancer Ctr. (USA); Stanislav Y. Emelianov, The Univ. of Texas at Austin (USA) . . . . . [9722-13]



# CONFERENCE 9722

LOCATION: ROOM 3002 (WEST LEVEL 3)

BIOS

4:40 pm: **Topical drug delivery by nanocarriers probed by spectromicroscopy** (*Invited Paper*), Kanji Yamamoto, Andre Klossek, Robert Schulz, Freie Univ. Berlin (Germany); Takuji Ohgashi, Institute for Molecular Science (Japan); Markus Weigand, Max-Planck-Institut für Intelligente Systeme (Germany); Roman Flesch, Freie Univ. Berlin (Germany); Sebastian Ahlberg, Fiorenza Rancan, Annika Vogt, Ulrike Blume-Peytavi, Petra Schrade, Sebastian Bachmann, Charité Universitätsmedizin Berlin (Germany); Rainer Haag, Emanuel Fleige, Sarah Hedtrich, Monika Schaefer-Korting, Freie Univ. Berlin (Germany); Nobuhiro Kosugi, Institute for Molecular Science (Japan); Ulrike Alexiev, Roland Netz, Eckart Ruehl, Freie Univ. Berlin (Germany) . . . . . [9722-45]

5:10 pm: **Energy transfer study between luminescent gold nanocluster and fluorescent donors** (*Invited Paper*), Eunkeu Oh, Alan L. Huston, Andrew Shabae, Alexander L. Efros, Marc Currie, Kimihiro Susumu, Konrad M. Bussmann, Ramasis Goswami, Fredrik K. Fatemi, Igor L. Medintz, U.S. Naval Research Lab. (USA) . . . . . [9722-15]

## BiOS Hot Topics

SAT 7:00 PM TO 9:00 PM  
LOCATION: ROOM 3022 (WEST LEVEL 3)

See page 16 for complete Hot Topic Listing and Times

### SESSION 3

LOCATION: ROOM 3002 (WEST LEVEL 3) . SUN 8:00 AM TO 11:50 AM

## Sensing with Nanoparticles

Session Chair: **Davide Proserpi**,  
Univ. degli Studi di Milano-Bicocca (Italy)

8:00 am: **Nanoparticles in sensing** (*Invited Paper*), Amelie Heuer-Jungemann, Antonios G. Kanaras, Univ. of Southampton (United Kingdom) . . . . . [9722-16]

8:30 am: **Mechanogenetic nanoprobes to interrogate spatial, temporal, and mechanical responses of cells**, Daeha Seo, Univ. of California, San Francisco (USA); Ji-wook Kim, Yonsei Univ. (Korea, Republic of); Kade Southard, Justin Farlow, Hyun Jung Lee, Thomas Haas, Univ. of California, San Francisco (USA); Jinwoo Cheon, Yonsei Univ. (Korea, Republic of); A. Paul Alivisatos, Univ. of California (USA) and Lawrence Berkeley National Lab. (USA); Zev Gartner, Young-wook Jun, Univ. of California, San Francisco (USA) . . . . . [9722-17]

8:50 am: **Diagnosis of cancers through liquid biopsy**, Hainan Xie, Sara Gómez De Pedro, Manuel Garcia Algar, Ramón A. Alvarez-Puebla, Medcom Advance S.A. (Spain); Eduardo García-Rico Fernández, HM Hospitales (Spain) . . . . . [9722-18]

9:10 am: **Quantum dot based enzyme activity sensors present deviations from Michaelis-Menten kinetic model** (*Invited Paper*), Sebastián A. Diaz, Carl W. Brown III, U.S. Naval Research Lab. (USA); Anthony P Malanoski, US Naval Research Lab (USA); Eunkeu Oh, Kimihiro Susumu, Igor L. Medintz, U.S. Naval Research Lab. (USA) . . . . . [9722-19]

9:40 am: **Colorimetric monitoring of nanometer distance changes in DNA-templated plasmon rulers**, Laurent Lermusiaux, Sebastien Bidault, Institut Langevin (France) . . . . . [9722-20]

Coffee Break . . . . . Sun 10:00 am to 10:30 am

10:30 am: **Zwitterionic quantum dots and amphiphilic polymer quantum dot composites: spray-and-wash multiplex colon cancer diagnosis and platform for cellular labeling and ratiometric oxygen sensing** (*Invited Paper*), Sungjee Kim, Youngrong Park, Pohang Univ. of Science and Technology (Korea, Republic of); Yeon-Mi Ryu, Asan Medical Ctr. (Korea, Republic of); Joonhyuck Park, Pohang Univ. of Science and Technology (Korea, Republic of); Sang Mun Bae, Jaehil Kim, Eun-Ju Do, Sang-Yeob Kim, Jun Ki Kim, Asan Medical Ctr. (Korea, Republic of); Euiheon Chung, Gwangju Institute of Science and Technology (Korea, Republic of); G-One Ahn, Ki Hean Kim, Pohang Univ. of Science and Technology (Korea, Republic of); Seung-Jae Myung, Asan Medical Ctr. (Korea, Republic of) . . . . . [9722-21]

11:00 am: **Comparison of Fe<sub>2</sub>O<sub>3</sub> and Fe<sub>2</sub>CoO<sub>4</sub> core-shell plasmonic nanoparticles for aptamer mediated SERS assays**, Haley L. Marks, Texas A&M Univ. (USA) and Univ. of Strathclyde (United Kingdom); Samuel Abbott, Univ. of Strathclyde (United Kingdom); Po-Jung Huang, Texas A&M Univ. (USA); George W. Jackson, BioTex, Inc. (USA) and Base Pair Biotechnologies, Inc. (USA); Jun Kameoka, Texas A&M Univ. (USA); Duncan Graham, Univ. of Strathclyde (United Kingdom); Gerard L. Cote, Texas A&M Univ. (USA) [9722-22]

11:20 am: **Label-free direct surface-enhanced Raman scattering (SERS) of nucleic acids** (*Invited Paper*), Luca Guerrini, Medcom Advance S.A. (Spain); Judit Morla-Folch, Patricia Gisbert-Quilis, Medcom Advance S.A. (Spain) and Univ. Rovira i Virgili (Spain); Hainan Xie, Medcom Advance S.A. (Spain); Ramón A. Alvarez-Puebla, Institució Catalana de Recerca i Estudis Avançats (Spain) and Medcom Advance S.A. (Spain) and Univ. Rovira i Virgili (Spain) . . . [9722-23]

Lunch/Exhibition Break . . . . . Sun 11:50 am to 1:20 pm

### SESSION 4

LOCATION: ROOM 3002 (WEST LEVEL 3) . . . SUN 1:20 PM TO 5:10 PM

## Interaction of Nanoparticles with Cells

Session Chair: **Christoph Rehbock**, Univ. Duisburg-Essen (Germany)

1:20 pm: **Standardized toxicological assays for utilization of colloidal nanoparticles in biomedical applications** (*Invited Paper*), Christoph Rehbock, Univ. Duisburg-Essen (Germany); Ulrike Taylor, Dettlef Rath, Friedrich-Loeffler-Institut (Germany); Stephan Barcikowski, Univ. Duisburg-Essen (Germany) . . . . . [9722-24]

1:50 pm: **What happens to nanoparticles once they are incorporated by cells in vitro and in vivo**, Wolfgang J. Parak, Philipps-Univ. Marburg (Germany) and CIC Biomague (Spain) . . . . . [9722-25]

2:10 pm: **The influence of cell penetrating peptide branching on cellular uptake of QDs**, Joyce Breger, James Delehanty, Kimihiro Susumu, George Anderson, U.S. Naval Research Lab. (USA); Markus Müttenhaller, Philip Dawson, The Scripps Research Institute (USA); Igor L. Medintz, U.S. Naval Research Lab. (USA) . . . . . [9722-26]

2:30 pm: **Imaging cellular membrane potential through ionization of quantum dots** (*Invited Paper*), Clare Rowland, Kimihiro Susumu, Michael H. Stewart, Eunkeu Oh, Antti J. Makinen, Thomas J. O'Shaughnessy, Gary Kushto, Mason A. Wolak, Jeffrey Erickson, Alexander L. Efros, Alan L. Huston, James B. Delehanty, U.S. Naval Research Lab. (USA) . . . . . [9722-27]

Coffee Break . . . . . Sun 3:00 pm to 3:30 pm

3:30 pm: **Size dependent gold nanoparticle interaction at nano-micro interface using both monolayer and multilayer (tissue-like) cell models** (*Invited Paper*), Devika B. Chithrani, Ryerson Univ. (Canada) . . . . . [9722-29]

4:00 pm: **Photo thermal efficacy of green light emitting diode and gold nano spheres for malignancy**, Poorani G. Ganathan, Aruna Prakasa Rao, Singaravelu Ganesan, Anna Univ. Chennai (India); Elanchezhiyan Manickan, Univ. of Madras Taramani Campus (India) . . . . . [9722-30]

4:20 pm: **Lanthanum fluoride nanoparticles for radiosensitization of tumors** (*Invited Paper*), Jay L. Nadeau, California Institute of Technology (USA) and McGill Univ. (Canada); Daniel Cooper, Devesh Bekah, McGill Univ. (Canada); Ido Badash, Collin T. Mayemura, Colin Hill, Stephen E. Bradforth, The Univ. of Southern California (USA) . . . . . [9722-31]

4:50 pm: **Attenuating the neurotoxic aggregation of the Alzheimer's peptide a $\beta$  with functionalized gold nanoparticles**, Christoph Rehbock, Carmen Streich, Laura Akkari, Thomas Schrader, Stephan Barcikowski, Univ. Duisburg-Essen (Germany) . . . . . [9722-32]

### POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BiOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/IPWPosterGuidelines>.

**In vitro antitumor efficacy of berberine-solid lipid nanoparticles against human HepG2, Huh7 and EC9706 cancer cell lines**, Zhi-ping Wang, Guangdong Pharmaceutical Univ. (China); Hua Fan, Guangdong Hinabiotech Co., Ltd. (China); Ju Jin, Guangdong Pharmaceutical Univ. (China); Yifei Wang, Institute of Biological Medicine, Jinan Univ. (China); Tongsheng Chen, Institute of Laser Life Science, South China Normal Univ. (China) . . . . . [9722-48]

**Design of Raman active nanoparticles for SERS-based detection**, Javier T. Garza, Gerard L. Cote, Texas A&M Univ. (USA) . . . . . [9722-49]

**Measuring pair-wise molecular interactions in a complex mixture**, Krishnendu Chakraborty, Manoj M. Varma, Murugesan Venkatapathi, Indian Institute of Science (India) . . . . . [9722-50]

# CONFERENCE 9722

LOCATION: ROOM 3002 (WEST LEVEL 3)

**Evaluation of free radical scavenging capacity and antioxidative damage effect of resveratrol-nanostructured lipid carrier**, Zhi-ping Wang, Ju Jin, Guangdong Pharmaceutical Univ. (China); Tongsheng Chen, South China Normal Univ. (China); Yifei Wang, Jinan Univ. (China) . . . . . [9722-51]

**Induced structural defects in Ti-doped ZnO and its two-photon-excitation**, Milton A. Martínez, Ivonnemary Rivera Gonzalez, Jaime A. Santillán Mercado, Univ. de Puerto Rico Mayagüez (USA); Heidy Sierra, Memorial Sloan-Kettering Cancer Ctr. (USA); Oscar J. Perales-Pérez, Univ. de Puerto Rico Mayagüez (USA) . . . . . [9722-52]

**In vitro studies of multifunctional perfluorocarbon nanoemulsions for cancer therapy and imaging**, Donald A. Fernandes, Ryerson Univ. (Canada); Dennis D. Fernandes, Claudiu C. Gradinaru, Univ. of Toronto Mississauga (Canada); Michael C. Kolios, Ryerson Univ. (Canada) . . . . . [9722-53]

**Bio-modified cobalt core/carbon shell nanoparticle for MR/photoacoustic/microwave-induced thermoacoustic triple-modality imaging**, Huan Qin, Dong Xu, South China Normal Univ. (China) . . . . . [9722-54]

## MONDAY 15 FEBRUARY

### SESSION 5

LOCATION: ROOM 3002 (WEST LEVEL 3) MON 8:30 AM TO 12:00 PM

### Imaging with Nanoparticles

Session Chair: **Ramón A. Alvarez-Puebla**, Univ. de Vigo (Spain)

8:30 am: **Persistent nanophosphors for in vivo optical imaging**, Cyrille Richard, Univ. Paris Descartes (France) . . . . . [9722-33]

8:50 am: **Single gold@silver nanoprobe for real-time tracing autophagy process at single-cell level** (*Invited Paper*), Junjie Zhu, Nanjing Univ. (China) . . . . . [9722-34]

9:20 am: **Photoluminescent nanodiamonds for bioimaging applications**, Ishan D. Rastogi, Carlo Bradac, Thomas Volz, Macquarie Univ. (Australia); Philipp Reineck, Brant Gibson, RMIT Univ. (Australia); Louise J. Brown, Macquarie Univ. (Australia) . . . . . [9722-35]

9:40 am: **Facile synthesis of NaYF<sub>4</sub>:Yb/Ho upconversion nanoparticles for NIR-excited fluorescent bio-imaging**, Xiao Peng, Shuai Ye, Guangsheng Wang, Yuliang Tian, Ming Zhu, Wei Yan, Jun Song, Junle Qu, Shenzhen Univ. (China) . . . . . [9722-36]

Coffee Break . . . . . Mon 10:00 am to 10:40 am

10:40 am: **Magnetic nanoparticle hyperthermia dosimetry by biomechanical properties revealed in magnetomotive optical coherence elastography**, Pin-Chieh Huang, Marina Marjanovic, Darold R. Spillman Jr., Boris M. Odintsov, Stephen A. Boppart, Univ. of Illinois at Urbana-Champaign (USA) . . . . [9722-37]

11:00 am: **Next generation in vivo optical imaging with short-wave infrared quantum dots** (*Invited Paper*), Oliver T. Bruns, Thomas S. Bischof, Daniel K. Harris, Daniel Franke, Christopher J. Rowlands, Peter T. C. So, Massachusetts Institute of Technology (USA); Rakesh K. Jain, Massachusetts General Hospital (USA); Mounsi G. Bawendi, Massachusetts Institute of Technology (USA) . . . . . [9722-38]

11:30 am: **Multi-harmonic nanoparticles for cell tracking** (*Invited Paper*), Luigi Bonacina, Univ. de Genève (Switzerland) . . . . . [9722-39]

Lunch Break . . . . . Mon 12:00 pm to 1:40 pm

### SESSION 6

LOCATION: ROOM 3002 (WEST LEVEL 3) . . MON 1:40 PM TO 4:50 PM

### Delivery with Nanoparticles

Session Chair: **Xing-Jie Liang**, National Ctr. for Nanoscience and Technology of China (China)

1:40 pm: **Combination of photothermal and photodynamic effects for cancer cell inactivation through surface plasmon resonance with Au nanoring based on two-photon absorption** (*Invited Paper*), Chih-Ken Chu, Jen-Hung Hsiao, Jian-He Yu, Yi-Chou Tu, Chih-Kang Yu, Shih-Yang Chen, Po-Hao Tseng, Shuai Chen, Yean-Woei Kiang, Chih-Chung Yang, National Taiwan Univ. (Taiwan) . . . . . [9722-41]

2:10 pm: **Membrane-targeting liquid crystal nanoparticles (LCNPs) for drug delivery**, Okhil Kumar Nag, Christopher M. Spillmann, Jawad Naciri, James B. Delehanty, U.S. Naval Research Lab. (USA) . . . . . [9722-42]

2:30 pm: **Nanomaterials: exploiting nanotechnology to optimize metronomic treatment of cancer** (*Invited Paper*), Serena Mazzucchelli, Michela Bellini, Luisa Fiandra, Marta Truffi, Maria A. Rizzuto, Manuela Nebuloni, Fabio Corsi, Davide Prosperi, Univ. degli Studi di Milano Bicocca (Italy) [9722-43]

3:00 pm: **Towards photodynamic therapy with ionising radiation: nanoparticle-mediated singlet oxygen generation**, Sandhya Clement, Wei Deng, Elizabeth Camilleri, Macquarie Univ. (Australia); Brian Wilson, Univ. Health Network (Canada); Ewa Goldys, Macquarie Univ. (Australia) . . . [9722-44]

Coffee Break . . . . . Mon 3:20 pm to 3:50 pm

3:50 pm: **Terbium complex to quantum dot Förster resonance energy transfer for homogeneous and multiplexed microRNA assay** (*Invited Paper*), Xue Qiu, Niko Hildebrandt, Univ. Paris-Sud 11 (France) . . . . . [9722-14]

4:20 pm: **VIVIT functionalized nanoparticles for inflammatory diseases treatment** (*Invited Paper*), Miriam Colombo, Ivan Zaroni, Fabio Corsi, Francesca Granucci, Davide Prosperi, Univ. degli Studi di Milano Bicocca (Italy) . . . . . [9722-46]

### CONCLUDING REMARKS

LOCATION: ROOM 3002 (WEST LEVEL 3) . . . . . 4:50 PM TO 5:00 PM

Conference Chairs: **Wolfgang J. Parak**, Philipps-Univ. Marburg (Germany); **Marek Osinski**, The Univ. of New Mexico (USA); **Xing-Jie Liang**, National Ctr. for Nanoscience and Technology, China (China)

### YOUNG INVESTIGATOR AWARD

LOCATION: ROOM 3002 (WEST LEVEL 3) . . . 5:00 PM TO 5:15 PM

### Ocean Optics Young Investigator Award

The Ocean Optics Young Investigator Awards will be given for the best contributed papers presented by a leading author who is either a graduate student or has graduated within less than five years of the paper submission date. In 2016, for the first time, two prizes will be awarded. The First Prize will consist of a \$1,000 cash prize for the Young Investigator and \$2,000 Ocean Optics equipment credit for the laboratory where the work was performed. The Second Prize will consist of a \$500 cash prize for the Young Investigator and \$1,000 Ocean Optics equipment credit for the laboratory where the work was performed.

AWARD SPONSOR:



**TUESDAY 16 FEBRUARY**

**BIOS**

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**Nano/Biophotonics Plenary Session**

**TUE 10:30 AM TO 11:30 AM**

**LOCATION: ROOM 3002 (WEST LEVEL 3)**

**Welcome and Introduction**

**Dan Nicolau**, McGill Univ. (Canada)

**Light moves life**

**Halina Rubinsztein-Dunlop**, Univ. of Queensland (Australia)

Light can be made to do the work. Imagine tweezers made out of light. Such optical tweezers can trap and move materials noninvasively at length scales ranging from tens of nanometers to tens of micrometers, and so have provided unprecedented access to physical, chemical and biological processes on a microscale. Since a light beam can carry angular momentum it is possible to use optical tweezers to exert torques to twist or rotate nano and microscopic objects. These optical rotors can be used to map the mechanical properties of cells. They can also be used in biotechnology and optomechanics.

Professor Rubinsztein-Dunlop is a Director of the Quantum Science Laboratory in the School of Mathematics and Physics at the University of Queensland. She obtained her PhD degree at the University of Gothenburg in Sweden. Halina's research interests are in quantum atom optics, laser micromanipulation, laser physics, linear and nonlinear high resolution spectroscopy, and nano-optics.

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**CONFERENCE 9723**  
**LOCATION: ROOM 3010 (WEST LEVEL 3)**

Monday–Tuesday 15–16 February 2016  
Proceedings of SPIE Vol. 9723

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# Reporters, Markers, Dyes, Nanoparticles, and Molecular Probes for Biomedical Applications VIII

*Conference Chairs:* **Samuel Achilefu**, Washington Univ. School of Medicine in St. Louis (USA); **Ramesh Raghavachari**, U.S. Food and Drug Administration (USA)

*Program Committee:* **Mingfeng Bai**, Univ. of Pittsburgh (USA); **Bohumil Bednar**, Merck & Co., Inc. (USA); **Mikhail Y. Berezin**, Washington Univ. School of Medicine in St. Louis (USA); **Richard B. Dorshow**, MediBeacon, LLC (USA); **Paul M. W. French**, Imperial College London (United Kingdom); **Yueqing Gu**, China Pharmaceutical Univ. (China); **Hisataka Kobayashi**, National Cancer Institute (USA); **Jonathan T. C. Liu**, Univ. of Washington (USA); **Ashok Kumar Mishra**, Indian Institute of Technology Madras (India); **D. Michael Olive**, LI-COR Biosciences (USA); **Gabor Patonay**, Georgia State Univ. (USA); **Attila Tarnok**, Univ. Leipzig (Germany); **Yasuteru Urano**, The Univ. of Tokyo (Japan)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: ROOM 3010 (WEST LEVEL 3) . . MON 8:00 AM TO 9:30 AM

#### NIR Fluorescence for Imaging

Session Chair: **Samuel Achilefu**,  
Washington Univ. School of Medicine in St. Louis (USA)

8:00 am: **Mechanism of eliciting host immunity against cancer cells treated with silica-phthalocyanine-based near infrared photoimmunotherapy** (*Invited Paper*), Hisataka Kobayashi, National Cancer Institute (USA) . . . [9723-1]

8:30 am: **Fluorenyl benzothiadiazole and benzoselenadiazole near-IR fluorescent probes for two-photon fluorescence imaging**, Kevin D. Belfield, New Jersey Institute of Technology (USA); Sheng Yao, Bosung Kim, Xiling Yue, Univ. of Central Florida (USA) . . . [9723-2]

8:50 am: **Noninvasive imaging of multiple myeloma using near infrared fluorescent molecular probe**, Walter J. Akers, Washington Univ. School of Medicine in St. Louis (USA); Deep Hathi, Haiying Zhou, Washington Univ. in St. Louis (USA); Monica Shokeen, Washington Univ. School of Medicine in St. Louis (USA) . . . [9723-3]

9:10 am: **Pyranyl-based near-IR fluorescent probes for tumor vascular imaging**, Kevin D. Belfield, New Jersey Institute of Technology (USA); Xiling Yue, Univ. of Central Florida (USA); Alma R. Morales, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Grace W. Githaiga, Adam W. Woodward, Simon Tang, Univ. of Central Florida (USA); Junko Sawada, Masanobu Komatsu, Sanford-Burnham Medical Research Institute (USA); Xuan Liu, New Jersey Institute of Technology (USA) . . . [9723-4]

### SESSION 2

LOCATION: ROOM 3010 (WEST LEVEL 3) . . MON 9:30 AM TO 11:40 AM

#### Two Photon Fluorescent Probes, Sensors, and Tracers

Session Chair: **Hisataka Kobayashi**, National Cancer Institute (USA)

9:30 am: **In vivo oxygen imaging: phosphorescent metalloporphyrins with internally enhanced two-photon absorption cross-sections**, Tatiana V. Espipova, Sergei A. Vinogradov, Univ. of Pennsylvania (USA) . [9723-5]

9:50 am: **Probes for two-photon phosphorescence lifetime microscopy (2PLM) of oxygen**, Sergei A. Vinogradov, Tatiana V. Espipova, Univ. of Pennsylvania (USA) . . . [9723-6]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

10:40 am: **Two-photon fluorescent sensor for K<sup>+</sup> imaging in live cells**, Binglin Sui, Xiling Yue, Bosung Kim, Univ. of Central Florida (USA); Kevin D. Belfield, New Jersey Institute of Technology (USA) . . . [9723-7]

11:00 am: **NIR and MR imaging supported hydrogel based delivery system for anti-TNF alpha probiotic therapy of IBD**, Jelena M. Janjic, Duquesne Univ. (USA); Ales Berlec, Jožef Stefan Institute (Slovenia); Christina Bagia, Lu S. Liu, Duquesne Univ. (USA); Bratislav M. Janjic, Univ. of Pittsburgh (USA); Irenej Jeric, Duquesne Univ. (USA); Michael Gach, Washington Univ. School of Medicine in St. Louis (USA); Borut Strukelj, Jožef Stefan Institute (Slovenia) and Univ. of Ljubljana (Slovenia) . . . [9723-8]

11:20 am: **Application of fluorescent tracer agent technology to point-of-care gastrointestinal permeability measurement**, Richard B. Dorshow, Jeng-Jong Shieh, Thomas E. Rogers, MediBeacon, LLC (USA); Carla Hall-Moore, Nurmohammad Shaikh, Michael Talcott, Phillip I. Tarr, Washington Univ. School of Medicine in St. Louis (USA) . . . [9723-9]

Lunch Break . . . . . Mon 11:40 am to 1:10 pm

### SESSION 3

LOCATION: ROOM 3010 (WEST LEVEL 3) . . . MON 1:10 PM TO 2:30 PM

#### Fluorescent Probes and Techniques for Imaging

Session Chair: **Gabor Patonay**, Georgia State Univ. (USA)

1:10 pm: **Vibrational imaging of glucose uptake activity in live cells and tissues by stimulated Raman scattering microscopy**, Fanghao Hu, Zhixing Chen, Luyuan Zhang, Yihui Shen, Lu Wei, Wei Min, Columbia Univ. (USA) . . . [9723-10]

1:30 pm: **Optimization of input parameters of acoustic-transfection for the intracellular delivery of macromolecules using FRET-based biosensors**, Sangpil Yoon, The Univ. of Southern California (USA); Yingxiao Wang, Univ. of California, San Diego (USA); K. Kirk Shung, The Univ. of Southern California (USA) . . . [9723-11]

1:50 pm: **Water-soluble BIODIPY-based fluorescent probe for mitochondrial imaging**, Binglin Sui, Simon Tang, Adam W. Woodward, Bosung Kim, Univ. of Central Florida (USA); Kevin D. Belfield, New Jersey Institute of Technology (USA) . . . [9723-12]

2:10 pm: **Graphene oxide: enhancer of bacterial growth or antimicrobial agent?**, Wen-Shuo Kuo, National Cheng Kung Univ. (Taiwan) . . . [9723-13]



# CONFERENCE 9723

## LOCATION: ROOM 3010 (WEST LEVEL 3)

BIOS

### SESSION 4

LOCATION: ROOM 3010 (WEST LEVEL 3) . . MON 2:30 PM TO 4:05 PM

## Imaging Beyond 1000 nm: Synthesis and Design

Session Chair: **Mikhail Y. Berezin**,

Washington Univ. School of Medicine in St. Louis (USA)

2:30 pm: **Photoluminescence quantum yields of PbSe and PbS QDs in the range of 1000 nm to 2000 nm** (*Invited Paper*), Matthew C. Beard, Octavi E. Semonin, Justin C. Johnson, Ashley Marshall, Jianbing Zhang, Boris D. Chernomordik, National Renewable Energy Lab. (USA) . . . . . [9723-14]

2:55 pm: **Setup for the power-dependent absolute quantum yield measurements of luminescent reporters in the VIS and IR spectral region: example of upconversion nanoparticles**, Christian Würth, Martin Kaiser, Marco Kraft, Bundesanstalt für Materialforschung und -prüfung (Germany); Verena Muhr, Stefan Wilhelm, Institut für Analytische Chemie-und Biosensorik (Germany) and Univ. Regensburg (Germany); Thomas Hirsch, Univ. Regensburg (Germany) and Institut für Analytische Chemie-und Biosensorik (Germany); Ute Resch-Genger, Bundesanstalt für Materialforschung und -prüfung (Germany) . . . . . [9723-16]

Coffee Break . . . . . Mon 3:15 pm to 3:45 pm

3:45 pm: **Quantum dot imaging depth and activatable quantum dot cancer probes in the near-infrared second optical window**, Sungjee Kim, Yebin Jung, Sanghwa Jeong, Pohang Univ. of Science and Technology (Korea, Republic of) . . . . . [9723-17]

### SESSION 5

LOCATION: ROOM 3010 (WEST LEVEL 3) . . MON 4:05 PM TO 5:35 PM

## Imaging Beyond 1000 nm: Applications

Session Chair: **Mikhail Y. Berezin**,

Washington Univ. School of Medicine in St. Louis (USA)

4:05 pm: **High quality SWIR emitters enable novel in vivo imaging applications** (*Invited Paper*), Oliver T. Bruns, Thomas S. Bischof, Daniel Franke, Jessica A. Carr, Mounji G. Bawendi, Massachusetts Institute of Technology (USA) . . . . . [9723-18]

4:30 pm: **TCSPC FLIM in the wavelength range from 800 nm to 1700 nm**, Wolfgang Becker, Vladislav Shcheslavsky, Becker & Hickl GmbH (Germany) . . . . . [9723-20]

4:50 pm: **Ag<sub>2</sub>S quantum dot: a new fluorescent nanoprobe in the second near-infrared window for in vivo imaging**, Qiangbin Wang, Suzhou Institute of Nano-Tech and Nano-Bionics (China) . . . . . [9723-21]

5:10 pm: **Novel approach for non-invasive glucose sensing using vibrational contrast CD absorption measurements** (*Invited Paper*), Vladislav V. Yakovlev, Carlos Tovar, Brett H. Hokr, Georgi I. Petrov, Texas A&M Univ. (USA) . [9723-19]

### POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

Conference attendees are invited to attend the BiOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Open-source multiprocessor software «KVAZAR» for biomolecular modeling**, Anna Kolesnikova, Olga E. Glukhova, Mikhail M. Slepchenkov, Georgy V. Savostyanov, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) . . . . . [9723-30]

**Theoretical investigation of interaction between the set of ligands and nicotinic acetylcholine receptor**, Olga E. Glukhova, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Tatiana R. Prytkova, Chapman Univ. (USA); Dmitriy S. Shmygin, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) . . . . . [9723-31]

**Calculation of electron transfer in ruthenium-modified derivatives of cytochrome b562**, Olga E. Glukhova, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Tatiana R. Prytkova, Chapman Univ. (USA); Vladislav V. Shunaev, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) . . . . . [9723-32]

**Predictive modeling of high density lipoprotein behavior on a few layer graphene undergoing nanoindentation by carbon nanotubes**, Olga E. Glukhova, George V. Savostyanov, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) . . . . . [9723-33]

**Theoretical prediction of mutual influence between phospholipid and nanotube during their interaction**, Mikhail M. Slepchenkov, Olga E. Glukhova, N.G. Chernyshevsky Saratov State Univ. (Russian Federation) . . . . . [9723-34]

**A dual function theranostic agent for near-infrared photoacoustic imaging and photothermal therapy**, Paul Kumar Upputuri, Shuo Huang, Mingfeng Wang, Manojit Pramanik, Nanyang Technological Univ. (Singapore) . . . [9723-35]

**Synthesis and spectroscopic evaluation of PbS quantum dots emitting at 1300 nm for optimized imaging in optical window II**, Alexander P. Aydt, Shane Blair, Hairong Zhang, Washington Univ. School of Medicine in St. Louis (USA); Boris D. Chernomordik, Matthew C. Beard, National Renewable Energy Lab. (USA); Mikhail Y. Berezin, Washington Univ. School of Medicine in St. Louis (USA) . . . . . [9723-36]

**High specificity ZnO quantum dots for diagnosis and treatment in bacterial infection**, Min Zhang, China Pharmaceutical Univ. (China); Zhiyu Qian, Nanjing Univ. of Aeronautics and Astronautics (China); Yueqing Gu, China Pharmaceutical Univ. (China) . . . . . [9723-37]

**Real time detection of bcl-2 mRNA expression in living cell using gold nanoparticle beacon**, Qiumei Zhou, China Pharmaceutical Univ. (China); Zhiyu Qian, Nanjing Univ. of Aeronautics and Astronautics (China); Yueqing Gu, China Pharmaceutical Univ. (China) . . . . . [9723-38]

## TUESDAY 16 FEBRUARY

### SESSION 6

LOCATION: ROOM 3010 (WEST LEVEL 3) . . TUE 9:00 AM TO 10:15 AM

## Imaging Beyond 1000 nm: Fundamentals

Session Chair: **Ramesh Raghavachari**,  
U.S. Food and Drug Administration (USA)

9:00 am: **Hyperspectral imaging in shortwave infrared: from stain-free microscopy to deep tissue imaging** (*Invited Paper*), Mikhail Y. Berezin, Washington Univ. School of Medicine in St. Louis (USA) . . . . . [9723-22]

9:25 am: **Golden optical window III from 1600 to 1870 for deep imaging of brain and other tissues** (*Invited Paper*), Lingyan Shi, Laura A. Sordillo, Adrian Rodriguez-Contreras, Robert R. Alfano, The City College of New York (USA) . . . . . [9723-23]

9:50 am: **Absolute fluorescence measurements > 1000 nm: setup design, calibration and standards** (*Invited Paper*), Ute Resch-Genger, Christian Würth, Jutta Pauli, Soheil Hatami, Martin Kaiser, Bundesanstalt für Materialforschung und -prüfung (Germany) . . . . . [9723-24]

Coffee Break . . . . . Tue 10:15 am to 10:30 am

# CONFERENCE 9723

LOCATION: ROOM 3010 (WEST LEVEL 3)

## Nano/Biophotonics Plenary Session

TUE 10:30 AM TO 11:30 AM  
LOCATION: ROOM 3002 (WEST LEVEL 3)

### Welcome and Introduction

Dan Nicolau, McGill Univ. (Canada)

### Light moves life

Halina Rubinsztein-Dunlop, Univ. of Queensland (Australia)

Light can be made to do the work. Imagine tweezers made out of light. Such optical tweezers can trap and move materials noninvasively at length scales ranging from tens of nanometers to tens of micrometers, and so have provided unprecedented access to physical, chemical and biological processes on a microscale. Since a light beam can carry angular momentum it is possible to use optical tweezers to exert torques to twist or rotate nano and microscopic objects. These optical rotors can be used to map the mechanical properties of cells. They can also be used in biotechnology and optomechanics.

Professor Rubinsztein-Dunlop is a Director of the Quantum Science Laboratory in the School of Mathematics and Physics at the University of Queensland. She obtained her PhD degree at the University of Gothenburg in Sweden. Halina's research interests are in quantum atom optics, laser micromanipulation, laser physics, linear and nonlinear high resolution spectroscopy, and nano-optics.

Lunch Break ..... Tue 11:30 am to 1:40 pm

## SESSION 7

LOCATION: ROOM 3010 (WEST LEVEL 3) ... TUE 1:40 PM TO 3:00 PM

### Non-Bleaching and Ultra-Small Fluorescent Probes I

Joint Session with Conferences 9723 and 9762

Session Chairs: **Ramesh Raghavachari**, U.S. Food and Drug Administration (USA); **Philip R. Hemmer**, Texas A&M Univ. (USA)

1:40 pm: **Intraneuronal traffic readout with fluorescent nanodiamonds**, François Treussart, Lab. Aimé Cotton (France); Simon Haziza, Lab. Aimé Cotton (France) and Ctr. de Psychiatrie et Neurosciences (France); Michel Simonneau, Yann Loe-Mie, Aude-Marie Lepagnol-Bestel, Ctr. de Psychiatrie et Neurosciences (France); Nitin Mohan, Lab. Aimé Cotton (France); Huan-Cheng Chang, Institute of Atomic and Molecular Science (Taiwan). . . . . [9762-1]

2:00 pm: **Multifunctional intracellular sensing with biologically-responsive nanodiamonds**, Zhiqin Chu, Univ. Stuttgart (Germany). . . . . [9762-2]

2:20 pm: **Nanodiamond as a multi-role fluorescent marker for bioimaging**, Brian R. Patton, Martin J. Booth, Univ. of Oxford (United Kingdom) . . . [9723-25]

2:40 pm: **Single-protein spin resonance spectroscopy and imaging under ambient conditions**, Jiangfeng Du, Univ. of Science and Technology of China (China) . . . . . [9762-3]

Coffee Break ..... Tue 3:00 pm to 3:30 pm

## SESSION 8

LOCATION: ROOM 3010 (WEST LEVEL 3) ... TUE 3:30 PM TO 5:20 PM

### Non-Bleaching and Ultra-Small Fluorescent Probes II

Joint Session with Conferences 9723 and 9762

Session Chairs: **Ramesh Raghavachari**, U.S. Food and Drug Administration (USA); **Philip R. Hemmer**, Texas A&M Univ. (USA)

3:30 pm: **Kilograms of bright nanodiamonds and bio-functionalization (Invited Paper)**, Arfaan Rampersaud, Columbus NanoWorks (USA) . . . . . [9762-4]

4:00 pm: **Fluorescent silica nanoparticles containing covalently bound dyes for reporter, marker and sensor applications**, Gabor Patonay, Maged M. Henary, Gala Chapman, Kyle Emer, Georgia State Univ. (USA) . . . . . [9723-26]

4:20 pm: **Synthesis and energy transfer within carbon-based fluorescent rare earth nanoparticles and nanocomposites**, Brian G. Yust, Mircea Chipara, Aaron Saenz, The Univ. of Texas Rio Grande Valley (USA) . . . . . [9723-27]

4:40 pm: **Nanoparticle-enhanced x-ray therapy for cancer**, Renat R. Letfullin, Rose-Hulman Institute of Technology (USA); Colin E. W. Rice, Univ. of Minnesota, Twin Cities (USA); Thomas F. George, Univ. of Missouri-St. Louis (USA) . . . . . [9723-28]

5:00 pm: **Anisotropic silver nanoparticles: sorption and desorption of cationic porphyrins**, Anna G. Gyulkhandanyan, Anna A. Zakoyan, Institute of Biochemistry (Armenia); Robert K. Ghazaryan, Yerevan State Medical Univ. (Armenia); Aram G. Gyulkhandanyan, Institute of Biochemistry (Armenia); Marina A. Sheyryanyan, Yerevan State Univ. (Armenia); Grigor V. Gyulkhandanyan, Institute of Biochemistry (Armenia) . . . . . [9723-29]

# CONFERENCE 9724

LOCATION: ROOM 3008 (WEST LEVEL 3)

Monday–Tuesday 15–16 February 2016 • Proceedings of SPIE Vol. 9724

# Plasmonics in Biology and Medicine XIII

BIOS

*Conference Chairs:* **Tuan Vo-Dinh**, Fitzpatrick Institute For Photonics, Duke Univ. (USA); **Joseph R. Lakowicz**, Univ. of Maryland School of Medicine (USA)

*Conference Co-Chairs:* **Ho-Pui A. Ho**, The Chinese Univ. of Hong Kong (Hong Kong, China); **Krishanu Ray**, Univ. of Maryland School of Medicine (USA)

*Program Committee:* **A. Claude Boccara**, Ecole Supérieure de Physique et de Chimie Industrielles (France); **Michael T. Canva**, Lab. Charles Fabry (France); **Volker Deckert**, Institut für Photonische Technologien e.V. (Germany); **Bruce S. Dunn**, Univ. of California, Los Angeles (USA); **Christopher D. Geddes**, Univ. of Maryland, Baltimore (USA); **Zygmunt Karol Gryczynski**, Univ. of North Texas Health Science Ctr. at Fort Worth (USA); **Naomi J. Halas**, Rice Univ. (USA); **Jiri Homola**, Institute of Photonics and Electronics of the ASCR, v.v.i. (Czech Republic); **Laura Maria Lechuga**, Ctr. d'Investigacions en Nanociència i Nanotecnologia (Spain); **Boris Mizaikoff**, Univ. Ulm (Germany); **Shuming Nie**, Emory Univ. (USA); **Wei-Chuan Shih**, Univ. of Houston (USA); **Weihong Tan**, Univ. of Florida (USA); **Andrew Taton**, Univ. of Minnesota, Twin Cities (USA); **Richard P. Van Duyne**, Northwestern Univ. (USA); **Jeffrey I. Zink**, Univ. of California, Los Angeles (USA)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: ROOM 3008 (WEST LEVEL 3) MON 9:00 AM TO 12:00 PM

### Plasmonics and Surface-Enhanced Raman Spectroscopy

Session Chairs: **Tuan Vo-Dinh**, Fitzpatrick Institute For Photonics, Duke Univ. (USA); **Claude Boccara**, Ecole Supérieure de Physique et de Chimie Industrielles (France)

9:00 am: **Building optical antennas with DNA** (*Invited Paper*), Sebastien Bidault, Ctr. National de la Recherche Scientifique (France) . . . . . [9724-1]

9:30 am: **SERS mapping of targeted silica-coated gold nanostars for detection and prediction of melanoma metastasis**, Michael B. Fenn Jr., Neda Parchami, Nikša Roki, Florida Institute of Technology (USA) . . . . . [9724-2]

9:50 am: **Simultaneous detection of multiple biomarkers by means of SERS on polymer nanopillar-gold arrays**, Carlo F. Morasso, Silvia Picciolini, Dora Mehn, Fondazione Don Carlo Gnocchi (Italy); Paola Pellacani, Plasmore S.r.l. (Italy); Gerardo R. Marchesini, Biospher Ltd. (United Kingdom); Renzo Vanna, Alice Gualerzi, Marzia Bedoni, Fondazione Don Carlo Gnocchi (Italy); Franco Marabelli, Univ. degli Studi di Pavia (Italy); Furio Gramatica, Fondazione Don Carlo Gnocchi (Italy) . . . . . [9724-3]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

10:40 am: **Plasmonic nanostructures for bioanalytical applications of SERS**, Mehmet Kahraman, Gaziantep Univ. (Turkey); Sebastian Wachsmann-Hogiu, Univ. of California, Davis (USA) . . . . . [9724-4]

11:00 am: **SERS sensing of sub-nanoliter analyte on diatom biosilica using inkjet printing**, Yuting Xi, Xianming Kong, Paul LeDuff, Gregory L. Rorrer, Alan X. Wang, Oregon State Univ. (USA) . . . . . [9724-5]

11:20 am: **SERS detection and targeted ablation of lymphoma cells using functionalized Ag nanoparticles**, Xiuhong Wang, Qian Yao, Fei Cao, Yan Zhao, Beijing Univ. of Technology (China) . . . . . [9724-6]

11:40 am: **Gold nanostructuring by soft UV-nanoimprint lithography for surface-enhanced Raman scattering applications: directional and enhancement localization properties**, Jean-François Bryche, Lab. Charles Fabry (France) and Univ. Paris-Sud 11 (France); Raymond Gillibert, Univ. Paris 13 (France) and HORIBA Jobin Yvon (France) and Lab. Charles Fabry (France); Mitraddeep Sarkar, Lab. Charles Fabry (France) and Institut d'Optique Graduate School (France); Grégory Barbillon, Institut d'Électronique Fondamentale (France) and Univ. Paris Sud 11 (France); Ryohei Yasukuni, Univ. Paris 13 (France); Aurore Olivéro, Lab. Charles Fabry (France) and HORIBA Jobin Yvon (France) and Univ. Paris 13 (France); Frédéric Hamouda, Univ. Paris-Sud 11 (France) and Institut d'Électronique Fondamentale (France); Mondher Besbes, Lab. Charles Fabry (France) and Institut d'Optique Graduate School (France); Julien Moreau, Institut d'Optique Graduate School (France) and Lab. Charles Fabry (France); Marc Lamy de la Chapelle, Univ. Paris 13 (France); Bernard Bartenlian, Institut d'Électronique Fondamentale (France) and Univ. Paris-Sud 11 (France); Michael T. Canva, Lab. Charles Fabry (France) and Univ. de Sherbrooke (Canada) . . . . . [9724-7]

Lunch Break . . . . . Mon 12:00 pm to 1:30 pm

### SESSION 2

LOCATION: ROOM 3008 (WEST LEVEL 3) . . MON 1:30 PM TO 3:30 PM

### Plasmonic Detection

Session Chair: **Ho-Pui A. Ho**, The Chinese Univ. of Hong Kong (Hong Kong, China)

1:30 pm: **New avenues for confocal surface plasmon microscopy** (*Invited Paper*), Mike G. Somekh, Suejit Pechprasarn, Shen Hong, Wai-Kin Chow, Jingkai Meng, The Hong Kong Polytechnic Univ. (Hong Kong, China) . . . . . [9724-8]

2:00 pm: **Plasmonic engineering of near-fields attains ultrasensitive super-resolved molecular detection** (*Invited Paper*), Donghyun Kim, Yonsei Univ. (Korea, Republic of) . . . . . [9724-9]

2:30 pm: **Near-, middle-, and far-field dipolar interactions in gold nanoparticle arrays**, Vira V. Kravets, Anatoliy O. Pinchuk, Univ. of Colorado at Colorado Springs (USA) . . . . . [9724-10]

2:50 pm: **Detecting rare CA125-immune cell binding in ovarian cancer using plasmonic gold nanoparticles**, Lauren A. Austin, Massachusetts General Hospital (USA) and Harvard Medical School (USA) and Wellman Ctr. for Photomedicine (USA); Petra B. Krauledat, W. P. Hansen, German Gonzalez, Plasmonic Nano Particle Research (USA); Daniel W. Cramer, Brigham and Women's Hospital (USA); Conor L. Evans, Massachusetts General Hospital (USA) and Harvard Medical School (USA) . . . . . [9724-11]

3:10 pm: **Photothermal inactivation of bacteria on plasmonic nanostructures**, Gregory M. Santos, Felipe Ibanez, Fusheng Zhao, Debora Rodrigues, Wei-Chuan Shih, Univ. of Houston (USA) . . . . . [9724-12]

Coffee Break . . . . . Mon 3:30 pm to 4:00 pm

### SESSION 3

LOCATION: ROOM 3008 (WEST LEVEL 3) . . MON 4:00 PM TO 5:10 PM

### Plasmonic Imaging and Devices

Session Chair: **Krishanu Ray**, Univ. of Maryland School of Medicine (USA)

4:00 pm: **Wavelength-scanning surface plasmon resonance imaging for real-time detection of biomolecular interactions in parallel** (*Invited Paper*), Junle Qu, Yonghong Shao, Shenzhen Univ. (China) . . . . . [9724-13]

4:30 pm: **Bimodal instrumentation to improve plasmonic biodetection**, Aurore Olivéro, Lab. Charles Fabry (France) and HORIBA Scientific (France); Julien Moreau, Lab. Charles Fabry (France); Jean-François Bryche, Lab. Charles Fabry (France) and Institut d'Électronique Fondamentale (France); Raymond Gillibert, Chimie, Structures, Propriétés de Biomatériaux et d'Agents Thérapeutiques (France) and HORIBA Scientific (France); Mitraddeep Sarkar, Lab. Charles Fabry (France); Grégory Barbillon, Institut d'Électronique Fondamentale (France); Emmanuel Maillart, HORIBA Scientific (France); Marc Lamy de la Chapelle, Chimie, Structures, Propriétés de Biomatériaux et d'Agents Thérapeutiques (France); Bernard Bartenlian, Institut d'Électronique Fondamentale (France); Michael T. Canva, Lab. Charles Fabry (France) and Univ. de Sherbrooke (Canada) . . . . . [9724-14]

4:50 pm: **Time-lapse scanning surface plasmon microscopy of living adherent cells with a radially polarized beam**, Lotfi Berguiga, Laura Streppa, Elise Boyer-Provera, Francesca Ratti, Evelyne Goillot, Cristina E. Martinez-Torres, Ecole Normale Supérieure de Lyon (France); Anne Devin, Institut de Biochimie et Génétique Cellulaires (France); Laurent Schaeffer, Alain Arneodo, Françoise Argoul, Ecole Normale Supérieure de Lyon (France) . . . . . [9724-15]

# CONFERENCE 9724

LOCATION: ROOM 3008 (WEST LEVEL 3)

## POSTERS-MONDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . MON 5:30 TO 7:30 PM

Conference attendees are invited to attend the BIOS poster session on Monday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Reusable tin plasmonic nanostructures for intracellular delivery**, Alexander J. Raun, Nabiha Saklayen, Christine M. Zgrabik, Daryl I. Vulis, Marina Madrid, Evelyn L. Hu, Eric Mazur, Harvard Univ. (USA) . . . . . [9724-30]

**Enhancement of scattering from nanoparticles using substrate effect**, Krishnendu Chakraborty, Abhay K. Tiwari, Manoj M. Varma, Murugesan Venkatapathi, Indian Institute of Science (India) . . . . . [9724-31]

**Effect of atmospheric pressure plasma on antimicrobial activity of cotton fabrics dyed with Zataria multiflora Bioss**, Soudabeh Hajahmadi, Najafabad Branch, Islamic Azad Univ. (Iran, Islamic Republic of) . . . . . [9724-33]

**A novel fast speed wavelength-scanned technology in wavelength interrogation SPR imaging sensors**, Yonghong Shao, Youjun Zeng, Kaiqiang Chen, Shenzhen Univ. (China); Jianan He, Dayong Gu, Shenzhen International Travel Health Care Ctr. (China) and Research Institute of Disease Control and Prevention (China); Junle Qu, Shenzhen Univ. (China); Ho-Pui A. Ho, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . [9724-34]

**Simultaneous trapping-and-detecting surface-enhanced Raman spectroscopy by self-aligned hot-spots**, Soonwoo Hong, On Shim, Hyosung Kwon, Korea Univ. (Korea, Republic of); Yeonho Choi, Korea Univ. College of Health Sciences (Korea, Republic of) . . . . . [9724-35]

**Nano structured plasmonic devices for immunodiagnosics, multiplexed label free biosensing and imaging**, Divya Sharma, R. P. Dwivedi, Shoolini Univ. (India); Santosh Kumar, Ashish Bisht, DIT Univ. (India) . . . . . [9724-36]

**Fabrication of tunable plasmonic 3D nanostructures for SERS applications**, Ayse Ozbay, Handan Yuksel, Ramazan Solmaz, Mehmet Kahraman, Gaziantep Üniv. (Turkey) . . . . . [9724-37]

**Development of SERS substrates for immunoassay applications**, Okkes Celik, Mehmet Kahraman, Gaziantep Üniv. (Turkey) . . . . . [9724-38]

**Aptamer conjugated silver nanoparticles for the detection of interleukin 6**, Andrea K. Locke, Nicole Norwood, Haley L. Marks, Monika Schechinger, Texas A&M Univ. (USA); George W. Jackson, BioTex, Inc. (USA) and Base Pair Biotechnologies, Inc. (USA); Duncan Graham, Univ. of Strathclyde (United Kingdom); Gerard L. Cote, Texas A&M Univ. (USA) . . . . . [9724-39]

**Surface-enhanced Raman spectroscopy on metal-dielectric-metal nanohole arrays using long-range surface plasmons to produce a sustained electric field depth profile**, David Galvan, Qiuming Yu, Univ. of Washington (USA) . . . . . [9724-40]

**A high sensitive surface plasmon resonance sensor using a genetically engineered M-13 phage**, Hyerin Song, Wonguen Kim, Kyujung Kim, Jin-Woo Oh, Pusan National Univ. (Korea, Republic of) . . . . . [9724-41]

**Near-field localization by two dimensional metallic nano-post arrays with ultrashort light pulses**, Hongki Lee, Donghyun Kim, Yonsei Univ. (Korea, Republic of) . . . . . [9724-42]

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: ROOM 3008 (WEST LEVEL 3) . TUE 8:30 AM TO 10:00 AM

## Plasmonic Nanostructures and Biomedical Applications

Session Chairs: **Joseph R. Lakowicz**, Univ. of Maryland School of Medicine (USA); **Krishanu Ray**, Univ. of Maryland School of Medicine (USA)

8:30 am: **Switching and logic manipulation of droplets and dielectric nanoparticles in micro-nanofluidics system** (*Invited Paper*), Guanghui Wang, Nanjing Univ. (China); Ho-Pui A. Ho, The Chinese Univ. of Hong Kong (Hong Kong, China); Xuping Zhang, Nanjing Univ. (China) . . . . . [9724-16]

9:00 am: **Plasmonic filter array for on-chip near-infrared spectroscopy**, Erwen Li, Alan X. Wang, Oregon State Univ. (USA) . . . . . [9724-17]

9:20 am: **Novel zwitterionic non-fouling modification on plasmonic optofluidic system toward real-time therapeutic monitoring**, Fang Sun, Shaoyi Jiang, Qiuming Yu, Univ. of Washington (USA) . . . . . [9724-18]

9:40 am: **Fluorescence intensity enhancement mechanism in presence of plasmonic nanoparticles**, Sumana Das, Brahmanandam Javvaji, Krishna H. Villa, Akshata Arikady, Rohit Sali, Gopalkrishna M. Hegde, D. Roy Mahapatra, Indian Institute of Science (India) . . . . . [9724-19]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

## Nano/Biophotonics Plenary Session

TUE 10:30 AM TO 11:30 AM

LOCATION: ROOM 3002 (WEST LEVEL 3)

## Welcome and Introduction

Dan Nicolau, McGill Univ. (Canada)

## Light moves life

Halina Rubinsztein-Dunlop, Univ. of Queensland (Australia)

Light can be made to do the work. Imagine tweezers made out of light. Such optical tweezers can trap and move materials noninvasively at length scales ranging from tens of nanometers to tens of micrometers, and so have provided unprecedented access to physical, chemical and biological processes on a microscale. Since a light beam can carry angular momentum it is possible to use optical tweezers to exert torques to twist or rotate nano and microscopic objects. These optical rotors can be used to map the mechanical properties of cells. They can also be used in biotechnology and optomechanics.

Professor Rubinsztein-Dunlop is a Director of the Quantum Science Laboratory in the School of Mathematics and Physics at the University of Queensland. She obtained her PhD degree at the University of Gothenburg in Sweden. Halina's research interests are in quantum atom optics, laser micromanipulation, laser physics, linear and nonlinear high resolution spectroscopy, and nano-optics.

Lunch Break . . . . . Tue 11:30 am to 1:40 pm



SESSION 5

LOCATION: ROOM 3008 (WEST LEVEL 3) .. TUE 1:40 PM TO 3:00 PM

Plasmonics and Related Systems

Session Chairs: **Joseph R. Lakowicz**,  
Univ. of Maryland School of Medicine (USA);

**Krishanu Ray**, Univ. of Maryland School of Medicine (USA)

1:40 pm: **Photoacoustic investigation of gold nanoshells for bioimaging applications**, Krishnan Sathiyamoorthy, Eric M. Strohm, Michael C. Kolios, Ryerson Univ. (Canada). . . . . [9724-20]

2:00 pm: **Plasmonic nanohole arrays on Si-Ge heterostructures: an approach for integrated biosensors**, Lion Augel, Inga A. Fischer, Univ. Stuttgart (Germany); Andrea L. Dunbar, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland); Stefan Bechler, Audrey Berrier, Univ. Stuttgart (Germany); Dordaneh Etezadi, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Florian Hornung, Konrad Kostecki, Univ. Stuttgart (Germany); Cenk Ibrahim Ozdemir, Maria Soler, Hatice Altug, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Jörg Schulze, Univ. Stuttgart (Germany). . . [9724-22]

2:20 pm: **High quality plasmon resonance in superparamagnetic Co nanoparticles**, Vladimir P. Drachev, Hari Bhatta, Soumya Nag, Univ. of North Texas (USA); Ali E. Aliev, The Univ. of Texas at Dallas (USA) . . . . . [9724-23]

2:40 pm: **Plasmonic fano resonance sensing system using gold nanosphere and J-aggregates**, Andrew M. Fales, B. M. Crawford, Stephen John Norton, Duke Univ. (USA); D. D. Delacy, U.S. Army Edgewood Chemical Biological Ctr. (USA); Tuan Vo-Dinh, Duke Univ. (USA) . . . . . [9724-24]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

SESSION 6

LOCATION: ROOM 3008 (WEST LEVEL 3) .. TUE 3:30 PM TO 5:20 PM

Plasmonic Substrates and Devices

Session Chairs: **Wei-Chuan Shih**, Univ. of Houston (USA);  
**Michael T. Canva**, Lab. Charles Fabry (France)

3:30 pm: **High-resolution imaging of cells using metal clad waveguides (MCWG) (Invited Paper)**, Paul G. Charette, Lab. Nanotechnologies Nanosystèmes (LN2)-CNRS UMI-3463 (France) and Univ. de Sherbrooke (Canada); Thomas Söllradl, Frederic A. Banville, Lab. Nanotechnologies Nanosystèmes, CNRS UMI-3463 (France) and Univ. de Sherbrooke (Canada); Ulrike Fröhlich, Vincent Chabot, Pierre-Jean Zermatten, Univ. de Sherbrooke (Canada); Michael T. Canva, Lab. Nanotechnologies Nanosystèmes, CNRS UMI-3463 (France) and Univ. de Sherbrooke (Canada); Michel Grandbois, Univ. de Sherbrooke (Canada) . . . . . [9724-25]

4:00 pm: **Plasmon-enhanced sensing in ZnO nano-structures**, Fang Xu, Zhiwen Kang, Jiajie Chen, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . [9724-26]

4:20 pm: **Plasmonic dual-cladding fiber probe for bio-sensing with integrated parasitic effects compensation**, Papiya Dhara, Indian School of Mines (Italy) and Politecnico di Torino (India); Yu Liu, Massimo Olivero, Politecnico di Torino (Italy); Andrea Braglia, Politecnico di Torino (Italy) and OPI Photonics s.r.l. (Italy); Alberto Vallan, Guido Perrone, Politecnico di Torino (Italy). . . . . [9724-27]

4:40 pm: **Portable multichannel surface plasmon resonance imaging (SPRI) device**, Chih Han Chen, Hsin-Yuan Chuang, How-Foo Chen, National Yang-Ming Univ. (Taiwan) . . . . . [9724-28]

5:00 pm: **Trapping of plasmonic nanocrystals for surface-enhanced Raman scattering via microbubble generation on random gold nano-island substrate**, Zhiwen Kang, Fang Xu, Jiajie Chen, Ho-Pui A. Ho, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . [9724-29]

# CONFERENCE 9725

LOCATION: ROOM 3000 (WEST LEVEL 3)

Sunday–Monday 14–15 February 2016 • Proceedings of SPIE Vol. 9725

# Frontiers in Biological Detection: From Nanosensors to Systems

*Conference Chairs:* **Benjamin L. Miller**, Univ. of Rochester Medical Ctr. (USA); **Brian T. Cunningham**, Univ. of Illinois at Urbana-Champaign (USA)

*Conference Co-Chairs:* **Amos Danielli**, Bar-Ilan Univ. (Israel); **G. Logan Liu**, Univ. of Illinois at Urbana-Champaign (USA); **Sharon M. Weiss**, Vanderbilt Univ. (USA)

*Program Committee:* **Xudong Fan**, Univ. of Michigan (USA); **Laura Maria Lechuga**, Catalan Institute of Nanoscience and Nanotechnology (Spain); **Frances S. Ligler**, U.S. Naval Research Lab. (USA); **Michael J. Sailor**, Univ. of California, San Diego (USA); **Oliver G. Schmidt**, Leibniz-Institut für Festkörper- und Werkstofforschung Dresden (Germany); **Christopher C. Striemer**, Adarza BioSystems, Inc. (USA)

## SUNDAY 14 FEBRUARY

### SESSION 1

LOCATION: ROOM 3000 (WEST LEVEL 3) . . . SUN 1:30 PM TO 3:10 PM

### Cellular Analysis and Detection

Session Chair: **Benjamin L. Miller**,  
Univ. of Rochester Medical Ctr. (USA)

1:30 pm: **Cellular biosensing using optical spectroscopy** (*Invited Paper*), Adam Wax, Duke Univ. (USA) . . . . . [9725-1]

2:00 pm: **Single exosome detection in serum using microtoroid optical resonators**, Judith Su, California Institute of Technology (USA) . . . . . [9725-2]

2:20 pm: **Detection of esophageal cancer cell by photoelectrochemical Cu<sub>2</sub>O/ZnO biosensor**, Chao-Hsin Hsu, Cheng-Hsun Chu, National Chung Cheng Univ. (Taiwan); Weichung Chen, I-Chen Wu, Ming Tsang Wu, Kaohsiung Medical Univ. (Taiwan); Chie-Tong Kuo, National Sun Yat-Sen Univ. (Taiwan); Raymond Chien-Chao Tsiang, Hsiang-Chen Wang, National Chung Cheng Univ. (Taiwan) . . . . . [9725-3]

2:40 pm: **Biodynamic Doppler imaging of subcellular motion inside 3D living tissue culture and biopsies** (*Invited Paper*), David D. Nolte, Animated Dynamics, Inc. (USA) . . . . . [9725-4]

Coffee Break . . . . . Sun 3:10 pm to 3:40 pm

### SESSION 2

LOCATION: ROOM 3000 (WEST LEVEL 3) . . SUN 3:40 PM TO 5:20 PM

### Interferometry and Photonic Crystals

Session Chair: **Brian T. Cunningham**,  
Univ. of Illinois at Urbana-Champaign (USA)

3:40 pm: **Fabrication and characterization of silicon nitride directional coupler interferometer for sensing aptamer hybridization**, Kyohei Okubo, Ken Uchiyamada, Kiyoshi Asakawa, Masatoshi Yokokawa, Hiroaki Suzuki, Univ. of Tsukuba (Japan) . . . . . [9725-5]

4:00 pm: **High-sensitivity high-throughput chip based biosensor array for multiplexed detection of heavy metals**, Hai Yan, The Univ. of Texas at Austin (USA); Naimei Tang, Swapnajt Chakravarty, Omega Optics, Inc. (USA); Ray T. Chen, The Univ. of Texas at Austin (USA) and Omega Optics, Inc. (USA) . . . . . [9725-6]

4:20 pm: **Label-free detection of protein molecules secreted from an organ-on-a-chip model for drug toxicity assays**, Andres W. Morales, The Univ. of Texas at San Antonio (USA); Yu S. Zhang, Julio Aleman, Brigham and Women's Hospital (USA) and Harvard-MIT Health Sciences and Technology (USA); Parissa Alerasool, Brigham and Women's Hospital (USA) and Harvard-MIT Health Sciences and Technology (USA) and Tufts Univ. (USA); Mehmet R. Dokmeci, Ali Khademhosseini, Brigham and Women's Hospital (USA) and Harvard-MIT Health Sciences and Technology (USA) and Harvard Univ. (USA); Jing Yong Ye, The Univ. of Texas at San Antonio (USA) . . . . . [9725-7]

4:40 pm: **Preliminary measurement results of biotinylated BSA detection of a low cost optical cavity based biosensor using differential detection**, Peter Cowles, Cody Joy, Tony Bujana, DongGee Rho, Seunghyun Kim, LeTourneau Univ. (USA) . . . . . [9725-8]

5:00 pm: **A miniaturized optoelectronic system for rapid quantitative label-free detection of harmful species in food**, Ioannis Raptis, Konstantinos Misiakos, National Ctr. for Scientific Research Demokritos (Greece); Eleni Makarona, Alex Salapatas, NCSR Demokritos (Greece); Panagiota Petrou, Sotirios E. Kakabakos, National Ctr. for Scientific Research Demokritos (Greece); A. Botsialas, ThetaMetrisis S.A. (Greece); Gerhard Jobst, Jobst Technologies GmbH (Germany); Willem Haasnoot, Wageningen Univ. (Netherlands); Amadeo Fernández-Alba, Univ. de Almería (Spain); Michelle Lees, Eurofins (France); Evangelos Valamontes, Technological Educational Institute of Athens (Greece) . . . . . [9725-9]

### POSTERS-SUNDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . SUN 5:30 TO 7:00 PM

Conference attendees are invited to attend the BIOS poster session on Sunday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Graphene oxide / plasmon nanoparticles bilayers for optimized SERS detection**, Martina Banchelli, Marella de Angelis, Roberto Pini, Istituto di Fisica Applicata "Nello Carrara" (Italy); Bruno Tiribilli, Istituto dei Sistemi Complessi (Italy) and Consiglio Nazionale delle Ricerche (Italy); Gabriella Caminati, Univ. degli Studi di Firenze (Italy); Paolo Matteini, Istituto di Fisica Applicata "Nello Carrara" (Italy) . . . . . [9725-25]

## MONDAY 15 FEBRUARY

### SESSION 3

LOCATION: ROOM 3000 (WEST LEVEL 3) MON 9:00 AM TO 10:10 AM

### Plasmonics I

Session Chair: **Sharon M. Weiss**, Vanderbilt Univ. (USA)

9:00 am: **A nanoplasmonic electrical-field enhanced resonating device for detection of multiple biotargets from whole saliva, blood and serum** (*Invited Paper*), Utkan Demirci, Stanford Univ. (USA) . . . . . [9725-10]

9:30 am: **Surface enhanced Raman optical activity for characterization of aqueous protein mixtures**, Clint Perlaki, Quan Liu, Nanyang Technological Univ. (Singapore) . . . . . [9725-11]

9:50 am: **Hybrid nanoparticle-nanocup array structure with a tunable sensitivity for colorimetric biosensing**, Sujin Seo, Gang Logan Liu, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9725-12]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

# CONFERENCE 9725

LOCATION: ROOM 3000 (WEST LEVEL 3)

**SESSION 4**  
LOCATION: ROOM 3000 (WEST LEVEL 3) MON 10:40 AM TO 11:50 AM

## Plasmonics II

Session Chair: **Amos Danielli**, Bar-Ilan Univ. (Israel)

10:40 am: **Plasmonic paper: an emerging analytical platform for highly sensitive biosensors** (*Invited Paper*), Srikanth Singamaneni, Washington Univ. in St. Louis (USA) . . . . . [9725-13]

11:10 am: **Plasmonic biosensor for label-free malachite green detection**, Suyan Qiu, Fusheng Zhao, Gregg M. Santos, Wei-Chuan Shih, Univ. of Houston (USA) . . . . . [9725-14]

11:30 am: **Dual-mode bioenabled nano-plasmonic sensors for biological and chemical detection**, Xianming Kong, Kenny Squire, Yuting Xi, Paul LeDuff, Gregory L. Rorrer, Alan X. Wang, Oregon State Univ. (USA) . . . . . [9725-15]

Lunch Break . . . . . Mon 11:50 am to 1:40 pm

**SESSION 5**  
LOCATION: ROOM 3000 (WEST LEVEL 3) . . MON 1:40 PM TO 3:30 PM

## Optofluidics

Session Chair: **Sharon M. Weiss**, Vanderbilt Univ. (USA)

1:40 pm: **Optofluidic nanotweezer methods for characterizing nanoparticles and viruses** (*Invited Paper*), David Erickson, Cornell Univ. (USA) . . . . . [9725-17]

2:10 pm: **An optofluidic FRET laser using quantum dots as donor**, Qiushu Chen, Univ. of Michigan (USA); Alper Kiraz, Koç Univ. (Turkey); Xudong Fan, Univ. of Michigan (USA) . . . . . [9725-18]

2:30 pm: **Optofluidic lasers and their applications in bioanalysis** (*Invited Paper*), Xudong Fan, Univ. of Michigan (USA) . . . . . [9725-19]

3:00 pm: **Hybrid optofluidic integration** (*Invited Paper*), Holger Schmidt, Univ. of California, Santa Cruz (USA) . . . . . [9725-20]

Coffee Break . . . . . Mon 3:30 pm to 4:00 pm

**SESSION 6**  
LOCATION: ROOM 3000 (WEST LEVEL 3) . MON 4:00 PM TO 5:40 PM

## New Biosensing Methods

Session Chair: **Amos Danielli**, Bar-Ilan Univ. (Israel)

4:00 pm: **Rapid detection of interleukin-8 at sub pg/ml concentration using magnetic modulation biosensing**, Jasenka Verbarq, Orr Hadass, Paul Olivo, MagBiosense, LLC (USA); Amos Danielli, Bar-Ilan Univ. (Israel) . . . . . [9725-21]

4:20 pm: **Performance limitations of label-free sensors in molecular diagnosis using complex samples**, Manoj M. Varma, Indian Institute of Science (India) . . . . . [9725-26]

4:40 pm: **Minimizing DNA microarrays to a single molecule per spot: using zero-mode waveguide technology to obtain kinetic data for a large number of short oligonucleotide hybridisation reactions**, Jens Sobek, Hubert Rehrauer, Ralph Schlapbach, ETH Zürich (Switzerland) . . . . . [9725-22]

5:00 pm: **Novel label-free biosensing technology for monitoring of aqueous solutions**, Florian Kehl, ETH Zürich (Switzerland); Robert Bielecki, Optics Balzers AG (Liechtenstein); Stephane Follonier, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland); Denis Dorokhin, Optics Balzers AG (Liechtenstein) . . . . . [9725-23]

5:20 pm: **Thermo-optical tuning of cascaded double micro-ring resonators for dynamic range enhancement**, Prashanth R. Prasad, Shankar Kumar Selvaraja, Manoj M. Varma, Indian Institute of Science (India) . . . . . [9725-24]

## TUESDAY 16 FEBRUARY

### Nano/Biophotonics Plenary Session

TUE 10:30 AM TO 11:30 AM  
LOCATION: ROOM 3002 (WEST LEVEL 3)

### Welcome and Introduction

**Dan Nicolau**, McGill Univ. (Canada)

### Light moves life

**Halina Rubinsztein-Dunlop**, Univ. of Queensland (Australia)

Light can be made to do the work. Imagine tweezers made out of light. Such optical tweezers can trap and move materials noninvasively at length scales ranging from tens of nanometers to tens of micrometers, and so have provided unprecedented access to physical, chemical and biological processes on a microscale. Since a light beam can carry angular momentum it is possible to use optical tweezers to exert torques to twist or rotate nano and microscopic objects. These optical rotors can be used to map the mechanical properties of cells. They can also be used in biotechnology and optomechanics.

Professor Rubinsztein-Dunlop is a Director of the Quantum Science Laboratory in the School of Mathematics and Physics at the University of Queensland. She obtained her PhD degree at the University of Gothenburg in Sweden. Halina's research interests are in quantum atom optics, laser micromanipulation, laser physics, linear and nonlinear high resolution spectroscopy, and nano-optics.

**SYMPOSIUM CHAIRS:**



**Bruce J. Tromberg**  
Beckman Laser Institute,  
Univ. of California, Irvine (USA)



**Gabriela Apiou**  
Harvard Medical School,  
Wellman Ctr. for Photomedicine,  
Massachusetts General  
Hospital (USA)

SPIE Translational Research 2016 will highlight papers from BiOS that showcase the latest photonics technologies, tools, and techniques with high potential to impact healthcare.

**TOPIC AREAS:**

- Photonic Therapeutics and Diagnostics**
- Clinical Technologies and Systems**
- Tissue Optics, Laser-Tissue Interaction, and Tissue Engineering**
- Biomedical Spectroscopy, Microscopy, and Imaging**
- Nano/Biophotonics**
- Neurophotonics, Neurosurgery, and Optogenetics**

**Saturday 13 Feb. 2016**

(ordered by day and time)

**Sub-diffuse structured light imaging provides macroscopic maps of microscopic tissue structure**

Paper 9696-1 • Saturday 13 Feb. 2016, 8:00 AM  
**Stephen C. Kanick**, Thayer School of Engineering at Dartmouth (USA), et al.  
Conference 9696: Molecular-Guided Surgery: Molecules, Devices, and Applications II  
SESSION 1: Advanced Molecular Imaging Methods I

**Imaging and modeling of collagen architecture in living tissue with polarized light transfer**

Paper 9696-2 • Saturday 13 Feb. 2016, 8:30 AM  
**Jessica C. Ramella-Roman**, Florida International Univ. (USA), et al.  
Conference 9696: Molecular-Guided Surgery: Molecules, Devices, and Applications II  
SESSION 1: Advanced Molecular Imaging Methods I

**Three-photon imaging of ovarian cancer**

Paper 9689-131 • Saturday 13 Feb. 2016, 8:50 AM  
**Jennifer K. Barton**, The Univ. of Arizona (USA), et al.  
Conference 9689C: Diagnosis and Treatment of Diseases in the Breast and Reproductive System II  
SESSION 1: Gynecology

**Noncontact diffuse optical assessment of blood flow changes in head and neck free tissue transfer flaps**

Paper 9689-67 • Saturday 13 Feb. 2016, 8:50 AM  
**Guoqiang Yu**, Univ. of Kentucky (USA), et al.  
Conference 9689C: Optical Imaging, Therapeutics, and Advanced Technology in Head and Neck Surgery and Otolaryngology  
SESSION 1: Clinical and Operative Head and Neck Cancer Imaging

**Diagnosis of female genital tract melanocytic lesions based on pigment chemistry using pump-probe laser microscopy**

Paper 9689-2 • Saturday 13 Feb. 2016, 9:00 AM  
**Francisco E. Robles**, Duke Univ. (USA), et al.  
Conference 9689A: Photonics in Dermatology and Plastic Surgery  
SESSION 2: Skin Cancer I

**Laser speckle rheology**

Paper 9710-1 • Saturday 13 Feb. 2016, 9:10 AM  
**Seemantini K. Nadkarni**, Harvard Medical School (USA), et al.  
Conference 9710: Optical Elastography and Tissue Biomechanics III  
SESSION 1: Novel Methods I

**New imaging-based biomarkers for melanoma diagnosis using CARS microscopy**

Paper 9689-3 • Saturday 13 Feb. 2016, 9:20 AM  
**Hequn Wang**, Wellman Ctr. for Photomedicine (USA), et al.  
Conference 9689A: Photonics in Dermatology and Plastic Surgery  
SESSION 2: Skin Cancer I

**First clinical pilot study with intravascular polarization sensitive OCT**

Paper 9689-94 • Saturday 13 Feb. 2016, 9:30 AM  
**Martin Villiger**, Harvard Medical School (USA), et al.  
Conference 9689D: Diagnostic and Therapeutic Applications of Light in Cardiology  
SESSION 1: Advanced OCT

**4D microscope-integrated OCT improves accuracy of ophthalmic surgical maneuvers**

Paper 9693-5 • Saturday 13 Feb. 2016, 9:30 AM  
**Oscar Carrasco-Zevallos**, Duke Univ. (USA), et al.  
Conference 9693: Ophthalmic Technologies XXVI  
SESSION 2: Ophthalmic Imaging: Clinical and Surgical

**Cervical Intraepithelial Neoplasia treatment: a non-invasive translational technology**

Paper 9689-135 • Saturday 13 Feb. 2016, 9:50 AM  
**Natalia M. Inada**, Univ. de São Paulo (Brazil), et al.  
Conference 9689E: Diagnosis and Treatment of Diseases in the Breast and Reproductive System II  
SESSION 1: Gynecology

**A portable cross-shape near-infrared spectroscopic detector for bone marrow lesions diagnosis**

Paper 9689-165 • Saturday 13 Feb. 2016, 9:50 AM  
**Ting Li**, Univ. of Electronic Science and Technology of China (China), et al.  
Conference 9689F: Optics in Bone Surgery and Diagnostics  
SESSION 1: Musculoskeletal Imaging and Diagnostics I

**Intraoperative detection and elimination of microscopic tumors in head and neck**

Paper 9689-70 • Saturday 13 Feb. 2016, 9:50 AM  
**Dmitri Lapotko**, Rice Univ. (USA), et al.  
Conference 9689C: Optical Imaging, Therapeutics, and Advanced Technology in Head and Neck Surgery and Otolaryngology  
SESSION 1: Clinical and Operative Head and Neck Cancer Imaging

**Serum Raman spectroscopic classification of buccal mucosa and tongue cancers**

Paper 9704-6 • Saturday 13 Feb. 2016, 10:30 AM  
**C. Murali Krishna**, Advanced Ctr. for Treatment, Research & Education in Cancer (India), et al.  
Conference 9704: Biomedical Vibrational Spectroscopy 2016: Advances in Research and Industry  
SESSION 2: Cancer Applications I

**Defining a path for critical dosimetry measures and surrogate tools that can facilitate clinical success**

Paper 9694-4 • Saturday 13 Feb. 2016, 10:50 AM  
**Brian W. Pogue**, Thayer School of Engineering at Dartmouth (USA), et al.  
Conference 9694: Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXV  
SESSION 2: Photodynamic Therapy II

**Intraoperative assessment of breast tumor margins using a multimodal photoacoustic tomography system**

Paper 9689-137 • Saturday 13 Feb. 2016, 11:00 AM  
**Rui Li**, Purdue Univ. (USA), et al.  
Conference 9689E: Diagnosis and Treatment of Diseases in the Breast and Reproductive System II  
SESSION 2: Tumor Margin Assessment

**Blood coagulation profiling in patients using optical Thromboelastography (OTEG)**

Paper 9689-98 • Saturday 13 Feb. 2016, 11:00 AM  
**Markandey M. Tripathi**, Wellman Ctr. for Photomedicine (USA), et al.  
Conference 9689D: Diagnostic and Therapeutic Applications of Light in Cardiology  
SESSION 2: Blood



# TRANSLATIONAL RESEARCH TRACK

## Preanalytical considerations in detection of colorectal cancer in blood serum using Raman molecular imaging

Paper 9704-8 • Saturday 13 Feb. 2016, 11:10 AM

**Patrick J. Treado**, ChemImage Corp. (USA), et al.  
Conference 9704: Biomedical Vibrational Spectroscopy 2016: Advances in Research and Industry  
SESSION 2: Cancer Applications I

## In-situ photopolymerized and monitored implants: successful application to an intervertebral disc replacement

Paper 9689-168 • Saturday 13 Feb. 2016, 11:20 AM

**Andreas Schmocker**, Ecole Polytechnique Fédérale de Lausanne (Switzerland), et al.  
Conference 9689F: Optics in Bone Surgery and Diagnostics  
SESSION 2: Bone Surgery and Diagnostics

## Optical profiling of anticoagulation status

Paper 9689-99 • Saturday 13 Feb. 2016, 11:20 AM

**Diane M. Tshikudi**, Massachusetts General Hospital (USA), et al.  
Conference 9689D: Diagnostic and Therapeutic Applications of Light in Cardiology  
SESSION 2: Blood

## Targeted illumination and tracking using optical fiber probe for optogenetics application

Paper 9690-80 • Saturday 13 Feb. 2016, 11:30 AM

**Anant B. Shinde**, Nanyang Technological Univ. (Singapore), et al.  
Conference 9690C: Optogenetics and Optical Manipulation  
SESSION 15: Optogenetics and Optical Control I

## Combining large area fluorescence with multiphoton microscopy for improved detection of oral epithelial neoplasia

Paper 9701-8 • Saturday 13 Feb. 2016, 11:30 AM

**Gracie Vargas**, The Univ. of Texas Medical Branch (USA), et al.  
Conference 9701: Multimodal Biomedical Imaging XI  
SESSION 2: Multimodality Microscopy

## A compact bio-inspired visible/NIR imager for image-guided surgery

Paper 9696-9 • Saturday 13 Feb. 2016, 11:45 AM

**Viktor Gruev**, Washington Univ. in St. Louis (USA), et al.  
Conference 9696: Molecular-Guided Surgery: Molecules, Devices, and Applications II  
SESSION 2: Advanced Molecular Imaging Methods II

## In-vivo continuous monitoring of mixed venous oxygen saturation by photoacoustic transesophageal echocardiography

Paper 9689-101 • Saturday 13 Feb. 2016, 12:00 PM

**Li Li**, Harvard Medical School (USA), et al.  
Conference 9689D: Diagnostic and Therapeutic Applications of Light in Cardiology  
SESSION 2: Blood

## If I had a magic wand....A dermatology photonics wish list

Paper 9689-8 • Saturday 13 Feb. 2016, 1:20 PM

**Kristen M. Kelly**, Univ. of California, Irvine (USA), et al.  
Conference 9689A: Photonics in Dermatology and Plastic Surgery  
SESSION 4: Clinical Perspective

## First multiphoton tomography of brain in man

Paper 9690-9 • Saturday 13 Feb. 2016, 1:40 PM

**Karsten König**, Univ. des Saarlandes (Germany), et al.  
Conference 9690A: Clinical and Translational Neurophotonics  
SESSION 3: Operative and Postop Therapy I

## Photoacoustic imaging to predict photodynamic therapy efficacy

Paper 9694-9 • Saturday 13 Feb. 2016, 1:40 PM

**Srivalleesha Mallidi**, Harvard Medical School (USA), et al.  
Conference 9694: Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXV  
SESSION 3: Photodynamic Therapy III

## Acoustic radiation force optical coherence elastography

Paper 9710-8 • Saturday 13 Feb. 2016, 1:40 PM

**Zhongping Chen**, Beckman Laser Institute and Medical Clinic (USA), et al.  
Conference 9710: Optical Elastography and Tissue Biomechanics III  
SESSION 4: Novel Methods II

## Quantitative assessment of optical properties in healthy cartilage and repair tissue by optical coherence tomography and histology

Paper 9689-170 • Saturday 13 Feb. 2016, 2:00 PM

**Sanne M. A. Jansen**, Academisch Medisch Centrum (Netherlands), et al.  
Conference 9689F: Optics in Bone Surgery and Diagnostics  
SESSION 3: Musculoskeletal Imaging and Diagnostics II

## Neural networks improve brain cancer detection with Raman spectroscopy in the presence of light artifacts

Paper 9690-10 • Saturday 13 Feb. 2016, 2:00 PM

**Michael Jermyn**, Montreal Neurological Institute and Hospital (Canada), et al.  
Conference 9690A: Clinical and Translational Neurophotonics  
SESSION 3: Operative and Postop Therapy I

## Visualization of tumor vascular reactivity in response to respiratory challenges by optical coherence tomography

Paper 9689-141 • Saturday 13 Feb. 2016, 2:20 PM

**Hoon Sup Kim**, Gwangju Institute of Science and Technology (Korea, Republic of), et al.  
Conference 9689E: Diagnosis and Treatment of Diseases in the Breast and Reproductive System II  
SESSION 3: Optical Coherence Tomography and Fluorescence Imaging

## Development of low-cost devices for image-guided photodynamic therapy treatment of oral cancer in global health settings

Paper 9694-11 • Saturday 13 Feb. 2016, 2:20 PM

**Hui Liu**, Univ. of Massachusetts Boston (USA), et al.  
Conference 9694: Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXV  
SESSION 3: Photodynamic Therapy III

## Imaging of skin surface architecture with out of plane polarimetry

Paper 9689-11 • Saturday 13 Feb. 2016, 2:30 PM

**Jessica C. Ramella-Roman**, Florida International Univ. (USA), et al.  
Conference 9689A: Photonics in Dermatology and Plastic Surgery  
SESSION 5: Wide-Field Imaging I

## Raman spectroscopy of oral cancer: investigations in pet canines

Paper 9704-12 • Saturday 13 Feb. 2016, 2:30 PM

**C. Murali Krishna**, Advanced Ctr. for Treatment, Research & Education in Cancer (India), et al.  
Conference 9704: Biomedical Vibrational Spectroscopy 2016: Advances in Research and Industry  
SESSION 3: Cancer Applications II

## Reliability analysis of instrument design of noninvasive bone marrow disease detector

Paper 9689-172 • Saturday 13 Feb. 2016, 2:40 PM

Univ. of Electronic Science and Technology of China (China), et al.  
Conference 9689F: Optics in Bone Surgery and Diagnostics  
SESSION 3: Musculoskeletal Imaging and Diagnostics II

## In vivo optical coherence tomography (OCT) examination of living kidney

Paper 9689-57 • Saturday 13 Feb. 2016, 2:40 PM

**Zheng Huang**, Fujian Normal Univ. (China), et al.  
Conference 9689B: Therapeutics and Diagnostics in Urology  
SESSION 3: Tissue imaging

## Porphyin lipid nanoparticles for enhanced photothermal therapy (PTT) in a patient-derived orthotopic pancreas xenograft cancer model

Paper 9696-14 • Saturday 13 Feb. 2016, 3:15 PM

Univ. Health Network (Canada), et al.  
Conference 9696: Molecular-Guided Surgery: Molecules, Devices, and Applications II  
SESSION 3: Molecular Contrast Agents

## Redox subpopulations and the risk of breast cancer progression

Paper 9689-145 • Saturday 13 Feb. 2016, 3:30 PM

**Lin Z. Li**, The Univ. of Pennsylvania Health System (USA), et al.  
Conference 9689E: Diagnosis and Treatment of Diseases in the Breast and Reproductive System II  
SESSION 4: Breast Cancer

## Fiber-based tissue identification for electrode placement in deep brain stimulation neurosurgery

Paper 9690-15 • Saturday 13 Feb. 2016, 3:50 PM

**Damon T. DePaoli**, Institut Univ. en Santé Mentale de Québec (Canada), et al.  
Conference 9690A: Clinical and Translational Neurophotonics  
SESSION 4: Operative and Postop Therapy II

## Combination photodynamic therapy using 5-fluorouracil and aminolevulinic acid enhances tumor-selective production of protoporphyrin IX and improves treatment efficacy of squamous skin cancers

Paper 9694-18 • Saturday 13 Feb. 2016, 3:50 PM

**Edward V. Maytin**, Cleveland Clinic Lerner Research Institute (USA), et al.  
Conference 9694: Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXV  
SESSION 4: Photodynamic Therapy IV

## Raman spectroscopy and oral exfoliative cytology: investigating misclassifications between contralateral normal and tumor sites

Paper 9689-81 • Saturday 13 Feb. 2016, 4:00 PM

**C. Murali Krishna**, Advanced Ctr. for Treatment, Research & Education in Cancer (India), et al.  
Conference 9689C: Optical Imaging, Therapeutics, and Advanced Technology in Head and Neck Surgery and Otolaryngology  
SESSION 3: Endocrine Imaging and Spectroscopy

## Assessing idiopathic pulmonary fibrosis with bronchoscopic optical coherence tomography

Paper 9691-43 • Saturday 13 Feb. 2016, 4:00 PM

**Lida P. Hariri**, Massachusetts General Hospital (USA), et al.  
Conference 9691B: Optical Techniques in Pulmonary Medicine III  
SESSION 11: New Techniques for Clinical Imaging

# TRANSLATIONAL RESEARCH TRACK

## Tissue-simulating phantoms for testing pretreatment planning of photodynamic therapy with optical flap

Paper 9700-16 • Saturday 13 Feb. 2016, 4:10 PM  
**Gal Shafirstein**, Roswell Park Cancer Institute (USA), et al.  
Conference 9700: Design and Quality for Biomedical Technologies IX  
SESSION 4: Phantom Technologies

## Combination strategy in photodynamic therapy of skin diseases

Paper 9694-14 • Saturday 13 Feb. 2016, 4:20 PM  
**Zheng Huang**, Fujian Normal Univ. (China), et al.  
Conference 9694: Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXV  
SESSION 4: Photodynamic Therapy IV

## Bioluminescence tomography-guided system for preclinical radiation research

Paper 9701-18 • Saturday 13 Feb. 2016, 4:20 PM  
**Ken Kang-Hsin Wang**, Johns Hopkins Univ. (USA), et al.  
Conference 9701: Multimodal Biomedical Imaging XI  
SESSION 4: Preclinical/Hybrid Imaging

## Intraoperative brain hemodynamic response assessment with real-time hyperspectral optical imaging

Paper 9690-17 • Saturday 13 Feb. 2016, 4:30 PM  
**Audrey Laurence**, Ecole Polytechnique de Montréal (Canada), et al.  
Conference 9690A: Clinical and Translational Neurophotonics  
SESSION 4: Operative and Postop Therapy II

## Analysis of the variation in OCT measurements of a structural bottle neck for eye-brain transfer of visual information from 3D-volumes of the optic nerve head, PIMD(0-2pi)

Paper 9693-23 • Saturday 13 Feb. 2016, 4:30 PM  
**Per G. Söderberg**, Uppsala Univ. (Sweden), et al.  
Conference 9693: Ophthalmic Technologies XXVI  
SESSION 5: Ophthalmic Image Processing and Analysis

## Design and validation of the ball lens-based intravascular catheter for fluorescence lifetime imaging microscopy of atherosclerosis

Paper 9689-109 • Saturday 13 Feb. 2016, 4:40 PM  
**Xi Chen**, Texas A&M Univ. (USA), et al.  
Conference 9689D: Diagnostic and Therapeutic Applications of Light in Cardiology  
SESSION 4: Photacoustics and Spectroscopy

## Using polarization-sensitive optical coherence tomography to identify tumor stromal fibrosis and increase tumor biopsy yield

Paper 9691-45 • Saturday 13 Feb. 2016, 4:40 PM  
**Lida P. Hariri**, Massachusetts General Hospital (USA), et al.  
Conference 9691B: Optical Techniques in Pulmonary Medicine III  
SESSION 11: New Techniques for Clinical Imaging

## Intravascular diagnosis by a dual modality imaging system combining optical frequency domain imaging (OFDI) and intravascular ultrasound imaging (IVUS)

Paper 9701-19 • Saturday 13 Feb. 2016, 4:40 PM  
**Jian Ren**, Wellman Ctr. for Photomedicine (USA), et al.  
Conference 9701: Multimodal Biomedical Imaging XI  
SESSION 4: Preclinical/Hybrid Imaging

## Goggle augmented imaging and navigation system (GAINS) for real-time fluorescence image-guided oncologic surgery

Paper 9696-17 • Saturday 13 Feb. 2016, 4:45 PM  
**Suman B. Mondal**, Washington Univ. in St. Louis (USA), et al.  
Conference 9696: Molecular-Guided Surgery: Molecules, Devices, and Applications II  
SESSION 4: Imaging Systems

## Localization analysis of lipid core plaques detected by a near infrared spectroscopy system as compared to histological finding: intracoronary imaging application

Paper 9689-110 • Saturday 13 Feb. 2016, 5:00 PM  
**Zhihua He**, InfraReDx, Inc. (USA), et al.  
Conference 9689D: Diagnostic and Therapeutic Applications of Light in Cardiology  
SESSION 4: Photacoustics and Spectroscopy

## Multimodal ophthalmic imaging using swept source spectrally encoded scanning laser ophthalmoscopy and optical coherence tomography

Paper 9693-25 •  
**Joseph Malone**, Cleveland Clinic (USA), et al.  
Conference 9693: Ophthalmic Technologies XXVI  
SESSION 6: Ophthalmic OCT and SLO Technology

## Thermal outlining using focused ultrasound (TOFU) with reversible temperature sensitive fluorescent probes

Paper 9701-20 • Saturday 13 Feb. 2016, 5:00 PM  
**Tiffany C. Kwong**, Univ. of California, Irvine (USA), et al.  
Conference 9701: Multimodal Biomedical Imaging XI  
SESSION 4: Preclinical/Hybrid Imaging

## Fluorescence guided lymph node biopsy in large animals using direct image projection device

Paper 9696-19 • Saturday 13 Feb. 2016, 5:15 PM  
**Walter J. Akers**, Washington Univ. School of Medicine in St. Louis (USA), et al.  
Conference 9696: Molecular-Guided Surgery: Molecules, Devices, and Applications II  
SESSION 4: Imaging Systems

## Home-use cancer detecting plaster

Paper 9694-17 • Saturday 13 Feb. 2016, 5:20 PM  
**Zeev Zalevsky**, Bar-Ilan Univ. (Israel), et al.  
Conference 9694: Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXV  
SESSION 4: Photodynamic Therapy IV

## Intraoperative vascular imaging with augmented microscopy

Paper 9696-20 • Saturday 13 Feb. 2016, 5:30 PM  
**Jeffrey R. Watson**, The Univ. of Arizona (USA), et al.  
Conference 9696: Molecular-Guided Surgery: Molecules, Devices, and Applications II  
SESSION 4: Imaging Systems

## Sunday 14 Feb. 2016

### Fluorophore-conjugated antibodies for imaging and resection of GI tumors

Paper 9696-22 • Sunday 14 Feb. 2016, 8:00 AM  
**Michael Bouvet**, Univ. of California, San Diego (USA), et al.  
Conference 9696: Molecular-Guided Surgery: Molecules, Devices, and Applications II  
SESSION 5: Preclinical Applications and Clinical Translation I

## Fluorescence-guided tumor visualization using a custom designed NIR attachment to a surgical microscope for high sensitivity imaging

Paper 9690-13 • Sunday 14 Feb. 2016, 8:10 AM  
**David S. Kittle**, Cedars-Sinai Medical Ctr. (USA), et al.  
Conference 9690A: Clinical and Translational Neurophotonics  
SESSION 5: Operative and Postop Therapy III

## Multimodal in vivo imaging of lung cancer and its microenvironment

Paper 9691-47 • Sunday 14 Feb. 2016, 8:30 AM  
**Lida P. Hariri**, Massachusetts General Hospital (USA), et al.  
Conference 9691B: Optical Techniques in Pulmonary Medicine III  
SESSION 12: New Approaches, Advancements and Techniques

## Optical coherence tomography imaging to analyze biofilm thickness from distal to proximal regions of endotracheal tubes

Paper 9691-48 • Sunday 14 Feb. 2016, 8:50 AM  
**Robert E. Dunn**, Univ. of California, Irvine (USA), et al.  
Conference 9691B: Optical Techniques in Pulmonary Medicine III  
SESSION 12: New Approaches, Advancements and Techniques

## Photodynamic therapy for targeting extracellular biophysical regulators of tumor growth and invasive behavior in pancreatic cancer

Paper 9694-13 • Sunday 14 Feb. 2016, 8:50 AM  
**Jonathan P. Celli**, Univ. of Massachusetts Boston (USA), et al.  
Conference 9694: Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXV  
SESSION V: Photodynamic Therapy V

## Development of multifunctional optical coherence tomography and application to mouse myocardial infarction model in vivo

Paper 9689-115 • Sunday 14 Feb. 2016, 9:00 AM  
**Sun-Joo Jang**, KAIST (Korea, Republic of), et al.  
Conference 9689D: Diagnostic and Therapeutic Applications of Light in Cardiology  
SESSION 5: Myocardium

## Optical coherence tomography based microangiography in dermatology applications

Paper 9689-20 • Sunday 14 Feb. 2016, 9:00 AM  
**Ruikang K. Wang**, Univ. of Washington (USA), et al.  
Conference 9689A: Photonics in Dermatology and Plastic Surgery  
SESSION 9: OCT

## Comparison of performance of mobile and traditional colposcopy in high- and low-resource settings

Paper 9699-22 • Sunday 14 Feb. 2016, 9:00 AM  
**David Levitz**, MobileODT Ltd. (Israel), et al.  
Conference 9699: Optics and Biophotonics in Low-Resource Settings II  
SESSION 6: Translational Research I: Microscopy Plus White Light Imaging

## Fiber-Bragg-grating-array MHz range optical coherence tomography

Paper 9720-21 • Sunday 14 Feb. 2016, 9:00 AM  
**Roman V. Kuranov**, Wasatch Photonics, Inc. (USA), et al.  
Conference 9720: High-Speed Biomedical Imaging and Spectroscopy: Toward Big Data Instrumentation and Management  
SESSION 5: 4D Imaging

# TRANSLATIONAL RESEARCH TRACK

## **Vitamin D for combination photodynamic therapy of skin cancer in individuals with vitamin D deficiency: Insights from a preclinical study in a mouse model of squamous cell carcinoma**

Paper 9694-19 • Sunday 14 Feb. 2016, 9:10 AM  
**Sanjay Anand**, Cleveland Clinic Lerner Research Institute (USA), et al.  
Conference 9694: Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXV  
SESSION V: Photodynamic Therapy V

## **Direct administration of nerve-specific fluorophores to guide nerve-sparing radical prostatectomy**

Paper 9696-25 • Sunday 14 Feb. 2016, 9:15 AM  
**Connor Barth**, Oregon Health & Science Univ. (USA), et al.  
Conference 9696: Molecular-Guided Surgery: Molecules, Devices, and Applications II  
SESSION 5: Preclinical Applications and Clinical Translation I

## **Field-testing of a cost-effective mobile-phone based microscope for screening of Schistosoma haematobium**

Paper 9699-23 • Sunday 14 Feb. 2016, 9:20 AM  
**Hatice Ceylan Koydemir**, Univ. of California, Los Angeles (USA), et al.  
Conference 9699: Optics and Biophotonics in Low-Resource Settings II  
SESSION 6: Translational Research I: Microscopy Plus White Light Imaging

## **Design and validation of a near-infrared fluorescence endoscope for detection of early oesophageal malignancy using a targeted imaging probe**

Paper 9698-2 • Sunday 14 Feb. 2016, 9:30 AM  
**Dale J. Waterhouse**, Univ. of Cambridge (United Kingdom), et al.  
Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
SESSION : Fluorescence and Raman Detection Systems I

## **Adapting biomodulatory approaches to enhance photodynamic therapy outcomes in new contexts: pancreatic and oral cancers**

Paper 9694-21 • Sunday 14 Feb. 2016, 9:50 AM  
**Sriram R. Anbil**, Harvard Medical School (USA), et al.  
Conference 9694: Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXV  
SESSION V: Photodynamic Therapy V

## **Tethered capsule OCT endomicroscopy: from bench to bedside at the primary care office**

Paper 9691-1 • Sunday 14 Feb. 2016, 10:30 AM  
CNRS (France), et al.  
Conference 9691A: Endoscopic Microscopy XI  
SESSION 2: OCT I

## **A novel automated instrument designed to determine photosensitivity thresholds**

Paper 9693-35 • Sunday 14 Feb. 2016, 10:30 AM  
**Mariela C. Aguilar**, Bascom Palmer Eye Institute (USA), et al.  
Conference 9693: Ophthalmic Technologies XXVI  
SESSION 8: Vision Assessment and Correction

## **Label-free vibrational stark imaging of neuronal membrane potential**

Paper 9712-4 • Sunday 14 Feb. 2016, 10:30 AM  
**Ji-Xin Cheng**, Purdue Univ. (USA), et al.  
Conference 9712: Multiphoton Microscopy in the Biomedical Sciences XVI  
SESSION 2: Biomedical Applications of Coherent Raman I

## **In vivo detection of oral epithelial cancer using endogenous fluorescence lifetime imaging: a pilot human study**

Paper 9698-4 • Sunday 14 Feb. 2016, 10:40 AM  
**Javier A. Jo**, Texas A&M Univ. (USA), et al.  
Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
SESSION : Fluorescence and Raman Detection Systems II

## **Initial clinical testing of a multi-spectral imaging system built on a smartphone platform**

Paper 9699-26 • Sunday 14 Feb. 2016, 10:50 AM  
**David Levitz**, MobileODT Ltd. (Israel), et al.  
Conference 9699: Optics and Biophotonics in Low-Resource Settings II  
SESSION 7: Translational Research II: New Technologies and Implementations

## **Broadband rotary joint for high speed ultrahigh resolution endoscopic OCT imaging**

Paper 9691-3 • Sunday 14 Feb. 2016, 11:10 AM  
**Milad Alemohammad**, Johns Hopkins Univ. (USA), et al.  
Conference 9691A: Endoscopic Microscopy XI  
SESSION 2: OCT I

## **Quantitative wound healing studies using a portable, low-cost, hand-held near-infrared optical scanner: preliminary sensitivity and specificity analysis**

Paper 9699-27 • Sunday 14 Feb. 2016, 11:10 AM  
**Anuradha Godavarty**, Florida International Univ. (USA), et al.  
Conference 9699: Optics and Biophotonics in Low-Resource Settings II  
SESSION 7: Translational Research II: New Technologies and Implementations

## **Illumination-parameter adjustable and illumination-distribution visible LED helmet for low-level light therapy on brain injury**

Paper 9700-27 • Sunday 14 Feb. 2016, 11:10 AM  
**Ting Li**, Univ. of Electronic Science and Technology of China (China), et al.  
Conference 9700: Design and Quality for Biomedical Technologies IX  
SESSION 6: Design of Biomedical Imaging Technologies

## **Raman and surface-enhanced Raman spectroscopy for renal condition monitoring**

Paper 9704-25 • Sunday 14 Feb. 2016, 11:10 AM  
**Wei-Chuan Shih**, Univ. of Houston (USA), et al.  
Conference 9704: Biomedical Vibrational Spectroscopy 2016: Advances in Research and Industry  
SESSION 6: Non-Cancer Applications II

## **Minimum energy and fiber diameter requirements for safe photoacoustic guidance of endonasal neurosurgeries**

Paper 9708-11 • Sunday 14 Feb. 2016, 11:15 AM  
**Muyinatu A. Lediju Bell**, Johns Hopkins Univ. (USA), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 2: Image Guidance for Surgery, Therapy and Biopsy

## **Visualization and characterization of the acoustic radiation force assisted displacement of particles using an OCT technique**

Paper 9707-8 • Sunday 14 Feb. 2016, 11:30 AM  
**Marjan Razani**, Ryerson Univ. (Canada), et al.  
Conference 9707: Dynamics and Fluctuations in Biomedical Photonics XIII  
SESSION 2: OCT Plus Speckle Imaging

## **Laser ablation of basal cell carcinomas guided by confocal microscopy**

Paper 9689-26 • Sunday 14 Feb. 2016, 11:40 AM  
**Heidy Sierra**, Memorial Sloan-Kettering Cancer Cent. (USA), et al.  
Conference 9689A: Photonics in Dermatology and Plastic Surgery  
SESSION 10: Therapeutics

## **Optical extended depth of focus lens design for children myopia control**

Paper 9693-40 • Sunday 14 Feb. 2016, 11:45 AM  
**Zeev Zalevsky**, Bar-Ilan Univ. (Israel), et al.  
Conference 9693: Ophthalmic Technologies XXVI  
SESSION 8: Vision Assessment and Correction

## **Volumetric optoacoustic monitoring of endovenous laser treatments**

Paper 9708-13 • Sunday 14 Feb. 2016, 11:45 AM  
**Thomas F. Fehm**, Technische Univ. München (Germany), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 2: Image Guidance for Surgery, Therapy and Biopsy

## **Photodynamic therapy for skin rejuvenation**

Paper 9689-28 • Sunday 14 Feb. 2016, 12:20 PM  
**Zheng Huang**, Fujian Normal Univ. (China), et al.  
Conference 9689A: Photonics in Dermatology and Plastic Surgery  
SESSION 10: Therapeutics

## **A novel piezoelectric microstage with embedded sensor for dual axes confocal endomicroscopy**

Paper 9691-5 • Sunday 14 Feb. 2016, 1:20 PM  
**Jongsoo Choi**, Univ. of Michigan (USA), et al.  
Conference 9691A: Endoscopic Microscopy XI  
SESSION 3: Confocal and Multimodality Imaging

## **Biological elements carry out optical tasks in coherent imaging systems**

Paper 9717-29 • Sunday 14 Feb. 2016, 1:20 PM  
**Pietro Ferraro**, Istituto di Scienze applicata e Sistemi Intelligenti (Italy), et al.  
Conference 9717: Adaptive Optics and Wavefront Control for Biological Systems II  
SESSION 9: Focusing Light Through Scattering Tissues III

## **Diffuse optical measurements of head and neck tumor hemodynamics for early prediction of radiation therapy**

Paper 9698-8 • Sunday 14 Feb. 2016, 1:40 PM  
**Guoqiang Yu**, Univ. of Kentucky (USA), et al.  
Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
SESSION : Optical Detection and Sensing Technologies

## **Intraoperative stimulated Raman scattering microscopy for guidance during brain tumor surgery**

Paper 9712-10 • Sunday 14 Feb. 2016, 1:45 PM  
**Daniel A. Orringer**, Univ. of Michigan Health System (USA), et al.  
Conference 9712: Multiphoton Microscopy in the Biomedical Sciences XVI  
SESSION 3: Biomedical Applications of Coherent Raman II

## **Handheld reflectance confocal endomicroscope for imaging of the oral cavity**

Paper 9700-30 • Sunday 14 Feb. 2016, 1:50 PM  
**Kristen Carlson Maitland**, Texas A&M University (USA), et al.  
Conference 9700: Design and Quality for Biomedical Technologies IX  
SESSION 7: Biomedical Imaging Technologies II

# TRANSLATIONAL RESEARCH TRACK

## **A prospective cohort: probe based confocal laser endomicroscopy for peripheral pulmonary lesions**

Paper 9691-7 • Sunday 14 Feb. 2016, 2:00 PM  
**Yuji Matsumoto**, National Cancer Ctr. Hospital East (Japan), et al.  
Conference 9691A: Endoscopic Microscopy XI  
SESSION 3: Confocal and Multimodality Imaging

## **Prostate cancer characterization by optical contrast enhanced photoacoustics**

Paper 9708-16 • Sunday 14 Feb. 2016, 2:00 PM  
**Guan Xu**, Univ. of Michigan Medical School (USA), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 3: Endoscopy and High Resolution Imaging

## **Estimating needle-tissue interaction forces for hollow needles using fiber Bragg grating sensors**

Paper 9702-29 • Sunday 14 Feb. 2016, 2:10 PM  
**Saurabh Kumar**, Indian Institute of Science (India), et al.  
Conference 9702: Optical Fibers and Sensors for Medical Diagnostics and Treatment Applications XVI  
SESSION 7: Sensors: Grating

## **Space travel thins skin as multiphoton tomography shows**

Paper 9689-30 • Sunday 14 Feb. 2016, 2:20 PM  
**Karsten König**, Univ. des Saarlandes (Germany), et al.  
Conference 9689A: Photonics in Dermatology and Plastic Surgery  
SESSION 11: Optical Microscopy I

## **Performance of combined OCT/MFI microendoscope for ovarian cancer detection**

Paper 9691-8 • Sunday 14 Feb. 2016, 2:20 PM  
**Molly Keenan**, The Univ. of Arizona (USA), et al.  
Conference 9691A: Endoscopic Microscopy XI  
SESSION 3: Confocal and Multimodality Imaging

## **Characterizing intestinal strictures with acoustic resolution photoacoustic microscopy**

Paper 9708-18 • Sunday 14 Feb. 2016, 2:30 PM  
**Guan Xu**, Univ. of Michigan Medical School (USA), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 3: Endoscopy and High Resolution Imaging

## **Two-photon autofluorescence/FLIM/SHG endoscopy to study the oral cavity and wound healing in humans**

Paper 9691-9 • Sunday 14 Feb. 2016, 2:40 PM  
**Karsten König**, Univ. des Saarlandes (Germany), et al.  
Conference 9691A: Endoscopic Microscopy XI  
SESSION 3: Confocal and Multimodality Imaging

## **Biodynamic Doppler imaging of subcellular motion inside 3D living tissue culture and biopsies**

Paper 9725-4 • Sunday 14 Feb. 2016, 2:40 PM  
**David D. Nolte**, Animated Dynamics, Inc. (USA), et al.  
Conference 9725: Frontiers in Biological Detection: From Nanosensors to Systems  
SESSION 1: Cellular Analysis and Detection

## **Intraoperative optical imaging of peritoneal carcinomatosis of colorectal origin using a vegfr-targeted fluorescent tracer: results of the hi-light study, a first in human imaging study**

Paper 9696-35 • Sunday 14 Feb. 2016, 2:45 PM  
**Marjory Koller**, Univ. Medical Ctr. Groningen (Netherlands), et al.  
Conference 9696: Molecular-Guided Surgery: Molecules, Devices, and Applications II  
SESSION 7: Clinical Applications

## **Mechanistic exploration of a bi-directional photochemotherapeutic combination for pancreatic cancer**

Paper 9694-30 • Sunday 14 Feb. 2016, 3:30 PM  
**Huang-Chiao Huang**, Massachusetts General Hospital (USA), et al.  
Conference 9694: Optical Methods for Tumor Treatment and Detection: Mechanisms and Techniques in Photodynamic Therapy XXV  
SESSION 8: Photodynamic Therapy VIII

## **Rapid diagnostic imaging and pathologic evaluation of surgical tissue using video rate structured illumination microscopy (VR-SIM)**

Paper 9698-12 • Sunday 14 Feb. 2016, 3:30 PM  
**Mei Wang**, Tulane Univ. (USA), et al.  
Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
SESSION : Microscopy and Imaging Technologies

## **Optoacoustic measurements of human placenta and umbilical cord blood oxygenation**

Paper 9708-21 • Sunday 14 Feb. 2016, 3:45 PM  
**Rinat O. Esenaliev**, The Univ. of Texas Medical Branch (USA), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 4: Preclinical Applications

## **Clinical use of a portable dual microscope system for smartphone**

Paper 9698-13 • Sunday 14 Feb. 2016, 3:50 PM  
**Cristina Kurachi**, Univ. de São Paulo (Brazil), et al.  
Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
SESSION : Microscopy and Imaging Technologies

## **Dispersion-based stimulated Raman scattering spectroscopy, holography, and optical coherence tomography**

Paper 9712-16 • Sunday 14 Feb. 2016, 3:55 PM  
**Francisco E. Robles**, Duke Univ. (USA), et al.  
Conference 9712: Multiphoton Microscopy in the Biomedical Sciences XVI  
SESSION 4: Coherent Raman Technical Development

## **Translation of integrated OCT/US system for cardiovascular imaging**

Paper 9700-35 • Sunday 14 Feb. 2016, 4:00 PM  
**Zhongping Chen**, University of California, Irvine (USA), et al.  
Conference 9700: Design and Quality for Biomedical Technologies IX  
SESSION 8: Translational Technology

## **Photoacoustic sensing of erythrocyte programmed cell death (eryptosis) for monitor cancer response to treatment**

Paper 9708-22 • Sunday 14 Feb. 2016, 4:00 PM  
**Muhannad Fadhel**, Ryerson Univ. (Canada), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 4: Preclinical Applications

## **Wide-field optical assessment of wounds using spatial frequency domain imaging (SFDI)**

Paper 9698-14 • Sunday 14 Feb. 2016, 4:10 PM  
**Amaan Mazhar**, Modulated Imaging, Inc. (USA), et al.  
Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
SESSION : Microscopy and Imaging Technologies

## **Clinical utility of endoscopic OCT: recent advances and future directions**

Paper 9700-36 • Sunday 14 Feb. 2016, 4:30 PM  
**Melissa Suter**, Harvard University (USA), et al.  
Conference 9700: Design and Quality for Biomedical Technologies IX  
SESSION 8: Translational Technology

## **Electric field mapping and dosimetry by means of spontaneous and coherent Raman microspectroscopy**

Paper 9712-19 • Sunday 14 Feb. 2016, 4:40 PM  
**Erwan Capitaine**, XLIM Institut de Recherche (France), et al.  
Conference 9712: Multiphoton Microscopy in the Biomedical Sciences XVI  
SESSION 4: Coherent Raman Technical Development

## **Lanthanum fluoride nanoparticles for radiosensitization of tumors**

Paper 9722-31 • Sunday 14 Feb. 2016, 4:40 PM  
**Jay L. Nadeau**, California Institute of Technology (USA), et al.  
Conference 9722: Colloidal Nanoparticles for Biomedical Applications XI  
SESSION 4: Interaction of Nanoparticles with Cells

## **Parafoveal retinal cone mosaic imaging in children with ultra-compact switchable SLO/OCT handheld probe**

Paper 9693-52 • Sunday 14 Feb. 2016, 4:45 PM  
**Francesco LaRocca**, Duke Univ. (USA), et al.  
Conference 9693: Ophthalmic Technologies XXVI  
SESSION 10: Adaptive Optics and Cellular Imaging

## **Characterizing intraocular tumors with physio-chemical photoacoustics**

Paper 9708-27 • Sunday 14 Feb. 2016, 5:15 PM  
**Guan Xu**, Univ. of Michigan Medical School (USA), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 4: Preclinical Applications

## **Large area 3-D optical coherence tomography imaging of lumpectomy specimens for radiation treatment planning**

Paper 9689-151 • Sunday 14 Feb. 2016, 5:30 PM  
**Mark C. Pierce**, Rutgers, The State Univ. of New Jersey (USA), et al.  
Conference 9689E: Diagnosis and Treatment of Diseases in the Breast and Reproductive System II  
SESSION PSun: Posters-Sunday

## **The lavender procedure: how we do it**

Paper 9689-157 • Sunday 14 Feb. 2016, 5:30 PM  
**Phillip Bretz**, The Visionary Breast Ctr. (USA), et al.  
Conference 9689E: Diagnosis and Treatment of Diseases in the Breast and Reproductive System II  
SESSION PSun: Posters-Sunday

## **A fiber-delivered optoacoustic guide for precise breast-conserving surgery**

Paper 9689-158 • Sunday 14 Feb. 2016, 5:30 PM  
**Ji-Xin Cheng**, Purdue Univ. (USA), et al.  
Conference 9689E: Diagnosis and Treatment of Diseases in the Breast and Reproductive System II  
SESSION PSun: Posters-Sunday



## Monday 15 Feb. 2016

### Metal-clad waveguide characterization for contact-based light transmission into tissue

Paper 9689-40 • Sunday 14 Feb. 2016, 5:30 PM  
**Jeff A. Chini**, Univ. of Missouri (USA), et al.  
 Conference 9689A: Photonics in Dermatology and Plastic Surgery  
 SESSION PSun: Posters-Sunday

### Safety and efficacy of photo modulation therapy for weight loss

Paper 9695-19 • Sunday 14 Feb. 2016, 5:30 PM  
**Ambereen Ahmed**, A&M Assorted Therapy, LLC (USA), et al.  
 Conference 9695: Mechanisms of Photobiomodulation Therapy XI  
 SESSION PSun: Posters-Sunday

### Intraoperative autofluorescence imaging of parathyroid gland using DSLR camera

Paper 9698-45 • Sunday 14 Feb. 2016, 5:30 PM  
**Yeh-Chan Ahn**, Pukyong National Univ. (Korea, Republic of), et al.  
 Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
 SESSION : Posters-Sunday

### Imaging of the median nerve neuropathy by optical coherence tomography in rabbits

Paper 9698-47 • Sunday 14 Feb. 2016, 5:30 PM  
**Yeh-Chan Ahn**, Pukyong National Univ. (Korea, Republic of), et al.  
 Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
 SESSION : Posters-Sunday

### Spectral aspects of noninvasive diagnostic melanoma imaging

Paper 9698-48 • Sunday 14 Feb. 2016, 5:30 PM  
**Daniel S. Gareau**, The Rockefeller Univ. (USA), et al.  
 Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
 SESSION : Posters-Sunday

### Melanoma detection using a mobile phone app

Paper 9699-30 • Sunday 14 Feb. 2016, 5:30 PM  
**Karin M. Ennser**, Swansea Univ. (United Kingdom), et al.  
 Conference 9699: Optics and Biophotonics in Low-Resource Settings II  
 SESSION PSun: Posters-Sunday

### Shed a light of wireless technology on portable/mobile design of NIRS

Paper 9699-31 • Sunday 14 Feb. 2016, 5:30 PM  
**Ting Li**, Univ. of Electronic Science and Technology of China (China), et al.  
 Conference 9699: Optics and Biophotonics in Low-Resource Settings II  
 SESSION PSun: Posters-Sunday

### Towards improved image reconstruction in breast diffuse optical tomography using compressed sensing: a comparative study among lp (0 ≤ p ≤ 2) sparsity regularizations

Paper 9700-41 • Sunday 14 Feb. 2016, 5:30 PM  
**Feng Gao**, Tianjin Univ. (China), et al.  
 Conference 9700: Design and Quality for Biomedical Technologies IX  
 SESSION PSun: Posters-Sunday

### Speckle contrast diffuse correlation tomography for flow contrast imaging of complex turbid media

Paper 9701-23 • Sunday 14 Feb. 2016, 5:30 PM  
**Guoqiang Yu**, Univ. of Kentucky (USA), et al.  
 Conference 9701: Multimodal Biomedical Imaging XI  
 SESSION PSun: Posters-Sunday

### Noncontact diffuse correlation tomography of human breast tumor

Paper 9701-24 • Sunday 14 Feb. 2016, 5:30 PM  
**Guoqiang Yu**, Univ. of Kentucky (USA), et al.  
 Conference 9701: Multimodal Biomedical Imaging XI  
 SESSION PSun: Posters-Sunday

### Multi-spectral, heterodyne frequency-domain diffuse optical tomography with surface profilometry for breast cancer imaging

Paper 9701-35 • Sunday 14 Feb. 2016, 5:30 PM  
**Han Y. Ban**, Univ. of Pennsylvania (USA), et al.  
 Conference 9701: Multimodal Biomedical Imaging XI  
 SESSION PSun: Posters-Sunday

### In vivo photoacoustic imaging in rabbit tumor models

Paper 9708-101 • Sunday 14 Feb. 2016, 5:30 PM  
**Yeh-Chan Ahn**, Pukyong National Univ. (Korea, Republic of), et al.  
 Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
 SESSION PSun: Posters-Sunday

### A broadband PVDF-based hydrophone with integrated readout circuit for intravascular photoacoustic imaging

Paper 9708-108 • Sunday 14 Feb. 2016, 5:30 PM  
**Verya Daeichin**, Erasmus MC (Netherlands), et al.  
 Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
 SESSION PSun: Posters-Sunday

### Planar waveguide light transmission modality for backward-mode photoacoustic tomography

Paper 9708-110 • Sunday 14 Feb. 2016, 5:30 PM  
**Mason W. Schellenberg**, Univ. of Missouri (USA), et al.  
 Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
 SESSION PSun: Posters-Sunday

### Evaluation of collagen by second-harmonic generation microscopy support the heterogeneity of luminal breast cancer

Paper 9712-58 • Sunday 14 Feb. 2016, 5:30 PM  
**Rodrigo de Andrade Natal**, Univ. Estadual de Campinas (Brazil), et al.  
 Conference 9712: Multiphoton Microscopy in the Biomedical Sciences XVI  
 SESSION PSun: Posters-Sunday

### Noninvasive visualization of pheomelanin using coherent Raman scattering microscopy

Paper 9712-62 • Sunday 14 Feb. 2016, 5:30 PM  
**Hequn Wang**, Massachusetts General Hospital (USA), et al.  
 Conference 9712: Multiphoton Microscopy in the Biomedical Sciences XVI  
 SESSION PSun: Posters-Sunday

### Higher harmonic generation microscopy of human brain tumors and temporal lobe epilepsy

Paper 9712-83 • Sunday 14 Feb. 2016, 5:30 PM  
**Nikolay Kuzmin**, Vrije Univ. Amsterdam (Netherlands), et al.  
 Conference 9712: Multiphoton Microscopy in the Biomedical Sciences XVI  
 SESSION PSun: Posters-Sunday

### Understanding the tissue interaction of new treatment modalities in laparoscopic surgery in view of safe and effective application

Paper 9706-12 • Monday 15 Feb. 2016, 8:00 AM  
**Rudolf M. Verdaasdonk**, Vrije Univ. Medical Ctr. (Netherlands), et al.  
 Conference 9706: Optical Interactions with Tissue and Cells XXVII  
 SESSION 2: Photothermal Interactions I

### Quantitative phase-digital holographic microscopy: a new imaging modality to identify original cellular biomarkers of diseases

Paper 9718-20 • Monday 15 Feb. 2016, 8:00 AM  
**Pierre Marquet**, Institut Univ. en Santé Mentale de Québec, Univ. Laval (Canada), et al.  
 Conference 9718: Quantitative Phase Imaging II  
 SESSION 3: QPI of Cells and Tissues I

### Mechanism of eliciting host immunity against cancer cells treated with silica-phthalocyanine-based near infrared photoimmunotherapy

Paper 9723-1 • Monday 15 Feb. 2016, 8:00 AM  
**Hisataka Kobayashi**, National Cancer Institute (USA), et al.  
 Conference 9723: Reporters, Markers, Dyes, Nanoparticles, and Molecular Probes for Biomedical Applications VIII  
 SESSION 1: NIR Fluorescence for Imaging

### Therapeutic effect of photodynamic therapy combined with targeted delivery of silencing vascular endothelial growth factor

Paper 9709-3 • Monday 15 Feb. 2016, 8:50 AM  
**Yih-Chih Hsu**, Chung Yuan Christian Univ. (Taiwan), et al.  
 Conference 9709: Biophotonics and Immune Responses XI  
 SESSION 1: PDT and Immune Responses

### Polarized spatial frequency domain imaging of heart valve fiber structure

Paper 9710-37 • Monday 15 Feb. 2016, 8:50 AM  
**Will Goth**, The Univ. of Texas at Austin (USA), et al.  
 Conference 9710: Optical Elastography and Tissue Biomechanics III  
 SESSION 10: Tissue Mechanical Contrast

### Monitoring in-vitro bovine embryo development during the first days after fertilization

Paper 9718-22 • Monday 15 Feb. 2016, 8:50 AM  
**Mikhail E. Kandel**, Univ. of Illinois at Urbana-Champaign (USA), et al.  
 Conference 9718: Quantitative Phase Imaging II  
 SESSION 3: QPI of Cells and Tissues I

### A novel 1050nm handheld optical frequency domain imaging system for pediatric retinoblastoma patients: translation from laboratory bench to clinical study

Paper 9697-4 • Monday 15 Feb. 2016, 9:15 AM  
**Oleg Nadiarnykh**, Vrije Univ. Amsterdam (Netherlands), et al.  
 Conference 9697: Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XX  
 SESSION 1: Ophthalmic New Technology

# TRANSLATIONAL RESEARCH TRACK

## **Investigating the effect of pixel size on of high spatial resolution FTIR imaging for detection of colorectal cancer**

Paper 9703-5 • Monday 15 Feb. 2016, 9:30 AM  
**Gavin R. Lloyd**, Gloucestershire Hospitals NHS Foundation Trust (United Kingdom), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 1: Towards the Mid-Infrared Optical Biopsy: MINERVA-I

## **Investigation of cell-matrix interactions in ovarian cancer via multiphoton excited fabrication of 3D image-based biomimetic stromal models**

Paper 9711-5 • Monday 15 Feb. 2016, 9:30 AM  
**Paul J. Campagnola**, Univ. of Wisconsin-Madison (USA), et al.  
Conference 9711: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX  
SESSION 1: Functional Imaging

## **Reducing the cost of tethered capsule endomicroscopy for Barrett's esophagus screening**

Paper 9691-21 • Monday 15 Feb. 2016, 10:30 AM  
**Rohith Reddy**, Massachusetts General Hospital (USA), et al.  
Conference 9691A: Endoscopic Microscopy XI  
SESSION 6: OCT II

## **A Spatially Resolved Diffuse Correlation Spectroscopy for Cerebral Blood Flow Measurement in the Layered Structure of Head**

Paper 9690-33 • Monday 15 Feb. 2016, 10:40 AM  
**Guoqiang Yu**, Univ. of Kentucky (USA), et al.  
Conference 9690B: Neural Imaging and Sensing  
SESSION 9: Neural Imaging II

## **Integrated RFA/OCT catheter for real-time guidance of cardiac radio-frequency ablation therapy**

Paper 9697-8 • Monday 15 Feb. 2016, 10:45 AM  
**Xiaoyong Fu**, Case Western Reserve Univ. (USA), et al.  
Conference 9697: Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XX  
SESSION 2: Cardiac Applications

## **Tethered capsule OCT endomicroscopy for upper gastrointestinal tract imaging by using ball lens based probe**

Paper 9691-22 • Monday 15 Feb. 2016, 10:50 AM  
**Jing Dong**, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA), et al.  
Conference 9691A: Endoscopic Microscopy XI  
SESSION 6: OCT II

## **Smart-phone based point-of-care detector of urine albumin**

Paper 9715-7 • Monday 15 Feb. 2016, 10:50 AM  
**Vratislav Cmiel**, Brno Univ. of Technology (Czech Republic), et al.  
Conference 9715: Optical Diagnostics and Sensing XVI: Toward Point-of-Care Diagnostics  
SESSION 2: Point-of-Care Diagnostics II: Cell Phone Based Systems

## **Evaluation of time-resolved multi-distance methods to retrieve absorption and reduced scattering coefficients of adult heads in vivo: Optical parameters dependences on geometrical structures of the models used to calculate reflectance**

Paper 9690-34 • Monday 15 Feb. 2016, 11:00 AM  
**Tadatashi Tanifuji**, Kitami Institute of Technology (Japan), et al.  
Conference 9690B: Neural Imaging and Sensing  
SESSION 9: Neural Imaging II

## **Multi-modality intravascular imaging: first-in-human OCT and near-infrared autofluorescence (NIRAF) imaging of coronary artery disease**

Paper 9697-9 • Monday 15 Feb. 2016, 11:00 AM  
**Giovanni Jacopo J. Ughi**, Wellman Ctr. for Photomedicine (USA), et al.  
Conference 9697: Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XX  
SESSION 2: Cardiac Applications

## **Detection of particle flow patterns in tumor by directional spatial frequency analysis**

Paper 9711-8 • Monday 15 Feb. 2016, 11:00 AM  
**Stewart Russell**, The City College of New York (USA), et al.  
Conference 9711: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX  
SESSION 1: Functional Imaging

## **NIR and MR imaging supported hydrogel based delivery system for anti-TNF alpha probiotic therapy of IBD**

Paper 9723-8 • Monday 15 Feb. 2016, 11:00 AM  
**Jelena M. Janjic**, Duquesne Univ. (USA), et al.  
Conference 9723: Reporters, Markers, Dyes, Nanoparticles, and Molecular Probes for Biomedical Applications VIII  
SESSION 2: Two Photon Fluorescent Probes, Sensors, and Tracers

## **Feasibility of optical coherence tomography to detect radiation-induced esophageal damage in small animal models**

Paper 9691-23 • Monday 15 Feb. 2016, 11:10 AM  
**Pouya Jelvehgaran**, Academisch Medisch Centrum (Netherlands), et al.  
Conference 9691A: Endoscopic Microscopy XI  
SESSION 6: OCT II

## **All-in-one detector of circulating mRNA based on a smartphone**

Paper 9715-8 • Monday 15 Feb. 2016, 11:10 AM  
**Vratislav Cmiel**, St. Anne's Univ. Hospital in Brno (Czech Republic), et al.  
Conference 9715: Optical Diagnostics and Sensing XVI: Toward Point-of-Care Diagnostics  
SESSION 2: Point-of-Care Diagnostics II: Cell Phone Based Systems

## **Plasmonic biosensor for label-free malachite green detection**

Paper 9725-14 • Monday 15 Feb. 2016, 11:10 AM  
**Wei-Chuan Shih**, Univ. of Houston (USA), et al.  
Conference 9725: Frontiers in Biological Detection: From Nanosensors to Systems  
SESSION 4: Plasmonics II

## **Optimal injection time of indocyanine green for intraoperative fluorescence image-guided thoracoscopic resection in rabbit model**

Paper 9698-21 • Monday 15 Feb. 2016, 11:40 AM  
**Minji Kim**, Korea Univ. (Korea, Republic of), et al.  
Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
SESSION 6: Visualization and Image-Guided Systems II

## **Comparison of perfusion diagnostics with optical coherence tomography, sidestream-darkfield, incident darkfield and laser speckle contrast imaging in a tissue-like phantom**

Paper 9698-22 • Monday 15 Feb. 2016, 1:30 PM  
**Sanne M. A. Jansen**, Academisch Medisch Centrum (Netherlands), et al.  
Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
SESSION 7: Optical Coherence Techniques

## **Spectrally encoded confocal microscopy (SECM) for rapid assessment of breast excision specimens**

Paper 9703-11 • Monday 15 Feb. 2016, 1:30 PM  
**DongKyun Kang**, Massachusetts General Hospital (USA), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 3: Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment I

## **Label-free detection of circulating melanoma cells by in vivo photoacoustic flow cytometry**

Paper 9709-11 • Monday 15 Feb. 2016, 1:50 PM  
**Xunbin Wei**, Shanghai Jiao Tong Univ. (China), et al.  
Conference 9709: Biophotonics and Immune Responses XI  
SESSION 3: In vivo Detection of Immune Responses

## **Classification of biological cells using a sound wave based flow cytometer**

Paper 9708-44 • Monday 15 Feb. 2016, 2:00 PM  
**Eric M. Strohm**, Ryerson Univ. (Canada), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 7: Quantitative and Functional Imaging

## **Precision resection of intestine using ultrashort laser pulses**

Paper 9706-24 • Monday 15 Feb. 2016, 2:10 PM  
**Rainer J. Beck**, Heriot-Watt Univ. (United Kingdom), et al.  
Conference 9706: Optical Interactions with Tissue and Cells XXVII  
SESSION 4: Ultrafast Laser-Tissue Interactions

## **Photoacoustic simulations of microvessels bleeding: spectral analysis and its implication for monitoring vascular-targeted treatments**

Paper 9708-45 • Monday 15 Feb. 2016, 2:15 PM  
**Muhannad Fadhel**, Ryerson Univ. (Canada), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 7: Quantitative and Functional Imaging

## **Rapid breast cancer assessment using a high resolution microendoscope system with structured illumination**

Paper 9703-13 • Monday 15 Feb. 2016, 2:20 PM  
**Jessica Dobbs**, Rice Univ. (USA), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 3: Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment I

## **Line-scanning, stage scanning confocal microscope**

Paper 9703-14 • Monday 15 Feb. 2016, 2:45 PM  
**Daniel S. Gareau**, The Rockefeller Univ. (USA), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 3: Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment I

# TRANSLATIONAL RESEARCH TRACK

## Automatic diagnosis system for prostate cancer using quantitative phase images and machine learning

Paper 9718-34 • Monday 15 Feb. 2016, 2:50 PM  
**Tan H. Nguyen**, Univ. of Illinois at Urbana-Champaign (USA), et al.  
Conference 9718: Quantitative Phase Imaging II  
SESSION 4: QPI Clinical Applications

## Photothermal inactivation of bacteria on plasmonic nanostructures

Paper 9724-12 • Monday 15 Feb. 2016, 3:10 PM  
**Wei-Chuan Shih**, Univ. of Houston (USA), et al.  
Conference 9724: Plasmonics in Biology and Medicine XIII  
SESSION 2: Plasmonic Detection

## Fluorescent nanodiamond and lanthanide labelled in situ hybridization for the identification of RNA transcripts in fixed and CLARITY-cleared central nervous system tissues

Paper 9690-42 • Monday 15 Feb. 2016, 3:40 PM  
**Lindsay M. Parker**, Macquarie Univ. (Australia), et al.  
Conference 9690B: Neural Imaging and Sensing  
SESSION 11: Neural Imaging IV

## An optical spectroscopy instrument designed for in-vivo use in a primary care clinical setting

Paper 9698-29 • Monday 15 Feb. 2016, 4:20 PM  
**Adam Eshain**, Northwestern Univ. (USA), et al.  
Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
SESSION : Optical Diagnostic Devices

## Confocal fluorometer for diffusion tracking in 3D engineered tissue constructs

Paper 9713-17 • Monday 15 Feb. 2016, 4:20 PM  
**Daniel J. Daly**, Lein Applied Diagnostics Ltd. (United Kingdom), et al.  
Conference 9713: Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XXIII  
SESSION 4: Instrumental Methods II

## Ex vivo applications of multiphoton microscopy in urology

Paper 9703-17 • Monday 15 Feb. 2016, 4:30 PM  
**Manu Jain**, Memorial Sloan-Kettering Cancer Ctr. (USA), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 4: Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment II

## High definition Mueller polarimetric endoscope

Paper 9698-30 • Monday 15 Feb. 2016, 4:40 PM  
**Ji Qi**, Imperial College London (United Kingdom), et al.  
Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
SESSION : Optical Diagnostic Devices

## Slide-free histology via MUSE: UV surface excitation microscopy for imaging unsectioned tissue

Paper 9703-18 • Monday 15 Feb. 2016, 4:55 PM  
**Richard M. Levenson**, Univ. of California, Davis (USA), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 4: Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment II

## Photoacoustic physio-chemical analysis of liver conditions in human subjects

Paper 9708-54 • Monday 15 Feb. 2016, 5:00 PM  
**Guan Xu**, Univ. of Michigan Medical School (USA), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 8: Spectroscopy and Analytic Sensing

## Obstructive sleep apnea-hypopnea results in significant variations in cerebral hemodynamics detected by diffuse optical spectroscopies

Paper 9690-63 • Monday 15 Feb. 2016, 5:30 PM  
**Guoqiang Yu**, Univ. of Kentucky (USA), et al.  
Conference 9690B: Neural Imaging and Sensing  
SESSION PMon: Posters-Monday

## Shed a light in fatigue detection with Near-infrared spectroscopy during long-lasting driving

Paper 9690-65 • Monday 15 Feb. 2016, 5:30 PM  
**Ting Li**, Univ. of Electronic Science and Technology of China (China), et al.  
Conference 9690B: Neural Imaging and Sensing  
SESSION PMon: Posters-Monday

## Hemodynamic signals change during motor skill learning: a functional NIRS study

Paper 9690-66 • Monday 15 Feb. 2016, 5:30 PM  
**Zhen Yuan**, Univ. of Macau (Macao, China), et al.  
Conference 9690B: Neural Imaging and Sensing  
SESSION PMon: Posters-Monday

## Tethered capsule endomicroscopy with capsule position localization for diagnosis of diseases of the upper gastrointestinal tract

Paper 9691-27 • Monday 15 Feb. 2016, 5:30 PM  
**Oriane Poupert**, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA), et al.  
Conference 9691A: Endoscopic Microscopy XI  
SESSION PMon: Posters-Monday

## Ex vivo brain tumor analysis using spectroscopic optical coherence tomography

Paper 9697-121 • Monday 15 Feb. 2016, 5:30 PM  
**Marcel Lenz**, Ruhr-Univ. Bochum (Germany), et al.  
Conference 9697: Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XX  
SESSION PMon: Posters-Monday

## Raman spectroscopy of cell lines: distinguishing oral dysplastic and squamous cell carcinoma cell lines

Paper 9704-28 • Monday 15 Feb. 2016, 5:30 PM  
**C. Murali Krishna**, Advanced Ctr. for Treatment, Research & Education in Cancer (India), et al.  
Conference 9704: Biomedical Vibrational Spectroscopy 2016: Advances in Research and Industry  
SESSION PMon: Posters-Monday

## Raman spectroscopy of hamster buccal pouch carcinogenesis: investigating precancer changes due to confounding factors

Paper 9704-33 • Monday 15 Feb. 2016, 5:30 PM  
**C. Murali Krishna**, Advanced Ctr. for Treatment, Research & Education in Cancer (India), et al.  
Conference 9704: Biomedical Vibrational Spectroscopy 2016: Advances in Research and Industry  
SESSION PMon: Posters-Monday

## Multi-channel photon migration study in visible Chinese human muscle for optical detection of deep vein thrombosis

Paper 9706-57 • Monday 15 Feb. 2016, 5:30 PM  
**Ting Li**, Univ. of Electronic Science and Technology of China (China), et al.  
Conference 9706: Optical Interactions with Tissue and Cells XXVII  
SESSION PMon: Posters-Monday

## Studying infrared light therapy for treating Alzheimer's disease

Paper 9709-23 • Monday 15 Feb. 2016, 5:30 PM  
**Xunbin Wei**, Shanghai Jiao Tong Univ. (China), et al.  
Conference 9709: Biophotonics and Immune Responses XI  
SESSION PMon: Posters-Monday

## Enhancement of trastuzumab penetration using atorvastatin and cyclophosphamide to Her2+ NCI N87 xenograft mouse model

Paper 9711-53 • Monday 15 Feb. 2016, 5:30 PM  
**Jin Su Kim**, Korea Institute of Radiological & Medical Sciences (Korea, Republic of), et al.  
Conference 9711: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX  
SESSION PMon: Posters-Monday

## Fourier spatial frequency analysis for image classification: training the training set

Paper 9711-58 • Monday 15 Feb. 2016, 5:30 PM  
**Stewart Russell**, The City College of New York (USA), et al.  
Conference 9711: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX  
SESSION PMon: Posters-Monday

## Tuesday 16 Feb. 2016

## Fluorescence lifetime spectroscopy and imaging of tissue specimens: applications in oncology and cardiovascular pathology

Paper 9703-20 • Tuesday 16 Feb. 2016, 8:05 AM  
**Laura Marcu**, Univ. of California, Davis (USA), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 5: Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment III

## Excitation-scanning hyperspectral imaging system for microscopic and endoscopic applications

Paper 9711-20 • Tuesday 16 Feb. 2016, 8:20 AM  
**Sam Mayes**, Univ. of South Alabama (USA), et al.  
Conference 9711: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX  
SESSION 4: Spectral Imaging

## Development and clinical translation of OTIS: a wide-field OCT imaging device for ex-vivo tissue characterization

Paper 9703-21 • Tuesday 16 Feb. 2016, 8:30 AM  
**Elizabeth A. Munro**, Perimeter Medical Imaging (Canada), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 5: Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment III

# TRANSLATIONAL RESEARCH TRACK

## **Analysis of stromal alterations in ovarian cancers via wavelength dependent second harmonic generation microscopy and optical scattering**

Paper 9712-37 • Tuesday 16 Feb. 2016, 8:30 AM  
**Paul J. Campagnola**, Univ. of Wisconsin-Madison (USA), et al.  
Conference 9712: Multiphoton Microscopy in the Biomedical Sciences XVI  
SESSION 10: Second/Third Harmonic Generation I

## **Which blood oxygen index by NIRS is sensitive to shock severity?**

Paper 9698-31 • Tuesday 16 Feb. 2016, 8:50 AM  
**Ting Li**, Univ. of Electronic Science and Technology of China (China), et al.  
Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
SESSION : Near Infrared Spectroscopy Sensing Methods

## **Parametric approaches to micro-scale characterization of tissue volumes in vivo and ex vivo: Imaging microvasculature, attenuation, birefringence, and stiffness**

Paper 9703-22 • Tuesday 16 Feb. 2016, 8:55 AM  
**David D. Sampson**, The Univ. of Western Australia (Australia), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 5: Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment III

## **Volumetric imaging of oral epithelial neoplasia by MPM-SHGM: epithelial connective tissue interface**

Paper 9712-38 • Tuesday 16 Feb. 2016, 8:55 AM  
**Gracie Vargas**, The Univ. of Texas Medical Branch (USA), et al.  
Conference 9712: Multiphoton Microscopy in the Biomedical Sciences XVI  
SESSION 10: Second/Third Harmonic Generation I

## **Multimode optical dermoscopy (SkinSpect) for skin with mole analysis**

Paper 9711-22 • Tuesday 16 Feb. 2016, 9:10 AM  
**Fartash Vasefi**, Spectral Molecular Imaging, Inc. (USA), et al.  
Conference 9711: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX  
SESSION 4: Spectral Imaging

## **Hyperspectral in vivo fluorescence imaging with multi wavelength LED excitation**

Paper 9711-23 • Tuesday 16 Feb. 2016, 9:30 AM  
**Siri Luthman**, Univ. of Cambridge (United Kingdom), et al.  
Conference 9711: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX  
SESSION 4: Spectral Imaging

## **A novel method to estimate oxygen saturation of the internal jugular vein blood**

Paper 9698-34 • Tuesday 16 Feb. 2016, 9:50 AM  
**Ting Li**, Univ. of Electronic Science and Technology of China (China), et al.  
Conference 9698: Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XIV  
SESSION : Near Infrared Spectroscopy Sensing Methods

## **Feasibility for detection of autofluorescent signatures in rat organs using a novel excitation-scanning hyperspectral imaging system**

Paper 9711-25 • Tuesday 16 Feb. 2016, 10:10 AM  
**Peter F. Favreau**, Univ. of South Alabama (USA), et al.  
Conference 9711: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX  
SESSION 4: Spectral Imaging

## **Two-photon imaging during brain surgery: first clinical study using a certified multiphoton tomograph**

Paper 9712-42 • Tuesday 16 Feb. 2016, 10:25 AM  
**Karsten König**, Univ. des Saarlandes (Germany), et al.  
Conference 9712: Multiphoton Microscopy in the Biomedical Sciences XVI  
SESSION 11: Second/Third Harmonic Generation II

## **Towards low-risk in vivo diagnosis of pulmonary fibrosis with optical coherence tomography**

Paper 9697-35 • Tuesday 16 Feb. 2016, 10:30 AM  
**Lida P. Hariri**, Massachusetts General Hospital (USA), et al.  
Conference 9697: Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XX  
SESSION 6: Catheter/Endoscopic/Needle Probes

## **A wearable continuous-wave optical device for continuous monitoring during neoadjuvant chemotherapy infusions**

Paper 9715-24 • Tuesday 16 Feb. 2016, 10:30 AM  
**Fei Teng**, Boston Univ. (USA), et al.  
Conference 9715: Optical Diagnostics and Sensing XVI: Toward Point-of-Care Diagnostics  
SESSION 6: Optical Blood Oxygenation Measurements

## **Implementation of fluorescence confocal mosaicing microscopy by “early adopter” Mohs surgeons: a review of recent progress in five settings**

Paper 9703-25 • Tuesday 16 Feb. 2016, 10:40 AM  
**Manu Jain**, Memorial Sloan-Kettering Cancer Ctr. (USA), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 6: Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment IV

## **Super-achromatic microprobe for ultrahigh-resolution endoscopic OCT imaging at 800 nm**

Paper 9697-37 • Tuesday 16 Feb. 2016, 11:00 AM  
**Wu Yuan**, Johns Hopkins Univ. (USA), et al.  
Conference 9697: Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XX  
SESSION 6: Catheter/Endoscopic/Needle Probes

## **A wearable, conformal bandage for non-invasive, two-dimensional imaging of skin oxygenation**

Paper 9715-26 • Tuesday 16 Feb. 2016, 11:10 AM  
**Zongxi Li**, Massachusetts General Hospital (USA), et al.  
Conference 9715: Optical Diagnostics and Sensing XVI: Toward Point-of-Care Diagnostics  
SESSION 6: Optical Blood Oxygenation Measurements

## **In vitro and in vivo analysis and characterization of engineered spinal neural implants**

Paper 9690-56 • Tuesday 16 Feb. 2016, 11:30 AM  
**Erez Shor**, Technion-Israel Institute of Technology (Israel), et al.  
Conference 9690B: Neural Imaging and Sensing  
SESSION 13: Neural Imaging VI

## **High speed, ultrahigh-resolution, distal scanning endoscopic OCT at 800 nm**

Paper 9697-39 • Tuesday 16 Feb. 2016, 11:30 AM  
**Jessica Mavadia-Shukla**, Johns Hopkins Univ. (USA), et al.  
Conference 9697: Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XX  
SESSION 6: Catheter/Endoscopic/Needle Probes

## **Raman spectroscopy of hamster buccal pouch tissues: investigating suitability of ex vivo models to evaluate in vivo spectra**

Paper 9703-28 • Tuesday 16 Feb. 2016, 11:40 AM  
**C. Murali Krishna**, Advanced Ctr. for Treatment, Research & Education in Cancer (India), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 6: Mini-Symposium: Optical Rapid Ex-Vivo Tissue Assessment IV

## **Noninvasive optical measurement of bone marrow lesions: a Monte Carlo study on visible human dataset**

Paper 9706-40 • Tuesday 16 Feb. 2016, 11:40 AM  
**Ting Li**, Univ. of Electronic Science and Technology of China (China), et al.  
Conference 9706: Optical Interactions with Tissue and Cells XXVII  
SESSION 7: Tissue Optics and Optical Properties of Tissue II

## **Four dimensional optoacoustic imaging of perfusion in preclinical breast tumor model in vivo**

Paper 9708-73 • Tuesday 16 Feb. 2016, 2:15 PM  
**Subhamoy Mandal**, Helmholtz Zentrum München GmbH (Germany), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 11: Molecular Imaging with Contrast Agents

## **Contrast enhancement using differential spinning disc structured illumination in high resolution microendoscopy for imaging nuclear morphology in tissue**

Paper 9711-28 • Tuesday 16 Feb. 2016, 2:40 PM  
**Pelham Keahey**, Rice Univ. (USA), et al.  
Conference 9711: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX  
SESSION 5: Biomedical Imaging using a DMD or Other Light Structuring Devices: Joint SESSION with Conferences 9711 and 9761

## **Fresh calibration-free framework for continuous spectroscopic sensing of blood analytes: single prick glucose detection**

Paper 9715-32 • Tuesday 16 Feb. 2016, 2:40 PM  
**Nicolas Spegazzini**, Massachusetts Institute of Technology (USA), et al.  
Conference 9715: Optical Diagnostics and Sensing XVI: Toward Point-of-Care Diagnostics  
SESSION 7: Optical Glucose Monitoring



# TRANSLATIONAL RESEARCH TRACK

## Handheld OCT for longitudinal tracking of chronic middle-ear infection in response to therapeutic interventions

Paper 9697-46 • Tuesday 16 Feb. 2016, 2:45 PM  
**Guillermo L. Monroy**, Univ. of Illinois at Urbana-Champaign (USA), et al.  
Conference 9697: Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XX  
SESSION 7: Brain, Small Animal and Hand-Held OCT

## Monitoring cancer treatment response using photoacoustic and ultrasound spectral analysis in combination with oxygenation and perfusion measurements

Paper 9708-75 • Tuesday 16 Feb. 2016, 2:45 PM  
**Eno Hysi**, Ryerson Univ. (Canada), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 11: Molecular Imaging with Contrast Agents

## Biodegradable polymer based theranostic agents for photoacoustic imaging and cancer therapy

Paper 9708-77 • Tuesday 16 Feb. 2016, 3:15 PM  
**Yan J. Wang**, Ryerson Univ. (Canada), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 11: Molecular Imaging with Contrast Agents

## Transcranial light-tissue interaction analysis

Paper 9706-46 • Tuesday 16 Feb. 2016, 3:40 PM  
**Kavleen Aulakh**, Carleton Univ. (Canada), et al.  
Conference 9706: Optical Interactions with Tissue and Cells XXVII  
SESSION 9: Tissue Optics and Optical Properties of Tissue IV

## Towards the application of Raman spectroscopy in lynch syndrome diagnostics

Paper 9715-35 • Tuesday 16 Feb. 2016, 4:10 PM  
**Riana Gaifulina**, Univ. College London (United Kingdom), et al.  
Conference 9715: Optical Diagnostics and Sensing XVI: Toward Point-of-Care Diagnostics  
SESSION 8: Optical Imaging for Cancer

## Choice of spectroscopy method for tumor margin detection

Paper 9715-36 • Tuesday 16 Feb. 2016, 4:30 PM  
**Viacheslav Artyushenko**, art photonics GmbH (Germany), et al.  
Conference 9715: Optical Diagnostics and Sensing XVI: Toward Point-of-Care Diagnostics  
SESSION 8: Optical Imaging for Cancer

## Increased epidermal laser fluence through simultaneous ultrasonic microporation

Paper 9706-49 • Tuesday 16 Feb. 2016, 4:40 PM  
**Paul J. D. Whiteside**, Univ. of Missouri (USA), et al.  
Conference 9706: Optical Interactions with Tissue and Cells XXVII  
SESSION 9: Tissue Optics and Optical Properties of Tissue IV

## Directional spatial frequency analysis of lipid distribution in atherosclerotic plaque

Paper 9711-32 • Tuesday 16 Feb. 2016, 4:40 PM  
**Stewart Russell**, The City College of New York (USA), et al.  
Conference 9711: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX  
SESSION 6: Data Analysis

## Deconvolution based photoacoustic reconstruction for directional transducer with sparsity regularization

Paper 9708-84 • Tuesday 16 Feb. 2016, 5:30 PM  
**Hamid Moradi**, The Univ. of British Columbia (Canada), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION 12: Signal Processing and Image Reconstruction

## Transcutaneous in vivo Raman spectroscopy: discrimination of benign from malignant breast lesions in animal models

Paper 9703-60 • Tuesday 16 Feb. 2016, 6:00 PM  
**C. Murali Krishna**, Advanced Ctr. for Treatment, Research & Education in Cancer (India), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION PTues: Posters-Tuesday

## Transmission (forward) mode, transcranial, noninvasive optoacoustic measurements for brain monitoring, imaging, and sensing

Paper 9708-178 • Tuesday 16 Feb. 2016, 6:00 PM  
**Rinat O. Esenaliev**, The Univ. of Texas Medical Branch (USA), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION PTue: Posters-Tuesday

## Comparison between transrectal photoacoustic, Doppler and magnetic resonance imaging for prostate cancer detection

Paper 9708-182 • Tuesday 16 Feb. 2016, 6:00 PM  
**Miya Ishihara**, National Defense Medical College (Japan), et al.  
Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
SESSION PTue: Posters-Tuesday

## Wednesday 17 Feb. 2016

### Fiber based imaging in bioengineered construct

Paper 9711-39 • Wednesday 17 Feb. 2016, 9:10 AM  
**Etai Sapoznik**, Wake Forest Institute for Regenerative Medicine (USA), et al.  
Conference 9711: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX  
SESSION 7: Instrumentation I

### Label-free vascular imaging in a spontaneous hamster cheek pouch carcinogen model for pre-cancer detection

Paper 9703-42 • Wednesday 17 Feb. 2016, 9:30 AM  
**Fangyao Hu**, Duke Univ. (USA), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 9: Applications of Spectral Imaging

### Hyperspectral imaging fluorescence excitation scanning for detecting colorectal cancer: pilot study

Paper 9703-43 • Wednesday 17 Feb. 2016, 9:50 AM  
**Silas J. Leavesley**, Univ. of South Alabama (USA), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 9: Applications of Spectral Imaging

### Visible-light OCT to quantify retinal oxygen metabolism

Paper 9697-72 • Wednesday 17 Feb. 2016, 2:15 PM  
**Hao F. Zhang**, Northwestern Univ. (USA), et al.  
Conference 9697: Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XX  
SESSION 11: Novel Contrast Mechanisms

### Intraoperative optical biopsy for brain tumors using spectro-lifetime properties of intrinsic fluorophores

Paper 9711-50 • Wednesday 17 Feb. 2016, 2:50 PM  
**Fartash Vasefi**, Cedars-Sinai Medical Ctr. (USA), et al.  
Conference 9711: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues IX  
SESSION 8: Instrumentation II

### LED-based endoscopic light source for spectral imaging

Paper 9703-53 • Wednesday 17 Feb. 2016, 3:40 PM  
**Craig Browning**, Univ. of South Alabama (USA), et al.  
Conference 9703: Optical Biopsy XIV: Toward Real-Time Spectroscopic Imaging and Diagnosis  
SESSION 12: Label-Free Spectroscopy Methods

### A novel method for sensing metastatic cells in the CSF of pediatric population with medulloblastoma by frequency domain FLIM system

Paper 9721-22 • Wednesday 17 Feb. 2016, 4:10 PM  
**Gilad Yahav**, Bar-Ilan Univ. (Israel), et al.  
Conference 9721: Nanoscale Imaging, Sensing, and Actuation for Biomedical Applications XIII  
SESSION 4: Nanoscale Imaging and Spectroscopy II

### Depth-resolved nanoscale nuclear architecture mapping for early prediction of cancer progression

Paper 9697-79 • Wednesday 17 Feb. 2016, 4:30 PM  
**Yang Liu**, Univ. of Pittsburgh (USA), et al.  
Conference 9697: Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XX  
SESSION 12: Novel Microscopy

### Optimization of imaging parameters for high sensitivity detection of skin cancer at the THz

Paper 9721-25 • Wednesday 17 Feb. 2016, 5:10 PM  
**Michael Ney**, Ben-Gurion Univ. of the Negev (Israel), et al.  
Conference 9721: Nanoscale Imaging, Sensing, and Actuation for Biomedical Applications XIII  
SESSION 4: Nanoscale Imaging and Spectroscopy II

# LASE.

THE LASER TECHNOLOGY AND INDUSTRIAL LASER CONFERENCE

## SYMPOSIUM CHAIRS:



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**Reinhart Poprawe**  
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Lasertechnik (Germany)



**Koji Sugioka**  
RIKEN (Japan)

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Program Chair: **Klaus P. Streubel**, OSRAM AG (Germany)

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- 9768 **Light-Emitting Diodes: Materials, Devices, and Applications for Solid State Lighting XX** (Jeon, Tu, Krames, Strassburg) ..... 349

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Program Chairs: **Henry Helvajian**, The Aerospace Corp. (USA) and **Alberto Piqué**, U.S. Naval Research Lab. (USA)

- 9735 **Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) XXI** (Neuenschwander, Roth, Grigoropoulos, Makimura) ..... 238
- 9736 **Laser-based Micro- and Nanoprocessing X** (Klotzbach, Washio, Arnold) ..... 242
- 9737 **Synthesis and Photonics of Nanoscale Materials XIII** (Kabashin, Geohegan, Dubowski) ..... 245
- 9759 **Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX** (von Freymann, Schoenfeld, Rumpf) ..... 324

### LASER APPLICATIONS

Program Chair: **Bo Gu**, Bos Photonics (USA)

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- 9740 **Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XVI** (Heisterkamp, Herman, Meunier, Nolte) ..... 254
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# LASE 2016 Best Paper Awards.

## BEST STUDENT ORAL PAPER COMPETITION

Fiber Lasers: Technology, Systems, and Applications (Conf. 9728)

Thursday 18 February  
AWARD CEREMONY · 5:40 to 6:00 pm

We are pleased to announce that a cash prize will be awarded to the best student oral presentation in this conference.

Throughout the conference, qualifying student oral presentations will be evaluated by the conference committee, and the results will be announced in this session. Student presentations will be judged based on scientific merit of the work, and clarity of the presentation. While the award is not judged by the manuscript, a manuscript must be submitted.

To be eligible for consideration, the student must be the first author on an accepted paper, and must make the oral presentation.

AWARD SPONSORS:



## BEST STUDENT PRESENTATION AWARD

Vertical External Cavity Surface Emitting Lasers (VECSELs) (Conf. 9734)

Tuesday 16 February  
AWARD CEREMONY · 12:05 to 12:15 pm

Throughout the conference, qualifying student oral presentations will be evaluated. Student presentations will be judged based on scientific merit, impact, and clarity of the presentation. While the award is not judged by the manuscript, a manuscript must be submitted.

AWARD SPONSOR:



## BEST STUDENT PAPER COMPETITION

Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) (Conf. 9735)

Thursday 18 February  
AWARD CEREMONY · 11:50 am to Noon

A cash prize will be awarded to the best student oral and poster presentation in this conference.

Throughout the conference, qualifying student presentations will be evaluated by the conference committee, and the results will be announced during the award ceremony on Thursday. Student presentations will be judged based on scientific merit of the work, and clarity of the presentation.

While the award is not judged by the manuscript, a manuscript must be submitted.

AWARD SPONSORS:



## BEST STUDENT PAPER COMPETITION

Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications (Conf. 9740)

Wednesday 17 February  
COMPETITION · 2:00 to 3:30 pm

JUDGING · 3:30 to 4:00 pm

AWARD CEREMONY · 4:00 to 4:20 pm

We are pleased to announce that cash prizes and plaques will be awarded to the best student presentations in this conference (1st, 2nd, and 3rd place; both poster and oral papers considered).

Papers submitted by graduate and undergraduate students are eligible.

In order to ensure a fair evaluation, the conference chairs and the program committee will judge the students during a special student competition session held during the conference. Here the students present a brief 5-minute summary of their original talk or poster presented at the conference. Candidates for the award need to be the presenting author, a full-time student, must have conducted the majority of the research presented in the paper, and must submit their manuscript to the conference proceedings.

Following the student competition, the judges will meet and decide on the top three students. Winners will be announced during the award ceremony.

In order to claim your cash prize, a manuscript must be submitted to the conference proceedings.cript must be submitted to the conference proceedings.

AWARD SPONSORS:



LASE

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
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**LASE POSTER SESSION**  
6:00 to 8:00 pm

**LASE PLENARY SESSION**  
10:20 am to 12:30 pm

### Laser Source Engineering

Program Chair: **Gregory J. Quarles**, Optoelectronics Management Network (USA)

- 9726 **Solid State Lasers XXV: Technology and Devices** (Clarkson, Shori), p. 210
- 9727 **Laser Resonators, Microresonators, and Beam Control XVIII** (Kudryashov, Paxton, Ilchenko, Aschke), p. 214
- 9728 **Fiber Lasers XIII: Technology, Systems, and Applications** (Ballato, Robin), p. 218
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- 9745 **Organic Photonic Materials and Devices XVIII** (Tabor, Kajzar, Kaino, Koike), p. 276
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### Semiconductor Lasers and LEDs

Program Chair: **Klaus Streubel**, OSRAM AG (Germany)

- 9730 **Components and Packaging for Laser Systems II** (Glebov, Leisher), p. 226
- 9733 **High-Power Diode Laser Technology and Applications XIV** (Zediker), p. 234
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- 9768 **Light-Emitting Diodes: Materials, Devices, and Applications for Solid State Lighting XX** (Jeon, Tu, Krames, Strassburg), p. 349



# LASE DAILY CONFERENCE SCHEDULE

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
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**LASE POSTER SESSION**  
6:00 to 8:00 pm

**LASE PLENARY SESSION**  
10:20 am to 12:30 pm

## Laser Micro-/Nanoengineering

Program Chairs: **Henry Helvajian**, The Aerospace Corp. (USA) and **Alberto Piqué**, U.S. Naval Research Lab. (USA)

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9736 **Laser-based Micro- and Nanoprocessing X** (Klotzbach, Washio, Arnold), p. 242

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9737 **Synthesis and Photonics of Nanoscale Materials XIII** (Kabashin, Geohegan, Dubowski), p. 245

9759 **Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX** (von Freymann, Schoenfeld, Rumpf), p. 324

## Laser Applications

Program Chair: **Bo Gu**, Bos Photonics (USA)

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LASE

# CONFERENCE 9726

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL)

Monday–Thursday 15–18 February 2016 • Proceedings of SPIE Vol. 9726

# Solid State Lasers XXV: Technology and Devices

Conference Chairs: **W. Andrew Clarkson**, Univ. of Southampton (United Kingdom); **Ramesh K. Shori**, SPAWAR Systems Ctr. (USA)

Program Committee: **Patrick A. Berry**, Air Force Research Lab. (USA); **Marc Eichhorn**, Institut Franco-Allemand de Recherches de Saint-Louis (France); **Dennis G. Harris**, MIT Lincoln Lab. (USA); **Norman Hodgson**, Coherent, Inc. (USA); **Helena Jelínková**, Czech Technical Univ. in Prague (Czech Republic); **Christian Kränkel**, Univ. Hamburg (Germany); **Jacob I. Mackenzie**, Univ. of Southampton (United Kingdom); **Markus Pollnau**, KTH Royal Institute of Technology (Sweden); **Narasimha S. Prasad**, NASA Langley Research Ctr. (USA); **Bojan Resan**, Lumentum Operations LLC (Switzerland), Univ. of Applied Sciences and Arts Northwestern (Switzerland); **Deyuan Shen**, Fudan Univ. (China); **Matteo Vannini**, Istituto Nazionale di Ottica, CNR (Italy)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL) . MON 8:00 TO 10:00 AM

### Eyesafe and Mid-IR Lasers I

Session Chair: **Patrick A. Berry**, Air Force Research Lab. (USA)

8:00 am: **Mid-IR laser source using hollow waveguide beam combining**, Ian F. Elder, Daniel H. Thorne, Robert A. Lamb, Selex ES Ltd. (United Kingdom); Richard M. Jenkins, HollowGuide Ltd. (United Kingdom) . . . . . [9726-1]

8:20 am: **High brightness diode pumped Er:YAG laser system at 2.94  $\mu\text{m}$  with 1kW peak power**, Manuel Messner, Arne Heinrich, Clemens Hagen, Bernhard Nussbaumer, Pantec Engineering AG (Liechtenstein); Karl Unterrainer, Technische Univ. Wien (Austria) . . . . . [9726-2]

8:40 am: **High peak power ultrafast Cr:ZnSe oscillator and power amplifier**, Evgeny Slobodchikov, IPG Photonics Corp. (USA); Logan R. Chieffo, Kevin F. Wall, Q-Peak, Inc. (USA) . . . . . [9726-3]

9:00 am: **Compact laser for high power eyesafe illumination**, Chris DePriest, Nadia Baranova, Ken Stebbins, Ilya Bystryak, Michael Rayno, Rui Pu, Kevin Ezzo, Q-Peak, Inc. (USA) . . . . . [9726-4]

9:20 am: **Er/Yb glass laser with compact mechanical Q-switch**, Brian Cole, Alan D. Hays, Nathaniel Hough, John Nettleton, Lew Goldberg, U.S. Army RDECOM CERDEC NVESD (USA) . . . . . [9726-5]

9:40 am: **Comparative study of broadband, narrowband, and multi-wavelength resonant pumping of Er:YAG lasers**, Haro Fritsche, DirectPhotonics Industries GmbH (Germany) and Technische Univ. Berlin (Germany); Oliver Lux, Martin Gaertner, Technische Univ. Berlin (Germany); Andreas Grohe, Wolfgang Gries, DirectPhotonics Industries GmbH (Germany); Hans Joachim Eichler, Technische Univ. Berlin (Germany) . . . . . [9726-6]

Coffee Break . . . . . Mon 10:00 am to 10:30 am

### SESSION 2

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL) . . . MON 10:30 TO 11:10 AM

### Eyesafe and Mid-IR Lasers II

Session Chair: **Patrick A. Berry**, Air Force Research Lab. (USA)

10:30 am: **High power and widely tunable Raman fiber laser around 1.7  $\mu\text{m}$** , Yongguang Zhao, Weichao Yao, Deyuan Shen, Jiangsu Key Lab. of Advanced Laser Materials (China) . . . . . [9726-7]

10:50 am: **Watt level Er:Lu<sub>2</sub>O<sub>3</sub> and Er:Y<sub>2</sub>O<sub>3</sub> ceramic lasers at ~2.7  $\mu\text{m}$  with optimized Er<sup>3+</sup>-concentration**, Wei Zhou, Li Wang, Haitao Huang, Yongguang Zhao, Deyuan Shen, Jian Zhang, Dingyuan Tang, Jiangsu Key Lab. of Advanced Laser Material (China) . . . . . [9726-8]

Lunch Break . . . . . Mon 11:10 am to 1:00 pm

### SESSION 3

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL) . . . MON 1:00 TO 3:00 PM

### Single Crystal Fiber Lasers

Session Chair: **Ramesh K. Shori**, SPAWAR Systems Ctr. (USA)

1:00 pm: **100W class compact Yb:YAG single crystal fiber amplifier for femtosecond lasers without CPA**, Vesna Markovic, Andreas Rohrbacher, Peter Hofmann, Wolfgang Pallmann, Simonette Pierrot, Lumentum (Switzerland); Bojan Resan, Lumentum (Switzerland) and Univ. of Applied Sciences and Arts Northwestern (Switzerland) . . . . . [9726-10]

1:20 pm: **Yb:YAG single-crystal fiber amplifiers for picosecond lasers using divided pulse amplification technic**, Fabien Lesparre, Jean-Thomas Gomes, Xavier Delen, Institut d'Optique Graduate School (France); Igor Marial, Julien Didierjean, FiberCryst S.A.S. (France); Wolfgang Pallmann, Lumentum (Switzerland); Bojan Resan, Lumentum (Switzerland) and Univ. of Applied Sciences and Arts Northwestern (Switzerland); Frederic Druon, François Balembois, Patrick Georges, Institut d'Optique Graduate School (France) . . . . . [9726-11]

1:40 pm: **Laser properties of LHPG-grown, diode-pumped, Yb:YAG single crystal fiber**, Jun Zhang, U.S. Army Research Lab. (USA); Youming Chen, U.S. Army Research Lab (USA); Mark Dubinskii, U.S. Army Research Lab. (USA); Gisele Maxwell, Shasta Crystals (USA) . . . . . [9726-12]

2:00 pm: **Cladding rare-earth doped single-crystal YAG fiber optics**, Subhabrata Bera, Craig D. Nie, James A. Harrington, Rutgers, The State Univ. of New Jersey (USA); Stephen C. Rand, Ayan A. Chakrabarty, Theresa Chick, James Chapman, Stephen Trembath-Reichert, Univ. of Michigan (USA) . . . . . [9726-13]

2:20 pm: **High power Nd:YAG single crystal fiber laser emitting at 1064 nm**, Zhaojun Liu, Sasa Zhang, Xingyu Zhang, Yang Liu, Zhenhua Cong, Shandong Univ. (China) . . . . . [9726-14]

2:40 pm: **Micro-pulling-down furnace modification and single crystal fibers growth**, Dongsheng Yuan, Zhitai Jia, Yang Li, Shandong Univ. (China); Baiyi Wu, Shandong Univ. (China); Xutang Tao, Shandong Univ. (China) . . . . . [9726-15]

Coffee Break . . . . . Mon 3:00 pm to 3:30 pm

### SESSION 4

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL) . . . MON 3:30 TO 6:10 PM

### Airborne and Space Qualified Lasers

Session Chair: **Ramesh K. Shori**, SPAWAR Systems Ctr. (USA)

3:30 pm: **Post-flight test results of diode laser bar subjected to space exposure**, Narasimha S. Prasad, NASA Langley Research Ctr. (USA) . [9726-22]

3:50 pm: **Ruggedized SLM Nd:YAG laser for airborne Doppler lidar applications**, Wade Collins, Ryan Feeler, Faming Xu, Mark Kushina, Northrop Grumman Cutting Edge Optronics (USA) . . . . . [9726-17]

4:10 pm: **Narrow linewidth UV laser sources for ozone dial remote sensing application (global ozone lidar demonstrator)**, Ti Chuang, Joe Hansell, Tim Shuman, Tom Schum, Kent Puffenberger, Ralph Burnham, Fibertek, Inc. (USA) . . . . . [9726-18]

4:30 pm: **Diode-pumped alexandrite ring laser for lidar applications**, Alexander Munk, Bernd Jungbluth, Michael Strotkamp, Hans-Dieter Hoffmann, Reinhart Poprawe, Fraunhofer-Institut für Lasertechnik (Germany); Josef Höffner, Leibniz-Institut für Atmosphärenphysik e.V. (Germany) . [9726-19]

# CONFERENCE 9726

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL)

## SESSION 6

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL) . . TUE 10:30 TO 11:50 AM

### Pulsed Lasers II

Session Chair: **Deyuan Shen**, Fudan Univ. (China)

10:30 am: **High-gain, high-energy picosecond Nd:YVO<sub>4</sub> amplifier end-pumped at 880 nm**, Xavier Delen, Institut d'Optique Graduate School (France); Loic Deyra, ALPhANOV (France) and Spark Lasers (France); Simon Salort, ALPhANOV (France); Pascal Dupriez, ALPhANOV (France) and Spark Lasers (France); François Balembos, Patrick Georges, Institut d'Optique Graduate School (France) . . . . . [9726-29]

10:50 am: **VCSEL-pumped passively Q-switched monolithic solid-state lasers**, Robert van Leeuwen, Bing Xu, Tong Chen, Qing Wang, Jean-Francois Seurin, Chuni L. Ghosh, Princeton Optronics, Inc. (USA) . . . . . [9726-30]

11:10 am: **Simple ps microchip Nd:YVO<sub>4</sub> laser with 3.3 ps pulses at 0.2 - 1.4 MHz and single-stage amplification to the microjoule level**, Erdal Türkyilmaz, MONTFORT Laser GmbH (Austria); Christian Guenther, Eva Mehner, Technische Hochschule Nürnberg Georg Simon Ohm (Germany); Daniel Kopf, MONTFORT Laser GmbH (Austria); Harald Giessen, Univ. Stuttgart (Germany); Bernd Braun, Technische Hochschule Nürnberg Georg Simon Ohm (Germany) . . . . . [9726-31]

11:30 am: **Efficient broadband TW level OPCPA pumped by a rectangular pulse**, Yuriy Stepanenko, Pawel Wnuk, Tomasz Kardas, Michal Nejbauer, Czeslaw Radzewicz, Univ. of Warsaw (Poland) . . . . . [9726-32]

Lunch/Exhibition Break . . . . . Tue 11:50 am to 1:00 pm

## SESSION 7

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL) . . . . TUE 1:00 TO 3:20 PM

### Ultrafast Lasers

Session Chair: **Bojan Resan**, Lumentum Operations LLC (Switzerland)

1:00 pm: **High average power (25W) high peak power (10 TW) high contrast (>1010) femtosecond laser chain**, Raphael Clady, Vadim I. Tcheremiskine, Yasmina Azamoum, Laurent Charmasson, Nicolas Sanner, Olivier P. Uteza, Marc L. Sentis, Lasers, Plasmas et Procédés Photoniques (France) . . . [9726-33]

1:20 pm: **Blue-diode-pumped SESAM modelocked Ti:sapphire oscillator generating 5 nJ 88 fs pulses**, Andreas Rohrbacher, Vesna Markovic, Wolfgang Pallmann, Simonette Pierrot, Peter Hofmann, Lumentum (Switzerland); Bojan Resan, Lumentum (Switzerland) and Univ. of Applied Sciences and Arts Northwestern (Switzerland) . . . . . [9726-34]

1:40 pm: **Performance of the Yb:Lu<sub>2</sub>O<sub>3</sub> laser crystal in diode-pumped femtosecond oscillators and high-power regenerative amplifiers**, Etienne Caracciolo, Univ. degli Studi di Pavia (Italy) and Spectra-Physics (Austria); Federico Pirzio, Univ. degli Studi di Pavia (Italy); Matthias Kemnitzer, Spectra-Physics (Austria); Annalisa Guandalini, Spectra-Physics (Austria); Florian Kienle, Spectra-Physics (Austria); Antonio Agnesi, Univ. degli Studi di Pavia (Italy); Juerg Aus der Au, Spectra-Physics (Austria) . . . . . [9726-35]

2:00 pm: **Modelling and simulation of ultrashort pulse amplification**, Christoph Pflaum, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); Rainer Hartmann, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany) and Erlangen Graduate School in Advanced Optical Technologies (Germany); Zhabiz Rahimi, ASLD GmbH (Germany) . . . . . [9726-36]

2:20 pm: **High contrast broadband seeder for multi-PW laser system**, Olivier J. Chalus, Alain Pellegrina, Olivier Casagrande, Christophe Derycke, Laurent Boudjemaa, Christophe Simon-Boisson, Sébastien Laux, François Lureau, Thales Optronique S.A.S. (France) . . . . . [9726-37]

2:40 pm: **Ultrafast laser with an average power of 120 W at 515 nm and a highly dynamic repetition rate in the MHz range for novel applications in micromachining**, Florian Harth, Melissa C. Piontek, Thomas Herrmann, Johannes L'huillier, Photonik-Zentrum Kaiserslautern e.V. (Germany) . . [9726-38]

3:00 pm: **Latest results of 10 petawatt laser beamline for ELI nuclear physics infrastructure**, François Lureau, Sébastien Laux, Olivier Casagrande, Olivier Chalus, Pierre-Antoine Duvochelle, Sandrine Herriot, Guillaume Matras, Christophe Radier, Christophe Simon-Boisson, Thales Optronique S.A.S. (France); Alexandru Boianu, Horia Hulubei National Institute of Physics and Nuclear Engineering (Romania); Ioan Dancus, Razvan Dabu, National Institute for Laser, Plasma and Radiation Physics (Romania) . . . . . [9726-39]

Coffee Break . . . . . Tue 3:20 pm to 3:50 pm

4:50 pm: **Laser transmitter design and performance for the slope imaging multi-polarization photon-counting lidar (SIMPL) instrument**, Anthony W. Yu, David J. Harding, Philip W. Dabney, NASA Goddard Space Flight Ctr. (USA) . . . . . [9726-20]

5:10 pm: **A single-frequency double-pulse Ho:YLF laser for CO<sub>2</sub>-lidar**, Philipp Kucirek, Ansgar Meissner, Patrick Eiselt, Marco Höfer, Hans-Dieter Hoffmann, Fraunhofer-Institut für Lasertechnik (Germany) . . . . . [9726-21]

5:30 pm: **Development of a conductively-cooled, tripled-pulsed 2-micron solid-state laser for simultaneous and independent measurements of water vapor and carbon dioxide from an airborne platform**, Upendra N. Singh, Mulugeta Petros, Tamer F. Refaat, NASA Langley Research Ctr. (USA); Hyung R. Lee, Karl D. Reithmaier, Science System & Applications, Inc. (USA); Charles W. Antill Jr., Jirong Yu, NASA Langley Research Ctr. (USA) . . . [9726-16]

5:50 pm: **Demonstration of a 500 mJ InnoSlab-amplifier for future lidar applications**, Jens Löhring, Michael Strotkamp, Florian Elsen, Raphael Kasemann, Jürgen Klein, Martin Traub, Gerd Kochem, Ansgar Meissner, Marco Höfer, Hans-Dieter Hoffmann, Fraunhofer-Institut für Lasertechnik (Germany) . . . . . [9726-53]

## TUESDAY 16 FEBRUARY

### SESSION 5

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL) . . TUE 8:00 TO 10:00 AM

### Pulsed Lasers I

Session Chair: **Helena Jelínková**, Czech Technical Univ. in Prague (Czech Republic)

8:00 am: **100 joule ultraviolet glass laser for dynamic compression research**, Jason S. Zweiback, Logos Technologies, Inc. (USA); Scott Fochs, Brian Ehrich, Jon Zuegel, Univ. of Rochester (USA) . . . . . [9726-23]

8:20 am: **Megawatt-level peak-power from a passively Q-switched hybrid fiber-bulk amplifier and its applications**, Axel Reiser, Juraj Bdzoch, Sven Höfer, Sina Riecke, Nicolas Kugler, Peter Genter, ROFIN-SINAR Laser GmbH (Germany) . . . . . [9726-24]

8:40 am: **High energy pulsewidth tunable CPA free picosecond source**, Julien Pouysegur, Florent Guichard, Institut d'Optique Graduate School (France); Yoann Zaouter, Amplitude Systèmes (France); Marc Hanna, Frédéric Druon, Institut d'Optique Graduate School (France); Clemens Hönninger, Eric Mottay, Amplitude Systèmes (France); Patrick Georges, Institut d'Optique Graduate School (France) . . . . . [9726-25]

9:00 am: **Multi-joule lasers operating at 60+ Hz for industrial and scientific applications**, Ryan Feeler, Chris Briggs, Wade Collins, Jay Doster, Faming Xu, Northrop Grumman Cutting Edge Optronics (USA) . . . . . [9726-26]

9:20 am: **A compact solid state laser**, Bhabana Pati, Eric D. Park, Kenneth Stebbins, Q-Peak, Inc. (USA) . . . . . [9726-27]

9:40 am: **High energetic and highly stable pulses from a Ho:YLF regenerative amplifier**, Peter Kroetz, Max-Planck-Institut für Struktur und Dynamik der Materie (Germany) and Deutsches Elektronen-Synchrotron (Germany); Axel Ruehl, Deutsches Elektronen-Synchrotron (Germany); Anne-Laure Calendron, Huseyin Cankaya, Deutsches Elektronen-Synchrotron (Germany) and Ctr. for Free-Electron Laser Science (Germany) and The Hamburg Ctr. for Ultrafast Imaging (Germany); Krishna Murari, Deutsches Elektronen-Synchrotron (Germany) and The Hamburg Ctr. for Ultrafast Imaging (Germany) and Univ. Hamburg (Germany); Gourab Chatterjee, Max-Planck-Institut für Struktur und Dynamik der Materie (Germany) and Ctr. for Free-Electron Laser Science (Germany); Franz X. Kärtner, Deutsches Elektronen-Synchrotron (Germany) and The Hamburg Ctr. for Ultrafast Imaging (Germany) and Ctr. for Free-Electron Laser Science (Germany); Ingmar Hartl, Deutsches Elektronen-Synchrotron (Germany); R. J. Dwayne Miller, Max-Planck-Institut für Struktur und Dynamik der Materie (Germany) and Ctr. for Free-Electron Laser Science (Germany) and The Hamburg Ctr. for Ultrafast Imaging (Germany) . . . . . [9726-28]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

LASE

# CONFERENCE 9726

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL)

## SESSION 8

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL) ... TUE 3:50 TO 6:00 PM

### Disk Lasers

Session Chair: **Marc Eichhorn**, Institut Franco-Allemand de Recherches de Saint-Louis (France)

3:50 pm: **High-energy ultra-short pulse thin disk lasers: new developments and applications**, Knut Michel, Sandro Klingebiel, Marcel Schultze, Catherine Y. Tesseit, Christoph Wandt, Stefan Prinz, Robert Bessing, Matthias Häfner, Thomas Metzger, TRUMPF Scientific Laser GmbH + Co., KG (Germany) ..... [9726-40]

4:10 pm: **Recent development of disk lasers at TRUMPF (Invited Paper)**, Sven-Silvius Schad, Tina Gottwald, Vincent Kuhn, Matthias Ackermann, Dominik Bauer, Michael Scharun, Alexander Killi, TRUMPF Laser GmbH (Germany) ..... [9726-41]

4:40 pm: **Innoslab and thin-disk amplifier system with 1.5 kW average power at 710 fs pulse duration**, Thomas Sartorius, Peter Rußbüldt, Fraunhofer-Institut für Lasertechnik (Germany); Dominik Bauer, Dirk Sutter, TRUMPF Laser GmbH (Germany); Hans-Dieter Hoffmann, Fraunhofer-Institut für Lasertechnik (Germany) ..... [9726-42]

5:00 pm: **Progress in kW-class picosecond thin-disk lasers development at the HiLASE**, Martin Smrž, Taisuke Miura, HiLASE Ctr. (Czech Republic); Michal Chyla, Jiri Muzik, Siva S. Nagisetty, HiLASE Ctr. (Czech Republic) and Czech Technical Univ. in Prague (Czech Republic); Ondrej Novák, Hana Turcicova, Jens Linnemann, HiLASE Ctr. (Czech Republic); Jaroslav Huynh, Patricie Severová, Pawel Sikocinski, HiLASE Ctr. (Czech Republic) and Czech Technical Univ. in Prague (Czech Republic); Akira Endo, Tomáš Mocek, HiLASE Ctr. (Czech Republic) ..... [9726-43]

5:20 pm: **High-gain Yb:YAG amplifier for ultrashort pulse laser at high-average power**, John Vetrovec, Drew A. Copeland, Amardeep S. Litt, Aqwest, LLC (USA); Detao Du, General Atomics Aeronautical Systems, Inc. (USA) ..... [9726-44]

5:40 pm: **Yb:YAG ceramic-based laser driver for inertial confinement fusion**, John Vetrovec, Drew A. Copeland, Amardeep S. Litt, Aqwest, LLC (USA) ..... [9726-45]

### POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Laser-diode pumped dysprosium-doped lead thiogallate laser output wavelength temporal evolution and tuning possibilities at 4.3-4.7  $\mu\text{m}$** , Helena Jelínková, Czech Technical Univ. in Prague (Czech Republic); Maxim E. Doroshenko, A. M. Prokhorov General Physics Institute (Russian Federation); Jan Šulc, Michal Němec, Michal Jelinek, Czech Technical Univ. in Prague (Czech Republic); Vjatcheslav V. Osiko, A. M. Prokhorov General Physics Institute (Russian Federation); Valerii V. Badikov, Dmitri V. Badikov, Kuban State Technological Univ. (Russian Federation) ..... [9726-9]

**Continuous-wave generation and tunability of eye-safe resonantly diode-pumped Er:YAG laser**, Michal Němec, Lukás Indra, Jan Šulc, Helena Jelínková, Czech Technical Univ. in Prague (Czech Republic) ..... [9726-68]

**Effect of cryogenic temperature on spectroscopic and laser properties of Er,La:SrF<sub>2</sub>-CaF<sub>2</sub> crystal**, Richard Švejkar, Jan Šulc, Michal Němec, Helena Jelínková, Czech Technical Univ. in Prague (Czech Republic); Maxim E. Doroshenko, Pavel P. Fedorov, Vjatcheslav V. Osiko, A. M. Prokhorov General Physics Institute (Russian Federation) ..... [9726-69]

**Characteristics and performance of a two-lens slit spatial filter for high power lasers**, Xiao Yuan, Han Xiong, Fan Gao, Xiang Zhang, Soochow Univ. (China) ..... [9726-70]

**1W level diode pumped Pr:YLF orange laser**, Martin Fibrich, Jan Šulc, Helena Jelínková, Czech Technical Univ. in Prague (Czech Republic) ..... [9726-71]

**Yb doping concentration and temperature influence on Yb:LuAg thermal lensing**, Karel Veselský, Jan Šulc, Helena Jelínková, Czech Technical Univ. in Prague (Czech Republic); Karel Nejezchleb, Václav Škoda, CRYTUR spol s.r.o. (Czech Republic) ..... [9726-72]

**Diode pumped compact cryogenic Yb:YAG/Cr:YAG pulsed laser**, Petr Navrátil, Venkatesan Jambunathan, Lucie Horackova, Antonio Lucianetti, Tomas Mocek, Institute of Physics of the ASCR, v.v.i. (Czech Republic) ..... [9726-73]

**Microchip laser based on Yb:YAG/v:YAG monolith crystal**, Karel Nejezchleb, CRYTUR spol s.r.o. (Czech Republic); Jan Šulc, Helena Jelínková, Czech Technical Univ. in Prague (Czech Republic); Václav Škoda, CRYTUR spol s.r.o. (Czech Republic) ..... [9726-74]

**Q-switched microchip MOPA generating 100 ps pulses at 532 nm**, Jari Nikkinen, Antti Härkönen, Iiro Leino, Ville-Markus Korpijärvi, Tampere Univ. of Technology (Finland); Gabriela Salamu, National Institute for Laser, Plasma and Radiation Physics (Romania); Mircea Guina, Tampere Univ. of Technology (Finland) ..... [9726-75]

**Direct generation of eye-safe vortex laser with opposite helicity**, Yongguang Zhao, Qiyao Liu, Deyuan Shen, Jiangsu Key Lab. of Advanced Laser Materials (China) ..... [9726-76]

**Generation of Vis-NIR light within the first biological optical window via frequency upconversion in Tm<sup>3+</sup>- and Tm<sup>3+</sup>/Er<sup>3+</sup>-doped tellurite glass excited at 1319 nm**, Artur S. Gouveia-Neto, Marcos V. D. Vermelho, Carlos Jacinto de Silva, Evandro J. T. A. Gouveia, Univ. Federal de Alagoas (Brazil); Fabia C. Cassanjes, Univ. Federal de Alfnas (Brazil) ..... [9726-78]

**Optical properties and upconversion emission in Yb<sup>3+</sup>-sensitized Er<sup>3+</sup>- and Pr<sup>3+</sup>-codoped PbGeO<sub>3</sub>:PbF<sub>2</sub>:xF<sub>2</sub> (x = Mg, Ba) glass**, Artur S. Gouveia-Neto, Univ. Federal de Alagoas (Brazil); Alexandre O. Silva, Univ. Federal Rural de Pernambuco (Brazil); Luciano A. Bueno, Univ. de Sorocaba (Brazil) ... [9726-79]

## WEDNESDAY 17 FEBRUARY

### SESSION 9

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL) ... WED 8:10 TO 9:50 AM

### Laser Materials and Characterization

Session Chair: **Dennis G. Harris**, MIT Lincoln Lab. (USA)

8:10 am: **Layered Yb:YAG ceramics produced by two different methods: processing, characterization and comparison**, Jan Hostasa, Laura Esposito, Valentina Biasini, Andreana Piancastelli, Istituto di Scienza e Tecnologia dei Materiali Ceramici (Italy); Matteo Vannini, Guido Toci, Istituto Nazionale di Ottica (Italy) ..... [9726-46]

8:30 am: **First laser operation and spectroscopic characterization of mixed garnet Yb:LuYAG ceramics**, Guido Toci, Istituto Nazionale di Ottica (Italy); Angela Pirri, Istituto di Fisica Applicata Nello Carrara (Italy); Jiang Li, Tengfei Xie, Yubai Pan, Shanghai Institute of Ceramics (China); Vladimir Babin, Alena Beitlerová, Martin Nikl, Institute of Physics of the ASCR, v.v.i. (Czech Republic); Matteo Vannini, Istituto Nazionale di Ottica (Italy) ..... [9726-47]

8:50 am: **Spectroscopic investigation of Yb, Ho, Pr:YAG as a 3  $\mu\text{m}$  laser source**, Ronald Stites, Thomas Harris, Air Force Research Lab. (USA) . [9726-48]

9:10 am: **Laser and optical properties of Yb:YAG ceramics with layered doping distribution: design, characterization and evaluation of different production processes**, Guido Toci, Antonio Lapucci, Marco Ciofini, Istituto Nazionale di Ottica (Italy); Laura Esposito, Jan Hostasa, Istituto di Scienza e Tecnologia dei Materiali Ceramici (Italy); Leonida A. Gizzi, Luca Labate, Paolo Ferrara, Istituto Nazionale di Ottica (Italy); Angela Pirri, Istituto di Fisica Applicata Nello Carrara (Italy); Matteo Vannini, Istituto Nazionale di Ottica (Italy) . [9726-49]

9:30 am: **Structurally enhanced phosphate glasses for eye-safe lasers**, Simi A. George, SCHOTT North America, Inc. (USA) ..... [9726-50]

Coffee Break ..... Wed 9:50 am to 10:20 am



# CONFERENCE 9726

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL)

## SESSION 11

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL) . . . WED 3:30 TO 5:50 PM

### Novel Concepts II

Session Chair: **Ramesh K. Shori**, SPAWAR Systems Ctr. (USA)

3:30 pm: **Spectral and temporal control of Q-switched solid-state lasers using intracavity MEMS**, Alan Paterson, Ralf Bauer, Ran Li, Univ. of Strathclyde (United Kingdom); Caspar Clark, Helia Photonics Ltd. (United Kingdom); Walter Lubeigt, Deepak Uttamchandani, Univ. of Strathclyde (United Kingdom) . . . . . [9726-55]

3:50 pm: **Compact single-frequency polarization maintaining CW single stage fiber amplifier**, Enkeleda Balliu, Magnus Engholm, Mid Sweden Univ. (Sweden); Lars Norin, Acreo FiberLab (Sweden); Gunnar Elgcróna, Jonas Hellström, Håkan Karlsson, Cobolt AB (Sweden) . . . . . [9726-56]

4:10 pm: **High brightness sub-nanosecond Q-switched laser using volume Bragg gratings**, Brian M. Anderson, Evan Hale, George Venus, Daniel Ott, Ivan Divliansky, Leonid Glebov, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9726-57]

4:30 pm: **Solid-state lasers directly pumped by InGaN diode lasers: Ti:sapphire and Pr<sup>3+</sup>:LiYF<sub>4</sub> lasers**, Hiroki Tanaka, Ryosuke Kariyama, Kodai Iijima, Ryota Sawada, Fumihiko Kannari, Keio Univ. (Japan) . . . . . [9726-58]

4:50 pm: **Tunability of the highly stable single-frequency mode of a hybrid laser**, Mamoun Wahbeh, Raman Kashyap, Ecole Polytechnique de Montréal (Canada) . . . . . [9726-59]

5:10 pm: **11.5W Yb:YAG planar waveguide laser grown by pulsed laser deposition**, Stephen J Beecher, James A Grant-Jacob, Tina L Parsonage, Ping Hua, Jacob I Mackenzie, Dave P Shepherd, Robert W Eason, Univ of Southampton (United Kingdom) . . . . . [9726-60]

5:30 pm: **Donut beam generation in a hybrid fiber-laser-pumped Ho:YAG laser**, A C Butler, P C Shardlow, R T Uren, W A Clarkson, Optoelectronics Research Centre (United Kingdom) . . . . . [9726-61]

## THURSDAY 18 FEBRUARY

### SESSION 12

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL) . . . THU 8:00 TO 9:40 AM

### UV and VIS Lasers

Session Chair: **Narasimha S. Prasad**, NASA Langley Research Ctr. (USA)

8:00 am: **Frequency extension of a high power diamond Raman laser by intracavity second harmonic generation**, Hadiya Jasbeer, Robert Williams, Aaron McKay, Richard Mildren, Macquarie Univ. (Australia) . . . . . [9726-62]

8:20 am: **A 7.5-mJ, 21-ns, 7-kHz green rotary disk laser with diffraction limited beam quality**, Santanu Basu, Basu Labs Inc. (USA) . . . . . [9726-63]

8:40 am: **Compact side-pumped passively Q-switched Yb:YAG laser with frequency conversion to UV**, Brian Cole, Chris McIntosh, Alan D. Hays, Tom DiLazaro, Lew Goldberg, U.S. Army RDECOM CERDEC NVESD (USA) [9726-64]

9:00 am: **Development of high coherence high power 193nm laser**, Satoshi Tanaka, Masaki Arakawa, Atsushi Fuchimukai, Yoichi Sasaki, Takashi Onose, Yasuhiro Kamba, Hironori Igarashi, Chen Qu, Mitsuru Tamiya, Shinji Ito, Koji Kakizaki, Gigaphoton Inc. (Japan); Hongwen Xuan, Yohei Kobayashi, The Univ. of Tokyo (Japan); Hakaru Mizoguchi, Gigaphoton Inc. (Japan) . . . . . [9726-66]

9:20 am: **White random lasing in mixture of ZnSe, CdS and CdSSe micropowders**, Ahmed Y. Alyamani, King Abdulaziz City for Science and Technology (Saudi Arabia); Maksim S. Leanenina, National Academy of Sciences of Belarus (Belarus); Lafi M. Alanazi, Maher M. Aljohani, Abdulaziz A. Aljarawi, King Abdulaziz City for Science and Technology (Saudi Arabia); Nikolay V. Rzhetskij, Evgeniy V. Lutsenko, Gennadiy P. Yablonskii, National Academy of Sciences of Belarus (Belarus) . . . . . [9726-67]

## LASE Plenary Session

WED 10:20 AM TO 12:30 PM

LOCATION: ROOM 103 (SOUTH EXHIBIT LEVEL)

- 10:20 am: **Welcome and Opening Remarks**  
**Guido Hennig**, Daetwyler Graphics AG (Switzerland)  
**Yongfeng Lu**, Univ. of Nebraska-Lincoln (USA)
- 10:25 am: **Announcement of the Green Photonics Best Paper Award and the 3D Printing, Fabrication, and Manufacturing Best Paper Award**  
**Stephen J. Eglash**, Energy and Environment Affiliates Program, Stanford Univ. (USA)  
**Henry Helvajian**, The Aerospace Corp. (USA)
- 10:30 am: **Emerging Applications of Photonic Crystal Fibers**  
**Philip Russell**, Max-Planck Institute for the Science of Light (Germany) and Univ. of Erlangen-Nuremberg (Germany)
- 11:10 am: **Optical 3D Nano-fabrication: Drawing or Growing?**  
**Satoshi Kawata**, Osaka Univ. (Japan) and RIKEN (Japan)
- 11:50 am: **High Power Semiconductor Lasers: Disrupting a Fragmented Industry**  
**Scott Keeney**, nLight Corp. (USA)

Lunch/Exhibition Break . . . . . Wed 12:30 pm to 2:00 pm

### SESSION 10

LOCATION: ROOM 132 (NORTH EXHIBIT LEVEL) . . WED 2:00 TO 3:00 PM

### Novel Concepts I

Session Chair: **Bojan Resan**, Lumentum Operations LLC (Switzerland)

2:00 pm: **High-power single-longitudinal mode and tunable diamond Raman laser at 1240 nm**, Soumya Sarang, Oliver Lux, Ondrej Kitzler, Robert Williams, Aaron McKay, Richard Mildren, Macquarie Univ. (Australia) . . . . . [9726-51]

2:20 pm: **100W class green 10ps 280µj laser with M2<1.4 using Z-slab amplifier**, Simon P. Chard, Cristtel Y. Ramirez-Corral, Powerlase Photonics Ltd. (United Kingdom); Michael Bass, Ying Chen, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Young K. Kwon, Powerlase Photonics Ltd. (United Kingdom) . . . . . [9726-52]

2:40 pm: **Random anti-reflection structures on large optics for high energy laser applications**, Jesse A. Frantz, Lynda E. Busse, Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA); Kevin J. Major, Gopal Sapkota, Menelaos K. Poutous, The Univ. of North Carolina at Charlotte (USA); Ishwar D. Aggarwal, Sotera Defense Solutions, Inc. (USA) . . . . . [9726-54]

Coffee Break . . . . . Wed 3:00 pm to 3:30 pm

LASE

# CONFERENCE 9727

LOCATION: ROOM 133 (NORTH EXHIBIT LEVEL)

Monday–Thursday 15–18 February 2016 • Proceedings of SPIE Vol. 9727

# Laser Resonators, Microresonators, and Beam Control XVIII

Conference Chairs: **Alexis V. Kudryashov**, Moscow State Open Univ. (Russian Federation); **Alan H. Paxton**, Air Force Research Lab. (USA); **Vladimir S. Ilchenko**, OEwaves, Inc. (USA)

Conference Co-Chair: **Lutz Aschke**, TRUMPF Laser- und Systemtechnik GmbH (Germany)

Program Committee: **Andrea M. Armani**, The Univ. of Southern California (USA); **Gaurav Bahl**, Univ. of Illinois at Urbana-Champaign (USA); **Yanne K. Chembo**, FEMTO-ST (France); **Jean-Claude M. Diels**, The Univ. of New Mexico (USA); **Hans Joachim Eichler**, Laser- und Medizin-Technologie GmbH, Berlin (Germany); **Andrew Forbes**, CSIR National Laser Ctr. (South Africa); **Pierre Galarneau**, INO (Canada); **Thomas Graf**, Univ. Stuttgart (Germany); **Tobias J. Kippenberg**, Ecole Polytechnique Fédérale de Lausanne (Switzerland); **James R. Leger**, Univ. of Minnesota, Twin Cities (USA); **Andrey B. Matsko**, OEwaves, Inc. (USA); **Gualtiero Nunzi Conti**, Istituto di Fisica Applicata Nello Carrara (Italy); **Andrew W. Poon**, Hong Kong Univ. of Science and Technology (Hong Kong, China); **Michelle L. Povinelli**, The Univ. of Southern California (USA); **Michael J. Scaggs**, Neoteric Concepts, LLC (USA); **Haiyin Sun**, ChemImage Corp. (USA); **Kunihiko Washio**, Paradigm Laser Research Ltd. (Japan); **Yun-Feng Xiao**, Peking Univ. (China); **Lei Xu**, Fudan Univ. (China); **Lan Yang**, Washington Univ. in St. Louis (USA)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . . . . . MON 8:05 TO 9:55 AM

### Novel Microresonator Optics I

Session Chair: **Vladimir S. Ilchenko**, OEwaves, Inc. (USA)

8:05 am: **Solvent diffusion measurements using polymeric resonators based on whispering gallery modes**, Amir R. Ali, The German Univ. in Cairo (Egypt) and Southern Methodist Univ. (USA); Catherine Elias, Sara Iskander, Khalid Al-Agha, The German Univ. in Cairo (Egypt); Tindaro Ioppolo, Southern Methodist Univ. (USA) . . . . . [9727-1]

8:25 am: **Long period gratings based frequency selective interrogation of micro-resonators along the same fiber**, Daniele Farnesi, Istituto di Fisica Applicata “Nello Carrara” (Italy) and Museo Storico della Fisica e Ctr. Studi e Ricerche “Enrico Fermi” (Italy); Francesco Chiavaioli, Francesco Baldini, Istituto di Fisica Applicata “Nello Carrara” (Italy); Giancarlo C. Righini, Centro Studi e Ricerche “E. Fermi” (Italy) and Museo Storico della Fisica e Ctr. Studi e Ricerche “Enrico Fermi” (Italy); Silvia Soria, Cosimo Trono, Gualtiero Nunzi Conti, Istituto di Fisica Applicata “Nello Carrara” (Italy) . . . . . [9727-2]

8:45 am: **Development of packaged silica microspheres coupled with tapered optical microfibres**, Pengfei Wang, Harbin Engineering Univ. (China); Ramgopal Madugani, Okinawa Institute of Science and Technology Graduate Univ. (Japan); Gerald Farrell, Dublin Institute of Technology (Ireland); Gilberto Brambilla, Univ. of Southampton (United Kingdom); Sile G. NicChormaic, Okinawa Institute of Science and Technology Graduate Univ. (Japan) . . [9727-3]

9:05 am: **Observation of optically induced transparency in a micro-cavity** (*Invited Paper*), Yuanlin Zheng, Jianjun Cao, Wenjie Wan, Shanghai Jiao Tong Univ. (China) . . . . . [9727-4]

9:30 am: **Deterministic photon-atom and photon-photon interactions based on single-photon Raman interaction** (*Invited Paper*), Barak Dayan, Weizmann Institute of Science (Israel) . . . . . [9727-5]

Coffee Break . . . . . Mon 9:55 am to 10:25 am

### SESSION 2

LOCATION: RM 133 (NORTH EXHIBIT LEVEL) MON 10:25 AM TO 12:00 PM

### Novel Microresonator Optics II

Session Chair: **Gaurav Bahl**, Univ. of Illinois at Urbana-Champaign (USA)

10:25 am: **High-Q GRIN resonators** (*Invited Paper*), Andrea M. Armani, Soheil Soltani, Hyungwoo Choi, Vinh Diep, Andre Kovach, Kelvin Kuo, The Univ. of Southern California (USA) . . . . . [9727-6]

10:50 am: **Laser nanofabrication for advanced micro-cavities** (*Invited Paper*), Hong-Bo Sun, Huai-Liang Xu, Xue-Peng Zhan, Qi-Dai Chen, Jilin Univ. (China) . . . . . [9727-7]

11:15 am: **Elastomer photonics** (*Invited Paper*), Diederik S. Wiersma, Karlsruher Institut für Technologie (Germany) and European Lab. for Non-linear Spectroscopy (Italy) and Consiglio Nazionale delle Ricerche-Istituto Nazionale di Ottica (Italy) . . . . . [9727-8]

11:40 am: **III-V-semiconductor vertically-coupled whispering-gallery mode resonators made by selective lateral oxidation**, Stephane Calvez, Gaël Lafleur, Clément Arlotti, Alexandre Larue, Pierre-Francois Calmon, Alexandre Arnoult, Guilhem Almuneau, Olivier Gauthier-Lafaye, Lab. d'Analyse et d'Architecture des Systèmes (France) . . . . . [9727-9]

Lunch Break . . . . . Mon 12:00 pm to 1:00 pm

### SESSION 3

LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . . MON 1:00 TO 3:00 PM

### Microresonator Frequency Combs I

Joint Session with Conferences 9727 and 9731

Session Chair: **Andrea M. Armani**, The Univ. of Southern California (USA)

1:00 pm: **Self-stabilized 3-5  $\mu\text{m}$  frequency comb based on frequency-divide-by-two GaAs OPO** (*Invited Paper*), Kevin F. Lee, Christian Mohr, Jie Jiang, IMRA America, Inc. (USA); Peter G. Schunemann, BAE Systems (USA); Konstantin L. Vodopyanov, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Martin E Fermann, IMRA America, Inc. (USA) . . . . . [9731-1]

1:25 pm: **Octave-wide frequency comb centered at 4  $\mu\text{m}$  based on a subharmonic OPO with Hz-level relative linewidth**, Viktor O. Smolski, Jia Xu, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Peter G. Schunemann, BAE Systems (USA); Konstantin L. Vodopyanov, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . [9731-2]

1:45 pm: **High-Q resonators for soliton combs and optical gyros** (*Invited Paper*), Kerry J. Vahala, California Institute of Technology (USA) . . . . . [9727-10]

2:10 pm: **Nonlinear control in optical microcavity systems: switching and Kerr comb generation in a whispering gallery mode cavity** (*Invited Paper*), Takasumi Tanabe, Keio Univ. (Japan) . . . . . [9727-11]

2:35 pm: **To be announced** (*Invited Paper*), Alexander L. Gaeta, Columbia Univ. (USA) . . . . . [9727-12]

Coffee Break . . . . . Mon 3:00 pm to 3:30 pm

# CONFERENCE 9727

LOCATION: ROOM 133 (NORTH EXHIBIT LEVEL)

## SESSION 4

LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . . MON 3:30 TO 6:00 PM

### Microresonator Frequency Combs II

Joint Session with Conferences 9727 and 9731

Session Chair: **Konstantin L. Vodopyanov**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

3:30 pm: **Soliton induced Cherenkov radiation based chipscale frequency combs** (*Invited Paper*), Victor Brasch, Michael Geiselmann, Martin H. P. Pfeiffer, Arne Kordts, Maxim Karpov, Hairun Guo, Michail Zervas, Junqiu Liu, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Michael L. Gorodetsky, Lomonosov Moscow State Univ. (Russian Federation) and Russian Quantum Ctr. (Romania); Tobias J. Kippenberg, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9727-13]

3:55 pm: **Miniature multioctave light source based on a monolithic microcavity** (*Invited Paper*), Wei Liang, Anatoliy A. Savchenkov, OEwaves, Inc. (USA); James F. McMillan, Columbia Univ. (USA); Zhenda Xie, Univ. of California, Los Angeles (USA); Jan Burkhardt, Columbia Univ. (USA); Vladimir S. Ilchenko, OEwaves, Inc. (USA); Chee Wei Wong, Univ. of California, Los Angeles (USA); Andrey B. Matsko, Lute Maleki, OEwaves, Inc. (USA) . . . . . [9731-3]

4:20 pm: **On-chip diamond frequency combs and Raman lasers** (*Invited Paper*), Marko Loncar, Pawel M. Latawiec, Vivek Venkataraman, Michael J. Burek, Harvard School of Engineering and Applied Sciences (USA) . . . . . [9727-14]

4:45 pm: **Dynamics and generation of microresonator frequency combs** (*Invited Paper*), Chee Wei Wong, Shu-Wei Huang, Jinkang Lim, Abhinav K. Vinod, Jinghui Yang, Univ. of California, Los Angeles (USA); Heng Zhou, Univ. of Electronic Science and Technology of China (China) . . . . . [9727-15]

5:10 pm: **Generation of ultra-low-noise optical parametric combs** (*Invited Paper*), Stojan Radic, Univ. of California, San Diego (USA) . . . . . [9731-4]

5:35 pm: **Optical frequency comb and spectroscopy with crystalline resonators in MIR** (*Invited Paper*), Nan Yu, Jet Propulsion Lab. (USA) . [9727-16]

## TUESDAY 16 FEBRUARY

## SESSION 5

LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . . TUE 8:00 TO 10:05 AM

### Frequency Combs and Lasers

Session Chair: **Tobias J. Kippenberg**, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

8:00 am: **Mode control for square resonator microlasers**, Yong-Zhen Huang, Ming-Ying Tang, Yue-De Yang, Jin-Long Xiao, Yun Du, Institute of Semiconductors (China) . . . . . [9727-17]

8:20 am: **On the phase noise of Kerr comb RF photonic oscillators**, Andrey B. Matsko, Wei Liang, Danny Eliyahu, Vladimir Ilchenko, Anatoliy A. Savchenkov, Lute Maleki, OEwaves, Inc. (USA) . . . . . [9727-18]

8:40 am: **Third order nonlinear phenomena in silica solid and hollow whispering gallery mode resonators**, Silvia Soria Huguet, Istituto di Fisica Applicata Nello Carrara (Italy); Daniele Farnesi, Istituto di Fisica Applicata Nello Carrara (Italy) and Museo Storico della Fisica e Centro Studi e Ricerche "Enrico Fermi" (Italy); Andrea Barucci, Franco Cosi, Istituto di Fisica Applicata Nello Carrara (Italy); Giancarlo C. Righini, Istituto di Fisica Applicata Nello Carrara (Italy) and Museo Storico della Fisica e Centro Studi e Ricerche "Enrico Fermi" (Italy); Gualtiero Nunzi Conti, Istituto di Fisica Applicata Nello Carrara (Italy) . . . . . [9727-19]

9:00 am: **Multi-scale nonlinear effects in whispering-gallery mode resonators**, Guoping Lin, Souleymane Diallo, Romain Martinenghi, Yanne K. Chembo, FEMTO-ST (France) . . . . . [9727-20]

9:20 am: **Diamond microresonator-based Raman laser at 2  $\mu$ m**, Pawel Latawiec, Vivek Venkataraman, Michael J. Burek, Harvard Univ. (USA); Birgit J. M. Hausmann, Lawrence Berkeley National Lab. (USA); Irfan Bulu, Schlumberger-Doll Research Ctr. (USA); Marko Loncar, Harvard Univ. (USA) . . . . . [9727-21]

9:40 am: **Novel ultrafast sources on chip: filter driven four wave mixing lasers, from high repetition rate to burst mode operation** (*Invited Paper*), Alessia Pasquazi, Marco Peccianti, Univ. of Sussex (United Kingdom); Sai T. Chu, City Univ. of Hong Kong (Hong Kong, China); David J. Moss, RMIT Univ. (Australia); Roberto Morandotti, Institut National de la Recherche Scientifique (Canada) . . . . . [9727-22]

Coffee Break . . . . . Tue 10:05 am to 10:35 am

## SESSION 6

LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . TUE 10:35 AM TO 12:00 PM

### Optomechanics with Microresonators

Session Chair: **Andrey B. Matsko**, OEwaves, Inc. (USA)

10:35 am: **Using mechanics to convert between microwave and optical frequencies** (*Invited Paper*), Andrew N. Cleland, Univ. of California, Santa Barbara (USA) . . . . . [9727-23]

11:00 am: **Droplet's acoustics**, Raphael Dahan, Technion-Israel Institute of Technology (Israel) . . . . . [9727-24]

11:20 am: **Optical binding in white light**, Shai Maayani, Technion-Israel Institute of Technology (Israel) . . . . . [9727-25]

11:40 am: **Tweezers controlled resonator**, Samuel Kaminski, Technion-Israel Institute of Technology (Israel) . . . . . [9727-26]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:40 pm

## SESSION 7

LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . . . TUE 1:40 TO 3:00 PM

### Beam Shaping I

Joint Session with Conferences 9727 and 9741

Session Chair: **Lutz Aschke**,

TRUMPF Laser- und Systemtechnik GmbH (Germany)

1:40 pm: **Gauss to top-hat beam shaping with aspheres**, Anna Möhl, Sven Wickenhagen, Ulrike Fuchs, asphericon GmbH (Germany) . . . . . [9741-1]

2:00 pm: **Field mappers for laser material processing**, Paul Blair, Matthew O. Currie, Natalia Trela, Howard J. Baker, Eoin Murphy, Duncan Walker, Roy McBride, PowerPhotonic Ltd. (United Kingdom) . . . . . [9727-27]

2:20 pm: **Novel specialty fiber delivering flat-top beams with on-demand beam parameter product**, Clémence Jollivet, Kevin F. Farley, Michael Conroy, Jaroslaw Abramczyk, Nufem (USA); Steffen Belke, Frank Becker, ROFIN-SINAR Laser GmbH (Germany); Kanishka Tankala, Nufem (USA) . . . . . [9727-28]

2:40 pm: **Real time M<sup>2</sup> and beam parameter product measurement using GigE CMOS sensors**, Michael J. Scaggs, Gilbert J. Haas, Haas Laser Technologies, Inc. (USA) . . . . . [9727-29]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

## SESSION 8

LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . . . TUE 3:30 TO 5:10 PM

### Beam Shaping II

Joint Session with Conferences 9727 and 9741

Session Chair: **Lutz Aschke**,

TRUMPF Laser- und Systemtechnik GmbH (Germany)

3:30 pm: **Monolithic fiber coupler for high power diode laser bars**, Jens Meinschien, Thomas Mitra, Klaus Bagschik, LIMO Lissotschenko Mikrooptik GmbH (Germany) . . . . . [9727-30]

3:50 pm: **Flexible assembly module for beam-shaping product families based on support structures**, Sebastian Haag, Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Olaf Ruebenach, INGENERIC GmbH (Germany); Andreas Beleke, Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Tobias Haverkamp, INGENERIC GmbH (Germany); Tobias Müller, Daniel Zontar, Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Christian Wenzel, Innolite GmbH (Germany) and Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Christian Brecher, Fraunhofer-Institut für Produktionstechnologie IPT (Germany) . . . . . [9727-31]

4:10 pm: **Industrial fiber beam delivery system for ultrafast lasers: Applications and recent advances**, Max C. Funck, Björn Wedel, Sebastian Eilzer, PT Photonic Tools GmbH (Germany) . . . . . [9741-2]

4:30 pm: **Monocrystalline CVD-diamond optics for high-power laser applications**, Carlo Holly, RWTH Aachen Univ. (Germany); Martin Traub, Hans-Dieter Hoffmann, Fraunhofer-Institut für Lasertechnik (Germany); Claudia Widmann, Dietmar Brink, Christoph Nebel, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); Titus Gotthardt, Muharrem Ceyhun Sözbir, Christian Wenzel, Fraunhofer-Institut für Produktionstechnologie (Germany) . . . . . [9741-4]

LASE

# CONFERENCE 9727

LOCATION: ROOM 133 (NORTH EXHIBIT LEVEL)

4:50 pm: **Computing specific intensity distributions for laser material processing by solving an inverse heat conduction problem**, Annika Völl, RWTH Aachen Univ. (Germany); Jochen Stollenwerk, RWTH Aachen Univ. (Germany) and Fraunhofer-Institut für Lasertechnik (Germany); Peter Loosen, Fraunhofer-Institut für Lasertechnik (Germany) and RWTH Aachen Univ (Germany) ..... [9741-5]

## POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Determination of induced thermal lensing from the coefficient of defocus aberration using Shack-Hartmann wavefront sensor**, Lebohang T. Bell, Sandile Ngcobo, Council for Scientific and Industrial Research (South Africa); Andrew Forbes, Univ. of KwaZulu-Natal (South Africa); Darryl Naidoo, CSIR National Laser Ctr. (South Africa) ..... [9727-55]

**White light emission from high density GaN-based nano-umbrellas acting as whispering gallery mode resonators**, Tetsuya Kouno, Shizuoka Univ. (Japan); Katsumi Kishino, Sophia Univ. (Japan); Masaru Sakai, Univ. of Yamanashi (Japan); Kazuhiko Hara, Shizuoka Univ. (Japan) ..... [9727-56]

**Investigations of a dual seeded 1178nm Raman laser system**, Leanne J. Henry, Air Force Research Lab. (USA); Michael Klopfer, The Univ. of New Mexico (USA); Matthew K. Block, Leidos, Inc. (USA); Ravinder Jain, The Univ. of New Mexico (USA) ..... [9727-57]

**The finite-difference matrix for beam propagation: Eigenvalues and eigenvectors**, Alan H. Paxton, Air Force Research Lab. (USA) ..... [9727-58]

**Intra-cavity generation of laser modes in a diode-pumped digital laser using incomplete amplitude masks**, Sandile Ngcobo, Teboho Bell, CSIR National Laser Ctr. (South Africa) ..... [9727-59]

**Femtosecond laser-induced two-photon polymerization of whispering gallery mode microresonators**, Nathália B. Tomazio, Instituto de Física de São Carlos IFSC-USP (Brazil); Xavier Roselló, Univ. de València (Spain); Adriano J. G. Otuka, Gustavo F. B. Almeida, Instituto de Física de São Carlos IFSC-USP (Brazil); Antonio D. Cremades, Miguel V. Andrés, Univ. de València (Spain); Cleber R. Mendonça, Instituto de Física de São Carlos IFSC-USP (Brazil) ..... [9727-60]

**Sugar sensor based on GaN nanoring lasers grown by nanocrystal growth technique**, Hoshi Takeshima, Tetsuya Kouno, Shizuoka Univ. (Japan); Katsumi Kishino, Sophia Univ. (Japan); Masaru Sakai, Univ. of Yamanashi (Japan); Kazuhiko Hara, Shizuoka Univ. (Japan) ..... [9727-61]

**Effect of the properties of a microresonator with a surface layer on the resonance frequency**, Gustav Schweiger, Thomas Weigel, Andreas Ostendorf, Ruhr-Univ. Bochum (Germany) ..... [9727-62]

**Time-domain observation of strong coupling between counter-propagating ultra-high Q whispering gallery modes**, Wataru Yoshiki, Zhelun Chen, Keio Univ. (Japan); Tomohiro Tetsumoto, Keio University (Japan); Takasumi Tanabe, Keio Univ. (Japan) ..... [9727-63]

**Random laser action in Al nanoparticle/Rh6G-doped silica gel**, Chao Yang, Guoying Feng, Hong Zhang, Sichuan University (China); Shouhuan Zhou, North China Research Institute of Electro-Optics (China) ..... [9727-64]

**Problems of uniform focal spot formation by means of deformable mirror**, Alexis V. Kudryashov, Moscow State Univ. of Mechanical Engineering (Russian Federation) ..... [9727-65]

**Nonperturbative monitoring of dissipative Kerr solitons in microresonators**, Michael L. Gorodetsky, Lomonosov Moscow State Univ. (Russian Federation) and Russian Quantum Ctr. (Russian Federation); Maxim Karpov, Hairun Guo, Erwan Lucas, Ecole Polytechnique Fédérale de Lausanne (Switzerland); G. Lihachev, Lomonosov Moscow State Univ. (Russian Federation) and Russian Quantum Ctr. (Russian Federation); Tobias J. Kippenberg, Ecole Polytechnique Fédérale de Lausanne (Switzerland) ..... [9727-66]

## WEDNESDAY 17 FEBRUARY

### SESSION 9

LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . WED 8:00 TO 9:40 AM

## Microresonators: Quantum and Nonlinear Phenomena and Applications

Session Chair: **Lei Xu**, Fudan Univ. (China)

8:00 am: **Nanofiber Bragg grating cavities for quantum optical devices**, Andreas W. Schell, Hideaki Takashima, Yasuko Oe, Shinjiro Fujita, Shigeki Takeuchi, Kyoto Univ. (Japan) ..... [9727-32]

8:20 am: **On-chip quantum optics using integrated quantum dot microlasers**, Pierce Munnely, Matthias M. Karow, Tobias Heindel, Technische Univ. Berlin (Germany); Martin Kamp, Sven Höfling, Christian Schneider, Julius-Maximilians-Univ. Würzburg (Germany); Stephan Reitzenstein, Technische Univ. Berlin (Germany) ..... [9727-33]

8:40 am: **On forced Rayleigh scattering observed in crystalline whispering gallery mode resonator**, Anatoliy Savchenkov, Andrey B. Matsko, Vladimir S. Ilchenko, Lute Maleki, OEwaves, Inc. (USA) ..... [9727-34]

9:00 am: **Phase matched second harmonic generation in an on-chip high-Q lithium niobate microresonator fabricated by femtosecond laser direct writing**, Jintian Lin, Shanghai Institute of Optics and Fine Mechanics (China); Yingxin Xu, Zhejiang Univ. (China); Zhiwei Fang, ShanghaiTech Univ. (China); Min Wang, Shanghai Institute of Optics and Fine Mechanics (China); Wei Fang, Zhejiang Univ. (China); Ya Cheng, ShanghaiTech Univ. (China); Jiangxin Song, Shanghai Institute of Optics and Fine Mechanics (China) ..... [9727-35]

9:20 am: **PT-symmetric microdisk lasers (Invited Paper)**, Qinghai Song, Harbin Institute of Technology Shenzhen Graduate School (China) ..... [9727-36]

Coffee Break ..... Wed 9:40 am to 10:20 am

## LASE Plenary Session

WED 10:20 AM TO 12:30 PM

LOCATION: ROOM 103 (SOUTH EXHIBIT LEVEL)

10:20 am: **Welcome and Opening Remarks**  
**Guido Hennig**, Daetwyler Graphics AG (Switzerland)  
**Yongfeng Lu**, Univ. of Nebraska-Lincoln (USA)

10:25 am: **Announcement of the Green Photonics Best Paper Award and the 3D Printing, Fabrication, and Manufacturing Best Paper Award**  
**Stephen J. Eglash**, Energy and Environment Affiliates Program, Stanford Univ. (USA)  
**Henry Helvajian**, The Aerospace Corp. (USA)

10:30 am: **Emerging Applications of Photonic Crystal Fibers**  
**Philip Russell**, Max-Planck Institute for the Science of Light (Germany) and Univ. of Erlangen-Nuremberg (Germany)

11:10 am: **Optical 3D Nano-fabrication: Drawing or Growing?**  
**Satoshi Kawata**, Osaka Univ. (Japan) and RIKEN (Japan)

11:50 am: **High Power Semiconductor Lasers: Disrupting a Fragmented Industry**  
**Scott Keeney**, nLight Corp. (USA)

Lunch/Exhibition Break ..... Wed 12:30 pm to 1:30 pm



# CONFERENCE 9727

LOCATION: ROOM 133 (NORTH EXHIBIT LEVEL)

THURSDAY 18 FEBRUARY

SESSION 10  
LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . . WED 1:30 TO 3:00 PM

## Microresonator Sensors I

Session Chair: **Vladimir S. Ilchenko**, OEwaves, Inc. (USA)

- 1:30 pm: **Micro-resonator-based electric field sensors with long durations of sensitivity**, Amir R. Ali, German Univ. in Cairo (Egypt); Nada El Ghandour, Shaimaa El Baklish, The German Univ. in Cairo (Egypt); Ben Wise, Volkan Ötügen, Tindaro Ioppolo, Southern Methodist Univ. (USA) . . . . . [9727-37]
- 1:50 pm: **Whispering-gallery mode resonator sensors based on liquid droplets**, Saverio Avino, Rosa Zullo, Antonio Giorgini, Pietro Malara, Gianluca Gagliardi, Istituto Nazionale di Ottica (Italy) . . . . . [9727-67]
- 2:10 pm: **Whispering gallery mode plasmonics and biosensing (Invited Paper)**, Frank Vollmer, Max-Planck-Institut für die Physik des Lichts (Germany) . . . . . [9727-39]
- 2:35 pm: **Optofluidic ring resonator technology platform for label-free biosensing, optomechanics, optofluidic lasers, and micro-gas chromatography (Invited Paper)**, Xudong Fan, Univ. of Michigan (USA) . . . . . [9727-40]
- Coffee Break . . . . . Wed 3:00 pm to 3:30 pm

SESSION 11  
LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . . WED 3:30 TO 5:55 PM

## Microresonator Sensors II

Session Chair: **Andrew W. Poon**, Hong Kong Univ. of Science and Technology (Hong Kong, China)

- 3:30 pm: **Quantum dot optofluidic lasers and their prospects for biochemical sensing (Invited Paper)**, Alper Kiraz, Koç Univ. (Turkey) and Univ. of Michigan (USA); Qiushu Chen, Univ. of Michigan (USA); Mehdi Aas, Koç Univ. (Turkey); Alexandr Jonas, Istanbul Technical Univ. (Turkey); Xudong Fan, Univ. of Michigan (USA) . . . . . [9727-41]
- 3:55 pm: **Microfluidic determination of vitamin D3 and its binding protein using a fluorescent cylindrical microcavity**, Stephen Lane, Peter West, Univ. of Alberta (Canada); Alexandre François, The Univ. of Adelaide (Australia); Al Meldrum, Univ. of Alberta (Canada) . . . . . [9727-42]
- 4:15 pm: **Flow sensor using a hollow WGM microlaser**, Jonathan M. Ward, Yong Yang, Sile G. NicChormaic, Okinawa Institute of Science and Technology Graduate Univ. (Japan) . . . . . [9727-43]
- 4:35 pm: **Localized biomolecules immobilization in optical microbubble resonators**, Simone Berneschi, Francesco Baldini, Andrea Barucci, Istituto di Fisica Applicata "Nello Carrara" (Italy); Alessandro Cosci, Museo Storico della Fisica e Ctr. Studi e Ricerche "Enrico Fermi" (Italy) and Istituto di Fisica Applicata "Nello Carrara" (Italy); Franco Cosi, Istituto di Fisica Applicata "Nello Carrara" (Italy); Daniele Farnesi, Museo Storico della Fisica e Ctr. Studi e Ricerche "Enrico Fermi" (Italy) and Istituto di Fisica Applicata "Nello Carrara" (Italy); Gualtiero Nunzi Conti, Istituto di Fisica Applicata "Nello Carrara" (Italy) and Museo Storico della Fisica e Ctr. Studi e Ricerche "Enrico Fermi" (Italy); Giancarlo C. Righini, Museo Storico della Fisica e Ctr. Studi e Ricerche "Enrico Fermi" (Italy); Silvia Soria, Sara Tombelli, Cosimo Trono, Istituto di Fisica Applicata "Nello Carrara" (Italy); Stefano Pelli, Istituto di Fisica Applicata "Nello Carrara" (Italy) and Museo Storico della Fisica e Ctr. Studi e Ricerche "Enrico Fermi" (Italy); Ambra Giannetti, Istituto di Fisica Applicata "Nello Carrara" (Italy) . . . . . [9727-44]
- 4:55 pm: **Optical heterodyne detection for ultra-high Q micro-disk laser sensor**, Myung-Gi Ji, Byung-Hee Son, Tae-Ryong Kim, Mi Jung, Chung-Ang Univ. (Korea, Republic of); Hong-Seung Kim, Chil-Min Kim, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of); Kwang Ryong Oh, Electronics and Telecommunications Research Institute (Korea, Republic of); Young-Wan Choi, Chung-Ang Univ. (Korea, Republic of) . . . . . [9727-45]
- 5:15 pm: **Water-walled microfluidics**, Shai Maayani, Technion-Israel Institute of Technology (Israel) . . . . . [9727-46]
- 5:35 pm: **Spinning optical resonator sensor for torsional vibrational applications measurements**, Amir R. Ali, The German Univ. in Cairo (Egypt) and Southern Methodist Univ. (USA); Andrew Gatherer, Rice Univ. (USA); Mariam Ibrahim, The German Univ. in Cairo (Egypt) . . . . . [9727-47]

SESSION 12  
LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . . THU 8:30 TO 10:10 AM

## Mode Control and Selection and Beam Characterization and Control I

Session Chair: **Alexis V. Kudryashov**, Moscow State Open Univ. (Russian Federation)

- 8:30 am: **A beam quality measure for cylindrical vector beams (Invited Paper)**, Andrew Forbes, Bienvenu I. Ndagano, Melanie G. McLaren, Univ. of the Witwatersrand (South Africa) . . . . . [9727-48]
- 9:00 am: **Selective generation of Laguerre-Gaussian mode output in double resonator configuration**, Ji Won Kim, Dong Joon Kim, Eun Jee Park, Hanyang Univ. (Korea, Republic of); Minjee Jeon, Hanyang Univ. (Korea, Republic of) and Korea Institute of Industrial Technology (Korea, Republic of); Hoon Jeong, Korea Institute of Industrial Technology (Korea, Republic of) . . . . . [9727-49]
- 9:20 am: **1 kW monolithic linearly polarized narrow linewidth single-mode fiber laser**, Wei Shi, Tianjin Univ. (China); Qiang Fang, HFB Photonics, Inc. (China) . . . . . [9727-50]
- 9:40 am: **Beam control through nonlinear propagation (Invited Paper)**, Jean Claude M. Diels, Ladan Arissian, The Univ. of New Mexico (USA) . . . . . [9727-51]
- Coffee Break . . . . . Thu 10:10 am to 10:40 am

SESSION 13  
LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . THU 10:40 TO 11:50 AM

## Mode Control and Selection and Beam Characterization and Control II

Session Chair: **Alan H. Paxton**, Air Force Research Lab. (USA)

- 10:40 am: **Largest in the world bimorph deformable mirror for high-power laser beam correction (Invited Paper)**, Alexis V. Kudryashov, Moscow State Univ. of Mechanical Engineering (Russian Federation) . . . . . [9727-52]
- 11:10 am: **Discrete excitation of mode pulses using a diode-pumped solid-state digital laser**, Sandile Ngcobo, Teboho Bell, CSIR National Laser Ctr. (South Africa) . . . . . [9727-53]
- 11:30 am: **Intracavity generation of low-loss radial-order Laguerre-Gaussian modes using digital holograms**, Lebohng T. Bell, Council for Scientific and Industrial Research (South Africa); Kamel Aït-Ameur, ENSICAEN (France); Andrew Forbes, Univ. of KwaZulu-Natal (South Africa); Sandile Ngcobo, Council for Scientific and Industrial Research (South Africa) . . [9727-54]

LASE

# CONFERENCE 9728

LOCATION: ROOM 131 (NORTH EXHIBIT LEVEL)

Monday-Thursday 15-18 February 2016 • Proceedings of SPIE Vol. 9728

# Fiber Lasers XIII: Technology, Systems, and Applications

Conference Chair: **John Ballato**, Clemson Univ. (USA)

Conference Co-Chair: **Craig Robin**, Lockheed Martin Aculight (USA)

Program Committee: **Thomas Tangaard Alkeskjold**, NKT Photonics A/S (Denmark); **Paulo Almeida**, Fianium Ltd. (United Kingdom); **Adrian L. Carter**, Nufem (USA); **Fabio Di Teodoro**, Raytheon Co. (USA); **Mark Dubinskii**, U.S. Army Research Lab. (USA); **Ingmar Hartl**, Deutsches Elektronen-Synchrotron (Germany); **Clifford Headley III**, OFS Labs. (USA); **Sami T. Hendow**, Adaptive Laser Processing (USA); **Stuart D. Jackson**, Macquarie Univ. (Australia); **Jens Limpert**, Friedrich-Schiller-Univ. Jena (Germany); **Jian Liu**, PolarOnyx (USA); **John D. Minelly**, Coherent, Inc. (USA); **Peter F. Moulton**, MIT Lincoln Lab. (USA); **Martin H. Muendel**, JDSU (USA); **Siddharth Ramachandran**, Boston Univ. (USA); **L. Brandon Shaw**, U.S. Naval Research Lab. (USA); **Akira Shirakawa**, The Univ. of Electro-Communications (Japan); **Ji Wang**, Corning Incorporated (USA); **Pu Wang**, Beijing Univ. of Technology (China); **Yoann Zaouter**, Amplitude Systèmes (France); **Michalis N. Zervas**, Univ. of Southampton (United Kingdom)

SPONSORS:



## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . MON 8:00 TO 10:10 AM

#### kW Fiber Lasers I

Session Chair: **Adrian L. Carter**, Nufem (USA)

8:00 am: **Multi-kilowatt power scaling and coherent beam combining of narrow-linewidth fiber lasers** (*Invited Paper*), Iyad Dajani, Angel Flores, Roger H. Holten, Thomas Ehrenreich, Air Force Research Lab. (USA). . . [9728-1]

8:30 am: **10-kW peak power femtosecond pulses from a mode-locked fiber ring laser emitting at 2.8  $\mu\text{m}$** , Simon S. Duval, Michel Olivier, Vincent Fortin, Martin Bernier, Michel Piché, Réal Vallée, Ctr. d'Optique, Photonique et Laser (Canada) . . . . . [9728-2]

8:50 am: **Kilowatt high-efficiency narrow-linewidth monolithic fiber amplifier operating at 1034 nm**, Nader A. Naderi, Angel Flores, Kenneth B. Rowland Jr., Iyad Dajani, Air Force Research Lab. (USA). . . . . [9728-3]

9:10 am: **Kilowatt-level narrow-linewidth monolithic fiber amplifier based on laser gain competition**, Nader A. Naderi, Iyad Dajani, Angel Flores, Air Force Research Lab. (USA). . . . . [9728-4]

9:30 am: **2 kW single-mode fiber laser with 20-m long delivery fiber and high SRS suppression**, Yasuhiro Mashiko, Huy K. Nguyen, Masahiro Kashiwagi, Tomoharu Kitabayashi, Kensuke Shima, Daiichiro Tanaka, Fujikura Ltd. (Japan) . . . . . [9728-5]

9:50 am: **Kilowatt narrowline Yb fiber amplifier pumped by ultrahigh brightness pump**, Charles X. Yu, Oleg Shatrovov, Tso Yee Fan, MIT Lincoln Lab. (USA) . . . . . [9728-6]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

### SESSION 2

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . MON 10:40 TO 11:40 AM

#### kW Fiber Lasers II

Session Chair: **John D. Minelly**, Coherent, Inc. (USA)

10:40 am: **>1.5kW narrow linewidth CW diffraction-limited fiber amplifier with 40nm bandwidth**, Roman Yagodkin, Nikolai Platonov, Alexander Yusim, Valentin P. Gapontsev, IPG Photonics Corp. (USA) . . . . . [9728-7]

11:00 am: **Passively cooled 405 W ytterbium fibre laser utilising a novel metal coated active fibre**, Jae M. Daniel, Defence Science and Technology Group (Australia) and Aether Photonics Ltd. (Australia); Nikita Simakov, Defence Science and Technology Group (Australia) and Univ. of Southampton (United Kingdom); Alexander V. Hemming, Defence Science and Technology Group (Australia); W. A. Clarkson, Univ. of Southampton (United Kingdom); John Haub, Defence Science and Technology Group (Australia). . . . . [9728-8]

11:20 am: **2 kW narrow-linewidth monolithic continuous wave fiber laser with near diffraction-limited beam quality**, Yang Xu, Wei Shi, Tianjin Univ. (China); Qiang Fang, HFB Photonics, Inc. (China) . . . . . [9728-9]

Lunch Break . . . . . Mon 11:40 am to 1:10 pm

### SESSION 3

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . . MON 1:10 TO 3:00 PM

#### Mode Instability

Session Chair: **Clifford Headley III**, OFS Fitel LLC (USA)

1:10 pm: **Low-threshold mode instability in Yb<sup>3+</sup>-doped few-mode fiber amplifiers: influence of a backward reflection** (*Invited Paper*), Oleg L. Antipov, Institute of Applied Physics of the RAS (Russian Federation); Maxim S. Kuznetsov, Institute of Applied Physics of the RAS (Russian Federation) and N.I. Lobachevsky State Univ. of Nizhni Novgorod (Russian Federation); Valentin A. Tyrtshnyy, IRE-Polus Co. (Russian Federation); Dmitry Alekseev, IRE-Polus Co. (Russian Federation) and Moscow Institute of Physics and Technology (Russian Federation); Oleg I. Vershinin, IRE-Polus Co (Russian Federation). . . . . [9728-10]

1:40 pm: **Optimizing the mode instability threshold of high-power fiber laser systems**, Cesar Jauregui-Misas, Hans-Jürgen Otto, Jens Limpert, Friedrich-Schiller-Univ. Jena (Germany); Andreas Tünnermann, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany). . . . . [9728-11]

2:00 pm: **A comparison of mode instability in Yb- and Tm-doped fiber amplifiers**, Arlee V. Smith, Jesse J. Smith, AS-Photonics, LLC (USA) . [9728-12]

2:20 pm: **Theoretical analysis of modal instability in high power core-pumped Raman amplifiers**, Shadi A. Naderi, Ball Aerospace & Technologies Corp. (USA); Iyad Dajani, Jacob Grosek, Timothy Madden, Air Force Research Lab. (USA) . . . . . [9728-13]

2:40 pm: **Average power limit of fiber-laser systems with nearly diffraction-limited beam quality**, Hans-Jürgen Otto, Cesar Jauregui, Friedrich-Schiller-Univ. Jena (Germany); Jens Limpert, Friedrich-Schiller-Univ. Jena (Germany) and Helmholtz-Institute Jena (Germany); Andreas Tünnermann, Friedrich-Schiller-Univ. Jena (Germany) and Helmholtz-Institute Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [9728-14]

Coffee Break . . . . . Mon 3:00 pm to 3:30 pm

### SESSION 4

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . . MON 3:30 TO 4:50 PM

#### Rod-Type and LMA Fibers

Session Chair: **Thomas Tangaard Alkeskjold**, NKT Photonics A/S (Denmark)

3:30 pm: **Accurate modeling of rod-type photonic crystal fiber amplifiers**, Benjamin G. Ward, U.S. Air Force Academy (USA). . . . . [9728-16]

3:50 pm: **Ultra large mode area pixelated Bragg fiber**, Jean-Paul Yehouessi, Gérard Bouwmans, Olivier Vanvincoq, Andy Cassez, Rémi Habert, Yves Quiquempois, Laurent Bigot, Lab. de Physique des Lasers, Atomes et Molécules (France) . . . . . [9728-17]

4:10 pm: **High-power fiber laser based on a non filamented-core fully-periodic large pitch fiber**, Aurélien Benoit, Romain Dauliat, Dia Darwich, Raphaël Jamier, XLIM Institut de Recherche (France); Stephan Grimm, Jens Kobelke, Kay Schuster, Leibniz-Institut für Photonische Technologien e.V. (Germany); Philippe Roy, XLIM Institut de Recherche (France) . . . . . [9728-18]

4:30 pm: **85 $\mu\text{m}$  core rod fiber amplifier delivering 350W/m**, Mette M. Johansen, Technical Univ. of Denmark (Denmark); Mattia Michieletto, Technical Univ. of Denmark (Denmark) and NKT Photonics A/S (Denmark); Torben Kristensen, Thomas T. Alkeskjold, NKT Photonics A/S (Denmark); Jesper Lægsgaard, Technical Univ. of Denmark (Denmark). . . . . [9728-19]

# CONFERENCE 9728

LOCATION: ROOM 131 (NORTH EXHIBIT LEVEL)

## TUESDAY 16 FEBRUARY

### SESSION 5

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . TUE 8:00 TO 10:00 AM

#### Advances in Infrared Fibers

Session Chair: **John Ballato**, Clemson Univ. (USA)

8:00 am: **Semiconductor optical fibers for nonlinear applications** (*Invited Paper*), Anna C. Peacock, Li Shen, Fariza H. H. Suhailin, Noel Healy, Univ. of Southampton (United Kingdom) . . . . . [9728-20]

8:30 am: **Advances in ultrafast mid-IR fiber lasers** (*Invited Paper*), Darren D. Hudson, The Univ. of Sydney (Australia). . . . . [9728-21]

9:00 am: **Mid-infrared supercontinuum generation up to 4.6  $\mu\text{m}$  using step-index indium fluoride fiber pumped by a femtosecond fiber laser near 2  $\mu\text{m}$** , Reza Salem, Thorlabs Quantum Electronics (USA); Zhuo Jiang, Dongfeng Liu, Robert M. Patchek, Paul Foy, Mohammed Saad, Doug Jenkins, Peter Fendel, Alex E. Cable, Thorlabs Inc. (USA) . . . . . [9728-22]

9:20 am: **Compact visible through mid-IR source based on a DFB diode, fiber amplifiers, PPLN and BIBO crystals**, Igor V. Melnikov, National Research Univ. of Electronic Technology (Russian Federation) and Moscow Institute of Physics and Technology (Russian Federation) and Univ of Illinois at Urbana-Champaign (USA); Nikolai Balakleisky, National Research Univ of Electronic Technology (Russian Federation); Andrey A. Machnev, National Research Univ. of Electronic Technology (Russian Federation); J. Gary Eden, Univ. of Illinois at Urbana-Champaign (USA). . . . . [9728-23]

9:40 am: **Average power scaling of ultrashort-pulse Tm-based fiber laser systems**, Christian Gaida, Martin Gebhardt, Fabian Stutzki, Hans-Jürgen Otto, Cesar Jauregui, Jens Limpert, Friedrich-Schiller-Univ. Jena (Germany); Andreas Tünnermann, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [9728-24]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

### SESSION 6

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . TUE 10:30 AM TO 12:30 PM

#### Thulium Doped Fiber Lasers and Amplifiers

Session Chair: **Peter F. Moulton**, MIT Lincoln Lab. (USA)

10:30 am: **Discretely tunable Tm-doped fiber-based MOPA using FBG arrays as spectral filters**, Tobias Tiess, Saher Junaid, Martin Becker, Manfred Rothhardt, Leibniz-Institut für Photonische Technologien e.V. (Germany); Hartmut Bartelt, Leibniz-Institut für Photonische Technologien e.V. (Germany) and Abbe School of Photonics (Germany); Matthias L. Jäger, Leibniz-Institut für Photonische Technologien e.V. (Germany) . . . . . [9728-25]

10:50 am: **Single-mode spectral beam combining of high power Tm-doped fiber lasers with WDM cascades**, Saniye Sinem Yilmaz, Laser Zentrum Hannover e.V. (Germany) and Bilkent Univ. (Turkey); Christoph Ottenhues, Thomas Theeg, Laser Zentrum Hannover e.V. (Germany); Samir Lamrini, Karsten Scholle, Michael Schaefer, Peter Fuhrberg, LISA Laser Products OHG (Germany); Hakan Sayinc, Laser Zentrum Hannover e.V. (Germany); Fatih Ömer İlday, Bilkent Univ. (Turkey); Jörg Neumann, Laser Zentrum Hannover e.V. (Germany); Ludger Overmeyer, Institut für Transport- und Automatisierungstechnik (Germany); Dietmar Kracht, Laser Zentrum Hannover e.V. (Germany). . . . . [9728-26]

11:10 am: **Spatially resolved measurement of the core temperature in a high-power thulium fiber system**, Till Walbaum, Matthias Heinzig, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Franz Beier, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) and Institute of Applied Physics, Friedrich-Schiller-University Jena (Germany); Andreas Liem, Thomas Schreiber, Ramona Eberhardt, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Andreas Tünnermann, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) and Institute of Applied Physics, Friedrich-Schiller-University Jena (Germany) . . . . . [9728-27]

11:30 am: **Wavelength agile holmium-doped fiber laser**, Nikita Simakov, Defence Science and Technology Group (Australia) and Univ. of Southampton (United Kingdom); Jae M. O. Daniel, Defence Science and Technology Group (Australia); Jon D. Ward, Gooch & Housego plc (United Kingdom); W. Andrew Clarkson, Univ. of Southampton (United Kingdom); Alexander V. Hemming, John Haub, Defence Science and Technology Group (Australia) . . . . . [9728-28]

11:50 am: **All-PM fiber, net normal cavity, Tm-doped fiber laser**, Claude Agueraray, Patrick Bowen, ALPhANOVA (France) . . . . . [9728-29]

12:10 pm: **Comparison of in-band pumped Tm: fiber and Ho: fiber**, Alex M. Sincore, Lawrence Shah, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Vadim Smirnov, OptiGrate Corp. (USA); Martin C. Richardson, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9728-30]

Lunch/Exhibition Break . . . . . Tue 12:30 pm to 2:00 pm

### SESSION 7

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . . TUE 2:00 TO 3:30 PM

#### Novel Fiber Laser Materials

Session Chair: **L. Brandon Shaw**, U.S. Naval Research Lab. (USA)

2:00 pm: **Nanoparticle doping for improved Er-doped fiber lasers** (*Invited Paper*), E. Joseph Friebele, Colin C. Baker, Charles G. Askins, U.S. Naval Research Lab. (USA); John R. Peele, Sotera Defense Solutions, Inc. (USA); Barbara A. Marcheschi, Woohong R. Kim, Jas S. Sanghera, U.S. Naval Research Lab. (USA); Jun Zhang, Radha K. Pattnaik, Larry D. Merkle, Mark Dubinskii, U.S. Army Research Lab. (USA) . . . . . [9728-31]

2:30 pm: **Bismuth-doped fibers and fiber lasers for a new spectral range of 1600-1800 nm** (*Invited Paper*), Evgeny M. Dianov, Fiber Optics Research Ctr. of the Russian Academy of Sciences (Russian Federation) . . . . . [9728-32]

3:00 pm: **Optical amplifiers and lasers based on tapered fiber geometry for power and energy scaling with low signal distortion** (*Invited Paper*), Valery N. Filippov, Tampere Univ. of Technology (Finland); Yuri K. Chamarovskii, Konstantin M. Golant, Institute of Radio Engineering and Electronics (Russian Federation); Andrei O. Vorotynskii, Oleg G. Okhotnikov, Tampere Univ. of Technology (Finland) . . . . . [9728-33]

Coffee Break . . . . . Tue 3:30 pm to 4:00 pm

### SESSION 8

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . . TUE 4:00 TO 6:20 PM

#### Erbium and Thulium Doped Fiber Lasers and Amplifiers

Session Chair: **Stuart D. Jackson**, Macquarie Univ. (Australia)

4:00 pm: **Highly efficient Yb-free Er-La-Al doped ultra-low Na large mode area single-trench fiber laser**, Deepak Jain, Shaiful Alam, Yongmin Jung, Pranabesh Barua, Martin M. N. Velazquez, Jayanta K. Sahu, Univ. of Southampton (United Kingdom) . . . . . [9728-34]

4:20 pm: **All-fiber arbitrary pulse form generation and amplification in Tm<sup>3+</sup> doped optical fibers**, Mateusz Wysmolek, Hakan Sayinc, Laser Zentrum Hannover e.V. (Germany); Samir Lamrini, Peter Fuhrberg, LISA Laser Products OHG (Germany); Kristian Lauritsen, Dietmar Klemme, PicoQuant GmbH (Germany); Uwe Morgner, Laser Zentrum Hannover eV (Germany) and Leibniz Univ. Hannover (Germany); Jörg Neumann, Dietmar Kracht, Laser Zentrum Hannover e.V. (Germany) . . . . . [9728-35]

4:40 pm: **Chirped pulse amplification of a dissipative soliton thulium-doped fiber laser**, Fangzhou Tan, Hongxing Shi, Peng Wang, Jiang Liu, Pu Wang, Beijing Univ. of Technology (China) . . . . . [9728-36]

5:00 pm: **All-fiber, 793nm cladding-pumped Tm-doped fiber laser with >90 nm of continuous tuning range**, Robert A. Stegeman, Eric D. Park, Q-Peak, Inc. (USA). . . . . [9728-37]

5:20 pm: **Comparison of high power large mode area and single mode 1908nm Tm-doped fiber lasers**, Daniel Creeden, Benjamin R. Johnson, Julia Limongelli, Herman Pretorius, Jon F. Blanchard, Scott D. Setzler, BAE Systems (USA) . . . . . [9728-38]

5:40 pm: **2 $\mu\text{m}$  single frequency fiber laser based on thulium-doped silica fiber**, Shijie Fu, Tianjin Univ. (China); Wei Shi, Tianjin Univ. (China) and Tianjin Institute of Modern Laser & Optics Technology (China); Qiang Fang, Tianjin Institute of Modern Laser & Optics Technology (China); Haiwei Zhang, Quan Sheng, Tianjin Univ. (China); Jianquan Yao, Tianjin Univ. (China) and Tianjin Institute of Modern Laser & Optics Technology (China) . . . . . [9728-39]

6:00 pm: **Widely tunable multi-wavelength Tm-doped mode-locked fiber laser**, Zhiyu Yan, Nanyang Technological University (Singapore) and Singapore Institute of Manufacturing Technology (Singapore); Xiaohui Li, Nanyang Technological Univ. (Singapore); Biao Sun, Jiaqi Lou, Nanyang Technological Univ. (Singapore) and Singapore Institute of Manufacturing Technology (Singapore); Xia YU, Singapore Institute of Manufacturing Technology (Singapore); Qi Jie Wang, Nanyang Technological Univ. (Singapore). . . [9728-40]

LASE



# CONFERENCE 9728

LOCATION: ROOM 131 (NORTH EXHIBIT LEVEL)

## POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Power scalability in rectangular core fiber**, Nan Xia, Seongwoo Yoo, Xuan Wu, Huizi Li, Nanyang Technological Univ. (Singapore) . . . . . [9728-15]

**All-fiber widely tunable thulium laser**, Gary Stevens, Thomas H. Legg, Gooch & Housego (Torquay) Ltd. (United Kingdom) . . . . . [9728-76]

**UV curable low refractive index clad coatings for high power fiber laser applications**, Jung Hyun Oh, Selee Chang, Sangsoo Oh, Luvantix ADM Co., Ltd. (Korea, Republic of); Suk-Youn Y. Suh, Luvantix SSCP (USA); Ilkwon Oh, Eunje Sung, Luvantix ADM Co., Ltd. (Korea, Republic of) . . . . . [9728-77]

**A new single-mode LMA optical fiber based on an anti-resonance in the cladding**, Avidan Sharabi, Uziel Sheintop, Shlomo Y. Goldin, Jerusalem College of Technology (Israel) . . . . . [9728-78]

**Characterization of chirally-coupled-core (3C) fibers fabricated with direct nanoparticle deposition (DND)**, Changheng Ye, Joona J. Koponen, Ossi Kimmelma, Ville Aallos, nLIGHT Corp., Lohja (Finland); Timothy S. McComb, Tyson L. Lowder, nLIGHT Corp. (USA) . . . . . [9728-79]

**Inner cladding influence on large mode area photonic crystal fiber properties under severe heat load**, Enrico Coscelli, Federica Poli, Univ. degli Studi di Parma (Italy); Romain Daullat, Univ. de Limoges (France) and Leibniz Institute of Photonic Technology (Germany) and XLIM Institut de Recherche (France); Dia Darwich, Univ. de Limoges (France) and XLIM Institut de Recherche (France) and CNRS (France); Annamaria Cucinotta, Stefano Selleri, Univ. degli Studi di Parma (Italy); Kay Schuster, Leibniz-Institut für Photonische Technologien e.V. (Germany); Aurélien Benoit, Raphael Jamier, Philippe Roy, XLIM Institut de Recherche (France) . . . . . [9728-80]

**Top hat single-mode polarization maintaining fiber and polarizing numerical design**, Pierre Gouriou, Lab. de Physique des Lasers, Atomes et Molécules (France) and CEA (France); Florent Scol, Commissariat à l'Énergie Atomique (France); Benoit Sevigny, Constance Valentin, Yves Quiquempois, Laurent Bigot, Rémi Habert, Andy Cassez, Olivier Vanvincq, Lab. de Physique des Lasers, Atomes et Molécules (France); Emmanuel Hugonnot, Commissariat à l'Énergie Atomique (France); Gérard Bouwmans, Lab. de Physique des Lasers, Atomes et Molécules (France) . . . . . [9728-81]

**1µm mode-locked fiber laser with tungsten disulphide absorber**, Yanrong Song, Heyang Guoyu, Kexuan Li, Zhiyuan Dou, Beijing Univ. of Technology (China) . . . . . [9728-82]

**5.5 W monolithic single-mode fiber laser and amplifier operated near 976 nm**, Svetlana S. Aleshkina, Mikhail E. Likhachev, Fiber Optics Research Ctr. of the Russian Academy of Sciences (Russian Federation); Denis S. Lipatov, Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences (Russian Federation) and N.I. Lobachevsky State Univ. of Nizhni Novgorod (Russian Federation); Oleg I. Medvedkov, Konstantin K. Bobkov, Mikhail M. Bubnov, Fiber Optics Research Ctr. of the Russian Academy of Sciences (Russian Federation); Alexei N. Guryanov, Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences (Russian Federation) . . . . . [9728-83]

**Experimental investigation of pedestal suppression in a figure-eight fiber laser by including a polarization asymmetrical NOLM**, Migel A. Bello-Jimenez, Erika Hernández-Escobar, Instituto de Investigación en Comunicación Óptica (Mexico); Evgeny A. Kuzin, Baldemar Ibarra-Escamilla, Manuel Durán-Sánchez, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Antonio Díez Cremades, Jose L. Cruz, Miguel V. Andrés, Univ. de València (Spain) . . . . . [9728-84]

**Single-frequency Raman fiber amplifier emitting 11 µj 150 W peak-power at 1645 nm for remote methane sensing applications**, Philippe Benoit, Nicolas Cézard, Anne Durécu, ONERA (France); Arnaud Mussot, Lab. de Physique des Lasers, Atomes et Molécules (France) and IRCICA (France); Alexandre Kudlinski, Univ. des Sciences et Technologies de Lille (France) and IRCICA (France); Guillaume Canat, ONERA (France) . . . . . [9728-85]

**Pulsed interferometric phase measurement for coherent beam combining**, Jeremy Le Dortz, Thales Research & Technology (France); Marie Antier, Thales Optronique S.A.S. (France); Jérôme Bourderionnet, Christian Larat, Eric Lallier, Thales Research & Technology (France); Louis Danialt, Severine Bellanger, Lab. pour l'Utilisation des Lasers Intenses (France) and Ecole Polytechnique (France); Christophe Simon-Boisson, Thales Optronique S.A.S. (France); Jean-Christophe F. Chanteloup, Ecole Polytechnique (France) and Lab. pour l'Utilisation des Lasers Intenses (France); Arnaud Brignon, Thales Research & Technology (France) . . . . . [9728-86]

**Statistical model of the energy transfer in Er<sup>3+</sup>:Yb<sup>3+</sup>-codoped glasses**, Michael Steinke, Jörg Neumann, Dietmar Kracht, Peter Wessels, Laser Zentrum Hannover e.V. (Germany) . . . . . [9728-87]

**Experimental study of a linear cavity dual wavelength Er/Yb double clad fiber laser operating in self-Q-switch, self-pulsing and CW**, Manuel Durán-Sánchez, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) and Cátedras CONACYT (Mexico); Ricardo I. Álvarez-Tamayo, Univ. Tecnológica de Puebla (Mexico); Olivier J. M. Pottiez, Ctr. de Investigaciones en Óptica, A.C. (Mexico); Berenice Posada-Ramírez, Baldemar Ibarra-Escamilla, Evgeny A. Kuzin, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Antonio Barcelata-Pinzón, Univ. Tecnológica de Puebla (Mexico) . . . . . [9728-88]

**Dual-comb spectroscopy with a free-running bidirectionally mode-locked fiber laser**, Khanh Q. Kieu, Seyed Soroush Mehravar, Robert A. Norwood, Nasser N. Peyghambarian, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9728-89]

**Passive mode locking through nonlinear coupling with different dual-core fiber length**, Xiaohui Fang, Beijing Univ. of Technology (China) . . . . . [9728-90]

**Characterization technique for long optical fiber cavities based on beating spectrum of multi-longitudinal mode fiber laser and beating spectrum in the RF domain**, George A. Adib, Yasser M. Sabry, Diaa A. Khalil, Ain Shams Univ. (Egypt) . . . . . [9728-91]

**Modelocked, Q-switched, or Q-switched modelocked operation of a fiber oscillator by adjusting the mode-field area within the graphene oxide saturable absorber**, Manuel Ryser, Alexander M. Heidt, Thomas Feurer, Valerio Romano, Univ. Bern (Switzerland) . . . . . [9728-92]

**Switchable dual-pulse-shape mode-locked figure-eight all-PM-fibre master oscillator with 0.5 W-level average output**, Sergey M. Kobtsev, Aleksey V. Ivanenko, Yurii Fedotov, Sergey V. Smirnov, Novosibirsk State Univ. (Russian Federation) . . . . . [9728-93]

**Broadband wavelength tuning of hybrid femtosecond Er/Tm fiber laser system in microstructured suspended-core tellurite fiber**, Maksim Y. Koptev, Institute of Applied Physics of the RAS (Russian Federation); Elena A. Anashkina, Institute of Applied Physics of the RAS (Russian Federation) and N.I. Lobachevsky State Univ. of Nizhni Novgorod (Russian Federation); Alexey V. Andrianov, Institute of Applied Physics of the RAS (Russian Federation); Vitaly V. Dorofeev, Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences (Russian Federation); Alexey F. Kosolapov, Fiber Optics Research Ctr. of the Russian Academy of Sciences (Russian Federation); Sergey V. Muravyev, Institute of Applied Physics of the RAS (Russian Federation); Arkady V. Kim, Institute of Applied Physics of the RAS (Russian Federation) and N.I. Lobachevsky State Univ. of Nizhni Novgorod (Russian Federation) [9728-94]

**Tunable pulse width and multi-megawatt peak-power pulses from a nonlinearly compressed monolithic fiber MOPA system**, Ryutarou Yamashita, Kazuo Maeda, Goro Watanabe, Kazuyoku Tei, Shigeru Yamaguchi, Tokai Univ. (Japan); Jun Enokidani, Shin Sumida, OPT-i Co., Ltd (Japan) . . . . . [9728-95]

**Fabrication and investigation of active composite fibers with phosphate core and silica cladding**, Sergey L. Semjonov, Olga N. Egorova, Oleg I. Medvedkov, Maxim S. Astapovich, Andrey G. Okhrimchuk, Evgeny M. Dianov, Fiber Optics Research Ctr. of the Russian Academy of Sciences (Russian Federation); Boris I. Denker, Boris I. Galagan, A. M. Prokhorov General Physics Institute of the Russian Academy of Sciences (Russian Federation); Sergey E. Sverchkov, A. M. Prokhorov General Physics Institute (Russian Federation) . . . . . [9728-96]

**Controlled generation of optical rogue waves in dispersion oscillating fiber**, Alexey Sysoliatin, Konstantin Gochelashvili, A. M. Prokhorov General Physics Institute of the Russian Academy of Sciences (Russian Federation); Andrey I. Konyukhov, N.G. Chernyshevsky Saratov State Univ. (Russian Federation); Leonid A. Melnikov, Saratov State Technical Univ. (Russian Federation); Mikhail Y. Salganskii, Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences (Russian Federation) . . . . . [9728-97]

**Broadband optical amplification with water-free hexagonal double-clad Bi doped silica fiber**, Soichi Kobayashi, Mikoto Takahashi, Mizuki Ohara, Ikki Kondo, Chitose Institute of Science and Technology (Japan); Yusuke Fujii, Photonic Science Technology, Inc. (Japan) . . . . . [9728-98]

**A diode drive mechanism for always resonant pumping with laser diodes without wavelength locking**, S. Arun, Ctr. for Nano Science and Engineering (CeNSE) (India) and Indian Institute of Science (India); Balaswamy Velpula, Indian Institute of Science (India) and Ctr. for Nano Science and Engineering (India); Great Chayran, Indian Institute of Science (India); P. Vanitha, Abhishek Kumar, V. R. Supradeepa, Indian Institute of Science (India) and Ctr. for Nano Science and Engineering (India) . . . . . [9728-99]

**Understanding gain saturation: A pseudo intensity limiter in pulsed fiber amplifiers**, Nishant K. Shekhar, Sourav Das Chowdhury, Ranjan Sen, Mrinmay Pal, Central Glass and Ceramic Research Institute (India) . . . . . [9728-100]



# CONFERENCE 9728

LOCATION: ROOM 131 (NORTH EXHIBIT LEVEL)

**Electrically tunable in-line graphene saturable absorber for pulsed fiber laser applications**, Dong-Il Yeom, Ajou Univ. (Korea, Republic of) . . . [9728-101]

**High power, high signal-to-noise ratio single-frequency 1 $\mu$ m Brillouin all-fiber laser**, Jing Wang, Yubin Hou, Dongchen Jin, Ruoyu Sun, Hongxing Shi, Qian Zhang, Jiang Liu, Pu Wang, Beijing Univ. of Technology (China). [9728-102]

**Yb-doped large mode area fibers with depressed clad and dopant confinement**, Vincent Roy, Claude Paré, Pierre Laperle, Louis Desbiens, Yves Taillon, INO (Canada) . . . [9728-103]

**Simultaneous mode and nonlinear-frequency conversion of HOMs**, Oleg Shatrovov, Boston Univ. (USA); Siddharth Ramachandran, Lars Rishoj, The Boston Univ. Photonics Ctr. (USA). . . [9728-104]

**Multi-kW coherent combining of fiber lasers seeded with pseudo random phase modulated light**, Angel Flores, Air Force Research Lab. (USA); Thomas Ehrenreich, Roger H. Holten, Leidos, Inc. (USA); Iyad Dajani, Air Force Research Lab. (USA) . . . [9728-105]

**Linewidth investigation of high-power single-frequency Tm-doped fiber amplifier**, Haiwei Zhang, Wei Shi, Quan Sheng, Tianjin Univ. (China) . [9728-106]

**2  $\mu$ m ultrafast fiber laser modelocked by mechanically exfoliated Sb<sub>2</sub>Te<sub>3</sub>**, Jan Tarka, Jakub Boguslawski, Maciej Kowalczyk, Grzegorz J. Sobon, Jaroslaw Z. Sotor, Wroclaw Univ. of Technology (Poland) . . . [9728-107]

**Hollow core inhibited coupling fibres with split cladding**, Xiaosheng Huang, Nanyang Technological Univ. (Singapore) . . . [9728-109]

**Dependence of photodarkening under different wavelength pumping**, Huizi Li, Seongwoo Yoo, Sidharthan Raghuraman, Daryl Ho, Xuan Wu, Tianye Huang, Nanyang Technological Univ. (Singapore) . . . [9728-110]

**Stable and narrow-linewidth wavelength swept laser at 800nm based on acousto optic tunable filter**, Gahee Han, Nam-Su Park, Chang-Hyun Park, Chang-Seok Kim, Pusan National Univ. (Korea, Republic of) . . . [9728-111]

**A passively mode locked thulium doped fiber laser using bismuth telluride deposited multimode interference**, Minwan Jung, Korea Institute of Science and Technology (Korea, Republic of) and Univ of Seoul (Korea, Republic of); Junsu Lee, The Univ. of Seoul (Korea, Republic of); Wongeun Song, Advanced Photonics Research Institute (Korea, Republic of) and The Univ. of Seoul (Korea, Republic of); Ju Han Lee, The Univ. of Seoul (Korea, Republic of); Woojin Shin, Gwangju Institute of Science and Technology (Korea, Republic of) . . . [9728-112]

**Wavelength selective Tm doped all fiber laser using grating pair and null core fiber**, Wongeun Song, Advanced Photonics Research Institute (Korea, Republic of) and The Univ. of Seoul (Korea, Republic of); Minwan Jung, Advanced Photonics Research Institute (Korea, Republic of) and Univ. of Seoul (Korea, Republic of); Daeyoung Kim, Advanced Photonics Research Institute (Korea, Republic of); Ju Han Lee, The Univ. of Seoul (Korea, Republic of); Bong-Ahn Yu, Woojin Shin, Advanced Photonics Research Institute (Korea, Republic of) . . . [9728-113]

**Enhanced higher order mode delocalization through highly asymmetric rod-type VLMA fiber**, Zeinab Sanjabi Eznaveh, J. E. Antonio Lopez, Gisela López-Galmiche, James Anderson, Axel Schülzgen, Rodrigo Amezcua Correa, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . [9728-114]

**All-bismuth ultrafast fiber systems**, Teppo Noronen, Oleg G. Okhotnikov, Tampere Univ. of Technology (Finland). . . [9728-115]

**Simple all-PM-fiber laser system seeded by an all-normal-dispersion oscillator mode-locked with a nonlinear optical loop mirror**, Jan Szczepanek, Tomasz M. Kardas, Univ. of Warsaw (Poland); Michal Nejbauer, Univ. of Warsaw (Poland) and Institute of Physical Chemistry (Poland); Czeslaw Radzewicz, Univ. of Warsaw (Poland); Yuriy Stepanenko, Univ. of Warsaw (Poland) and Institute of Physical Chemistry (Poland) . . . [9728-116]

**High average power harmonic mode-locking of a Raman fiber laser based on nonlinear polarization evolution**, Jun Liu, Chujun Zhao, Shenzhen Univ. (China); Yanxia Gao, Shenzhen University (China); Dianyuan Fan, Shenzhen Univ. (China) . . . [9728-117]

**486nm blue laser operating at 500 kHz pulse repetition frequency**, Daniel Creeden, Jon Blanchard, Herman Pretorius, Julia Limongelli, Scott D. Setzler, BAE Systems (USA) . . . [9728-118]

**Generation of broadband mid-infrared supercontinuum radiation in cascaded soft-glass fibers**, Christian Kneis, Institut Franco-Allemand de Recherches de Saint-Louis (France) and Univ. Bordeaux 1 (France); Thierry Robin, Benoît Cadier, ixFiber SAS (France); Franck Joulain, Marcel Poulain, Le Verre Fluoré (France); Inka Manek-Hönninger, Univ. Bordeaux 1 (France); Marc Eichhorn, Christelle Kieleck, Institut Franco-Allemand de Recherches de Saint-Louis (France) . . . [9728-119]

**High power narrow bandwidth fiber amplifier with a FBG-based seed**, Jinping Hao, Hong Zhao, Dayong Zhang, Liming Zhang, Kun Zhang, North China Research Institute of Electro-optics (China) . . . [9728-120]

**Millijoule class, all-fibered front end nanosecond pulse, single frequency, with spatially coherent top-hat beam output used as seeder for high power laser: current status and future perspectives of industrial version**, Jean-François Gleyze, Arnaud Perrin, Pierre Gouriou, Florent Scol, Commissariat à l'Énergie Atomique (France); Constance Valentin, Géraud Bouwmans, Lab. de Physique des Lasers, Atomes et Molécules (France); Emmanuel Hugonnot, Commissariat à l'Énergie Atomique (France) . . . [9728-121]

**2.9 GHz 780w narrow linewidth fiber laser**, Hong Zhao, Nianjiang Chen, North China Research Institute of Electro-optics (China) . . . [9728-122]

## WEDNESDAY 17 FEBRUARY

### SESSION 9

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . WED 8:00 TO 9:50 AM

## Fiber Lasers and Amplifiers I

Session Chair: **Paulo Almeida**, Fianium Ltd. (United Kingdom)

8:00 am: **High-power, high-brightness laser beam combining** (*Invited Paper*), John D. Hybl, MIT Lincoln Lab. (USA) . . . [9728-41]

8:30 am: **Femtosecond fiber-CPA system employing coherent combination of a multicore fiber**, Arno Klenke, Friedrich-Schiller-Univ. Jena (Germany) and Helmholtz Institute Jena (Germany); Michal Wojdyr, Michael Müller, Friedrich-Schiller-Univ. Jena (Germany); Marco Kienel, Friedrich-Schiller-Univ. Jena (Germany) and Helmholtz-Institute Jena (Germany); Jens Limpert, Andreas Tünnermann, Friedrich-Schiller-Univ. Jena (Germany) and Helmholtz-Institute Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . [9728-42]

8:50 am: **Self-compression to 24 MW peak power in a fused silica solid-core fiber using a high-repetition rate thulium-based fiber laser system**, Martin Gebhardt, Friedrich-Schiller-Univ. Jena (Germany) and Helmholtz Institute Jena (Germany); Christian Gaida, Fabian Stutzki, Friedrich-Schiller-Univ. Jena (Germany); Steffen Hädrich, Friedrich-Schiller-Univ. Jena (Germany) and Helmholtz Institute Jena (Germany); Cesar Jauregui, Friedrich-Schiller-Univ. Jena (Germany); Jens Limpert, Andreas Tünnermann, Friedrich-Schiller-Univ. Jena (Germany) and Helmholtz Institute Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . [9728-43]

9:10 am: **Cascaded coherent pulse stacking from fiber chirped-pulse amplifiers**, Tong Zhou, John M. Ruppe, Cheng Zhu, John A. Nees, Univ. of Michigan (USA); Russell B. Wilcox, Lawrence Berkeley National Lab. (USA); Almantas Galvanauskas, Univ. of Michigan (USA) . . . [9728-44]

9:30 am: **Electro-optically controlled divided-pulse amplification**, Michael Mueller, Marco Kienel, Michal Wojdyr, Arno Klenke, Jens Limpert, Andreas Tünnermann, Friedrich-Schiller-Univ. Jena (Germany) . . . [9728-45]

Coffee Break . . . . . Wed 9:50 am to 10:20 am

## LASE Plenary Session

WED 10:20 AM TO 12:30 PM

LOCATION: ROOM 103 (SOUTH EXHIBIT LEVEL)

10:20 am: **Welcome and Opening Remarks**

**Guido Hennig**, Daetwyler Graphics AG (Switzerland)  
**Yongfeng Lu**, Univ. of Nebraska-Lincoln (USA)

10:25 am: **Announcement of the Green Photonics Best Paper Award and the 3D Printing, Fabrication, and Manufacturing Best Paper Award**

**Stephen J. Eglash**, Energy and Environment Affiliates Program, Stanford Univ. (USA)  
**Henry Helvajian**, The Aerospace Corp. (USA)

10:30 am: **Emerging Applications of Photonic Crystal Fibers**  
**Philip Russell**, Max-Planck Institute for the Science of Light (Germany) and Univ. of Erlangen-Nuremberg (Germany)

11:10 am: **Optical 3D Nano-fabrication: Drawing or Growing?**  
**Satoshi Kawata**, Osaka Univ. (Japan) and RIKEN (Japan)

11:50 am: **High Power Semiconductor Lasers: Disrupting a Fragmented Industry**  
**Scott Keeney**, nLight Corp. (USA)

Lunch/Exhibition Break . . . . . Wed 12:30 pm to 2:00 pm

# CONFERENCE 9728

LOCATION: ROOM 131 (NORTH EXHIBIT LEVEL)

## SESSION 10

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . WED 2:00 TO 3:00 PM

### Fiber Lasers and Amplifiers II

Session Chair: **Mark Dubinskii**, U.S. Army Research Lab. (USA)

2:00 pm: **Single frequency 1560nm Er:Yb fiber amplifier with 207W output power and 50.5% slope efficiency**, Daniel Creeden, Herman Pretorius, Julia Limongelli, Scott D. Setzler, BAE Systems (USA) . . . . . [9728-46]

2:20 pm: **Polarization maintaining, very-large-mode area, Er fiber amplifier for high energy pulses at 1572.3 nm**, Jeffrey W. Nicholson, Anthony M. DeSantolo, Man F. Yan, Patrick W. Wisk, Brian J. Mangan, Gabe S. Puc, OFS Fitel LLC (USA); Anthony W. Yu, Mark A. Stephen, NASA Goddard Space Flight Ctr. (USA) . . . . . [9728-47]

2:40 pm: **Power scaling of Er-doped LMA triple-clad fiber laser based on silicate glass**, Jun Zhang, Youming Chen, Radha Pattnaik, Mark Dubinskii, U.S. Army Research Lab. (USA); Shibin Jiang, AdValue Photonics, Inc. (USA) . . . . . [9728-48]

Coffee Break . . . . . Wed 3:00 pm to 3:30 pm

## SESSION 11

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . . WED 3:30 TO 5:50 PM

### Fiber Lasers and Amplifiers III

Session Chair: **Ji Wang**, Corning Incorporated (USA)

3:30 pm: **Eye-safe ns pulses from a high-aspect-ratio-core fiber amplifier**, Fabio Di Teodoro, Raytheon Co. (USA); Friedrich P. Strohkendl, Raytheon Space and Airborne Systems (USA) . . . . . [9728-49]

3:50 pm: **Temperature measurements in an ytterbium fiber amplifier up to the mode instability threshold**, Franz Beier, Friedrich-Schiller-Univ. Jena (Germany); Matthias Heinzig, Till Walbaum, Nicoletta Haarlammer, Thomas Schreiber, Ramona Eberhardt, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Andreas Tünnermann, Friedrich-Schiller-Univ. Jena (Germany) and Fraunhofer-IOP (Germany) . . . . . [9728-50]

4:10 pm: **Efficient ytterbium-doped phosphosilicate double-clad leakage-channel-fiber laser at 1008-1020 nm**, Guan Cheng Gu, Clemson Univ. (USA); Zhengyong Liu, The Hong Kong Polytechnic Univ. (Hong Kong, China); Fanting Kong, Clemson Univ. (USA); Hwa-Yaw Tam, The Hong Kong Polytechnic Univ. (Hong Kong, China); Ramesh K. Shori, SPAWAR Systems Ctr. (USA); Liang Dong, Clemson Univ. (USA) . . . . . [9728-51]

4:30 pm: **Extremely low Na Yb doped preforms (<0.03) fabricated by MCVD**, Vincent Petit, Richard P. Tumminelli, Coherent, Inc., Salem (USA); John D. Minelly, Victor Khitrov, Coherent, Inc. (USA) . . . . . [9728-52]

4:50 pm: **High energy, narrow linewidth 1572nm ErYb-fiber based MOPA for a multi-aperture CO<sub>2</sub> trace-gas laser space transmitter**, Doruk Engin, Brian Mathason, Fibertek, Inc. (USA); Mark A. Stephen, Anthony W. Yu, NASA Goddard Space Flight Ctr. (USA); He Cao, Jean-Luc Fouron, Mark Storm, Fibertek, Inc. (USA) . . . . . [9728-53]

5:10 pm: **1018nm SM fiber laser with 230W CW power**, Yaakov Glick, Yoav Sintov, Roey Zuitlin, Shaul Pearl, Revital Feldman, Zvi Horvitz, Noam Shafir, Soreq Nuclear Research Ctr. (Israel) . . . . . [9728-54]

5:30 pm: **Monolithic high peak-power coherent Doppler lidar system**, Leonid V. Kotov, Fiber Optics Research Ctr. of the Russian Academy of Sciences (Russian Federation) and Moscow Institute of Physics and Technology (Russian Federation); Albert Töws, Alfred Kurtz, Fachhochschule Köln (Germany); Konstantin K. Bobkov, Fiber Optics Research Ctr. of the Russian Academy of Sciences (Russian Federation); Svetlana S Aleshkina, Fiber Optics Research Ctr (Russian Federation); Mikhail M. Bubnov, Fiber Optics Research Ctr. of the Russian Academy of Sciences (Russian Federation); Denis S. Lipatov, Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences (Russian Federation) and N.I. Lobachevsky State Univ. of Nizhni Novgorod (Russian Federation); Alexei N. Guryanov, Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences (Russian Federation); Mikhail E. Likhachev, Fiber Optics Research Ctr. of the Russian Academy of Sciences (Russian Federation) . . . . . [9728-55]

## THURSDAY 18 FEBRUARY

## SESSION 12

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . THU 8:00 TO 10:00 AM

### Short Pulse and Tunable Lasers

Session Chair: **Martin H. Muendel**, Lumentum Operations, LLC (USA)

8:00 am: **Energetic tunable ultrafast sources using soliton shifting in HOMs**, Lars Rishoj, Gautam Prabhakar, Siddharth Ramachandran, The Boston Univ. Photonics Ctr. (USA) . . . . . [9728-56]

8:20 am: **Investigation of a 10 MHz, non-steady state cavity for pulse energy enhancement of ultrafast fiber lasers**, Sven Breitkopf, Stefano Wunderlich, Friedrich-Schiller-Univ. Jena (Germany) and Abbe School of Photonics (Germany); Tino Eidam, Active Fiber Systems GmbH (Germany); Evgeny Shestaev, Thomas Gottschall, Friedrich-Schiller-Univ. Jena (Germany) and Abbe School of Photonics (Germany); Henning Carstens, Max-Planck-Institut für Quantenoptik (Germany) and Ludwig-Maximilians-Univ. München (Germany); Simon Holzberger, Ludwig-Maximilians-Univ. München (Germany); Ioachim Pupeza, Max-Planck-Institut für Quantenoptik (Germany); Jens Limpert, Friedrich-Schiller-Univ. Jena (Germany) and Active Fiber Systems GmbH (Germany) and Helmholtz Institute Jena (Germany); Andreas Tünnermann, Friedrich-Schiller-Univ. Jena (Germany) and Helmholtz Institute Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [9728-57]

8:40 am: **10µj, ultrashort sub-100 fs FCPA synthesizer**, Florent Guichard, Marc Hanna, Lab. Charles Fabry (France); Ronic Chiche, Lab. de l'Accélérateur Linéaire (France); Yoann Zaouter, Amplitude Systèmes (France); Fabian Zomer, Lab. de l'Accélérateur Linéaire (France); Franck Morin, Clemens Hönninger, Eric P. Mottay, Amplitude Systèmes (France); Patrick Georges, Lab. Charles Fabry (France) . . . . . [9728-58]

9:00 am: **Multi-mJ bursts of green light obtained by frequency doubling the output of a fiber based MOPA**, Eitan E. Rowen, Nir Shalev, Eran Tal, Jacob Lasri, Eran Inbar, Spectra-Physics Tel-Aviv (Israel) . . . . . [9728-59]

9:20 am: **High-power picosecond pulse delivery through hollow core photonic band gap fibers**, Mattia Michieletto, NKT Photonics A/S (Denmark) and DTU Fotonik (Denmark); Mette M. Johansen, DTU Fotonik (Denmark); Jens K. Lyngsø, NKT Photonics A/S (Denmark); Jesper Lægsgaard, Ole Bang, DTU Fotonik (Denmark); Thomas T. Alkeskjold, NKT Photonics A/S (Denmark) . . . . . [9728-60]

9:40 am: **Self-tuning fiber lasers**, Steven Brunton, J. Nathan Kutz, Univ. of Washington (USA); Xing Fu, Nokia (USA) . . . . . [9728-61]

Coffee Break . . . . . Thu 10:00 am to 10:30 am

## SESSION 13

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . THU 10:30 AM TO 12:00 PM

### Pioneers Session: Early Development of Active PC Fibers

Session Chair: **Fabio Di Teodoro**, Raytheon Co. (USA)

10:30 am: **Rod-type photonic crystal fibers: Only the performance counts** (*Invited Paper*), Jens Limpert, Friedrich-Schiller-Univ. Jena (Germany) . [9728-62]

11:00 am: **Title to be announced** (*Invited Paper*), Jes Broeng, DTU Fotonik (Denmark) . . . . . [9728-63]

11:30 am: **Title to be announced** (*Invited Paper*), François Salin, MoriaLase (France) . . . . . [9728-64]

**PIONEERS SESSION DISCUSSION PERIOD**  
LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . 12:00 TO 12:20 PM

Moderated by **Fabio Di Teodoro**, Raytheon Co. (USA)

Lunch/Exhibition Break . . . . . Thu 12:20 pm to 1:30 pm

# CONFERENCE 9728

LOCATION: ROOM 131 (NORTH EXHIBIT LEVEL)

## SESSION 14

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . . . THU 1:30 TO 3:10 PM

### Fiber Lasers and Amplifiers IV

Session Chair: **Michalis N. Zervas**,  
Optoelectronics Research Ctr. (United Kingdom)

1:30 pm: **2 $\mu$ m all-fiber dissipative soliton master oscillator power amplifier**, Dmitry Gaponov, NOVAE (France); Laure Lavoute, NOVAE (France); Sébastien Février, XLIM Institut de Recherche (France); Ammar A. Hideur, CORIA (France); Nicolas Ducros, NOVAE (France) . . . . . [9728-65]

1:50 pm: **High power single-frequency erbium-ytterbium all-fiber laser in MOPA**, Xiaolei Bai, Wei Shi, Quan Sheng, Tianjin Univ. (China) . . . . . [9728-66]

2:10 pm: **Mode-locked fiber laser with cascaded generation of coherent Raman dissipative solitons**, Denis S. Kharenko, Institute of Automation and Electrometry (Russian Federation) and Novosibirsk State Univ. (Russian Federation); Anastasia E. Bednyakova, Novosibirsk State Univ. (Russian Federation) and Institute of Computational Technologies (Russian Federation); Evgenii V. Podivilov, Institute of Automation and Electrometry (Russian Federation) and Novosibirsk State Univ. (Russian Federation); Mikhail P. Fedoruk, Novosibirsk State Univ. (Russian Federation) and Institute of Computational Technologies (Russian Federation); Alexander A. Apolonskiy, Ludwig-Maximilians-Univ. München (Germany) and Institute of Automation and Electrometry (Russian Federation); Sergey A. Babin, Institute of Automation and Electrometry (Russian Federation) and Novosibirsk State Univ. (Russian Federation) . . . . . [9728-67]

2:30 pm: **High power, picosecond green laser based on a frequency-doubled, all-fiber, narrow-bandwidth, linearly polarized, Yb-doped fiber laser**, Wenyang Tian, Yelena Isyanova, Robert A. Stegeman, Ye Huang, Q-Peak, Inc. (USA); Logan R. Chieffo, Peter F. Moulton, Q-Peak Inc. (USA) . . . . [9728-68]

2:50 pm: **Advances in CO<sub>2</sub> laser fabrication for high power fibre laser devices**, Keiron Boyd, Simon M. Rees, Defence Science and Technology Group (Australia); Nikita Simakov, Defence Science and Technology Group (Australia) and Univ. of Southampton (United Kingdom); Jae M. O. Daniel, Defence Science and Technology Group (Australia); Robert Swain, Eric W. Mies, Sub-Micron Engineering (USA); Alexander V. Hemming, Defence Science and Technology Group (Australia); W. Andrew Clarkson, Univ. of Southampton (United Kingdom); John Haub, Defence Science and Technology Group (Australia) . . . . . [9728-69]

Coffee Break . . . . . Thu 3:10 pm to 3:40 pm

## SESSION 15

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . . THU 3:40 TO 5:40 PM

### Fiber Lasers and Amplifiers V

Session Chair: **John Ballato**, Clemson Univ. (USA)

3:40 pm: **New generation of high average power industry grade ultrafast ytterbium fiber lasers**, Alexander Yusim, Igor Samartsev, Oleg Shkurikhin, IPG Photonics Corp. (USA); Daniil V. Myashnikov, IRE-Polus Co. (Russian Federation); Andrey Bordenyuk, Nikolai Platonov, Vijay Kancharla, Valentin P. Gapontsev, IPG Photonics Corp. (USA) . . . . . [9728-70]

4:00 pm: **Mechanical reliability of double clad fibers in typical deployment conditions**, Michael Walornyj, Jaroslaw Abramczyk, Kanishka Tankala, Nils Jacobson, Nufem (USA) . . . . . [9728-71]

4:20 pm: **Novel all-polarization-maintaining femtosecond Yb-fiber laser for in-vivo nonlinear microscopy in zebrafish larvae**, Aart Verhoef, Medizinische Univ. Wien (Austria) and Technische Universität Wien (Austria); Lingxiao Zhu, Univ. Wien (Austria) and Technische Univ. Wien (Austria); Marco Andreana, Medizinische Univ. Wien (Austria); Martin Distel, St. Anna Kinderkrebsforschung e.V. (Austria); Stine Møller Israelsen, Karsten Rottwitt, Technical Univ. of Denmark (Denmark); Wolfgang Kautek, Univ. Wien (Austria); Andrius Baltuska, Technische Univ. Wien (Austria); Alma del Carmen Fernandez Gonzalez, Medizinische Univ. Wien (Austria) and Technische Univ. Wien (Austria); Wolfgang Drexler, Angelika Unterhuber, Medizinische Univ. Wien (Austria) . . . . . [9728-72]

4:40 pm: **Efficient pump combiners for fiber lasers and amplifiers**, Lalitkumar Bansal, Andrea Rosales-Garcia, OFS Fitel LLC (USA); V. R. Supradeepa, Indian Institute of Science (India); Thierry F. Taunay, Clifford Headley III, OFS Fitel LLC (USA) . . . . . [9728-73]

5:00 pm: **Next generation of specialty beam delivery fibers delivering flat-top beams with controlled BPP for high-power CW and pulsed laser systems**, Clémence Jollivet, Kevin F. Farley, Michael Conroy, Jaroslaw Abramczyk, Nufem (USA); Steffen Belke, Frank Becker, ROFIN-SINAR Laser GmbH (Germany); Kanishka Tankala, Nufem (USA) . . . . . [9728-74]

5:20 pm: **Compact frequency-quadrupled pulsed 1030nm fiber laser**, Chris McIntosh, Lew Goldberg, Brian J. Cole, Alan D. Hays, U.S. Army RDECOM CERDEC NVESD (USA) . . . . . [9728-75]

## AWARDS AND CLOSING REMARKS

LOCATION: RM 131 (NORTH EXHIBIT LEVEL) . . . . 5:40 TO 6:00 PM

A cash prize will be awarded to the best student oral presentation in the conference.

Throughout the conference, qualifying student oral presentations will be evaluated by the conference committee, and the results will be announced in this session. Student presentations will be judged based on scientific merit of the work, and clarity of the presentation. While the award is not judged by the manuscript, a manuscript must be submitted.

See <http://spie.org/x90939.xml> for eligibility requirements.  
To check your eligibility status, contact Jen Lowell (JenL@SPIE.org).

LASE

# CONFERENCE 9729

LOCATION: ROOM 130 (NORTH EXHIBIT LEVEL)

Monday–Tuesday 15–16 February 2016 • Proceedings of SPIE Vol. 9729

# High Energy/Average Power Lasers and Intense Beam Applications IX

Conference Chairs: **Steven J. Davis**, Physical Sciences Inc. (USA); **Michael C. Heaven**, Emory Univ. (USA); **J. Thomas Schriempf**, Naval Sea Systems Command (USA)

Program Committee: **David L. Carroll**, CU Aerospace LLC (USA); **Jarmila Kodymová**, Institute of Physics of the ASCR, v.v.i. (Czech Republic); **Timothy Madden**, Air Force Research Lab. (USA); **Wilson T. Rawlins**, Physical Sciences Inc. (USA); **Greg A. Pitz**, Air Force Research Lab. (USA)

## MONDAY 15 FEBRUARY

### WELCOME AND INTRODUCTION

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . . . . . 8:00 TO 8:10 AM

Conference Chair: **Steven J. Davis**, Physical Sciences Inc. (USA)

### SESSION 1

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . . MON 8:10 AM TO 12:10 PM

### Diode Pumped Alkali Lasers

Session Chair: **Wilson T. Rawlins**, Physical Sciences Inc. (USA)

8:10 am: **Recent advances in flowing diode pumped alkali lasers (FDPAL)**, Greg A. Pitz, Air Force Research Lab. (USA) . . . . . [9729-1]

8:30 am: **Operation of static and flowing Cs DPAL with different buffer gas mixtures**, Boris V. Zhdanov, Matthew Rotondaro, Michael Shaffer, Randall Knize, U.S. Air Force Academy (USA) . . . . . [9729-2]

8:50 am: **Modeling of static and flowing gas diode pumped alkali lasers (Invited Paper)**, Boris D. Barmashenko, Ilya Auslender, Eyal Yacoby, Karol Waichman, Oren Sadot, Salman Rosenwaks, Ben-Gurion Univ. of the Negev (Israel) . . . . . [9729-3]

9:20 am: **Power scaling of a wavelength-narrowed diode laser system for pumping alkali vapors**, F. W. Hersman, The Univ. of New Hampshire (USA) and Xemed LLC (USA); J. H. Distelbrink, J. Wilson, Xemed LLC (USA) . . . . . [9729-4]

9:40 am: **Two color pumped rubidium laser with an effective quantum efficiency above 100%**, Andrey E. Mironov, William Goldschlag, James G. Eden, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9729-5]

Coffee Break . . . . . Mon 10:00 am to 10:30 am

10:30 am: **Wave optics simulation of diode pumped alkali laser (DPAL) (Invited Paper)**, Masamori Endo, Tokai Univ. (Japan); Ryuji Nagaoka, Hiroki Nagaoka, Toru Nagai, Fumio Wani, Kawasaki Heavy Industries, Ltd. (Japan) . . . . . [9729-6]

11:00 am: **Deactivation and reaction of excited states of Rb in collisions with H<sub>2</sub>, CH<sub>4</sub> and C<sub>2</sub>H<sub>6</sub>**, Valeriy N. Azyazov, Aleksei P. Torbin, Samara State Aerospace Univ. (Russian Federation); Alexander M. Mebel, Florida International Univ. (USA); Sean Bresler, Michael C. Heaven, Emory Univ. (USA) . . . . . [9729-8]

11:20 am: **Myths, legends and facts; from SDI to tactical battlefield lasers: Reflections of a 'star warrior' (Invited Paper)**, James A. Horkovich, Directed Energy Professional Society (USA) . . . . . [9729-9]

11:50 am: **Measurement of the total ionization rate in an operating Cs DPAL**, Michael Shaffer, Boris V. Zhdanov, Matthew Rotondaro, Randall Knize, U.S. Air Force Academy (USA) . . . . . [9729-7]

Lunch Break . . . . . Mon 12:10 pm to 1:40 pm

### SESSION 2

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . . MON 1:40 TO 3:20 PM

### Optically Pumped Rare Gas Lasers

Session Chair: **Steven J. Davis**, Physical Sciences Inc. (USA)

1:40 pm: **Laser excitation dynamics of argon metastables generated in atmospheric pressure flows by microwave frequency microplasma arrays**, Wilson T. Rawlins, Kristin L. Galbally-Kinney, Steven J. Davis, Physical Sciences Inc. (USA); Alan R. Hoskinson, Jeffrey A. Hopwood, Tufts Univ. (USA) . [9729-10]

2:00 pm: **Demonstration of a diode-pumped CW advanced noble gas laser (ANGL)**, Greg A. Pitz, Air Force Research Lab. (USA) . . . . . [9729-11]

2:20 pm: **Pulsed discharge production Ar\* metastables**, Jiande Han, Michael C. Heaven, Emory Univ. (USA); William F. Bailey, Daniel J. Emmons, Glen P. Perram, Air Force Institute of Technology (USA) . . . . . [9729-12]

2:40 pm: **Measurement of pressure broadening of the Kr 811.3 nm absorption line using a diode laser**, Pavel A. Mikhayev, Samara State Aerospace Univ. (Russian Federation); Alexander K. Churnyshov, Nikolay I. Ufimtsev, P.N. Lebedev Physical Institute (Russian Federation); Valeriy N. Azyazov, Samara State Aerospace Univ. (Russian Federation); Michael C. Heaven, Emory Univ. (USA) . . . . . [9729-13]

3:00 pm: **Narrow spectral width laser diode for metastable argon atoms pumping**, Jun Gao, Wuhan National Lab. for Optoelectronics (China); Duluo Zuo, Wuhan National Lab. for Optoelectronics (China) and Huazhong Univ. of Science and Technology (China); Xinbing Wang, Bin Li, Huazhong Univ. of Science and Technology (China) . . . . . [9729-14]

Coffee Break . . . . . Mon 3:20 pm to 3:50 pm

### SESSION 3

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . . MON 3:50 TO 4:30 PM

### Novel COIL Lasers

Session Chair: **David L. Carroll**, CU Aerospace LLC (USA)

3:50 pm: **Optical pumping of the oxygen-iodine laser medium**, Marsel V. Zagidullin, P.N. Lebedev Physical Institute (Russian Federation); Mikhail S. Malyshev, Valeriy N. Azyazov, Samara State Aerospace Univ. (Russian Federation); Michael C. Heaven, Emory Univ. (USA) . . . . . [9729-15]

4:10 pm: **Oxygen assisted iodine atoms production in an RF discharge**, Pavel A. Mikhayev, Samara State Aerospace Univ. (Russian Federation); Nikolay I. Ufimtsev, P.N. Lebedev Physical Institute (Russian Federation); Andrey V. Demyanov, Troitsk Institute for Innovation and Fusion Research (Russian Federation); Igor V. Kochetov, Valeriy N. Azyazov, P.N. Lebedev Physical Institute (Russian Federation); Anatoly P. Napartovich, Troitsk Institute for Innovation and Fusion Research (Russian Federation); Michael C. Heaven, Emory Univ. (USA) . . . . . [9729-16]



# CONFERENCE 9729

LOCATION: ROOM 130 (NORTH EXHIBIT LEVEL)

TUESDAY 16 FEBRUARY

## SESSION 4

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . . MON 4:30 TO 5:30 PM

### Other Laser Systems and Applications

Session Chair: **Greg A. Pitz**, Air Force Research Lab. (USA)

- 4:30 pm: **Wide-bandwidth Tm-based amplifier for laser acceleration driver**, Drew A. Copeland, John Vetrovec, Amardeep S. Litt, Aqwest, LLC (USA); Joseph M. Fukumoto, Steven Jensen, General Atomics Aeronautical Systems, Inc. (USA) . . . . . [9729-18]
- 4:50 pm: **Effect of laser power on the microstructural behaviour and strength of modified laser deposited Ti<sub>6</sub>Al<sub>4</sub>V+Cu alloy for medical application**, Mutiu F. Erinosh, Esther T. Akinlabi, Univ. of Johannesburg (South Africa) . . . . . [9729-19]
- 5:10 pm: **High pulse energy 1123nm laser of Nd:GdLuAG mixed garnet medium**, Yang Liu, Zhaojun Liu, Sasa Zhang, Jinbao Xia, Yanmin Zhang, Chen Guan, Shandong Univ. (China) . . . . . [9729-20]

## POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Lidar for monitoring methane emission in Siberian permafrost**, Aleksandr S. Grishkanich, Aleksandr Zhevlakov, Sergey Kascheev, ITMO Univ. (Russian Federation); Igor Sidorov, Univ. of Eastern Finland (Finland); Valentin Elizarov, ITMO Univ. (Russian Federation) . . . . . [9729-21]

**The control of CO<sub>2</sub> lasing temporal characteristics by modulated self-injected irradiation**, Vadim V. Kiyko, A. M. Prokhorov General Physics Institute of the Russian Academy of Sciences (Russian Federation) and ITMO Univ. (Russian Federation); Danil Mikhaylov, A. M. Prokhorov General Physics Institute of the Russian Academy of Sciences (Russian Federation) . . . . . [9729-22]

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# CONFERENCE 9730

LOCATION: ROOM 130 (NORTH EXHIBIT LEVEL)

Tuesday–Thursday 16–18 February 2016 • Proceedings of SPIE Vol. 9730

# Components and Packaging for Laser Systems II

Conference Chairs: **Alexei L. Glebov**, OptiGrate Corp. (USA); **Paul O. Leisher**, Rose-Hulman Institute of Technology (USA)

Program Committee: **Igor Anisimov**, Air Force Research Lab. (USA); **Gunnar Böttger**, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); **Kristian J. Buchwald**, Ibsen Photonics A/S (Denmark); **Te-Yuan Chung**, National Central Univ. (Taiwan); **Joseph L. Dallas**, Avo Photonics, Inc. (USA); **Martin Forrer**, FISBA OPTIK AG (Switzerland); **Alexander V. Laskin**, AdlOptica Optical Systems GmbH (Germany); **Jian Liu**, PolarOnyx, Inc. (USA); **Victor Liu**, Xi'an Focuslight Technologies Co., Ltd. (China); **Jens Meinschien**, LIMO Lissotschenko Mikrooptik GmbH (Germany); **Christian V. Poulsen**, NKT Photonics Inc. (USA); **Mark A. Stephen**, NASA Goddard Space Flight Ctr. (USA); **Takunori Taira**, Institute for Molecular Science (Japan); **Torsten Vahrenkamp**, ficonTEC Service GmbH (Germany); **Alexander Yusim**, IPG Photonics Corp. (USA); **Arnaud Zoubir**, ALPhANOV (France)

## TUESDAY 16 FEBRUARY

### SESSION 1

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . TUE 8:30 TO 10:00 AM

#### 2 $\mu$ m Laser Components: European ISLA Program

Session Chairs: **Alexei L. Glebov**, OptiGrate Corp. (USA);  
**Bruce Napier**, Vivid Components Ltd. (Germany)

8:30 am: **Integrated disruptive components for 2 $\mu$ m fibre lasers (ISLA): Project overview and passive component development** (*Invited Paper*), Gary Stevens, Gooch & Housego (Torquay) Ltd. (United Kingdom) . . . . . [9730-1]

9:00 am: **Acousto-optic devices for operation with 2 $\mu$ m fibre lasers**, Jon D. Ward, Gooch & Housego PLC (United Kingdom); Gary Stevens, Gooch & Housego (Torquay) Ltd. (United Kingdom); Peter C. Shardlow, Univ. of Southampton (United Kingdom) . . . . . [9730-2]

9:20 am: **Broadband saturable absorber mirrors**, Kangpeng Wang, Aidan Baker-Murray, Werner J. Blau, Trinity College Dublin (Ireland) . . . . . [9730-3]

9:40 am: **Thulium-doped silica fibers optimized for high lasing efficiency**, Peter C. Shardlow, Deepak Jain, Richard Parker, Jayanta K. Sahu, W. Andrew Clarkson, Univ. of Southampton (United Kingdom) . . . . . [9730-4]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

### SESSION 2

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . TUE 10:30 TO 11:50 AM

#### MID-IR Laser Components and Packaging

Session Chair: **Christian V. Poulsen**, NKT Photonics A/S (Denmark)

10:30 am: **Volume Bragg gratings for 2-micron laser systems**, Vadim Smirnov, OptiGrate Corp. (USA); Alex Sincore, Joshua Bradford, Lawrence Shah, Martin Richardson, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Oleksiy Mokhun, Alexei L. Glebov, OptiGrate Corp. (USA); Leonid Glebov, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) and OptiGrate Corp. (USA) . . . . . [9730-5]

10:50 am: **Polarization maintaining chalcogenide fiber for mid-IR quantum cascade laser pigtailling**, Céline Caillaud, Univ. de Rennes 1 (France); Clément Gilles, mirSense (France); Laurent Brilland, PERFOS (France) and SelenOptics (France); Laurent Provino, PERFOS (France); Mathieu Carras, Mickael Brun, mirSense (France); David Méchin, PERFOS (France); Johann Troles, Univ. de Rennes 1 (France) and SelenOptics (France) . . . . . [9730-6]

11:10 am: **Mid-IR fused fiber couplers**, Gary Stevens, Toby Woodbridge, Gooch & Housego (Torquay) Ltd. (United Kingdom) . . . . . [9730-7]

11:30 am: **Thermal management of quantum cascade lasers in an individually addressable monolithic array architecture**, Leo J. Missaggia, Christine A. Wang, Michael K. Connors, Brian G. Saar, Antonio Sanchez-Rubio, Kevin J. Creedon, George W. Turner, William Herzog, MIT Lincoln Lab. (USA) . . . . . [9730-8]

Lunch/Exhibition Break . . . . . Tue 11:50 am to 1:20 pm

### SESSION 3

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . . . TUE 1:20 TO 3:00 PM

#### Laser Diode Packaging I

Joint Session with Conferences 9730 and 9733

Session Chairs: **Kurt J. Linden**, N2 Biomedical (USA);  
**Paul O. Leisher**, Rose-Hulman Institute of Technology (USA)

1:20 pm: **Integrated high power VCSEL systems**, Holger Moench, Ralf Conrads, Stephan Gronenborn, Philips Technologie GmbH (Germany); Xi Gu, Philips Lighting B.V. (Netherlands); Michael Miller, Philips GmbH U-L-M Photonics (Germany); Pavel Pekarski, Jens Pollmann-Retsch, Philips Research (Germany); Armand Pruijboom, Philips Lighting B.V. (Netherlands); Ulrich Weichmann, Philips Technologie GmbH (Germany) . . . . . [9733-30]

1:40 pm: **Industrial grade assembly solution for micro optics utilized in high power diode laser stacks**, Daniel Zontar, Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Harald Vogt, MA micro automation GmbH (Germany); Sebastian Haag, Tobias Müller, Sebastian Sauer, Christian Brecher, Fraunhofer-Institut für Produktionstechnologie IPT (Germany) . . . . . [9733-31]

2:00 pm: **High power diode laser array development using completely indium free packaging technology with narrow spectrum**, Dong Hou, Jingwei Wang, Lijun Gao, Dong Lu, Xingsheng Liu, Xiaoning Li, Xi'an Focuslight Technologies Co., Ltd. (China) . . . . . [9730-9]

2:20 pm: **Blue-emitting external cavity laser diode**, Hong Man Na, Korea Univ. (Korea, Republic of) . . . . . [9730-10]

2:40 pm: **Optical feedback module for stabilizing the optical power of laser-diode modules without thermoelectric coolers**, John Downing, USL Technologies LLC (USA) . . . . . [9730-11]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

### SESSION 4

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . . . TUE 3:30 TO 5:20 PM

#### Laser Diode Packaging II

Session Chair: **Torsten Vahrenkamp**,  
ficonTEC Service GmbH (Germany)

3:30 pm: **Teradiode's high brightness semiconductor lasers** (*Invited Paper*), Robin K. Huang, TeraDiode, Inc. (USA) . . . . . [9730-12]

4:00 pm: **Packaging of hard solder 500W QCW diode laser array**, Xiaoning Li, Jingwei Wang, Xi'an Focuslight Technologies Co., Ltd. (China); Dong Hou, Xi'an Focuslight Technologies Inc. (China); Xingsheng Liu, Xi'an Focuslight Technologies Co., Ltd. (China) . . . . . [9730-13]

4:20 pm: **Fully automated hybrid diode laser assembly using high precision active alignment**, Gunnar Böttger, Daniel Weber, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); Friedemann Scholz, Eagleyard Photonics GmbH (Germany); Henning Schröder, Martin Schneider-Ramelow, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); Klaus-Dieter Lang, Technische Univ. Berlin (Germany) . . . . . [9730-14]

# CONFERENCE 9730

LOCATION: ROOM 130 (NORTH EXHIBIT LEVEL)

4:40 pm: **Approaching improved adhesive bonding repeatability**, Christian Schlette, Institute for Man-Machine Interaction (Germany); Tobias Müller, Daniel Zontar, Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Jürgen Rossmann, Institute for Man-Machine Interaction (Germany); Christian Brecher, Fraunhofer-Institut für Produktionstechnologie IPT (Germany) ..... [9730-15]

5:00 pm: **980nm diode laser pump modules operating at high temperature**, Jenna Campbell, Freedom Photonics, LLC (USA); Tadej Semenic, Teledyne Scientific Co. (USA); Paul O. Leisher, Rose-Hulman Institute of Technology (USA); Avijit Bhunia, Teledyne Scientific Co. (USA); Milan Mashanovitch, Daniel Renner, Freedom Photonics, LLC (USA) ..... [9730-16]

## POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Efficient ultrafast fiber laser using chirped fiber Bragg grating and chirped volume Bragg grating stretcher/compressor configuration**, Andrejus Michailovas, EKSPLA uab (Lithuania); Saulius Frankinas, Nerijus Rusteika, EKSPLA uab (Lithuania) and Ctr. for Physical Sciences and Technology (Lithuania); Vadim Smirnov, Ruslan Vasilyev, Alexei L. Glebov, OptiGrate Corp. (USA) ..... [9730-43]

**Radiation pressure based laser power measurements using photonic microcantilevers**, Lewis G. Carpenter, Christopher Holmes, Peter A. Cooper, James C. Gates, Corin B. E. Gawith, Peter G. R. Smith, Univ. of Southampton (United Kingdom) ..... [9730-44]

**Machine platform and software environment for rapid optics assembly process development**, Sebastian Sauer, Sebastian Haag, Tobias Müller, Daniel Zontar, Christian Brecher, Fraunhofer-Institut für Produktionstechnologie IPT (Germany) ..... [9730-45]

**Sub-nanosecond passively Q-switched monolithic green laser**, Lihe Zheng, Takunori Taira, Institute for Molecular Science (Japan) ..... [9730-46]

**Optical attachment for spatial transformation of excimer laser beam**, Alexandr S. Grishkanich, Alexandr Zhevnikov, ITMO Univ. (Russian Federation); Egor Gavrilov, Lasers and Optical Systems, J.S.C. (Russian Federation) and Institute for Laser Physics (Russian Federation); Sergey Kascheev, ITMO Univ. (Russian Federation); Veli Kujanpää, VTT Industrial Systems (Finland) ..... [9730-47]

**Polarization and wavelength insensitive optical feedback control systems for stabilizing CO<sub>2</sub> lasers**, Mohamed Amine Jebali, AFL (USA) ..... [9730-48]

**High speed printing with polygon scan heads**, Glenn Stutz, Lincoln Laser Co. (USA) ..... [9730-49]

## WEDNESDAY 17 FEBRUARY

### SESSION 5

LOCATION: ROOM 130 (NORTH EXHIBIT LEVEL) ... WED 8:30 AM TO 10:00 AM

### Laser Diode Packaging III

Session Chair: **Jens Meinschien**, LIMO Lissotschenko Mikroskopik GmbH (Germany)

8:30 am: **Beam shaping concepts for kW-class CW and QCW diode lasers** (*Invited Paper*), Andreas Unger, Wilhelm Fassbender, Holger Müntz, Bernd Köhler, Jens Biesenbach, DILAS Diodenlaser GmbH (Germany) ..... [9730-17]

9:00 am: **Packaging of wavelength stabilized 976nm 100W 105µm 0.15 NA fiber coupled diode lasers**, Xiaochen Jiang, Rui Liu, Yanyan Gao, Tujia Zhang, Xiaoguang He, Jing Zhu, Qiang Zhang, Thomas C. Yang, CuiPeng Zhang, BWT Beijing Ltd. (China) ..... [9730-18]

9:20 am: **Ultrashort pulse written volume-Bragg-gratings in fused silica for external stabilization of diode lasers with ultra-low spectral-drift**, Daniel Richter, Christian Voigtländer, Jens U. Thomas, Ria G. Krämer, Friedrich-Schiller-Univ. Jena (Germany); Hagen Zimer, TRUMPF Laser GmbH (Germany); Andreas Tünnermann, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) and Friedrich-Schiller-Univ. Jena (Germany); Stefan Nolte, Friedrich-Schiller-Univ. Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) ..... [9730-19]

9:40 am: **Performance improvements to wavelength stabilized high power 885nm diode laser modules**, David M. Hemenway, Ling Bao, Manoj Kanskar, Mark DeVito, Wolfram Urbanek, Mike P. Grimshaw, Kevin Bruce, David Dawson, Robert Martinsen, nLIGHT Corp. (USA); Paul O. Leisher, Rose-Hulman Institute of Technology (USA) ..... [9730-20]

Coffee Break ..... Wed 10:00 am to 10:20 am

## LASE Plenary Session

WED 10:20 AM TO 12:30 PM

LOCATION: ROOM 103 (SOUTH EXHIBIT LEVEL)

10:20 am: **Welcome and Opening Remarks**

**Guido Hennig**, Daetwyler Graphics AG (Switzerland)  
**Yongfeng Lu**, Univ. of Nebraska-Lincoln (USA)

10:25 am: **Announcement of the Green Photonics Best Paper Award and the 3D Printing, Fabrication, and Manufacturing Best Paper Award**

**Stephen J. Eglash**, Energy and Environment Affiliates Program, Stanford Univ. (USA)  
**Henry Helvajian**, The Aerospace Corp. (USA)

10:30 am: **Emerging Applications of Photonic Crystal Fibers**

**Philip Russell**, Max-Planck Institute for the Science of Light (Germany) and Univ. of Erlangen-Nuremberg (Germany)

11:10 am: **Optical 3D Nano-fabrication: Drawing or Growing?**

**Satoshi Kawata**, Osaka Univ. (Japan) and RIKEN (Japan)

11:50 am: **High Power Semiconductor Lasers: Disrupting a Fragmented Industry**

**Scott Keeney**, nLight Corp. (USA)

Lunch/Exhibition Break ..... Wed 12:30 pm to 1:50 pm

### SESSION 6

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) .. WED 1:50 TO 3:30 PM

### Emerging Laser Components

Session Chair: **Martin Forrer**, FISBA AG (Switzerland)

1:50 pm: **Integration and performance of graphene modulators in Er fiber frequency combs** (*Invited Paper*), Martin E. Fermann, IMRA America, Inc. (USA) ..... [9730-21]

2:20 pm: **Efficient crystalline fiber lasers and broadband emissions** (*Invited Paper*), Shih-Chang Wang, Teng-Yi Yang, Dong-Yo Jheng, Chun-Yang Hsu, Tzu-Te Yang, National Taiwan Univ. (Taiwan); Pinghui S. Yeh, National Taiwan Univ. of Science and Technology (Taiwan); Sheng-Lung L. Huang, National Taiwan Univ. (Taiwan) ..... [9730-22]

2:50 pm: **Modeling and optimization of multimode fiber fused combiners**, Yu Liu, Hao Yu, Politecnico di Torino (Italy); Alessio Califano, OPI Photonics s.r.l. (Italy); Andrea Braglia, Politecnico di Torino (Italy) and OPI Photonics (Italy); Guido Perrone, Politecnico di Torino (Italy) ..... [9730-23]

3:10 pm: **Key optical components for spaceborne lasers**, Jens Löhring, Matthias Winzen, Heinrich Faidel, Jörn Miesner, Heinz-Dieter Plum, Jürgen Klein, Oliver Fitzau, Martin Giesberts, Wolfgang Brandenburg, Anja Seidel, Natascha Schwanen, Dana Risters, Hans-Dieter Hoffmann, Fraunhofer-Institut für Lasertechnik (Germany) ..... [9730-24]

Coffee Break ..... Wed 3:30 pm to 4:00 pm

# CONFERENCE 9730

LOCATION: ROOM 130 (NORTH EXHIBIT LEVEL)

## SESSION 7

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . WED 4:00 TO 5:50 PM

### Advanced Laser Packaging Solutions

Session Chair: **Gunnar Böttger**, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany)

4:00 pm: **Cost-effective manufacturing of compact TDLAS sensors for hazardous area applications** (*Invited Paper*), Michael B. Frish, Mathew C. Laderer, Clinton J. Smith, Physical Sciences Inc. (USA); Ryan Ehid, Joseph L. Dallas, Avo Photonics, Inc. (USA) . . . . . [9730-25]

4:30 pm: **Multi-100W class, fully integrated, monolithic ytterbium-doped photonic-crystal fiber amplifier module** (*Invited Paper*), Johan Boulet, ALPhANOV (France); Germain Guiraud, Lab. Photonique, Numérique et Nanosciences (France) and Azur Light Systems (France); Giorgio Santarelli, Lab. Photonique, Numérique et Nanosciences (France); Cyril Vincont, Simon Salort, Christophe Pierre, ALPhANOV (France) . . . . . [9730-26]

5:00 pm: **Optical packaging for downhole photometry** (*Invited Paper*), Jess V. Ford, Weatherford International Ltd. (USA); Tom Haslett, Avo Photonics, Inc. (USA) . . . . . [9730-27]

5:30 pm: **Model-based adhesive shrinkage compensation for increased bonding repeatability**, Tobias Müller, Sebastian Haag, Daniel Zontar, Sebastian Sauer, Christian Brecher, Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Christian Schlette, Jürgen Rossmann, Institute for Man-Machine Interaction (Germany) . . [9730-28]

## THURSDAY 18 FEBRUARY

## SESSION 8

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . . THU 8:00 TO 9:50 AM

### Components and Packaging for Ultrafast Lasers

Session Chair: **Alexander Yusim**, IPG Photonics Corp. (USA)

8:00 am: **Hybrid high power fs lasers** (*Invited Paper*), Bojan Resan, Lumentum (Switzerland) and Univ. of Applied Sciences and Arts Northwestern (Switzerland) . . . . . [9730-29]

8:30 am: **Small structures, big impact! High-performance diffraction gratings for laser applications**, Frank Fuchs, Gitterwerk GmbH (Germany) . . . . . [9730-30]

8:50 am: **Integrated pulse stretchers for high-energy CPA and OPCPA systems**, Lawrence Shah, Nathan Bodnar, Joshua Bradford, Benjamin Webb, Jess Lane, Michael Chini, Martin Richardson, Univ. of Central Florida (USA) . . . . . [9730-31]

9:10 am: **Efficient chirped Bragg gratings for stretching and compression of high power ultra short laser pulses at 800-2500 nm**, Vadim Smirnov, Eugeniu Rotari, Ruslan Vasilyeu, Oleg Smolski, Alexei L. Glebov, Leonid Glebov, OptiGrate Corp. (USA) . . . . . [9730-32]

9:30 am: **Broadband 7 microns OPCPA pumped by a 2 microns picosecond Ho:YLF CPA system**, Christophe Simon-Boisson, Olivier Chalus, Thales Optronique S.A.S. (France); Daniel Sanchez, Michael Hemmer, Matthias Baudisch, Seth Cousin, ICFO - Institut de Ciències Fotòniques (Spain); Jens Biegert, ICFO - Institut de Ciències Fotòniques (Spain) and Institució Catalana de Recerca i Estudis Avançats (Spain); Kevin Zawilski, Peter G. Schunemann, BAE Systems (USA); Vadim Smirnov, OptiGrate Corp. (USA); Heinar Hoogland, Ronald Holzwarth, Menlo Systems GmbH (Germany) . . . . . [9730-33]

Coffee Break . . . . . Thu 9:50 am to 10:20 am

## SESSION 9

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . THU 10:20 AM TO 12:10 PM

### Components and Packaging for Laser Beam Engineering

Session Chair: **Kristian J. Buchwald**, Ibsen Photonics A/S (Denmark)

10:20 am: **Fiber laser beam combining for power scaling** (*Invited Paper*), Eric C. Honea, Robert Afzal, Matthias Savage-Leuchs, Dan Hu, Craig Robin, Lockheed Martin Laser and Sensor Systems (USA) . . . . . [9730-34]

10:50 am: **Engineering of freeform refractive and reflective slow axis collimation solutions**, Martin Forrer, Hansruedi Moser, Hans Forrer, Dzelal Kura, FISBA AG (Switzerland) . . . . . [9730-35]

11:10 am: **Wavefront distortion of laser beams corrected with volume Bragg gratings in photothermorefractive glass**, Fan Gao, Xiaojie Sun, Jing Hu, Xiang Zhang, Xiao Yuan, Soochow Univ. (China) . . . . . [9730-36]

11:30 am: **Customised low-angle refractive diffusers for high power laser applications**, Matthew O. Currie, Paul Blair, Roy McBride, Eoin Murphy, PowerPhotonic Ltd. (United Kingdom) . . . . . [9730-37]

11:50 am: **Advanced centering of mounted optics**, Christian Wenzel, Innolite GmbH (Germany) . . . . . [9730-38]

Lunch/Exhibition Break . . . . . Thu 12:10 pm to 1:40 pm

## SESSION 10

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . . . THU 1:40 TO 3:10 PM

### Components and Packaging for High Power/Energy Lasers

Session Chair: **Joseph Louis Dallas**, Avo Photonics, Inc. (USA)

1:40 pm: **Packaging of fiber lasers and components for use in harsh environments** (*Invited Paper*), Daniel Creeden, Benjamin R. Johnson, Casey W. Jones, Charles R. Ibach, Michael L. Lemons, Peter A. Budni, James P. Zona, Adam J. Marciniuk, Chris L. Willis, James Sweeney, Scott D. Setzler, BAE Systems (USA) . . . . . [9730-39]

2:10 pm: **Laser surface texturization for high power cladding light stripper**, Claude Aguergaray, Catherine Lesaux, Léo Lebrun, Marc Faucon, Rainer Kling, Christophe Pierre, Johan Boulet, ALPhANOV (France) . . . . . [9730-40]

2:30 pm: **High power coatings for line beam laser optics of up to 2-meter in length**, Mathias Mende, Jürgen Kohlhaas, Wolfgang Ebert, LASEROPTIK GmbH (Germany) . . . . . [9730-41]

2:50 pm: **Environmental durability of antireflective surface structures on silica windows for high energy lasers**, Lynda E. Busse, Jesse A. Frantz, U.S. Naval Research Lab. (USA); Menelaos K. Poutous, Rajendra Joshi, The Univ. of North Carolina at Charlotte (USA); Ishwar D. Aggarwal, Sotera Defense Solutions, Inc. (USA); Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA) . . . . . [9730-42]



# CONFERENCE 9731

LOCATION: ROOM 133 AND ROOM 120 (NORTH EXHIBIT LEVEL)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9731

# Nonlinear Frequency Generation and Conversion: Materials, Devices, and Applications XV

Conference Chairs: **Konstantin L. Vodopyanov**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); **Kenneth L. Schepler**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

Program Committee: **Darrell J. Armstrong**, Sandia National Labs. (USA); **Majid Ebrahim-Zadeh**, ICFO - Institut de Ciències Fotòniques (Spain); **Peter Günter**, ETH Zurich (Switzerland); **Baldemar Ibarra-Escamilla**, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); **Yehoshua Y. Kalisky**, Nuclear Research Ctr. Negev (Israel); **Yun-Shik Lee**, Oregon State Univ. (USA); **Rita D. Peterson**, Air Force Research Lab. (USA); **Peter G. Schunemann**, BAE Systems (USA); **Andrei V. Shchegrov**, KLA-Tencor Corp. (USA); **Wei Shi**, Tianjin Univ. (China); **Michael Vasilyev**, The Univ. of Texas at Arlington (USA)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . . MON 1:00 TO 3:00 PM

### Microresonator Frequency Combs I

Joint Session with Conferences 9727 and 9731

Session Chair: **Andrea M. Armani**,  
The Univ. of Southern California (USA)

1:00 pm: **Self-stabilized 3-5  $\mu\text{m}$  frequency comb based on frequency-divide-by-two GaAs OPO** (*Invited Paper*), Kevin F. Lee, Christian Mohr, Jie Jiang, IMRA America, Inc. (USA); Peter G. Schunemann, BAE Systems (USA); Konstantin L. Vodopyanov, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Martin E. Fermann, IMRA America, Inc. (USA) . . . [9731-1]

1:25 pm: **Octave-wide frequency comb centered at 4  $\mu\text{m}$  based on a subharmonic OPO with Hz-level relative linewidth**, Viktor O. Smolski, Jia Xu, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Peter G. Schunemann, BAE Systems (USA); Konstantin L. Vodopyanov, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . [9731-2]

1:45 pm: **High-Q resonators for soliton combs and optical gyros** (*Invited Paper*), Kerry J. Vahala, California Institute of Technology (USA) . . . [9727-10]

2:10 pm: **Nonlinear control in optical microcavity systems: switching and Kerr comb generation in a whispering gallery mode cavity** (*Invited Paper*), Takasumi Tanabe, Keio Univ. (Japan) . . . [9727-11]

2:35 pm: **To be announced** (*Invited Paper*), Alexander L. Gaeta, Columbia Univ. (USA) . . . [9727-12]

Coffee Break . . . . . Mon 3:00 pm to 3:30 pm

### SESSION 2

LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . . MON 3:30 TO 6:00 PM

### Microresonator Frequency Combs II

Joint Session with Conferences 9727 and 9731

Session Chair: **Konstantin L. Vodopyanov**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

3:30 pm: **Soliton induced Cherenkov radiation based chip-scale frequency combs** (*Invited Paper*), Victor Brasch, Michael Geiselmann, Martin H. P. Pfeiffer, Arne Kordts, Maxim Karpov, Hairun Guo, Michail Zervas, Junqiu Liu, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Michael L. Gorodetsky, Lomonosov Moscow State Univ. (Russian Federation) and Russian Quantum Ctr. (Romania); Tobias J. Kippenberg, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . [9727-13]

3:55 pm: **Miniature multioctave light source based on a monolithic microcavity** (*Invited Paper*), Wei Liang, Anatoliy A. Savchenkov, OEwaves, Inc. (USA); James F. McMillan, Columbia Univ. (USA); Zhenda Xie, Univ. of California, Los Angeles (USA); Jan Burkhart, Columbia Univ. (USA); Vladimir S. Ilchenko, OEwaves, Inc. (USA); Chee Wei Wong, Univ. of California, Los Angeles (USA); Andrey B. Matsko, Lute Maleki, OEwaves, Inc. (USA) . . . [9731-3]

4:20 pm: **On-chip diamond frequency combs and Raman lasers** (*Invited Paper*), Marko Loncar, Pawel M. Latawiec, Vivek Venkataraman, Michael J. Burek, Harvard School of Engineering and Applied Sciences (USA) . . . [9727-14]

4:45 pm: **Dynamics and generation of microresonator frequency combs** (*Invited Paper*), Chee Wei Wong, Shu-Wei Huang, Jinkang Lim, Abhinav K. Vinod, Jinghui Yang, Univ. of California, Los Angeles (USA); Heng Zhou, Univ. of Electronic Science and Technology of China (China) . . . [9727-15]

5:10 pm: **Generation of ultra-low-noise optical parametric combs** (*Invited Paper*), Stojan Radic, Univ. of California, San Diego (USA) . . . [9731-4]

5:35 pm: **Optical frequency comb and spectroscopy with crystalline resonators in MIR** (*Invited Paper*), Nan Yu, Jet Propulsion Lab. (USA) . [9727-16]

## TUESDAY 16 FEBRUARY

### SESSION 3

LOCATION: RM 120 (NORTH EXHIBIT LEVEL) . TUE 8:00 TO 10:00 AM

### NOTE ROOM CHANGE

### Visible-UV Generation

Session Chairs: **Baldemar Ibarra-Escamilla**, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); **Darrell J. Armstrong**, Sandia National Labs. (USA)

8:00 am: **New generation of highly efficient ultrahigh power visible and UV fiber lasers** (*Keynote Presentation*), Alexey Avdokhin, Valentin P. Gapontsev, IPG Photonics Corp. (USA) . . . [9731-5]

8:30 am: **High power high-harmonics generation using a 30-m enhancement cavity** (*Invited Paper*), Shuntaro Tani, Akira Ozawa, Zhigang Zhao, Makoto Kuwata-Gonokami, Yohei Kobayashi, The Univ. of Tokyo (Japan) . . . [9731-6]

9:00 am: **High efficiency fourth-harmonic generation from nanosecond fiber master oscillator power amplifier**, Xiaodong Mu, Paul Steinvurzel, Todd S. Rose, William T. Lotshaw, Steven M. Beck, James H. Clemmons, The Aerospace Corp. (USA) . . . [9731-7]

9:20 am: **Comparison of yellow light emitting micro integrated laser modules with different geometries of the crystals for second harmonic generation**, Julian Hofmann, Nils Werner, David Feise, Alexander Sahn, Roland Bege, Bernd Eppich, Gunnar Blume, Katrin Paschke, Ferdinand-Braun-Institut (Germany) . . . [9731-8]

9:40 am: **Compact deep UV laser system at 222.5 nm by single-pass frequency doubling of high-power GaN diode laser emission**, Norman Ruhnke, André Müller, Bernd Eppich, Reiner Güther, Martin Maiwald, Bernd Sumpf, Götz Erbert, Günther Tränkle, Ferdinand-Braun-Institut (Germany) . . . [9731-9]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

# CONFERENCE 9731

LOCATION: ROOM 120 (NORTH EXHIBIT LEVEL)

## SESSION 4

LOCATION: RM 120 (NORTH EXHIBIT LEVEL) . TUE 10:30 AM TO 12:00 PM

### New Nonlinear Materials and Characterization I

Session Chair: **Rita D. Peterson**, Air Force Research Lab. (USA)

10:30 am: **Mid-IR Kerr-lens mode-locked polycrystalline Cr:ZnS and Cr:ZnSe lasers with intracavity frequency conversion via random quasi-phase-matching** (*Invited Paper*), Sergey Vasilyev, Igor S. Moskalev, Mikhail S. Mirov, IPG Photonics - Mid-Infrared Lasers (USA); Sergey B. Mirov, IPG Photonics - Mid-Infrared Lasers (USA) and The Univ. of Alabama at Birmingham (USA); Valentin P. Gapontsev, IPG Photonics Corp. (USA) . . . . . [9731-10]

11:00 am: **Broadband electrical control of second-harmonic generation in bilayer MoS<sub>2</sub> by inversion symmetry breaking**, Julian Klein, Walter Schottky Institut (Germany) and Technische Univ. München (Germany); Jakob Wierzbowski, Armin Regler, Jonathan Becker, Walter Schottky Institut (Germany); Florian Heimbach, Technische Univ. München (Germany); Michael Kaniber, Walter Schottky Institut (Germany); Kai Müller, Stanford Univ. (USA) and Walter Schottky Institut (Germany); Jonathan J. Finley, Walter Schottky Institut (Germany) . . . . . [9731-11]

11:20 am: **Improved grating propagation during HVPE growth of orientation-patterned gallium arsenide and gallium phosphide**, Peter G. Schunemann, Daniel J. Magarrell, Lee Mohnkern, Leonard A. Pomeranz, BAE Systems (USA) . . . . . [9731-12]

11:40 am: **Frequency conversion efficiency in free-standing periodically oriented gallium nitride**, Christopher G. Brown, Univ. Research Foundation (USA); Steven R. Bowman, Jennifer K. Hite, Jaime A. Freitas, Francis J. Kub, Charles R. Eddy Jr., Igor Vurgaftman, Jerry R. Meyer, U.S. Naval Research Lab. (USA); Jacob H. Leach, Kevin Udway, Kyra Technologies, Inc. (USA) [9731-13]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:40 pm

## SESSION 5

LOCATION: RM 120 (NORTH EXHIBIT LEVEL) . . . TUE 1:40 TO 3:30 PM

### New Nonlinear Materials and Characterization II

Session Chair: **Peter G. Schunemann**, BAE Systems (USA)

1:40 pm: **Nonlinear refraction dynamics of solvents and gases** (*Keynote Presentation*), Eric W. Van Stryland, Peng Zhao, Trenton Ensley, Matthew C. Reichert, David J. Hagan, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9731-46]

2:10 pm: **Homo and heteroepitaxial growth and study of orientation-patterned GaP for nonlinear frequency conversion devices**, Vladimr L. Tassev, Rita D. Peterson, Shivashankar Vangala, Michael Snure, Martin Kimani, Air Force Research Lab. (USA) . . . . . [9731-14]

2:30 pm: **Linear and nonlinear optical properties of GaAs and GaP grown using hydride vapor phase epitaxy**, Shekhar Guha, Air Force Research Lab. (USA); Jean Wei, Joel M. Murray, Jacob O. Barnes, Air Force Research Lab. (USA) and UES, Inc. (USA); Peter G. Schunemann, BAE Systems (USA) [9731-15]

2:50 pm: **Determination of the type II phase-transition region in random relaxor ferroelectrics using Cherenkov second-harmonic microscopy**, Mousa Ayoub, Hannes Futterlieb, Jörg Imbrock, Cornelia Denz, Westfälische Wilhelms-Univ. Münster (Germany) . . . . . [9731-16]

3:10 pm: **Optical limiting properties of carbon disulfide at 2.05µm wavelength**, Magnus W. Haakestad, Lars G. Holmen, Norwegian Defence Research Establishment (Norway) . . . . . [9731-17]

Coffee Break . . . . . Tue 3:30 pm to 4:00 pm

## SESSION 6

LOCATION: RM 120 (NORTH EXHIBIT LEVEL) . . TUE 4:00 TO 5:20 PM

### Supercontinuum Generation

Session Chairs: **Kenneth L. Schepler**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA);

**Michael Vasilyev**, The Univ. of Texas at Arlington (USA)

4:00 pm: **High-power mid-infrared high repetition-rate supercontinuum source based on a chalcogenide step-index fiber**, Stefan Kedenburg, Tobias R. J. Steinle, Florian Mörz, Andy Steinmann, Harald Giessen, Univ. Stuttgart (Germany) . . . . . [9731-18]

4:20 pm: **Experimental study of supercontinuum generation in an amplifier based on an Yb<sup>3+</sup> doped nonlinear photonic crystal fiber**, Tobias Baselt, Christopher Tautd, Fraunhofer IWS Dresden (Germany) and Westsächsische Hochschule Zwickau (Germany) and TU Dresden (Germany); Bryan Nelson, Westsächsische Hochschule Zwickau (Germany); Andrés-Fabián Lasagni, Fraunhofer IWS Dresden (Germany) and TU Dresden (Germany); Peter Hartmann, Westsächsische Hochschule Zwickau (Germany) and Fraunhofer IWS Dresden (Germany) . . . . . [9731-19]

4:40 pm: **All-normal dispersion supercontinuum generation in the near-infrared by Raman conversion in standard optical fiber**, Christophe Louot, Erwan Capitaine, Badr M. Shalaby, Katarzyna Krupa, Alessandro Tonello, Dominique Pagnoux, Claire Lefort, Philippe Leproux, Vincent Couderc, XLIM Institut de Recherche (France) . . . . . [9731-20]

5:00 pm: **Multi-component gas detection in the mid-infrared with supercontinuum**, Caroline Amiot, Piotr Ryczkowski, Antti Aalto, Juha Toivonen, Goëry Genty, Tampere Univ. of Technology (Finland) . . . . . [9731-21]

## POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Novel efficient high power parametric THz source based on QPM nonlinear crystal fiber**, Pengxiang Liu, Wei Shi, Degang Xu, Tianjin Univ. (China); Nasser N. Peyghambarian, The Univ. of Arizona (USA) . . . . . [9731-35]

**Walk-off free 266 nm generation of freely triggerable 60 ps pulses in periodically poled LBG0**, Thomas Schoenau, Dietmar Klemme, Romano Haertel, Kristian Lauritsen, Rainer Erdmann, PicoQuant GmbH (Germany) . . . . . [9731-36]

**Pulsed 266 nm laser based on fiber laser source for sensing application**, Junji Hirohashi, Yasuhiro Tomihari, Satoshi Makio, Yasunori Furukawa, Oxide Corp. (Japan); Marc Le Flohic, Keopsys SA (France) . . . . . [9731-37]

**Stimulated polariton scattering in KTA crystal and its application in tunable stokes laser generation**, Jie Zang, Zhenhua Cong, Xiaohan Chen, Xingyu Zhang, Zengguang Qin, Zhaojun Liu, Jianren Lu, Shandong Univ. (China); Shiqi Jiang, Shandong Univ. (China); Qiang Fu, Dong Wu, Shandong Univ. (China) . . . . . [9731-38]

**Polarization study of a supercontinuum light source for different wavelengths through a photonic crystal fiber**, Julian M. Estudillo-Ayala, Jose D. Filoteo-Razo, Juan Carlos Hernández-García, Univ. de Guanajuato (Mexico); Jesus Pablo Lauterio-Cruz, Ctr. de Investigaciones en Óptica, A.C. (Mexico); Daniel Jáuregui-Vázquez, Univ. de Guanajuato (Mexico); Baldemar Ibarra-Escamilla, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Oliver J. M. Pottiez, Ctr. de Investigaciones en Óptica, A.C. (Mexico); Roberto Rojas-Laguna, Univ. de Guanajuato (Mexico); Evgeny A. Kuzin, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [9731-39]

**2 nm continuously tunable 488nm micro-integrated diode-laser-based SHG light source for Raman spectroscopy**, Marcel Braune, Martin Maiwald, Bernd Sumpf, Günther Tränkle, Ferdinand-Braun-Institut (Germany) . . [9731-40]

**Phase-matching properties of GaS<sub>0.4</sub>Se<sub>0.6</sub> for type-2 DFG in the 100.4-1030.6µm range**, Kiyoshi Kato, Chitose Institute of Science and Technology (Japan); Valentin P. Petrov, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany); Nobuhiro Umemura, Chitose Institute of Science and Technology (Japan) . . . . . [9731-41]

**Studying an advanced regime of the non-collinear two-phonon light scattering for applications to the optical spectrum analysis**, Alexandre S. Shcherbakov, Adan O. Arellanes, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [9731-42]

**Thermal study of second harmonic generation in periodically poled crystals**, Alphonse L. Rasoloniaina, Rodolphe Collin, Christelle Pareige, Ecole Nationale Supérieure des Sciences Appliquées et de Technologie (France); Stéphane Balac, Univ. de Rennes 1 (France); Thierry Chartier, Ecole Nationale Supérieure des Sciences Appliquées et de Technologie (France); Pascal Besnard, CNRS-Fonctions Optiques pour les Technologistes de l'information (France); Alain Mugnier, David Pureur, Quantel Group (France) . . . . . [9731-43]

**Third-harmonic generation in metallo-dielectric stacks**, Han Li, Joseph W. Haus, Partha P. Banerjee, Univ. of Dayton (USA) . . . . . [9731-44]

**Surface states of silicon crystalline films detected by nonlinear optical laser spectroscopy**, Dmitry E. Milovzorov, Fluens Technology Group Ltd. (Russian Federation) . . . . . [9731-45]

# CONFERENCE 9731

LOCATION: ROOM 120 (NORTH EXHIBIT LEVEL)

## WEDNESDAY 17 FEBRUARY

### SESSION 7

LOCATION: RM 120 (NORTH EXHIBIT LEVEL) . WED 8:00 TO 9:50 AM

### Raman and Other High-Order Nonlinear Processes

Session Chair: **Darrell J. Armstrong**, Sandia National Labs. (USA)

8:00 am: **Delivering kilojoules of pre-heat to fusion targets in Sandia's Z-Machine: Or why do we care about nonlinearities in laser-plasma interactions?** (*Keynote Presentation*), Matthias Geissel, Adam J. Harvey-Thomson, Thomas J. Awe, Sandia National Labs. (USA); Michael E. Campbell, Lab. for Laser Energetics (USA); Matthew R. Gomez, Eric Harding, Christopher Jennings, Mark W. Kimmel, Patrick F. Knapp, Sandia National Labs. (USA); Sean M. Lewis, The Univ. of Texas at Austin (USA); Kyle Peterson, Marius Schollmeier, Adam B. Sefkow, Jonathon E. Shores, Daniel B. Sinars, Stephen A. Slutz, Ian C. Smith, Christopher S. Speas, Roger A. Vesey, John L. Porter, Sandia National Labs. (USA). . . . . [9731-22]

8:30 am: **Efficient cascaded generation of narrowband linearly-polarized radiation in random Raman fiber laser**, Sergey A. Babin, Ekaterina A. Zlobina, Sergey I. Kablukov, Evgeniy V. Podivilov, Institute of Automation and Electrometry (Russian Federation) . . . . . [9731-23]

8:50 am: **Temporal characterization of a multi-wavelength hybrid Brillouin-erbium fiber laser**, Victor L. Lambin-lezzi, Ecole Polytechnique de Montréal (Canada); Thomas F. S. Büttner, Ctr. for Ultrahigh bandwidth Devices for Optical Systems (Australia); Amirhossein Tehranchi, Sébastien Loranger, Ecole Polytechnique de Montréal (Canada); Irina V. Kabakova, Benjamin J. Eggleton, The Univ. of Sydney (Australia); Raman Kashyap, Ecole Polytechnique de Montréal (Canada) . . . . . [9731-24]

9:10 am: **Compact silica-fiber Brillouin laser with highly damped intensity-noise**, Schadrac Fresnel, Stéphane Trebaol, Yohann Léguillon, Christelle Pareige, Pascal Besnard, Ecole Nationale Supérieure des Sciences Appliquées et de Technologie (France); Sophie LaRochelle, Univ. Laval (Canada). . [9731-25]

9:30 am: **Mid-infrared, external cavity BaWO<sub>4</sub> Raman laser at 2602 nm with 1.25-W output power**, Onur Kuzucu, ASELSAN Inc. (Turkey) . . . . . [9731-26]

Coffee Break . . . . . Wed 9:50 am to 10:20 am

## LASE Plenary Session

WED 10:20 AM TO 12:30 PM

LOCATION: ROOM 103 (SOUTH EXHIBIT LEVEL)

10:20 am: **Welcome and Opening Remarks**

**Guido Hennig**, Daetwyler Graphics AG (Switzerland)  
**Yongfeng Lu**, Univ. of Nebraska-Lincoln (USA)

10:25 am: **Announcement of the Green Photonics Best Paper Award and the 3D Printing, Fabrication, and Manufacturing Best Paper Award**

**Stephen J. Eglash**, Energy and Environment Affiliates Program, Stanford Univ. (USA)  
**Henry Helvajian**, The Aerospace Corp. (USA)

10:30 am: **Emerging Applications of Photonic Crystal Fibers**  
**Philip Russell**, Max-Planck Institute for the Science of Light (Germany) and Univ. of Erlangen-Nuremberg (Germany)

11:10 am: **Optical 3D Nano-fabrication: Drawing or Growing?**  
**Satoshi Kawata**, Osaka Univ. (Japan) and RIKEN (Japan)

11:50 am: **High Power Semiconductor Lasers: Disrupting a Fragmented Industry**  
**Scott Keeney**, nLight Corp. (USA)

Lunch/Exhibition Break . . . . . Wed 12:30 pm to 2:00 pm

### SESSION 8

LOCATION: RM 120 (NORTH EXHIBIT LEVEL) . WED 2:00 TO 3:30 PM

### Optical Parametric Processes

Session Chair: **Kenneth L. Schepler**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

2:00 pm: **Designing non-trivial QPM spectral shapes in Titanium in-diffused PPLN** (*Invited Paper*), Alexander V. Sergienko, Boston Univ. (USA). . . . . [9731-27]

2:30 pm: **Broadband wavelength control for optical parametric oscillation in radially poled whispering gallery resonators**, Sarah-Katharina Meisenheimer, Univ. of Freiburg (Germany) and Fraunhofer-Institut für Physikalische Messtechnik (Germany); Josef U. Fürst, Univ. of Freiburg (Germany); Karsten Buse, Fraunhofer-Institut für Physikalische Messtechnik (Germany) and Univ. of Freiburg (Germany); Ingo Breunig, Univ. of Freiburg (Germany). . . . . [9731-28]

2:50 pm: **Broadly tunable OPGaAs OPO pumped by Cr:ZnSe laser**, Rita D. Peterson, Gary Cook, Air Force Research Lab. (USA) . . . . . [9731-29]

3:10 pm: **High-repetition rate, picosecond-pulse, tunable, mid-IR PPLN OPG source**, Yelena Isyanova, Wenyan Tian, Q-Peak, Inc. (USA); Peter F. Moulton, MIT Lincoln Lab. (USA) . . . . . [9731-30]

Coffee Break . . . . . Wed 3:30 pm to 4:00 pm

### SESSION 9

LOCATION: RM 120 (NORTH EXHIBIT LEVEL) . WED 4:00 TO 5:30 PM

### Novel Concepts of Nonlinear Optics

Session Chairs: **Kenneth L. Schepler**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA);

**Baldemar Ibarra-Escamilla**, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico)

4:00 pm: **Mid-infrared nonlinear upconversion imaging and sensing** (*Invited Paper*), Christian Pedersen, Peter Tidemand-Lichtenberg, Jeppe S. Dam, Technical Univ. of Denmark (Denmark) . . . . . [9731-31]

4:30 pm: **Multi-octave IR pulses generation in DAST crystal**, Carlo Vicario, Paul Scherrer Institut (Switzerland); Gunnar Arisholm, Norwegian Defence Research Establishment (Norway); Christoph P. Hauri, Paul Scherrer Institut (Switzerland) and Ecole Polytechnique Fédérale de Lausanne (Switzerland); Balazs Monoszlai, Paul Scherrer Institut (Hungary) and Univ. of Pécs (Hungary) . . . . . [9731-32]

4:50 pm: **Simultaneous fully phase-matched sum frequency and second harmonic generation of a high-power CW fiber laser using an aperiodically poled LN**, Ameneh Bostani, Amirhossein Tehranchi, Raman Kashyap, Ecole Polytechnique de Montréal (Canada) . . . . . [9731-33]

5:10 pm: **Evidence of Anderson localization effects in random Raman lasing**, Brett H. Hokr, Texas A&M Univ. (USA); Marlan O. Scully, Texas A&M Univ. (USA) and Baylor Univ. (USA) and Princeton Univ. (USA); Vladislav V. Yakovlev, Texas A&M Univ. (USA) . . . . . [9731-34]

LASE



# CONFERENCE 9732

LOCATION: ROOM 110 (NORTH EXHIBIT LEVEL)

Monday - Tuesday 15-16 February 2016 • Proceedings of SPIE Vol. 9732

# Real-time Measurements, Rogue Events, and Emerging Applications

*Conference Chairs:* **Bahram Jalali**, Univ. of California, Los Angeles (USA); **Sergei K. Turitsyn**, Aston Univ. (United Kingdom); **Daniel R. Solli**, Univ. of California, Los Angeles (USA), Georg-August-Univ. Göttingen (Germany); **John M. Dudley**, FEMTO-ST, Univ. de Franche - Comté, CNRS (France)

*Program Committee:* **Nail Akhmediev**, The Australian National Univ. (Australia); **Mohammad Hossein Asghari**, Univ. of California, Los Angeles (USA); **Neil G. R. Broderick**, The Univ. of Auckland (New Zealand); **Christophe Dorrer**, Univ. of Rochester (USA); **Miro Erkintalo**, The Univ. of Auckland (New Zealand); **Goëry Genty**, Tampere Univ. of Technology (Finland); **Keisuke Goda**, The Univ. of Tokyo (Japan); **Tsuyoshi Konishi**, Osaka Univ. (Japan); **Claus Ropers**, Georg-August-Univ. Göttingen (Germany); **Günter Steinmeyer**, Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy (Germany); **Majid Taki**, Univ. des Sciences et Technologies de Lille (France); **Paul D. Trinh**, Time Photonics, Inc. (USA); **Chao Wang**, Univ. of Kent (United Kingdom)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) . MON 9:00 AM TO 12:10 PM

#### Recent Trends

Session Chair: **Bahram Jalali**, Univ. of California, Los Angeles (USA)

9:00 am: **Reviving analog computing with optics**, Daniel R. Solli, Bahram Jalali, Univ. of California, Los Angeles (USA) . . . . . [9732-1]

9:20 am: **Resolving the buildup of mode-locking with real-time spectroscopy at 90 MHz** (*Invited Paper*), Georg Herink, Claus Ropers, Georg-August-Univ. Göttingen (Germany); Bahram Jalali, Univ. of California, Los Angeles (USA); Daniel R. Solli, Univ. of California, Los Angeles (USA) and Georg-August-Univ. Göttingen (Germany) . . . . . [9732-2]

9:50 am: **Dynamics of soliton explosions in ultrafast fibre lasers**, Miro Erkintalo, Antoine F. J. Runge, Neil G. R. Broderick, The Univ. of Auckland (New Zealand) . . . . . [9732-3]

Coffee Break . . . . . Mon 10:10 am to 10:40 am

10:40 am: **Nonlinear time series analysis: Towards an effective forecast of rogue waves** (*Invited Paper*), Günter Steinmeyer, Simon Birkholz, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany); Carsten Brée, Weierstrass-Institut für Angewandte Analysis und Stochastik (Germany); Ivan Veselic, Technische Univ. Chemnitz (Germany); Ayhan Demircan, Leibniz Univ. Hannover (Germany) . . . . . [9732-4]

11:10 am: **Extreme events in coupled nanolasers**, Mathias Marconi, Philippe Hamel, Fabrice Raineri, Ariel Levenson, Alejandro M. Giacomotti, Lab. de Photonique et de Nanostructures (France) . . . . . [9732-5]

11:30 am: **Temporal ghost imaging**, Piotr Ryczkowski, Margaux Barbier, Tampere Univ. of Technology (Finland); Ari Friberg, Univ. of Eastern Finland (Finland); John M. Dudley, Univ. de Franche-Comté (France); Goëry Genty, Tampere Univ. of Technology (Finland) . . . . . [9732-6]

11:50 am: **Lighting up microscopy with random Raman lasing**, Brett H. Hokr, Texas A&M Univ. (USA); Marlan O. Scully, Texas A&M Univ. (USA) and Baylor Univ. (USA) and Princeton Univ. (USA); Vladislav V. Yakovlev, Texas A&M Univ. (USA) . . . . . [9732-7]

Lunch break . . . . . Mon 12:10 pm to 1:40 pm

### SESSION 2

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) . . MON 1:40 TO 3:30 PM

#### Novel Instruments

Session Chair: **Daniel R. Solli**, Univ. of California, Los Angeles (USA)

1:40 pm: **Measurement of the complete temporal intensity and phase of supercontinuum** (*Invited Paper*), Rick Trebino, Tsz Chun Wong, Michelle Rhodes, Zhe Guang, Georgia Institute of Technology (USA) . . . [9732-8]

2:10 pm: **Roguescope: Real-time high-throughput spectroscopy at 100 million frames per second**, Mohammad H. Asghari, Univ. of California, Los Angeles (USA); Paul Trinh, Time Photonics Inc. (USA); Bahram Jalali, Univ. of California, Los Angeles (USA) . . . . . [9732-9]

2:30 pm: **Towards pattern generation and chaotic series prediction with photonic reservoir computers**, Piotr Antonik, Michiel Hermans, François Dupont, Marc Hälterman, Serge Massar, Univ. Libre de Bruxelles (Belgium) . . . . . [9732-10]

2:50 pm: **Real-time characterization of spectral coherence of ultrafast laser based on optical time-stretch**, Yiqing Xu, Zhibo Ren, Xiaoming Wei, Kenneth K. Y. Wong, Kevin Tsia, The Univ. of Hong Kong (Hong Kong, China) . . . . . [9732-11]

3:10 pm: **Dissipative temporal solitons in an excitable micropillar laser with integrated saturable absorber and delayed feedback**, Sylvain Barbay, Félix Lelièvre, Ali Golestani, Foued Selmi, Rémy Braive, Grégoire Beaudoin, Isabelle Sagnes, Lab. de Photonique et de Nanostructures (France) . . . [9732-12]

Coffee Break . . . . . Mon 3:30 pm to 4:00 pm

### SESSION 3

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) . . MON 4:00 TO 5:30 PM

#### Theoretical Developments

Session Chair: **Sergei K. Turitsyn**, Aston Univ. (United Kingdom)

4:00 pm: **Periodic wave-trains, supercontinuum generation and the formation of rogue waves in an optical fiber cavity** (*Invited Paper*), Majid Taki, Zheng Liu, Saliya Coulibaly, Univ. des Sciences et Technologies de Lille (France); François Léo, Univ. Libre de Bruxelles (Belgium) . . . . [9732-13]

4:30 pm: **Convective Nozaki-Bekki holes in a long laser**, Svetlana Slepneva, Tyndall National Institute (Ireland); Ben O'Shaughnessy, Cork Institute of Technology (Ireland) and Tyndall National Institute (Ireland); Stephen P. Hegarty, Cork Institute of Technology (Ireland) and Tyndall National Institute (Ireland); Bryan Kelleher, Univ. College Cork (Ireland); Sergio Rica, Univ. Adolfo Ibáñez (Chile); Guillaume Huyet, Cork Institute of Technology (Ireland) and Tyndall National Institute (Ireland) . . . . . [9732-14]

4:50 pm: **Levy statistics and rare events in random laser emission**, Ravitej Uppu, Tata Institute of Fundamental Research (India) and Univ. Twente (Netherlands); Sushil A. Mujumdar, Tata Institute of Fundamental Research (India) . . . . . [9732-15]

5:10 pm: **Spatiotemporal chaos induces extreme events in a spatially extended microcavity laser**, Sylvain Barbay, Lab. de Photonique et de Nanostructures (France); Saliya Coulibaly, Lab. de Physique des Lasers, Atomes et Molécules (France); Foued Selmi, Lab. de Photonique et de Nanostructures (France); Marcel G. Clerc, Univ. de Chile (Chile) . . . . . [9732-16]



## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) . .TUE 8:00 TO 10:10 AM

#### Rogue Waves

Session Chair: **John M. Dudley**, FEMTO-ST (France)

- 8:00 am: **Spatio-temporal intensity dynamics of passively mode-locked fiber laser** (*Invited Paper*), Dmitry V. Churkin, Aston Univ. (United Kingdom) . . . . . [9732-17]
- 8:30 am: **Caustics, rogue waves and an optical sea**, Amaury Mathis, Pierre-Ambroise Lacourt, Luc Froehly, Shanti Toenger, FEMTO-ST (France); Frédéric Dias, Univ. College Dublin (Ireland); Goery Genty, Tampere Univ. of Technology (Finland); John M. Dudley, FEMTO-ST (France) . . . . . [9732-18]
- 8:50 am: **Slow deterministic vector rogue waves**, Sergey V. Sergeev, Chengbo Mou, Stanislav Kolpakov, Vladimir Kalashnikov, Sergei K. Turitsyn, Aston Univ. (United Kingdom) . . . . . [9732-19]
- 9:10 am: **Optical isolator based on topological insulator nano-particles**, Moti Fridman, Shir Shahal, Vlada Artel, Doron Naveh, Bar-Ilan Univ. (Israel) . . . . . [9732-20]
- 9:30 am: **Optical rogue waves in integrable turbulence**, Pierre Suret, Lab. de Physique des Lasers, Atomes et Molécules (France); Stephane Randoux, Pierre Walczak, Univ. des Sciences et Technologies de Lille (France) and Lab. de Physique des Lasers, Atomes et Molécules (France) . . . . . [9732-21]
- 9:50 am: **A route to rogue wave generation**, Saliya Coulibaly, Zheng Liu, Majid Taki, Univ. des Sciences et Technologies de Lille (France) . . . . . [9732-22]
- Coffee Break . . . . . Tue 10:10 am to 10:40 am

### SESSION 5

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) . TUE 10:40 AM TO 12:50 PM

#### Lasers and Novel Concepts

Session Chair: **Daniel R. Solli**, Univ. of California, Los Angeles (USA)

- 10:40 am: **FDML lasers with MHz wavelength sweep repetition rates for fastest real-time OCT, spectroscopy, and sensing** (*Invited Paper*), Wolfgang Draxinger, Wolfgang Wieser, Optores GmbH (Germany); Jan Philip Kolb, Tom Pfeiffer, Matthias Eibl, Univ. zu Lübeck (Germany); Thomas Klein, Optores GmbH (Germany); Sebastian N. Karpf, LMU München (Germany); Robert A. Huber, Univ. zu Lübeck (Germany) and Ludwig-Maximilians-Univ. München (Germany) . . . . . [9732-23]
- 11:10 am: **Single-shot high-resolution fiber-based phase-diversity photodetection of optical pulses**, Christophe Dorrer, Leon Waxer, Adam Kalb, Elizabeth Hill, Jake Bromage, Univ. of Rochester (USA) . . . . . [9732-24]
- 11:30 am: **Spectral phase interrogation using nonlinear spectra (SPINS)**, Aram Gragossian, The Univ. of New Mexico (USA); Brook A. Jilek, Sandia National Labs. (USA); Mansoor Sheik-Bahae, The Univ. of New Mexico (USA) . . . . . [9732-25]
- 11:50 am: **Unstable multipulsing can be invisible to some ultrashort pulse measurement techniques**, Michelle Rhodes, Zhe Guang, Rick Trebino, Georgia Institute of Technology (USA) . . . . . [9732-26]
- 12:10 pm: **Modelling of noise-like pulses generated in mode-locked fibre lasers**, Sergey M. Kobtsev, Sergey Smirnov, Novosibirsk State Univ. (Russian Federation) . . . . . [9732-27]
- 12:30 pm: **Development of on-line laser power monitoring system**, Chien-Fang Ding, Meng-Shiou Lee, Kuan-Ming Li, National Taiwan Univ. (Taiwan) . . . . . [9732-28]

# Journal of Nanophotonics

**Ali Adibi**

Georgia Institute of Technology  
Editor-in-Chief

The *Journal of Nanophotonics* (JNP) focuses on the fabrication and application of nanostructures that facilitate the generation, propagation, manipulation, and detection of light from the infrared to the ultraviolet regimes.

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# CONFERENCE 9733

LOCATION: ROOM 306 (SOUTH ESPLANADE)

Monday–Tuesday 15–16 February 2016 • Proceedings of SPIE Vol. 9733

# High-Power Diode Laser Technology and Applications XIV

Conference Chair: **Mark S. Zediker**, Nuburu Inc. (USA)

Program Committee: **Friedrich G. Bachmann**, FriBa LaserNet (Germany); **Stefan W. Heinemann**, TRUMPF Photonics (USA); **Volker Krause**, Laserline GmbH (Germany); **Robert Martinsen**, nLIGHT Corp. (USA); **Kurt J. Linden**, N2 Biomedical (USA); **Erik P. Zucker**, Lumentum (USA)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: RM 306 (SOUTH ESPLANADE) . . . MON 8:30 TO 10:30 AM

### LD Device Reliability

Session Chair: **Erik Zucker**, Lumentum (USA)

8:30 am: **Reliability of high power laser diodes with external optical feedback**, Dennis Bonsendorf, Stephan Schneider, Jens Meinschien, LIMO Lissotschenko Mikrooptik GmbH (Germany) . . . . . [9733-1]

8:50 am: **Rapid stress-testing vs. long-term aging: A case study of 980-nm emitting single-spatial mode lasers**, Martin Hempel, Jens Wolfgang W. Tomm, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany); David Venables, Victor Rossin, Erik Zucker, Lumentum (USA); Thomas Elsaesser, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany) . . . . . [9733-2]

9:10 am: **Reliability, failure modes, and degradation mechanisms in high power single- and multi-mode InGaAs-AlGaAs strained quantum well lasers**, Yongkun Sin, Nathan Presser, Zachary Lingley, Miles Brodie, Adam Bushmaker, Brendan Foran, Steven C. Moss, The Aerospace Corp. (USA) . . . . . [9733-3]

9:30 am: **Reliability study on high power 638-nm triple emitter broad area laser diode**, Tetsuya Yagi, Kyosuke Kuramoto, Kaoru Kadoiwa, Ryuta Wakamatsu, Motoharu Miyashita, Mitsubishi Electric Corp. (Japan) . . . . . [9733-4]

9:50 am: **Sequential description of the catastrophic optical damage of high power laser diodes**, Juan Jimenez, Jorge Souto, Jose Luis Pura, Alfredo Torres, Univ. de Valladolid (Spain); Mauro A. Bettiati, Francois J. Laruelle, 3SP Technologies S.A.S. (France) . . . . . [9733-5]

10:10 am: **Improved long wavelength 14xx and 19xx nm InGaAsP/InP lasers**, Tawee Tanbun-Ek, Rajiv Pathak, Zuntu Xu, Heiko Winhold, Serguei Kim, Fei Zhou, Arne-Heike Meissner-Schenk, Michael Peter, Geunmin Ryu, David A. Schleuning, Coherent, Inc. (USA) . . . . . [9733-6]

Coffee Break . . . . . Mon 10:30 am to 11:00 am

### SESSION 2

LOCATION: RM 306 (SOUTH ESPLANADE) . . MON 11:00 AM TO 12:00 PM

### High Power Fiber Coupled Devices I

Session Chair: **Volker Krause**, Laserline GmbH (Germany)

11:00 am: **A fiber-coupled 9xx module with tap water cooling**, David A. Schleuning, Athanasios N. Chryssis, Geunmin Ryu, Guoli Liu, Heiko Winhold, Li Fan, Zuntu Xu, Tawee Tanbun-Ek, Sami Lehtonen, Bruno Acklin, Coherent, Inc. (USA) . . . . . [9733-7]

11:20 am: **High-brightness laser diode module over 300W with 100µm / Na 0.22 fiber**, Yohei Kasai, Shinichi Sakamoto, Yukihiko Takahashi, Ken Katagiri, Fujikura Ltd. (Japan); Yuji Yamagata, OPTOENERGY Inc. (Japan); Akira Sakamoto, Daiichiro Tanaka, Fujikura Ltd. (Japan) . . . . . [9733-8]

11:40 am: **Multi-kW high-brightness fiber coupled diode laser based on two dimensional stacked tailored diode bars**, Andreas Bayer, Andreas Unger, Bernd Köhler, Matthias Küster, Sascha Dürsch, Heiko Kissel, Jens Biesenbach, DILAS Diodenlaser GmbH (Germany) . . . . . [9733-9]

Lunch Break . . . . . Mon 12:00 pm to 1:40 pm

### SESSION 3

LOCATION: RM 306 (SOUTH ESPLANADE) . . . . MON 1:40 TO 3:00 PM

### High Power Fiber Coupled Devices II

Session Chair: **Volker Krause**, Laserline GmbH (Germany)

1:40 pm: **Advances in high-power 9XXnm laser diodes for pumping fiber lasers**, Jay Skidmore, Matthew Peters, Victor Rossin, Lei Xu, James Guo, Yan Xiao, Jane Cheng, Janice Cheng, Allen Shieh, Abdullah Demir, Raman Srinivasan, Jaspreet Singh, Cailin Wei, Bruce Schmitt, Richard Duesterberg, Lumentum (USA) . . . . . [9733-10]

2:00 pm: **Lightweight diode laser pump modules push to a new class of higher power and lower weight**, David A. Irwin, DILAS Diode Laser, Inc. (USA) . . . . . [9733-11]

2:20 pm: **Reduced-mode (REM) diodes enable high brightness fiber-coupled modules**, Manoj Kanskar, Ling Bao, Zhigang Chen, David Dawson, Mark DeVito, Weimin Dong, Mike P. Grimshaw, Xinguo Guan, Marty Hemenway, Keith Kennedy, Rob Martinsen, Wolfram Urbanek, Shiguo Zhang, nLIGHT Corp. (USA) . . . . . [9733-12]

2:40 pm: **DPAL pump system exceeding 3kW at 766nm and 30 GHz bandwidth**, Tobias P. Koenning, Dan McCormick, David A. Irwin, Dean Stapleton, Tina Guiney, Steve G. Patterson, DILAS Diode Laser, Inc. (USA) . . . . . [9733-13]

Coffee Break . . . . . Mon 3:00 pm to 3:30 pm

### SESSION 4

LOCATION: RM 306 (SOUTH ESPLANADE) . . . . MON 3:30 TO 5:30 PM

### External Feedback and Beam Combining

Session Chair: **Stefan W. Heinemann**, TRUMPF Photonics (USA)

3:30 pm: **Spectral beam combining of multi-single emitters**, Baohua Wang, Weirong Guo, Zhijie Guo, Dan Xu, Jing Zhu, Qiang Zhang, Thomas C. Yang, Xiaohua Chen, BWT Beijing Ltd. (China) . . . . . [9733-14]

3:50 pm: **Building block diode laser concept for high brightness laser output in the kW range and its applications**, Andreas Grohe, Fabio Ferrario, Haro Fritsche, Thomas Hagen, Holger Kern, Ralf Koch, Bastian Kruschke, Axel Reich, Dennis Sanftleben, Ronny Steger, Till Wallendorf, Wolfgang Gries, DirectPhotonics Industries GmbH (Germany) . . . . . [9733-15]

4:10 pm: **Compact 35µm fiber coupled diode laser module based on dense wavelength division multiplexing of NBA mini bars**, Ulrich Witte, Martin Traub, Angelo Di Meo, Marcus Hamann, David Rubel, Stefan Hengesbach, Hans-Dieter Hoffmann, Fraunhofer-Institut für Lasertechnik (Germany) [9733-16]

4:30 pm: **High-power operation of coherently coupled tapered laser diodes in an external cavity**, Guillaume Schimmel, Ioana Doyen, Sylvie Janicot, Marc Hanna, Patrick Georges, Gaëlle Lucas-Leclin, Lab. Charles Fabry (France); Jonathan Decker, Paul Crump, Goetz Erbert, Ferdinand-Braun-Institut (Germany); Simeon Kaunga-Nyirenda, Daniel Moss, Steve Bull, Eric Larkins, The Univ. of Nottingham (United Kingdom) . . . . . [9733-17]

4:50 pm: **Wavelength locking of single emitters and multi-emitter modules: Simulation and experiments**, Dan Yanson, Noam Rappaport, Ophir Peleg, Yuri Berk, Nir Dahan, Genady Klumel, Ilya Baskin, Moshe Levy, Yoram Karni, SCD Semiconductor Devices (Israel) . . . . . [9733-18]

5:10 pm: **Simultaneous frequency stabilization and high-power dense wavelength division multiplexing (HP-DWDM) using an external cavity based on volume Bragg gratings (VBGs)**, Stefan Hengesbach, Sarah Klein, Carlo Holly, Ulrich Witte, Martin Traub, Hans-Dieter Hoffmann, Fraunhofer-Institut für Lasertechnik (Germany) . . . . . [9733-19]

# CONFERENCE 9733

LOCATION: ROOM 306 (SOUTH ESPLANADE) AND ROOM 130 (NORTH EXHIBIT LEVEL)

## TUESDAY 16 FEBRUARY

### SESSION 5

LOCATION: RM 306 (SOUTH ESPLANADE) . . . TUE 8:00 TO 10:10 AM

#### High Power Devices I

Session Chair: **Robert Martinsen**, nLIGHT Corp. (USA)

8:00 am: **940nm QCW diode laser bars with 70% efficiency at 1 kW output power at 203K: analysis of remaining limits and path to higher efficiency and power at 200K and 300K** (*Invited Paper*), Carlo F. Frevert, Frank Bugge, Steffen Knigge, Arnim Ginolas, Götz Erbert, Paul Crump, Ferdinand-Braun-Institut (Germany) . . . . . [9733-20]

8:30 am: **High duty-cycle, high-efficiency QCW stacks for medical applications**, Alex Kindsvater, Matthias Schroeder, Ekkehard A. Werner, Sebastian Seidel, Martin Woelz, Valentin Loyo, JENOPTIK Laser GmbH (Germany) . . . . . [9733-21]

8:50 am: **980nm semiconductor lasers and spot size converter monolithically integrated technology research**, Wentao Guo, Manqing Tan, Institute of Semiconductors (China) . . . . . [9733-22]

9:10 am: **Assessing the influence of the vertical design on the lateral beam quality of high-power broad area diode lasers**, Martin Winterfeldt, Steffen Knigge, André Maaßdorf, Ferdinand-Braun-Institut (Germany); Martin Hempel, Jens W. Tomm, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany); Götz Erbert, Paul Crump, Ferdinand-Braun-Institut (Germany) . . . . . [9733-23]

9:30 am: **Optical mode engineering and high power density per facet length (>8.4 kW/cm) in tilted wave laser diodes**, Nikolay Ledentsov, Vitaly A. Shchukin, VI Systems GmbH (Germany); Mikhail V. Maximov, Nikita Y. Gordeev, Nikolay A. Kaluzhnyi, Sergey A. Mintairov, Alexey S. Payusov, Yuri M. Shernyakov, Ioffe Physical-Technical Institute (Russian Federation) . . . . . [9733-24]

9:50 am: **Single-mode tapered DBR lasers emitting 400 mW at 1550 nm**, Jukka Viheriälä, Joel Salmi, Tampere Univ. of Technology (Finland); Jaakko M. Mäkelä, Univ. of Turku (Finland); Antti T. Aho, Heikki A. Virtanen, Tomi Leinonen, Mihail M. Dumitrescu, Mircea Guina, Tampere Univ. of Technology (Finland) . . . . . [9733-25]

Coffee Break . . . . . Tue 10:10 am to 10:40 am

### SESSION 6

LOCATION: RM 306 (SOUTH ESPLANADE) TUE 10:40 AM TO 12:00 PM

#### High Power Devices II

Session Chair: **Kurt J. Linden**, N2 Biomedical (USA)

10:40 am: **High-power single emitters and low fill factor bars emitting at 808 nm**, Agnieszka Pietrzak, Ralf Hülsewede, Martin Zorn, JENOPTIK Diode Lab GmbH (Germany); Jens Meusel, JENOPTIK Laser GmbH (Germany); Jürgen Sebastian, JENOPTIK Diode Lab GmbH (Germany) . . . . . [9733-26]

11:00 am: **Thermal investigation on high power dfb broad area lasers at 975 nm, with 60% efficiency**, Roberto Mostallino, Michel Garcia, III-V Lab. (France); Yannick Deshayes, Univ. Bordeaux 1 (France); Alexandre Larrue, Yannick Robert, Eric Vinet, III-V Lab. (France); Laurent Bechou, Univ. Bordeaux 1 (France); Michel Lecomte, Olivier Parillaud, Michel Krakowski, III-V Lab. (France) . . . . . [9733-27]

11:20 am: **Advances in 808nm high power diode laser bars and single emitters**, John M. Morales, Sami Lehtonen, David A. Schleunig, Bruno Acklin, Coherent, Inc. (USA) . . . . . [9733-28]

11:40 am: **Characterization of high performance VMJ PV cells for laser power transmission applications**, Mico Perales, MH GoPower Co., Ltd. (USA); Mei-huan Yang, John Wu, MH GoPower Co., Ltd. (Taiwan); Terry Zahuranec, MH GoPower Co., Ltd. (USA); Talan Hsu, MH GoPower Co., Ltd. (Taiwan) . . . . . [9733-29]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:20 pm

### SESSION 7

LOCATION: RM 130 (NORTH EXHIBIT LEVEL) . . . TUE 1:20 TO 3:00 PM

#### NOTE ROOM CHANGE

#### Laser Diode Packaging I

Joint Session with Conferences 9730 and 9733

Session Chairs: **Kurt J. Linden**, N2 Biomedical (USA); **Paul O. Leisher**, Rose-Hulman Institute of Technology (USA)

1:20 pm: **Integrated high power VCSEL systems**, Holger Moench, Ralf Conrads, Stephan Gronenborn, Philips Technologie GmbH (Germany); Xi Gu, Philips Lighting B.V. (Netherlands); Michael Miller, Philips GmbH U-L-M Photonics (Germany); Pavel Pekarski, Jens Pollmann-Retsch, Philips Research (Germany); Armand Pruijboom, Philips Lighting B.V. (Netherlands); Ulrich Weichmann, Philips Technologie GmbH (Germany) . . . . . [9733-30]

1:40 pm: **Industrial grade assembly solution for micro optics utilized in high power diode laser stacks**, Daniel Zontar, Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Harald Vogt, MA micro automation GmbH (Germany); Sebastian Haag, Tobias Müller, Sebastian Sauer, Christian Brecher, Fraunhofer-Institut für Produktionstechnologie IPT (Germany) . . . . . [9733-31]

2:00 pm: **High power diode laser array development using completely indium free packaging technology with narrow spectrum**, Dong Hou, Jingwei Wang, Lijun Gao, Dong Lu, Xingsheng Liu, Xiaoning Li, Xi'an Focuslight Technologies Co., Ltd. (China) . . . . . [9730-9]

2:20 pm: **Blue-emitting external cavity laser diode**, Hong Man Na, Korea Univ. (Korea, Republic of) . . . . . [9730-10]

2:40 pm: **Optical feedback module for stabilizing the optical power of laser-diode modules without thermoelectric coolers**, John Downing, USL Technologies LLC (USA) . . . . . [9730-11]

### POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/IPWPosterGuidelines>.

**Spatial mode phase locking in a laser diode bar**, Shir Shahal, Hamootal Duadi, Moti Fridman, Bar-Ilan Univ. (Israel) . . . . . [9733-32]

**Holographic 3D display based on laser recording and reconstruction**, Hongyue Gao, Jilcheng Liu, Shanghai Univ. (China) . . . . . [9733-33]

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# CONFERENCE 9734

LOCATION: ROOM 301 (SOUTH ESPLANADE)

Monday–Tuesday 15–16 February 2016 • Proceedings of SPIE Vol. 9734

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# Vertical External Cavity Surface Emitting Lasers (VECSELS) VI

Conference Chair: **Keith G. Wilcox**, Univ. of Dundee (United Kingdom)

Program Committee: **Juan L. Chilla**, Coherent, Inc. (USA); **Arnaud Garnache**, Univ. Montpellier 2 (France); **Mircea Guina**, Tampere Univ. of Technology (Finland); **Jennifer E. Hastie**, Univ. of Strathclyde (United Kingdom); **Elyahou Kapon**, Ecole Polytechnique Fédérale de Lausanne (Switzerland); **Ursula Keller**, ETH Zürich (Switzerland); **Jerome V. Moloney**, College of Optical Sciences, The Univ. of Arizona (USA); **Wolfgang Stolz**, NAsP III/V GmbH (Germany); **Anne C. Tropper**, Univ. of Southampton (United Kingdom)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: RM 301 (SOUTH ESPLANADE) . . . MON 8:30 TO 10:30 AM

#### Aram Mooradian Memorial Session

Session Chair: **Anne C. Tropper**, Univ. of Southampton (United Kingdom)

8:30 am: **How we developed OP-VECSELS at Micracor** (*Invited Paper*), Mark E. Kuznetsov, AXSUN Technologies Inc. (USA) . . . . . [9734-1]

9:00 am: **Evolution of the Novalux extended cavity surface-emitting laser (NECSEL)** (*Invited Paper*), John G. McInerney, Univ. College Cork (Ireland) . . . . . [9734-2]

9:30 am: **Continuous-wave VECSELS: Review of recent progress** (*Invited Paper*), Mircea Guina, Tampere Univ. of Technology (Finland) . . . . . [9734-3]

10:00 am: **Ultrafast vertical external cavity surface emitting lasers (VECSELS)** (*Invited Paper*), Ursula Keller, ETH Zürich (Switzerland) . . . . . [9734-4]

Coffee Break . . . . . Mon 10:30 am to 11:00 am

### SESSION 2

LOCATION: RM 301 (SOUTH ESPLANADE) MON 11:00 AM TO 12:35 PM

#### Mode-locked I

Session Chair: **Michael Jetter**, Univ. Stuttgart (Germany)

11:00 am: **Gigahertz dual-comb modelocked diode-pumped semiconductor and solid-state lasers** (*Invited Paper*), Sandro M. Link, Mario Mangold, Matthias Golling, Alexander Klenner, Ursula Keller, ETH Zürich (Switzerland) . . . . . [9734-5]

11:25 am: **Recent progress in high-power ultrafast MIXSELS**, Cesare G. E. Alfieri, Dominik Waldburger, Sandro M. Link, Emilio Gini, Matthias Golling, Bauke W. Tilma, Mario Mangold, Ursula Keller, ETH Zürich (Switzerland) [9734-6]

11:40 am: **High-order chirp in sub-200-fs VECSELS**, Christopher R. Head, Univ. of Southampton (United Kingdom); Alexander Hein, Univ. of Ulm (Germany); Andrew P. Turnbull, Univ. of Southampton (United Kingdom); Markus Polanik, Univ. Ulm (Germany); Edward A. Shaw, Theo Chen Sverre, Univ. of Southampton (United Kingdom); Peter Unger, Univ. Ulm (Germany); Anne C. Tropper, Univ. of Southampton (United Kingdom) . . . . . [9734-7]

11:55 am: **High-power sub-150-fs VECSELS**, Dominik Waldburger, Cesare G. E. Alfieri, Sandro M. Link, Emilio Gini, Matthias Golling, Mario Mangold, Bauke W. Tilma, Ursula Keller, ETH Zürich (Switzerland) . . . . . [9734-8]

12:10 pm: **Advances in low-repetition-rate modelocked semiconductor disk lasers in multi-pass cavity geometries** (*Invited Paper*), Loyd J. McKnight, Peter J. Schlosser, Alexander A. Lagatsky, Martin D. Dawson, John-Mark Hopkins, Fraunhofer Ctr. for Applied Photonics (United Kingdom) . . . . . [9734-9]

Lunch Break . . . . . Mon 12:35 pm to 2:05 pm

### SESSION 3

LOCATION: RM 301 (SOUTH ESPLANADE) . . . . . MON 2:05 TO 3:25 PM

#### Single Frequency I

Session Chair: **Mircea Guina**, Tampere Univ. of Technology (Finland)

2:05 pm: **Single frequency 2-3 micron VECSELS** (*Invited Paper*), Marcel Rattunde, Peter Holl, Steffen Adler, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); Sebastian Kaspar, AIM INFRAROT-MODULE GmbH (Germany); Andreas Bächle, Elke Diwo, Rolf Aidam, Wolfgang Bronner, Joachim Wagner, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany) . . . . . [9734-10]

2:30 pm: **Industrial integration of high coherence tunable single frequency semiconductor lasers based on VECSEL technology for scientific instrumentation in NIR & MIR**, Stéphane Denet, Innoptics SAS (France); Baptiste Chomet, Univ. Montpellier 2 (France); Isabelle Sagnes, Lab. de Photonique et de Nanostructures (France); Laurence Ferrières, Innoptics SAS (France); Mikhaël Myara, Univ. Montpellier 2 (France); Vincent Lecocq, Innoptics SAS (France); Laurent Cerutti, Arnaud Garnache, Univ. Montpellier 2 (France) . . . . . [9734-11]

2:45 pm: **Dual-frequency VECSELS for microwave photonics applications** (*Invited Paper*), Fabien Bretenaker, Lab. Aimé Cotton (France) and Ecole Normale Supérieure de Cachan (France) . . . . . [9734-12]

3:10 pm: **Laser cooling of trapped ions using a frequency quadrupled VECSEL**, Shaun C. Burd, National Institute of Standards and Technology (USA) and Univ. of Colorado at Boulder (USA); Tomi Leinonen, Jussi-Pekka Penttinen, Optoelectronics Research Ctr. (Finland); David T. Allcock, National Institute of Standards and Technology (USA); Raghavendra Srinivas, National Institute of Standards and Technology (USA) and Univ. of Colorado at Boulder (USA); Daniel H. Slichter, Andrew C. Wilson, Dietrich Leibfried, National Institute of Standards and Technology (USA); Mircea Guina, Optoelectronics Research Ctr. (Finland); David J. Wineland, National Institute of Standards and Technology (USA) and Univ. of Colorado at Boulder (USA) . . . . . [9734-13]

Coffee Break . . . . . Mon 3:25 pm to 3:55 pm

### SESSION 4

LOCATION: RM 301 (SOUTH ESPLANADE) . . . . . MON 3:55 TO 5:05 PM

#### Novel I

Session Chair: **Jerome V. Moloney**, College of Optical Sciences, The Univ. of Arizona (USA)

3:55 pm: **Generation of new spatial and temporal coherent light states using III-V semiconductor laser technology: VORTEX, continuum, dual frequency for THz** (*Invited Paper*), Arnaud Garnache, Univ. Montpellier 2 (France) . . . . . [9734-14]

4:20 pm: **Terahertz quantum cascade VECSEL**, Luyao Xu, Christopher A. Curwen, Philip W. C. Hon, Tatsuo Itoh, Benjamin S. Williams, Univ. of California, Los Angeles (USA) . . . . . [9734-15]

4:35 pm: **1.2µm emitting VECSEL based on type-II aligned QWs**, Christoph Möller, Christian Berger, Christian Fuchs, Philipps-Univ. Marburg (Germany); Antje Ruiz Perez, NAsP III/V GmbH (Germany); Stephan W. Koch, Philipps-Univ. Marburg (Germany); Jörg Hader, Jerome V. Moloney, Nonlinear Control Strategies (USA); Wolfgang Stolz, Philipps-Univ. Marburg (Germany) and NAsP III/V GmbH (Germany) . . . . . [9734-16]

4:50 pm: **Widely tunable DBR-free semiconductor disk laser**, Zhou Yang, Alexander R. Albrecht, The Univ. of New Mexico (USA); Jeffrey G. Cederberg, Sandia National Labs. (USA); Shawn Hackett, The Univ. of New Mexico (USA) and Air Force Research Lab. (USA); Mansoor Sheik-Bahae, The Univ. of New Mexico (USA) . . . . . [9734-17]

### SESSION 5

LOCATION: RM 301 (SOUTH ESPLANADE) . . . . . MON 5:05 TO 6:25 PM

#### Novel Mode-locking and Characterization

Session Chair: **Loyd J. McKnight**, Fraunhofer Ctr. for Applied Photonics (United Kingdom)

5:05 pm: **Resonant measurements of nonlinear lensing in a VECSEL gain sample** (*Invited Paper*), Adrian H. Quarterman, Univ. of Dundee (United Kingdom); Edward E. Shaw, Univ. of Southampton (United Kingdom); Keith G. Wilcox, Univ. of Dundee (United Kingdom) . . . . . [9734-18]



# CONFERENCE 9734

## LOCATION: ROOM 301 (SOUTH ESPLANADE)

5:30 pm: **Ultrafast characterization of semiconductor gain and absorber devices for mode-locked VECSELS**, Caleb Baker, Maik Scheller, Hwang-Jye Yang, College of Optical Sciences, The Univ. of Arizona (USA); Stephan W. Koch, College of Optical Sciences, The Univ. of Arizona (USA) and Philipps- Univ. Marburg (Germany); Ronald J. Jones, Jerome V. Moloney, College of Optical Sciences, The Univ. of Arizona (USA); Antje Ruiz Perez, Wolfgang Stolz, Philipps- Univ. Marburg (Germany); Sadhvikas Addamane, Ganesh Balakrishnan, The Univ. of New Mexico (USA) . . . . . [9734-19]

5:45 pm: **Reflection z-scan measurements of the non-linear lens in VECSEL gain structures**, Edward A. Shaw, Univ. of Southampton (United Kingdom); Adrian Quarterman, Univ. of Dundee (United Kingdom); Andrew P. Turnbull, Theo Chen Sverre, Christopher R. Head, Anne C. Tropper, Univ. of Southampton (United Kingdom); Keith G. Wilcox, Univ. of Dundee (United Kingdom) . . . . . [9734-20]

6:00 pm: **Self-mode-locked vertical-external-cavity surface-emitting laser (Invited Paper)**, Arash Rahimi-Iman, Mahmoud Gaafar, Christoph Möller, Max Vaupel, Fan Zhang, Dalia Al-Nakdali, Philipps- Univ. Marburg (Germany); Ksenia A. Fedorova, Aston Univ. (United Kingdom); Wolfgang Stolz, Philipps- Univ. Marburg (Germany) and NAsP III/IV GmbH (Germany); Edik U. Rafailov, Aston Univ. (United Kingdom); Martin Koch, Philipps- Univ. Marburg (Germany) . . . . . [9734-21]

## TUESDAY 16 FEBRUARY

### SESSION 6

LOCATION: RM 301 (SOUTH ESPLANADE) . . . . . TUE 8:00 TO 8:55 AM

## Single Frequency II/Wavelength Conversion

Session Chair: **Juan L. Chilla**, Coherent, Inc. (USA)

8:00 am: **Narrow linewidth visible/UV semiconductor disk lasers for quantum technologies (Invited Paper)**, David Paboeuf, Brynmor E. Jones, Julio M. Rodríguez García, Peter J. Schlosser, Univ. of Strathclyde (United Kingdom); Dariusz Swierad, Joshua Hughes, Ole Kock, Lyndsie Smith, Kai Bongs, Yeshpal Singh, The Univ. of Birmingham (United Kingdom); Stefano Origlia, Stephan Schiller, Heinrich-Heine- Univ. Düsseldorf (Germany); Jennifer E. Hastie, Univ. of Strathclyde (United Kingdom) . . . . . [9734-22]

8:25 am: **InGaAs-QW VECSEL emitting <math>1.3\mu\text{m}</math> via intracavity Raman conversion**, Daniele C. Parrotta, Riccardo Casula, Univ. of Strathclyde (United Kingdom); Jussi-Pekka Penttinen, Tomi Leinonen, Mircea Guina, Tampere Univ. of Technology (Finland); Alan J. Kemp, Jennifer E. Hastie, Univ. of Strathclyde (United Kingdom) . . . . . [9734-23]

8:40 am: **A 1.5-W frequency doubled semiconductor disk laser tunable over 40 nm at around 745 nm**, Esa J. Saarinen, Jari Lytykäinen, Sanna Ranta, Antti Rantamäki, Antti Saarela, Tampere Univ. of Technology (Finland); Alexei Sirbu, Vladimir Iakovlev, Eli Kapon, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Oleg G. Okhotnikov, Tampere Univ. of Technology (Finland) . . . . . [9734-25]

### SESSION 7

LOCATION: RM 301 (SOUTH ESPLANADE) . . . . . TUE 8:55 TO 10:05 AM

## High Power CW/Materials

Session Chair: **Keith G. Wilcox**, Univ. of Dundee (United Kingdom)

8:55 am: **Advances in optically pumped semiconductor lasers for blue emission under frequency doubling (Invited Paper)**, Yanbo Bai, Jeffrey A. Wisdom, John P. Charles, Patrick Hyland, Christian Scholz, Zuntu Xu, Yong Lin, Eli S. Weiss, Juan L. Chilla, Arnaud Y. Lepert, Coherent, Inc. (USA) . . . . . [9734-26]

9:20 am: **Over 10 Watt, collinear blue and green vertical external cavity surface emitting laser**, Michal L. Lukowski, Chris Hennesius, Jason T. Meyer, Mahmoud Fallahi, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9734-27]

9:35 am: **Optimization of 2.5 $\mu\text{m}$  VECSEL: influence of QW strain**, Peter Holl, Marcel Rattunde, Steffen Adler, Andreas Bächle, Elke Diwo-Emmer, Rolf Aidam, Wolfgang Bronner, Joachim Wagner, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany) . . . . . [9734-28]

9:50 am: **Gain chip design, power scaling and intra cavity frequency doubling with LBO of optically pumped red-emitting AlGaInP-VECSELS**, Hermann Kahle, Cherry M N. Mateo, Uwe Brauch, Roman Bek, Univ. Stuttgart (Germany); Thomas Schwarzbäck, TRUMPF Laser Systems for Semiconductor Manufacturing GmbH (Germany); Michael Jetter, Thomas Graf, Peter Michler, Univ. Stuttgart (Germany) . . . . . [9734-29]

Coffee Break . . . . . Tue 10:05 am to 10:35 am

### SESSION 8

LOCATION: RM 301 (SOUTH ESPLANADE) . TUE 10:35 AM TO 12:05 PM

## Mode-locked II

Session Chair: **Ursula Keller**, ETH Zürich (Switzerland)

10:35 am: **Influence of kinetic hole filling on the stability of mode-locked semiconductor disk lasers (Invited Paper)**, Jerome V. Moloney, Isak Kilen, Jörg Hader, College of Optical Sciences, The Univ. of Arizona (USA); Stephan W. Koch, Philipps- Univ. Marburg (Germany) . . . . . [9734-30]

11:00 am: **Mode-locked AlGaInP-VECSEL for the red and UV spectral range (Invited Paper)**, Michael Jetter, Roman Bek, Hermann Kahle, Quynh Duong-Ederer, Ana Cutuk, Univ. Stuttgart (Germany); Thomas Schwarzbäck, Univ. Stuttgart (Germany) and TRUMPF Lasersystems for Semiconductor Manufacturing GmbH (Germany); Maria Ana Cataluna, Univ. of Dundee (United Kingdom); Peter Michler, Univ. Stuttgart (Germany) . . . . . [9734-31]

11:25 am: **Colliding pulse mode-locked VECSEL**, Declan Marah, Univ. College Cork (Ireland); Alexandre Laurain, College of Optical Sciences, The Univ. of Arizona (USA); Wolfgang Stolz, Stephan Koch, Antje Ruiz Perez, Philipps- Univ. Marburg (Germany); John McInerney, Univ. College Cork (Ireland); Jerome Moloney, College of Optical Sciences, The Univ. of Arizona (USA) . . . . [9734-32]

11:40 am: **Advances in commercial, mode-locked vertical external cavity surface emitting lasers (Invited Paper)**, Nils Hempler, Walter Lubeigt, Bartłomiej Białkowski, Gareth T. Maker, Graeme P. A. Malcolm, M Squared Lasers Ltd. (United Kingdom) . . . . . [9734-33]

## COHERENT STUDENT PRIZE AWARD AND CONFERENCE CLOSE

LOCATION: ROOM 301 (SOUTH ESPLANADE) . . 12:05 TO 12:15 PM

### POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Vertical external cavity surface emitting lasers for sodium Guidestar applications and improvement of current Guidestar systems**, Shawn Hackett, Air Force Research Lab. (USA); Alexander R. Albrecht, Zhou Yang, The Univ. of New Mexico (USA); Jeffrey G. Cederberg, Sandia National Labs. (USA); Mansoor Sheik-Bahae, The Univ. of New Mexico (USA) . . . . . [9734-24]

**Tunable repetition rate VECSEL for resonant acoustic-excitation of nanostructures**, Theo Chen Sverre, Christopher R. Head, Andy Turnbull, Edward Shaw, Anne Tropper, Otto Muskens, Univ. of Southampton (United Kingdom) . . . . . [9734-34]

**Efficiency and power scaling of in-well and multi-pass pumped AlGaInP-VECSELS**, Cherry M. N. Mateo, Uwe Brauch, Hermann Kahle, Roman Bek, Univ. Stuttgart (Germany); Thomas Schwarzbäck, Univ. Stuttgart (Germany) and TRUMPF Laser Systems for Semiconductor Manufacturing GmbH (Germany); Michael Jetter, Marwan Abdou Ahmed, Peter Michler, Thomas Graf, Univ. Stuttgart (Germany) . . . . . [9734-35]

**Single-Frequency 570 nm VECSEL for photo-ionization of magnesium**, Shaun Burd, National Institute of Standards and Technology (USA) and Univ. of Colorado at Boulder (USA); Tomi Leinonen, Jussi-Pekka Penttinen, Optoelectronics Research Ctr. (Finland); Dietrich Leibfried, Andrew C. Wilson, National Institute of Standards and Technology (USA); Mircea Guina, Optoelectronics Research Ctr. (Finland) . . . . . [9734-36]

**Multi-photon imaging with high peak power VECSELS**, Shamil Mirkhanov, Adrian H. Quarterman, Conor J. C. P. Smyth, Samuel Swift, Keith G. Wilcox, Univ. of Dundee (United Kingdom) . . . . . [9734-37]

**Thermal management of VECSELS by front surface direct liquid cooling**, Conor J. C. P. Smyth, Adrian H. Quarterman, Shamil Mirkhanov, Keith G. Wilcox, Univ. of Dundee (United Kingdom) . . . . . [9734-38]

**A serially-connected two-chip VECSEL for dual-wavelength emission with high intracavity power**, Fan Zhang, Mahmoud Gaafar, Christoph Möller, Philipps- Univ. Marburg (Germany); Wolfgang Stolz, Philipps- Univ. Marburg (Germany) and NAsP III/IV GmbH (Germany); Martin Koch, Arash Rahimi-Iman, Philipps- Univ. Marburg (Germany) . . . . . [9734-39]

**Hybrid metal-semiconductor mirror for high power VECSEL**, Alexandre Laurain, Kokou Gbele, College of Optical Sciences, The Univ. of Arizona (USA); Wolfgang Stolz, Stephan Koch, Antje Ruiz Perez, Philipps- Univ. Marburg (Germany); Jerome Moloney, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9734-40]

LASE

**CONFERENCE 9735**  
**LOCATION: ROOM 304 (SOUTH ESPLANADE)**

Monday-Thursday 15-18 February 2016 • Proceedings of SPIE Vol. 9735



# Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) XXI

*Conference Chairs:* **Beat Neuenschwander**, Berner Fachhochschule Technik und Informatik (Switzerland); **Stephan Roth**, BLZ Bayerisches Laserzentrum GmbH (Germany); **Costas P. Grigoropoulos**, Univ. of California, Berkeley (USA); **Tetsuya Makimura**, Univ. of Tsukuba (Japan)

*Program Committee:* **Craig B. Arnold**, Princeton Univ. (USA); **J. Thomas Dickinson**, Washington State Univ. (USA); **Jan J. Dubowski**, Univ. de Sherbrooke (Canada); **Bo Gu**, Bos Photonics (USA); **Henry Helvajian**, The Aerospace Corp. (USA); **Sami T. Hendow**, Adaptive Laser Processing (USA); **Guido Hennig**, Daetwyler Graphics AG (Switzerland); **Michel Meunier**, Ecole Polytechnique de Montréal (Canada); **Yoshiki Nakata**, Osaka Univ. (Japan); **Hiroyuki Niino**, National Institute of Advanced Industrial Science and Technology (Japan); **Alberto Piqué**, U.S. Naval Research Lab. (USA); **Gediminas Račiukaitis**, Ctr. for Physical Sciences and Technology (Lithuania); **Andrei V. Rode**, The Australian National Univ. (Australia); **Klaus Sokolowski-Tinten**, Univ. Duisburg-Essen (Germany); **Razvan Stoian**, Lab. Hubert Curien (France); **Koji Sugioka**, RIKEN (Japan); **Xianfan Xu**, Purdue Univ. (USA); **Steven M. Yalisove**, Univ. of Michigan (USA)

## MONDAY 15 FEBRUARY

### SESSION 1

**LOCATION: RM 304 (SOUTH ESPLANADE) ... MON 8:30 TO 9:50 AM**

#### Lasers in Photovoltaics

Session Chair: **Beat Neuenschwander**, Berner Fachhochschule Technik und Informatik (Switzerland)

8:30 am: **CIGS P3 scribes using ultra-short laser pulses and thermal annealing**, Gabor Matthäus, Klaus Bergner, Friedrich-Schiller-Univ. Jena (Germany); Mawuli Ametowobla, Andreas Letsch, Robert Bosch GmbH (Germany); Andreas Tünnermann, Stefan Nolte, Friedrich-Schiller-Univ. Jena (Germany) ..... [9735-1]

8:50 am: **Selective structuring of multi-layer functional thin films using a laser-induced shockwave delamination process**, Pierre Lorenz, Martin Ehrhardt, Lukas Bayer, Leibniz-Institut für Oberflächenmodifizierung e.V. (Germany); Emilio Sanchez Cortezon, Abengoa Solar Espana SA (Spain); Carlos Molpeceres, Univ. Politécnica de Madrid (Spain); Carlos Antonio Herrera Ramirez, Abengoa Solar Espana SA (Spain); Alexander Braun, Solarion AG (Germany); Klaus-Peter Zimmer, Leibniz-Institut für Oberflächenmodifizierung e.V. (Germany) ..... [9735-2]

9:10 am: **High throughput laser scribing of Cu(In,Ga)Se<sub>2</sub> thin-film solar cells**, Andreas Burn, Christian Heger, Berner Fachhochschule Technik und Informatik (Switzerland); Stephan Bücheler, Shiro Nishiwaki, EMPA (Switzerland); David Bremaud, Roger Ziltener, Flisom AG (Switzerland); Lukas Kräiner, Gabriel J. Spuehler, Onefive GmbH (Switzerland); Valerio Romano, Berner Fachhochschule Technik und Informatik (Switzerland) ..... [9735-3]

9:30 am: **A dual beam laser process for rapid high temperature processing of silicon photovoltaic materials**, Brian J. Simonds, National Institute of Standards and Technology (USA); Anthony Teal, Tian Zhang, The Univ. of New South Wales (Australia); Joshua A. Hadler, National Institute of Standards and Technology (USA); Zibo Zhou, Sergey Varlamov, Ivan Perez-Wurfl, The Univ. of New South Wales (Australia) ..... [9735-4]

Coffee Break ..... Mon 9:50 am to 10:20 am

### SESSION 2

**LOCATION: RM 304 (SOUTH ESPLANADE) .. MON 10:20 AM TO 12:00 PM**

#### Lasers in Electronic Production

Session Chair: **Stephan Roth**, BLZ Bayerisches Laserzentrum GmbH (Germany)

10:20 am: **Tailored femtosecond Bessel beams for high-throughput, taper-free through-silicon vias (TSVs) fabrication (Invited Paper)**, Fei He, Shanghai Institute of Optics and Fine Mechanics (China) and RIKEN Ctr. for Advanced Photonics (Japan); Junjie Yu, Wei Chu, Zhaohui Wang, Yuanxin Tan, Ya Cheng, Shanghai Institute of Optics and Fine Mechanics (China); Koji Sugioka, RIKEN Ctr. for Advanced Photonics (Japan) ..... [9735-5]

11:00 am: **Laser induced selective copper plating of polypropylene surface**, Karolis Ratautas, Mindaugas Gedvilas, Ina Stankevičienė, Aldona Jagminienė, Eugenijus Norkus, Ctr. for Physical Sciences and Technology (Lithuania); Nello Li Pira, Ctr. Ricerche Fiat S.C.p.A. (Italy); Stefano Sinopoli, Bioage Srl (Italy); Gediminas Račiukaitis, Ctr. for Physical Sciences and Technology (Lithuania) ..... [9735-6]

11:20 am: **Laser applications in advanced chip packaging**, Dirk Mueller, Coherent, Inc. (USA); Andrew Held, Coherent Inc. (USA); Rainer Pätzl, Coherent GmbH (Germany); Dave Clark, Coherent, Inc. (Germany); Joris F. P. van Nunen, Coherent GmbH (Germany) ..... [9735-7]

11:40 am: **Laser processing of metal nanowire for flexible and stretchable electronics**, Seung Hwan Ko, Hyunmin Cho, Dongkwan Kim, Seoul National Univ. (Korea, Republic of) ..... [9735-8]

Lunch Break ..... Mon 12:00 pm to 1:10 pm

### SESSION 3

**LOCATION: RM 304 (SOUTH ESPLANADE) .... MON 1:10 TO 3:30 PM**

#### Laser 3D Micro/Nano Structuring

Joint Session with Conferences 9735 and 9738

Session Chair: **Henry Helvajian**, The Aerospace Corp. (USA)

1:10 pm: **3D photonic and opto-fluidic devices (Invited Paper)**, Ajoy K. Kar, Heriot-Watt Univ. (United Kingdom) ..... [9735-9]

1:50 pm: **Femtosecond laser fabricated electrofluidic devices in glass for 3D manipulation of biological samples**, Jian Xu, Katsumi Midorikawa, Koji Sugioka, RIKEN (Japan) ..... [9735-10]

2:10 pm: **Improvement in contact resistance of 4H-SiC by excimer laser doping using silicon nitride films**, Ryota Kojima, Kyushu Univ. (Japan) [9738-1]

2:30 pm: **A cantilever based optical fiber acoustic sensor fabricated by femtosecond laser micromachining**, Jie Liu, Lei Yuan, Clemson Univ. (USA); Jie Huang, Missouri Univ. of Science and Technology (USA); Hai Xiao, Clemson Univ. (USA) ..... [9738-2]

2:50 pm: **Photo-direct machining of polydimethylsiloxane using laser plasma EUV sources**, Tetsuya Makimura, Hikari Urai, Univ. of Tsukuba (Japan); Daisuke Nakamura, Akihiko Takahashi, Kyushu Univ. (Japan); Hiroyuki Niino, National Institute of Advanced Industrial Science and Technology (Japan); Tatsuo Okada, Kyushu Univ. (Japan) ..... [9735-11]

3:10 pm: **Laser-assisted morphing of complex three dimensional objects**, Yves Bellouard, Jakob Drs, Ecole Polytechnique Fédérale de Lausanne (Switzerland) ..... [9735-12]

Coffee Break ..... Mon 3:30 pm to 4:00 pm

# CONFERENCE 9735

LOCATION: ROOM 304 (SOUTH ESPLANADE)

## SESSION 4

LOCATION: RM 304 (SOUTH ESPLANADE) . . . . MON 4:00 TO 5:30 PM

### Laser Direct Writing

Joint Session with Conferences 9735 and 9738

Session Chair: **Costas P. Grigoropoulos**,  
Univ. of California, Berkeley (USA)

4:00 pm: **Laser-assisted inkjet printing of highly viscous fluids with sub-nozzle resolution**, Paul Delrot, Miguel A. Modestino, Demetri Psaltis, Christophe Moser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9738-3]

4:20 pm: **Laser induced forward transfer: a novel tool for printing sensors and characterizing surface wetting properties**, Ioanna Zergioti, National Technical Univ. of Athens (Greece) . . . . . [9735-13]

4:40 pm: **Laser-printing and femtosecond laser-structuring of electrode materials for the manufacturing of 3D lithium-ion micro-batteries** (*Invited Paper*), Johannes Pröll, Karlsruher Institut für Technologie (Germany); Heungsoo Kim, U.S. Naval Research Lab. (USA); Yijing Zheng, Peter Smyrek, Hans J. Seifert, Karlsruher Institut für Technologie (Germany); Alberto Piqué, U.S. Naval Research Lab. (USA); Wilhelm Pflöging, Karlsruher Institut für Technologie (Germany) . . . . . [9738-4]

5:10 pm: **Green microfabrication for flexible electronics by laser direct synthesis and patterning technology**, Ming-Tsang Lee, National Chung Hsing Univ. (Taiwan) . . . . . [9735-14]

## TUESDAY 16 FEBRUARY

## SESSION 5

LOCATION: RM 304 (SOUTH ESPLANADE) . . . . TUE 8:00 TO 10:10 AM

### Dynamics of Laser Ablation I

Joint Session with Conferences 9735 and 9740

Session Chair: **Peter R. Herman**, Univ. of Toronto (Canada)

8:00 am: **Towards a more complete understanding of laser ablation with ultrashort pulses: Mechanisms of confined laser ablation and pulse duration dependence of laser ablation efficiency** (*Invited Paper*), Heinz P. Huber, Jan Winter, Juergen Sotrop, Regina Moser, Stephan Rapp, Rudolph Reiel, Hochschule für Angewandte Wissenschaften München (Germany); Matthias Domke, FH Vorarlberg (Austria) . . . . . [9735-15]

8:30 am: **Engineering model for ultrafast laser microprocessing**, Eric P. Mottay, Eric Audouard, Pierre Couplier, Amplitude Systèmes (France) . . . . . [9740-40]

8:50 am: **Ablation of silicon with bursts of femtosecond laser pulses**, Caterina Gaudioso, Univ. degli Studi di Bari Aldo Moro (Italy) and Istituto di Fotonica e Nanotecnologie (Italy); Helena Kämmer, Felix Dreisow, Friedrich-Schiller-Universität Jena (Germany); Antonio Ancona, CNR-Istituto di Fotonica e Nanotecnologie (Italy); Andreas Tünnermann, Stefan Nolte, Friedrich-Schiller-Universität Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [9740-41]

9:10 am: **Laser energy deposition at the surface of dielectrics exposed to single 15-fs laser pulse**, Corinne Pasquier, Marc L. Sentis, Olivier P. Utéza, Nicolas Sanner, Lasers, Plasmas et Procédés Photoniques (France) and Aix-Marseille Univ. (France) . . . . . [9735-16]

9:30 am: **Laser damage experiments at 10 fs in air**, Olivier P. Utéza, Corinne Pasquier, Raphaël Clady, Nicolas Sanner, Marc L. Sentis, Lasers, Plasmas et Procédés Photoniques (France) . . . . . [9735-17]

9:50 am: **Laser ablation of borosilicate glass with high power shaped UV nanosecond laser pulses**, Philipp von Witzendorff, Andrea Bordin, Laser Zentrum Hannover e.V. (Germany); Rajesh S. Patel, James M. Bovatsek, Spectra-Physics® (USA); Oliver Suttman, Ludger Overmeyer, Laser Zentrum Hannover e.V. (Germany) . . . . . [9735-18]

Coffee Break . . . . . Tue 10:10 am to 10:40 am

## SESSION 6

LOCATION: RM 304 (SOUTH ESPLANADE) TUE 10:40 AM TO 12:10 PM

### Dynamics of Laser Ablation II

Joint Session with Conferences 9735 and 9740

Session Chair: **Alexandre Mermillod-Blondin**, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany)

10:40 am: **Ab-initio molecular dynamics simulation of nonthermal structural phenomena in laser excited solids** (*Invited Paper*), Martin E. Garcia, Tobias Zier, Bernd Bauerhenne, Eeuwé S. Zijlstra, Univ. Kassel (Germany) . . . [9735-19]

11:10 am: **Ultrafast laser-induced complex refractive index changes in metals measured by pump-probe ellipsometry**, Stephan Rapp, Albert Althammer, Max Bung, Heinz P. Huber, Hochschule für Angewandte Wissenschaften München (Germany) . . . . . [9735-20]

11:30 am: **Numerical study of the influence of picosecond laser spot size on ablated depth and threshold fluence of metal**, Yiming Zhang, Berner Fachhochschule Technik und Informatik (Switzerland) and Univ. Bern (Switzerland); Benjamin Lauer, Beat Neuenschwander, Valerio Romano, Berner Fachhochschule Technik und Informatik (Switzerland) . . . . . [9735-21]

11:50 am: **Investigation of the breaking strength of ultrashort pulse laser diced thin Si wafers**, Matthias Domke, Bernadette Egle, FH Vorarlberg (Austria); Gernot Fasching, Marius Bodea, Elisabeth Schwarz, Infineon Technologies Austria AG (Austria) . . . . . [9740-42]

Lunch/Exhibition Break . . . . . Tue 12:10 pm to 1:40 pm

## SESSION 7

LOCATION: RM 304 (SOUTH ESPLANADE) . . . . TUE 1:40 TO 3:10 PM

### Machining of Transparent Materials I

Joint Session with Conferences 9735 and 9740

Session Chair: **Heinz P. Huber**, Hochschule für Angewandte Wissenschaften München (Germany)

1:40 pm: **Ultrashort-pulse laser processing of transparent materials: Insight from numerical and semi-analytical models** (*Invited Paper*), Nadezhda M. Bulgakova, HiLASE Ctr. (Czech Republic) and Institute of Thermophysics (Russian Federation); Vladimir P. Zhukov, Institute of Computational Technologies (Russian Federation) and Novosibirsk State Technical Univ. (Russian Federation); Yuri P. Meshcheryakov, Institute of Hydrodynamics (Russian Federation); Tomáš Mocek, HiLASE Ctr. (Czech Republic) . . . [9735-22]

2:10 pm: **Influence of plasma-induced self-effects on surface ablation of glass using fs-laser pulses**, Javier Hernandez Rueda, Univ. of California, Davis (USA); Jasper Clarijs, Univ. of California, Davis (USA) and Utrecht Univ. (Netherlands); Jan Siegel, Javier Solis, Instituto de Óptica "Daza de Valdés" (Spain) and Consejo Superior de Investigaciones Científicas (Spain); Hao Zhang, Dries van Oosten, Utrecht Univ. (Netherlands); Denise M. Krol, Univ. of California, Davis (USA) . . . . . [9740-43]

2:30 pm: **Fundamental investigations of ultrashort-pulse micromachining of different types of crystalline lithium niobate**, Mareike Stolze, Thomas Herrmann, Johannes A. L'huillier, Photonik-Zentrum Kaiserslautern e.V. (Germany) . . . . . [9735-23]

2:50 pm: **Time resolved study of femtosecond laser induced micro-modifications inside transparent brittle materials**, Frank Hendricks, Victor V. Matyilitsky, Spectra-Physics (Austria); Matthias Domke, FH Vorarlberg (Austria); Heinz P. Huber, Munich Univ. of Applied Sciences (Germany) [9740-44]

Coffee Break . . . . . Tue 3:10 pm to 3:40 pm

LASE

# CONFERENCE 9735

LOCATION: ROOM 304 (SOUTH ESPLANADE)

## SESSION 8

LOCATION: RM 304 (SOUTH ESPLANADE) . . . . TUE 3:40 TO 5:50 PM

### Machining of Transparent Materials II

Joint Session with Conferences 9735 and 9740

Session Chair: **Nadezhda M. Bulgakova**, HiLASE Ctr. (Czech Republic), Institute of Thermophysics {Russian Federation}

3:40 pm: **Few-cycle pulses for bulk microprocessing of fused silica** (*Invited Paper*), Alexandre Mermillod-Blondin, Benjamin Klessen, Federico J. A. Furch, Marc J. J. Vrakking, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany) . . . . . [9740-45]

4:10 pm: **Probing temporal and spatial properties of electronic excitation in dielectrics after interaction with temporally shaped femtosecond laser pulses: experiments and simulations**, Thomas Winkler, Univ. Kassel (Germany); Lasse Haahr-Lillevang, Aarhus Univ. (Denmark); Cristian Sarpe-Tudoran, Nadine Götte, Bastian Zielinski, Nikolai Jelzow, Arne Senftleben, Thomas Baumert, Univ. Kassel (Germany) . . . . . [9740-46]

4:30 pm: **Plasma dynamics and spectroscopy during fs-laser fabrication of waveguides in glass**, Javier Hernandez Rueda, Univ. of California, Davis (USA); Dries van Oosten, Utrecht Univ. (Netherlands); Jonathan J. Witcher, Univ. of California, Davis (USA); Jasper Clarijs, Univ. of California, Davis (USA) and Utrecht Univ. (Netherlands); Denise M. Krol, Univ. of California, Davis (USA) . . . . . [9740-47]

4:50 pm: **Ultrafast laser processing of transparent materials supported by in-situ diagnostics**, Malte Kumkar, Myriam Kaiser, Jonas Kleiner, TRUMPF Laser- und Systemtechnik GmbH (Germany); Daniel Grossmann, TRUMPF Laser- und Systemtechnik GmbH (Germany) and RWTH Aachen Univ. (Germany); Daniel Flamm, TRUMPF Laser- und Systemtechnik GmbH (Germany); Klaus Bergner, Stefan Nolte, Friedrich-Schiller-Univ. Jena (Germany) . . . . . [9735-24]

5:10 pm: **Laser filamentation of glass and other transparent, brittle materials: Fundamentals and applications**, Roland M. Mayerhofer, Rofin-Baasel Lasertechnik GmbH & Co. KG (Germany); Abbas S. Hosseini, ROFIN-Sinar, Inc. (USA) . . . . . [9735-25]

5:30 pm: **Investigation of the micro-mechanical properties of femtosecond laser-induced phases in amorphous silica matrix**, Christos E. Athanasiou, Yves Bellouard, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9740-48]

## POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

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*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Formation of periodic micro/nanostructure onto silicone rubber surface by ArF excimer laser**, Wisnu Setyo Pambudi, Masayuki Okoshi, National Defense Academy (Japan); Tsugito Yamashita, Kanto Gakuin Univ. (Japan) . . . . [9735-43]

**SiO<sub>2</sub>-glass drilling by short-pulse CO<sub>2</sub> laser with controllable pulse-tail energy**, Kazuyuki Uno, Takuya Yamamoto, Miyu Watanabe, Tetsuya Akitsu, Univ. of Yamanashi (Japan); Takahisa Jitsuno, Osaka Univ. (Japan) . . . [9735-44]

**Graphical fiber shaping control interface**, Eric T. Basso, Yasuyuki Ninomiya, AFL (USA) . . . . . [9735-45]

**Benefits of CO<sub>2</sub> laser heating for high reliability fiber splicing**, Usman B. Nasir, Douglas M. Duke, AFL (USA); Elli Saravanos, Corning Cable Systems LLC (USA) . . . . . [9735-46]

**Femtosecond laser processing of transparent materials for assembly-free fabrication of photonic microsensors**, Lei Yuan, Clemson Univ. (USA); Jie Huang, Missouri Univ. of Science and Technology (USA); Jie Liu, Yang Song, Qi Zhang, Jincheng Lei, Hai Xiao, Clemson Univ. (USA) . . . . . [9735-47]

**Tribological properties of femtosecond laser-induced periodic surface structures on metals**, Jörn Bonse, Robert Koter, Manfred Hartelt, Dirk Spaltmann, Simone Pentzien, Bundesanstalt für Materialforschung und -prüfung (Germany); Sandra Höhm, Arkadi Rosenfeld, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany); Jörg Krüger, Bundesanstalt für Materialforschung und -prüfung (Germany) . . . . . [9735-48]

**Femtosecond laser ablation of silica based glasses and the role of the dissociation energy**, Moritz Grehn, Technische Univ. Berlin (Germany); Thomas Seuthe, Fraunhofer-IKTS CMD (Germany); Michael Höfner, Nils Griga, Technische Univ. Berlin (Germany); Alexandre Mermillod-Blondin, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany); Markus Eberstein, Fraunhofer-IKTS CMD (Germany); Jörn Bonse, Bundesanstalt für Materialforschung und -prüfung (Germany) . . . . . [9735-49]

**High-efficiency bispectral laser source for EUV lithography**, Aleksandr S. Grishkanich, Aleksandr P. Zhevlakov, Sergey V. Kascheev, ITMO Univ. (Russian Federation); Ruben P. Seisyan, Ioffe Physical-Technical Institute (Russian Federation); Aleksandr Bagdasarov, S.I. Vavilov State Optical Institute (Russian Federation); Igor S. Sidorov, Univ. of Eastern Finland (Finland) . . . . . [9735-50]

## WEDNESDAY 17 FEBRUARY

### SESSION 9

LOCATION: RM 304 (SOUTH ESPLANADE) . . . WED 8:30 TO 9:50 AM

### Thin Film Processing

Session Chair: **Beat Neuenschwander**, Berner Fachhochschule Technik und Informatik (Switzerland)

8:30 am: **Observation of pressure waves due to ultra-short laser ablation in thin molybdenum films by reflective and transmissive pump-probe microscopy**, Rudolf Reiel, Christoph Aichele, Stephan Rapp, Jürgen Sotrop, Heinz P. Huber, Hochschule für Angewandte Wissenschaften München (Germany) . . . . . [9735-26]

8:50 am: **Investigative analysis: Experimental data compared to simulation of confined laser ablation for silicon dioxide layers on silicon substrates**, Regina Moser, Jürgen Sotrop, Heinz P. Huber, Hochschule für Angewandte Wissenschaften München (Germany); Gerd Marowsky, Laser-Lab. Göttingen e.V. (Germany) . . . . . [9735-27]

9:10 am: **Quantized blistering of transparent films with femtosecond laser interference**, Stephen Ho, Prasoon Jha, Peter R. Herman, Univ. of Toronto (Canada) . . . . . [9735-28]

9:30 am: **Ultra-short pulse laser patterning of fully printed flexible devices based on carbon nanotubes thin-films**, Juergen Sotrop, Heinz P. Huber, Hochschule für Angewandte Wissenschaften München (Germany) . . . [9735-29]

Coffee Break . . . . .Wed 9:50 am to 10:20 am

## LASE Plenary Session

WED 10:20 AM TO 12:30 PM

LOCATION: ROOM 103 (SOUTH EXHIBIT LEVEL)

10:20 am: **Welcome and Opening Remarks**  
**Guido Hennig**, Daetwyler Graphics AG (Switzerland)  
**Yongfeng Lu**, Univ. of Nebraska-Lincoln (USA)

10:25 am: **Announcement of the Green Photonics Best Paper Award and the 3D Printing, Fabrication, and Manufacturing Best Paper Award**  
**Stephen J. Eglash**, Energy and Environment Affiliates Program, Stanford Univ. (USA)  
**Henry Helvajian**, The Aerospace Corp. (USA)

10:30 am: **Emerging Applications of Photonic Crystal Fibers**  
**Philip Russell**, Max-Planck Institute for the Science of Light (Germany) and Univ. of Erlangen-Nuremberg (Germany)

11:10 am: **Optical 3D Nano-fabrication: Drawing or Growing?**  
**Satoshi Kawata**, Osaka Univ. (Japan) and RIKEN (Japan)

11:50 am: **High Power Semiconductor Lasers: Disrupting a Fragmented Industry**  
**Scott Keeney**, nLight Corp. (USA)

Lunch/Exhibition Break . . . . .Wed 12:30 pm to 2:00 pm



# CONFERENCE 9735

LOCATION: ROOM 304 (SOUTH ESPLANADE)

THURSDAY 18 FEBRUARY

## SESSION 10

LOCATION: RM 304 (SOUTH ESPLANADE) ... WED 2:00 TO 3:40 PM

### Laser-induced Nanostructures I: LIPSS

Joint Session with Conferences 9735 and 9737

Session Chair: **Andrei V. Kabashin**, Aix-Marseille Univ. (France)

2:00 pm: **Laser-induced periodic surface structures (ripples): Dynamics, control, and applications** (*Invited Paper*), Jörn Bonse, Bundesanstalt für Materialforschung und -prüfung (Germany); Sandra Höhm, Arkadi Rosenfeld, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany); Jörg Krüger, Bundesanstalt für Materialforschung und -prüfung (Germany) ..... [9735-30]

2:40 pm: **Sub-diffraction limit nanostructures induced by femtosecond laser direct writing**, Xiaolong He, Purdue Univ. (USA) and Harbin Institute of Technology (China); Woongsik Nam, Xianfan Xu, Purdue Univ. (USA) .. [9735-31]

3:00 pm: **High density semiconductor nanodots by direct laser fabrication**, Haeyon Yang, Anahita Haghizadeh, South Dakota School of Mines and Technology (USA) ..... [9737-19]

3:20 pm: **Ultrafast laser ablation of transparent materials**, Lara Bauer, TRUMPF Laser GmbH (Germany) and Univ. Stuttgart (Germany); Simone Russ, TRUMPF Laser GmbH (Germany); Myriam Kaiser, Malte Kumkar, Birgit Faisst, TRUMPF Laser- und Systemtechnik GmbH (Germany); Rudolf Weber, Thomas Graf, Univ. Stuttgart (Germany) ..... [9735-32]

Coffee Break ..... Wed 3:40 pm to 4:10 pm

## SESSION 11

LOCATION: RM 304 (SOUTH ESPLANADE) ... WED 4:10 TO 6:10 PM

### Laser-induced Nanostructures II

Joint Session with Conferences 9735 and 9737

Session Chair: **Jörn Bonse**,  
Bundesanstalt für Materialforschung und -prüfung (Germany)

4:10 pm: **Observation of graphene growth on SiC(0001) surfaces induced by KrF excimer laser irradiation**, Masakazu Hattori, Hiroshi Ikenoue, Daisuke Nakamura, Tatsuo Okada, Kyushu Univ. (Japan) ..... [9735-33]

4:30 pm: **Role of enhanced laser field in laser processing of nanomaterials**, Tao Zhang, Seungkuk Kuk, Stony Brook Univ. (USA); Eunpa Kim, Costas P. Grigoropoulos, Univ. of California, Berkeley (USA); David J. Hwang, Stony Brook Univ. (USA) ..... [9735-34]

4:50 pm: **Ultrafast laser mixing of metals as a route to create stable nanocrystalline materials**, Keegan J. Schrider, Ben R. Torralva, Steven M. Yalisove, Univ. of Michigan (USA) ..... [9735-35]

5:10 pm: **Femtosecond laser irradiation of dielectric materials containing randomly arranged nano-defects**, Anton Rudenko, Jean-Philippe Colombier, Tatiana E. Itina, Lab. Hubert Curien (France) ..... [9737-20]

5:30 pm: **Pulsed laser deposition of ultrasmall nanoparticles: Transformation into photosensitive black-TiO<sub>2</sub> core-shell nanostructures**, David B. Geohegan, Masoud Mahjouri-Samani, Oak Ridge National Lab. (USA); Mengkun Tian, The Univ. of Tennessee (USA); Gerd Duscher, The Univ. of Tennessee Knoxville (USA); Gyula Eres, Alexander A. Puzetzy, Christopher M. Rouleau, Mina Yoon, Oak Ridge National Lab. (USA) ..... [9737-21]

5:50 pm: **Fabrication and bandgap engineering of doped ZnO microspheres by simple laser ablation in air**, Daisuke Nakamura, Tetsuya Shimogaki, Toshinobu Tanaka, Fumiaki Nagasaki, Yuki Fujiwara, Mitsuhiro Higashihata, Tatsuo Okada, Kyushu Univ. (Japan) ..... [9735-36]

## SESSION 12

LOCATION: RM 304 (SOUTH ESPLANADE) ... THU 8:40 TO 10:00 AM

### Laser Surface Structuring I

Session Chair: **Guido Hennig**, Daetwyler Graphics AG (Switzerland)

8:40 am: **Nanotexturation inspired by nature** (*Invited Paper*), Rainer Kling, Marc Faucon, Girolamo Mincuzzi, ALPhANOV (France) ..... [9735-37]

9:20 am: **Time-optimized laser micro machining by using a new high dynamic and high precision galvo scanner**, Beat Jaeggi, Beat Neuenschwander, Markus Zimmermann, Berner Fachhochschule Technik und Informatik (Switzerland); Markus Zecherle, Ernst Wilhelm Boeckler, SCANLAB AG (Germany) ..... [9735-38]

9:40 am: **Studies on laser material processing with nanosecond & sub-nanosecond and picosecond & sub-picosecond pulses**, Jie Zhang, Sha Tao, Brian Wang, Jay Zhao, Advanced Optowave Corp (USA) ..... [9735-39]

Coffee Break ..... Thu 10:00 am to 10:30 am

## SESSION 13

LOCATION: RM 304 (SOUTH ESPLANADE) ... THU 10:30 TO 11:50 AM

### Laser Surface Structuring II

Session Chair: **Rainer Kling**, ALPhANOV (France)

10:30 am: **Large area micro-/nano-structuring using direct laser interference patterning** (*Invited Paper*), Andres F. Lasagni, Fraunhofer IWS Dresden (Germany) and TU Dresden (Germany); Tim Kunze, Matthias Bieda, Fraunhofer IWS Dresden (Germany); Denise Günther, TU Dresden (Germany) and Fraunhofer IWS Dresden (Germany); Anne Gärtner, Technische Universität Dresden (Germany); Valentin Lang, TU Dresden (Germany) and Fraunhofer IWS Dresden (Germany); Andreas Rank, TU Dresden (Germany); Teja Roch, Fraunhofer IWS Dresden (Germany) and TU Dresden (Germany) ..... [9735-40]

11:10 am: **Power scaling into the 100W regime for surface structuring of metals with ultra-short laser pulses**, Beat Neuenschwander, Markus Zimmermann, Beat Jaeggi, Berner Fachhochschule Technik und Informatik (Switzerland) ..... [9735-41]

11:30 am: **Laser-assisted manufacturing of thermal energy devices**, Tao Zhang, Mahder Tewolde, Jon P. Longtin, David J. Hwang, Stony Brook Univ. (USA) ..... [9735-42]

## Announcement of Award Winners

11:50 AM TO 12:00 PM

LOCATION: ROOM 304 (SOUTH ESPLANADE)

Conference Chair: **Beat Neuenschwander**, Berner Fachhochschule Technik und Informatik (Switzerland)

# CONFERENCE 9736

LOCATION: ROOM 302 (SOUTH ESPLANADE)

Tuesday–Thursday 16–18 February 2016 • Proceedings of SPIE Vol. 9736

# Laser-based Micro- and Nanoprocessing X

Conference Chair: **Udo Klotzbach**, Fraunhofer IWS Dresden (Germany)

Conference Co-Chairs: **Kunihiko Washio**, Paradigm Laser Research Ltd. (Japan); **Craig B. Arnold**, Princeton Univ. (USA)

Program Committee: **Antonio Ancona**, CNR-Institute for Photonics and Nanotechnologies (Italy); **Arkadiusz J. Antonczak**, Wroclaw Univ. of Technology (Poland); **Jiyeon Choi**, Korea Institute of Machinery & Materials (Korea, Republic of); **Francois Courvoisier**, FEMTO-ST (France); **Chunlei Guo**, Univ. of Rochester (USA); **Miguel Holgado Bolaños**, Univ. Politécnica de Madrid (Spain); **Minghui Hong**, National Univ. of Singapore (Singapore); **Rainer Kling**, ALPhANOV (France); **Andres F. Lasagni**, Fraunhofer IWS Dresden (Germany); **Yongfeng Lu**, Univ. of Nebraska-Lincoln (USA); **Andreas E. H. Oehler**, Time-Bandwidth Products JDSU (Switzerland); **Yasuhiro Okamoto**, Okayama Univ. (Japan); **Roberto Osellame**, Politecnico di Milano (Italy); **Andreas Ostendorf**, Ruhr-Univ. Bochum (Germany); **Wilhelm Pflöging**, Karlsruhe Institute of Technology (Germany); **Alberto Piqué**, U.S. Naval Research Lab. (USA); **Martin Sharp**, Liverpool John Moores Univ. (United Kingdom); **Razvan Stoian**, Lab. Hubert Curien (France); **Koji Sugioka**, RIKEN (Japan); **Hong-Bo Sun**, Jilin Univ. (China); **Jorma Vihinen**, Tampere Univ. of Technology (Finland); **Akira Watanabe**, Tohoku Univ. (Japan); **Michael J. Withford**, Macquarie Univ. (Australia); **Xianfan Xu**, Purdue Univ. (USA); **Haibin Zhang**, Electro Scientific Industries, Inc. (USA); **Haiyan Zhao**, Tsinghua Univ. (China)

## TUESDAY 16 FEBRUARY

### SESSION 1

LOCATION: RM 302 (SOUTH ESPLANADE) ... TUE 8:00 TO 10:00 AM

#### Laser Micro-Structuring and Processing I

Session Chair: **Udo Klotzbach**, Fraunhofer IWS Dresden (Germany)

8:00 am: **Laser assisted glass-glass micro welding** (*Invited Paper*), Ville Hevonkorpi, Heidi Lundén, Antti Määttänen, Primoceler, Inc. (Finland) ..... [9736-1]

8:30 am: **Femtosecond laser induced local compositional changes in glass for photonics applications** (*Invited Paper*), Javier Solis, Instituto de Óptica "Daza de Valdés" (Spain) ..... [9736-2]

9:00 am: **New trends in laser micromachining**, Frank Gaebler, Coherent (Deutschland) GmbH (Germany) ..... [9736-3]

9:20 am: **Laser joining of metal-glass nanocomposite and glass**, Amin Abdolvand, Univ. of Dundee (United Kingdom) ..... [9736-4]

9:40 am: **Laser induced permanent and peculiar shape transformation of embedded metallic nanoparticles in glass**, Amin Abdolvand, William A. Gillespie, Mateusz A. Tyrk, Svetlana A. Zolotovskaya, Univ. of Dundee (United Kingdom) ..... [9736-5]

Coffee Break ..... Tue 10:00 am to 10:30 am

### SESSION 2

LOCATION: RM 302 (SOUTH ESPLANADE) ... TUE 10:30 AM TO 12:00 PM

#### Laser Nano-Structuring and Processing

Session Chair: **Haibin Zhang**, Electro Scientific Industries, Inc. (USA)

10:30 am: **Ultrafast laser direct micro-/nano-fabrication: Towards 4D optical printing** (*Invited Paper*), Mangirdas Malinauskas, Sima Rekštytė, Albertas Žukauskas, Simas Butkus, Vilnius Univ. (Lithuania); Saulius Juodkazis, Swinburne Univ. of Technology (Australia) ..... [9736-6]

11:00 am: **Rapid fabrication of microdevices using laser direct writing and replica moulding technique**, Arkadiusz J. Antonczak, Bogusz D. Stepak, Krzysztof M. Abramski, Wroclaw Univ. of Technology (Poland) ..... [9736-7]

11:20 am: **Waveguides and nonlinear refractive index in chalcogenide glass containing Ag<sub>2</sub>S nanocrystals**, Juliana M. P. Almeida, Emerson C. Barbano, Lino Misoguti, Univ. de São Paulo (Brazil); Craig B. Arnold, Princeton Univ. (USA); Cleber R. Mendonça, Univ. de São Paulo (Brazil) ..... [9736-8]

11:40 am: **Ultrafast graphene and carbon nanotube film patterning by picoseconds laser pulses**, Nerea Otero, Ivan I. Bobrinetskiy, Pablo Romero, AIMEN - Asociación de Investigación Metalúrgica del Noroeste (Spain) ..... [9736-9]

Lunch/Exhibition Break ..... Tue 12:00 pm to 1:30 pm

### SESSION 3

LOCATION: RM 302 (SOUTH ESPLANADE) ..... TUE 1:30 TO 3:00 PM

#### Laser Micro-Structuring and Processing II

Session Chair: **François Courvoisier**, FEMTO-ST (France)

1:30 pm: **microPREP: A new laser tool for high-throughput sample preparation** (*Invited Paper*), Tino Petsch, 3D-Micromac AG (Germany) [9736-10]

2:00 pm: **Formation of copper micropatterns by laser direct writing using copper nanoparticle ink**, Akira Watanabe, Jinguang Cai, Tohoku Univ. (Japan); Gang Qin, Lidan Fan, Henan Polytechnic Univ. (China) ..... [9736-11]

2:20 pm: **Multiwave hybrid laser processing of micrometer scale features for flexible electronic circuits**, Joseph T. Hillman, Y. Sukhman, D. Miller, M. Oropeza, C. Risser, Universal Laser Systems, Inc. (USA) ..... [9736-12]

2:40 pm: **Zero degree contour cutting below 100 μm feature size with femtosecond laser**, Klaus Stolberg, Susanna Friedel, JENOPTIK Laser GmbH (Germany) ..... [9736-14]

Coffee Break ..... Tue 3:00 pm to 3:30 pm

### SESSION 4

LOCATION: RM 302 (SOUTH ESPLANADE) ..... TUE 3:30 TO 5:30 PM

#### Direct Write Processing, Ablation, and Surface Modification I

Session Chair: **Kunihiko Washio**, Paradigm Laser Research Ltd. (Japan)

3:30 pm: **Nanotextured surfaces for surface enhanced Raman spectroscopy and sensors** (*Invited Paper*), Saulius Juodkazis, Swinburne Univ. of Technology (Australia) ..... [9736-15]

4:00 pm: **Surface functionalization with femtosecond lasers** (*Invited Paper*), Chunlei Guo, Univ. of Rochester (USA) ..... [9736-13]

4:30 pm: **Laser heating surface finishing for adapting the nucleate boiling heat transfer**, Nerea Otero, Pablo M. Romero, Paula Rico, AIMEN - Asociación de Investigación Metalúrgica del Noroeste (Spain); Jose M. Saiz-Jabardo, Pablo Fariñas, Univ. da Coruña (Spain) ..... [9736-16]

4:50 pm: **Single shot ultrafast laser ablation of single layer CVD graphene**, Abel Gil Villalba, Chen Xie, Roland Salut, Luca Fufaro, Remo Giusti, Maxime Jacquot, Pierre-Ambroise Lacourt, John M. Dudley, François Courvoisier, FEMTO-ST (France) ..... [9736-17]

5:10 pm: **Nanosecond pulsed laser generation of holographic structures on metals**, Krystian L. Włodarczyk, Heriot-Watt Univ. (United Kingdom); Marcus Ardron, Nick J. Weston, Renishaw plc (United Kingdom); Duncan P. Hand, Heriot-Watt Univ. (United Kingdom) ..... [9736-19]

# CONFERENCE 9736

LOCATION: ROOM 302 (SOUTH ESPLANADE)

WEDNESDAY 17 FEBRUARY

SESSION 5

LOCATION: RM 302 (SOUTH ESPLANADE) .. WED 8:00 TO 10:00 AM

## High Speed Laser Beam Engineering Systems for High Power Ultra Short Pulsed Laser I

Session Chair: **Michael J. Withford**, Macquarie Univ. (Australia)

- 8:00 am: **Electro-optic and acousto-optic laser beam scanners** (*Invited Paper*), Johannes Heberle, Peter Bechtold, Johannes Strauß, Michael Schmidt, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany) . . . . . [9736-20]
- 8:30 am: **The generation of obstructions and sealed micro-cavities during ultrafast laser drilling in glass** (*Invited Paper*), Omer Dolev, Yuval Berg, Niv Gorodesky, Zvi Kotler, Orbotech Ltd. (Israel) . . . . . [9736-21]
- 9:00 am: **Ultra high-speed micromachining of transparent materials using high PRF ultrafast lasers and new resonant scanning systems**, Florian Harth, Thomas Herrmann, Melissa C. Piontek, Johannes A. L'huillier, Photonik-Zentrum Kaiserslautern e.V. (Germany) . . . . . [9736-22]
- 9:20 am: **Throughput optimization for laser micro structuring**, Jan S. Hoppius, Alexander Kanitz, Andreas Ostendorf, Ruhr-Univ. Bochum (Germany) . . . . . [9736-23]
- 9:40 am: **Enhancing ablation efficiency in micro structuring using a deformable mirror for beam shaping of ultra-short laser pulses**, Marco Smarra, Klaus Dickmann, Fachhochschule Münster (Germany) . . . . . [9736-24]
- Coffee Break . . . . . Wed 10:00 am to 10:20 am

LASE

POSTERS-TUESDAY  
LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Random lasing of microporous surface based on Cr<sup>2+</sup>:ZnSe crystal**, Xianheng Yang, Guoying Feng, Shouhuan Zhou, Sichuan Univ. (China) [9736-50]

**System design of programmable 4f phase modulation techniques for rapid intensity shaping: A conceptual comparison**, Matthias Roth, TU Dresden (Germany); Jörg Heber, Fraunhofer-Institut für Photonische Mikrosysteme (Germany); Klaus Janschek, TU Dresden (Germany) . . . . . [9736-51]

**Direct formation of 100 nm-sized structure by laser-induced forward transfer (LIFT) using femtosecond laser beam**, Takahiro Nakamura, Koki Omachi, Shinichi Sato, Tohoku Univ. (Japan) . . . . . [9736-52]

**Heat transfer analysis of two wavelengths laser microprocessing inside glass**, Aoi Matsumoto, Takayuki Tamaki, Shinichi Enoki, Nara National College of Technology (Japan); Etsuji Ohmura, Osaka Univ. (Japan) . . . . . [9736-53]

**Online process-monitoring at quasi-simultaneous laser transmission welding using a 3D-scanner with integrated pyrometer**, Anton Schmailzl, Sebastian Steger, Michael Dostalek, Stefan Hierl, Ostbayerische Technische Hochschule Regensburg (Germany) . . . . . [9736-54]

**Pattern transfer, self-organized surface nanostructuring, and nanodrilling of dielectrics using nanosecond laser irradiation**, Pierre Lorenz, Leibniz-Institut für Oberflächenmodifizierung e.V. (Germany); Michael Klöppel, TU Dresden (Germany); Martin Ehrhardt, Lukas Bayer, Klaus-Peter Zimmer, Leibniz-Institut für Oberflächenmodifizierung e.V. (Germany) . . . . . [9736-55]

**Waveguide optical amplifiers and lasers produced by fs-laser induced ion migration in phosphate glass**, Pedro Moreno Zarate, Instituto Tecnológico Superior de Tepexi de Rodríguez (Mexico); Jesús del Hoyo Muñoz, Instituto de Óptica "Daza de Valdés" (Spain); Juan Antonio Vallés, Miguel Angel Rebolledo, Univ. de Zaragoza (Spain); Jan Siegel, Javier Solis, Instituto de Óptica "Daza de Valdés" (Spain) . . . . . [9736-56]

**Surface separation investigation of ultrafast pulsed laser welding**, Jianyong Chen, Richard M. Carter, Robert R. Thomson, Duncan P. Hand, Heriot-Watt Univ. (United Kingdom) . . . . . [9736-57]

**Fabrication of waveguides in L-threonine crystals by femtosecond lasers**, Gustavo F. B. Almeida, Univ. de São Paulo (Brazil); José J. Rodrigues Jr., Univ. Federal de Sergipe (Brazil); Cleber R. Mendonça, Univ. de São Paulo (Brazil) . . . . . [9736-58]

**Picosecond pulsed laser processing of polycrystalline diamond and cubic boron nitride composite materials**, Maximilian G. Warhanek, Josquin Pfaff, Linus Meier, Christian Walter, ETH Zürich (Switzerland); Konrad Wegener, ETH Zürich (Switzerland) and Inspire AG (Switzerland) . . . . . [9736-59]

**Advances in 193 nm excimer lasers for mass spectrometry applications**, Ralph F. Delmdahl, Hans-Gerd Esser, Rainer Paetzel, Guido F. Bonati, Coherent LaserSystems GmbH & Co. KG (Germany) . . . . . [9736-60]

**Periodic surface structures induced by femtosecond laser shaped pulses on silicon**, Gustavo F. B. Almeida, Renato J. Martins, Adriano J. G. Otuka, Jonathas P. Siqueira, Cleber R. Mendonça, Univ. de São Paulo (Brazil) [9736-61]

**Solutions for laser welding and hot-stamping hybrid process of Al-Si coated boron steel for automotive**, Myeong Hwan Oh, Chung Yun Kang, Pusan National Univ. (Korea, Republic of) . . . . . [9736-62]

**Enhancement of optical emission signals in laser-induced breakdown spectroscopy using micro-torches**, Lei Liu, Xi Huang, Univ. of Nebraska-Lincoln (USA); Shuo Li, Univ. of Pittsburgh (USA); Yao Lu, Univ. of Nebraska-Lincoln (USA); Kevin P. Chen, Univ. of Pittsburgh (USA); Yongfeng Lu, Univ. of Nebraska-Lincoln (USA) . . . . . [9736-63]

**The influence of ArF excimer laser micromachining on physicochemical properties of bioresorbable poly(L-lactide)**, Bogusz D. Stepak, Arkadiusz J. Antonczak, Konrad Szustakiewicz, Celina Pezowicz, Krzysztof M. Abramski, Wrocław Univ. of Technology (Poland) . . . . . [9736-64]

## LASE Plenary Session

WED 10:20 AM TO 12:30 PM

LOCATION: ROOM 103 (SOUTH EXHIBIT LEVEL)

- 10:20 am: **Welcome and Opening Remarks**  
**Guido Hennig**, Daetwyler Graphics AG (Switzerland)  
**Yongfeng Lu**, Univ. of Nebraska-Lincoln (USA)
- 10:25 am: **Announcement of the Green Photonics Best Paper Award and the 3D Printing, Fabrication, and Manufacturing Best Paper Award**  
**Stephen J. Eglash**, Energy and Environment Affiliates Program, Stanford Univ. (USA)  
**Henry Helvajian**, The Aerospace Corp. (USA)
- 10:30 am: **Emerging Applications of Photonic Crystal Fibers**  
**Philip Russell**, Max-Planck Institute for the Science of Light (Germany) and Univ. of Erlangen-Nuremberg (Germany)
- 11:10 am: **Optical 3D Nano-fabrication: Drawing or Growing?**  
**Satoshi Kawata**, Osaka Univ. (Japan) and RIKEN (Japan)
- 11:50 am: **High Power Semiconductor Lasers: Disrupting a Fragmented Industry**  
**Scott Keeney**, nLight Corp. (USA)

Lunch/Exhibition Break . . . . . Wed 12:30 pm to 2:00 pm

SESSION 6

LOCATION: RM 302 (SOUTH ESPLANADE) . . . WED 2:00 TO 3:20 PM

## High Speed Laser Beam Engineering Systems for High Power Ultra Short Pulsed Laser II

Session Chair: **Andrés-Fabián Lasagni**, Fraunhofer IWS Dresden (Germany)

- 2:00 pm: **Super-resolved laser photo-inscription using structured light** (*Invited Paper*), Yannick G. Petit, Institut de Chimie de la Matière Condensée de Bordeaux (France); Konstantin Mishchik, Eungjang Lee, Ctr. Lasers Intenses et Applications (France); Etienne Brasselet, Univ. Bordeaux 1 (France); Arnaud Royon, Ctr. Lasers Intenses et Applications (France); Inka B. Manek-Hönniger, Univ. Bordeaux 1 (France); Sylvain Danto, Thierry Cardinal, Institut de Chimie de la Matière Condensée de Bordeaux (France); Lionel Canioni, Univ. Bordeaux 1 (France) . . . . . [9736-25]



# CONFERENCE 9736

LOCATION: ROOM 302 (SOUTH ESPLANADE)

2:30 pm: **High-throughput machining using high average power ultrashort pulse lasers and ultrafast polygon scanner** (*Invited Paper*), Joerg Schille, Lutz Schneider, André Streek, Lars Hartwig, Sascha Kloetzer, Udo Loeschner, Hochschule Mittweida (Germany) . . . . . [9736-26]

3:00 pm: **Micro drilling using deformable mirror for beam shaping of ultra-short laser pulses**, Marco Smarra, Klaus Dickmann, Anja Strube, Fachhochschule Münster (Germany) . . . . . [9736-27]

Coffee Break . . . . .Wed 3:20 pm to 3:50 pm

## SESSION 7

LOCATION: RM 302 (SOUTH ESPLANADE) . . . . WED 3:50 TO 5:30 PM

### Direct Write Processing, Ablation, and Surface Modification II: Ultrafast Laser Machining Applications

Session Chair: **Hong-Bo Sun**, Jilin Univ. (China)

3:50 pm: **Simultaneous spatial and temporal focusing: A route towards confined nonlinear materials processing** (*Invited Paper*), Robert Kammel, Friedrich-Schiller-Univ. Jena (Germany); Klaus Bergner, Friedrich Schiller Univ. Jena (Germany); Jens Thomas, Roland Ackermann, Friedrich-Schiller-Univ. Jena (Germany); Stefan Skupin, Ctr. Lasers Intenses et Applications (France); Stefan Nolte, Friedrich-Schiller-Univ. Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [9736-28]

4:20 pm: **Eternal 5D data storage by ultrafast laser writing in glass** (*Invited Paper*), Peter G. Kazansky, Martynas Beresna, Jingyu Zhang, Rokas Drevinskas, Aabid Patel, Aušra Cerkauskaitė, Optoelectronics Research Ctr. (United Kingdom) . . . . . [9736-29]

4:50 pm: **Aerial treatment with small laser spots: an approach for the comparison of surface treatment parameters**, Stefan Kreling, Hinrich Grefe, Klaus Dilger, Technische Univ. Braunschweig (Germany) . . . . . [9736-30]

5:10 pm: **Extending ultrashort pulses laser texturing over large area**, Girolamo Mincuzzi, Marc Faucon, Rainer Kling, ALPhANOV (France) . . [9736-31]

## THURSDAY 18 FEBRUARY

## SESSION 8

LOCATION: RM 302 (SOUTH ESPLANADE) . . . THU 8:00 TO 10:10 AM

### Large Area Micro/Nano Structuring, Laser Interference Patterning

Session Chair: **Chunlei Guo**, Univ. of Rochester (USA)

8:00 am: **Nanofabrication of metals by interfering femtosecond laser processing and their applications** (*Invited Paper*), Yoshiki Nakata, Noriaki Miyana, Osaka Univ. (Japan) . . . . . [9736-32]

8:30 am: **Improved large area uniformity and production capacity of laser interference lithography with beam flattening device**, Yin-Kuang Yang, National Tsing Hua Univ. (Taiwan) . . . . . [9736-33]

8:50 am: **World record in high speed laser surface microstructuring of polymer and steel using direct laser interference patterning**, Teja Roch, Valentin Lang, Andres F. Lasagni, TU Dresden (Germany) and Fraunhofer IWS Dresden (Germany) . . . . . [9736-34]

9:10 am: **Laser-assisted reduction of graphene oxide for paper based large area flexible electronics**, Enkeleda Balliu, Henrik Andersson, Magnus Engholm, Sven Forsberg, Håkan Olin, Mid Sweden Univ. (Sweden) . . . [9736-35]

9:30 am: **Direct laser interference patterning for decreased bacterial attachment**, Denise Guenther, Florian Roessler, TU Dresden (Germany); Joaquin Valle, Saioa Burgui, Carmen Gil, Cristina Solano, Alejandro Toledo-Arana, Univ. Pública de Navarra (Spain); Ralf Helbig, Leibniz-Institut für Polymerforschung Dresden e.V. (Germany); Inigo Lasa, Univ. Pública de Navarra (Spain); Andrés F. Lasagni, TU Dresden (Germany) . . . . . [9736-36]

9:50 am: **Precision laser processing of diamond with 3D resolution**, Patrick S. Salter, Yu-Chen Chen, Bangshan Sun, Jason M. Smith, Martin J. Booth, Univ. of Oxford (United Kingdom) . . . . . [9736-37]

Coffee Break . . . . . Thu 10:10 am to 10:40 am

## SESSION 9

LOCATION: RM 302 (SOUTH ESPLANADE) THU 10:40 AM TO 12:10 PM

### Ultrafast Laser Machining Applications I

Session Chair: **Wilhelm Pfleging**, Karlsruhe Institute of Technology (Germany)

10:40 am: **Fluorine laser induced surface modification and micro/nanostructuring of metal thin films** (*Invited Paper*), Masayuki Okoshi, National Defense Academy (Japan) and Kanto Gakuin Univ. (Japan) . . . . . [9736-38]

11:10 am: **CFRP bonding pre-treatment with laser radiation of 3µm wavelength: Laser/material interaction**, David Blass, Stefan Kreling, Klaus Dilger, Technische Univ. Braunschweig (Germany) . . . . . [9736-39]

11:30 am: **Picosecond laser welding of optical to metal components**, Richard M. Carter, Heriot-Watt Univ. (United Kingdom); Michael Troughton, Selex ES Ltd. (United Kingdom); Jianyong Chen, Heriot-Watt Univ. (United Kingdom); Ian F. Elder, Selex ES Ltd. (United Kingdom); Robert R. Thomson, Heriot-Watt Univ. (United Kingdom); Robert A. Lamb, Selex ES Ltd. (United Kingdom); M. J. Daniel Esser, Duncan P. Hand, Heriot-Watt Univ. (United Kingdom) . . . . . [9736-40]

11:50 am: **Sapphire ablation by water jet guided 532nm ns-pulsed laser**, Yury Kuzminykh, Seyed Payam Vahdati, EMPA (Switzerland); Annika Richmann, Bernhard Richerzhagen, Synova S.A. (Switzerland); Patrik W. Hoffmann, EMPA (Switzerland) . . . . . [9736-41]

Lunch/Exhibition Break . . . . . Thu 12:10 pm to 2:00 pm

## SESSION 10

LOCATION: RM 302 (SOUTH ESPLANADE) . . . . THU 2:00 TO 3:00 PM

### Ultrafast Laser Machining Applications II

Session Chair: **Craig B. Arnold**, Princeton Univ. (USA)

2:00 pm: **Photochemical reduction of graphene oxide (GO) by femtosecond laser irradiation**, Muttaqin Yasin, Takahiro Nakamura, Shunichi Sato, Tohoku Univ. (Japan); Yuta Nishina, Okayama Univ. (Japan) . . . . . [9736-42]

2:20 pm: **Laser ablation of metal and semiconductors in arsenic sulfide solution**, Tingyi Gu, Princeton Univ. (USA); Burhan Abdi, Cornell Univ. (USA); Romain Fardel, Craig B. Arnold, Princeton Univ. (USA) . . . . . [9736-43]

2:40 pm: **Analysis of process parameter for the ablation of optical glasses with femto- and picosecond laser pulses**, Christian Schindler, Jens Bliedtner, Ernst-Abbe-Hochschule Jena (Germany); Maria Friedrich, Günter-Köhler-Institut für Fügetechnik und Werkstoffprüfung GmbH (Germany) . . . . . [9736-44]

Coffee Break . . . . . Thu 3:00 pm to 3:30 pm

## SESSION 11

LOCATION: RM 302 (SOUTH ESPLANADE) . . . . THU 3:30 TO 5:20 PM

### Advanced Laser Structuring for Energy Storage and Conversion

Session Chair: **Udo Klotzbach**, Fraunhofer IWS Dresden (Germany)

3:30 pm: **Laser processing of compound semiconductor thin film photovoltaics** (*Invited Paper*), Michael A. Scarpulla, The Univ. of Utah (USA) . . . . . [9736-45]

4:00 pm: **Laser direct interference patterning and ultrafast laser-induced micro/nano structuring of current collectors for lithium-ion batteries**, Yijing Zheng, Karlsruhe Institute of Technology (USA); Johannes Pröll, Karlsruhe Institute of Technology (Germany); Tim Kunze, Fraunhofer IWS Dresden (Germany); Andrés-Fabián Lasagni, Fraunhofer IWS Dresden (Germany) and TU Dresden (Germany); Christian Brösicke, Karlsruhe Institute of Technology (Germany); Peter Smyrek, Karlsruhe Institute of Technology (Germany) and Karlsruhe Nano Micro Facility (Germany); Hans J. Seifert, Wilhelm Pfleging, Karlsruhe Institute of Technology (Germany) . . . . . [9736-46]

4:20 pm: **Post-mortem characterization of fs laser-generated micro-pillars in Li(Ni<sub>1/3</sub>Mn<sub>1/3</sub>Co<sub>1/3</sub>)O<sub>2</sub> electrodes by laser-induced breakdown spectroscopy**, Peter Smyrek, Johannes Pröll, Karlsruhe Institute of Technology (Germany) and Karlsruhe Nano Micro Facility (Germany); Hans J. Seifert, Karlsruhe Institute of Technology (Germany); Wilhelm Pfleging, Karlsruhe Institute of Technology (Germany) and Karlsruhe Nano Micro Facility (Germany) . . . . . [9736-47]

4:40 pm: **Flexible carbon micro-supercapacitors prepared by laser direct writing**, Jinguang Cai, Akira Watanabe, Tohoku Univ. (Japan) . . . . . [9736-48]

5:00 pm: **High speed, high quality Li-ion battery foil cutting using nanosecond lasers**, Jim M. Bovatsek, Rajesh S. Patel, Robert S. Sposili, Spectra-Physics (USA); Rukun Yang, Xueke Wu, Shenzhen Geesun Automation Technology Co., Ltd. (China) . . . . . [9736-49]



# CONFERENCE 9737

LOCATION: ROOM 302 (SOUTH ESPLANADE)

Monday and Wednesday 15 and 17 February 2016 • Proceedings of SPIE Vol. 9737

# Synthesis and Photonics of Nanoscale Materials XIII

Conference Chairs: **Andrei V. Kabashin**, Aix-Marseille Univ. (France); **David B. Geohegan**, Oak Ridge National Lab. (USA);  
**Jan J. Dubowski**, Univ. de Sherbrooke (Canada)

Program Committee: **Jason D. Fowlkes**, Oak Ridge National Lab. (USA); **Reuven Gordon**, Univ. of Victoria (Canada); **Costas P. Grigoropoulos**, Univ. of California, Berkeley (USA); **Richard F. Haglund Jr.**, Vanderbilt Univ. (USA); **Henry Helvajian**, The Aerospace Corp. (USA); **Hiroshi Kumagai**, Kitasato Univ. (Japan); **Thomas K. Lippert**, Paul Scherrer Institut (Switzerland); **Yongfeng Lu**, Univ. of Nebraska-Lincoln (USA); **Rajesh Menon**, The Univ. of Utah (USA); **Rahul Rao**, Honda Research Institute USA, Inc. (USA); **Federico Rosei**, Univ. du Québec (Canada); **James P. Schuck**, The Molecular Foundry (USA); **Oleksandr Voznyy**, Univ. of Toronto (Canada); **Xianfan Xu**, Purdue Univ. (USA)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: RM 302 (SOUTH ESPLANADE) . . . . MON 8:10 TO 9:50 AM

### Laser Synthesis of Nanomaterials I

Session Chair: **Andrei V. Kabashin**, Aix-Marseille Univ. (France)

8:10 am: **Biocompatible gold submicrometer spheres with controlled surface textures fabricated by pulsed laser melting in liquids**, Christoph Rehbock, Alexander Heinemann, Janina Zwartscholten, Stephan Barcikowski, Univ. Duisburg-Essen (Germany) . . . . . [9737-1]

8:30 am: **Direct laser fabrication of nanowires on semiconductor surfaces**, Haeyeon Yang, Anahita Haghizadeh, South Dakota School of Mines and Technology (USA) . . . . . [9737-2]

8:50 am: **Modeling nanoparticle formation by laser ablation and by plasma discharges (Invited Paper)**, Tatiana E. Itina, Andrey Voloshko, Lab. Hubert Curien (France); Mikhail E. Povarnicyn, Joint Institute for High Temperatures (Russian Federation); Stéphane Mottin, Lab. Hubert Curien (France) and Univ. de Lyon (France); Laure Delfour, Lab. Hubert Curien (France) and Univ. de Lyon (France) . . . . . [9737-3]

9:20 am: **Laser-assisted synthesis and manipulation of two-dimensional layered semiconductors (Invited Paper)**, Masoud Mahjouri-Samani, Oak Ridge National Lab. (USA); Mengkun Tian, The Univ. of Tennessee Knoxville (USA); Ming Wei Ling, Andrew R. Lupini, Kai Wang, Christopher M. Rouleau, Alexander A. Puzretsky, Gyula Eres, Ilya N. Ivanov, Kai Xiao, Oak Ridge National Lab. (USA); Gerd Duscher, The Univ. of Tennessee Knoxville (USA); David B. Geohegan, Oak Ridge National Lab. (USA) . . . . . [9737-4]

Coffee Break . . . . . Mon 9:50 am to 10:20 am

### SESSION 2

LOCATION: RM 302 (SOUTH ESPLANADE) . . . MON 10:20 AM TO 12:10 PM

### Laser Synthesis of Nanomaterials II

Session Chair: **David B. Geohegan**, Oak Ridge National Lab. (USA)

10:20 am: **Modeling of laser-assisted nanostructuring of materials (Invited Paper)**, Irina N. Zvestovskaya, P.N. Lebedev Physical Institute (Russian Federation) . . . . . [9737-5]

10:50 am: **Large area, homogeneous laser-induced-periodic-surface-structures (LIPSS) produced by high repetition rate, fs-laser beam scanning at high speed**, Daniel Puerto, Jan Siegel, Instituto de Óptica "Daza de Valdés" (Spain); Ruth Lahoz, Instituto de Ciencia de Materiales de Aragón (Spain); Javier Hernandez-Rueda, Univ. of California, Davis (USA); Alexandro Ruiz de la Cruz, Instituto de Óptica "Daza de Valdés" (Spain); Xerman F. de la Fuente, Instituto de Ciencia de Materiales de Aragón (Spain); Javier Solis, Instituto de Óptica "Daza de Valdés" (Spain) . . . . . [9737-6]

11:10 am: **Ejection of glass melts and generation of nanofibers from the back surface of a glass plate induced by pulsed UV laser irradiation**, Sho Itoh, Nippon Electric Glass Co., Ltd. (Japan) and Kyoto Univ. (Japan); Masaaki Sakakura, Yasuhiko Shimotsuma, Kiyotaka Miura, Kyoto Univ. (Japan) . . . . . [9737-7]

11:30 am: **Effects of laser parameters on size and dispersion of gold nanoparticle colloids formed by laser ablation in water**, Alexandr A. Antipov, Sergey M. Arakelyan, Vladimir State Univ. (Russian Federation); Yury V. Ryabchikov, Ahmed Al-Kattan, Andrei V. Kabashin, Aix-Marseille Univ. (France) and Lasers, Plasmas et Procédés Photoniques (France); Stella V. Kutrovskaya, Alexey O. Kucherik, Vladimir State Univ. (Russian Federation); Tatiana E. Itina, Lab. Hubert Curien (France) . . . . . [9737-8]

11:50 am: **Laser synthesis of ultrapure nanomaterials for cancer theranostics**, Andrei V. Kabashin, Lasers, Plasmas et Procédés Photoniques (France) . . . . . [9737-9]

Lunch Break . . . . . Mon 12:10 pm to 1:40 pm

### SESSION 3

LOCATION: RM 302 (SOUTH ESPLANADE) . . . . MON 1:40 TO 3:50 PM

### Nanostructures for Telecommunications, Energy, and Biomedical Applications

Session Chair: **Jan J. Dubowski**, Univ. de Sherbrooke (Canada)

1:40 pm: **Graphene plasmonics: Hybrid graphene-waveguide modulators (Keynote Presentation)**, Sasha Grigorenko, The Univ. of Manchester (United Kingdom) . . . . . [9737-10]

2:20 pm: **Quantum-dot based ultrafast photoconductive antennae for efficient THz radiation (Invited Paper)**, Edik U. Rafailov, Aston Univ. (United Kingdom) . . . . . [9737-11]

2:50 pm: **Development of metamaterials for combined optical transduction/SERS biosensing/imaging platforms**, Artem Danilov, Aix-Marseille Univ. (France) . . . . . [9737-12]

3:10 pm: **Electrically biased GaAs/AlGaAs heterostructures for enhanced detection of bacteria**, Mohammad Reza Aziziyan, Jan J. Dubowski, Univ. de Sherbrooke (Canada) . . . . . [9737-13]

3:30 pm: **Structural, linear and nonlinear optical properties of metal-semiconductor nanohybrids prepared by laser ablation**, Yury V. Ryabchikov, Aix-Marseille Univ. (France) and P.N. Lebedev Physical Institute (Russian Federation); Artem Danilov, Aix-Marseille Univ. (France); Vladimir Lysenko, Institut des Nanotechnologies de Lyon (France); Ronan Le Dantec, Univ. de Savoie (France); Victor Y. Timoshenko, Lomonosov Moscow State Univ. (Russian Federation); Andrei V. Kabashin, Aix-Marseille Univ. (France) . [9737-14]

Coffee Break . . . . . Mon 3:50 pm to 4:20 pm

### SESSION 4

LOCATION: RM 302 (SOUTH ESPLANADE) . . . . MON 4:20 TO 5:50 PM

### Nanoparticle-enhanced Diagnostic Devices

Session Chair: **Tatiana E. Itina**, Lab. Hubert Curien (France)

4:20 pm: **Brillouin microspectroscopy of nanostructured biomaterials: Photonics assisted tailoring mechanical properties (Invited Paper)**, Vladislav V. Yakovlev, Texas A&M Univ. (USA) . . . . . [9737-15]

4:50 pm: **Triions photogeneration in tungsten disulfide monolayers**, Abdelaziz Boulesbaa, Bing Huang, Kai Wang, Ming-Wei Lin, Masoud Mahjouri-Samani, Christopher M. Rouleau, Kai Xiao, Mina Yoon, Bobby G. Sumpter, Alexander A. Puzretsky, David B. Geohegan, Oak Ridge National Lab. (USA) . . . . . [9737-16]

LASE

# CONFERENCE 9737

LOCATION: ROOM 302 AND ROOM 304 (SOUTH ESPLANADE)

5:10 pm: **Zinc oxide nanowire gamma ray detector with high spatiotemporal resolution**, Daniel C. Mayo, Vanderbilt Univ. (USA); Ryan Nolen, Lipscomb Univ. (USA); Andrew Cook, Richard Mu, Fisk Univ. (USA); Richard F. Haglund Jr., Vanderbilt Univ. (USA) . . . . . [9737-17]

5:30 pm: **Ultra-low frequency Raman spectroscopy of two-dimensional MoSe<sub>2</sub> crystals with arbitrary stacking configurations**, Alexander A. Puzos, Liangbo Liang, Xufan Li, Kai Xiao, Kai Wang, Masoud Mahjouri-Samani, Oak Ridge National Lab. (USA); Leonardo Basile, Escuela Politécnica Nacional (Ecuador); Juan Carlos Idrobo, Bobby G. Sumpter, Oak Ridge National Lab. (USA); Vincent Meunier, Rensselaer Polytechnic Institute (USA); David B. Geohegan, Oak Ridge National Lab. (USA) . . . . . [9737-18]

## WEDNESDAY 17 FEBRUARY

### LASE Plenary Session

WED 10:20 AM TO 12:30 PM

LOCATION: ROOM 103 (SOUTH EXHIBIT LEVEL)

- 10:20 am: **Welcome and Opening Remarks**  
Guido Hennig, Daetwyler Graphics AG (Switzerland)  
Yongfeng Lu, Univ. of Nebraska-Lincoln (USA)
- 10:25 am: **Announcement of the Green Photonics Best Paper Award and the 3D Printing, Fabrication, and Manufacturing Best Paper Award**  
Stephen J. Eglash, Energy and Environment Affiliates Program, Stanford Univ. (USA)  
Henry Helvajian, The Aerospace Corp. (USA)
- 10:30 am: **Emerging Applications of Photonic Crystal Fibers**  
Philip Russell, Max-Planck Institute for the Science of Light (Germany) and Univ. of Erlangen-Nuremberg (Germany)
- 11:10 am: **Optical 3D Nano-fabrication: Drawing or Growing?**  
Satoshi Kawata, Osaka Univ. (Japan) and RIKEN (Japan)
- 11:50 am: **High Power Semiconductor Lasers: Disrupting a Fragmented Industry**  
Scott Keeney, nLight Corp. (USA)

Lunch/Exhibition Break . . . . .Wed 12:30 pm to 2:00 pm

### SESSION 5

LOCATION: RM 304 (SOUTH ESPLANADE) . . . WED 2:00 TO 3:40 PM

#### NOTE ROOM CHANGE

### Laser-induced Nanostructures I: LIPSS

Joint Session with Conferences 9735 and 9737

Session Chair: **Andrei V. Kabashin**, Aix-Marseille Univ. (France)

2:00 pm: **Laser-induced periodic surface structures (ripples): Dynamics, control, and applications** (*Invited Paper*), Jörn Bonse, Bundesanstalt für Materialforschung und -prüfung (Germany); Sandra Höhm, Arkadi Rosenfeld, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany); Jörg Krüger, Bundesanstalt für Materialforschung und -prüfung (Germany) . . . . . [9735-30]

2:40 pm: **Sub-diffraction limit nanostructures induced by femtosecond laser direct writing**, Xiaolong He, Purdue Univ. (USA) and Harbin Institute of Technology (China); Woongsik Nam, Xianfan Xu, Purdue Univ. (USA) . . [9735-31]

3:00 pm: **High density semiconductor nanodots by direct laser fabrication**, Haeyon Yang, Anahita Haghizadeh, South Dakota School of Mines and Technology (USA) . . . . . [9737-19]

3:20 pm: **Ultrafast laser ablation of transparent materials**, Lara Bauer, TRUMPF Laser GmbH (Germany) and Univ. Stuttgart (Germany); Simone Russ, TRUMPF Laser GmbH (Germany); Myriam Kaiser, Malte Kumkar, Birgit Faisst, TRUMPF Laser- und Systemtechnik GmbH (Germany); Rudolf Weber, Thomas Graf, Univ. Stuttgart (Germany) . . . . . [9735-32]

Coffee Break . . . . .Wed 3:40 pm to 4:10 pm

### SESSION 6

LOCATION: RM 304 (SOUTH ESPLANADE) . . . WED 4:10 TO 6:10 PM

### Laser-induced Nanostructures II

Joint Session with Conferences 9735 and 9737

Session Chair: **Jörn Bonse**,  
Bundesanstalt für Materialforschung und -prüfung (Germany)

4:10 pm: **Observation of graphene growth on SiC(0001) surfaces induced by KrF excimer laser irradiation**, Masakazu Hattori, Hiroshi Ikenoue, Daisuke Nakamura, Tatsuo Okada, Kyushu Univ. (Japan) . . . . . [9735-33]

4:30 pm: **Role of enhanced laser field in laser processing of nanomaterials**, Tao Zhang, Seungkuk Kuk, Stony Brook Univ. (USA); Eunpa Kim, Costas P. Grigoropoulos, Univ. of California, Berkeley (USA); David J. Hwang, Stony Brook Univ. (USA) . . . . . [9735-34]

4:50 pm: **Ultrafast laser mixing of metals as a route to create stable nanocrystalline materials**, Keegan J. Schrider, Ben R. Torralva, Steven M. Yalisove, Univ. of Michigan (USA) . . . . . [9735-35]

5:10 pm: **Femtosecond laser irradiation of dielectric materials containing randomly arranged nano-defects**, Anton Rudenko, Jean-Philippe Colombier, Tatiana E. Itina, Lab. Hubert Curien (France) . . . . . [9737-20]

5:30 pm: **Pulsed laser deposition of ultrasmall nanoparticles: Transformation into photosensitive black-TiO<sub>2</sub> core-shell nanostructures**, David B. Geohegan, Masoud Mahjouri-Samani, Oak Ridge National Lab. (USA); Mengkun Tian, The Univ. of Tennessee (USA); Gerd Duscher, The Univ. of Tennessee Knoxville (USA); Gyula Eres, Alexander A. Puzos, Christopher M. Rouleau, Mina Yoon, Oak Ridge National Lab. (USA) . . . . . [9737-21]

5:50 pm: **Fabrication and bandgap engineering of doped ZnO microspheres by simple laser ablation in air**, Daisuke Nakamura, Tetsuya Shimogaki, Toshinobu Tanaka, Fumiaki Nagasaki, Yuki Fujiwara, Mitsuhiro Higashihata, Tatsuo Okada, Kyushu Univ. (Japan) . . . . . [9735-36]

# CONFERENCE 9738

LOCATION: ROOM 304 (SOUTH ESPLANADE)  
AND ROOM 123 (NORTH EXHIBIT LEVEL)

Monday–Thursday 15–18 February 2016 • Proceedings of SPIE Vol. 9738

## Laser 3D Manufacturing III

Conference Chairs: **Bo Gu**, Bos Photonics (USA); **Henry Helvajian**, The Aerospace Corp. (USA); **Alberto Piqué**, U.S. Naval Research Lab. (USA)

Program Committee: **John T. Fourkas**, Univ. of Maryland, College Park (USA); **Youping Gao**, Aerojet Rocketdyne (USA); **Craig Goldberg**, Newport Corp. (USA); **Weidong Huang**, Northwestern Polytechnical Univ. (China); **Jian Liu**, PolarOnyx, Inc. (USA); **Michael Thiel**, Nanoscribe GmbH (Germany); **Paul S. Unwin**, Stanmore Implants (United Kingdom); **Augustine M. Urbas**, Air Force Research Lab. (USA); **Martin Wegener**, Karlsruher Institut für Technologie (Germany)

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### MONDAY 15 FEBRUARY

#### SESSION 1

LOCATION: RM 304 (SOUTH ESPLANADE) . . . . . MON 1:10 TO 3:30 PM

#### Laser 3D Micro/Nano Structuring

Joint Session with Conferences 9735 and 9738

Session Chair: **Henry Helvajian**, The Aerospace Corp. (USA)

1:10 pm: **3D photonic and opto-fluidic devices** (*Invited Paper*), Ajoy K. Kar, Heriot-Watt Univ. (United Kingdom) . . . . . [9735-9]

1:50 pm: **Femtosecond laser fabricated electrofluidic devices in glass for 3D manipulation of biological samples**, Jian Xu, Katsumi Midorikawa, Koji Sugioka, RIKEN (Japan) . . . . . [9735-10]

2:10 pm: **Improvement in contact resistance of 4H-SiC by excimer laser doping using silicon nitride films**, Ryota Kojima, Kyushu Univ. (Japan) [9738-1]

2:30 pm: **A cantilever based optical fiber acoustic sensor fabricated by femtosecond laser micromachining**, Jie Liu, Lei Yuan, Clemson Univ. (USA); Jie Huang, Missouri Univ. of Science and Technology (USA); Hai Xiao, Clemson Univ. (USA) . . . . . [9738-2]

2:50 pm: **Photo-direct machining of polydimethylsiloxane using laser plasma EUV sources**, Tetsuya Makimura, Hikari Urai, Univ. of Tsukuba (Japan); Daisuke Nakamura, Akihiko Takahashi, Kyushu Univ. (Japan); Hiroyuki Niino, National Institute of Advanced Industrial Science and Technology (Japan); Tatsuo Okada, Kyushu Univ. (Japan) . . . . . [9735-11]

3:10 pm: **Laser-assisted morphing of complex three dimensional objects**, Yves Bellouard, Jakub Drs, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9735-12]

Coffee Break . . . . . Mon 3:30 pm to 4:00 pm

#### SESSION 2

LOCATION: RM 304 (SOUTH ESPLANADE) . . . . . MON 4:00 TO 5:30 PM

#### Laser Direct Writing

Joint Session with Conferences 9735 and 9738

Session Chair: **Costas P. Grigoropoulos**, Univ. of California, Berkeley (USA)

4:00 pm: **Laser-assisted inkjet printing of highly viscous fluids with sub-nozzle resolution**, Paul Delrot, Miguel A. Modestino, Demetri Psaltis, Christophe Moser, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9738-3]

4:20 pm: **Laser induced forward transfer: a novel tool for printing sensors and characterizing surface wetting properties**, Ioanna Zergioti, National Technical Univ. of Athens (Greece) . . . . . [9735-13]

4:40 pm: **Laser-printing and femtosecond laser-structuring of electrode materials for the manufacturing of 3D lithium-ion micro-batteries** (*Invited Paper*), Johannes Pröll, Karlsruher Institut für Technologie (Germany); Heungsoo Kim, U.S. Naval Research Lab. (USA); Yijing Zheng, Peter Smyrek, Hans J. Seifert, Karlsruher Institut für Technologie (Germany); Alberto Piqué, U.S. Naval Research Lab. (USA); Wilhelm Pfleging, Karlsruher Institut für Technologie (Germany) . . . . . [9738-4]

5:10 pm: **Green microfabrication for flexible electronics by laser direct synthesis and patterning technology**, Ming-Tsang Lee, National Chung Hsing Univ. (Taiwan) . . . . . [9735-14]

### TUESDAY 16 FEBRUARY

#### SESSION 3

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) . TUE 8:00 TO 10:00 AM

**NOTE ROOM CHANGE**

#### 3D Laser Structuring Devices and Lithography I

Joint Session with Conferences 9738 and 9759

Session Chair: **Stephen M. Kuebler**, Univ. of Central Florida (USA)

8:00 am: **Photonics walking up a human hair** (*Invited Paper*), Diederik S. Wiersma, Hao Zeng, Camilla Parmeggiani, Daniele Martella, Matteo Burrelli, European Lab. for Non-linear Spectroscopy (Italy); Piotr Wasylczyk, Univ. of Warsaw (Poland) . . . . . [9759-32]

8:30 am: **Complex micro-optics fabricated by femtosecond 3D direct laser writing** (*Invited Paper*), Harald Giessen, Univ. Stuttgart (Germany) . . . . . [9759-33]

9:00 am: **Study of 3D printing method for GRIN micro-optics devices**, Pei-Jen Wang, Jer-Liang A. Yeh, National Tsing Hua Univ. (Taiwan); Yuan-Chieh Cheng, Instrument Technology Research Ctr. (Taiwan); Rong-Jie Chang, National Tsing Hua Univ. (Taiwan) . . . . . [9759-34]

9:20 am: **Beam-bending in spatially variant photonic crystals at telecommunications wavelengths**, Rashi Sharma, Univ. of Central Florida (USA); Jennifer L. Digaum, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Daniel Batista, Univ. of Central Florida (USA); Javier J. Pazos, Raymond C. Rumpf, The Univ. of Texas at El Paso (USA); Stephen M. Kuebler, Univ. of Central Florida (USA) . . . . . [9759-35]

9:40 am: **Realization of photonic quantum simulators with direct laser writing**, Christina Joerg, Technische Univ. Kaiserslautern (Germany); Fabian Letscher, Technische Univ. Kaiserslautern (Germany) and Exzellenz-Graduiertenschule "Materials Science in Mainz" (MAINZ) (Germany); Michael Fleischhauer, Technische Univ. Kaiserslautern (Germany); Georg von Freymann, Technische Univ. Kaiserslautern (Germany) and Fraunhofer-Institut für Physikalische Messtechnik (Germany) . . . . . [9759-36]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

#### SESSION 4

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) . TUE 10:30 AM TO 12:00 PM

#### 3D Laser Structuring Devices and Lithography II

Joint Session with Conferences 9738 and 9759

Session Chair: **Georg von Freymann**, Technische Univ. Kaiserslautern (Germany)

10:30 am: **Hybrid integration approaches for functional nanophotonic circuits** (*Invited Paper*), Wolfram Pernice, Westfälische Wilhelms-Univ. Münster (Germany) . . . . . [9759-38]

11:00 am: **STED lithography for applications in biology**, Richard Wollhofen, Johannes Kepler Univ. Linz (Austria); Jaroslav Jacak, Johannes Kepler Univ. Linz (Austria) and Fachhochschule Oberösterreich (Austria); Thomas A. Klar, Johannes Kepler Univ. Linz (Austria) . . . . . [9759-39]

11:20 am: **3D SLM-based STED-lithography**, Julian Hering, Erik H. Waller, Technische Univ. Kaiserslautern (Germany); Georg von Freymann, Technische Univ. Kaiserslautern (Germany) and Fraunhofer-Institut für Physikalische Messtechnik (Germany) . . . . . [9759-40]

LASE

# CONFERENCE 9738

LOCATION: RM 123 (NORTH EXHIBIT LEVEL)

11:40 am: **Multi-photon lithography of 3D micro-structures in As<sub>2</sub>S<sub>3</sub> and Ge<sub>5</sub>(As<sub>2</sub>Se<sub>3</sub>)<sub>95</sub> chalcogenide glasses.** Casey M. Schwarz, Shreya Labh, Jayk E. Barker, Ryan J. Sapia, Gerald D. Richardson III, Univ. of Central Florida (USA); Clara Rivero-Baleine, Lockheed Martin Missiles and Fire Control (USA); Kathleen A. Richardson, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Alexej Pogrebnjakov, Theresa S. Mayer, The Pennsylvania State Univ. (USA); Stephen M. Kuebler, Univ. of Central Florida (USA) . . . . . [9759-41]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:30 pm

## SESSION 5

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) . . . TUE 1:30 TO 3:00 PM

### 3D Laser Structuring Devices and Lithography III

Joint Session with Conferences 9738 and 9759

Session Chair: **Winston V. Schoenfeld**, CREOL,  
The College of Optics and Photonics, Univ. of Central Florida (USA)

1:30 pm: **Cloaked contact fingers on solar cells enabled by 3D laser lithography** (*Invited Paper*), Martin F. Schumann, Karlsruhe Institut für Technologie (Germany); Samuel Wiesendanger, Friedrich-Schiller-Univ. Jena (Germany); Jan Christoph Goldschmidt, Benedikt Bläsi, Fraunhofer-Institut für Solare Energiesysteme (Germany); Karsten Bittkau, Ulrich W. Paetzold, Forschungszentrum Jülich GmbH (Germany); Alexander N. Sprafke, Martin-Luther Univ. Halle-Wittenberg (Germany); Ralf B. Wehrspohn, Martin-Luther Univ. Halle-Wittenberg (Germany) and Fraunhofer-Institut für Werkstoffmechanik (Germany); Carsten Rockstuhl, Martin Wegener, Karlsruhe Institut für Technologie (Germany) . . . . . [9738-5]

2:00 pm: **Fabrication of metamaterial-based infrared perfect absorber structures using direct laser write lithography**, Ihar Fanyaeu, Vygantas Mizeikis, Shizuoka Univ. (Japan) . . . . . [9759-42]

2:20 pm: **Precise 3D printing of micro/nanostructures using highly conductive carbon nanotube-acrylate composites**, Ying Liu, Wei Xiong, Li Jia Jiang, Yunshen Zhou, Yongfeng Lu, Univ. of Nebraska-Lincoln (USA) . . [9738-6]

2:40 pm: **Potential for GPC-based laser direct writing**, Silvia Saldaña Cercós, Technical Univ. of Denmark (Denmark); Andrew R. Bañas, OptoRobotix ApS (Denmark); Jesper Glückstad, Technical Univ. of Denmark (Denmark) . . [9738-7]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

## SESSION 6

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) . . . TUE 3:30 TO 5:40 PM

### 3D Laser Structuring Devices and Lithography IV

Joint Session with Conferences 9738 and 9759

Session Chair: **Michael Thiel**, Nanoscribe GmbH (Germany)

3:30 pm: **3D light robotics** (*Invited Paper*), Jesper Glückstad, Technical Univ. of Denmark (Denmark) . . . . . [9738-8]

4:00 pm: **3D direct laser writing of metal structures for novel optical applications** (*Invited Paper*), Michael G. Moebius, SeungYeon Kang, Kevin Vora, Philip A. Muñoz, Yang Li, Guoliang Deng, Eric Mazur, Harvard School of Engineering and Applied Sciences (USA) . . . . . [9759-43]

4:30 pm: **Manufacturing of functional micro/nano structures by fs-laser microfabrication**, Cleber R. Mendonça, Nathália B. Tomazio, Franciele Henrique, Adriano J. G. Otuka, Juliana M. P. Almeida, Instituto de Física de São Carlos (Brazil); Carla R. Fontana, Univ. Estadual Paulista "Júlio de Mesquita Filho" (Brazil) . . . . . [9738-9]

4:50 pm: **Femtosecond laser direct-write of lab-in-fiber sensors through polymer-coated optical fiber**, Kevin A. J. Joseph, Moez Haque, Stewart J. Aitchison, Peter R. Herman, Univ. of Toronto (Canada) . . . . . [9759-44]

5:10 pm: **Advanced two-photon photolithography for patterning of transparent, electrically conductive ionic liquid-polymer nanostructures** (*Invited Paper*), Natalia A. Bakhtina, Neil MacKinnon, Jan G. Korvink, Karlsruhe Institut für Technologie (Germany) . . . . . [9738-10]

## POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Experiments for practical education in process parameter optimization for selective laser sintering to increase workpiece quality**, Bernd Reutterer, Lukas Traxler, Natascha Bayer, Andreas Drauschke, Fachhochschule Technikum Wien (Austria) . . . . . [9738-38]

**Optically active acrylate/SWCNT composite microdevices produced by multi-photon polymerization**, Adriano Jose Galvani Otuka, Instituto de Física de São Carlos (Brazil); Gustavo F. Almeida, Cleber R. Mendonça, Univ. de São Paulo (Brazil) . . . . . [9738-41]

**Maskless lithography stage-shutter-free microfabrication based on serial area-controlled hologram**, Chenchu Zhang, Jingjing Zhang, Yanlei Hu, Jiawen Li, Zhaoxin Lao, Ze Cai, Dong Wu, Jiaru Chu, Univ. of Science and Technology of China (China) . . . . . [9738-42]

**Laser point cloud registration in object 3D reconstruction**, Da Liu, Beijing Institute of Control Engineering (China) . . . . . [9738-43]

**Improving accuracy of overhanging structures for selective laser melting through reliability characterization of single track formation on thick powder beds**, Sankhya Mohanty, Jesper H. Hattel, Technical Univ. of Denmark (Denmark) . . . . . [9738-44]

**Experimental study on Ti alloy plate fabrication by vacuum selective laser melting**, Yuji Sato, Masahiro Tsukamoto, Osaka Univ. (Japan); Yorihiro Yamashita, Industrial Research Institute of Ishikawa (Japan); Shinichiro Masuno, Nobuyuki Abe, Osaka Univ. (Japan) . . . . . [9738-45]



# CONFERENCE 9738

LOCATION: ROOM 301 (SOUTH ESPLANADE)

## WEDNESDAY 17 FEBRUARY

PANEL DISCUSSION..... WED 8:00 TO 10:00 AM

LOCATION: ROOM 103 (SOUTH EXHIBIT LEVEL)

### Industry Panel on 3D Printing: Outlook and Opportunities

Session Chair: **Bo Gu**, Bos Photonics (USA)

Market analysts valued the global 3D printing market at \$2.3B in 2013 and are projecting global revenues of \$8.6B by 2020—an impressive compound annual growth rate of more than 20% over seven years! At the same time, Siemens estimates that 3D printing will become 50% less expensive and 400% faster over the next five years.

However, 3D printing can only reach its economic potential and fulfill its promise of revolutionizing manufacturing across multiple industries if a number of significant real-world structural challenges are addressed. Hurdles to widespread implementation of 3D printing include implementation of a proper regulatory framework, provisions to protect intellectual property, and establishment of appropriate standards and certification, to name a few.

We will open our Laser 3D Printing Manufacturing conference with this industry panel discussion about these hurdles and how they might be overcome. Hear expert perspectives on 3D printing technology, cyber security, intellectual property, and other key elements to be addressed before the widespread adoption of 3D printing. Find out how industry leaders view the outlook for 3D printing and learn what they think needs to happen for digital manufacturing to go mainstream and fulfill its promise to create a broad range of new opportunities

8:00 to 8:15 am: **3D Printing Will Rock the World**

**John F. Hornick**, Partner Finnegan, Henderson, Farabow, Garrett & Dunner, LLP

8:15 to 8:25 am: **Smart Additive Manufacturing System (S-AMS) with Capability to Certify as you Build**

**Jyoti Mazumder**, Member of US National Academy of Engineering, Robert H Lurie Professor of Engineering, Professor of Mechanical Engineering, Professor of Materials Science and Engineering, Director, NSF Industry University Co-operative Research Center on Lasers and Plasmas in Advanced Manufacturing, University of Michigan

8:25 to 8:35 am: **3D Printing and the Future of Manufacturing**

**John D. Murray**, President and CEO, Concept Laser Inc.

8:35 to 8:45 am: **Cyber Security Concerns in 3D Printing**

**Rebecca R. Taylor**, Senior Vice President, National Center for Manufacturing Sciences (NCMS)

8:45 am: **Panel Discussion with Q&A to Follow**

*Moderated by* **Stephen G. Anderson**, Director, Industry Development, SPIE

Coffee Break.....Wed 10:00 am to 10:20 am

## LASE Plenary Session

WED 10:20 AM TO 12:30 PM

LOCATION: ROOM 103 (SOUTH EXHIBIT LEVEL)

10:20 am: **Welcome and Opening Remarks**

**Guido Hennig**, Daetwyler Graphics AG (Switzerland)  
**Yongfeng Lu**, Univ. of Nebraska-Lincoln (USA)

10:25 am: **Announcement of the Green Photonics Best Paper Award and the 3D Printing, Fabrication, and Manufacturing Best Paper Award**

**Stephen J. Eglash**, Energy and Environment Affiliates Program, Stanford Univ. (USA)  
**Henry Helvajian**, The Aerospace Corp. (USA)

10:30 am: **Emerging Applications of Photonic Crystal Fibers**

**Philip Russell**, Max-Planck Institute for the Science of Light (Germany) and Univ. of Erlangen-Nuremberg (Germany)

11:10 am: **Optical 3D Nano-fabrication: Drawing or Growing?**

**Satoshi Kawata**, Osaka Univ. (Japan) and RIKEN (Japan)

11:50 am: **High Power Semiconductor Lasers: Disrupting a Fragmented Industry**

**Scott Keeney**, nLight Corp. (USA)

Lunch/Exhibition Break.....Wed 12:30 pm to 2:00 pm

## SESSION 7

LOCATION: RM 301 (SOUTH ESPLANADE) ..... WED 2:00 TO 3:10 PM

### NOTE ROOM CHANGE

## Laser Induced Forward Transfer (LIFT)

Session Chair: **Craig Goldberg**, Newport Corp. (USA)

2:00 pm: **Laser induced forward transfer: A technique for 3D manufacturing of functional devices** (*Invited Paper*), Ioanna Zergioti, National Technical Univ. of Athens (Greece)..... [9738-11]

2:30 pm: **Laser printing of 3D metallic interconnects**, Alberto Piqué, Iyoel Beniam, Scott A Mathews, Nicholas A. Charipar, U.S. Naval Research Lab. (USA)..... [9738-12]

2:50 pm: **Characterization of transfer regimes of high-viscosity silver pastes printed by LIFT**, David Munoz-Martin, Univ. Politécnica de Madrid (Spain); C. Frederik Brasz, Princeton Univ. (USA); Chen Yu, Miguel Morales, Univ. Politécnica de Madrid (Spain); Craig B. Arnold, Princeton Univ. (USA); Carlos Molpeceres, Univ. Politécnica de Madrid (Spain)..... [9738-13]

Coffee Break.....Wed 3:10 pm to 3:40 pm

## SESSION 8

LOCATION: RM 301 (SOUTH ESPLANADE) ..... WED 3:40 TO 6:00 PM

## Materials, Processes, and Post-Printing Processes for Additive Manufacturing

Session Chair: **Henry Helvajian**, The Aerospace Corp. (USA)

3:40 pm: **3D manufacturing of micro and nano-architected materials** (*Invited Paper*), Lorenzo Valdevit, Univ. of California, Irvine (USA)..... [9738-14]

4:10 pm: **Aperiodic mechanical metamaterial: Bridging the gap between matter and machine** (*Invited Paper*), Corentin Coullais, Leiden Univ. (Netherlands)..... [9738-15]

4:40 pm: **The TEMPS facility for optical property metrology of materials at high temperatures: Goals and current status**, Sergey Mekhontsev, Weston L. Tew, Steven E. Grantham, Vladimir B. Khromchenko, Leonard M. Hanssen, National Institute of Standards and Technology (USA)..... [9738-16]

5:00 pm: **Electrochemistry and corrosion of multi-metal printed structures** (*Invited Paper*), Owen Hildreth, Arizona State Univ. (USA); Timothy W. Simpson, The Pennsylvania State Univ. (USA)..... [9738-17]

5:30 pm: **Laser powder injection additive manufacturing of novel alloys and composites** (*Invited Paper*), Baolong Zheng, Yizhang Zhou, Univ. of California, Irvine (USA); Nancy Y. C. Yang, Sandia National Labs. (USA); Enrique J. Lavernia, Julie M. Schoenung, Univ. of California, Irvine (USA)..... [9738-18]

LASE

# CONFERENCE 9738

LOCATION: ROOM 301 (SOUTH ESPLANADE)

THURSDAY 18 FEBRUARY

## SESSION 9

LOCATION: RM 301 (SOUTH ESPLANADE) . . . . THU 8:00 TO 10:10 AM

### Modeling, Design, Process Monitoring, and Controls for Additive Manufacturing

Session Chair: **Alberto Piqué**, U.S. Naval Research Lab. (USA)

8:00 am: **Modeling the metal additive manufacturing process at the scale of the part and the powder** (*Invited Paper*), Wayne King, Lawrence Livermore National Lab. (USA) . . . . . [9738-19]

8:30 am: **Towards in-situ process monitoring in selective laser sintering using optical coherence tomography**, Guangying Guan, The Univ. of Nottingham (United Kingdom); Zeng H. Lu, The Univ. of Sheffield (United Kingdom); Matthias Hirsch, The Univ. of Nottingham (United Kingdom); David T. D. Childs, Stephen J. Matcher, The Univ. of Sheffield (United Kingdom); Ruth Goodridge, Adam T. Clare, The Univ. of Nottingham (United Kingdom); Kristian M. Groom, The Univ. of Sheffield (United Kingdom) . . . . . [9738-20]

8:50 am: **Sensing for directed energy deposition and powder bed fusion additive manufacturing at Penn State University** (*Invited Paper*), Edward W. Reutzel, Abdalla R. Nassar, John P. Morgan Jr., Donald J. Natale, Sean D. Knecht, Richard L. Tutwiler, Applied Research Lab. (USA) . . . . . [9738-21]

9:20 am: **Optical design and initial results from NIST's AMMT/TEMPS Facility**, Steven E. Grantham, Brandon Lane, Jorge E. Neira, Sergey Mekhontsev, Mihaela Vlasea, Leonard M. Hanssen, National Institute of Standards and Technology (USA) . . . . . [9738-22]

9:40 am: **Photo-activated micro swimmers** (*Invited Paper*), Stefano Palagi, Max Planck Institute for Intelligent Systems (Germany); Andrew G. Mark, Max-Planck-Gesellschaft (Germany); Kai Melde, Tian Qiu, Max Planck Institute for Intelligent Systems (Germany); Hao Zeng, Camilla Parmeggiani, Daniele Martella, Diederik S. Wiersma, European Lab. for Non-linear Spectroscopy (Italy); Peer Fischer, Max Planck Institute for Intelligent Systems (Germany) . . . . . [9738-23]

Coffee Break . . . . . Thu 10:10 am to 10:40 am

## SESSION 10

LOCATION: RM 301 (SOUTH ESPLANADE) THU 10:40 AM TO 12:10 PM

### SLM, DMLS, SLS, SLM with Ultrafast Lasers

Session Chair: **Alberto Piqué**, U.S. Naval Research Lab. (USA)

10:40 am: **Femtosecond fiber laser additive manufacturing of tungsten** (*Invited Paper*), Jian Liu, Pei Yang, Baolong Zheng, Huan Huang, Shuang Bai, PolarOnyx, Inc. (USA); Lih-Mei Yang, PolarOnyx Laser Inc. (USA) . . . . . [9738-24]

11:10 am: **Femtosecond laser pulse induced rapid melting and resolidification of aluminum silicon powder for additive manufacturing**, Tobias Ullsperger, Gabor Matthäus, Markus Rettenmayr, Friedrich-Schiller-Universität Jena (Germany); Stefan Risse, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Andreas Tünnermann, Stefan Nolte, Friedrich-Schiller-Universität Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [9738-25]

11:30 am: **Laser post-processing of Inconel 625 made by selective laser melting**, David B. Witkin, William W. Hansen, Lee F. Steffeny, Henry Helvajian, David P. Taylor, The Aerospace Corp. (USA) . . . . . [9738-26]

11:50 am: **Fabrication and heat treatment of high strength Al-Cu-Mg alloy processed using selective laser melting**, Hu Zhang, Haihong Zhu, Xiaojia Nie, Ting Qi, Zhiheng Hu, Xiaoyan Zeng, Huazhong Univ. of Science and Technology (China) . . . . . [9738-27]

Lunch/Exhibition Break . . . . . Thu 12:10 pm to 1:10 pm

## SESSION 11

LOCATION: ROOM 301 (SOUTH ESPLANADE) THU 1:10 PM TO 2:50 PM

### Applications, Systems, Process Developments for Additive Manufacturing I

Session Chair: **Jian Liu**, PolarOnyx, Inc. (USA)

1:10 pm: **Additive manufacturing of glass for optical applications** (*Invited Paper*), Junjie Luo, Luke Gilbert, Douglas A. Bristow, Robert G. Landers, Missouri Univ. of Science and Technology (USA); Jonathan T. Goldstein, Augustine M. Urbas, Air Force Research Lab. (USA); Edward C. Kinzel, Missouri Univ. of Science and Technology (USA) . . . . . [9738-28]

1:40 pm: **Reducing residual stresses and deformations in selective laser melting through multilevel multiscale optimization of cellular scanning strategy**, Sankhya Mohanty, Jesper H. Hattel, Technical Univ. of Denmark (Denmark) . . . . . [9738-29]

2:00 pm: **Application of laser ultrasonic non-destructive evaluation technique to additive manufacturing**, Henry Helvajian, Anthony J. Manzo, Shant Kenderian, The Aerospace Corp. (USA) . . . . . [9738-30]

2:20 pm: **Repurposing mainstream CNC machine tools for laser-based additive manufacturing** (*Invited Paper*), Jason B. Jones, Hybrid Manufacturing Technologies (USA) . . . . . [9738-31]

Coffee Break . . . . . Thu 2:50 pm to 3:20 pm

## SESSION 12

LOCATION: RM 301 (SOUTH ESPLANADE) . . . . THU 3:20 TO 5:40 PM

### Applications, Systems, Process Developments for Additive Manufacturing II

Session Chair: **Bo Gu**, Bos Photonics (USA)

3:20 pm: **Femtosecond laser written microresonators and nanophotonic circuitry** (*Invited Paper*), Robert A. Norwood, Khanh Q. Kieu, Gregory A. Cohoon, College of Optical Sciences, The Univ. of Arizona (USA); Babak Amirsolaimani, Soha Namnabat, Jeff Pyun, The Univ. of Arizona (USA) [9738-32]

3:50 pm: **Inkjet printed 3D micro- and nano-structures for Phased Array Antenna** (*Invited Paper*), Peter M. Grubb, The Univ. of Texas at Austin (USA); Harish Subbaraman, Omega Optics, Inc. (USA); Ray T. Chen, The Univ. of Texas at Austin (USA) . . . . . [9738-34]

4:20 pm: **Improving resolution of periodic patterns with three-color photolithography**, Zuleykhan Tomova, John T. Fourkas, Univ. of Maryland, College Park (USA) . . . . . [9738-35]

4:40 pm: **Continuous liquid interface production (CLIP)** (*Invited Paper*), John Tumbleston, Carbon3D, Inc. (USA) . . . . . [9738-36]

5:10 pm: **The application of digital medical 3D printing technology on tumor operation** (*Invited Paper*), Jimin Chen, Beijing Univ. of Technology (China) . . . . . [9738-37]

# CONFERENCE 9739

LOCATION: ROOM 303 (SOUTH ESPLANADE)

Monday–Tuesday 15–16 February 2016 • Proceedings of SPIE Vol. 9739

# Free-Space Laser Communication and Atmospheric Propagation XXVIII

Conference Chairs: **Hamid Hemmati**, Facebook Inc. (USA); **Don M. Boroson**, MIT Lincoln Lab. (USA)

Program Committee: **Abhijit Biswas**, Jet Propulsion Lab. (USA); **Donald M. Cornwell Jr.**, NASA Goddard Space Flight Ctr. (USA); **Olga Korotkova**, Univ. of Miami (USA); **William S. Rabinovich**, U.S. Naval Research Lab. (USA); **Zoran Sodnik**, European Space Research and Technology Ctr. (Netherlands); **Morio Toyoshima**, National Institute of Information and Communications Technology (Japan)

## MONDAY 15 FEBRUARY

### WELCOMING REMARKS

LOCATION: ROOM 303 (SOUTH ESPLANADE) .. 8:30 AM TO 8:40 AM

Conference Chairs: **Hamid Hemmati**, Facebook Inc. (USA);  
**Don M. Boroson**, MIT Lincoln Lab. (USA)

### SESSION 1

LOCATION: RM 303 (SOUTH ESPLANADE) .. MON 8:40 TO 10:20 AM

## Flight Demonstrations and Measurements I

Session Chair: **Hamid Hemmati**, Facebook Inc. (USA)

8:40 am: **Alphasat-Sentinel-1A optical inter-satellite links: Run-up for the European data relay satellite system**, Daniel Troendle, Patricia Martin Pimentel, Christoph Rochow, Herwig Zech, Gerd Muehlnikel, Frank F. Heine, Tesat-Spacecom GmbH & Co. KG (Germany); Rolf Meyer, Sabine D. Philipp-May, Michael Lutzer, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Edoardo Benzi, Philippe Sivad, Silvia Mezzasoma, Harald Hauschildt, Mike Krassenburg, European Space Research and Technology Ctr. (Netherlands); Ian Shurmer, European Space Research and Technology Ctr. (Germany) ..... [9739-1]

9:00 am: **In-orbit verification of small optical transponder (SOTA) evaluation of satellite-to-ground laser communication links (Invited Paper)**, Hideki Takenaka, Yoshisada Koyama, Maki Akioka, Dimitar Kolev, Naohiko Iwakiri, Yasushi Munemasa, National Institute of Information and Communications Technology (Japan); Eiji Okamoto, Nagoya Institute of Technology (Japan); Morio Toyoshima, National Institute of Information and Communications Technology (Japan) ..... [9739-2]

9:30 am: **LEO-to-ground optical communications link using adaptive optics correction on the OPALS downlink (Invited Paper)**, Malcolm W. Wright, Joseph M. Kovalik, Jet Propulsion Lab. (USA); Jeff Morris, The Boeing Co. (USA); Matthew Abrahamson, Abhijit Biswas, Jet Propulsion Lab. (USA) [9739-3]

10:00 am: **Implementation and validation of a CubeSat laser transmitter**, Ryan W. Kingsbury, Massachusetts Institute of Technology (USA); David O. Caplan, MIT Lincoln Lab. (USA); Kerri L. Cahoy, Massachusetts Institute of Technology (USA) ..... [9739-4]

Coffee Break ..... Mon 10:20 am to 10:50 am

### SESSION 2

LOCATION: RM 303 (SOUTH ESPLANADE) .. MON 10:50 AM TO 12:20 PM

## Flight Demonstrations and Measurements II

Session Chair: **Don M. Boroson**, MIT Lincoln Lab. (USA)

10:50 am: **The Tesat transportable adaptive optical ground station**, Karen Saucke, Frank F. Heine, Mark Gregory, Daniel Troendle, Christoph Seiter, Tesat-Spacecom GmbH & Co. KG (Germany); Edgar Fischer, Thomas Berkefeld, Mikael Feriencik, Marco Feriencik, Synopta GmbH (Switzerland); Ines Richter, Rolf Meyer, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) ..... [9739-5]

11:10 am: **Laser downlink demonstration from a 1.5U CubeSat**, Todd S. Rose, Richard P. Welle, Darren W. Rowen, Siegfried W. Janson, Stephen D. LaLumondiere, Nicolette I. Werner, The Aerospace Corp. (USA) ..... [9739-6]

11:30 am: **The Lunar Laser Communication Demonstration time-of-flight measurement system: overview, on-orbit performance and ranging analysis**, Mark L. Stevens, Ronald R. Parenti, Matthew M. Willis, Joseph A. Greco, Farzana I. Khatri, Bryan S. Robinson, Don M. Boroson, MIT Lincoln Lab. (USA) ..... [9739-7]

11:50 am: **Telecom & Scintillation first data analysis for DOMINO: Laser Communication between SOTA, onboard SOCRATES satellite, and MEO Optical Ground Station (Invited Paper)**, Duy-Ha Phung, Observatoire de la Côte d'Azur (France) ..... [9739-8]

Lunch Break ..... Mon 12:20 pm to 1:50 pm

### SESSION 3

LOCATION: RM 303 (SOUTH ESPLANADE) ..... MON 1:50 TO 3:10 PM

## Proposed New Systems

Session Chair: **Bryan S. Robinson**, MIT Lincoln Lab. (USA)

1:50 pm: **A new approach for delivering extremely large volumes of data from LEO to ground**, Bryan S. Robinson, Curt M. Schieler, Don M. Boroson, MIT Lincoln Lab. (USA) ..... [9739-9]

2:10 pm: **Overview of Ground Station 1 supporting the NASA Laser Communications Relay Demonstration Project**, William T. Roberts, Jet Propulsion Lab. (USA) and California Institute of Technology (USA); Sabino Piazzolla, Thang Trinh, Vachik Garkanian, Lewis C. Roberts, Malcolm W. Wright, Ryan Rogalin, Janet P. Wu, Loren P. Clare, Arvid P. Croonquist, Jet Propulsion Lab. (USA) ..... [9739-10]

2:30 pm: **Laser communication relay demonstration**, Eduard Y. Luzhanskiy, David Israel, Bernard Edwards, NASA Goddard Space Flight Ctr. (USA) ..... [9739-11]

2:50 pm: **Overview of optical data relay system in JAXA (Invited Paper)**, Yoshikazu Chishiki, Shiro Yamakawa, Yutaka Takano, Yuko Miyamoto, Tomohiro Araki, Hiroki Kohata, Japan Aerospace Exploration Agency (Japan) ..... [9739-12]

Coffee Break ..... Mon 3:10 pm to 3:40 pm

### SESSION 4

LOCATION: RM 303 (SOUTH ESPLANADE) ... MON 3:40 TO 4:40 PM

## Beam Control

Session Chair: **Zoran Sodnik**,  
European Space Research and Technology Ctr. (Netherlands)

3:40 pm: **Adaptive optics for high data rate satellite to ground laser link**, Nicolas Vedrenne, Jean-Marc Conan, Cyril Petit, Vincent Michau, ONERA (France) ..... [9739-13]

4:00 pm: **Multi-spots with MEMS deformable mirrors for laser guide star in astronomy**, Franck Marchis, Iris AO, Inc. (USA) and SETI Institute (USA); Romain Fetick, SETI Institute (USA); Daniel Asoubar, Christian Hellman, LightTrans International UG (Germany); Thierry Fusco, ONERA (France) ..... [9739-14]

4:20 pm: **Two-axis gimbal for stratospheric air-to-air and air-to-ground laser communication**, Amnon G. Talmor, Facebook, Inc. (USA) ..... [9739-15]

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# CONFERENCE 9739

LOCATION: ROOM 303 (SOUTH ESPLANADE)

## SESSION 5

LOCATION: RM 303 (SOUTH ESPLANADE) ... MON 4:40 TO 5:40 PM

### Underwater Communications

Session Chair: **Abhijit Biswas**, Jet Propulsion Lab. (USA)

4:40 pm: **A burst-mode photon-counting receiver with automatic channel estimation and bit rate detection**, Hemonth G. Rao, Catherine DeVoe, Andrew S. Fletcher, Igor Gaschits, Farhad Hakimi, Scott A. Hamilton, Nicholas D. Hardy, John Ingwersen, Rich D. Kaminsky, John D. Moores, Marvin S. Scheinbart, Timothy M. Yarnall, MIT Lincoln Lab. (USA) ..... [9739-16]

5:00 pm: **Propagation modeling results for narrow-beam undersea laser communications**, Andrew S. Fletcher, Nicholas D. Hardy, Scott A. Hamilton, MIT Lincoln Lab. (USA) ..... [9739-17]

5:20 pm: **Free-space optical communications using encoding of data on different orbital-angular-momentum modes**, Asher J. Willner, Yongxiong Ren, Guodong Xie, Long Li, Yinwen Cao, Zhe Zhao, Peicheng Liao, Zhe Wang, Yan Yan, Nisar Ahmed, Cong Liu, The Univ. of Southern California (USA); Moshe Tur, Tel Aviv Univ. (Israel); Alan E. Willner, The Univ. of Southern California (USA) ..... [9739-43]

## TUESDAY 16 FEBRUARY

## SESSION 6

LOCATION: RM 303 (SOUTH ESPLANADE) ... TUE 8:40 TO 10:00 AM

### Systems Engineering I: Analysis and Demos

Session Chair: **Hamid Hemmati**, Facebook Inc. (USA)

8:40 am: **Innovative free space optical communication and navigation system with high data rate communication, precision ranging, rang rate measurements, and accurate spacecraft pointing**, Guangning Yang, NASA Goddard Space Flight Ctr. (USA) ..... [9739-18]

9:00 am: **Gigabit per second modulation and transmission of a partially coherent beam through laboratory turbulence**, Anatoly Efimov, Los Alamos National Lab. (USA) ..... [9739-19]

9:20 am: **Characterization of modems and error correcting protocols using a scintillation playback system**, William S. Rabinovich, Rita Mahon, Mike S. Ferraro, James L. Murphy, Christopher I. Moore, U.S. Naval Research Lab. (USA) ..... [9739-20]

9:40 am: **Demonstration of lasercom and spatial tracking in the near infra red with a silicon Geiger-mode APD array**, Timothy M. Yarnall, MIT Lincoln Lab. (USA); Benjamin W. Horkley, MIT Lincoln Lab. (USA) and Massachusetts Institute of Technology (USA); Ajay S. Garg, Scott A. Hamilton, MIT Lincoln Lab. (USA) ..... [9739-21]

Coffee Break ..... Tue 10:00 am to 10:30 am

## SESSION 7

LOCATION: RM 303 (SOUTH ESPLANADE) ... TUE 10:30 TO 11:30 AM

### Systems Engineering II: Analysis

Session Chair: **Don M. Boroson**, MIT Lincoln Lab. (USA)

10:30 am: **Optical links sizing for future broadband geostationary satellite feeder**, Sylvain Poulenard, Airbus Defence and Space SAS (France); Jean-Marc Conan, ONERA (France); Bernard Roy, Airbus Defence and Space SAS (France); Angélique Rissons, Institut Supérieur de l'Aéronautique et de l'Espace (France) ..... [9739-22]

10:50 am: **Architectural and operational considerations emerging from hybrid RF-optical network loading simulations**, Yijiang Chen, Douglas S. Abraham, David P. Heckman, Andrew Kwok, Bruce E. MacNeal, Kristy Tran, Janet P. Wu, Jet Propulsion Lab. (USA) ..... [9739-23]

11:10 am: **Deep space laser communications**, Abhijit Biswas, Joseph M. Kovalik, Meera Srinivasan, Malcolm W. Wright, William H. Farr, Jet Propulsion Lab. (USA) ..... [9739-24]

Lunch/Exhibition Break ..... Tue 11:30 am to 1:00 pm

## SESSION 8

LOCATION: RM 303 (SOUTH ESPLANADE) ..... TUE 1:00 TO 2:00 PM

### Receivers I: Devices

Session Chair: **Bryan S. Robinson**, MIT Lincoln Lab. (USA)

1:00 pm: **Two dimensional thermo-optic beam steering using a silicon photonic optical phased array**, Rita Mahon, William S. Rabinovich, Peter G. Goetz, Marcel W. Preussner, Mike S. Ferraro, James L. Murphy, U.S. Naval Research Lab. (USA) ..... [9739-25]

1:20 pm: **Impact ionization engineered avalanche photodiode arrays for free space optical communication**, Mike S. Ferraro, William S. Rabinovich, Rita Mahon, U.S. Naval Research Lab. (USA) ..... [9739-26]

1:40 pm: **Novel photon counting detectors for free space communication**, Michael A. Krainak, Guangning Yang, Xiaoli Sun, NASA Goddard Space Flight Ctr. (USA); Wei Lu, ASRC Federal Space and Defense (USA); Scott Merritt, NASA Goddard Space Flight Ctr. (USA); Jeff Beck, DRS Technologies, Inc. (USA) ..... [9739-27]

## SESSION 9

LOCATION: RM 303 (SOUTH ESPLANADE) ..... TUE 2:00 TO 3:00 PM

### Transmitters

Session Chair: **Abhijit Biswas**, Jet Propulsion Lab. (USA)

2:00 pm: **AlGaInN laser diode technology for free-space and plastic optical fibre telecom applications**, Stephen P. Najda, Piotr Perlin, Tadek Suski, Lucja Marona, Michal Bockowski, Mike Leszczynski, Przemek Wisniewski, Robert Czernecki, TopGaN Ltd. (Poland); Robert Kucharski, Ammono S.A. (Poland); Scott Watson, Anthony E. Kelly, Univ. of Glasgow (United Kingdom); Malcolm A. Watson, Paul M. Blanchard, Henry J. White, BAE Systems (United Kingdom) ..... [9739-28]

2:20 pm: **Development, testing and initial space qualification of 1.5- $\mu$ m, high-power (6W), pulse-position-modulated (PPM) fiber laser transmitter for deep-space laser communication**, Shantanu Gupta, Doruk Engin, Dave Pachowicz, Jean-Luc Fouron, Juan Lander, Xung Dang, Slava Litvinovich, Ti Chuang, Kent Puffenberger, Frank Kimpel, Rich Utano, Fibertek, Inc. (USA); Malcolm W. Wright, Jet Propulsion Lab. (USA) ..... [9739-29]

2:40 pm: **WDM laser transmitters for mobile free-space laser communications**, David O. Caplan, Robert T. Schulein, Mark L. Stevens, MIT Lincoln Lab. (USA); Steven J. Spector, Draper Lab. (USA) ..... [9739-30]

Coffee Break ..... Tue 3:00 pm to 3:30 pm

## SESSION 10

LOCATION: RM 303 (SOUTH ESPLANADE) ..... TUE 3:30 TO 4:10 PM

### Receivers II: Architectures and Algorithms

Session Chair: **Zoran Sodnik**, European Space Research and Technology Ctr. (Netherlands)

3:30 pm: **Photon counting detector array algorithms for deep space optical communications**, Meera Srinivasan, Kenneth S. Andrews, William H. Farr, Andre Wong, Jet Propulsion Lab. (USA) ..... [9739-31]

3:50 pm: **Experimental demonstration of multi-aperture digital coherent combining for next-generation optical communication receivers**, David J. Geisler, Timothy M. Yarnall, Curt M. Shieler, Mark L. Stevens, Bryan S. Robinson, MIT Lincoln Lab. (USA) ..... [9739-32]



# CONFERENCE 9739

LOCATION: ROOM 303 (SOUTH ESPLANADE)

SESSION 11  
LOCATION: RM 303 (SOUTH ESPLANADE) . . . . . TUE 4:10 TO 5:30 PM

## Quantum Communications

Session Chair: **Don M. Boroson**, MIT Lincoln Lab. (USA)

- 4:10 pm: **An adaptation method to improve secret key rates of time-frequency QKD in atmospheric turbulence channels**, Xiaole Sun, Ivan B. Djordjevic, Mark A. Neifeld, The Univ. of Arizona (USA) . . . . . [9739-33]
- 4:30 pm: **Ultimate capacity of linear time-invariant bosonic channels with additive Gaussian noise**, Bhaskar Roy Bardhan, Jeffrey H. Shapiro, Massachusetts Institute of Technology (USA) . . . . . [9739-34]
- 4:50 pm: **Advanced techniques for free-space optical quantum cryptography over water**, Alexander D. Hill, Bradley G. Christensen, Paul G. Kwiat, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9739-35]
- 5:10 pm: **SuperDense teleportation for space applications**, Chris Zeidler, Trent Graham, Univ. of Illinois at Urbana-Champaign (USA); Herbert Bernstein, Hampshire College (USA); Paul G. Kwiat, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9739-36]

## POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

- Fiber coupling and field mixing of coherent free-space optical beams in satellite communications**, Juraj Poliak, Dirk Giggenbach, Ahmad Mustafa, Ramon Mata Calvo, Dominik Bok, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [9739-37]
- Propagation properties of quantized Laguerre-Gaussian beams in atmospheric turbulence**, Aya Saito, Japan Women's Univ. (Japan) . . [9739-38]
- Generation of multiple optical frequencies referenced to a frequency comb for precision free-space frequency transfer**, Young-Jin Kim, Byung Jae Chun, Nanyang Technological Univ. (Singapore) . . . . . [9739-39]
- Investigation of algorithm discretization error in a zonal wavefront estimation process**, Biswajit Pathak, Bosanta R. Boruah, Indian Institute of Technology Guwahati (India) . . . . . [9739-40]
- Performance evaluation of packet delivery ratio (PDR) for FSO link**, Syed J. Hussain, Abir Touati, Farid Touati, Qatar Univ. (Qatar) . . . . . [9739-41]
- Prediction accuracy of various models for angle-of-arrival fluctuations**, Omer Porat, Joseph Shapira, Soreq Nuclear Research Ctr. (Israel) . . . [9739-42]
- Digital coherent receiver technique for onboard receiver of future optical data relay system**, Tomohiro Araki, Yuta Kobayashi, Japan Aerospace Exploration Agency (Japan); Toshiharu Ito, Manabu Arikawa, Arihide Noda, Norifumi Kamiya, Yoichi Hashimoto, NEC Corp. (Japan) . . . . . [9739-44]

**Laser Communications**  
7:30 PM TO 9:00 PM  
LOCATION: INTERCONTINENTAL HOTEL, FREMONT  
Session Chairs: **Hamid Hemmati**, Facebook Inc. (USA);  
**Don Boroson**, MIT Lincoln Lab. (USA)

This technical event on Laser Communications will hold its informal annual meeting in conjunction with the Free-Space Laser Communication and Atmospheric Propagation conference. All professionals involved in theory and applications of free-space laser communications, remote sensing and supporting technologies are invited to participate in an open discussion on a variety of topics related to the challenges and advancement of the field. Attendees are invited to bring suggestions for discussion topics.



# CONFERENCE 9740

LOCATION: ROOM 2016 (WEST LEVEL 2)

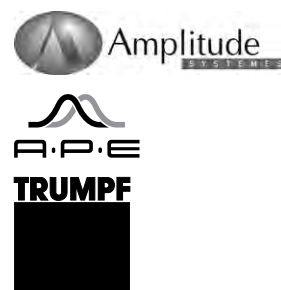
Sunday–Tuesday 14–16 February 2016 • Proceedings of SPIE Vol. 9740

# Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XVI

Conference Chairs: **Alexander Heisterkamp**, Leibniz Univ. Hannover (Germany); **Peter R. Herman**, Univ. of Toronto (Canada); **Michel Meunier**, Ecole Polytechnique de Montréal (Canada); **Stefan Nolte**, Friedrich-Schiller-Univ. Jena (Germany)

Program Committee: **Craig B. Arnold**, Princeton Univ. (USA); **Denise M. Krol**, Univ. of California, Davis (USA); **Yves Bellouard**, Ecole Polytechnique Fédérale de Lausanne (Switzerland); **Eric Mazur**, Harvard Univ. (USA); **Eric P. Mottay**, Amplitude Systèmes (France); **Beat Neuenschwander**, Berner Fachhochschule Technik und Informatik (Switzerland); **Roberto Osellame**, CNR-Istituto di Fotonica e Nanotecnologie (Italy); **Christopher B. Schaffer**, Cornell Univ. (USA); **Koji Sugioka**, RIKEN (Japan); **Alfred Vogel**, Univ. zu Lübeck (Germany); **Sascha Weiler**, TRUMPF Inc. (USA); **Dvir Yelin**, Technion-Israel Institute of Technology (Israel)

COSPONSORS:



## SUNDAY 14 FEBRUARY

### SESSION 1

LOCATION: ROOM 2016 (WEST LEVEL 2) . SUN 8:30 AM TO 10:00 AM

### Cellular Manipulation Using Ultrashort Laser

Session Chair: **Alexander Heisterkamp**,  
Leibniz Univ. Hannover (Germany)

8:30 am: **SERS spectroscopy, electrical recording and intracellular injection in neuronal networks with 3D plasmonic nanoantennas** (*Invited Paper*), Michele Dipalo, Gabriele C. Messina, Rosanna La Rocca, Victoria Shalabaeva, Pierfrancesco Zilio, Francesco De Angelis, Istituto Italiano di Tecnologia (Italy) . . . . . [9740-1]

9:00 am: **Comparing physical mechanisms of ultrafast laser-induced nanocavitation for in- and off-resonance plasmonic nanoparticles**, Michel Meunier, Adrien Dagallier, Remi Lachaine, Christos Boutopoulos, Étienne Boulais, Ecole Polytechnique de Montréal (Canada) . . . . . [9740-2]

9:20 am: **Plasmonic substrates for high-throughput intracellular delivery**, Nabih Saklayen, Harvard Univ. (USA); Marinus Huber, Ludwig-Maximilians-Univ. München (Germany); Marina Madrid, Daryl I. Vulis, Harvard Univ. (USA); Weilu Shen, Rensselaer Polytechnic Institute (USA); Valeria Nuzzo, ECE Paris (France); Eric Mazur, Harvard Univ. (USA) . . . . . [9740-3]

9:40 am: **Polarization-dependend nanocavitation in plasmonic nanobowties enhanced femtosecond laser generation of nanobubbles**, Christos Boutopoulos, Adrien Dagallier, Maria Sansone, Évelyne Lecavalier-Hurtubise, André-Pierre Blanchard-Dionne, Ecole Polytechnique de Montréal (Canada); Ali Hatef, Nipissing Univ. (Canada); Michel Meunier, Ecole Polytechnique de Montréal (Canada) . . . . . [9740-4]  
Coffee Break . . . . . Sun 10:00 am to 10:30 am

### SESSION 2

LOCATION: ROOM 2016 (WEST LEVEL 2) . SUN 10:30 AM TO 12:40 PM

### New Technologies

Session Chair: **Francesco De Angelis**,  
Istituto Italiano di Tecnologia (Italy)

10:30 am: **Illuminate the bone marrow with nonlinear optics** (*Invited Paper*), Charles P. Lin, Massachusetts General Hospital and Harvard Medical School (USA) . . . . . [9740-5]

11:00 am: **High-precision 3D printing for biomedical applications**, Ruth Houbertz, Multiphoton Optics GmbH (Germany); Soenke Steenhusen, Kerstin Obel, Herbert Wolter, Fraunhofer-Institut für Silicattforschung (Germany); Joachim Nickel, Heike Walles, Universitätsklinikum Würzburg (Germany) . . . . . [9740-6]

11:20 am: **Femtosecond laser direct writing of silver microwire in hydrogel**, Mitsuhiro Terakawa, Keio Univ. (Japan); Maria Leilani Y. Torres-Mapa, Leibniz Univ. Hannover (Germany); Dag Heinemann, Anton Hördt, Laser Zentrum Hannover e.V. (Germany); Yasutaka Nakajima, Keio Univ. (Japan); Nikolay N. Nedyalkov, Bulgarian Academy of Sciences (Bulgaria); Heiko Meyer, Tammo Ripken, Laser Zentrum Hannover e.V. (Germany); Alexander Heisterkamp, Leibniz Univ. Hannover (Germany) and Laser Zentrum Hannover e.V. (Germany) . . . . . [9740-7]

11:40 am: **Improved image reconstruction methods for non-line-of-sight imaging**, Jessica Zeman, Kevin Eliceiri, Andreas Velten, Univ. of Wisconsin-Madison (USA) . . . . . [9740-8]

12:00 pm: **High-speed arbitrary phase and amplitude femtosecond pulse shaping with a digital micromirror device**, Yina Chang, Chenglin Gu, Dapeng Zhang, Shih-Chi Chen, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . [9740-9]

12:20 pm: **Engineering 3D cell culture matrices by means of multiphoton processing**, Peter M. Gruber, M. Markovic, K. Hoelzl, M. Tromayer, Jürgen Stampfl, Robert Liska, Aleksandr Ovsianikov, Technische Univ. Wien (Austria) . . . . . [9740-56]

Lunch Break . . . . . Sun 12:40 pm to 2:00 pm

### SESSION 3

LOCATION: ROOM 2016 (WEST LEVEL 2) . . . SUN 2:00 PM TO 3:30 PM

### Techniques and Laser Systems for Nonlinear Imaging

Session Chair: **Charles P. Lin**, Harvard Univ. (USA)

2:00 pm: **Temporal focusing: Principles and applications** (*Invited Paper*), Ben Leshem, Weizmann Institute of Science (Israel) . . . . . [9740-10]

2:30 pm: **New class of compact diode pumped sub 10-fs lasers for biomedical applications**, Tuan Le, FEMTOLASERS Produktions GmbH (Austria); Ole B. Jensen, Technical Univ. of Denmark (Denmark); André Müller, Bernd Sumpf, Ferdinand-Braun-Institut (Germany); Angelika Unterhuber, Medizinische Univ. Wien (Austria); Peter E. Andersen, Technical Univ. of Denmark (Denmark) . . . . . [9740-11]

2:50 pm: **Single-pulse coherent anti-Stokes Raman spectroscopy via fiber Bragg grating**, Seung Ryeol Oh, KAIST (Korea, Republic of); Joo Hyun Park, Korea Research Institute of Standards and Science (Korea, Republic of); Won Sik Kwon, Jin Hwan Kim, Kyung-Soo Kim, KAIST (Korea, Republic of); Jae Yong Lee, KRISS (Korea, Republic of); Soohyun Kim, KAIST (Korea, Republic of) . . . . . [9740-12]

3:10 pm: **Completely all-fibered ytterbium fiber chirped pulse amplifier for nonlinear microscopy**, Alma Fernández, Aart Verhoef, Medizinische Univ. Wien (Austria) and Technische Univ. Wien (Austria); Marco Andreana, Medizinische Univ. Wien (Austria); Martin Distel, St. Anna Kinderkrebsforschung e.V. (Austria); Kim G. Jespersen, Thomas V. Andersen, NKT Photonics A/S (Denmark); Lingxiao Zhu, Univ. Wien (Austria) and Technische Univ. Wien (Austria); Tobias Flöry, Andrius Baltuska, Technische Univ. Wien (Austria); Wolfgang Drexler, Angelika Unterhuber, Medizinische Univ. Wien (Austria) . . . . . [9740-13]

Coffee Break . . . . . Sun 3:30 pm to 4:00 pm

# CONFERENCE 9740

LOCATION: ROOM 2016 (WEST LEVEL 2) AND ROOM 305 (SOUTH ESPLANADE)

## SESSION 4

LOCATION: ROOM 2016 (WEST LEVEL 2) . . . SUN 4:00 PM TO 5:20 PM

### Characterization and Measurement

Session Chair: **Michel Meunier**,  
Ecole Polytechnique de Montréal (Canada)

- 4:00 pm: **Measuring spatiotemporal intensity-and-phase complexity of multimode fiber output pulses**, Zhe Guang, Michelle Rhodes, Rick Trebino, Georgia Institute of Technology (USA) . . . . . [9740-16]
- 4:20 pm: **Experimental and analysis considerations for transmission/reflection spectrograms used in ultrafast x-ray pulse diagnostics**, Daniel J. Kane, Mesa Photonics, LLC (USA); Nick Hartmann, Ryan N. Coffee, Alan R. Fry, SLAC National Accelerator Lab. (USA) . . . . . [9740-17]
- 4:40 pm: **The effect of pulse duration, energy deposited and pulse energy on the formation of nanogratings**, Yves Bellouard, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9740-54]
- 5:00 pm: **Effects of polarization and absorption on laser induced optical breakdown threshold for skin rejuvenation**, Babu Varghese, Valentina Bonito, Simona Turco, Rieko Verhagen, Philips Research (Netherlands) . . . . . [9740-57]

## MONDAY 15 FEBRUARY

### SESSION 5

LOCATION: ROOM 305 (SOUTH ESPLANADE) . MON 8:00 TO 10:10 AM

**NOTE ROOM CHANGE**

### Novel Processing for Advanced Devices

Session Chair: **Stefan Nolte**, Friedrich-Schiller-Univ. Jena (Germany)

- 8:00 am: **Integrating additive and subtractive processes in 3D nanofabrication (Invited Paper)**, Yongfeng Lu, Wei Xiong, Ying Liu, Yunshen Zhou, Univ. of Nebraska-Lincoln (USA); Lan Jiang, Beijing Institute of Technology (China); Tommaso Baldacchini, Newport Corp. (USA); Jean-Francois Silvain, Institut de Chimie de la Matière Condensée de Bordeaux (France) . . . . . [9740-18]
- 8:30 am: **Advanced optic fabrication using ultrafast laser radiation**, Lauren L. Taylor, Rochester Institute of Technology (USA); Jun Qiao, Rochester Institute of Technology (USA) and Univ. of Science and Technology Liaoning (China); Jie Qiao, Rochester Institute of Technology (USA) . . . . . [9740-19]
- 8:50 am: **All optical fiber polarization controlling devices fabricated by femtosecond laser irradiation**, Lei Yuan, Baokai Cheng, Jie Liu, Clemson Univ. (USA); Jie Huang, Missouri Univ. of Science and Technology (USA); Hai Xiao, Clemson Univ. (USA) . . . . . [9740-20]
- 9:10 am: **Direct writing of fiber optic components in photonic crystal fibers and other specialty fibers**, Luis Andre Fernandes, Omur Sezerman, Garland Best, Mi Li Ng, Saidou Kane, OZ Optics Ltd. (Canada) . . . . . [9740-21]
- 9:30 am: **Fabrication of homogeneously emitting optical fiber diffusers using fs-laser ablation**, Johannes Gratt, Matthias Domke, FH Vorarlberg (Austria); Ronald Sroka, Laser-Forschungslabor (Germany) . . . . . [9740-22]
- 9:50 am: **Progress on femtosecond laser-based system-materials: three-dimensional monolithic electrostatic micro-actuator for optomechanics**, Tao Yang, Yves Bellouard, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9740-23]
- Coffee Break . . . . . Mon 10:10 am to 10:40 am

## SESSION 6

LOCATION: RM 305 (SOUTH ESPLANADE) . . MON 10:40 AM TO 12:00 PM

### Novel Laser Sources

Session Chair: **Eric P. Mottay**, Amplitude Systèmes (France)

- 10:40 am: **Ultrabroadband parametric oscillator with ultrafast tuning speed**, Thomas Binhammer, VENTÉON Laser Technologies GmbH (Germany); Yuliya Khanukaeva, Tino Lang, Leibniz Univ. Hannover (Germany); Alex Pape, Laser Quantum GmbH (Germany); Hauke Bensch, Leibniz Univ. Hannover (Germany) and Laser Quantum GmbH (Germany); Jan Ahrens, Oliver Prochnow, Laser Quantum GmbH (Germany); Uwe Morgner, Leibniz Univ. Hannover (Germany) . . . . . [9740-24]
- 11:00 am: **Development of a kilowatt-class, joule-level ultrafast laser for driving compact high average power coherent EUV / soft x-ray sources**, Brendan Reagan, XUV Lasers (USA) and Colorado State Univ. (USA); Cory Baumgarten, Michael Pedicone, Colorado State Univ. (USA); Herman Bravo, XUV Lasers (USA); Liang Yin, Colorado State Univ. (USA); Mark Woolston, XUV Lasers (USA) and Colorado State Univ. (USA); Hanchen Wang, Colorado State Univ. (USA); Carmen S. Menoni, XUV Lasers (USA) and Colorado State Univ. (USA); Jorge Rocca, Colorado State Univ. (USA) and XUV Lasers (USA) . . . . . [9740-25]
- 11:20 am: **High power and high energy femtosecond lasers based on hybrid architectures**, Clemens Hönninger, Julien Pouysegur, Birgit Weichelt, Martin Delaigue, Guillaume Machinet, Franck Morin, Florent Guichard, Yoann Zauoter, Amplitude Systèmes (France); Marc Hanna, Frédéric Duiron, Patrick Georges, Lab. Charles Fabry (France); Eric Mottay, Amplitude Systèmes (France) [9740-26]
- 11:40 am: **Non infrared femto lasers: Status and prospects**, Max Kahmann, TRUMPF GmbH & Co. KG (Germany) . . . . . [9740-27]
- Lunch Break . . . . . Mon 12:00 pm to 1:00 pm

## SESSION 7

LOCATION: RM 305 (SOUTH ESPLANADE) . . . . MON 1:00 TO 3:10 PM

### Internal Processing of Transparent Materials

Session Chair: **Arnold Gillner**,  
Fraunhofer-Institut für Lasertechnik (Germany)

- 1:00 pm: **Ultrafast laser micro- and nanoprocessing of dielectrics with Bessel beams (Invited Paper)**, François Courvoisier, Rémi Meyer, Ludovic Rapp, Ismail Quadghiri Idrissi, Remo Giust, Pierre-Ambroise Lacourt, Luc Froehly, Luca Fufaro, Maxime Jacquot, John M. Dudley, FEMTO-ST (France) . . . . . [9740-28]
- 1:30 pm: **Glass processing using ultrashort laser pulses: free carrier dynamics and the role of different decay channels**, Klaus Bergner, Friedrich-Schiller-Univ. Jena (Germany); Malte Kumkar, TRUMPF Laser- und Systemtechnik GmbH (Germany); Andreas Tünnermann, Friedrich-Schiller-Univ. Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Stefan Nolte, Friedrich-Schiller-Univ. Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [9740-29]
- 1:50 pm: **Dash line glass- and sapphire-cutting with high power USP laser**, John Lopez, Univ. Bordeaux 1 (France) . . . . . [9740-30]
- 2:10 pm: **Controlling ultrafast laser filamentation with spatial light modulator**, Erden Ertorer, Ehsan Alimohammadian, Dale Gottlieb, Jianzhao Li, Peter Herman, Univ. of Toronto (Canada) . . . . . [9740-31]
- 2:30 pm: **Pulse front control with adaptive optics**, Patrick S. Salter, Bangshan Sun, Martin J. Booth, Univ. of Oxford (United Kingdom) . . . . . [9740-32]
- 2:50 pm: **Femtosecond lasers for machining of transparent, brittle materials: Ablative vs. non-ablative femtosecond laser processing**, Victor V. Matyilitsky, Frank Hendricks, Spectra-Physics (Austria) . . . . . [9740-33]
- Coffee Break . . . . . Mon 3:10 pm to 3:40 pm

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# CONFERENCE 9740

LOCATION: ROOMS 304 AND 305 (SOUTH ESPLANADE)

## SESSION 8

LOCATION: RM 305 (SOUTH ESPLANADE) ... MON 3:40 TO 6:00 PM

### Ultrashort Pulse Laser Processing

Session Chair: **François Courvoisier**, FEMTO-ST (France)

3:40 pm: **High power parallel ultrashort pulse laser processing** (*Invited Paper*), Arnold Gillner, M. Jüngst, Patrick Gretzki, Martin Reininghaus, Fraunhofer-Institute for Laser Technology (Germany) ..... [9740-34]

4:10 pm: **Ultrafast laser drilling of injector nozzles**, Eric P. Mottay, Amélie Letan, Clemens Hönninger, Amplitude Systèmes (France); Patrick Thibaut, Posalux SA (Switzerland) ..... [9740-35]

4:30 pm: **Analysis of the hole shape evolution in fs-pulse percussion drilling with bursts**, Helena Kämmer, Felix Dreisow, Andreas Tünnermann, Stefan Nolte, Friedrich-Schiller-Univ. Jena (Germany) ..... [9740-36]

4:50 pm: **Laser processes and analytics for high power 3D battery materials** (*Invited Paper*), Wilhelm Pfefing, Peter Smyrek, Karlsruhe Institute of Technology (Germany) and Karlsruhe Nano Micro Facility (Germany); Melanie Mangang, Yijing Zheng, Karlsruhe Institute of Technology (Germany); Johannes Pröll, Karlsruhe Institute of Technology (Germany) and Karlsruhe Nano Micro Facility (Germany) ..... [9740-37]

5:20 pm: **Ultrafast pulse lasers jump to industrial macro applications**, Martin Griebel, JENOPTIK Automatisierungstechnik GmbH (Germany). [9740-38]

5:40 pm: **Picosecond and fs lasers for industrial material processing**, Roland M. Mayerhofer, Jürgen Serbin, Fred-Walter Deeg, Rofin-Baasel Lasertechnik GmbH & Co. KG (Germany). [9740-39]

## TUESDAY 16 FEBRUARY

### SESSION 9

LOCATION: RM 304 (SOUTH ESPLANADE) ... TUE 8:00 TO 10:10 AM

**NOTE ROOM CHANGE**

### Dynamics of Laser Ablation I

Joint Session with Conferences 9735 and 9740

Session Chair: **Peter R. Herman**, Univ. of Toronto (Canada)

8:00 am: **Towards a more complete understanding of laser ablation with ultrashort pulses: Mechanisms of confined laser ablation and pulse duration dependence of laser ablation efficiency** (*Invited Paper*), Heinz P. Huber, Jan Winter, Juergen Sotrop, Regina Moser, Stephan Rapp, Rudolph Reiel, Hochschule für Angewandte Wissenschaften München (Germany); Matthias Domke, FH Vorarlberg (Austria) ..... [9735-15]

8:30 am: **Engineering model for ultrafast laser microprocessing**, Eric P. Mottay, Eric Audouard, Pierre Couplier, Amplitude Systèmes (France) ..... [9740-40]

8:50 am: **Ablation of silicon with bursts of femtosecond laser pulses**, Caterina Gaudiuso, Univ. degli Studi di Bari Aldo Moro (Italy) and Istituto di Fotonica e Nanotecnologie (Italy); Helena Kämmer, Felix Dreisow, Friedrich-Schiller-Univ. Jena (Germany); Antonio Ancona, CNR-Istituto di Fotonica e Nanotecnologie (Italy); Andreas Tünnermann, Stefan Nolte, Friedrich-Schiller-Univ. Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany). [9740-41]

9:10 am: **Laser energy deposition at the surface of dielectrics exposed to single 15-fs laser pulse**, Corinne Pasquier, Marc L. Sentis, Olivier P. Utéza, Nicolas Sanner, Lasers, Plasmas et Procédés Photoniques (France) and Aix-Marseille Univ. (France) ..... [9735-16]

9:30 am: **Laser damage experiments at 10 fs in air**, Olivier P. Utéza, Corinne Pasquier, Raphaël Clady, Nicolas Sanner, Marc L. Sentis, Lasers, Plasmas et Procédés Photoniques (France) ..... [9735-17]

9:50 am: **Laser ablation of borosilicate glass with high power shaped UV nanosecond laser pulses**, Philipp von Witzendorff, Andrea Bordin, Laser Zentrum Hannover e.V. (Germany); Rajesh S. Patel, James M. Bovatsek, Spectra-Physics® (USA); Oliver Suttman, Ludger Overmeyer, Laser Zentrum Hannover e.V. (Germany) ..... [9735-18]

Coffee Break ..... Tue 10:10 am to 10:40 am

## SESSION 10

LOCATION: RM 304 (SOUTH ESPLANADE) TUE 10:40 AM TO 12:10 PM

### Dynamics of Laser Ablation II

Joint Session with Conferences 9735 and 9740

Session Chair: **Alexandre Mermillod-Blondin**, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany)

10:40 am: **Ab-initio molecular dynamics simulation of nonthermal structural phenomena in laser excited solids** (*Invited Paper*), Martin E. Garcia, Tobias Zier, Bernd Bauerhenne, Eeuwe S. Zijlstra, Univ. Kassel (Germany) ..... [9735-19]

11:10 am: **Ultrafast laser-induced complex refractive index changes in metals measured by pump-probe ellipsometry**, Stephan Rapp, Albert Althammer, Max Bung, Heinz P. Huber, Hochschule für Angewandte Wissenschaften München (Germany) ..... [9735-20]

11:30 am: **Numerical study of the influence of picosecond laser spot size on ablated depth and threshold fluence of metal**, Yiming Zhang, Berner Fachhochschule Technik und Informatik (Switzerland) and Univ. Bern (Switzerland); Benjamin Lauer, Beat Neuenschwander, Valerio Romano, Berner Fachhochschule Technik und Informatik (Switzerland) ..... [9735-21]

11:50 am: **Investigation of the breaking strength of ultrashort pulse laser diced thin Si wafers**, Matthias Domke, Bernadette Egle, FH Vorarlberg (Austria); Gernot Fasching, Marius Bodea, Elisabeth Schwarz, Infineon Technologies Austria AG (Austria). [9740-42]

Lunch/Exhibition Break ..... Tue 12:10 pm to 1:40 pm

## SESSION 11

LOCATION: RM 304 (SOUTH ESPLANADE) ..... TUE 1:40 TO 3:10 PM

### Machining of Transparent Materials I

Joint Session with Conferences 9735 and 9740

Session Chair: **Heinz P. Huber**, Hochschule für Angewandte Wissenschaften München (Germany)

1:40 pm: **Ultrashort-pulse laser processing of transparent materials: Insight from numerical and semi-analytical models** (*Invited Paper*), Nadezhda M. Bulgakova, HiLASE Ctr. (Czech Republic) and Institute of Thermophysics (Russian Federation); Vladimir P. Zhukov, Institute of Computational Technologies (Russian Federation) and Novosibirsk State Technical Univ. (Russian Federation); Yuri P. Meshcheryakov, Institute of Hydrodynamics (Russian Federation); Tomáš Mocek, HiLASE Ctr. (Czech Republic) ... [9735-22]

2:10 pm: **Influence of plasma-induced self-effects on surface ablation of glass using fs-laser pulses**, Javier Hernandez Rueda, Univ. of California, Davis (USA); Jasper Clarijs, Univ. of California, Davis (USA) and Utrecht Univ. (Netherlands); Jan Siegel, Javier Solis, Instituto de Óptica "Daza de Valdés" (Spain) and Consejo Superior de Investigaciones Científicas (Spain); Hao Zhang, Dries van Oosten, Utrecht Univ. (Netherlands); Denise M. Krol, Univ. of California, Davis (USA) ..... [9740-43]

2:30 pm: **Fundamental investigations of ultrashort-pulse micromachining of different types of crystalline lithium niobate**, Mareike Stolze, Thomas Herrmann, Johannes A. L'huillier, Photonik-Zentrum Kaiserslautern e.V. (Germany) ..... [9735-23]

2:50 pm: **Time resolved study of femtosecond laser induced micro-modifications inside transparent brittle materials**, Frank Hendricks, Victor V. Matyitsky, Spectra-Physics (Austria); Matthias Domke, FH Vorarlberg (Austria); Heinz P. Huber, Munich Univ. of Applied Sciences (Germany) ..... [9740-44]

Coffee Break ..... Tue 3:10 pm to 3:40 pm



# CONFERENCE 9740

LOCATION: RM 304 (SOUTH ESPLANADE)

WEDNESDAY 17 FEBRUARY

## Best Student Paper Competition and Awards Ceremony

2:00 PM TO 4:20 PM

LOCATION: ROOM 274 (SOUTH MEZZANINE)

COMPETITION ..... 2:00 pm to 3:30 pm

JUDGING ..... 3:30 pm to 4:00 pm

AWARD CEREMONY ..... 4:00 pm to 4:20 pm

We are pleased to announce that a cash prize will be awarded to the best student presentation in this conference (both poster and oral papers considered).

Papers submitted and presented by graduate and undergraduate students are eligible. In order to ensure a fair evaluation, the conference chairs and the program committee will judge the students during a special student competition session held during the conference. Here the students present a brief 5-minute summary of their original talk or poster presented at the conference.

Following the student competition, the judges will meet and decide on the winner. The winner and runner-up will be announced during the award ceremony and awarded a cash prize. In order to claim your cash prize, a manuscript must be submitted to the conference proceedings.

LASE

## SESSION 12

LOCATION: RM 304 (SOUTH ESPLANADE) . . . . TUE 3:40 TO 5:50 PM

### Machining of Transparent Materials II

Joint Session with Conferences 9735 and 9740

Session Chair: **Nadezhda M. Bulgakova**, HiLASE Ctr. (Czech Republic), Institute of Thermophysics (Russian Federation)

3:40 pm: **Few-cycle pulses for bulk microprocessing of fused silica** (*Invited Paper*), Alexandre Mermillod-Blondin, Benjamin Klessen, Federico J. A. Furch, Marc J. J. Vrakking, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany) . . . . . [9740-45]

4:10 pm: **Probing temporal and spatial properties of electronic excitation in dielectrics after interaction with temporally shaped femtosecond laser pulses: experiments and simulations**, Thomas Winkler, Univ. Kassel (Germany); Lasse Haahr-Lillevang, Aarhus Univ. (Denmark); Cristian Sarpe-Tudoran, Nadine Götte, Bastian Zielinski, Nikolai Jelzow, Arne Senftleben, Thomas Baumert, Univ. Kassel (Germany) . . . . . [9740-46]

4:30 pm: **Plasma dynamics and spectroscopy during fs-laser fabrication of waveguides in glass**, Javier Hernandez Rueda, Univ. of California, Davis (USA); Dries van Oosten, Utrecht Univ. (Netherlands); Jonathan J. Witcher, Univ. of California, Davis (USA); Jasper Clarijs, Univ. of California, Davis (USA) and Utrecht Univ. (Netherlands); Denise M. Krol, Univ. of California, Davis (USA) . . . . . [9740-47]

4:50 pm: **Ultrafast laser processing of transparent materials supported by in-situ diagnostics**, Malte Kumkar, Myriam Kaiser, Jonas Kleiner, TRUMPF Laser- und Systemtechnik GmbH (Germany); Daniel Grossmann, TRUMPF Laser- und Systemtechnik GmbH (Germany) and RWTH Aachen Univ. (Germany); Daniel Flamm, TRUMPF Laser- und Systemtechnik GmbH (Germany); Klaus Bergner, Stefan Nolte, Friedrich-Schiller-Univ. Jena (Germany) . . . . . [9735-24]

5:10 pm: **Laser filamentation of glass and other transparent, brittle materials: Fundamentals and applications**, Roland M. Mayerhofer, Rofin-Baasel Lasertechnik GmbH & Co. KG (Germany); Abbas S. Hosseini, ROFIN-Sinar, Inc. (USA) . . . . . [9735-25]

5:30 pm: **Investigation of the micro-mechanical properties of femtosecond laser-induced phases in amorphous silica matrix**, Christos E. Athanasiou, Yves Bellouard, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9740-48]

## POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**The influence of femtosecond laser wavelength on waveguide fabrication inside glasses**, Javier Hernandez Rueda, Jasper Clarijs, Univ. of California, Davis (USA); Charmayne E. Smith, Richard K. Brow, Missouri Univ. of Science and Technology (USA); Denise M. Krol, Univ. of California, Davis (USA) [9740-49]

**Pulsewidth dependence of laser-induced periodic surface structure formed on yttria-stabilized zirconia polycrystal**, Masayuki Kakehata, Hidehiko Yashiro, National Institute of Advanced Industrial Science and Technology (Japan); Ayako Oyane, Nanosystem Research Institute (Japan) and National Institute of Advanced Industrial Science and Technology (Japan); Atsuo Ito, Health Research Ctr., AIST (Japan); Kenji Torizuka, Electronics and Photonics Research Institute (Japan) and National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [9740-50]

**Femtosecond laser waveguide writing in zinc magnesium phosphate glasses**, Nikolay Skovorodnikov, Javier Hernandez Rueda, Vladimir A. Semenov, Denise M. Krol, Univ. of California, Davis (USA) . . . . . [9740-51]

**Studying ultrafast laser parameters to deter self-focusing for deep tissue ablation**, Christopher Martin, Murat Yildirim, Adela Ben-Yakar, The Univ. of Texas at Austin (USA) . . . . . [9740-52]

**Analysis of human hairs and nails by femtosecond laser-induced breakdown spectroscopy**, Sergey S. Golik, Alexey A. Ilyin, Tamara M. Agapova, Michael Y. Babiy, Yuliya S. Biryukova, Alexander Y. Mayor, Nataliya N. Golik, Far Eastern Federal Univ. (Russian Federation) . . . . . [9740-53]

**Femtosecond laser-triggered rupture of biodegradable polymer capsules containing fluorescent molecules**, Kazumasa Ariyasu, Mitsuhiro Terakawa, Keio Univ. (Japan) . . . . . [9740-55]

# CONFERENCE 9741

LOCATION: ROOM 133 (NORTH EXHIBIT LEVEL) AND ROOM 306 (SOUTH ESPLANADE)

Tuesday–Thursday 16–18 February 2016 • Proceedings of SPIE Vol. 9741

# High-Power Laser Materials Processing: Lasers, Beam Delivery, Diagnostics, and Applications V

Conference Chairs: **Friedhelm Dorsch**, TRUMPF Laser- und Systemtechnik GmbH (Germany); **Stefan Kaierle**, Laser Zentrum Hannover e.V. (Germany)

Program Committee: **Bo Gu**, Bos Photonics (USA); **Stefan W. Heinemann**, TRUMPF Photonics (USA); **Klaus R. Kleine**, Coherent, Inc. (USA); **Annett Klotzbach**, Fraunhofer IWS Dresden (Germany); **Wolfgang Knapp**, Cooperation Laser Franco-Allemande (France); **Lin Li**, The Univ. of Manchester (United Kingdom); **Silke Pflueger**, DirectPhotonics, Inc. (USA); **Stephan Roth**, BLZ Bayerisches Laserzentrum GmbH (Germany); **Leonardo D. Scintilla**, Politecnico di Bari (Italy); **Kunihiko Washio**, Paradigm Laser Research Ltd. (Japan)

## TUESDAY 16 FEBRUARY

### SESSION 1

LOCATION: ROOM 133 (NORTH EXHIBIT LEVEL) TUE 1:40 TO 3:00 PM

### Beam Shaping I

Joint Session with Conferences 9727 and 9741

Session Chair: **Lutz Aschke**,  
TRUMPF Laser- und Systemtechnik GmbH (Germany)

1:40 pm: **Gauss to top-hat beam shaping with aspheres**, Anna Möhl, Sven Wickenhagen, Ulrike Fuchs, asphericon GmbH (Germany) . . . . . [9741-1]

2:00 pm: **Field mappers for laser material processing**, Paul Blair, Matthew O. Currie, Natalia Trela, Howard J. Baker, Eoin Murphy, Duncan Walker, Roy McBride, PowerPhotonic Ltd. (United Kingdom) . [9727-27]

2:20 pm: **Novel specialty fiber delivering flat-top beams with on-demand beam parameter product**, Clémence Jollivet, Kevin F. Farley, Michael Conroy, Jaroslav Abramczyk, Nufem (USA); Steffen Belke, Frank Becker, ROFIN-SINAR Laser GmbH (Germany); Kanishka Tankala, Nufem (USA) . . . . . [9727-28]

2:40 pm: **Real time M<sup>2</sup> and beam parameter product measurement using GigE CMOS sensors**, Michael J. Scaggs, Gilbert J. Haas, Haas Laser Technologies, Inc. (USA) . . . . . [9727-29]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

### SESSION 2

LOCATION: RM 133 (NORTH EXHIBIT LEVEL) . . . TUE 3:30 TO 5:10 PM

### Beam Shaping II

Joint Session with Conferences 9727 and 9741

Session Chair: **Lutz Aschke**,  
TRUMPF Laser- und Systemtechnik GmbH (Germany)

3:30 pm: **Monolithic fiber coupler for high power diode laser bars**, Jens Meinschien, Thomas Mitra, Klaus Bagschik, LIMO Lissotschenko Mikrooptik GmbH (Germany) . . . . . [9727-30]

3:50 pm: **Flexible assembly module for beam-shaping product families based on support structures**, Sebastian Haag, Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Olaf Ruebenach, INGENERIC GmbH (Germany); Andreas Beleke, Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Tobias Haverkamp, INGENERIC GmbH (Germany); Tobias Müller, Daniel Zontar, Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Christian Wenzel, Innolite GmbH (Germany) and Fraunhofer-Institut für Produktionstechnologie IPT (Germany); Christian Brecher, Fraunhofer-Institut für Produktionstechnologie IPT (Germany) . . . . . [9727-31]

4:10 pm: **Industrial fiber beam delivery system for ultrafast lasers: Applications and recent advances**, Max C. Funck, Björn Wedel, Sebastian Eilzer, PT Photonic Tools GmbH (Germany) . . . . . [9741-2]

4:30 pm: **Monocrystalline CVD-diamond optics for high-power laser applications**, Carlo Holly, RWTH Aachen Univ. (Germany); Martin Traub, Hans-Dieter Hoffmann, Fraunhofer-Institut für Lasertechnik (Germany); Claudia Widmann, Dietmar Brink, Christoph Nebel, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); Titus Gotthardt, Muharrem Ceyhan Sözbir, Christian Wenzel, Fraunhofer-Institut für Produktionstechnologie (Germany) . . . . . [9741-4]

4:50 pm: **Computing specific intensity distributions for laser material processing by solving an inverse heat conduction problem**, Annika Völl, RWTH Aachen Univ. (Germany); Jochen Stollenwerk, RWTH Aachen Univ. (Germany) and Fraunhofer-Institut für Lasertechnik (Germany); Peter Loosen, Fraunhofer-Institut für Lasertechnik (Germany) and RWTH Aachen Univ. (Germany) . . . . . [9741-5]

### POSTERS-TUESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . TUE 6:00 TO 8:00 PM

Conference attendees are invited to attend the LASE poster session on Tuesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Analysis of weld seam uniformity through temperature distribution by spatially resolved detector elements in the wavelength range of 0.3µm to 5µm for the detection of structural changing heating and cooling processes**, Benjamin Lempe, Christopher Taudt, Tobias Baselt, Peter Hartmann, Westsächsische Hochschule Zwickau (Germany) and Fraunhofer IWS Dresden (Germany) . . . . . [9741-28]

## WEDNESDAY 17 FEBRUARY

### SESSION 3

LOCATION: RM 306 (SOUTH ESPLANADE) . . . WED 8:00 TO 9:50 AM

### NOTE ROOM CHANGE

### Cutting, Drilling, Structuring

Session Chair: **Wolfgang Knapp**,  
Cooperation Laser Franco-Allemande (France)

8:00 am: **The influence of scanning speed and number of scans on the properties of laser formed steel**, Kazeem O Sanusi, Stephen Akinlabi, Esther T Akinlabi, Univ. of Johannesburg (South Africa) . . . . . [9741-29]

8:20 am: **High precision and high aspect ratio laser drilling: Challenges and solutions (Invited Paper)**, Arnold Gillner, Fraunhofer-Institut für Lasertechnik (Germany) . . . . . [9741-6]

8:50 am: **Can fiber laser improve high speed multi-pulse drilling of aeronautic alloy?**, Charlie Ioumena, ALPhANOV (France) . . . . . [9741-7]

9:10 am: **Calibration of ultra high speed laser engraving processes by correlating influencing variables including correlative evaluation with SEM and CLSM**, Markus Bohrer, Dr. Bohrer Lasertec GmbH (Austria) . . . . . [9741-8]

# CONFERENCE 9741

LOCATION: ROOM 306 (SOUTH ESPLANADE)

9:30 am: **Industrial fiber-coupled laser system delivering ultrashort high-power pulses for micromachining**, Sebastian Pricking, Petra Welp, Raphael Gebbs, Robert Fleischhaker, Jochen Kleinbauer, Aleksander Budnicki, Dirk H. Sutter, Alexander Killi, TRUMPF Laser GmbH (Germany); Michael Mielke, TRUMPF Inc. (USA) . . . . . [9741-9]

Coffee Break . . . . . Wed 9:50 am to 10:20 am

## LASE Plenary Session

WED 10:20 AM TO 12:30 PM

LOCATION: ROOM 103 (SOUTH EXHIBIT LEVEL)

10:20 am: **Welcome and Opening Remarks**

**Guido Hennig**, Daetwyler Graphics AG (Switzerland)  
**Yongfeng Lu**, Univ. of Nebraska-Lincoln (USA)

10:25 am: **Announcement of the Green Photonics Best Paper Award and the 3D Printing, Fabrication, and Manufacturing Best Paper Award**

**Stephen J. Eglash**, Energy and Environment Affiliates Program, Stanford Univ. (USA)  
**Henry Helvajian**, The Aerospace Corp. (USA)

10:30 am: **Emerging Applications of Photonic Crystal Fibers**

**Philip Russell**, Max-Planck Institute for the Science of Light (Germany) and Univ. of Erlangen-Nuremberg (Germany)

11:10 am: **Optical 3D Nano-fabrication: Drawing or Growing?**

**Satoshi Kawata**, Osaka Univ. (Japan) and RIKEN (Japan)

11:50 am: **High Power Semiconductor Lasers: Disrupting a Fragmented Industry**

**Scott Keeney**, nLight Corp. (USA)

Lunch/Exhibition Break . . . . . Wed 12:30 pm to 2:00 pm

## SESSION 4

LOCATION: RM 306 (SOUTH ESPLANADE) . . . . WED 2:00 TO 3:20 PM

### Joining

Session Chair: **Klaus R. Kleine**, Coherent, Inc. (USA)

2:00 pm: **Simulation based analysis of laser beam brazing**, Michael Dobler, Lehrstuhl für Photonische Technologien (Germany) and Erlangen Graduate School in Advanced Optical Technologies (Germany); Philipp Wiethop, Daniel Schmid, AUDI AG (Germany); Michael Schmidt, Lehrstuhl für Photonische Technologien (Germany) and Erlangen Graduate School in Advanced Optical Technologies (Germany) . . . . . [9741-10]

2:20 pm: **Laser-based gluing of diamond-tipped saw blades**, Christian Hennigs, Rabi Lahdo, André Springer, Stefan Kaierle, Michael Hustedt, Laser Zentrum Hannover e.V. (Germany); Helmut Brand, Richard Wloka, Frank Zobel, Peter Dültgen, Institut für Werkzeugforschung und Werkstoffe (Germany) . . . . . [9741-11]

2:40 pm: **Laser welding of polymers: Phenomenological process model for a quick and reliable process quality estimation considering beam shape influences**, Nathalie F. Timpe, Julia Stuch, Ulrich A. Russek, Marcus Scholl, Rheinische Fachhochschule Köln (Germany) . . . . . [9741-12]

3:00 pm: **A review article: The mechanical properties and the microstructural behaviour of laser metal deposited Ti-6Al-4V and TiC composite**, Mutiu F. Erinosh, Esther T. Akinlabi, Univ. of Johannesburg (South Africa) . . . . . [9741-13]

Coffee Break . . . . . Wed 3:20 to 3:50 pm

## SESSION 5

LOCATION: RM 306 (SOUTH ESPLANADE) . WED 3:50 PM TO 5:50 PM

### Welding

Session Chair: **Stefan W. Heinemann**, TRUMPF Photonics (USA)

3:50 pm: **Strategies to prevent hot cracking during close edge laser welding**, Peter Stritt, Daniel Weller, Rudolf Weber, Thomas Graf, Univ. Stuttgart (Germany) . . . . . [9741-14]

4:10 pm: **High-power CW and long-pulse lasers in the green wavelength regime for copper welding**, Sebastian Pricking, Rudolf Huber, Konrad Klausmann, Elke Kaiser, Christian Stolzenburg, Alexander Killi, TRUMPF Laser GmbH (Germany) . . . . . [9741-15]

4:30 pm: **Monitoring of solidification crack propagation mechanism in pulsed laser welding of 6082 aluminum**, Philipp von Witzendorff, Stefan Kaierle, Oliver Suttmann, Laser Zentrum Hannover e.V. (Germany); Ludger Overmeyer, Leibniz Univ. Hannover (Germany) . . . . . [9741-16]

4:50 pm: **Fiber laser welding of dual-phase galvanized sheet steel (DP590): traditional analysis and new quality assessment techniques**, Stephanie Miller, Erik Pfeif, Andrei Kazakov, Esther Baumann, Marla Dowell, National Institute of Standards and Technology (USA) . . . . . [9741-17]

5:10 pm: **Detection of transient reflections during laser beam welding of copper**, Andreas Ganser, Stefan Liebl, Patrick Schmitz, Michael F. Zäh, Technische Univ. München (Germany) . . . . . [9741-18]

5:30 pm: **Transmission laser bonding of low melting eutectic alloys**, Christian Hoff, Kevin Cromwell, Jörg Hermsdorf, Laser Zentrum Hannover e.V. (Germany); Meriem Akin, Marc C. Wur, Leibniz Univ. Hannover (Germany); Stefan Kaierle, Ludger Overmeyer, Laser Zentrum Hannover e.V. (Germany) . . . . . [9741-30]

## THURSDAY 18 FEBRUARY

### SESSION 6

LOCATION: RM 306 (SOUTH ESPLANADE) . . . . THU 8:30 TO 10:10 AM

### Beam Measurement

Session Chair: **Kunihiko Washio**, Paradigm Laser Research Ltd. (Japan)

8:30 am: **Measuring laser power as a force: a new paradigm to accurately monitor optical power during laser-based machining operations**, Paul A. Williams, Brian J. Simonds, National Institute of Standards and Technology (USA); Andrey Gumenyuk, Marco Lammers, Bundesanstalt für Materialforschung und -prüfung (Germany) . . . . . [9741-19]

8:50 am: **Localisation: Characterisation of laser beam shape for materials processing using a new parameter**, Julia Stuch, Nathalie F. Timpe, Marcus Scholl, Ulrich A. Russek, Rheinische Fachhochschule Köln (Germany) . [9741-20]

9:10 am: **Development of a non-contact diagnostic tool for high power lasers**, Jed A. Simmons, Jeffrey L. Guttman, John McCauley, Ophir-Spiricon, LLC (USA) . . . . . [9741-21]

9:30 am: **Demonstrations of an optical differentiation wavefront sensor**, Jie Qiao, Rochester Institute of Technology (USA) and Aktiwave LLC (USA); Aaron Schweinsberg, Univ. of Rochester (USA); Zachary Mulhollan, Mathieu Chalifour, Rochester Institute of Technology (USA); Christophe Dorrer, Aktiwave LLC (USA) . . . . . [9741-22]

9:50 am: **Absorption driven focus shift**, Nicholas J. Harrop, Reinhard Kramer, Otto Maerten, Stefan Wolf, PRIMES GmbH (Germany) . . . . . [9741-23]

Coffee Break . . . . . Thu 10:10 am to 10:40 am

### SESSION 7

LOCATION: RM 306 (SOUTH ESPLANADE) THU 10:40 AM TO 12:10 PM

### Process Monitoring

Session Chair: **Stefan Kaierle**, Laser Zentrum Hannover e.V. (Germany)

10:40 am: **Comprehensive process monitoring for laser welding process optimization (Invited Paper)**, Peter Stritt, Meiko Boley, Andreas Heider, Institut für Strahlwerkzeuge (Germany); Florian Fetzer, Michael Jarwitz, Daniel Weller, Institut für Strahlwerkzeuge (Germany); Rudolf Weber, Institut für Strahlwerkzeuge (Germany); Peter Berger, Institut für Strahlwerkzeuge (Germany); Thomas Graf, Institut für Strahlwerkzeuge (Germany) . . . . . [9741-24]

11:10 am: **Inline monitoring of laser processing: new industrial results with the low coherence interferometry sensor approach**, Markus Kogel-Hollacher, Martin Schoenleber, Precitec Optronik GmbH (Germany) . . . . . [9741-25]

11:30 am: **Observation of melting conditions in selective laser melting of metals (SLM)**, Ulrich Thombansen, Peter Abels, Fraunhofer-Institut für Lasertechnik (Germany) . . . . . [9741-26]

11:50 am: **Binary hologram based high speed zonal wavefront sensing with reduced estimation time**, Biswajit Pathak, Bosanta R. Boruah, Indian Institute of Technology Guwahati (India) . . . . . [9741-27]

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# Journal of Nanophotonics

**Ali Adibi**

Georgia Institute of Technology  
Editor-in-Chief

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- Quantum dots and other low-dimensional nanostructures
- Nanotubes, nanowires, and nanofibers
- Nanowaveguides and nanoantennas
- Sculptured thin films and nanostructured photonic crystals
- Quantum optics and spintronics
- Nanoscale optical electronics
- Surface plasmons and nanoplasmonics
- Light-harvesting materials and devices
- Nanophotonic detectors
- Near-field optics
- Optical manipulation techniques, spectroscopies, and scattering techniques
- Molecular self-assembly, and other nanofabrication techniques
- Nanobiophotonics
- Nanophotonic concepts and systems that facilitate continued integration of various optical and/or electronic functions
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OPTO

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**OPTO PLENARY SESSION**  
8:00 TO 10:10 AM

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6:00 TO 8:00 PM

**Optoelectronic Materials and Devices** Program Chair: **James G. Grote**, Air Force Research Lab. (USA)

- 9742 **Physics and Simulation of Optoelectronic Devices XXIV** (Witzigmann, Osirski, Arakawa), p. 255
- 9743 **Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V** (Freundlich, Lombez, Sugiyama), p. 269
- 9744 **Optical Components and Materials XIII** (Jiang, Digonnet), p. 273
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- 9749 **Oxide-based Materials and Devices VII** (Teherani, Look, Rogers), p. 291

**Photonic Integration** Program Chair: **Yakov Sidorin**, Quarles & Brady LLP (USA)

- 9750 **Integrated Optics: Devices, Materials, and Technologies XX** (Broquin, Nunzi Conti), p. 295
- 9747 **Terahertz, RF, Millimeter, and Submillimeter-Wave Technology and Applications IX** (Sadwick, Yang), p. 283
- 9751 **Smart Photonic and Optoelectronic Integrated Circuits XVIII** (He, Lee, Eldada), p. 299
- 9752 **Silicon Photonics XI** (Reed, Knights), p. 302
- 9753 **Optical Interconnects XVI** (Schröder, Chen), p. 305
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8:00 TO 10:10 AM

**OPTO POSTER SESSION**  
6:00 TO 8:00 PM

## MOEMS-MEMS in Photonics

Program Chairs: **Holger Becker**, microfluidic ChipShop GmbH (Germany) and **Winston V. Schoenfeld**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

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## Advanced Quantum and Optoelectronic Applications

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# OPTO DAILY CONFERENCE SCHEDULE

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# CONFERENCE 9742

LOCATION: ROOM 272 (SOUTH MEZZANINE)

Monday–Thursday 15–18 February 2016 • Proceedings of SPIE Vol. 9742

# Physics and Simulation of Optoelectronic Devices XXIV

Conference Chairs: **Bernd Witzigmann**, Univ. Kassel (Germany); **Marek Osipiński**, The Univ. of New Mexico (USA); **Yasuhiko Arakawa**, The Univ. of Tokyo (Japan)

Program Committee: **Hiroshi Amano**, Nagoya Univ. (Japan); **Toshihiko Baba**, Yokohama National Univ. (Japan); **Enrico Bellotti**, Boston Univ. (USA); **Guillermo Carpintero del Barrio**, Univ. Carlos III de Madrid (Spain); **Weng W. Chow**, Sandia National Labs. (USA); **Alexandre Freundlich**, Univ. of Houston (USA); **Frédéric Grillot**, Télécom ParisTech (France); **Ortwin Hess**, Imperial College London (United Kingdom); **Thomas A. Klar**, Johannes Kepler Univ. Linz (Austria); **Stephan W. Koch**, Philipps-Univ. Marburg (Germany); **Cun-Zheng Ning**, Arizona State Univ. (USA); **Joachim Piprek**, NUSOD Institute LLC (USA); **Marc Sciamanna**, Supélec (France); **Ikuo Suemune**, Hokkaido Univ. (Japan)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative, Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break ..... Mon 10:10 am to 10:30 am

### SESSION 1

LOCATION: RM 272 (SOUTH MEZZANINE) .. MON 10:30 AM TO 12:20 PM

### Light Emitting Diodes

Session Chair: **Sze-Chun Chan**, City Univ. of Hong Kong (Hong Kong, China)

- 10:30 am: **Challenges towards the simulation of GaN-based LEDs beyond the semiclassical framework** (*Invited Paper*), Michele Goano, Francesco Bertazzi, Xiangyu Zhou, Marco Mandurrino, Stefano Dominici, Marco Vallone, Giovanni Ghione, Fabrizio Dolcini, Fausto Rossi, Politecnico di Torino (Italy); Giovanni Verzellesi, Univ. degli Studi di Modena e Reggio Emilia (Italy); Matteo Meneghini, Enrico Zanoni, Univ. degli Studi di Padova (Italy); Enrico Bellotti, Boston Univ. (USA) ..... [9742-1]
- 11:00 am: **AlGaN digital alloys for deep-ultraviolet application**, Wei Sun, Chee-Keong Tan, Nelson Tansu, Lehigh Univ. (USA) ..... [9742-2]
- 11:20 am: **Performance enhancement in 365-nm ultraviolet light-emitting diodes by specific-designed composition-graded multiple quantum barrier electron-blocking layer**, Ya-Hsuan Shih, National Cheng Kung Univ. (Taiwan); Jih-Yuan Chang, National Changhua Univ. of Education (Taiwan); Jinn-Kong Sheu, National Cheng Kung Univ. (Taiwan); Yen-Kuang Kuo, Fang-Ming Chen, National Changhua Univ. of Education (Taiwan); Ming-Lun Lee, Southern Taiwan Univ. of Science & Technology (Taiwan) ..... [9742-3]
- 11:40 am: **Numerical analysis on the influence of quantum barriers in UV-A AlGaN light-emitting diodes**, Yen-Kuang Kuo, Fang-Ming Chen, Jih-Yuan Chang, National Changhua Univ. of Education (Taiwan) ..... [9742-4]

12:00 pm: **Rare-earth-doped GaN-based light-emitting diode: a model of current injection efficiency**, Ioannis Fragkos, Chee-Keong Tan, Volkmar Dierolf, Lehigh Univ. (USA); Yasufumi Fujiwara, Osaka Univ. (Japan); Nelson Tansu, Lehigh Univ. (USA) ..... [9742-5]

Lunch Break ..... Mon 12:20 pm to 1:40 pm

### SESSION 2

LOCATION: RM 272 (SOUTH MEZZANINE) ..... MON 1:40 TO 3:00 PM

### Photodetectors

Session Chair: **K. Alan Shore**, Bangor Univ. (United Kingdom)

- 1:40 pm: **A Monte Carlo simulator for noise analysis of avalanche photodiode pixels in low-light image sensing**, Tomislav Resetar, IMEC (Belgium) and KU Leuven (Belgium); Andreas Süss, IMEC (Belgium); Elke Vermandere, Bogdan Karpiak, KU Leuven (Belgium); Robert Puers, KU Leuven (Belgium) and IMEC (Belgium); Chris A. Van Hoof, IMEC (Belgium) and KU Leuven (Belgium) ..... [9742-6]
- 2:00 pm: **Modeling and simulation of a 3D-CMOS silicon photodetector for low-intensity light detection**, Iman Sabri Alirezaei, Edmund P. Burté, Otto-von-Guericke Univ. Magdeburg (Germany) ..... [9742-7]
- 2:20 pm: **Graphene-based heterojunction photodetectors with ultra-broadband and high responsivity at room temperature**, Che-Hung Liu, You-Chia Chang, Theodore Norris, Zhaohui Zhong, Univ. of Michigan (USA) ..... [9742-8]
- 2:40 pm: **Toward designing back-illuminated CMOS image sensor based on 3D modeling**, Yegao Xiao, Crosslight Software Inc. (Canada); Kentaro Uehara, Crosslight Software Inc. (Japan); Yue Fu, Michel Lestrade, Zhiqiang L. Li, Yijie Zhou, Simon Li, Crosslight Software Inc. (Canada) ..... [9742-9]
- Coffee Break ..... Mon 3:00 pm to 3:30 pm

### SESSION 3

LOCATION: RM 272 (SOUTH MEZZANINE) ..... MON 3:30 TO 5:50 PM

### Optical Injection and Feedback

Session Chair: **Frédéric Grillot**, Télécom ParisTech (France)

- 3:30 pm: **Dynamics of nanolasers subject to optical injection and optical feedback** (*Invited Paper*), Zubaida Abdul Sattar, K. Alan Shore, Bangor Univ. (United Kingdom) ..... [9742-10]
- 4:00 pm: **Randomness extraction from a chaotic laser diode with dispersive self-injection** (*Invited Paper*), Song-Sui Li, Xiao-Zhou Li, Jun-Ping Zhuang, City Univ. of Hong Kong (Hong Kong, China); Sze-Chun Chan, City Univ. of Hong Kong (Hong Kong, China) and City Univ. of Hong Kong (Hong Kong, China) ..... [9742-11]
- 4:30 pm: **Optically induced lasing state hysteresis in a two-state quantum dot laser**, Bryan Kelleher, Univ. College Cork (Ireland) and Tyndall National Institute (Ireland); David Goulding, Boguslaw Tykalewicz, Tyndall National Institute (Ireland) and Cork Institute of Technology (Ireland); Nikita Fedorov, Ilya Dubinkin, ITMO Univ. (Russian Federation); Stephen P. Hegarty, Tyndall National Institute (Ireland) and Cork Institute of Technology (Ireland); Guillaume Huyet, Cork Institute of Technology (Ireland) and Tyndall National Institute (Ireland); Thomas Erneux, Univ. Libre de Bruxelles (Belgium); Evgeny A. Viktorov, ITMO Univ. (Russian Federation) and Univ. Libre de Bruxelles (Belgium) ..... [9742-12]

OPTO

# CONFERENCE 9742

LOCATION: ROOM 272 (SOUTH MEZZANINE)

4:50 pm: **Gain compression effect on the modulation dynamics of an optically injection-locked semiconductor laser using gain lever**, Jean-Maxime Sarraute, Kevin Schires, Télécom ParisTech (France); Sophie Laroche, Univ. Laval (Canada); Frédéric Grillot, Télécom ParisTech (France) . . . . . [9742-13]

5:10 pm: **Influence of master linewidth on the relaxation regime of a laser submitted to optical injection**, Gabriel Basset, Omar M. Sahni, Stéphane Trebaol, Pascal Besnard, CNRS-Fonctions Optiques pour les Technologistes de l'information (France) . . . . . [9742-14]

5:30 pm: **Dynamics of optically-injected semiconductor nanolasers**, Jean-Maxime Sarraute, Télécom ParisTech (France) and Univ. Laval (Canada); Kevin Schires, Télécom ParisTech (France); Sophie Laroche, Univ. Laval (Canada); Frédéric Grillot, Télécom ParisTech (France) . . . . . [9742-15]

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: RM 272 (SOUTH MEZZANINE) . . . . TUE 8:20 TO 10:10 AM

### Nonlinear Laser Dynamics

Session Chair: **Marek Osirski**, The Univ. of New Mexico (USA)

8:20 am: **Modeling of ultrashort pulse generation in mode-locked VECSELS** (*Invited Paper*), Isak Kilen, Jörg Hader, College of Optical Sciences, The Univ. of Arizona (USA); Stephan W. Koch, College of Optical Sciences, The Univ. of Arizona (USA) and Philipps-Univ. Marburg (Germany); Jerome V. Moloney, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9742-16]

8:50 am: **Dynamic model of pulsed laser generators based on multi-junction N-p-N-i-P heterostructures**, Sergey O. Slipchenko, Aleksandr A. Podoskin, Olga S. Soboleva, Nikita A. Pikhin, Il'ya S. Tarasov, Valentin S. Yuferev, Ioffe Physical-Technical Institute (Russian Federation) . . . . . [9742-17]

9:10 am: **Investigation on electro-optic optical comb generation with higher spectral resolution and bandwidth**, Takahide Sakamoto, Isao Morohashi, National Institute of Information and Communications Technology (Japan) . . . . . [9742-18]

9:30 am: **Coherence properties of fast frequency swept lasers revealed via full electric field reconstruction**, Thomas P. Butler, David Goulding, Svetlana Slepneva, Ben O'Shaughnessy, Tyndall National Institute (Ireland) and Cork Institute of Technology (Ireland); Bryan Kelleher, Tyndall National Institute (Ireland) and Univ. College Cork (Ireland); Stephen P. Hegarty, Tyndall National Institute (Ireland) and Cork Institute of Technology (Ireland); Maciej Wojtkowski, Nicolaus Copernicus Univ. (Poland); Andrei G. Vladimirov, Weierstrass-Institut für Angewandte Analysis und Stochastik (Germany); Guillaume Huyet, Cork Institute of Technology (Ireland) and Tyndall National Institute (Ireland) and ITMO Univ. (Russian Federation) . . . . . [9742-19]

9:50 am: **Spectral filtering effects in synchronized semiconductor laser networks**, Apostolos Argyris, Michail Bourmpos, Dimitris Syvridis, National and Kapodistrian Univ. of Athens (Greece) . . . . . [9742-20]

Coffee Break . . . . . Tue 10:10 am to 10:40 am

### SESSION 5

LOCATION: RM 272 (SOUTH MEZZANINE) TUE 10:40 AM TO 12:00 PM

### Electromagnetics

Session Chair: **Bernd Witzigmann**, Univ. Kassel (Germany)

10:40 am: **Model order reduction for the time-harmonic Maxwell equation applied to complex nanostructures**, Martin Hammerschmidt, Sven Herrmann, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany); Jan Pomplun, JCMwave GmbH (Germany); Sven Burger, Frank Schmidt, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany) and JCMwave GmbH (Germany) . . . . . [9742-21]

11:00 am: **Criteria of backscattering in chiral one-way photonic crystals**, Pi-Ju Cheng, Shu-Wei Chang, Academia Sinica (Taiwan) . . . . . [9742-22]

11:20 am: **Short pulse generation based on ultrafast transient Bragg gratings**, Yonatan Sivan, Aviran Halstuch, Shai Rozenberg, Shlomo Pinhas, Amiel Ishaaya, Ben-Gurion Univ. of the Negev (Israel) . . . . . [9742-23]

11:40 am: **Diffraction patterns from multiple tilted laser apertures: numerical analysis**, Anton V. Kovalev, Vadim M. Polyakov, ITMO Univ. (Russian Federation) . . . . . [9742-68]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:30 pm

### SESSION 6

LOCATION: RM 272 (SOUTH MEZZANINE) . . . . . TUE 1:30 TO 3:10 PM

### Quantum Dots

Session Chair: **Jacky Even**,

Institut National des Sciences Appliquées de Rennes (France)

1:30 pm: **Improved quantum-dot laser modulation by multi-state lasing**, Benjamin Lingnau, André Röhm, Kathy Lüdge, Technische Univ. Berlin (Germany) . . . . . [9742-25]

1:50 pm: **All-optical control of quantum-dot single-photon emission**, Dominik Breddermann, Dirk Heinze, Artur Zrenner, Stefan Schumacher, Univ. Paderborn (Germany) . . . . . [9742-26]

2:10 pm: **Electro-absorption effects in 1300nm InGaAs/GaAs quantum dot materials**, Soroush Alisobhani, Richard A. Hogg, Nasser Babazadeh, David T. D. Childs, The Univ. of Sheffield (United Kingdom); Kenichi Nishi, Mitsuru Sugawara, QD Laser, Inc. (Japan) . . . . . [9742-27]

2:30 pm: **Spatial hole burning, comb spectrum robustness, and intensity noise in quantum dot lasers and microlasers**, Artem V. Savelyev, Alexey Zhukov, Mikhail V. Maximov, St. Petersburg Academic Univ. (Russian Federation) . . . . . [9742-28]

2:50 pm: **Study of light emission polarisation control in quantum dot laser**, Dharmendra Kumar, Jitendra Kumar, Indian School of Mines (India); Chandra M. Negi, Banasthali Univ. (India) . . . . . [9742-29]

Coffee Break . . . . . Tue 3:10 pm to 3:40 pm

### SESSION 7

LOCATION: RM 272 (SOUTH MEZZANINE) . . . . TUE 3:40 TO 4:50 PM

### Non-Classical Light

Session Chair: **Christopher Gies**, Univ. Bremen (Germany)

3:40 pm: **Superradiance in quantum-dot nanolasers** (*Invited Paper*), Christopher Gies, Frank Jahnke, Univ. Bremen (Germany); Heinrich A. M. Leymann, Alexander Foerster, Jan Wiersig, Otto-von-Guericke Univ. Magdeburg (Germany); Christian Schneider, Martin Kamp, Sven Höfling, Julius-Maximilians-Univ. Würzburg (Germany); Marc Assmann, Manfred Bayer, Technische Univ. Dortmund (Germany) . . . . . [9742-30]

4:10 pm: **Quantum feedback stabilized solid-state emitters**, Julia Kabuss, Alexander Carmele, Technische Univ. Berlin (Germany); Dmitry O. Krimer, Stefan Rotter, Technische Univ. Wien (Austria); Andreas Knorr, Technische Univ. Berlin (Germany) . . . . . [9742-31]

4:30 pm: **Creation and control of entanglement by time-delayed quantum-coherent feedback**, Sven M. Hein, Alexander Carmele, Andreas Knorr, Technische Univ. Berlin (Germany) . . . . . [9742-32]

## WEDNESDAY 17 FEBRUARY

### SESSION 8

LOCATION: RM 272 (SOUTH MEZZANINE) . . . WED 8:20 TO 10:30 AM

### Silicon Opto-/Electronics

Session Chair: **Weng W. Chow**, Sandia National Labs. (USA)

8:20 am: **Challenges in the monolithic integration of quantum cascade laser on Si** (*Invited Paper*), Sergio Nicoletti, Salim Boutami, CEA LETI MINATEC (France); Mickael Brun, Mathieu Carras, mirSense (France); Jean-Guillaume Coutard, Jean-Marc Fédéli, Pierre R. Labeye, CEA LETI MINATEC (France) . . . . . [9742-33]

8:50 am: **Integrated nanophotonic devices for optical interconnections** (*Invited Paper*), Yidong Huang, Xue Feng, Kaiyu Cui, Yongzhao Li, Yu Wang, Tsinghua Univ. (China) . . . . . [9742-34]

9:20 am: **Towards an edge-emitting strained-Ge laser fabricated by means of a CMOS process** (*Invited Paper*), Giovanni Capellini, IHP GmbH (Germany); Michele Virgilio, Univ. di Pisa (Italy); Yuji Yamamoto, Stefan Lischke, Jochen Kreissl, IHP GmbH (Germany); Lars Zimmermann, Bernd Tillack, IHP GmbH (Germany) and Technische Univ. Berlin (Germany); D. Peschka, M. Thomas, Annegret Glitzky, R. Nürnberg, Weierstrass-Institut für Angewandte Analysis und Stochastik (Germany); Klaus Gärtner, Univ. della Svizzera italiana (Switzerland); Thomas Koprucki, Weierstrass-Institut für Angewandte Analysis und Stochastik (Germany); Thomas Schroeder, IHP GmbH (Germany) . . . . . [9742-35]

# CONFERENCE 9742

LOCATION: ROOM 272 (SOUTH MEZZANINE)

9:50 am: **On the way of pushing silicon transistors beyond their limits**, Dzianis Saladukha, Tomasz J. Ochalski, Tyndall National Institute (Ireland) and Cork Institute of Technology (Ireland); Felipe Murphy-Armando, Tyndall National Institute (Ireland); Michael Clavel, Mantu Hudait, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9742-36]

10:10 am: **CMOS compatible laser with a nonlinear microring**, Igor V. Melnikov, National Research Univ. of Electronic Technology (Russian Federation) and Univ. of Illinois at Urbana-Champaign (USA) and Moscow Institute of Physics and Technology (Russian Federation); Georgy L. Alfimov, National Research Univ. of Electronic Technology (Russian Federation); Alexander Chernyavsky, McMaster Univ. (Canada) . . . . . [9742-37]

Coffee Break . . . . .Wed 10:30 am to 11:00 am

## SESSION 9

LOCATION: RM 272 (SOUTH MEZZANINE) WED 11:00 AM TO 12:10 PM

### Semiconductor Lasers

Session Chair: **Cun-Zheng Ning**, Arizona State Univ. (USA)

11:00 am: **Parity-time-symmetric lasers** (*Invited Paper*), Mercedesh Khajavikhan, Hossein Hodaei, Mohammad-Ali Miri, Demetrios N. Christodoulides, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9742-38]

11:30 am: **Reciprocity principle and nonequivalence of counterpropagating modes in whistle-geometry ring lasers**, Fei-Hung Chu, Hemashilpa Kalagara, Gennady A. Smolyakov, Marek Osiriski, The Univ. of New Mexico (USA) . . . . . [9742-39]

11:50 am: **The role of optoelectronic feedback on Franz-Keldysh voltage modulation of transistor lasers**, Chi-Hsiang Chang, National Taiwan Univ. (Taiwan); Shu-Wei Chang, Academia Sinica (Taiwan); Chao-Hsin Wu, National Taiwan Univ. (Taiwan) . . . . . [9742-40]

Lunch/Exhibition Break . . . . .Wed 12:10 pm to 1:40 pm

## SESSION 10

LOCATION: RM 272 (SOUTH MEZZANINE) . . . . . WED 1:40 TO 3:30 PM

### Active Materials

Session Chair: **Sergio Nicoletti**, MINATEC (France)

1:40 pm: **Modeling atomtronic circuits** (*Invited Paper*), Weng W. Chow, Sandia National Labs. (USA); Cameron J. Straatsma, Univ. of Colorado (USA); Dana Z. Anderson, Univ. of Colorado at Boulder (USA) . . . . . [9742-42]

2:10 pm: **Solid-state-based analogue of optomechanics**, Nicolas L. Naumann, Leon Droenner, Alexander Carmele, Andreas Knorr, Technische Univ. Berlin (Germany); Weng W. Chow, Sandia National Labs. (USA); Julia Kabuss, Technische Univ. Berlin (Germany) . . . . . [9742-43]

2:30 pm: **Photon momentum and optical forces in cavities**, Mikko Partanen, Teppo Häyrynen, Jani Oksanen, Jukka Tulkki, Aalto Univ. School of Science and Technology (Finland) . . . . . [9742-44]

2:50 pm: **Theoretical investigations of optical properties of Ga(In)AsBi quantum well systems using 8-band and 14-band models**, Marta Gladysiewicz, Wroclaw Univ. of Technology (Poland); Igor Ivashev, Marek S. Wartak, Wilfrid Laurier Univ. (Canada) . . . . . [9742-45]

3:10 pm: **Influence of p-doping on the gain and refractive index dynamics in quantum dash based semiconductor optical amplifiers**, Katarzyna Komolibus, Cork Institute of Technology (Ireland); Tomasz Piwonski, Tyndall National Institute (Ireland); Siddharth Joshi, Nicolas Chimot, III-V Lab. (France); John Houlihan, Waterford Institute of Technology (Ireland); François Lelarge, III-V Lab. (France); Guillaume Huyet, Cork Institute of Technology (Ireland) . . . . . [9742-46]

Coffee Break . . . . .Wed 3:30 pm to 4:00 pm

## SESSION 11

LOCATION: RM 272 (SOUTH MEZZANINE) . . . . . WED 4:00 TO 5:10 PM

### Photovoltaics Modeling

Joint Session with Conferences 9742 and 9743

Session Chairs: **Alexandre Freundlich**, Univ. of Houston (USA); **Bernd Witzigmann**, Univ. Kassel (Germany)

4:00 pm: **Theoretical and experimental insights into hybrid perovskites for optoelectronic applications** (*Invited Paper*), Jacky Even, Laurent Pedesseau, Institut National des Sciences Appliquées de Rennes (France); Mikaël Kepenekian, Univ. de Rennes 1 (France); Alain Rolland, Alexandre Beck, Daniel Saporì, Institut National des Sciences Appliquées de Rennes (France); Claudine Katan, Institut des Sciences Chimiques de Rennes (France); Hong-Hua Fang, Maria Antonietta Loi, Univ. of Groningen (Netherlands) . . . . . [9742-47]

4:30 pm: **Theoretical studies of Rashba and Dresselhaus effects in hybrid organic-inorganic perovskites for optoelectronic applications**, Laurent Pedesseau, Institut National des Sciences Appliquées de Rennes (France); Mikaël Kepenekian, Univ. de Rennes 1 (France); Roberto Robles, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain); Daniel Saporì, Institut National des Sciences Appliquées de Rennes (France); Claudine Katan, Institut des Sciences Chimiques de Rennes (France); Jacky Even, Institut National des Sciences Appliquées de Rennes (France) . . . . . [9742-48]

4:50 pm: **Simulation study of GaAsP/Si tandem cells including the impact of threading dislocations on the luminescent coupling between the cells**, Arthur L. Onno, Univ. College London (United Kingdom); Nils-Peter Harder, Lars Oberbeck, Total S.A. (France); Huiyun Liu, Univ. College London (United Kingdom) . . . . . [9743-45]

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Wrinkled polymer film to enhance the outcoupling efficiency of OLEDs**, Jun-Hwan Park, Pusan National Univ. (Korea, Republic of) . . . . . [9742-24]

**Absorption enhancement by textured InP in solar cells**, Seokhun Yun, Taeksoo Ji, Chonnam National Univ. (Korea, Republic of) . . . . . [9742-49]

**Industrial robot's vision systems**, Radda Iureva, Evgenii O. Raskin, Igor I. Komarov, Nadezhda K. Maltseva, ITMO Univ. (Russian Federation); Michael E Fedosovsky, AO "Diakont" (Russian Federation) . . . . . [9742-63]

**Design and simulation of photonic crystal structure based channel drop filter for optical communication system**, Mayur K. Chhipa, Engineering College Ajmer (India); Ekta Rewar, Manipal Univ. (India); Lalit Kumar Dusat, Engineering College Ajmer (India) . . . . . [9742-64]

**The simulation and experimental research on the sensing characteristics of few-mode-fiber based LPFG**, Guanghui Chen, Mei Sang, Chenhao Zhong, Tianjin Univ. (China); Biao Wang, Weigang Zhang, Nankai Univ. (China) [9742-65]

**Laser-assisted photoprocesses in nanostructured silicon films**, Dmitry E. Milovzorov, Fluens Technology Group Ltd. (Russian Federation) . . . . . [9742-66]

**Characterization of the non-collinear acousto-optical cell based on calomel (Hg<sub>2</sub>Cl<sub>2</sub>) crystal and operating within the two-phonon light scattering**, Alexandre S. Shcherbakov, Adan O. Arellanes, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [9742-67]

**Highly sensitive temperature sensor based on the weak value amplification with a swept source laser**, Kwang-Wook Yoo, Sunduck Kim, Young-Geun Han, Hanyang Univ. (Korea, Republic of) . . . . . [9742-69]

**Long-period fiber grating induced by mechanical oscillations**, Shir Shahal, Hamootal Duadi, Moti Fridman, Bar-Ilan Univ. (Israel) . . . . . [9742-70]

**Dielectric elastomer-based laser beam pointing method with broadband wavelength**, Tomohiko Hayakawa, Lihui Wang, Masatoshi Ishikawa, The Univ. of Tokyo (Japan) . . . . . [9742-72]

OPTO

# CONFERENCE 9742

LOCATION: ROOM 272 (SOUTH MEZZANINE)

**Temperature and field effect tunable multi-featured perfect absorber with high conductivity silicon**, Abdullah Gok, Bilkent Univ. (Turkey) . . . . . [9742-73]

**Photo-induced dynamics in the Reststrahlen band of SiC using transient infrared spectroscopy**, Bryan T. Spann, Ryan Compton, Daniel Ratchford, Adam D. Dunkelberger, James P. Long, U.S. Naval Research Lab. (USA); Paul Klein, Sotera Defense Solutions, Inc. (USA); Joshua D. Caldwell, Jeff C. Owrutsky, U.S. Naval Research Lab. (USA) . . . . . [9742-74]

**Development of new maskless manufacturing method for anti-reflection structure and application to large-area lens with curved surface**, Kazuya Yamamoto, Nalux Co., Ltd. (Japan) . . . . . [9742-75]

**III-nitride monolithic LED covering full sRGB color gamut**, Hussein S. El-Ghoroury, Chih-Li Chuang, Mikhail V. Kisin, Ostendo Technologies, Inc. (USA) . . . . . [9742-77]

## THURSDAY 18 FEBRUARY

### SESSION 12

LOCATION: RM 272 (SOUTH MEZZANINE) . . . . . THU 8:20 TO 10:10 AM

#### Plasmonics

Session Chair: **Giovanni Capellini**, IHP GmbH (Germany)

8:20 am: **Complex shaped plasmonic nanoparticles** (*Invited Paper*), Calin Hrelescu, Johannes Kepler Univ. Linz (Austria) . . . . . [9742-50]

8:50 am: **Simulation of semiconductor plasmonic terahertz antennas**, Bernd Witzigmann, Maximilian Bettenhausen, Univ. Kassel (Germany); Subhajit Guha, Marcin Kazmierczak, Thomas Schroeder, IHP GmbH (Germany) . . . . . [9742-51]

9:10 am: **Long-wave infrared plasmonics**, Byungwoo Lee, Hoe Min Kwak, Ha Sul Kim, Chonnam National Univ. (Korea, Republic of) . . . . . [9742-52]

9:30 am: **3D-FDTD simulations for the design and optimization of nanostructures and the resulting plasmonic enhancement in organic ultraviolet photodetector performance**, Monica Esopi, Qiuming Yu, Univ. of Washington (USA) . . . . . [9742-53]

9:50 am: **Nonlinear scattering in gold nanospheres**, Po-Ting Shen, National Taiwan Univ. (Taiwan); Cheng Wei Lin, Hsiang-Lin Liu, National Taiwan Normal Univ. (Taiwan); Shi-Wei Chu, National Taiwan Univ. (Taiwan) . . . . . [9742-54]

Coffee Break . . . . . Thu 10:10 am to 10:40 am

### SESSION 13

LOCATION: RM 272 (SOUTH MEZZANINE) THU 10:40 AM TO 12:00 PM

#### Resonators and Gratings

Session Chair: **Thomas A. Klar**, Johannes Kepler Univ. Linz (Austria)

10:40 am: **Hybrid integration of high-Q nanocavities onto silicon-on-insulator**, Dorian Sanchez, Lab. de Photonique et de Nanostructures (France); Guillaume Crosnier, Lab. de Photonique et de Nanostructures (France) and STMicroelectronics SA (France); Alexandre Bazin, Univ. Gent (Belgium); Paul Monnier, Sophie Bouchoule, Grégoire Beaudoin, Isabelle Sagnes, Rama Raj, Lab. de Photonique et de Nanostructures (France); Fabrice Raineri, Lab. de Photonique et de Nanostructures (France) and Univ. Paris Diderot (France) . . . . . [9742-55]

11:00 am: **Mid-IR high-index dielectric Huygens metasurfaces**, Jun Ding, Han Ren, Mi Zhou, Yuankun Lin, Univ. of North Texas (USA); Juejun Hu, Massachusetts Institute of Technology (USA); Hualiang Zhang, Univ. of North Texas (USA) . . . . . [9742-56]

11:20 am: **Enhancement of effective quality-factor using asymmetric Mach-Zehnder interferometer with ring resonator for optical bio and chemical sensor**, Tae-Ryong Kim, Tae-Kyeong Lee, Chung-Ang Univ. (Korea, Republic of); Guem-Yoon Oh, Korea Electronics Technology Institute (Korea, Republic of); Hong-Seung Kim, Electronics and Telecommunications Research Institute (Korea, Republic of); Myung-Gi Ji, Byung-Hee Son, Chung-Ang Univ. (Korea, Republic of); Doo-Gun Kim, Korea Photonics Technology Institute (Korea, Republic of); Mi Jung, Young-Wan Choi, Chung-Ang Univ. (Korea, Republic of) . . . . . [9742-57]

11:40 am: **Temperature-insensitive chemical sensor using a microfiber Mach-Zehnder interferometer**, Yeon-Jun Kim, Min-Seok Yoon, Jong Cheol Shin, Young-Geun Han, Hanyang Univ. (Korea, Republic of) . . . . . [9742-58]

Lunch/Exhibition Break . . . . . Thu 12:00 pm to 1:30 pm

### SESSION 14

LOCATION: ROOM 272 (SOUTH MEZZANINE) . . . THU 1:30 TO 2:50 PM

#### Numerical Methods and Process Simulation

Session Chair: **Yidong Huang**, Tsinghua Univ. (China)

1:30 pm: **Efficient and accurate modelling of quantum nanostructures**, Marina A. Ayad, Mohamed A. Swillam, The American Univ. in Cairo (Egypt); Salah Sabry A. Obayya, Zewail City of Science and Technology (Egypt) [9742-59]

1:50 pm: **Enhancing accuracy with subpixel smoothing for multiband effective-mass Hamiltonians of semiconductor nanostructures**, Chi-Ti Hsieh, Tung-Han Hsieh, Academia Sinica (Taiwan); Shu-Wei Chang, Academia Sinica (Taiwan) and National Chiao-Tung Univ. (Taiwan) . . . [9742-60]

2:10 pm: **Fine controlling of organic semiconductor by charged-beam irradiation effect**, Seokho Kim, Hyeong Tae Kim, Ho Jin Lee, Dong Hyuk Park, Inha Univ. (Korea, Republic of) . . . . . [9742-61]

2:30 pm: **Optical fiber poling by induction: analysis using 2D numerical modeling**, Ding Huang, A\*STAR Institute of High Performance Computing (Singapore); Francesco De Lucia, Costantino Corbari, Noel Healy, Pier J. Sazio, Univ. of Southampton (United Kingdom) . . . . . [9742-62]



# CONFERENCE 9743

LOCATION: ROOM 274 (SOUTH MEZZANINE)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9743

# Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V

Conference Chairs: **Alexandre Freundlich**, Univ. of Houston (USA); **Laurent Lombez**, Institut de Recherche et Développement sur l'Énergie Photovoltaïque (France); **Masakazu Sugiyama**, The Univ. of Tokyo (Japan)

Program Committee: **Kylie R. Catchpole**, The Australian National Univ. (Australia); **Gavin Conibeer**, The Univ. of New South Wales (Australia); **Olivier Durand**, Institut National des Sciences Appliquées de Rennes (France); **Nicholas J. Ekins-Daukes**, Imperial College London (United Kingdom); **Jean-François Guillemoles**, Institut de Recherche et Développement sur l'Énergie Photovoltaïque (France); **Next PV** (Japan); **Karin Hinzer**, Univ. of Ottawa (Canada); **Louise C. Hirst**, U.S. Naval Research Lab. (USA); **Seth M. Hubbard**, Rochester Institute of Technology (USA); **Marek Osinski**, The Univ. of New Mexico (USA); **Robert J. Walters**, U.S. Naval Research Lab. (USA); **David M. Wilt**, Air Force Research Lab. (USA); **Peichen Yu**, National Chiao Tung Univ. (Taiwan)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative, Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break . . . . . Mon 10:10 am to 10:30 am

### SESSION 1

LOCATION: RM 274 (SOUTH MEZZANINE) .. MON 10:30 AM TO 12:00 PM

### Emerging Topics in Design and Characterization of Photovoltaic Devices

Session Chairs: **Alexandre Freundlich**, Univ. of Houston (USA); **Laurent Lombez**, Institut de Recherche et Développement sur l'Énergie Photovoltaïque (France)

- 10:30 am: **High-efficiency photoelectrochemical water-splitting on III-nitride nanowire arrays** (*Invited Paper*), Zetian Mi, McGill Univ. (Canada) . . . . . [9743-1]
- 11:00 am: **Polycrystalline absorbers: unraveling grain boundary properties** (*Invited Paper*), Mariana Bertoni, Arizona State Univ. (USA) . . . . . [9743-2]
- 11:30 am: **Advances with vertical epitaxial heterostructure architecture (VEHSA) phototransducers for optical to electrical power conversion efficiencies exceeding 50 percent** (*Invited Paper*), Simon Fafard, Azastra Opto Inc. (Canada) . . . . . [9743-3]
- Lunch Break . . . . . Mon 12:00 pm to 1:30 pm

### SESSION 2

LOCATION: RM 274 (SOUTH MEZZANINE) . . . . . MON 1:30 TO 3:00 PM

### Advances in Simulation of Photovoltaic Devices

Session Chairs: **Gavin Conibeer**, The Univ. of New South Wales (Australia); **Jacky Even**, Institut National des Sciences Appliquées de Rennes (France)

- 1:30 pm: **Energy and entropy currents for nanoscaled optoelectronics** (*Invited Paper*), Fabienne Michelini, Katawoura Beltako, Institut Matériaux Microélectronique Nanosciences de Provence (France); Adeline Crépeux, Ctr. de Physique Théorique (France) . . . . . [9743-4]
- 2:00 pm: **Numerical modeling of photon recycling and luminescence coupling in non-ideal multijunction solar cell**, Mengyang Yuan, Zheng Lyu, Tsinghua Univ. (China); Jieyang Jia, Yusi Chen, Stanford Univ. (USA); Yi Liu, Peking Univ. (China); Yijie Huo, Yu Miao, James S. Harris, Stanford Univ. (USA) . . . . . [9743-5]
- 2:20 pm: **Nanostructured plasmonic electrode design guided by simulation for enhanced performance of ITO-free organic solar cells**, Beau J. Richardson, Qiuming Yu, Univ. of Washington (USA) . . . . . [9743-6]
- 2:40 pm: **Development of numerical modeling program for organic/inorganic hybrid solar cells by including tail/interfacial states models**, Kuan-Ying Ho, I-Hsin Lu, Yuh-Renn Wu, National Taiwan Univ. (Taiwan) [9743-7]
- Coffee Break . . . . . Mon 3:00 pm to 3:30 pm

### SESSION 3

LOCATION: RM 274 (SOUTH MEZZANINE) . . . . . MON 3:30 TO 6:00 PM

### Advances in Characterization of Photovoltaic Devices

Session Chairs: **Mariana Bertoni**, Arizona State Univ. (USA); **Laurent Lombez**, Institut de Recherche et Développement sur l'Énergie Photovoltaïque (France)

- 3:30 pm: **Nanospectroscopy of PV devices** (*Invited Paper*), Marina S. Leite, Univ. of Maryland, College Park (USA) . . . . . [9743-8]
- 3:50 pm: **Characterization and modeling of chalcogenide materials and the resulting photovoltaic devices** (*Invited Paper*), Angus A. Rockett, M. Tuteja, X. He, P. Martin, D. Heinzl, Y. Liu, N. Johnson, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9743-9]
- 4:20 pm: **Direct observation of electrons transported in second conduction mini-band of a semiconductor superlattice by visible-light photoemission spectroscopy**, Fumiaki Ichihashi, Kenji Nishitani, Xinyu Dong, Takahiko Kawaguchi, Makoto Kuwahara, Takahiro Ito, Shunta Harada, Miho Tagawa, Toru Ujihara, Nagoya Univ. (Japan) . . . . . [9743-10]
- 4:40 pm: **Local transport properties investigation by correlating hyperspectral and confocal luminescence images**, Gilbert El-Hajje, Daniel Ory, Myriam Paire, Electricité de France (France); Jean-François Guillemoles, Tokyo Univ. (Japan); Laurent Lombez, Ctr. National de la Recherche Scientifique (France) . . . . . [9743-11]

OPTO

# CONFERENCE 9743

LOCATION: ROOM 274 (SOUTH MEZZANINE)

5:00 pm: **Calibration standards and measurement accuracy of absolute electroluminescence and internal properties in multi-junction and arrayed solar cells**, Masahiro Yoshita, Lin Zhu, Changsu Kim, The Univ. of Tokyo (Japan) and Japan Science and Technology Agency (Japan); Toshimitsu Mochizuki, National Institute of Advanced Industrial Science and Technology (Japan); Tetsuya Nakamura, Mitsuru Imaizumi, Japan Aerospace Exploration Agency (Japan); Shaoqiang Chen, East China Normal Univ. (China); Hidehiro Kubota, ATTO Corp. (Japan) and Japan Science and Technology Agency (Japan); Yoshihiko Kanemitsu, Kyoto Univ. (Japan) and Japan Science and Technology Agency (Japan); Hidefumi Akiyama, The Univ. of Tokyo (Japan) and Japan Science and Technology Agency (Japan) ..... [9743-12]

5:20 pm: **Carrier collection mechanism in the strain-balanced InGaAs/GaAsP super-lattice solar cells by investigating the temperature changes of the surface photovoltage, photoluminescence, and piezoelectric photothermal signals**, Atsuhiko Fukuyama, Tsubasa Nakamura, Univ. of Miyazaki (Japan); Takanori Usuki, The Univ. of Tokyo (Japan); Kouki Matsuochoi, Univ. of Miyazaki (Japan); Kasidit Toprasertpong, Masakazu Sugiyama, Yoshiaki Nakano, The Univ. of Tokyo (Japan); Tetsuo Ikari, Univ. of Miyazaki (Japan) ..... [9743-13]

5:40 pm: **A novel measurement method of luminescence coupling in multijunction solar cells based on external quantum efficiency**, Zheng Lyu, Mengyang Yuan, Tsinghua Univ. (China); Jieyang Jia, Stanford Univ. (USA); Yi Liu, Peking Univ. (China); Yijie Huo, Yu Miao, James S. Harris, Stanford Univ. (USA) ..... [9743-50]

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: RM 274 (SOUTH MEZZANINE) . . . . TUE 8:00 TO 10:00 AM

#### Advances in Light Management and Spectral Shaping of Photovoltaic Devices

Session Chairs: **Arno H. M. Smets**, Technische Univ. Delft (Netherlands); **Karin Hinzer**, Univ. of Ottawa (Canada)

8:00 am: **Computational optimization and solution-processing of thick and efficient luminescent down-shifting layers for photovoltaics**, Anastasiia Solodovnyk, Christopher Kick, Bayerisches Zentrum für Angewandte Energieforschung e.V. (Germany); Andres Osvet, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); Hans J. Egelhaaf, Edda Stern, Bayerisches Zentrum für Angewandte Energieforschung e.V. (Germany); Miroslaw Batentschuk, Karen K. Forberich, Christoph J. Brabec, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany) ..... [9743-14]

8:20 am: **Light-trapping in ultra-thin solar cells fabricated by direct nanoimprint of sol-gel derived films**, Andrea Cattoni, Alexandre Gaucher, Nicolas Vandamme, Julie Goffard, Lab. de Photonique et de Nanostructures (France); Marco Faustini, Collège de France (France); Nathalie Bardou, Aristide Lemaitre, Lab. de Photonique et de Nanostructures (France); Negar Naghavi, Institut de Recherche et Développement sur l'Energie Photovoltaïque (France); Pere Roca i Cabarrocas, Ecole Polytechnique (France); Jean-François Guillemoles, Institut de Recherche et Développement sur l'Energie Photovoltaïque (France); Stéphane Collin, Lab. de Photonique et de Nanostructures (France) ..... [9743-15]

8:40 am: **Up-conversion equivalent circuit for photovoltaic and photo-electrolysis cells**, Gavin Conibeer, Santosh Shrestha, Shujuan Huang, Binesh Puthen-Veetil, The Univ. of New South Wales (Australia) ..... [9743-16]

9:00 am: **Rapid 2D incoherent mirror fabrication by laser interference lithography and wet etching for III-V MQW solar cells**, Wei Wang, Alexandre Freundlich, Univ. of Houston (USA) ..... [9743-17]

9:20 am: **Silicon solar cell using optimized intermediate reflector layer**, Mohamed A. Swillam, Ahmed Emad, The American Univ. in Cairo (Egypt) ..... [9743-18]

9:40 am: **Design and fabrication of a micro CPV system based on Cu(In,Ga)Se<sub>2</sub> microcells array**, Sebastien Jutteau, Myriam Paire, Laurent Lombez, Institut de Recherche et Développement sur l'Energie Photovoltaïque (France); Jean-François Guillemoles, Institut de Recherche et Développement sur l'Energie Photovoltaïque (Japan) ..... [9743-19]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

### SESSION 5

LOCATION: RM 274 (SOUTH MEZZANINE) . TUE 10:30 AM TO 12:10 PM

#### Perovskites and Hybrid Photovoltaic Devices

Session Chairs: **Peichen Yu**, National Chiao Tung Univ. (Taiwan); **Angus A. Rockett**, Univ. of Illinois at Urbana-Champaign (USA)

10:30 am: **Carrier processes and photostability in perovskites materials and solar cells** (*Invited Paper*), Wanyi Nie, Jean-Christophe Blancon, Amanda J. Neukirch, Hsinhan Tsai, Los Alamos National Lab. (USA); Muhammad A. Alam, Purdue Univ. (USA); Claudine Katan, Institut des Sciences Chimiques de Rennes (France); Jacky Even, Institut National des Sciences Appliquées de Rennes (France); Sergei Tretiak, Jared J. Crochet, Gautam Gupta, Aditya D. Mohite, Los Alamos National Lab. (USA) ..... [9743-20]

11:00 am: **Dielectric properties of hybrid perovskites and drift-diffusion modelling of perovskite/silicon tandem cells**, Laurent Pedesseau, Institut National des Sciences Appliquées de Rennes (France); Mikael Kepenekian, Institut des Sciences Chimiques de Rennes (France); Daniel Sapori, Alain Rolland, Alexandre Beck, Yong Huang, Shijian Wang, Charles Cornet, Olivier Durand, Institut National des Sciences Appliquées de Rennes (France); Claudine Katan, Institut des Sciences Chimiques de Rennes (France); Jacky Even, Institut National des Sciences Appliquées de Rennes (France) . . [9743-21]

11:20 am: **Design optimization of thin-film/wafer-based tandem junction solar cells using analytical modeling**, Lauren M. Davidson, Fatima Toor, The Univ. of Iowa (USA) ..... [9743-22]

11:40 am: **Title to be determined**, Arno H. M. Smets, Technische Univ. Delft (Netherlands) ..... [9743-23]

Lunch/Exhibition Break . . . . . Tue 12:10 pm to 1:40 pm

### SESSION 6

LOCATION: ROOM 274 (SOUTH MEZZANINE) TUE 1:40 PM TO 3:10 PM

#### Hot Carrier Solar Cells

Session Chairs: **Jean-François Guillemoles**, Institut de Recherche et Développement sur l'Energie Photovoltaïque (France); **Louise C. Hirst**, U.S. Naval Research Lab. (USA)

1:40 pm: **Hot carrier effects in nanostructured metals for solar-energy conversion** (*Invited Paper*), Jeremy N. Munday, Univ. of Maryland, College Park (USA) ..... [9743-24]

2:10 pm: **Hot-carrier solar cell NEGF-based simulations**, Nicolas Cavassilas, Fabienne Michelini, Marc Bescond, Thibault Joie, Institut Matériaux Microélectronique Nanosciences de Provence (France) ..... [9743-25]

2:30 pm: **Third generation hot carrier solar cells: paths towards innovative energy contacts structures**, Francois Gibelli, Institut de Recherche et Développement sur l'Energie Photovoltaïque (France); Anatole Julian, Zacharie Jehl Li Kao, Jean-François Guillemoles, Research Ctr. for Advanced Science and Technology - NextPV (Japan) ..... [9743-26]

2:50 pm: **Practical absorber and energy-selective contacts for hot carrier solar cells**, Santosh Shrestha, Simon Chung, Yuanxun Liao, Wenkai Cao, Qiuyang Zhang, Gavin Conibeer, The Univ. of New South Wales (Australia) ..... [9743-27]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

# CONFERENCE 9743

LOCATION: ROOMS 274 AND 272 (SOUTH MEZZANINE)

## SESSION 7

LOCATION: RM 274 (SOUTH MEZZANINE) . . . . . TUE 3:40 TO 6:00 PM

### Advances in III-V Photovoltaic Materials and Devices

Session Chairs: **Olivier Durand**, Institut National des Sciences Appliquées de Rennes (France);  
**Masakazu Sugiyama**, The Univ. of Tokyo (Japan)

3:40 pm: **Characterization and modeling of radiation damages via internal radiative efficiency in multi-junction solar cells**, Lin Zhu, Masahiro Yoshita, The Univ. of Tokyo (Japan); Tetsuya Nakamura, Mitsuru Imaizumi, Japan Aerospace Exploration Agency (Japan); Changsu Kim, The Univ. of Tokyo (Japan); Toshimitsu Mochizuki, National Institute of Advanced Industrial Science and Technology (Japan); Shaoqiang Chen, East China Normal Univ. (China); Yoshihiko Kanemitsu, Kyoto Univ. (Japan); Hidefumi Akiyama, The Univ. of Tokyo (Japan) . . . . . [9743-28]

4:00 pm: **Optical and electronic characterization of InAlAs and InAlAsSb grown by MOVPE for photovoltaic applications**, Brittany L. Smith, Zachary S. Bittner, Staffan D. Hellström, Michael A. Slocum, George T. Nelson, Seth M. Hubbard, Rochester Institute of Technology (USA) . . . . . [9743-29]

4:20 pm: **Performance impact of luminescent coupling on monolithic 3- to 6-volt phototransducers for photonic power systems**, Matthew M. Wilkins, Christopher E. Valdivia, Univ. of Ottawa (Canada); Simon Fafard, Denis P. Masson, Azastra Opto Inc. (Canada); Karin Hinzer, Univ. of Ottawa (Canada) . . . . . [9743-30]

4:40 pm: **Thin-film vapor-liquid-solid growth of InP for III-V photovoltaics**, Christopher G. Bailey, Sean Babcock, Marlene Lichty, Grace Rajan, Tasnuva Ashrafee, Sylvain Marsillac, Old Dominion Univ. (USA); Sergey I. Maximenko, Robert J. Walters, U.S. Naval Research Lab. (USA); Elisabeth L. McClure, Brittany L. Smith, Seth M. Hubbard, Rochester Institute of Technology (USA) . . . . . [9743-31]

5:00 pm: **Enhanced photocarrier extraction mechanisms in ultra-thin photovoltaic GaAs n/p junctions**, Mark C. A. York, Univ. de Sherbrooke (Canada); Francine Proulx, Univ. de Sherbrooke (Canada) and Azastra Opto Inc. (Canada); Denis P. Masson, Azastra Opto Inc. (Canada); Abdelatif Jaouad, Boussairi Bouzazi, Richard Arès, Julien Sylvestre, Vincent Aimez, Univ. de Sherbrooke (Canada); Simon Fafard, Univ. de Sherbrooke (Canada) and Azastra Opto Inc. (Canada) . . . . . [9743-32]

5:20 pm: **Modeling of effects of using polycrystalline substrates for low-cost III-V photovoltaics**, Zachary S. Bittner, Michael A. Slocum, Elisabeth L. McClure, Seth M. Hubbard, Rochester Institute of Technology (USA) . . . . . [9743-33]

5:40 pm: **1.7eV AlGaAs solar cells epitaxially grown on silicon by SSMBE using a superlattice and dislocation filters**, Arthur L. Onno, Jiang Wu, Qi Jiang, Siming Chen, Mingchu Tang, Univ. College London (United Kingdom); Lars Oberbeck, Total S.A. (France); Huiyin Liu, Univ. College London (United Kingdom) . . . . . [9743-34]

## WEDNESDAY 17 FEBRUARY

## SESSION 8

LOCATION: RM 274 (SOUTH MEZZANINE) . . . . . WED 8:00 TO 10:10 AM

### Advances in Quantum Well and Superlattice-Enhanced Photovoltaic Devices

Session Chairs: **Seth M. Hubbard**, Rochester Institute of Technology (USA); **Simon Fafard**, Azastra Opto Inc. (Canada)

8:00 am: **Quantum well for high-efficiency photovoltaics** (*Invited Paper*), Diego Alonso-Álvarez, Imperial College London (United Kingdom) . . . . . [9743-35]

8:30 am: **Observation of mini-band formation in the ground and high-energy electronic states of super-lattice solar cells**, Takanori Usuki, The Univ. of Tokyo (Japan); Kouki Matsuuchi, Tsubasa Nakamura, Univ. of Miyazaki (Japan); Kasidit Toprasertpong, The Univ. of Tokyo (Japan); Atsuhiko Fukuyama, Univ. of Miyazaki (Japan); Masakazu Sugiyama, Yoshiaki Nakano, The Univ. of Tokyo (Japan); Tetsuo Ikari, Univ. of Miyazaki (Japan) . . . . . [9743-36]

8:50 am: **Carrier dynamics in QW and bulk bismide materials and epitaxial lift off InGaP double heterostructures grown by MOVPE for multi-junction solar cells**, Yongkun Sin, Zachary Lingley, Mark Peterson, Stephen LaLumondiere, Steven C. Moss, The Aerospace Corp. (USA); Honghyuk Kim, Kamran Forghani, Yingxin Guan, Univ. of Wisconsin-Madison (USA); Kangho Kim, Jaejin Lee, Ajou Univ. (Korea, Republic of); Luke Mawst, Thomas Kuech, Univ. of Wisconsin-Madison (USA); Sudersena Rao Tatavarti, MicroLink Devices, Inc. (USA) . . . . . [9743-37]

9:10 am: **High performance 1 eV dilute nitride solar cells using quantum wells with cascaded thermally-assisted resonant tunneling design**, Alexandre Freundlich, Gopi K. Vijaya, Wei Wang, Michael Fitchette, Kaveh Shervin, Univ. of Houston (USA) . . . . . [9743-38]

9:30 am: **Effective drift mobility approximation in multiple quantum-well solar cells**, Kasidit Toprasertpong, Tomoyuki Inoue, The Univ. of Tokyo (Japan); Kentaroh Watanabe, RCAST, The Univ. of Tokyo (Japan); Takashi Kita, Kobe Univ. (Japan); Masakazu Sugiyama, Yoshiaki Nakano, The Univ. of Tokyo (Japan) . . . . . [9743-39]

9:50 am: **Quasi-Fermi level splitting evaluation based on electroluminescence analysis in multiple quantum-well solar cells for investigating cell performance under concentrated light**, Tomoyuki Inoue, Kasidit Toprasertpong, Amaury Delamarre, The Univ. of Tokyo (Japan); Kentaroh Watanabe, RCAST, The Univ. of Tokyo (Japan); Myriam Paire, Laurent Lombez, Institut de Recherche et Développement sur l'Energie Photovoltaïque (France); Jean-François Guillemoles, Institut de Recherche et Développement sur l'Energie Photovoltaïque (France) and RCAST, The Univ. of Tokyo (Japan); Masakazu Sugiyama, Yoshiaki Nakano, The Univ. of Tokyo (Japan) . . . . . [9743-40]

Coffee Break . . . . . Wed 10:10 am to 10:40 am

## SESSION 9

LOCATION: RM 274 (SOUTH MEZZANINE) . . WED 10:40 AM TO 12:20 PM

### Intermediate Band Solar Cells

Session Chairs: **Masakazu Sugiyama**, The Univ. of Tokyo (Japan); **Laurent Lombez**, Institut de Recherche et Développement sur l'Energie Photovoltaïque (France)

10:40 am: **Carrier dynamics in type-II quantum dots for wide-bandgap intermediate-band solar cells** (*Invited Paper*), Takeshi Tayagaki, Takeyoshi Sugaya, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [9743-41]

11:10 am: **Design optimization for two-step photon absorption in quantum dots by infrared photocurrent spectroscopy**, Ryo Tamaki, Yasushi Shoji, Yoshitaka Okada, RCAST, The Univ. of Tokyo (Japan) . . . . . [9743-42]

11:30 am: **Device simulation of thin-film intermediate-band solar cell using drift-diffusion model and FDTD method**, Akio Ogura, Mizuki Mori, Katsuhisa Yoshida, Tomah Sogabe, The Univ. of Tokyo (Japan); Yoshitaka Okada, RCAST, The Univ. of Tokyo (Japan) . . . . . [9743-43]

11:50 am: **Self-formation of ultrahigh-density InAs quantum dots for intermediate-band solar cell applications** (*Invited Paper*), Koichi Yamaguchi, Kazuki Sameshima, Katsuyoshi Sakamoto, Kohdai Nii, The Univ. of Electro-Communications (Japan) . . . . . [9743-44]

## SESSION 10

LOCATION: RM 272 (SOUTH MEZZANINE) . . . . . WED 4:00 TO 5:10 PM

### NOTE ROOM CHANGE

### Photovoltaics Modeling

Joint Session with Conferences 9742 and 9743

Session Chairs: **Alexandre Freundlich**, Univ. of Houston (USA); **Bernd Witzigmann**, Univ. Kassel (Germany)

4:00 pm: **Theoretical and experimental insights into hybrid perovskites for optoelectronic applications** (*Invited Paper*), Jacky Even, Laurent Pedesseau, Institut National des Sciences Appliquées de Rennes (France); Mikael Kepenekian, Univ. de Rennes 1 (France); Alain Rolland, Alexandre Beck, Daniel Saporì, Institut National des Sciences Appliquées de Rennes (France); Claudine Katan, Institut des Sciences Chimiques de Rennes (France); Hong-Hua Fang, Maria Antonietta Loi, Univ. of Groningen (Netherlands) . . . . . [9742-47]

4:30 pm: **Theoretical studies of Rashba and Dresselhaus effects in hybrid organic-inorganic perovskites for optoelectronic applications**, Laurent Pedesseau, Institut National des Sciences Appliquées de Rennes (France); Mikael Kepenekian, Univ. de Rennes 1 (France); Roberto Robles, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain); Daniel Saporì, Institut National des Sciences Appliquées de Rennes (France); Claudine Katan, Institut des Sciences Chimiques de Rennes (France); Jacky Even, Institut National des Sciences Appliquées de Rennes (France) . . . . . [9742-48]

4:50 pm: **Simulation study of GaAsP/Si tandem cells including the impact of threading dislocations on the luminescent coupling between the cells**, Arthur L. Onno, Univ. College London (United Kingdom); Nils-Peter Harder, Lars Oberbeck, Total S.A. (France); Huiyin Liu, Univ. College London (United Kingdom) . . . . . [9743-45]



# CONFERENCE 9743

LOCATION: ROOM 274 (SOUTH MEZZANINE)

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 ... WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Down-conversion of solar photons using alkali vapors**, Hal Gokturk, Ecken (USA) ..... [9743-46]

**Asymmetric angular-selective thermal emission**, Enas Sakr, Peter Bermel, Purdue Univ. (USA) ..... [9743-47]

**Competitive hybridization in quantum-dot-based nanodevices interacting with light**, Katawoura Beltako, Nicolas Cavassilas, Fabienne Michelini, Institut Matériaux Microélectronique Nanosciences de Provence (France) . . . . [9743-48]

**The behavior of series resistance of a p-n junction: the diode and the solar cell cases**, Poliana H. Bueno, Diogo Costa, Alexander Eick, Davies Monteiro, André Carvalho, Univ. Federal de Minas Gerais (Brazil) . . . . . [9743-49]

**Metal/metal-oxide nanocoatings on black silicon nano-grass for enhanced solar absorption and photochemical activity**, Pabitra Dahal, Raquel Flores, Elangovan Elamurugu, Nitul S. Rajput, Mustapha Jouiad, Jaime Viegas, Masdar Institute of Science & Technology (United Arab Emirates) . . . . . [9743-51]

**Organic solar cells with various plasmonic nanostructures using titanium nitride**, Sara Magdi, The American Univ. in Cairo (Egypt); Qiaoqiang Gan, Univ. at Buffalo (USA); Mohamed A. Swillam, The American Univ. in Cairo (Egypt) . . . . . [9743-52]

**Numerical analysis of the supercontinuum spectrum generation in a couple of photonic crystal fibers with different structure by using the RK4IP method**, Jesus Pablo Lauterio-Cruz, Ctr. de Investigaciones en Óptica, A.C. (Mexico); Juan Carlos Hernández-García, Univ. de Guanajuato (Mexico); Olivier J. M. Pottiez, Ctr. de Investigaciones en Óptica, A.C. (Mexico); Julián Moises Estudillo-Ayala, Roberto Rojas-Laguna, Daniel Jáuregui-Vázquez, José David Filoteo Razo, Luis Fernando Sámano-Aguilar, Univ. de Guanajuato (Mexico) . . . . . [9743-53]

**Nanostructure-based enhancement of performance in thin-film photovoltaic devices**, Jagdish Anakkavoor Krishnaswamy, Gopalakrishna M. Hegde, Praveen C. Ramamurthy, D. Roy Mahapatra, Indian Institute of Science (India) . . . . . [9743-54]

**Green solar cells using natural pigments having complementary absorption spectrum**, Sreeja S., Bala Pesala, C.S.I.R. Madras Complex (India) . . . [9743-55]



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# CONFERENCE 9744

LOCATION: ROOM 270 (SOUTH MEZZANINE)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9744

## Optical Components and Materials XIII

Conference Chairs: **Shibin Jiang**, AdValue Photonics, Inc. (USA); **Michel J. F. Dignonnet**, Stanford Univ. (USA)

Program Committee: **Jean-Luc Adam**, Univ. de Rennes 1 (France); **Joel Bagwell**, Edmund Optics Inc. (USA); **Rolindes Balda**, Univ. del País Vasco (Spain); **Robert P. Dahlgren**, CSUMB/NASA Ames Research Ctr. (USA); **Leonid B. Glebov**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); **Seppo K. Honkanen**, Univ. of Eastern Finland (Finland); **Jacques Lucas**, Univ. de Rennes 1 (France); **Yasutake Ohishi**, Toyota Technological Institute (Japan); **Aydogan Ozcan**, Univ. of California, Los Angeles (USA); **Giancarlo C. Righini**, Museo Storico della Fisica e Centro Studi e Ricerche Enrico Fermi (Italy); **Setsumi Tanabe**, Kyoto Univ. (Japan); **John M. Zavada**, National Science Foundation (USA)

### MONDAY 15 FEBRUARY

#### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative, Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break . . . . . Mon 10:10 am to 10:40 am

#### SESSION 1

LOCATION: RM 270 (SOUTH MEZZANINE) . . . . . MON 10:40 AM TO 12:00 PM

#### Fabrication and Characterization I

Session Chair: **Michel J. F. Dignonnet**, Stanford Univ. (USA)

- 10:40 am: **Pulsed laser deposition of rare-earth-doped glasses: a step toward lightwave circuits** (*Invited Paper*), Jose Gonzalo, Roberta Morea, Instituto de Óptica “Daza de Valdés” (Spain); Joaquín Fernández, Rolindes Balda, Univ. del País Vasco (Spain) and Ctr. de Física de Materiales (Spain) . . . . . [9744-1]
- 11:10 am: **Large-scale growth of graphene by chemical vapor deposition (CVD) and electrostatic deposition characterized by global hyperspectral Raman imaging**, Laura-Isabelle Dion-Bertrand, Photon etc. Inc. (Canada); Vincent Aymong, Minh Nguyen, Univ. de Montréal (Canada); Charles Trudeau, École de Technologie Supérieure (Canada); Saman Choubak, École Polytechnique de Montréal (Canada); Pierre Lévesque, Univ. de Montréal (Canada); Nicolas David, Photon etc. Inc. (Canada); Sylvain G. Cloutier, École de Technologie Supérieure (Canada); Patrick Desjardins, École Polytechnique de Montréal (Canada); Richard Martel, Univ. de Montréal (Canada) . . . . . [9744-2]
- 11:30 am: **Direct femtosecond laser writing of buried infrared waveguides in chalcogenide glasses** (*Invited Paper*), David Le Coq, Univ. de Rennes 1 (France); Eugène Bychkov, Pascal Masselin, Univ. du Littoral Côte d’Opale (France) . . . . . [9744-3]
- Lunch Break . . . . . Mon 12:00 pm to 1:40 pm

#### SESSION 2

LOCATION: RM 270 (SOUTH MEZZANINE) . . . . . MON 1:40 TO 2:50 PM

#### Supercontinuum and White-Light Generation

Session Chair: **Shibin Jiang**, AdValue Photonics, Inc. (USA)

- 1:40 pm: **Deep-ultraviolet to mid-infrared supercontinuum generation in ZBLAN photonic crystal fibre pumped by infrared pulses** (*Invited Paper*), Xin Jiang, Nicolas Y. Joly, Fehim Babic, John C. Travers, Philip St. J. Russell, Max-Planck-Institut für die Physik des Lichts (Germany) . . . . . [9744-5]
- 2:10 pm: **White-light emission studies of dysprosium-doped halide crystals**, Rami R. Bommareddi, Mical Culp, Alabama A&M Univ. (USA); Sudhir B. Trivedi, Brimrose Corp. of America (USA); Uwe H. Hömmerich, Hampton Univ. (USA) . . . . . [9744-8]
- 2:30 pm: **Near-infrared diode-pumped white-light emission from erbium-doped calcium fluoride crystal**, Rami R. Bommareddi, Mical Culp, Vernessa M. Edwards, Alabama A&M Univ. (USA) . . . . . [9744-9]
- Coffee Break . . . . . Mon 2:50 pm to 3:30 pm

#### SESSION 3

LOCATION: RM 270 (SOUTH MEZZANINE) . . . . . MON 3:30 TO 5:30 PM

#### Optical Properties of Materials

Session Chair: **Shibin Jiang**, AdValue Photonics, Inc. (USA)

- 3:30 pm: **Spatial and geometry control of second-order optical properties in inorganic amorphous materials** (*Invited Paper*), Marc Dussauze, Vincent Rodriguez, Frédéric Adamietz, Flavie Bondu, Antoine Lepicard, Univ. Bordeaux 1 (France) and Institut des Sciences Moléculaires (France); Thierry Cardinal, Evelyne Fargin, Institut de Chimie de la Matière Condensée de Bordeaux (France) . . . . . [9744-10]
- 4:00 pm: **Circular and linear birefringence in laser-grade single-crystal CVD diamond**, Hadiya Jasbeer, Robert J. Williams, Ondrej Kitzler, Aaron M. McKay, Jipeng Lin, Richard P. Mildren, Macquarie Univ. (Australia) . . . . . [9744-11]
- 4:20 pm: **Mid-IR gain media based on transition metal-doped II-VI chalcogenides** (*Invited Paper*), Sergey B. Mirov, Vladimir V. Fedorov, Dmitry V. Martyshkin, The Univ. of Alabama at Birmingham (USA) and IPG Photonics - Mid-Infrared Lasers (USA); Igor S. Moskalev, Mikhail S. Mirov, IPG Photonics - Mid-Infrared Lasers (USA); Alan D. Martinez, The Univ. of Alabama at Birmingham (USA); Sergey Vasilyev, IPG Photonics - Mid-Infrared Lasers (USA); Valentin P. Gapontsev, IPG Photonics Corp. (USA) . . . . . [9744-12]
- 4:50 pm: **Plasmon excitation and determination of atomic clusters and their assemblies**, Guanghou Wang, Nanjing Univ. (China) . . . . . [9744-13]
- 5:10 pm: **Design of a grating-coupled surface plasmon color filter**, Jingjing Guo, Yan Tu, Lanlan Yang, Lili Wang, Baoping Wang, Southeast Univ. (China) . . . . . [9744-44]

OPTO

# CONFERENCE 9744

LOCATION: ROOM 270 (SOUTH MEZZANINE)

TUESDAY 16 FEBRUARY

## SESSION 4

LOCATION: RM 270 (SOUTH MEZZANINE) . . . . TUE 8:40 TO 10:30 AM

### Optical Systems

Session Chair: **Michel J. F. Digonnet**, Stanford Univ. (USA)

8:40 am: **Integrated compact optical current sensors with high sensitivity** (*Invited Paper*), Duanni Huang, Sudharsanan Srinivasan, Univ. of California, Santa Barbara (USA); Paolo Pintus, Scuola Superiore Sant'Anna (Italy); John E. Bowers, Univ. of California, Santa Barbara (USA) . . . . . [9744-14]

9:10 am: **Enhancement of Rayleigh scatter in optical fiber by simple UV treatment: an order of magnitude increase in distributed sensing sensitivity**, Sébastien Loranger, François Parent, Victor Lambin-Iezzi, Raman Kashyap, Ecole Polytechnique de Montréal (Canada) . . . . . [9744-15]

9:30 am: **Spherical transceivers for ultrafast optical wireless communications**, Xian Jin, Blago A. Hristovski, Christopher M. Collier, Simon Geoffroy-Gagnon, Brandon Born, Jonathan F. Holzman, The Univ. of British Columbia (Canada) . . . . . [9744-16]

9:50 am: **CMOS-TDI detector for high-resolution applications**, Andreas Eckardt, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Ralf Reulke, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) and Humboldt Univ. zu Berlin (Germany); Karsten Sengebusch, Eureka Messtechnik GmbH (Germany) . . . . . [9744-17]

10:10 am: **Design and test of a new facility for assessing spectral normal emittance of solid materials at high temperature**, Luca Mercatelli, Elisa Sani, Marco Meucci, Istituto Nazionale di Ottica (Italy) . . . . . [9744-18]

Coffee Break . . . . . Tue 10:30 am to 11:00 am

## SESSION 5

LOCATION: RM 270 (SOUTH MEZZANINE) . TUE 11:00 AM TO 12:20 PM

### Bulk-Optic Components

Session Chair: **Ciro Falcony**, Ctr. de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Mexico)

11:00 am: **Photo-thermo-refractive glass with sensitivity extended into the near-infrared region**, Fedor M. Kompan, George B. Venus, Larissa N. Glebova, Helene Mingareev, Leonid B. Glebov, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9744-27]

11:20 am: **Expanding the optical design glass map with new IR materials for multispectral optics**, Shyam S. Bayya, Daniel J. Gibson, Vinh Q. Nguyen, Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA); Mikhail Kotov, Sotera Defense Solutions, Inc. (USA) . . . . . [9744-28]

11:40 am: **IR-transmitting GRIN chalcogenide materials**, Daniel J. Gibson, Shyam S. Bayya, Vinh Q. Nguyen, U.S. Naval Research Lab. (USA); Mikhail Kotov, Sotera Defense Solutions, Inc. (USA); Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA) . . . . . [9744-29]

12:00 pm: **700 kHz beam scanning using electro-optic KTN planar optical deflector**, Shoko Tatsumi, Yuzo Sasaki, Seiji Toyoda, Tadayuki Imai, Junya Kobayashi, Tadashi Sakamoto, Nippon Telegraph and Telephone Corp. (Japan) . . . . . [9744-30]

Lunch/Exhibition Break . . . . . Tue 12:20 pm to 2:00 pm

## SESSION 6

LOCATION: ROOM 270 (SOUTH MEZZANINE) . . TUE 2:00 PM TO 3:00 PM

### Fabrication and Characterization II

Session Chair: **Rolindes Balda**, Univ. del País Vasco (Spain)

2:00 pm: **Determination of the geometric ray contents of light propagating in highly-multimode optical fiber**, Philippe Décoste, Nicolas Godbout, Ecole Polytechnique de Montréal (Canada) . . . . . [9744-23]

2:20 pm: **Two-dimensional refractive index profiling of optical fibers by modified refractive near-field technique**, Ali F. El Sayed, Univ. Bern (Switzerland); Sönke Pilz, Berner Fachhochschule Technik und Informatik (Switzerland); Manuel Ryser, Univ. Bern (Switzerland); Valerio Romano, Univ. Bern (Switzerland) and Berner Fachhochschule Technik und Informatik (Switzerland) . . . . . [9744-24]

2:40 pm: **Coherent perfect absorption in silicon**, Lorelle N. Pye, Ayman F. Abouraddy, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9744-25]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

## SESSION 7

LOCATION: RM 270 (SOUTH MEZZANINE) . . . . .TUE 3:30 TO 4:30 PM

### Optical Amplifiers

Session Chair: **Jasbinder S. Sanghera**, U.S. Naval Research Lab. (USA)

3:30 pm: **An efficient scheme of intermodal distributed Raman amplification using tailored doping profiles in spatial-division multiplexed coherent fiber-optic transmission systems**, Yi Weng, Zhongqi Pan, Univ. of Louisiana at Lafayette (USA) . . . . . [9744-20]

3:50 pm: **Highly nonlinear chalcogenide optical fibers with flattened chromatic dispersion invariant to the core fluctuation and their performances of parametric amplification**, Hoang Tuan Tong, Kenshiro Nagasaka, Lei Zhang, Tonglei Cheng, Takenobu Suzuki, Yasutake Ohishi, Toyota Technological Institute (Japan) . . . . . [9744-21]

4:10 pm: **KY<sub>2</sub>F<sub>10</sub>:Er<sup>3+</sup>/Yb<sup>3+</sup> nanocrystals doped laser-induced self-written waveguide for optical amplification in the C band**, Xiaojie Xue, Tonglei Cheng, Takenobu Suzuki, Yasutake Ohishi, Toyota Technological Institute (Japan) . . . . . [9744-22]

## SESSION 8

LOCATION: RM 270 (SOUTH MEZZANINE) . . . . TUE 4:30 TO 5:40 PM

### Lasers

Session Chair: **Angel Flores**, Air Force Research Lab. (USA)

4:30 pm: **Ho-doped fibers for high-energy laser applications** (*Invited Paper*), E. Joseph Friebele, Colin C. Baker, Charles G. Askins, U.S. Naval Research Lab. (USA); John R. Peele, Sotera Defense Solutions, Inc. (USA); Barbara Marcheschi, Woohong Kim, Steven R. Bowman, Leslie B. Shaw, Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA) . . . . . [9744-31]

5:00 pm: **High-power eye-safe Er<sup>3+</sup>:YVO<sub>4</sub> laser diode-pumped at 976 nm**, Alex A. Newburgh, Mark Dubinskii, U.S. Army Research Lab. (USA) . . . [9744-32]

5:20 pm: **1.8- $\mu$ m thulium microlasers integrated on silicon**, Jonathan D. B. Bradley, Zhan Su, Emir Salih Magden, Massachusetts Institute of Technology (USA); Nanxi Li, Massachusetts Institute of Technology (USA) and Harvard Univ. (USA); Purnawirman Purnawirman, Massachusetts Institute of Technology (USA); Thomas N. Adam, Gerald Leake, Douglas Coolbaugh, SUNY Polytechnic Institute (USA); Michael R. Watts, Massachusetts Institute of Technology (USA) . . . . . [9744-33]

# WEDNESDAY 17 FEBRUARY

## SESSION 9

LOCATION: RM 270 (SOUTH MEZZANINE) . . . WED 8:30 TO 10:00 AM

### Optical Properties of Rare-Earth-Doped Materials

Session Chair: **Shibin Jiang**, AdValue Photonics, Inc. (USA)

8:30 am: **Excitation mechanisms of Er optical centers in GaN epilayers** (*Invited Paper*), Vinh Nguyen, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9744-34]

9:00 am: **Luminescence of lanthanide-doped nanocrystals**, Andries Meijerink, Freddy T. Rabouw, Tim Senden, Yiming Zhao, Celso Donega, Utrecht Univ. (Netherlands) . . . . . [9744-35]

9:20 am: **Efficient 800nm upconversion luminescence emission in 1.319  $\mu$ m excited thulium-doped fluorogermanate glass**, Artur S. Gouveia-Neto, Marcos V. D. Vermelho, Carlos J. Silva, Evandro J. T. A. Gouveia, Univ. Federal de Alagoas (Brazil); Luciano A. Bueno, Univ. de Sorocaba (Brazil) . . . . [9744-36]

9:40 am: **Light emission in the NIR and VIS from SIALON rare-earth-doped thin films for integrated optical devices**, Ivan Camps, Antonio Mariscal, Rosalia Serna, Consejo Superior de Investigaciones Científicas (Spain) [9744-37]

Coffee Break . . . . . Wed 10:00 am to 10:30 am

### SESSION 10

LOCATION: RM 270 (SOUTH MEZZANINE) WED 10:30 AM TO 12:10 PM

## Guided-Wave Components

Session Chair: **Michel J. F. Digonnet**, Stanford Univ. (USA)

10:30 am: **Metamaterial nanostructures with tuneable properties for optical switching**, Johann Toudert, Alexander Cuadrado, Rosalia Serna, Consejo Superior de Investigaciones Científicas (Spain) . . . . . [9744-38]

10:50 am: **Dynamic control of a Fano resonance with a fully integrated silicon nanostructure**, Arijit Bera, Matthieu Roussey, Markku Kuittinen, Seppo Honkanen, Univ. of Eastern Finland (Finland) . . . . . [9744-39]

11:10 am: **Spectral selective perfect light absorption in ultra-thin silicon films on aluminum for color filters**, Seyed Sadreddin Mirshafieyan, Junpeng Guo, The Univ. of Alabama in Huntsville (USA) . . . . . [9744-40]

11:30 am: **Pseudo-circulator implemented as a multimode fiber coupler**, Francis Bulota, Philippe Bélanger, Mikael Leduc, Caroline Boudoux, Nicolas Godbout, Ecole Polytechnique de Montréal (Canada) . . . . . [9744-41]

11:50 am: **Lithium-niobate-integrated photonic crystal and waveguides**, Soon Thor Lim, Thomas Ang, A\*STAR Institute of High Performance Computing (Singapore); Ching Eng Png, A\*STAR Institute of High Performance Computing (Singapore) and Optic2Connect Pte Ltd. (Singapore); Jun Deng, Siemens Ltd. (China); Aaron J. Danner, National Univ. of Singapore (Singapore) . . . . [9744-43]

### POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 ... WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Coherent mid-infrared supercontinuum generation in all-solid chalcogenide microstructured fibers with all-normal dispersion**, Lai Liu, Yasutake Ohishi, Takenobu Suzuki, Tonglei Cheng, Kenshiro Nagasaka, Toyota Technological Institute (Japan) . . . . . [9744-6]

**Supercontinuum generation in a suspended core birefringent tellurite microstructured optical fiber pumped in telecommunication band by a picosecond laser**, Lei Zhang, Hoang Tuan Tong, Harutaka Kawamura, Takenobu Suzuki, Yasutake Ohishi, Toyota Technological Institute (Japan) . . . . . [9744-7]

**Low polarization dependent loss of InP-based waveguide photodetector integrated with spot-size converter for 100Gb/s coherent receiver**, Young-Ho Ko, Joong-Seon Choe, Won-Seok Han, Jong-Hoi Kim, Yong-Hwan Kwon, Electronics and Telecommunications Research Institute (Korea, Republic of) . . . . . [9744-42]

**Freeform lens for uniform illumination by an extended light source**, Sina Babadi, Roberto Ramirez-Iniguez, Tuleen Boutaleb, Glasgow Caledonian Univ. (United Kingdom); Tapas Mallick, Univ. of Exeter (United Kingdom) . . . . . [9744-45]

**SiPM optimization for 3D ranging applications**, Carl Jackson, Stephen J. Bellis, Steve Buckley, Deborah Herbert, SensL (Ireland) . . . . . [9744-46]

**Gain control dynamics of thulium-doped fibre amplifier at 2  $\mu$ m**, Mustafa A. Khamis, Karin M. Ennser, Swansea Univ. (United Kingdom) [9744-47]

**Optical and electrical properties of graphene/polymer heterostructure for optoelectronic applications**, Anjali Yadav, Saral Gupta, Chandra M. Negi, Gayatri Chauhan, Ajay Verma, Banasthali Univ. (India) . . . . . [9744-48]

**Evolution of the mid-infrared higher-order soliton fission in a tapered tellurite microstructured optical fiber**, Tonglei Cheng, Xiaojie Xue, Lai Liu, Weiqing Gao, Takenobu Suzuki, Yasutake Ohishi, Toyota Technological Institute (Japan) . . . . . [9744-49]

**Electric field sensor using long pitch cholesteric liquid crystals**, Myeong Ock Ko, Sung-Jo Kim, Jong-Hyun Kim, Min Yong Jeon, Chungnam National Univ. (Korea, Republic of) . . . . . [9744-50]

**Multi-wavelength fiber laser based on liquid crystal Fabry-Perot device**, Hyun Ji Lee, Myeong Ock Ko, Sung-Jo Kim, Jong-Hyun Kim, Min Yong Jeon, Chungnam National Univ. (Korea, Republic of) . . . . . [9744-51]

**Controlling the thermo-optic response in silicon elastomers**, James Ramies, G. M. Poliskie, Gillian Fry, Daniel Gonzalez, Jesse Galvan, NuSil Technology LLC (USA) . . . . . [9744-52]

**Design methods for tunable notch filters in shortwave infrared**, Neelam Gupta, U.S. Army Research Lab. (USA); Mark S. Mirotznik, Univ. of Delaware (USA) . . . . . [9744-54]

**Erbium-doped zinc-oxide waveguide amplifiers for hybrid photonic integrated circuits**, Lawrence O'Neal, Deion Anthony, Carl E. Bonner Jr., Demetris L. Geddis, Norfolk State Univ. (USA) . . . . . [9744-55]

**Design of intrinsically single-mode double clad crystalline fiber waveguides for high-power lasers**, Da Li, Stephanie K. Meissner, Helmut E. Meissner, Onyx Optics Inc. (USA); Mark Dubinskii, U.S. Army Research Lab. (USA) . . . . . [9744-56]

**Power scaling analysis of crystalline fiber waveguides based on RE<sup>3+</sup>-doped YAG cores**, Da Li, Stephanie K. Meissner, Helmut E. Meissner, Onyx Optics Inc. (USA); Mark Dubinskii, U.S. Army Research Lab. (USA) . . . [9744-57]

**Confocal Raman spectroscopy and AFM for evaluation of sidewalls in type II superlattices and MCT materials**, Alexander A. Ukhanov, Pranav Rathi, Kevin J. Malloy, Pablo A. Reyes, Actoprobe LLC (USA); Marvin Jaime-Vasquez, U.S. Army RDECOM CERDEC NVESD (USA); Dmitri A. Tenne, Boise State Univ. (USA); Elena Plis, Sanjay Krishna, SKINfrared LLC (USA) . . . . . [9744-58]

**Low-power compact hybrid plasmonic double-microring electro-optical modulator**, Aya O. Zaki, Nourhan H. Fouad, The American Univ. in Cairo (Egypt); Dimitrios C. Zografopoulos, Romeo Beccherellic, Consiglio Nazionale delle Ricerche (Italy); Mohamed A. Swillam, The American Univ. in Cairo (Egypt) . . . . . [9744-59]

**A 1280 x 1024 15 $\mu$ m pitch hybrid silicon FPA for NIR imaging**, Selim Eminoglu, Mikro-Tasarim San. ve Tic. Ltd. Sti. (Turkey) . . . . . [9744-60]

**Modern collinear LiNbO<sub>3</sub> acousto-optical filter for optical spectroscopy: the exploration of efficiency and spectral resolution**, Alexandre S. Shcherbakov, Adan O. Arellanes, Emanuele Bertone, Instituto Nacional de Astrofisica, Optica y Electrónica (Mexico) . . . . . [9744-61]

# CONFERENCE 9745

LOCATION: ROOM 276 (SOUTH MEZZANINE)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9745

# Organic Photonic Materials and Devices XVIII

*Conference Chairs:* **Christopher E. Tabor**, Air Force Research Lab. (USA); **François Kajzar**, Univ. Politehnica of Bucharest (Romania); **Toshikuni Kaino**, Tohoku Univ. (Japan); **Yasuhiro Koike**, Keio Univ. (Japan)

*Program Committee:* **Chantal Andraud**, Ecole Normale Supérieure de Lyon (France); **Werner J. Blau**, Trinity College Dublin (Ireland); **Andreas Bräuer**, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); **Fabrice Charra**, Commissariat à l'Énergie Atomique (France); **Beata J. Derkowska-Zielinska**, Nicolaus Copernicus Univ. (Poland); **Raluca Dinu**, GigOptix, Inc. (USA); **Manfred Eich**, Technische Univ. Hamburg-Harburg (Germany); **Alain F. Fort**, Institut de Physique et Chimie des Matériaux de Strasbourg (France); **James G. Grote**, Air Force Research Lab. (USA); **F. Kenneth Hopkins**, Air Force Research Lab. (USA); **Alex K. Y. Jen**, Univ. of Washington (USA); **Michael H. C. Jin**, Johns Hopkins Univ. Applied Physics Lab., LLC (USA); **Eunkyoung Kim**, Yonsei Univ. (Korea, Republic of); **Jang-Joo Kim**, Seoul National Univ. (Korea, Republic of); **Nakjoong Kim**, Hanyang Univ. (Korea, Republic of); **Isabelle Ledoux-Rak**, Ecole Normale Supérieure de Cachan (France); **Charles Y. C. Lee**, Air Force Office of Scientific Research (USA); **Kwang-Sup Lee**, Hannam Univ. (Korea, Republic of); **Misoon Y. Mah**, Asian Office of Aerospace Research and Development (Japan); **Seth R. Marder**, Georgia Institute of Technology (USA); **Antoni C. Mitus**, Wroclaw Univ. of Technology (Poland); **Jaroslawn Mysliwiec**, Wroclaw Univ. of Technology (Poland); **Robert L. Nelson**, Air Force Research Lab. (USA); **Robert A. Norwood**, College of Optical Sciences, The Univ. of Arizona (USA); **Jean-Michel Nunzi**, Queen's Univ. (Canada); **Shuji Okada**, Yamagata Univ. (Japan); **Akira Otomo**, National Institute of Information and Communications Technology (Japan); **Ileana Rau**, Univ. Politehnica of Bucharest (Romania); **Niyazi Serdar Sariciftci**, Johannes Kepler Univ. Linz (Austria); **Devanand K. Shenoy**, Defense Advanced Research Projects Agency (USA); **Kenneth D. Singer**, Case Western Reserve Univ. (USA); **Attila A. Szep**, Air Force Research Lab. (USA); **Rebecca E. Taylor**, Lockheed Martin Space Systems Co. (USA); **Jeong-Weon Wu**, Ewha Womans Univ. (Korea, Republic of); **Shiyoshi Yokoyama**, Kyushu Univ. (Japan); **Roberto Zamboni**, Istituto per la Sintesi Organica e la Fotoreattività (Italy)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative,  
Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break ..... Mon 10:10 am to 10:30 am

### SESSION 1

LOCATION: RM 276 (SOUTH MEZZANINE) .. MON 10:30 AM TO 12:30 PM

### Biophotonics

Session Chair: **François Kajzar**,  
Univ. Politehnica of Bucharest (Romania)

10:30 am: **Progress of DNA nucleobase passivation layers for photonics and electronics** (*Invited Paper*), Fahima Ouchen, Air Force Research Lab. (USA); **François Kajzar**, Ileana Rau, Univ. Politehnica of Bucharest (Romania); **James G. Grote**, Air Force Research Lab. (USA) ..... [9745-1]

11:00 am: **Studies of new optically active molecules interacting with DNA** (*Invited Paper*), Katarzyna Matczyszyn, Marco Deiana, Ziemowit Pokladek, Wroclaw Univ. of Technology (Poland); **Bastien Mettra**, Ecole Normale Supérieure de Lyon (France); **Joanna Olesiak-Banska**, Wroclaw Univ. of Technology (Poland); **Cyrille Monnereau**, Chantal Andraud, Ecole Normale Supérieure de Lyon (France); **Marek Samoc**, Wroclaw Univ. of Technology (Poland) ..... [9745-2]

11:30 am: **DNA-based membranes for multiple applications** (*Invited Paper*), Ileana Rau, François Kajzar, Mihaela Mindroiu, Gratiela T. Tihan, Ana-Maria Manea, Univ. Politehnica of Bucharest (Romania); **Agnieszka Pawlicka**, Instituto de Química de São Carlos (Brazil); **Cristian Pirvu**, Univ. Politehnica of Bucharest (Romania) ..... [9745-3]

12:00 pm: **Living materials-opportunities with biopolymers for technological applications** (*Invited Paper*), Fiorenzo G. Omenetto, Tufts Univ. (USA) . . [9745-4]

Lunch Break ..... Mon 12:30 pm to 1:50 pm

### SESSION 2

LOCATION: RM 276 (SOUTH MEZZANINE) ..... MON 1:50 TO 3:30 PM

### Solar Cells

Session Chair: **Ileana Rau**, Univ. Politehnica of Bucharest (Romania)

1:50 pm: **Photothermally-Activated Polymer Films for Harvesting of Near IR Energy with a Hybrid Cell Structure** (*Invited Paper*), Eunkyoung Kim, Teahoon Park, Jongbeom Na, Byeongwan Kim, Younghoon Kim, Haejin Shin, Yonsei Univ. (Korea, Republic of) ..... [9745-5]

2:20 pm: **Organic solar cells: recent advances in simplifying device architecture** (*Invited Paper*), Bernard Kippelen, Talha M. Khan, Vladimir Kolesov, F. Larrain, Canek Fuentes-Hernandez, Georgia Institute of Technology (USA) ..... [9745-6]

2:50 pm: **Organic molecules for photo-isomeric storage**, Hal Gokturk, Ecoken (USA) ..... [9745-7]

3:10 pm: **Investigation of the microstructures of F8T2:PC71BM blends and their effects on bulk heterojunction ultraviolet photodetectors**, Monica Esopi, Qiuming Yu, Univ. of Washington (USA) ..... [9745-8]

Coffee Break ..... Mon 3:30 pm to 4:00 pm



# CONFERENCE 9745

LOCATION: ROOM 276 (SOUTH MEZZANINE)

## SESSION 3

LOCATION: RM 276 (SOUTH MEZZANINE) . . . . MON 4:00 TO 5:40 PM

### Optical Waveguides

Session Chair: **Bernard Kippelen**,  
Georgia Institute of Technology (USA)

4:00 pm: **Parity-time symmetry in organic thin films and waveguides** (*Invited Paper*), Noel C. Giebink, The Pennsylvania State Univ. (USA) . . . . . [9745-9]

4:30 pm: **Functionalization of light induced self-written waveguides and their interactions in photopolymers.** (*Invited Paper*), Loic Mager, Kokou Dodzi H. Dorkenoo, Alberto Barsella, Institut de Physique et Chimie des Matériaux de Strasbourg (France) . . . . . [9745-10]

5:00 pm: **Ultra-high refractive index chalcogenide based copolymers for infrared optics**, Soha Namnabat, Laura E. Anderson, Jeffrey Pyun, The Univ. of Arizona (USA); Robert A. Norwood, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9745-11]

5:20 pm: **Fabrication of polymer based integrated photonic devices by maskless lithography**, Maik Rahlves, Bernhard Roth, Leibniz Univ. Hannover (Germany) . . . . . [9745-12]

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: RM 276 (SOUTH MEZZANINE) . . . . .TUE 8:00 TO 10:10 AM

### Materials I

Session Chair: **Yasuhiro Koike**, Keio Univ. (Japan)

8:00 am: **3D printing of natural organic materials by photochemistry** (*Keynote Presentation*), Patrice L. Baldeck, Ecole Normale Supérieure de Lyon (France) . . . . . [9745-13]

8:40 am: **Optical patterning and preparation of liquid crystalline elastomers: shape-changing materials** (*Invited Paper*), Timothy J. White, Air Force Research Lab. (USA) . . . . . [9745-14]

9:10 am: **Exploiting the intermolecular charge transfer state for organic near-infrared detectors**, Bernhard Siegmund, Andreas Mischok, Johannes Benduhn, Donato F. Spoltore, Hartmut Fröb, Christian Körner, Karl Leo, Koehn Vandewal, TU Dresden (Germany) . . . . . [9745-16]

9:30 am: **High-conductance low-voltage organic thin film transistor with locally rearranged poly(3-hexylthiophene) domain by current annealing on plastic substrate**, Zingway Pei, National Chung Hsing Univ. (Taiwan) . [9745-19]

9:50 am: **Protein-based flexible whispering gallery mode resonators**, Huzeyfe Yilmaz, Washington Univ. in St. Louis (USA); Abdon Pena-Francesch, The Pennsylvania State Univ. (USA); Linhua Xu, Washington Univ. in St. Louis (USA); Robert Shreiner, Huihun Jung, The Pennsylvania State Univ. (USA); Steven H. Huang, Sahin K. Ozdemir, Lan Yang, Washington Univ. in St. Louis (USA); Melik C. Demirel, The Pennsylvania State Univ. (USA) . . . . . [9745-61]

Coffee Break . . . . . Tue 10:10 am to 10:40 am

### SESSION 5

LOCATION: RM 276 (SOUTH MEZZANINE) TUE 10:40 AM TO 12:00 PM

### Materials II

Session Chair: **Patrice L. Baldeck**,  
Ecole Normale Supérieure de Lyon (France)

10:40 am: **Photophysical properties and applications of functionalized acenes** (*Invited Paper*), John E. Anthony, Univ. of Kentucky (USA) . . . . [9745-17]

11:10 am: **Control of optical properties in metamaterial by nematic liquid crystals** (*Invited Paper*), Jeong Weon Wu, Yeon Ui Lee, Ewha Womans Univ. (Korea, Republic of) . . . . . [9745-18]

11:40 am: **Characterization of collagen liquid crystal organizations using polarization-resolved nonlinear optical microscopy**, Claire Teulon, Ecole Polytechnique (France) and INSERM (France); Aurélien Tidu, François Portier, Gervaise Mosser, Univ. Pierre et Marie Curie (France) and Collège de France (France); Marie-Claire Schanne-Klein, Ecole Polytechnique (France) and INSERM (France) . . . . . [9745-15]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:20 pm

### SESSION 6

LOCATION: RM 276 (SOUTH MEZZANINE) . . . . . TUE 1:20 TO 3:30 PM

### EO-Polymer Materials/Devices

Session Chair: **Toshikuni Kaino**, Tohoku Univ. (Japan)

1:20 pm: **High-performance organic electro-optic materials enabling efficient optical modulation for dielectric photonics and silicon nanophotonics and plasmonics** (*Keynote Presentation*), Alex K. Y. Jen, Univ. of Washington (USA) . . . . . [9745-20]

2:00 pm: **Hybrid EO polymer modulator to CMOS compatible waveguides** (*Invited Paper*), Shiyoshi Yokoyama, Feng Qiu, Andrew Mark Spring, Kyushu Univ. (Japan) . . . . . [9745-21]

2:30 pm: **Bias-free operation of EO polymer modulator using MMI coupler**, Hiromu Sato, Kazuhiro Yamamoto, Hiroki Miura, Shiyoshi Yokoyama, Kyushu Univ. (Japan) . . . . . [9745-22]

2:50 pm: **Surface treatment of organic electro-optic polymers and devices for durability improvements**, Yukihiro Tominari, Shukichi Tanaka, Isao Aoki, Akira Otomo, National Institute of Information and Communications Technology (Japan) . . . . . [9745-23]

3:10 pm: **Hybrid plasmonic/electro-optic polymer modulator**, Fanghui Ren, Oregon State Univ. (USA); Jingdong Luo III, Alex K. Y. Jen, Univ. of Washington (USA); Alan X. Wang, Oregon State Univ. (USA) . . . . . [9745-24]

Coffee Break . . . . . Tue 3:30 pm to 4:00 pm

### SESSION 7

LOCATION: RM 276 (SOUTH MEZZANINE) . . . . . TUE 4:00 TO 5:40 PM

### Nanophotonics

Session Chair: **Alex K. Y. Jen**, Univ. of Washington (USA)

4:00 pm: **Optimization of electrospinning techniques for the realization of nanofiber plastic lasers** (*Invited Paper*), Luana Persano, Maria Moffa, Consiglio Nazionale delle Ricerche (Italy); Vito Fasano, Martina Montinaro, Univ. del Salento (Italy); Giovanni Morello, Consiglio Nazionale delle Ricerche (Italy); Vincenzo Resta, Univ. del Salento (Italy); Andrea Camposeo, Consiglio Nazionale delle Ricerche (Italy); Dario Pisignano, Univ. del Salento (Italy) . . . . . [9745-25]

4:30 pm: **Control of photon transport properties in nanocomposite nanowires** (*Invited Paper*), Maria Moffa, Andrea Camposeo, Luana Persano, Consiglio Nazionale delle Ricerche (Italy); Dario Pisignano, Univ. del Salento (Italy) . . . . . [9745-26]

5:00 pm: **Measurement of molecular length of self-assembled monolayer probed by localized surface plasmon resonance**, Juri Ito, Kotaro Kajikawa, Tokyo Institute of Technology (Japan) . . . . . [9745-27]

5:20 pm: **Improving quantum dot photo-stability via ligand exchange to optimize resonant energy transfer**, Jose Amaral, Univ. of California, Merced (USA) . . . . . [9745-28]

## WEDNESDAY 17 FEBRUARY

### SESSION 8

LOCATION: RM 276 (SOUTH MEZZANINE) . . . WED 8:30 TO 10:00 AM

### OLEDs

Session Chair: **Timothy J. White**, Air Force Research Lab. (USA)

8:30 am: **Organic semiconductors: structuring light for visible light communications** (*Invited Paper*), Ifor D. W. Samuel, Univ. of St. Andrews (United Kingdom) . . . . . [9745-29]

9:00 am: **Fully solution-processed organic light-emitting electrochemical cells (OLEC) with inkjet-printed micro-lenses for disposable lab-on-chip applications at ambient conditions**, Zhe Shu, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) and Friedrich-Schiller-Univ. Jena (Germany); Oliver Pabst, Erik Beckert, Ramona Eberhardt, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Andreas Tünnermann, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) and Friedrich-Schiller-Univ. Jena (Germany) . . . . . [9745-30]

9:20 am: **Switching azobenzene-functionalized surfaces with organic light-emitting diodes**, Matthias Bremer, Christine Kallweit, Andre Iwers, Markus Köpke, Martina Gerken, Christian-Albrechts-Univ. zu Kiel (Germany) . . [9745-31]

9:40 am: **Solution-processed inverted polymer light-emitting diodes**, Jongjang Park, Jaeheung Ha, Narkhyeon Seong, Changhee Lee, Yongtaek Hong, Seoul National Univ. (Korea, Republic of) . . . . . [9745-32]

OPTO

# CONFERENCE 9745

LOCATION: ROOM 276 (SOUTH MEZZANINE)

Coffee Break .....Wed 10:00 am to 10:30 am

## SESSION 9

LOCATION: RM 276 (SOUTH MEZZANINE) .. WED 10:30 AM TO 12:30 PM

### Nonlinear Optics

Session Chair: **Ifor D. W. Samuel**,  
Univ. of St. Andrews (United Kingdom)

10:30 am: **Nanocarbon as versatile materials platform for photonics** (*Invited Paper*), Werner J. Blau, Trinity College Dublin (Ireland) ..... [9745-33]

11:00 am: **Quantum calculation of the second-order hyperpolarizability of chiral molecules in the "one-electron" model** (*Invited Paper*), Francois Hache, Lab. d'Optique et Biosciences (France) ..... [9745-34]

11:30 am: **Revisiting nonlinear liquid crystal cored fiber array for imaging, all-optical switching, and transmission control applications** (*Invited Paper*), Iam Choon Khoo, The Pennsylvania State Univ. (USA) ..... [9745-35]

12:00 pm: **NLO properties of the substituted [2,2]paracyclophanes** (*Invited Paper*), Lada N. Puntus, Institute of Radio Engineering and Electronics (Russian Federation); Konstantin A. Lyssenko, Ivan V. Fedyanin, A.N. Nesmeyanov Institute of Organoelement Compounds (Russian Federation); Ileana Rau, Ana-Maria Manea, Univ. Politehnica of Bucharest (Romania) ..... [9745-36]

Lunch/Exhibition Break .....Wed 12:30 pm to 1:50 pm

## SESSION 10

LOCATION: RM 276 (SOUTH MEZZANINE) ..... WED 1:50 TO 3:30 PM

### Organic/Inorganic Hybrids I

Session Chair: **Christopher E. Tabor**, Air Force Research Lab. (USA)

1:50 pm: **Optical interconnection based on silicon photonics and photonic polymers** (*Invited Paper*), Okihiko Sugihara, Utsunomiya Univ. (Japan). [9745-37]

2:20 pm: **3D building blocks for self-assembling chromophores on sp<sup>2</sup>-carbon based substrates** (*Invited Paper*), Ping Du, David Kreher, Fabrice Mathevet, Univ. Pierre et Marie Curie (France); Fabrice Charra, Commissariat à l'Énergie Atomique (France); André-Jean Attias, Univ. Pierre et Marie Curie (France) ..... [9745-38]

2:50 pm: **Printed optically transparent graphene cellulose electrodes**, Dogan Sinar, George K. Knopf, Western Univ. (Canada); Suwas Nikumb, National Research Council Canada (Canada) ..... [9745-39]

3:10 pm: **Unusual electro-optic effects in liquid crystals**, Mamatha Nagaraj, Univ. of Leeds (United Kingdom) ..... [9745-40]

Coffee Break .....Wed 3:30 pm to 4:00 pm

## SESSION 11

LOCATION: RM 276 (SOUTH MEZZANINE) ..... WED 4:00 TO 5:10 PM

### Organic/Inorganic Hybrids II

Session Chair: **André-Jean Attias**, Univ. Pierre et Marie Curie (France)

4:00 pm: **Organic-inorganic composites for THz device fabrication** (*Invited Paper*), Cai Bin, Bo Guo, Xuecheng Wang, Yunzhou Li, Univ. of Shanghai for Science and Technology (China) ..... [9745-41]

4:30 pm: **Nanostars for plasmonically-enhanced organic light-emitting diodes**, Battulga Munkhbat, Hannes Pöhl, Patrick Denk, Thomas A. Klar, Niyazi Serdar Sariciftci, Markus C. Scharber, Calin Hrelescu, Johannes Kepler Univ. Linz (Austria) ..... [9745-42]

4:50 pm: **Exciton-dominated fast recombination in low-temperature CH<sub>3</sub>NH<sub>3</sub>PbCl<sub>1-x</sub>I<sub>x</sub> perovskite thin films**, Som Sarang, Univ. of California, Merced (USA) ..... [9745-43]

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 ... WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Nonlinear thin film organic co-crystal grown on a polymer substrate: a method and properties**, Iliia M. Pavlovetc, ITMO Univ. (Russian Federation); Henryk J. Laszewski, Ecole Normale Supérieure de Cachan (France); Elizaveta B. Shekhanova, Maria I. Fokina, ITMO Univ. (Russian Federation) ..... [9745-44]

**Investigation of the nonlinear absorption spectrum of all-trans retinoic acid by using the steady and transient two-photon absorption-induced spectroscopy**, Marcelo G. Vivas, Univ. Federal de Alfenas (Brazil); Jonathas De Paula Siqueira, Univ. de São Paulo (Brazil); Daniel Silva, Univ. Federal de São Carlos (Brazil); Leonardo De Boni, Cleber R. Mendonça, Instituto de Física de São Carlos IFSC-USP (Brazil) ..... [9745-45]

**Two-photon absorption in branched molecular systems**, Ruben Dario Fonseca Rodriguez, Univ. de São Paulo (Brazil); Marcelo G. Vivas, Univ. Federal de Alfenas (Brazil); Daniel Silva, Univ. Federal de São Carlos (Brazil); Leonardo De Boni, Cleber R. Mendonça, Instituto de Física de São Carlos IFSC-USP (Brazil) ..... [9745-46]

**Second- and third-order nonlinear optical properties of chalcones**, Luís M. G. Abegão, Univ. Federal de Sergipe (Brazil); Ruben Dario Fonseca Rodriguez, Emerson Cristiano C. Barbano, Univ. de São Paulo (Brazil); Francisco A. Santos, André L. B. S. Barreiros, Marizeth L. Barreiros, Univ. Federal de Sergipe (Brazil); Cleber R. Mendonça, Instituto de Física de São Carlos IFSC-USP (Brazil); Lino Misoguti, Univ. de São Paulo (Brazil); Márcio A. R. C. Alencar, Univ. Federal de Sergipe (Brazil); Leonardo De Boni, Instituto de Física de São Carlos IFSC-USP (Brazil); José J. Rodrigues Jr., Univ. Federal de Sergipe (Brazil) ..... [9745-47]

**High efficiency polymer light-emitting diodes using ternary electron injection layers**, Ten-Chin Wen, Kai-Wei Tsai, Jiun-Yun Jan, Tzung-Fang Guo, National Cheng Kung Univ. (Taiwan) ..... [9745-48]

**Electronic effects of aromatic amine moiety on red phosphorescent iridium(III) complexes for solution-processable OLEDs**, Sang Yong Park, Dong-Myung Shin, Hongik Univ. (Korea, Republic of) ..... [9745-49]

**New red phosphorescent iridium(III) complex with 4-tert-butylphenylboronic acid of organic borane**, Sang Wook Lee, Dong-Myung Shin, Hongik Univ. (Korea, Republic of) ..... [9745-50]

**Thin films of cyanine J-aggregates doped with silver nanoparticles and their laser-induced modification**, Anton A. Starovoytov, Nikita A. Toropov, Rezida Nabiullina, National Research Univ. of Information Technologies, Mechanics and Optics (Russian Federation) ..... [9745-51]

**Carrier injection and recombination processes in perovskite CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub> solar cells studied by electroluminescence spectroscopy**, Taketo Handa, Kyoto Univ. (Japan); Makoto Okano, Keio Univ. (Japan); Ai Shimazaki, Tomoko Aharen, Atsushi Wakamiya, Yoshihiko Kanemitsu, Kyoto Univ. (Japan) [9745-52]

**Growth directions of C8-BTBT thin films during drop-casting**, Naoki Iizuka, Tomohiko Zanka, Yosuke Onishi, Ichiro Fujieda, Ritsumeikan Univ. (Japan) ..... [9745-53]

**Effects of UV activation on sorption/desorption kinetics and electronic response of carbon allotropes in humid and oxygen rich environments**, Eric Muckley, Oak Ridge National Lab. (USA) and The Univ. of Tennessee Knoxville (USA); Tony Nelson, Virginia Polytechnic Institute and State Univ. (USA); Iliia Ivanov, Oak Ridge National Lab. (USA) ..... [9745-54]

**Highly crystalline growth of organic small molecule assisted with biomolecules**, Ho Jin Lee, Seokho Kim, Hyeong Tae Kim, Dong Hyuk Park, Inha Univ. (Korea, Republic of); Chunzhi Cui, Yanbian Univ. (China) and Korea Univ. (Korea, Republic of) ..... [9745-55]

**Random laser properties changes in rhodamine-B-doped organic/silica hybrid materials using femtosecond laser micromachining**, Luís M. G. Abegão, Paulo Henrique D. Ferreira, Univ. Federal de São Carlos (Brazil); Adriano J. G. Otuka, Instituto de Física de São Carlos IFSC-USP (Brazil); Diego S. Manoel, Fábio S. De Vicente, Univ. Estadual Paulista "Júlio de Mesquita Filho" (Brazil); Cleber R. Mendonça, Instituto de Física de São Carlos IFSC-USP (Brazil); Gabriel Herbert Gomes, Univ. Federal de São Carlos (Brazil); Dario A. Donatti, Univ. Estadual Paulista "Júlio de Mesquita Filho" (Brazil); Márcio A. R. C. Alencar, José J. Rodrigues Jr., Univ. Federal de Sergipe (Brazil) ... [9745-57]

**Investigation of organolead halide perovskite phototransistors with low-temperature processed gate dielectrics**, Youngseo Park, Sang Jin Park, Hui Joon Park, Junseok Heo, Ajou Univ. (Korea, Republic of) ..... [9745-58]

**Plasmon-enhanced optical waveguide based on organic crystals**, Hyeong Tae Kim, Ho Jin Lee, Seokho Kim, Dong Hyuk Park, Inha Univ. (Korea, Republic of) ..... [9745-59]

**Low-loss and high-bandwidth graded-index plastic optical fibers for 4K/8K transmissions**, Soichi Furukawa, Kotaro Koike, Yasuhiro Koike, Keio Univ. (Japan) ..... [9745-60]

**Photonic device applications based on biological/inorganic nano hybrids**, Pengfei Wu, Nankai Univ. (China) ..... [9745-62]

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# Ultrafast Phenomena and Nanophotonics XX

Conference Chairs: **Markus Betz**, Technische Univ. Dortmund (Germany); **Abdulahkem Y. Elezzabi**, Univ. of Alberta (Canada)

Program Committee: **Alan D. Bristow**, West Virginia Univ. (USA); **Yujie J. Ding**, Lehigh Univ. (USA); **Kazuhiko Hirakawa**, The Univ. of Tokyo (Japan); **Rupert Huber**, Univ. Regensburg (Germany); **Robert A. Kaindl**, Lawrence Berkeley National Lab. (USA); **Dai-Sik Kim**, Seoul National Univ. (Korea, Republic of); **Xiaoqin Li**, The Univ. of Texas at Austin (USA); **Christoph Lienau**, Carl von Ossietzky Univ. Oldenburg (Germany); **Torsten Meier**, Univ. Paderborn (Germany); **Walter Pfeiffer**, Univ. Bielefeld (Germany); **Pascal Ruello**, Univ. du Maine (France); **Volker J. Sorger**, The George Washington Univ. (USA); **Fabrice Vallee**, Univ. Claude Bernard Lyon 1 (France)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

**MON 8:00 AM TO 10:10 AM**

**LOCATION: ROOM 3009 (WEST LEVEL 3)**

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative, Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break . . . . . Mon 10:10 am to 10:30 am

### SESSION 1

**LOCATION: RM 250 (SOUTH MEZZANINE) .. MON 10:30 AM TO 12:00 PM**

#### THz Plasmonics

Session Chair: **Abdulahkem Y. Elezzabi**, Univ. of Alberta (Canada)

- 10:30 am: **Terahertz-field-induced ionization effect in a single nano island (Invited Paper)**, Minah Seo, Korea Institute of Science and Technology (Korea, Republic of) . . . . . [9746-1]
- 11:00 am: **Funneling of electromagnetic waves through angstrom gaps (Invited Paper)**, Young-Mi Bahk, Seoul National Univ. (Korea, Republic of); Bong Joo Kang, Ajou Univ. (Korea, Republic of); Yong Seung Kim, Sejong Univ. (Korea, Republic of); Joon-Yeon Kim, Seoul National Univ. (Korea, Republic of); Won Tae Kim, Ajou Univ. (Korea, Republic of); Tae Yun Kim, Taehee Kang, Ji Yeah Rhie, Sanghoon Han, Cheol-Hwan Park, Seoul National Univ. (Korea, Republic of); Fabian Rotermund, Ajou Univ. (Korea, Republic of); Dai-Sik Kim, Seoul National Univ. (Korea, Republic of) . . . . . [9746-2]
- 11:30 am: **Nonlinear quantum plasmonics of terahertz nanoantennas**, Joon-Yeon Kim, Seoul National Univ. (Korea, Republic of); Bong Joo Kang, Ajou Univ. (Korea, Republic of); Joohyun Park, Hanyang Univ. (Korea, Republic of); Young-Mi Bahk, Seoul National Univ. (Korea, Republic of); Won Tae Kim, Ajou Univ. (Korea, Republic of); Ji Yeah Rhie, Seoul National Univ. (Korea, Republic of); Hyeongtag Jeon, Hanyang Univ. (Korea, Republic of); Fabian Rotermund, Ajou Univ. (Korea, Republic of); Dai-Sik Kim, Seoul National Univ. (Korea, Republic of) . . . . . [9746-3]

- 11:45 am: **THz magneto-spectroscopy of superconducting metamaterials in the mK range**, Curdin Maissen, Giacomo Scalfari, ETH Zürich (Switzerland); Sara Cibella, Roberto Leoni, CNR-Istituto di Fotonica e Nanotecnologie (Italy); Gianlorenzo Paravicini Bagliani, Mattias Beck, Jérôme Faist, ETH Zürich (Switzerland) . . . . . [9746-4]
- Lunch Break . . . . . Mon 12:00 pm to 1:30 pm

### SESSION 2

**LOCATION: RM 250 (SOUTH MEZZANINE) . . . . . MON 1:30 TO 3:15 PM**

#### THz Spectroscopy I

Session Chair: **Markus Betz**, Technische Univ. Dortmund (Germany)

- 1:30 pm: **Ultrafast spectroscopy and control from THz through x-rays (Keynote Presentation)**, Keith A. Nelson, Massachusetts Institute of Technology (USA) . . . . . [9746-5]
- 2:15 pm: **Very strong field-induced high-harmonic generation in semiconductors and atoms (Invited Paper)**, Stephan W. Koch, Philipps-Univ. Marburg (Germany) . . . . . [9746-6]
- 2:45 pm: **Application of ultrafast electron field emission induced by strong terahertz transient for nonlinear terahertz spectroscopy (Invited Paper)**, Krzysztof Iwaszczuk, Abebe T. Tarekegne, Peter Uhd Jepsen, DTU Fotonik (Denmark) . . . . . [9746-7]
- Coffee Break . . . . . Mon 3:15 pm to 3:45 pm

### SESSION 3

**LOCATION: RM 250 (SOUTH MEZZANINE) . . . . . MON 3:45 O 5:45 PM**

#### Dynamics in Semiconductor Nanostructures

Session Chair: **Michael B. Johnston**, Univ. of Oxford (United Kingdom)

- 3:45 pm: **Broad gain InAs quantum dash nanostructures on InP: recent progress in material structures and device demonstrations (Invited Paper)**, Boon S. Ooi, Mohammed Zahed Mustafa Khan, Tien Khee Ng, King Abdullah Univ. of Science and Technology (Saudi Arabia) . . . . . [9746-8]
- 4:15 pm: **Excitonic effects in quantum dot intraband spectroscopy indicating the formation of bound continuum excitons**, Sandra Kuhn, Marten Richter, Technische Univ. Berlin (Germany) . . . . . [9746-9]
- 4:30 pm: **Two-photon emission from quantum dot biexcitons**, Dirk Heinze, Dominik Breddermann, Artur Zrenner, Stefan Schumacher, Univ. Paderborn (Germany) . . . . . [9746-10]
- 4:45 pm: **Control of macroscopic quantum interference in an inhomogeneous quantum dot ensemble**, Shota Ichikawa, Yuto Arai, Sayaka Kitazawa, Keio Univ. (Japan); Kouichi Akahane, National Institute of Information and Communications Technology (Japan); Junko Ishi-Hayase, Keio Univ. (Japan) . . . . . [9746-11]
- 5:00 pm: **On-chip broadband sources of correlated photon pairs in AlGaAs nanowaveguides**, Pisek Kultavewuti, Eric Y. Zhu, Qian Li, Univ. of Toronto (Canada); Vincenzo Pusino, Marc Sorel, Univ. of Glasgow (United Kingdom); J. Stewart Aitchison, Univ. of Toronto (Canada) . . . . . [9746-12]

OPTO



# CONFERENCE 9746

LOCATION: ROOM 250 (SOUTH MEZZANINE)

5:15 pm: **An investigation of semiconductor nanoparticles for application to all-optical switching**, Brandon Born, Simon Geoffroy-Gagnon, Jonathan F. Holzman, UBC Okanagan (Canada) . . . . . [9746-13]

5:30 pm: **Theory of coupled hybrid inorganic/organic systems: excitation transfer at semiconductor/molecule interfaces**, Judith F. Specht, Eike Verdenhalven, T. Sverre Theuerholz, Andreas Knorr, Marten Richter, Technische Univ. Berlin (Germany) . . . . . [9746-14]

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: RM 250 (SOUTH MEZZANINE) . . . . TUE 8:00 TO 10:00 AM

## Ultrafast Phenomena in Carbon Nanomaterials

Session Chair: **Markus Betz**, Technische Univ. Dortmund (Germany)

8:00 am: **Ultrafast electron transport in graphene and magnetic nanostructures** (*Invited Paper*), Dmitry Turchinovich, Max-Planck-Institut für Polymerforschung (Germany) . . . . . [9746-15]

8:30 am: **Theory of photo-induced Floquet topological states in graphene and beyond** (*Invited Paper*), Michael A. Sentef, Max-Planck-Institut für Struktur und Dynamik der Materie (Germany) . . . . . [9746-16]

9:00 am: **Buckled graphene-like materials in ultrashort and strong optical field: coherent control of symmetry and reversibility**, Hamed Koochaki Kelardeh, Vadym Apalkov, Mark I. Stockman, Georgia State Univ. (USA) . . . . . [9746-17]

9:15 am: **Broadband ultrafast saturable absorption of black phosphorus nanosheets over near- to middle-infrared region**, Kangpeng Wang, Beata M. Szydłowska, Gaozhong Wang, Johnathan N. Coleman, Werner J. Blau, Trinity College Dublin (Ireland) . . . . . [9746-18]

9:30 am: **Carbon nanotubes for ultrafast switching: nonlinear polarization**, Hanieh Afkhamiardakani, Jean Claude M. Diels, Ladan Arissian, The Univ. of New Mexico (USA) . . . . . [9746-19]

9:45 am: **Electrically-driven carbon-based plasmonic laser on silicon for ultrafast modulation**, Ke Liu, Volker J. Sorger, The George Washington Univ. (USA) . . . . . [9746-20]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

### SESSION 5

LOCATION: RM 250 (SOUTH MEZZANINE) . . . . TUE 10:30 TO 11:45 AM

## Ultrafast Phenomena in Perovskites

Session Chair: **Dmitry Turchinovich**, Max-Planck-Institut für Polymerforschung (Germany)

10:30 am: **Charge-carrier dynamics in perovskite semiconductors and the significance for solar cells and lasers** (*Invited Paper*), Michael B. Johnston, Univ. of Oxford (United Kingdom) . . . . . [9746-21]

11:00 am: **Ultrafast spin dynamics and ultra-large Faraday rotation in methylammonium lead iodide perovskite thin films**, David Giovanni, Nanyang Technological Univ. (Singapore); Hong Ma, Shandong Normal Univ. (China); Julianto Chua, Nanyang Technological Univ. (Singapore); Michael Grätzel, Ecole Polytechnique Fédérale de Lausanne (Switzerland) and Nanyang Technological Univ. (Singapore); Ramamoorthy Ramesh, Univ. of California, Berkeley (USA); Subodh G. Mhaisalkar, Nripan Mathews, Tze Chien Sum, Nanyang Technological Univ. (Singapore) . . . . . [9746-22]

11:15 am: **Structure-function relationship of perovskite film morphology and charge dynamics**, Swee Sien Lim, Nanyang Technological Univ. (Singapore); Wee Kiang Chong, Nanyang Technological Univ. (Singapore) and Interdisciplinary Graduate School (Singapore); Herlina Dewi, Nripan Mathews, Subodh G. Mhaisalkar, Tze Chien Sum, Nanyang Technological Univ. (Singapore) . . . . . [9746-23]

11:30 am: **Factors affecting amplified spontaneous emission in  $(\text{C}_6\text{H}_5\text{C}_2\text{H}_4\text{NH}_2)_2\text{PbI}_4$  perovskite**, Wee Kiang Chong, David Giovanni, Teck Wee Goh, Krishnamoorthy Thirumal, Nanyang Technological Univ. (Singapore); Xinfeng Liu, Nanyang Technological Univ. (Singapore); Nripan Mathews, Subodh G. Mhaisalkar, Tze Chien Sum, Nanyang Technological Univ. (Singapore) . . . . . [9746-24]

Lunch/Exhibition Break . . . . . Tue 11:45 am to 1:30 pm

### SESSION 6

LOCATION: RM 250 (SOUTH MEZZANINE) . . . . . TUE 1:30 TO 3:30 PM

## THz Spectroscopy II

Session Chair: **Krzysztof Iwaszczuk**, DTU Fotonik (Denmark)

1:30 pm: **Ultrafast terahertz scanning tunneling microscopy** (*Invited Paper*), Vedran Jelic, Peter H. Nguyen, Graham J. Hornig, Haille M. Sharum, James R. Hoffman, Univ. of Alberta (Canada); Christopher Rathje, Univ. of Göttingen (Germany); Claus Ropers, Georg-August-Univ. Göttingen (Germany); Frank A. Hegmann, Univ. of Alberta (Canada) . . . . . [9746-25]

2:00 pm: **Nonperturbative THz nonlinearities for many-body quantum control in semiconductors** (*Invited Paper*), Christoph Lange, Thomas Maag, Univ. Regensburg (Germany); Andreas Bayer, Univ. of Regensburg (Germany); Olaf Schubert, Matthias Hohenleutner, Sebastian Baierl, Dominique Bougeard, Univ. Regensburg (Germany); Eric R. J. Edwards, Martin-Luther-Univ. Halle-Wittenberg (Germany); Georg Woltersdorf, Martin-Luther Univ. Halle-Wittenberg (Germany); Martin Mootz, Mackillo Kira, Stephan W. Koch, Philipps-Univ. Marburg (Germany); Rupert Huber, Univ. Regensburg (Germany) . . . . . [9746-26]

2:30 pm: **Strong sub-terahertz surface waves generated by relativistic laser pulses** (*Invited Paper*), Shigeki Tokita, Osaka Univ. (Japan); Shunsuke Inoue, Kyoto Univ. (Japan); Ryo Yasuhara, National Institute for Fusion Science (Japan); Kensuke Teramoto, Kyoto Univ. (Japan); Takeshi Nagashima, Setsunan Univ. (Japan); Masaki Hashida, Shuji Sakabe, Kyoto Univ. (Japan) . . . . . [9746-27]

3:00 pm: **Terahertz cyclotron spectroscopy of spin-split holes in Ge quantum wells and polarons in ZnO heterostructures** (*Invited Paper*), James Lloyd-Hughes, The Univ. of Warwick (United Kingdom) . . . . . [9746-28]

Coffee Break . . . . . Tue 3:30 pm to 4:00 pm

### SESSION 7

LOCATION: RM 250 (SOUTH MEZZANINE) . . . . TUE 4:00 TO 5:30 PM

## Nonlinear Optical Phenomena

Session Chair: **Giulio Cerullo**, Politecnico di Milano (Italy)

4:00 pm: **Optically-induced currents in dielectrics and semiconductors: a new ultrafast nonlinear optical effect** (*Invited Paper*), Jacob B. Khurgin, Johns Hopkins Univ. (USA) . . . . . [9746-29]

4:30 pm: **Investigation of coupled optical parametric oscillators for novel applications** (*Invited Paper*), Yujie J. Ding, Lehigh Univ. (USA) . . . . . [9746-30]

5:00 pm: **A unified microscopic approach to photocurrents in semiconductors using k.p-based semiconductor Bloch equations**, Reinold Podzinski, Torsten Meier, Univ. Paderborn (Germany); Huynh Thanh Duc, Vietnamese Academy of Science and Technology (Viet Nam); Shekhar Priyadarshi, Christian Schmidt, Mark Bieler, Physikalisch-Technische Bundesanstalt (Germany) . . . . . [9746-31]

5:15 pm: **All-optical field-induced second-harmonic generation**, Roderick B. Davidson II, Vanderbilt Univ. (USA); Anna Yanchenko, Univ. of Virginia (USA); Jed I. Ziegler, Sergey M. Avanesyan, Vanderbilt Univ. (USA); Benjamin J. Lawrie, Oak Ridge National Lab. (USA); Richard F. Haglund Jr., Vanderbilt Univ. (USA) . . . . . [9746-32]



# CONFERENCE 9746

LOCATION: ROOM 250 (SOUTH MEZZANINE)

## WEDNESDAY 17 FEBRUARY

### SESSION 8

LOCATION: RM 250 (SOUTH MEZZANINE) ... WED 8:00 TO 10:00 AM

### Plasmonics and Metamaterials

Session Chair: **Maiken H. Mikkelsen**, Duke Univ. (USA)

8:00 am: **Phase manipulation of nonlinear processes by metasurfaces** (*Invited Paper*), Thomas Zentgraf, Univ. Paderborn (Germany); Guixin Li, Univ. of Birmingham (United Kingdom) and Hong Kong Baptist Univ. (Hong Kong, China); Shumei Chen, The Univ. of Birmingham (United Kingdom) and Hong Kong Baptist Univ. (Hong Kong, China); Nitipat Pholchai, King Mongkut's Univ. of Technology North Bangkok (Thailand); Bernhard Reineke, Univ. Paderborn (Germany); Polis Wing Han Wong, Edwin Y. Pun, City Univ. of Hong Kong (Hong Kong, China); Kok-Wai Cheah, Hong Kong Baptist Univ. (Hong Kong, China); Shuang Zhang, The Univ. of Birmingham (United Kingdom) ... [9746-34]

8:30 am: **Long-range energy transfer mechanism between two coupled plasmonic nanoantennas** (*Invited Paper*), Martin Aeschlimann, Technische Univ. Kaiserslautern (Germany); Tobias Brixner, Julius-Maximilians-Univ. Würzburg (Germany); Benjamin Frisch, Technische Univ. Kaiserslautern (Germany); Bert Hecht, Bernhard Huber, Julius-Maximilians-Univ. Würzburg (Germany); Matthias Hensen, Univ. Bielefeld (Germany); Christian Kramer, Enno Krauss, Julius-Maximilians-Univ. Würzburg (Germany); Walter Pfeiffer, Univ. Bielefeld (Germany); Martin Piecuch, Technische Univ. Kaiserslautern (Germany); Christian Strüber, Imperial College London (United Kingdom); Philip Thielen, Technische Univ. Kaiserslautern (Germany) ... [9746-35]

9:00 am: **Ultrafast imaging of plasmons in a transmission electron microscope** (*Invited Paper*), Tom Lummen, G. Berruto, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Andrea Toma, Istituto Italiano di Tecnologia (Italy); R. J. Lamb, D. McGrouther, Univ. of Glasgow (United Kingdom); Fabrizio Carbone, Ecole Polytechnique Fédérale de Lausanne (Switzerland) ... [9746-36]

9:30 am: **Strong optical modulation of surface plasmon polaritons in metal/semiconductor nanostructures**, Tae Young Jeong, Seunghyun Kim, Hyangrok Lee, Kiju Yee, Chungnam National Univ. (Korea, Republic of) ... [9746-37]

9:45 am: **Design of integrated YIG-based isolators and high-speed modulators**, Curtis J. Firby, Abdulhakem Y. Elezzabi, Univ. of Alberta (Canada) ... [9746-38]

Coffee Break ... Wed 10:00 am to 10:30 am

### SESSION 9

LOCATION: RM 250 (SOUTH MEZZANINE) WED 10:30 AM TO 12:15 PM

### Nanophotonics

Session Chair: **Thomas Zentgraf**, Univ. Paderborn (Germany)

10:30 am: **Sub-one nanometer gap (SONG) for SERS** (*Invited Paper*), Yung Doug Suh, Korea Research Institute of Chemical Technology (Korea, Republic of) ... [9746-39]

11:00 am: **Subwavelength and ultrafast optical rogue waves in photonic chips**, Changxu Liu, King Abdullah Univ. of Science and Technology (Saudi Arabia); Ruben van derWel, Nir Rotenberg, Kobus Kuipers, FOM Institute for Atomic and Molecular Physics (Netherlands); Thomas F. Krauss, The Univ. of York (United Kingdom); Andrea Di Falco, Univ. of St. Andrews (United Kingdom); Andrea Fratallocchi, King Abdullah Univ. of Science and Technology (Saudi Arabia) ... [9746-40]

11:15 am: **Ultrafast all-optical switching with photonic nanojets and semiconductor nanoparticles**, Brandon Born, Jeffrey D. Krupa, Simon Geoffroy-Gagnon, Jonathan F. Holzman, UBC Okanagan (Canada) ... [9746-41]

11:30 am: **Quantification of electric field enhancement factors of nanogaps in visible - near IR frequencies**, Taehee Kang, Ji Yeah Rhie, Seoul National Univ. (Korea, Republic of); Joohyun Park, Hanyang Univ. (Korea, Republic of); Young-Mi Bahk, Jae Sung Ahn, Seoul National Univ. (Korea, Republic of); Hyeon-tag Jeon, Hanyang Univ. (Korea, Republic of); Dai-Sik Kim, Seoul National Univ. (Korea, Republic of) ... [9746-42]

11:45 am: **Record high normalized light-matter-coupling strength surpassing unity**, Curdin Maissen, Giacomo Scalari, Jérôme Faist, Christian Reichl, Werner Wegscheider, ETH Zürich (Switzerland) ... [9746-43]

12:00 pm: **SPASER as a complex system: femtosecond dynamics traced by ab-initio simulations**, Juan Sebastian Totero Gongora, King Abdullah Univ. of Science and Technology (Saudi Arabia); Andrey E. Miroshnichenko, Yuri S. Kivshar, The Australian National Univ. (Australia); Andrea Fratallocchi, King Abdullah Univ. of Science and Technology (Saudi Arabia) ... [9746-44]

Lunch/Exhibition Break ... Wed 12:15 pm to 2:30 pm

### SESSION 10

LOCATION: RM 250 (SOUTH MEZZANINE) ... WED 2:30 TO 3:45 PM

### Two-Dimensional Spectroscopy

Session Chair: **Christoph Lange**, Univ. Regensburg (Germany)

2:30 pm: **2D electronic spectroscopy of low-dimensional semiconductors** (*Invited Paper*), Tatjana Stoll, Politecnico di Milano (Italy); Kenneth L. Knappenberger Jr., Florida State Univ. (USA); Giulio Cerullo, Politecnico di Milano (Italy) ... [9746-45]

3:00 pm: **Multidimensional coherent spectroscopy of a semiconductor microcavity**, Brian Wilmer, West Virginia Univ. (USA); Felix Passmann, Technische Univ. Dortmund (Germany) and West Virginia Univ. (USA); Michael R. Gehl, College of Optical Sciences, The Univ. of Arizona (USA); Galina Khitrova, The Univ. of Arizona (USA) and The Univ. of Arizona, College of Optical Sciences (USA); Alan D. Bristow, West Virginia Univ. (USA) ... [9746-46]

3:15 pm: **Persistent coherence in nonlinear 2D vibrational THz spectroscopy of sucrose**, Pernille Klarskov Pedersen, Brown Univ. (USA); Peter Uhd Jepsen, DTU Fotonik (Denmark) ... [9746-47]

3:30 pm: **Efficient numerical method for calculating Coulomb coupling elements and its application to two-dimensional spectroscopy**, Anke Zimmermann, Sandra Kuhn, Marten Richter, Technische Univ. Berlin (Germany) ... [9746-48]

Coffee Break ... Wed 3:45 pm to 4:15 pm

### SESSION 11

LOCATION: RM 250 (SOUTH MEZZANINE) ... WED 4:15 TO 5:45 PM

### Ultrafast Carrier and Spin Dynamics

Session Chair: **Fabrizio Carbone**,

Ecole Polytechnique Fédérale de Lausanne (Switzerland)

4:15 pm: **Ultrafast spin transport and spin transfer in ferromagnet-metal heterostructures and metal-organic adsorbates** (*Invited Paper*), Andrea Eschenlohr, Jens Wieczorek, Jinghao Chen, Shunhao Xiao, Boris Weidtmann, Univ. Duisburg-Essen (Germany); Malte Roesner, Univ. Bremen (Germany); Nicolas Bergeard, Alexander Tarasevitch, Univ. Duisburg-Essen (Germany); Tim O. Wehling, Univ. Bremen (Germany); Uwe Bovensiepen, Univ. Duisburg-Essen (Germany) ... [9746-50]

4:45 pm: **Femtosecond modulations based on periodic patterns of excited free-carriers in semiconductors**, Yonatan Sivan, Ben-Gurion Univ. of the Negev (Israel); Georgios Ctistis, Emre Yüce, Allard P. Mosk, Univ. Twente (Netherlands) ... [9746-51]

5:00 pm: **Universal ultrafast dynamics of the phase transition in vanadium dioxide thin films**, Nathaniel Brady, The Univ. of Alabama at Birmingham (USA); Kannatassen Appavoo, Vanderbilt Univ. (USA); Minah Seo, Los Alamos National Lab. (USA); Joyeeta Nag, Vanderbilt Univ. (USA); Rohit P. Prasankumar, Los Alamos National Lab. (USA); Richard F. Haglund Jr., Vanderbilt Univ. (USA); David J. Hilton, The Univ. of Alabama at Birmingham (USA) ... [9746-52]

5:15 pm: **Heat-induced and coherent effects in the magnetization dynamics of ferromagnets and ferrimagnets** (*Invited Paper*), Hans Christian Schneider, Technische Univ. Kaiserslautern (Germany) ... [9746-49]

### POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 ... WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Upconversion fluorescence engineering on nanopatterned metasurface**, Huijun Wu, Ming Lun Tseng, Wei-Yi Tsai, National Taiwan Univ. (Taiwan); Din Ping Tsai, National Taiwan Univ. (Taiwan) and Academia Sinica (Taiwan) ... [9746-70]

**On the problems of stability and durability of field-emission current sources for electrovacuum devices**, Alexander N. Yakunin, Institute of Precision Mechanics and Control (Russian Federation); Nikolay P. Abanshin, Volga-Svet Co. Ltd. (Russian Federation); Garif G. Akchurin, Georgy G. Akchurin, Yuri A. Avetisyan, Institute of Precision Mechanics and Control (Russian Federation) ... [9746-71]

**Large-area fabrication of TiN nanoantenna arrays for refractory plasmonics in the mid-infrared**, Shahin Bagheri, Univ. Stuttgart (Germany); Christine M. Zgrabik, Harvard Univ. (USA); Timo Gissibl, Andreas Tittl, Florian Sterl, Ramon Walter, Stefano De Zuani, Audrey Berrier, Univ. Stuttgart (Germany); Thomas Stauden, Technische Univ. Ilmenau (Germany); Gunther Richter, Max-Planck-Institut für Intelligente Systeme (Germany); Evelyn L. Hu, Harvard Univ. (USA); Harald Giessen, Univ. Stuttgart (Germany) ... [9746-72]

# CONFERENCE 9746

LOCATION: ROOM 250 (SOUTH MEZZANINE)

THURSDAY 18 FEBRUARY

## SESSION 12

LOCATION: RM 250 (SOUTH MEZZANINE) . . . . THU 8:00 TO 10:00 AM

### Ultrafast Structural and Phononic Dynamics

Session Chair: **James Lloyd-Hughes**,  
The Univ. of Warwick (United Kingdom)

8:00 am: **Femtosecond electrons probing ultrafast phenomena in nanostructures by diffraction and imaging** (*Invited Paper*), Melanie Müller, Lutz Waldecker, Roman Bertoni, Thomas Vasileiadis, Fritz-Haber-Institut der Max-Planck-Gesellschaft (Germany); Vasily Kravtsov, The Univ. of Colorado at Boulder (USA); Markus B. Raschke, Univ. of Colorado at Boulder (USA); Alexander Paarmann, Ralph Ernstorfer, Fritz-Haber-Institut der Max-Planck-Gesellschaft (Germany) . . . . . [9746-53]

8:30 am: **Ultrafast transmission electron microscopy with highly-coherent electron sources** (*Invited Paper*), Armin Feist, Katharina Echternkamp, Nara Rubiano, Marcel Möller, Sergey V. Yalunin, Sascha Schäfer, Claus Ropers, Georg-August-Univ. Göttingen (Germany) . . . . . [9746-54]

9:00 am: **Electrical manipulations of coherent phononic functionalities** (*Invited Paper*), Young-Dahl Jho, Gwangju Institute of Science and Technology (Korea, Republic of) and California Institute of Technology (USA); Hoonil Jeong, Gwangju Institute of Science and Technology (Korea, Republic of); Kiju Yee, Chungnam National Univ. (Korea, Republic of); Christopher J. Stanton, Univ. of Florida (USA) . . . . . [9746-55]

9:30 am: **Tuning coherent acoustic phonon dynamics by strain engineering of ultrathin suspended nanostructures**, Markus R. Wagner, Juan S. Reparaz, Bartłomiej Graczykowski, Alexandros El Sachat, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain); Pablo O. Vaccaro, Alejandro R. Goni, Institut de Ciència de Materials de Barcelona (Spain) and Institutio Catalana de Recerca i Estudis Avançats (Spain); Damia Pero, M. Isabel Alonso, Miquel Garriga, Institut de Ciència de Materials de Barcelona (Spain); Francesc Alzina, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain); Clivia M. Sotomayor Torres, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain) and Institutio Catalana de Recerca i Estudis Avançats (Spain) . . . . . [9746-56]

9:45 am: **Modified vibrational dynamics via coupling to optical microcavities**, Adam D. Dunkelberger, Bryan T. Spann, Kenan P. Fears, James P. Long, Blake S. Simpkins, Jeff C. Owrutsky, U.S. Naval Research Lab. (USA) . . . . . [9746-57]

Coffee Break . . . . . Thu 10:00 am to 10:30 am

## SESSION 13

LOCATION: RM 250 (SOUTH MEZZANINE) . THU 10:30 AM TO 12:15 PM

### Plasmonics

Session Chair: **Martin Aeschlimann**,  
Technische Univ. Kaiserslautern (Germany)

10:30 am: **Ultrafast spontaneous emission from semiconductor quantum dots coupled to plasmonic nanoantennas** (*Invited Paper*), Maiken H. Mikkelsen, Duke Univ. (USA) . . . . . [9746-58]

11:00 am: **Time-resolved near-field imaging of plasmonic vortices** (*Invited Paper*), Deirdre Kilbane, Anna-Katharina Mahro, Technische Univ. Kaiserslautern (Germany); Grisha Spektor, Meir Orenstein, Technion-Israel Institute of Technology (Israel); Stefan Mathias, Martin Aeschlimann, Technische Univ. Kaiserslautern (Germany) . . . . . [9746-59]

11:30 am: **A remotely driven ultrafast electron source**, Jan Vogelsang, Jörg Robin, Carl von Ossietzky Univ. Oldenburg (Germany); Benedek J. Nagy, Wigner Research Ctr. for Physics of the H.A.S. (Hungary) and Univ. of Pécs (Hungary); Péter Dombi, Wigner Research Ctr. for Physics of the H.A.S. (Hungary); Daniel Rosenkranz, Manuela Schiek, Petra Gross, Christoph Lienau, Carl von Ossietzky Univ. Oldenburg (Germany) . . . . . [9746-60]

11:45 am: **High-energy attosecond nanoplasmonic-based electron gun**, Shawn R. Greig, Abdulhakem Y. Elezzabi, Univ. of Alberta (Canada) . . [9746-61]

12:00 pm: **Control and mapping ultrafast plasmonic field with PEEM**, Boyu Ji, Jiang Qin, Alemayehu Nana, Zuoqiang Hao, Toshihisa Tomie, Jingquan Lin, Changchun Univ. of Science and Technology (China) . . [9746-62]

Lunch/Exhibition Break . . . . . Thu 12:15 pm to 2:00 pm

## SESSION 14

LOCATION: RM 250 (SOUTH MEZZANINE) . . . . . THU 2:00 TO 3:15 PM

### Ultrafast Phenomena in 2D Materials I

Session Chair: **Bernhard Urbaszek**,  
Lab. de Physique et Chimie des Nano-objets (France)

2:00 pm: **Unraveling functionality in two-dimensional quantum materials using ultrafast optical and terahertz spectroscopy** (*Invited Paper*), Rohit P. Prasankumar, Natarajan Kamaraju, Yaomin Dai, Los Alamos National Lab. (USA); Rolando Valdes Aguilar, Los Alamos National Lab. (USA) and Ohio State Univ. (USA); Dmitry A. Yarotski, Antoinette J. Taylor, Los Alamos National Lab. (USA) . . . . . [9746-63]

2:30 pm: **Coherent quantum dynamics of excitons in monolayer transition metal dichalcogenides** (*Invited Paper*), Galan Moody, The Univ. of Texas at Austin (USA) and National Institute of Standards & Technology (USA) . [9746-64]

3:00 pm: **Carrier-phonon interaction in transition-metal-dichalcogenides**, Michael Lorke, Univ. Bremen (Germany); Alexander Steinhoff-List, Malte Roesner, Univ. of Bremen (Germany); Matthias Florian, Christopher Gies, Univ. Bremen (Germany); Tim O. Wehling, Univ. of Bremen (Germany); Frank Jahnke, Univ. Bremen (Germany) . . . . . [9746-65]

Coffee Break . . . . . Thu 3:15 pm to 3:45 pm

## SESSION 15

LOCATION: RM 250 (SOUTH MEZZANINE) . . . . . THU 3:45 TO 5:00 PM

### Ultrafast Phenomena in 2D Materials II

Session Chair: **Rohit P. Prasankumar**, Los Alamos National Lab. (USA)

3:45 pm: **Linear and non-linear optical spectroscopy in binary and ternary transition metal dichalcogenide monolayers** (*Invited Paper*), Bernhard Urbaszek, Cédric Robert, Lab. de Physique et Chimie des Nano-objets (France) . . . . . [9746-66]

4:15 pm: **Efficient excitonic photoluminescence from atomically thin MoS<sub>2</sub>**, Alexander Steinhoff-List, Univ. of Bremen (Germany); Ji-Hee Kim, Sungkyunkwan Univ. (Korea, Republic of); Frank Jahnke, Univ. Bremen (Germany); Malte Roesner, Univ. of Bremen (Germany); D.S. Kim, Institute for Basic Science (Korea, Republic of); C. Lee, Gang Hee Han, Sungkyunkwan Univ. (Korea, Republic of); Mun Seok Jeong, Institute for Basic Science (Korea, Republic of) and Sungkyunkwan Univ. (Korea, Republic of); Tim O Wehling, Christopher Gies, Univ. Bremen (Germany) . . . . . [9746-67]

4:30 pm: **Second- and third-harmonic generation microscopy of layered molybdenum disulfide**, Antti Säynätjoki, Aalto Univ. (Finland) and Univ. of Eastern Finland (Finland); Lasse Karvonen, Aalto Univ. (Finland); Seyed Soroush Mehravar, Univ. of Arizona (USA); Antonio Lombardo, Ravi S. Sundaran, Tawfique Hasan, Univ. of Cambridge (United Kingdom); Robert A. Norwood, Nasser N. Peyghambarian, Univ. of Arizona (USA); Harri Lipsanen, Aalto Univ. School of Science and Technology (Finland); Andrea C. Ferrari, Univ. of Cambridge (United Kingdom); Khanh Q. Kieu, Univ. of Arizona (USA); Zhipei Sun, Aalto Univ. School of Science and Technology (Finland) . . . . . [9746-68]

4:45 pm: **Tuning of valley polarization in few-layer MoS<sub>2</sub> by electric-field-induced symmetry breaking**, Jakob Wierzbowski, Julian Klein, Armin Regler, Jonathan Becker, Walter Schottky Institut (Germany); Florian Heimbach, Technische Univ. München (Germany); Michael Kaniber, Walter Schottky Institut (Germany); Kai Müller, Walter Schottky Institut (Germany) and Stanford Univ. (USA); Jonathan J. Finley, Walter Schottky Institut (Germany) . . . . . [9746-69]



Monday–Thursday 15–18 February 2016 • Proceedings of SPIE Vol. 9747

# Terahertz, RF, Millimeter, and Submillimeter-Wave Technology and Applications IX

Conference Chairs: **Laurence P. Sadwick**, InnoSys, Inc. (USA); **Tianxin Yang**, Tianjin Univ. (China)

Program Committee: **René Beigang**, Technische Univ. Kaiserslautern (Germany); **Jianji Dong**, Huazhong Univ. of Science and Technology (China); **Frank Ellrich**, Fraunhofer-Institut für Physikalische Messtechnik (Germany); **Robert H. Giles**, Univ. of Massachusetts Lowell (USA); **R. Jennifer Hwu**, InnoSys, Inc. (USA); **Anthony Murphy**, National Univ. of Ireland, Maynooth (Ireland); **Crédhe O’Sullivan**, National Univ. of Ireland, Maynooth (Ireland); **Kyung Hyun Park**, Electronics and Telecommunications Research Institute (Korea, Republic of); **Alessia Portieri**, TeraView Ltd. (United Kingdom); **Jinghua Teng**, A\*STAR Institute of Materials Research and Engineering (Singapore); **Michael Weibel**, Joint Research and Development, Inc. (USA); **Jiangfeng Zhou**, Univ. of South Florida (USA)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

**MON 8:00 AM TO 10:10 AM**

**LOCATION: ROOM 3009 (WEST LEVEL 3)**

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative, Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break ..... Mon 10:10 am to 10:30 am

### SESSION 1

**LOCATION: RM 258 (SOUTH MEZZANINE) .. MON 10:30 AM TO 12:00 PM**

#### THz Technology I

Session Chairs: **Jiangfeng Zhou**, Univ. of South Florida (USA);  
**Laurence P. Sadwick**, InnoSys, Inc. (USA)

- 10:30 am: **Near-field responses of plasmonic terahertz geometries** (*Invited Paper*), Weili Zhang, Oklahoma State Univ. (USA) and Tianjin Univ. (China) ..... [9747-1]
- 11:00 am: **Sub-wavelength electrode structures to improve the performance of terahertz photomixers**, Qing Yang Steve Wu, Hendrix Tanoto, Ding Lu, Chan Choy Chum, A\*STAR Institute of Materials Research and Engineering (Singapore); Mei Sun, Institute for Infocomm Research, Agency for Science, Technology and Research (A\*STAR) (Singapore); Zhi Ning Chen, Department of Electrical and Computer Engineering, National University of Singapore (Singapore); Soo-Jin Chua, Jinghua Teng, A\*STAR Institute of Materials Research and Engineering (Singapore) ..... [9747-2]
- 11:20 am: **Simulation, fabrication, and measurement of a plasmonic-enhanced terahertz photoconductive antenna**, Nathan Burford, Magda El-Shenawee, Univ. of Arkansas (USA) ..... [9747-9]
- 11:40 am: **THz phase shifters based on graphene and liquid crystals**, Yang Wu, Yang Hyunsoo, National Univ. of Singapore (Singapore) ..... [9747-4]
- Lunch Break ..... Mon 12:00 pm to 1:30 pm

### SESSION 2

**LOCATION: RM 258 (SOUTH MEZZANINE) ..... MON 1:30 TO 3:00 PM**

#### THz Technology II

Session Chairs: **Jinghua Teng**, A\*STAR Institute of Materials Research and Engineering (Singapore); **Tianxin Yang**, Tianjin Univ. (China)

- 1:30 pm: **Multilayer thickness measurement technique based on terahertz time-domain technology for industrial purposes** (*Invited Paper*), Frank Ellrich, Jens Klier, Soufiene Krimi, Joachim Jonuscheit, Georg von Freymann, Fraunhofer-Institut für Physikalische Messtechnik (Germany) [9747-5]
- 2:00 pm: **Low-bias gate tuneable terahertz plasmonic signatures in chemical vapour deposited graphene of varying grain size**, Varun S. Kamboj, Philipp Braeuninger-Weimer, Univ. of Cambridge (United Kingdom); Piran R. Kidambi, Massachusetts Institute of Technology (USA); David S. Jessop, Juraj Sibik, Yuan Ren, Stephan Hofmann, J. Axel Zeitler, Harvey E. Beere, David A. Ritchie, Univ. of Cambridge (United Kingdom) ..... [9747-6]
- 2:20 pm: **Thickness measurement of thin film on metal substrate using ultra short THz pulses**, Yuji Nishizawa, Toshifumi Kodama, JFE Steel Corp. (Japan); Tsubasa Minami, Kodo Kawase, Nagoya Univ. (Japan) ..... [9747-7]
- 2:40 pm: **Thickness measurement of tablet coating using continuous-wave terahertz reflection spectroscopy**, Nirmala Devi, Shaumik Ray, Jyotirmayee Dash, Bala Pesala, C.S.I.R. Madras Complex (India) ..... [9747-8]
- Coffee Break ..... Mon 3:00 pm to 3:30 pm

### SESSION 3

**LOCATION: RM 258 (SOUTH MEZZANINE) ..... MON 3:30 TO 5:10 PM**

#### GHz Technology

Session Chairs: **Laurence P. Sadwick**, InnoSys, Inc. (USA);  
**R. Jennifer Hwu**, InnoSys, Inc. (USA)

- 3:30 pm: **Microwave generation using a tunable dual-wavelength erbium with a single longitudinal mode**, Soo Kyung Kim, Young Bo Shim, Juil Hwang, Sanggwon Song, Min-Seok Yoon, Sunduck Kim, Young-Geun Han, Hanyang Univ. (Korea, Republic of) ..... [9747-10]
- 3:50 pm: **Use of optical speckle patterns for compressive sensing of RF signals in the GHz band**, George C. Valley, George A. Sefler, Thomas J. Shaw, The Aerospace Corp. (USA) ..... [9747-11]
- 4:10 pm: **Oxygen detection system consisting of a millimeter wave Fabry-Perot resonator and an integrated SiGe front-end**, Julia Wecker, Steffen Kurth, Gauri Mangalgiri, Fraunhofer-Institut für Elektronische Nanosysteme (Germany); Markus Gaitzsch, Technische Univ. Chemnitz (Germany); Thomas Gessner, Fraunhofer-Institut für Elektronische Nanosysteme (Germany) and Technische Univ. Chemnitz (Germany); Andreas Bauch, Ismail Nasr, Robert Weigel, Dietmar Kissinger, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); Angelika Hackner, Ulrich Prechtel, Airbus Group Innovations (Germany) ..... [9747-14]

OPTO

# CONFERENCE 9747

LOCATION: ROOM 258 (SOUTH MEZZANINE)

4:30 pm: **High-efficiency W-band hybrid integrated photoreceiver module using UTC-PD and pHEMT amplifier**, Toshimasa Umezawa, National Institute of Information and Communications Technology (Japan); Kenichi Kashima, Hitachi Kokusai Electric Inc. (Japan); Atsushi Kanno, Kouichi Akahane, Atsushi Matsumoto, Naokatsu Yamamoto, National Institute of Information and Communications Technology (Japan); Tetsuya Kawanishi, National Institute of Information and Communications Technology (Japan) and Waseda Univ. (Japan)..... [9747-12]

4:50 pm: **Optical resonators metrology using an RF-spectrum approach**, Zeina Abdallah, Lab. d'Analyse et d'Architecture des Systèmes (France); Yann G. Boucher, Institut National des Sciences Appliquées de Rennes (France) and Ecole Nationale d'Ingénieurs de Brest (France) and Ecole Nationale Supérieure des Sciences Appliquées et de Technologie (France); Arnaud Fernandez, Lab. d'Analyse et d'Architecture des Systèmes (France); Stéphane Balac, Univ. de Rennes 1 (France); Olivier Llopis, Lab. d'Analyse et d'Architecture des Systèmes (France)..... [9747-13]

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: RM 258 (SOUTH MEZZANINE) .....TUE 8:00 TO 10:10 AM

### THz Sensing and Detection

Session Chairs: **Laurence P. Sadwick**, InnoSys, Inc. (USA); **Frank Ellrich**, Fraunhofer-Institut für Physikalische Messtechnik (Germany)

8:00 am: **Development of terahertz endoscopic system for cancer detection (Invited Paper)**, Pallavi Doradla, Univ. of Massachusetts Lowell (USA); Karim Alavi, Univ. of Massachusetts Medical School (USA); Cecil S. Joseph, Robert H. Giles, Univ. of Massachusetts Lowell (USA)..... [9747-15]

8:30 am: **Characterizations of diffractive microlens in Nb5N6 microbolometers array for THz detection**, Xuecou Tu, Yufeng Pei, Pen Xiao, Chao Wan, Lin Kang, Pei Heng Wu, Jian Chen, Nanjing Univ. (China) . . [9747-16]

8:50 am: **A spectral analysis of silicon wafers in terms of electrical characteristics using a continuous terahertz wave**, Chi Hoon Kim, Chonnam National Univ. (Korea, Republic of) and Korea Photonics Technology Institute (Korea, Republic of); Taeksu Ji, Chonnam National Univ. (Korea, Republic of); Joo Beom Eom, Jaesung Ahn, Korea Photonics Technology Institute (Korea, Republic of)..... [9747-17]

9:10 am: **Retroactive terahertz detection for imaging and remote sensing applications in a standard CMOS technology**, Richard Al Hadi, Yan Zhao, Yilei Li, Yuan Du, Frank M. Chang, Univ. of California, Los Angeles (USA)..... [9747-18]

9:30 am: **Horn-type components based on optical devices at terahertz frequencies**, Won-Hui Lee, Eui Su Lee, Namje Kim, Sang-Pil Han, Hyunsung Ko, Kyung Hyun Park, Electronics and Telecommunications Research Institute (Korea, Republic of)..... [9747-19]

9:50 am: **Fourier domain interferometry-based spotlight-mode synthetic-aperture optical imaging system for use from low-earth orbit**, John Rogers, Spectra Medical (United Kingdom); Chris Pannell, Spectra Medical (United Kingdom)..... [9747-20]

Coffee Break ..... Tue 10:10 am to 10:40 am

### SESSION 5

LOCATION: RM 258 (SOUTH MEZZANINE) TUE 10:40 AM TO 12:00 PM

### Materials for THz and GHz

Session Chairs: **Tianxin Yang**, Tianjin Univ. (China); **Laurence P. Sadwick**, InnoSys, Inc. (USA)

10:40 am: **Optical properties of aluminum nitride in 1-8 THz region**, Aleksej Majkic, Univ. of Ljubljana (Slovenia); Uroš Puc, Jožef Stefan Institute (Slovenia); Alexander Franke, Ronny Kirste, Ramon Collazo, Zlatko Sitar, North Carolina State Univ. (USA); Marko Zgonik, Univ. of Ljubljana (Slovenia) and Jožef Stefan Institute (Slovenia)..... [9747-21]

11:00 am: **Textured semiconductors for enhanced photoconductive terahertz emission**, Christopher M. Collier, Jeffrey D. A. Krupa, Ilija R. Hristovski, Trevor J. Stirling, Mark H. Bergen, Jonathan F. Holzman, UBC Okanagan (Canada)..... [9747-22]

11:20 am: **Microfabrication of SU-8 Fresnel lenses for THz imaging**, Maryam Hajji, Dagou Zeze, Claudio Balocco, Andrew Gallant, Durham Univ. (United Kingdom)..... [9747-23]

11:40 am: **Perfect absorber metamaterial for real time detection and recognition of micro-poisons in aqueous solutions and atmosphere using millimeter wavelength spectroscopy**, Amir Abramovich, David Rotshild, Meir Ochana, Daniel Rozban, Ariel Univ. (Israel)..... [9747-24]

Lunch/Exhibition Break ..... Tue 12:00 pm to 1:30 pm

### SESSION 6

LOCATION: RM 258 (SOUTH MEZZANINE) ..... TUE 1:30 TO 3:10 PM

### THz Spectroscopy

Session Chairs: **Anthony Murphy**, National Univ. of Ireland, Maynooth (Ireland); **Laurence P. Sadwick**, InnoSys, Inc. (USA)

1:30 pm: **Enhancement of water retention in UV-exposed fuel-cell proton exchange membrane studied using terahertz-pulsed spectroscopy**, Nirmala Devi, Shaumik Ray, Jyotirmayee Dash, Gutru Rambabu, Santoshkumar D. Bhat, Bala Pesala, C.S.I.R. Madras Complex (India)..... [9747-25]

1:50 pm: **SOA-integrated dual-mode laser diode and a photodiode for a compact and cost-effective CW terahertz system**, Eui Su Lee, Namje Kim, Sang-Pil Han, Il-Min Lee, Jun-Hwan Shin, Won-Hui Lee, Kyung Hyun Park, Electronics and Telecommunications Research Institute (Korea, Republic of)..... [9747-26]

2:10 pm: **Dynamic measurements at THz frequencies with a fast rotary delay line**, Hang Qu, Hichem Guerboukha, Maksim A. Skorobogatiy, Ecole Polytechnique de Montréal (Canada)..... [9747-27]

2:30 pm: **highly sensitive terahertz spectroscopy of residual pesticide using nano-antenna array**, Dong-Kyu Lee, Korea Institute of Science and Technology (Korea, Republic of); Giyoung Kim, National Academy of Agricultural Science (Korea, Republic of); Joo-Hiuk Son, The Univ. of Seoul (Korea, Republic of); Minah Seo, Korea Institute of Science and Technology (Korea, Republic of)..... [9747-28]

2:50 pm: **Pulsed THz spectroscopy of substance under disordered opaque cover**, Vyacheslav A. Trofimov, Irina G. Zakharova, Dmitrii Y. Zagursky, Lomonosov Moscow State Univ. (Russian Federation)..... [9747-29]

Coffee Break ..... Tue 3:10 pm to 3:40 pm

### Best Student Paper Awards Ceremony

TUE. 3:30 PM TO 3:50 PM

LOCATION: ROOM 258 (SOUTH MEZZANINE)

Join us as we award the best student paper(s) for the Terahertz, RF, Millimeter, and Sub-Millimeter-Wave Technology and Applications conference.

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### SESSION 7

LOCATION: RM 258 (SOUTH MEZZANINE) .....TUE 3:50 TO 5:50 PM

### Optical/Opto-Electronics, THz and GHz, and New Developments

Session Chairs: **René Beigang**, Technische Univ. Kaiserslautern (Germany); **Kyung Hyun Park**, Electronics and Telecommunications Research Institute (Korea, Republic of)

3:50 pm: **Frequency measurement of THz waves by electro-optic sampling using Mach-Zehnder-modulator-based flat comb generator**, Isao Morohashi, National Institute of Information and Communications Technology (Japan); Mayu Kirigaya, Yuta Kaneko, Ikufumi Katayama, Yokohama National Univ. (Japan); Takahide Sakamoto, Norihiko Sekine, Akifumi Kasamatsu, Iwao Hosako, National Institute of Information and Communications Technology (Japan)..... [9747-30]

4:10 pm: **Advances in optoelectronic oscillators**, Romain Matinenghi, FEMTO-ST (France); Romain M. Nguimdo, Vrije Univ. Brussel (Belgium); Patrice Salzenstein, Khaldoun Saleh, Souleymane Diallo, Guoping Lin, FEMTO-ST (France); Geraud R. Goune Chengui, Alain F. Talla, Jimmi H. Talla Mbé, Paul Woafo, Univ. de Yaoundé 1 (Cameroon); Yanne K. Chembo, FEMTO-ST (France)..... [9747-31]



# CONFERENCE 9747

LOCATION: ROOM 258 (SOUTH MEZZANINE)

4:30 pm: **All-optical real-time data format conversion in FBG sensing network**, Rui Ma, Zhaoying Wang, Sha Luo, Shiyuan Liu, Quan Yuan, Tianxin Yang, Tianjin Univ. (China) . . . . . [9747-32]

4:50 pm: **A single longitudinal erbium-doped fiber laser based on a microfiber knot resonator**, Young Bo Shim, Soo Kyung Kim, Min-Seok Yoon, Sunduck Kim, Juil Hwang, Sanggwon Song, Young-Geun Han, Hanyang Univ. (Korea, Republic of) . . . . . [9747-33]

5:10 pm: **Double wavelengths parallel sweeping optical source**, Quan Yuan, Zhaoying Wang, Shiyuan Liu, Sha Luo, Rui Ma, Tianxin Yang, Tianjin Univ. (China) . . . . . [9747-34]

5:30 pm: **Piroxicam derivatives THz classification**, Lukasz Sterczewski, Michal Grzelczak, Kacper Nowak, Wroclaw Univ. of Technology (Poland); Stanislaw Plinska, Boguslaw Fuglewicz, Berenika Szczesniak-Siega, Wieslaw Malinka, Wroclaw Medical Univ. (Poland); Edward F. Plinski, Wroclaw Univ. of Technology (Poland) . . . . . [9747-79]

## WEDNESDAY 17 FEBRUARY

### SESSION 8

LOCATION: RM 258 (SOUTH MEZZANINE) . . . . WED 8:00 TO 10:10 AM

### THz Security and Sensing

Session Chairs: **René Beigang**, Technische Univ. Kaiserslautern (Germany); **Laurence P. Sadwick**, InnoSys, Inc. (USA)

8:00 am: **Terahertz imaging and spectroscopy for detection and identification of drugs and explosives in letters and small packages** (*Invited Paper*), Frank Ellrich, Daniel Molter, Joachim Jonuscheit, Georg von Freymann, Fraunhofer-Institut für Physikalische Messtechnik (Germany); Maik Schubert, Daniel Hübsch, Thorsten Sprenger, HÜBNER GmbH & Co. KG (Germany) . . . . . [9747-35]

8:30 am: **Enhancement of THz signal intensity by plasmonic monopole nanoantenna** (*Invited Paper*), Ekmel Ozbay, Bayram Butun, Mert Bozaci, Tolga Kartaloglu, Bilkent Univ. (Turkey) . . . . . [9747-36]

9:00 am: **Photoconductive antennas based on low temperature grown GaAs on silicon substrates for broadband terahertz generation and detection**, Matthias Klos, Technische Univ. Kaiserslautern (Germany); Richard Bartholdt, Technische Univ. Kaiserslautern (Germany) and Fraunhofer-Institut für Physikalische Messtechnik (Germany); Jens Klier, Fraunhofer-Institut für Physikalische Messtechnik (Germany); Jean-François Lampin, Univ. des Sciences et Technologies de Lille (France); René Beigang, Technische Univ. Kaiserslautern (Germany) . . . . . [9747-37]

9:20 am: **Electronic FM CW THz system for security applications** (*Invited Paper*), Janez Trontelj, Aleksander Sešek, Univ. of Ljubljana (Slovenia) . . . . . [9747-38]

9:50 am: **Terahertz imaging of composite materials in reflection and transmission mode with a time-domain spectroscopy system**, Magnus W. Haakestad, Arthur D. van Rheeën, Trygve R. Sorgård, Norwegian Defence Research Establishment (Norway) . . . . . [9747-39]

Coffee Break . . . . . Wed 10:10 am to 10:40 am

### SESSION 9

LOCATION: RM 258 (SOUTH MEZZANINE) .. WED 10:40 AM TO 12:20 PM

### Quantum Cascade and Other Laser-based Developments

Session Chairs: **Robert H. Giles**, Univ. of Massachusetts Lowell (USA); **Laurence P. Sadwick**, InnoSys, Inc. (USA)

10:40 am: **Measuring intensity correlations of a THz quantum cascade laser around its threshold at sub-cycle timescales**, Ileana-Cristina Benea-Chelmus, Giacomo Scialari, Mattias Beck, Jérôme Faist, ETH Zürich (Switzerland) . . . . . [9747-40]

11:00 am: **Terahertz quantum cascade laser with broad band extractor**, Christopher B. Bonzon, ETH Zürich (Switzerland); Matthias Justen, Univ. zu Köln (Germany); Keita Otani, ETH Zürich (Switzerland); Urs Graf, ETH Zürich (Germany); Mattias Beck, ETH Zürich (Switzerland); Jürgen Stutzki, Univ. zu Köln (Germany); Jérôme Faist, ETH Zürich (Switzerland) . . . . . [9747-41]

11:20 am: **Coherent THz light source based on photo-mixing with a UTC-PD and ASE-free tunable diode lasers**, Daisuke Fukuoka, Kiyofumi Muro, Spectra Quest Lab. Inc. (Japan); Kazufusa Noda, Oshima Prototype Engineering Co. (Japan) . . . . . [9747-42]

11:40 am: **Highly efficient local-oscillator-free photonic microwave down-converters based on period-one nonlinear dynamics of semiconductor lasers**, Yu-Han Hung, Sheng-Kwang Hwang, National Cheng Kung Univ. (Taiwan) . . . . . [9747-43]

12:00 pm: **Hybrid polymer/InP dual DBR laser for 1.5 µm continuous-wave terahertz systems**, David de Felipe Mesquida, Walter Brinker, Dennis Stanze, Crispin Zawadzki, Moritz Kleinert, Martin Möhrle, Norbert Keil, Thorsten Göbel, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut (Germany); Klaus Petermann, Technische Univ. Berlin (Germany); Martin Schell, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut (Germany) . . . . . [9747-44]

Lunch/Exhibition Break . . . . . Wed 12:20 pm to 1:50 pm

### SESSION 10

LOCATION: RM 258 (SOUTH MEZZANINE) . . . . . WED 1:50 TO 3:30 PM

### THz Sources and Antennas

Session Chairs: **Tianxin Yang**, Tianjin Univ. (China); **Laurence P. Sadwick**, InnoSys, Inc. (USA)

1:50 pm: **High-power continuous-wave terahertz radiation through GaAs plasmonic photomixers**, Shang Hua Yang, Univ. of Michigan (USA) and Univ. of California, Los Angeles (USA); Mona Jarrahi, Univ. of California, Los Angeles (USA) and Univ. of Michigan (USA) . . . . . [9747-45]

2:10 pm: **Terahertz generation and detection using femtosecond mode-locked Yb-doped fiber laser**, Moonsik Kong, Ji Su Kim, Chungnam National Univ. (Korea, Republic of); Sang-Pil Han, Namje Kim, Kiwon Moon, Kyung Hyun Park, Electronics and Telecommunications Research Institute (Korea, Republic of); Min Yong Jeon, Chungnam National Univ. (Korea, Republic of) . . . . . [9747-46]

2:30 pm: **Generation and evaluation of THz waves from electric-optic polymer films**, Takahiro Kaji, Toshiki Yamada, Shingo Saito, Isao Morohashi, Yukihiro Tominari, Isao Aoki, Shukichi Tanaka, Akira Otomo, National Institute of Information and Communications Technology (Japan) . . . . . [9747-47]

2:50 pm: **Enhanced terahertz guiding strength of two-wire line using dielectric coating**, Tae-In Jeon, Jingshu Zha, Korea Maritime and Ocean Univ. (Korea, Republic of) . . . . . [9747-48]

3:10 pm: **Fast terahertz optoelectronic amplitude modulator based on plasmonic metamaterial antenna arrays and graphene**, David S. Jessop, Riccardo Degl'Innocenti, Univ. of Cambridge (United Kingdom); Christian W. O. Sol, Univ. College London (United Kingdom); Philipp Braeuning-Weimer, Hungyen Lin, Varun S. Kamboj, Stephan Hofmann, J. Axel Zeitler, Harvey E. Beere, David A. Ritchie, Univ. of Cambridge (United Kingdom) . . . . . [9747-49]

Coffee Break . . . . . Wed 3:30 pm to 4:00 pm

### SESSION 11

LOCATION: RM 258 (SOUTH MEZZANINE) . . . . WED 4:00 TO 5:40 PM

### Electric/Magnetic and Related Measurements/Simulations

Session Chairs: **Tianxin Yang**, Tianjin Univ. (China); **Anthony Murphy**, National Univ. of Ireland, Maynooth (Ireland)

4:00 pm: **Atom-based RF electric field measurements for weak fields above 100 GHz**, Matt T. Simons, Joshua A. Gordon, Christopher L. Holloway, National Institute of Standards and Technology (USA) . . . . . [9747-50]

4:20 pm: **The effect of carrier lifetime and substrate conductivity on the performance of large-area plasmonic photoconductive emitters**, Nezhil T. Yardimci, Univ. of California, Los Angeles (USA); Rodolfo Salas, Seth R. Bank, The Univ. of Texas at Austin (USA); Mona Jarrahi, Univ. of California, Los Angeles (USA) . . . . . [9747-51]

4:40 pm: **Electromagnetic modelling of a space-borne far-infrared interferometer**, Anthony Donohoe, Créidhe O'Sullivan, Anthony Murphy, Colm P. Bracken, National Univ. of Ireland, Maynooth (Ireland); Giorgio Savini, Univ. College London (United Kingdom); Enzo Pascale, Cardiff Univ. (United Kingdom) . . . . . [9747-52]

5:00 pm: **Experimental demonstration of trapping waves with terahertz metamaterial absorbers on flexible polyimide films**, Wei Wang, Jinsong Liu, Wuhan National Lab. for Optoelectronics (China) . . . . . [9747-53]

5:20 pm: **Broadband frequency-chirped terahertz-wave signal generation using periodically-poled lithium niobate for frequency-modulated continuous-wave radar application**, Junichi Hamazaki, Yoh Ogawa, Norihiko Sekine, Akifumi Kasamatsu, Atsushi Kanno, Naokatsu Yamamoto, Iwao Hosako, National Institute of Information and Communications Technology (Japan) . . . . . [9747-54]

OPTO

# CONFERENCE 9747

LOCATION: ROOM 258 (SOUTH MEZZANINE)

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 ... WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Planar array antenna with director on indium phosphide substrate for 300GHz wireless link**, Haruichi Kanaya, Tomoki Oda, Naoto Iizasa, Kazutoshi Kato, Kyushu Univ. (Japan) ..... [9747-73]

**Thickness measurement based on high-speed broadband frequency sweeping of continuous-wave terahertz radiation**, Dae-Su Yee, Ji Sang Yahng, Choon-Su Park, Korea Research Institute of Standards and Science (Korea, Republic of); Hwi Don Lee, Chang-Seok Kim, Pusan National Univ. (Korea, Republic of) ..... [9747-74]

**High-speed frequency-domain terahertz coherence tomography using a frequency-swept source and beam steering**, Ji Sang Yahng, Choon-Su Park, Korea Research Institute of Standards and Science (Korea, Republic of); Hwi Don Lee, Chang-Seok Kim, Pusan National Univ. (Korea, Republic of); Dae-Su Yee, Korea Research Institute of Standards and Science (Korea, Republic of) ..... [9747-75]

**Realization of optical isotropy using terahertz anisotropic metamaterials**, Joong-Wook Lee, Chonnam National Univ. (Korea, Republic of) ..... [9747-76]

**Optimization method of a slot ring antenna integrated with a terahertz photomixer**, Han-Cheol Ryu, Sahmyook Univ. (Korea, Republic of); Eui Su Lee, Kyung Hyun Park, Electronics and Telecommunications Research Institute (Korea, Republic of) ..... [9747-77]

**FDTD simulation of space-time cloaking structure based on transformation optics for terahertz frequency range**, Egor A. Gurvitz, Mikhail V. Sharaevsky, Mikhail K. Khodzitsky, ITMO Univ. (Russian Federation) ..... [9747-78]

## THURSDAY 18 FEBRUARY

### SESSION 12

LOCATION: RM 258 (SOUTH MEZZANINE) .... THU 8:00 TO 10:10 AM

## Design and Approaches for Optics, THz, RF, and X-Ray Applications

Session Chairs: **Tianxin Yang**, Tianjin Univ. (China);

**Jianji Dong**, Huazhong Univ. of Science and Technology (China)

8:00 am: **Multilayers for EUV, soft x-ray, and x-ray optics** (*Invited Paper*), Zhanshan Wang, Qiushi Huang, Zhong Zhang, Tongji Univ. (China) ... [9747-55]

8:30 am: **Design and optimization of polymer ring resonator modulators for analog microwave photonic applications**, Arash Hosseinzadeh, Christopher T. Middlebrook, Michigan Technological Univ. (USA) ..... [9747-56]

8:50 am: **Graphene plasmon modes near thin metallic layer in THz frequency regime**, Il-Min Lee, Jun-Hwan Shin, Kiwon Moon, Eui Su Lee, Sang-Pil Han, Kyung Hyun Park, Electronics and Telecommunications Research Institute (Korea, Republic of) ..... [9747-57]

9:10 am: **Graded index porous optical fibers: dispersion management in terahertz range**, Tian Ma, Maksim A. Skorobogatiy, Ecole Polytechnique de Montréal (Canada) ..... [9747-58]

9:30 am: **Coherent THz power combiner consisting of arrayed uni-traveling carrier photodiodes and planar lightwave circuit**, Kazuki Sakuma, Jun Haruki, Kazutoshi Kato, Kyushu Univ. (Japan); Shintaro Hisatake, Tadao Nagatsuma, Osaka Univ. (Japan) ..... [9747-59]

9:50 am: **Novel fiber fused lens for advanced optical communication systems**, Andrew A. Chesworth, LightPath Technologies, Inc. (USA); Randy K. Rannow, APIC Corp. (USA); Omar Ruiz, Matthew DeRemer, Joseph Leite, LightPath Technologies, Inc. (USA); Armando Martinez, APIC Corp. (USA) ..... [9747-60]

Coffee Break ..... Thu 10:10 am to 10:40 am

### SESSION 13

LOCATION: RM 258 (SOUTH MEZZANINE) THU 10:40 AM TO 12:10 PM

## Novel Testing, Development, Measurement, and Characterization

Session Chairs: **Tianxin Yang**, Tianjin Univ. (China);  
**Laurence P. Sadwick**, InnoSys, Inc. (USA)

10:40 am: **Advancing sonic IR imaging for materials and structures** (*Invited Paper*), Xiaoyan Han, Wayne State Univ. (USA) ..... [9747-61]

11:10 am: **Non-destructive characterization of nanocomposite deep-level defects using terahertz technique**, Karen L. Ke, A\*STAR Institute of Materials Research and Engineering (Singapore) ..... [9747-62]

11:30 am: **Low-loss and low-dispersion transmission line over DC-to-THz spectrum**, Faezeh Fesharaki, Tarek Djerafi, Ecole Polytechnique de Montréal (Canada); Mohamed Chaker, Institut National de la Recherche Scientifique (Canada); Ke Wu, Ecole Polytechnique de Montréal (Canada) ..... [9747-63]

11:50 am: **RF beam transmission/reception of x-band PAA system utilizing large-area, light-weight, and conformal polymer-based true-time-delay module developed using imprinting and inkjet printing**, Zeyu Pan, The Univ. of Texas at Austin (USA); Cheng Zhang, Univ. of Michigan (USA); Harish Subbaraman, Omega Optics, Inc. (USA); Chi-Jui Chung, The Univ. of Texas at Austin (USA); Qiaochu Li, Ashwin Panday, Univ. of Michigan (USA); Xiaochuan Xu, Omega Optics, Inc. (USA); Xingyu Zhang, Yi Zou, The Univ. of Texas at Austin (USA); L. Jay Guo, Univ. of Michigan (USA); Ray T. Chen, The Univ. of Texas at Austin (USA) ..... [9747-64]

Lunch/Exhibition Break ..... Thu 12:10 pm to 1:40 pm

### SESSION 14

LOCATION: RM 258 (SOUTH MEZZANINE) ..... THU 1:40 TO 3:20 PM

## Detectors and Sensors

Session Chairs: **Jinghua Teng**, A\*STAR Institute of Materials Research and Engineering (Singapore); **Frank Ellrich**, Fraunhofer-Institut für Physikalische Messtechnik (Germany)

1:40 pm: **Large-dynamic-range plasmonic photomixer for heterodyne terahertz detection**, Ning Wang, Univ. of Michigan (USA) and Univ. of California, Los Angeles (USA); Hamid Javadi, Jet Propulsion Lab. (USA); Mona Jarrahi, Univ. of California, Los Angeles (USA) ..... [9747-65]

2:00 pm: **Fully packaged high-performance RF sensor featuring slotted photonic crystal waveguides in silicon-on-sapphire**, Chi-Jui Chung, The Univ. of Texas at Austin (USA); Harish Subbaraman, Omega Optics, Inc. (USA); Jingdong Luo, Alex K. Y. Jen, Univ. of Washington (USA); Robert L. Nelson, Charles Y. C. Lee, Air Force Research Lab. (USA); Ray T. Chen, The Univ. of Texas at Austin (USA) and Omega Optics, Inc. (USA) ..... [9747-66]

2:20 pm: **Optical fiber based microwave-photonic interferometric sensors**, Jie Huang, Missouri Univ. of Science and Technology (USA); Liwei Hua, Lei Yuan, Clemson Univ. (USA) ..... [9747-67]

2:40 pm: **High-power MUTC photodetectors for RF photonic links**, Steven Estrella, Leif A. Johansson, Milan L. Mashanovitch, Freedom Photonics, LLC (USA); Andreas Beling, Univ. of Virginia (USA) ..... [9747-68]

3:00 pm: **THz dual-band metasurfaces**, Jun Ding, Univ. of North Texas (USA); Ningning Xu, Oklahoma State Univ. (USA); Han Ren, Mi Zhou, Univ. of North Texas (USA); Weili Zhang, Oklahoma State Univ. (USA); Yuankun Lin, Hualiang Zhang, Univ. of North Texas (USA) ..... [9747-69]

Coffee Break ..... Thu 3:20 pm to 3:50 pm

### SESSION 15

LOCATION: RM 258 (SOUTH MEZZANINE) ..... THU 3:50 TO 4:50 PM

## Modulation

Session Chairs: **Laurence P. Sadwick**, InnoSys, Inc. (USA);  
**Robert H. Giles**, Univ. of Massachusetts Lowell (USA)

3:50 pm: **Large cross-phase modulation driven by intense THz field**, Carlo Vicario, Mostafa Shalaby, Paul Scherrer Institut (Switzerland); Christoph P. Hauri, Paul Scherrer Institut (Switzerland) and Ecole Polytechnique Fédérale de Lausanne (Switzerland) ..... [9747-70]

4:10 pm: **Experimental studies on WDM to TDM signal conversions using gigahertz electro-absorption modulators**, Tianxin Yang, Peirui Gao, Tianjin Univ. (China) ..... [9747-71]

4:30 pm: **Effective THz modulators by ionic liquid gating on graphene**, Yang Wu, Yang Hyunsoo, National Univ. of Singapore (Singapore) ..... [9747-72]

# CONFERENCE 9748

LOCATION: ROOM 252 (SOUTH MEZZANINE)

Monday–Thursday 15–18 February 2016 • Proceedings of SPIE Vol. 9748

# Gallium Nitride Materials and Devices XI

Conference Chairs: **Jen-Inn Chyi**, National Central Univ. (Taiwan); **Hiroshi Fujioka**, The Univ. of Tokyo (Japan); **Hadis Morkoç**, Virginia Commonwealth Univ. (USA)

Conference Co-Chairs: **Yasushi Nanishi**, Ritsumeikan Univ. (Japan); **Ulrich T. Schwarz**, IMTEK, Univ. Freiburg (Germany); **Jong-In Shim**, Hanyang Univ. (Korea, Republic of)

Program Committee: **Frank Bertram**, Otto-von-Guericke-Univ. Magdeburg (Germany); **Michal Bockowski**, Institute of High Pressure Physics (Poland); **Enrique Calleja**, Univ. Politécnica de Madrid (Spain); **Shigefusa F. Chichibu**, Tohoku Univ. (Japan); **Bernard Gil**, Univ. Montpellier 2 (France); **Nicolas Grandjean**, Ecole Polytechnique Fédérale de Lausanne (Switzerland); **Hideki Hirayama**, RIKEN (Japan); **Ray-Hua Horng**, National Chung Hsing Univ. (Taiwan); **Stacia Keller**, Univ. of California, Santa Barbara (USA); **Michael Kneissl**, Technische Univ. Berlin (Germany); **Hao-Chung Kuo**, National Chiao Tung Univ. (Taiwan); **Masaaki Kuzuhara**, Univ. of Fukui (Japan); **Koh Matsumoto**, Taiyo Nippon Sanso Corp. (Japan); **Hideito Miyake**, Mie Univ. (Japan); **Eva Monroy**, CEA Grenoble (France); **Yong-Tae Moon**, LG Electronics Inc. (Korea, Republic of); **Ki-Bum Nam**, Seoul Semiconductor (Korea, Republic of); **Ümit Özgür**, Virginia Commonwealth Univ. (USA); **Joachim Piprek**, NUSOD Institute LLC (USA); **Tae-Yeon Seong**, Korea Univ. (Korea, Republic of); **Chih-Chung Yang**, National Taiwan Univ. (Taiwan); **Euijoon Yoon**, Seoul National Univ. (Korea, Republic of); **Enrico Zanoni**, Univ. degli Studi di Padova (Italy)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative, Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break . . . . . Mon 10:10 am to 10:40 am

### SESSION 1

LOCATION: RM 252 (SOUTH MEZZANINE) . MON 10:30 AM TO 12:00 PM

#### BN I

Session Chair: **Hadis Morkoç**, Virginia Commonwealth Univ. (USA)

- 10:30 am: **Properties and applications of hexagonal boron nitride single crystals** (*Invited Paper*), James Edgar, Tim Hoffman, Jared Sperber, Yi Zhang, Song Liu, Kansas State Univ. (USA) . . . . . [9748-1]
- 11:00 am: **Hexagonal boron nitride (h-BN) epilayers: growth, properties, and applications** (*Invited Paper*), Hongxing Jiang, Jingyu Lin, Texas Tech Univ. (USA) . . . . . [9748-2]
- 11:30 am: **Chronological Advances in Two Dimensional Hexagonal Boron Nitride Growth** (*Invited Paper*), Roland Yingjie Tay, Nanyang Technological Univ. (Singapore); Siu Hon Tsang, Nanyang Technological Univ. (Singapore) and Temasek Labs. (Singapore); Edwin Hang Tong Teo, Nanyang Technological Univ. (Singapore) . . . . . [9748-3]
- Lunch Break . . . . . Mon 12:00 pm to 1:15 pm

### SESSION 2

LOCATION: RM 252 (SOUTH MEZZANINE) . . . . . MON 1:15 TO 3:00 PM

#### BN II

Session Chair: **Bernard Gil**, Univ. Montpellier 2 (France)

- 1:15 pm: **Heteroepitaxial growth of cubic boron nitride films on diamond(001) substrates and their n-type doping** (*Invited Paper*), Hong Yin, Jilin Univ. (China) . . . . . [9748-4]
- 1:45 pm: **Optical properties of hexagonal boron nitride** (*Invited Paper*), Guillaume Cassabois, Univ. Montpellier 1 (France); Pierre Valvin, Bernard Gil, Univ. Montpellier 2 (France) . . . . . [9748-5]
- 2:15 pm: **New single photon source in hBN: an application of cathodoluminescence intensity interferometry experiments at the nanometer scale.** (*Invited Paper*), Luiz Henrique Galvao Tizei, Romain Bourreillier, Sophie Meuret, Anna Tararan, Lab. de Physique des Solides (France); Michele Amato, Univ. Paris-Sud 11 (France); Alexandre Gloter, Katia March, Odile Stéphan, Mathieu Kociak, Lab. de Physique des Solides (France); Takashi Tanigushi, National Institute for Materials Science (Japan); Alberto Zobelli, Lab. de Physique des Solides (France) . . . . . [9748-6]
- 2:45 pm: **Growth of single-phase wurtzite BAIN with relatively large thicknesses and high B contents by metalorganic chemical vapor deposition**, Xiao-Hang Li, King Abdullah Univ. of Science and Technology (Saudi Arabia); Shuo Wang, Hanxiao Liu, Hongen Xie, Fernando A. Ponce, Arizona State Univ. (USA); Theeradetch Detchprohm, Russell D. Dupuis, Georgia Institute of Technology (USA) . . . . . [9748-7]
- Coffee Break . . . . . Mon 3:00 pm to 3:30 pm

### SESSION 3

LOCATION: RM 252 (SOUTH MEZZANINE) . . . . . MON 3:30 TO 5:45 PM

#### Growth I

Session Chair: **Yasushi Nanishi**, Ritsumeikan Univ. (Japan)

- 3:30 pm: **HVPE-GaN growth on GaN-based advanced substrates by Smart Cut™** (*Invited Paper*), Malgorzata Iwinska, Institute of High Pressure Physics (Poland); Mikolaj Amilusik, Institute of High Pressure Physics (Poland) and TopGaN Ltd. (Poland); Michal Fijalkowski, Institute of High Pressure Physics (Poland); Tomasz Sochacki, Boleslaw Lucznik, Institute of High Pressure Physics (Poland) and TopGaN Ltd. (Poland); Anna Nowakowska-Siwinska, TopGaN Ltd. (Poland); Izabella Grzegory, Institute of High Pressure Physics (Poland); Pascal Guenard, Raphael Caulmilone, Soitec S.A. (France); Martin Seiss, Tobias Mrotzek, PLANSEE SE (Austria); Michal Bockowski, Institute of High Pressure Physics (Poland) and TopGaN Ltd. (Poland) . . . . . [9748-8]
- 4:00 pm: **High Quality Bulk GaN Crystal Grown by Acidic Ammonothermal Method** (*Invited Paper*), Makoto Saito, Tohoku Univ. (Japan) and Mitsubishi Chemical Corp. (Japan); Quanxi Bao, Kohei Kurimoto, Tohoku Univ. (Japan) and The Japan Steel Works, Ltd. (Japan); Daisuke Tomida, Kazunobu Kojima, Tohoku Univ. (Japan); Yuji Kagamitani, Mitsubishi Chemical Corp. (Japan); Rinzo Kayano, The Japan Steel Works, Ltd. (Japan); Toru Ishiguro, Shigefusa F. Chichibu, Tohoku Univ. (Japan) . . . . . [9748-9]

OPTO



# CONFERENCE 9748

LOCATION: ROOM 252 (SOUTH MEZZANINE)

4:30 pm: **High rate InN growth by two-step precursor generation hydride vapor phase epitaxy** (*Invited Paper*), Rie Togashi, Quang Tu Thieu, Hisashi Murakami, Tokyo Univ. of Agriculture and Technology (Japan); Yoshihiro Ishitani, Chiba Univ. (Japan); Bo Monemar, Tokyo Univ. of Agriculture and Technology (Japan) and Linköping Univ. (Sweden); Akinori Koukita, Yoshinao Kumagai, Tokyo Univ. of Agriculture and Technology (Japan) . . . . . [9748-10]

5:00 pm: **Hydride Vapor Phase Epitaxy for High Conductivity N-type AlN**, Jacob H. Leach, Kevin Udway, Keith R. Evans, Kyma Technologies, Inc. (USA) . . . . . [9748-11]

5:15 pm: **Challenges and future perspectives in HVPE-GaN growth**, Michal Bockowski, Institute of High Pressure Physics (Poland) . . . . . [9748-12]

5:30 pm: **High-conductivity p-type layer with an alternating p-GaN/u-GaN structure**, Hao-Tsung Chen, Yu-Feng Yao, Chang-Gan Tu, Chia-Ying Su, Chun-Han Lin, Chieh Hsieh, Chih-Chung Yang, National Taiwan Univ. (Taiwan) . . . . . [9748-69]

11:30 am: **Structural Properties of AlGaN-Layers for UV-Detectors Deposited on AlN/Sapphire-Templates and AlN-Substrates**, Lutz Kirste, Susanne Kopta, Lars Hahn, Jannik Richter, Mario Prescher, Martin Walther, Oliver Ambacher, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany) . . . . . [9748-21]

11:45 am: **Application of high-resolution dark-field electron holography for study of a composition distribution in blue and green (In,Ga)N LEDs**, Maxim Korytov, Nikolay Cherkashin, Martin Hytch, Ctr. d'Elaboration de Matériaux et d'Etudes Structurales (France); Andrei F. Tsatsulnikov, Alexey V. Sakharov, Andrey Nikolaev, Wsevolod V. Lundin, Ioffe Physical-Technical Institute (Russian Federation); Philippe De Mierry, Lars Kappel, Jesús Zúñiga-Pérez, Ctr. de Recherche sur l'Hétéro-Epitaxie et ses Applications (France); Matthias Auf der Maur, Aldo Di Carlo, Univ. degli Studi di Roma "Tor Vergata" (Italy) . . . [9748-22]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:30 pm

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: RM 252 (SOUTH MEZZANINE) . . . . . TUE 8:00 TO 10:15 AM

### Growth II

Session Chair: **Michal Bockowski**,  
Institute of High Pressure Physics (Poland)

8:00 am: **Control of surface kinetics during the growth of III-nitrides on native substrates** (*Invited Paper*), Zlatko Sitar, Ramon Collazo, Isaac Bryan, Zachary Bryan, Anthony Rice, North Carolina State Univ. (USA) . . . . . [9748-13]

8:30 am: **In-situ monitoring of InGaN growth by laser absorption and scattering method** (*Invited Paper*), Yoshio Honda, Tetsuya Yamamoto, Akira Tamura, Maki Kushimoto, Hiroshi Amano, Nagoya Univ. (Japan) . . . . . [9748-14]

9:00 am: **Fabrication of high-quality AlN on sapphire using high-temperature annealing technique** (*Invited Paper*), Hideto Miyake, Chia-Hung Lin, Kazumasa Hiramatsu, Mie Univ. (Japan) . . . . . [9748-15]

9:30 am: **Control of defects and compensation by MOVPE growth conditions in heavily n- and p-type doped GaN**, Marc Hoffmann, Christoph Berger, Jonas Hennig, Andreas Lesnik, Otto-von-Guericke Univ. Magdeburg (Germany); Silvio Neugebauer, Otto-von-Guericke-Univ. Magdeburg (Germany); Ronny Kirste, Felix Kaess, Ramon Collazo, Zlatko Sitar, North Carolina State Univ. (USA); Armin Dadgar, Otto-von-Guericke-Univ. Magdeburg (Germany); André Strittmatter, Otto-von-Guericke Univ. Magdeburg (Germany) . . . [9748-16]

9:45 am: **MOVPE growth of a-plane GaN on r-plane sapphire using AlN buffer deposited by sputtering**, Daiki Jinno, Meijo Univ. (Japan) and Koito Manufacturing Co., Ltd. (Japan); Teruyuki Niimi, Meijo Univ. (Japan); Hisayoshi Daicho, Koito Manufacturing Co., Ltd. (Japan); Motoaki Iwaya, Tetsuya Takeuchi, Satoshi Kamiyama, Isamu Akasaki, Meijo Univ. (Japan) . . . . . [9748-17]

10:00 am: **Optical and Crystal Quality Improvement in Green Emitting InxGa1-xN Multi-Quantum Wells through Optimization of MOCVD Growth**, Erkan A. Berkman, Soo Min Lee, Frank Ramos, Eric Tucker, Ronald A. Arif, Eric A. Armour, George D. Papasouliotis, Veeco Instruments Inc. (USA) . . . . . [9748-18]

Coffee Break . . . . . Tue 10:15 am to 10:45 am

### SESSION 5

LOCATION: RM 252 (SOUTH MEZZANINE) TUE 10:45 AM TO 12:00 PM

### Characterization I

Session Chair: **Hiroshi Fujioka**, The Univ. of Tokyo (Japan)

10:45 am: **Quantum Well Intermixing and Radiation Effects in InGaN/GaN Multi Quantum Wells** (*Invited Paper*), Katharina Lorenz, M. C. Sequeira, A. Freitas, Marco B. Peres, Andrés Redondo-Cubero, L. C. Alves, Eduardo P. Alves, Instituto Superior Técnico (Portugal); M. P. Leitão, Joana Rodrigues, Nabih Ben Sedrine, Maria R. Correia, Teresa Monteiro, Univ. de Aveiro (Portugal) . . . . . [9748-19]

11:15 am: **Investigation of mechanical wear rates in III-nitride materials**, Guosong Zeng, Chee-Keong Tan, Brandon A. Krick, Nelson Tansu, Lehigh Univ. (USA) . . . . . [9748-20]

### SESSION 6

LOCATION: RM 252 (SOUTH MEZZANINE) . . . . . TUE 1:30 TO 3:00 PM

### Characterization II

Session Chair: **Frank Bertram**, Otto-von-Guericke-Univ. Magdeburg (Germany)

1:30 pm: **Multimode mapping of III-nitrides in the scanning electron microscope** (*Invited Paper*), Robert Martin, Univ. of Strathclyde (United Kingdom) . . . . . [9748-23]

2:00 pm: **New Advances in GaN Photonics** (*Invited Paper*), Jung Han, Yale Univ. (USA) . . . . . [9748-24]

2:30 pm: **Comparison of high indium content InGaN quantum wells grown on c and (20-21) planes by means of time resolved photoluminescence with applied bias**, Lucja Marona, Institute of High Pressure Physics (Poland); Michal Baranowski, Wroclaw Univ. of Technology (Poland); Dario Schiavon, TopGaN Ltd. (Poland); Piotr Perlin, Tadek Suski, Institute of High Pressure Physics (Poland) . . . . . [9748-25]

2:45 pm: **Analysis of radiative and non-radiative lifetimes in GaN using accurate internal-quantum-efficiency values estimated by simultaneous photoluminescence and photo-acoustic measurements**, Kouhei Kawakami, Takashi Nakano, Atsushi A. Yamaguchi, Kanazawa Institute of Technology (Japan) . . . . . [9748-27]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

### SESSION 7

LOCATION: RM 252 (SOUTH MEZZANINE) . . . . . TUE 3:30 TO 5:30 PM

### Characterization III

Session Chair: **Robert Martin**, Univ. of Strathclyde (United Kingdom)

3:30 pm: **Direct microscopic correlation of optical and structural properties of individual GaN/AlN quantum dots formed at threading dislocations using nanoscale cathodoluminescence** (*Invited Paper*), Frank Bertram, Gordon Schmidt, Otto-von-Guericke-Univ. Magdeburg (Germany); Christoph Berger, Otto-von-Guericke Univ. Magdeburg (Germany); Peter Veit, Otto-von-Guericke-Univ. Magdeburg (Germany); Gordon Callsen, Stefan Kalinowski, Technische Univ. Berlin (Germany); Armin Dadgar, Otto-von-Guericke-Univ. Magdeburg (Germany); Axel Hoffmann, Technische Univ. Berlin (Germany); André Strittmatter, Otto-von-Guericke Univ. Magdeburg (Germany); Jürgen H. Christen, Otto-von-Guericke-Univ. Magdeburg (Germany) . . . . . [9748-28]

4:00 pm: **Approaches to highly efficient UV emitters based on AlGaN quantum wells** (*Invited Paper*), Shuhei Ichikawa, Mitsuru Funato, Yoichi Kawakami, Kyoto Univ. (Japan) . . . . . [9748-29]

4:30 pm: **Room-temperature ballistic transport in III-Nitride semiconductors** (*Invited Paper*), Elison Matioli, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9748-30]

5:00 pm: **Influence of vacancies on GaN/AlN interface characteristics**, Yahor V. Lebiadok, Tatyana V. Bezyazchnaya, Dzmitri M. Kabanau, Vladimir V. Kabanov, Gennady I. Ryabtev, B.I. Stepanov Institute of Physics (Belarus) . . . . . [9748-31]

5:15 pm: **Band gap narrowing with dilute-anion GaN materials for visible emission**, Chee-Keong Tan, Damir Borovac, Nelson Tansu, Lehigh Univ. (USA) . . . . . [9748-32]



# CONFERENCE 9748

LOCATION: ROOM 252 (SOUTH MEZZANINE)

## WEDNESDAY 17 FEBRUARY

### SESSION 8

LOCATION: RM 252 (SOUTH MEZZANINE) . . . . WED 8:00 TO 10:15 AM

### Electron Devices

Session Chair: **Jen-Inn Chyi**, National Central Univ. (Taiwan)

8:00 am: **Interface control technologies for high-power GaN transistors** (*Invited Paper*), Tamotsu Hashizume, Masamichi Akazawa, Taketomo Sato, Hokkaido Univ. (Japan) . . . . . [9748-33]

8:30 am: **Monolithic inverter of enhancement-mode and depletion-mode GaN-based MOSHEMTs** (*Invited Paper*), Ching-Ting Lee, Jhe-Hao Chang, Chun-Yen Tseng, National Cheng Kung Univ. (Taiwan) . . . . . [9748-34]

9:00 am: **Power conversion with Gallium Nitride devices** (*Invited Paper*), Srabanti Chowdhury, Arizona State Univ. (USA) . . . . . [9748-35]

9:30 am: **High Breakdown Voltage AlGaIn/GaN HEMTs by Fluorine Plasma Treatment**, Ray-Hua Horng, Chih-Tung Yeh, Yi-Siang Shen, National Chung Hsing Univ. (Taiwan) . . . . . [9748-36]

9:45 am: **Investigation of the channel mobility in vertical and lateral normally-off GaN MOSFETs using Monte-Carlo methods**, Sara Shishehchi, Hanqing Wen, Enrico Bellotti, Boston Univ. (USA) . . . . . [9748-37]

10:00 am: **A study of GaN-based semiconductor devices using 3D self-consistent Monte-Carlo approach incorporating quantization effects**, Hanqing Wen, Sara Shishehchi, Enrico Bellotti, Boston Univ. (USA) . . . [9748-38]

Coffee Break . . . . . Wed 10:15 am to 10:45 am

### SESSION 9

LOCATION: ROOM 252 (SOUTH MEZZANINE) WED 10:45 TO 11:45 AM

### Lasers I

Session Chair: **Ulrich T. Schwarz**, Univ. of Freiburg (Germany)

10:45 am: **Progress of GaN/AlGaIn THz-quantum cascade lasers** (*Invited Paper*), Hideki Hirayama, Wataru Terashima, RIKEN (Japan) . . [9748-39]

11:15 am: **Development for ultraviolet vertical-cavity surface-emitting lasers**, Yuh-Shiuan Liu, Tsung-Ting Kao, Karan Mehta, Georgia Institute of Technology (USA); Hongen Xie, Arizona State Univ. (USA); Shyh-Chiang Shen, Theeradetch Detchprohm, Paul Douglas Yoder, Georgia Institute of Technology (USA); Fernando A. Ponce, Arizona State Univ. (USA); Russell D. Dupuis, Georgia Institute of Technology (USA) . . . . . [9748-40]

11:30 am: **MOVPE growth of p-AlGaIn super-lattices for UV-C lasers**, Christian Kuhn, Martin Martens, Frank Mehnke, Tino Simoneit, Felix Krueger, Technische Univ. Berlin (Germany); Arne Knauer, Viola Kueller, Mickael Lapeyrade, Sven Einfeldt, Ferdinand-Braun-Institut (Germany); Tim Wernicke, Technische Univ. Berlin (Germany); Markus Weyers, Ferdinand-Braun-Institut (Germany); Michael Kneissl, Technische Univ. Berlin (Germany) and Ferdinand-Braun-Institut (Germany) . . . . . [9748-41]

Lunch/Exhibition Break . . . . . Wed 11:45 am to 1:15 pm

### SESSION 10

LOCATION: RM 252 (SOUTH MEZZANINE) . . . . WED 1:15 TO 3:00 PM

### Lasers II

Session Chair: **Hideki Hirayama**, RIKEN (Japan)

1:15 pm: **Continuous wave operation of high-power GaN-based blue vertical-cavity surface-emitting lasers using epitaxial lateral overgrowth** (*Invited Paper*), Tatsushi Hamaguchi, Noriyuki Fuutagawa, Shouchiro Izumi, Masahiro Murayama, Hironobu Narui, Sony Corp. (Japan) . . . . . [9748-42]

1:45 pm: **Optical loss suppressed InGaIn laser diodes using undoped thick waveguide structure** (*Invited Paper*), Masao Kawaguchi, Osamu Imafuji, Shinichiro Nozaki, Hiroyuki Hagino, Shinichi Takigawa, Takuma Katayama, Tsuyoshi Tanaka, Panasonic Corp. (Japan) . . . . . [9748-43]

2:15 pm: **AlGaIn laser diode technology for systems applications**, Stephen P. Najda, Piotr Perlin, Tadek Suski, Lucja Marona, Michal Bockowski, Przemek Wisniewski, TopGaN Ltd. (Poland); Robert Czernecki, Ammono S.A. (Poland); Grzegorz Targowski, TopGaN Ltd. (Poland); Scott Watson, Anthony E. Kelly, Univ. of Glasgow (United Kingdom) . . . . . [9748-44]

2:30 pm: **InGaIn/GaN DFB laser diodes at 434 nm with deeply etched sidewall gratings**, Thomas J. Slight, Compound Semiconductor Technologies Global Ltd. (United Kingdom); Opeoluwa Odedina, Univ. of Glasgow (United Kingdom); Wyn Meredith, Compound Semiconductor Technologies Global Ltd. (United Kingdom); Kevin E. Docherty, Kelvin Nanotechnology Ltd. (United Kingdom); Anthony E. Kelly, Univ. of Glasgow (United Kingdom) . . . . . [9748-45]

2:45 pm: **Comparison of nonpolar III-nitride vertical-cavity surface-emitting lasers with tunnel junction and ITO intracavity contacts**, John T. Leonard, Erin C. Young, Ben P. Yonkee, Daniel A. Cohen, Univ. of California, Santa Barbara (USA); Chao Shen, King Abdullah Univ. of Science and Technology (Saudi Arabia); Tal Margalith, Univ. of California, Santa Barbara (USA); Tien K Ng, King Abdullah Univ. of Science and Technology (Saudi Arabia); Steven P. DenBaars, Univ. of California, Santa Barbara (USA); Boon S Ooi, King Abdullah Univ. of Science and Technology (Saudi Arabia); James S. Speck, Shuji Nakamura, Univ. of California, Santa Barbara (USA) . . . . . [9748-46]

Coffee Break . . . . . Wed 3:00 pm to 3:30 pm

### SESSION 11

LOCATION: RM 252 (SOUTH MEZZANINE) . . . . WED 3:30 TO 5:45 PM

### Nanostructures

Session Chair: **Elison Matioli**,

Ecole Polytechnique Fédérale de Lausanne (Switzerland)

3:30 pm: **III-nitride nanowires for optochemical sensing** (*Invited Paper*), Martin Eickhoff, Justus-Liebig-Univ. Giessen (Germany) . . . . . [9748-47]

4:00 pm: **Dislocation-free c-oriented platelets based on GaN nanowire seeds** (*Invited Paper*), Lars Samuelson, Lund Univ. (Sweden) and Glo AB (Sweden); Jonas B. Ohlsson, Lund Univ. (Sweden) and QuNano AB (Sweden); Zhaoxia Bi, Lund Univ. (Sweden) . . . . . [9748-48]

4:30 pm: **Linearly polarized single-photons from small site-controlled GaN nanowire quantum dots**, Mark Holmes, Satoshi Kako, Kihyun Choi, Munetaka Arita, Yasuhiko Arakawa, The Univ. of Tokyo (Japan) . . . . . [9748-49]

4:45 pm: **Bandgap emission modulation of gallium nitride nanomembranes due to external stretching**, Rami T. ElAfandy, Pawan Mishra, Mohammed A. Majid, Tien Khee Ng, Boon S. Ooi, King Abdullah Univ. of Science and Technology (Saudi Arabia) . . . . . [9748-50]

5:00 pm: **Strain engineered high-reflectivity DBRs and microcavities in the deep UV**, Alexander Franke, Luis Hernandez-Balderrama, Felix Kaess, Marc P. Hoffmann, Isaac S. Bryan, Zachary Bryan, Milena Bobea, North Carolina State Univ. (USA); James Tweedie, Ronny Kirste, North Carolina State Univ. (USA) and Adroit Materials (USA); Edward Sachet, Jon-Paul Maria, North Carolina State Univ. (USA); Michael D. Gerhold, U.S. Army Research Office (USA); Ramon Collazo, Zlatko Sitar, North Carolina State Univ. (USA) . . . . . [9748-51]

5:15 pm: **Harmonic generation in GaN photonic crystal circuits on silicon**, Philippe Boucaud, Yijia Zeng, Iannis Roland, Xavier Chécoury, Zheng Han, Moustafa El Kurdi, Sébastien Sauvage, Institut d'Électronique Fondamentale (France); Bruno Gayral, Commissariat à l'Énergie Atomique (France); Christelle Brimont, Thierry Guillet, Lab. Charles Coulomb (France); Meletios Mexis, Fabrice Semond, Ctr. de Recherche sur l'Hétéro-Epitaxie et ses Applications (France) . . . . . [9748-52]

5:30 pm: **Next generation of III-nitride materials and devices**, Nelson Tansu, Jonathan J. Wierer Jr., Lehigh Univ. (USA) . . . . . [9748-53]

### POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/IPWPosterGuidelines>.

**Investigation of active region degradation in InGaIn laser diodes**, Pengyan Wen, Shuming Zhang, Deyao Li, Jianping Liu, Linqun Zhang, Aiqin Tian, Hui Yang, Suzhou Institute of Nano-Tech and Nano-Bionics (China) . . [9748-73]

**Numerical analysis on the carrier characteristics of active region in deep-ultraviolet AlGaIn-based light-emitting diodes**, Fang-Ming Chen, Jih-Yuan Chang, National Changhua Univ. of Education (Taiwan); Ya-Hsuan Shih, National Cheng Kung Univ. (Taiwan); Hui-Tzu Chang, Yen-Kuang Kuo, National Changhua Univ. of Education (Taiwan) . . . . . [9748-74]

**Fabrication of AlN-based transparent electrodes with conducting filament: its application to lateral-type GaN light-emitting diodes**, Tae Ho Lee, Dae Yun Kang, Ju Hyun Park, Kyoung Heon Kim, Byoung Ryoung Lee, Tae Geun Kim, Korea Univ. (Korea, Republic of) . . . . . [9748-76]

**Determination of the ideality factor of GaN-based light-emitting diodes by the measurement of photovoltaic characteristics**, Han-Youl Ryu, Guen-Hwan Ryu, Young-Hwan Choi, Inha Univ. (Korea, Republic of) . . . . . [9748-77]

# CONFERENCE 9748

LOCATION: ROOM 252 (SOUTH MEZZANINE)

**Compressive strain induced enhancement of indium incorporation into InGaN MQWs on strained AlN/GaN multilayers**, Morteza Monavarian, Shopan D. Hafiz, Ümit Özgür, Hadis Morkoç, Vitaliy Avrutin, Virginia Commonwealth Univ. (USA) . . . . . [9748-78]

**Exciton localization in (11-22)-oriented semi-polar InGaN multiple quantum wells**, Morteza Monavarian, Virginia Commonwealth Univ. (USA); Daniel Rosales, Bernard Gil, Univ. Montpellier 2 (France); Natalia Izyumskaya, Saikat Das, Ümit Özgür, Hadis Morkoç, Vitaliy Avrutin, Virginia Commonwealth Univ. (USA) . . . . . [9748-79]

**Wurtzite/zinc-blende electronic-band alignment in basal-plane stacking faults in semipolar GaN**, Morteza Monavarian, Shopan D. Hafiz, Natalia Izyumskaya, Ümit Özgür, Hadis Morkoç, Vitaliy Avrutin, Virginia Commonwealth Univ. (USA) . . . . . [9748-80]

**Optical investigation of microscopic defect distribution in semi-polar (1-101 and 11-22) light-emitting diodes**, Shopan D. Hafiz, Morteza Monavarian, Nicolas Andrade, Fan Zhang, Vitaliy Avrutin, Hadis Morkoç, Ümit Özgür, Virginia Commonwealth Univ. (USA) . . . . . [9748-81]

**Characterization of dynamic channel resistance of GaN-based HEMTs**, Jen-Inn Chyi, Yue-Ming Hsin, Wen-Chia Liao, Wei-Hsin Kao, Hsing-Ching Pan, Geng-Yen Lee, National Central Univ. (Taiwan) . . . . . [9748-82]

## THURSDAY 18 FEBRUARY

### SESSION 12

LOCATION: RM 252 (SOUTH MEZZANINE) . . . . THU 8:00 TO 10:30 AM

#### LEDs I

Session Chair: **Jong-In Shim**, Hanyang Univ. (Korea, Republic of)

8:00 am: **Deep ultraviolet light-emitting and laser diodes** (*Invited Paper*), Asif Khan, Univ. of South Carolina (USA) . . . . . [9748-54]

8:30 am: **(Al,Ga)N-based quantum-dot heterostructures grown by molecular beam epitaxy for the fabrication of UV LEDs** (*Invited Paper*), Julien Brault, Benjamin Damilano, Ctr. de Recherche sur l'Hétéro-Epitaxie et ses Applications (France) . . . . . [9748-55]

9:00 am: **Realization of high-performance AlGaIn-based UV emitters and photodetectors** (*Invited Paper*), Motoaki Iwaya, Tetsuya Takeuchi, Satoshi Kamiyama, Meijo Univ. (Japan); Isamu Akasaki, Meijo Univ. (Japan) and Nagoya Univ. (Japan) . . . . . [9748-56]

9:30 am: **Advances in AlGaIn-based deep UV LED technologies** (*Invited Paper*), Michael Kneissl, Frank Mehnke, Christian Kuhn, Christoph Reich, Martin Guttman, Johannes Enslin, Luca Sulmoni, Tim Wernicke, Technische Univ. Berlin (Germany); Viola Kueller, Arne Knauer, Ute Zeimer, Mickael Lapeyrade, Jens Rass, Neysha Lobo-Ploch, Tim Kolbe, Johannes Glaab, Sven Einfeldt, Markus Weyers, Ferdinand-Braun-Institut (Germany) . . . [9748-57]

10:00 am: **A surface-emitting electrically-injected near-vacuum ultraviolet light source with aluminum nitride nanowires**, Songrui Zhao, David Laleyan, Mehrdad Djavid, Binh H. Le, Xianhe Liu, Zetian Mi, McGill Univ. (Canada) . . . . . [9748-58]

10:15 am: **Influence of the LED heterostructure and chip package on the lifetime of high power UV-B and UV-C LEDs**, Neysha Lobo Ploch, Ferdinand-Braun-Institut (Germany) and Leibniz Institut für Höchstfrequenztechnik (Germany); Johannes Glaab, Christoph Stölmacker, Jens Rass, Tim Kolbe, Ferdinand-Braun-Institut (Germany) and Leibniz-Institut für Höchstfrequenztechnik (Germany); Tim Wernicke, Frank Mehnke, Christian Kuhn, Johannes Enslin, Technische Univ. Berlin (Germany); Sven Einfeldt, Markus Weyers, Ferdinand-Braun-Institut (Germany) and Leibniz-Institut für Höchstfrequenztechnik (Germany); Michael Kneissl, Ferdinand-Braun-Institut (Germany) and Leibniz-Institut für Höchstfrequenztechnik (Germany) and Technische Univ. Berlin (Germany) . . . . . [9748-59]

Coffee Break . . . . . Thu 10:30 am to 11:00 am

### SESSION 13

LOCATION: RM 252 (SOUTH MEZZANINE) . THU 11:00 AM TO 12:30 PM

#### LEDs II

Session Chair: **Asif M. Khan**, Univ. of South Carolina (USA)

11:00 am: **GaN IC applied in LED lighting driver** (*Invited Paper*), Chiacheng Liu, Schang-jing Hon, Epistar Corp. (Taiwan) . . . . . [9748-60]

11:30 am: **Interrelations between the forward voltage and the internal quantum efficiency of InGaIn-based light-emitting diodes**, Jong-In Shim, Dong-Pyo Han, Dong-Soo Shin, Won-Jin Choi, Hanyang Univ. (Korea, Republic of); Kyu-Sang Kim, Sangji Univ. (Korea, Republic of) . . . . . [9748-61]

11:45 am: **Bipolar non-quasiequilibrium carrier dynamics in III-N LEDs**, Pyy Kivisaari, Lund Univ. (Sweden); Toufik Sadi, Univ. of Glasgow (United Kingdom); Jani Oksanen, Jukka Tulkki, Aalto Univ. School of Science and Technology (Finland) . . . . . [9748-62]

12:00 pm: **Tunable full-color nanowire light-emitting diode arrays monolithically-integrated on Si and sapphire**, Renjie Wang, Yong-Ho Ra, Songrui Zhao, Hieu P. Nguyen, Ishiang Shih, Zetian Mi, McGill Univ. (Canada) . . . . . [9748-63]

12:15 pm: **Use of tin and indium interlayers for forming low resistance Ti/Al-based ohmic contacts to N-polar n-GaN for high-power GaN-based vertical light-emitting diodes**, Tae-Yeon Seong, Sung Ki Kim, Tae Wook Kang, Korea Univ. (Korea, Republic of) . . . . . [9748-64]

Lunch/Exhibition Break . . . . . Thu 12:30 pm to 1:30 pm

### SESSION 14

LOCATION: RM 252 (SOUTH MEZZANINE) . . . . . THU 1:30 TO 3:30 PM

#### LEDs III

Session Chair: **Hadis Morkoç**, Virginia Commonwealth Univ. (USA)

1:30 pm: **High-efficiency blue LEDs with thin AlGaIn interlayers in InGaIn/GaN MQWs grown on Si (111) substrates** (*Invited Paper*), Shigeya Kimura, Hisashi Yoshida, Toshihide Ito, Aoi Okada, Kenjiro Uesugi, Shinya Nunoue, Toshiba Corp. (Japan) . . . . . [9748-65]

2:00 pm: **GaN-based superluminescent diodes with long lifetime**, Antonino Castiglia, Marco Rossetti, Nicolai Matuschek, Raffaele Rezzonico, Marcus Duell, Christian Vélez, Exalos AG (Switzerland); Jean-François Carlin, Nicolas Grandjean, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9748-66]

2:15 pm: **Determination of internal quantum efficiency in GaIn by simultaneous measurements of photoluminescence and photo-acoustic signals**, Takashi Nakano, Kouhei Kawakami, Atsushi A. Yamaguchi, Kanazawa Institute of Technology (Japan) . . . . . [9748-67]

2:30 pm: **Demonstration of uniform and stable GaIn ultraviolet p-i-n avalanche photodiode array**, Mi-Hee Ji, Jeomoh Kim, Theeradetch Detchprohm, Russell D. Dupuis, Georgia Institute of Technology (USA); Ashok K. Sood, Magnolia Optical Technologies, Inc. (USA); Nibir K. Dhar, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Jay S. Lewis, Defense Advanced Research Projects Agency (USA) . . . . . [9748-68]

2:45 pm: **Optical, structural, and compositional nano-scale characterization of InGaIn/GaN core-shell microrod heterostructures**, Marcus Müller, Otto-von-Guericke Univ. Magdeburg (Germany); Sebastian Metzner, Peter Veit, Frank Bertram, Otto-von-Guericke-Univ. Magdeburg (Germany); Florian F. Krause, Thorsten Mehrrens, Knut Müller-Caspary, Andreas Rosenauer, Univ. Bremen (Germany); Tilman Schimpke, Adrian Avramescu, Martin Strassburg, OSRAM Opto Semiconductors GmbH (Germany); Jürgen H. Christen, Otto-von-Guericke-Univ. Magdeburg (Germany) . . . . . [9748-70]

3:00 pm: **Designing optically-pumped InGaIn quantum wells with long wavelength emission for a phosphor-free device with polarized white-light emission**, Stacy Kowsz, Christopher Pynn, Robert M. Farrell, James S. Speck, Steven P. DenBaars, Shuji Nakamura, Univ. of California, Santa Barbara (USA) . . . . . [9748-71]

3:15 pm: **Hierarchical growth of GaIn nanowires for light-emitting diode applications**, Rishabh Raj, Vellore Institute of Technology (India); Yong-Ho Ra, Cheul-Ro Lee, Chonbuk National Univ. (Korea, Democratic Peoples Republic of); Sonika Obheroi, R. Navamathavan, Vellore Institute of Technology (India) . . . . . [9748-72]

# CONFERENCE 9749

LOCATION: ROOM 2004 (WEST LEVEL 2)

Sunday–Wednesday 14–17 February 2016 • Proceedings of SPIE Vol. 9749

# Oxide-based Materials and Devices VII

Conference Chairs: **Ferechteh H. Teherani**, Nanovation (France); **David C. Look**, Wright State Univ. (USA); **David J. Rogers**, Nanovation (France)

Program Committee: **Ivan Bozovic**, Brookhaven National Lab. (USA); **Subhananda Chakrabarti**, Indian Institute of Technology Bombay (India); **Kwang-Leong Choy**, Univ. College London (United Kingdom); **Jean-Jacques Delaunay**, The Univ. of Tokyo (Japan); **Aleksandra B. Djuriši**, The Univ. of Hong Kong (Hong Kong, China); **Michael Gerhold**, U.S. Army Research Office (USA); **Silvia Gross**, Univ. degli Studi di Padova (Italy); **Hanns-Ulrich Habermeier**, Max-Planck-Institut für Festkörperforschung (Germany); **Michael A. Harper**, CIV USN ONR GLOBAL (USA); **Adrián Hierro**, Univ. Politécnica de Madrid (Spain); **Axel Hoffmann**, Technische Univ. Berlin (Germany); **Seref Kalem**, TÜBITAK BILGEM (Turkey); **Ching-Ting Lee**, National Cheng Kung Univ. (Taiwan); **Tariq Manzur**, Naval Undersea Warfare Ctr. (USA); **Fabrice Odobel**, Univ. de Nantes (France); **Tatsuo Okada**, Kyushu Univ. (Japan); **Seong-Ju Park**, Gwangju Institute of Science and Technology (Korea, Republic of); **Thierry Pauporté**, Ecole Nationale Supérieure de Chimie de Paris (France); **Matthew R. Phillips**, Univ. of Technology, Sydney (Australia); **Manijeh Razeghi**, Northwestern Univ. (USA); **Vinod Eric Sandana**, Graphos (France); **Chong-Xin Shan**, Changchun Institute of Optics, Fine Mechanics and Physics (China); **Maria Vamvakaki**, Foundation for Research and Technology-Hellas (Greece); **Bruno Viana**, Ecole Nationale Supérieure de Chimie de Paris (France); **Magnus Willander**, Linköping Univ. (Sweden); **Hideki Yamamoto**, NTT Basic Research Labs. (Japan)

## SUNDAY 14 FEBRUARY

### WELCOME AND OPENING REMARKS

LOCATION: ROOM 2004 (WEST LEVEL 2) ..... 2:00 PM TO 2:10 PM

David J. Rogers, Nanovation (France)

### SESSION 1

LOCATION: ROOM 2004 (WEST LEVEL 2) ... SUN 2:10 PM TO 5:25 PM

## Transparent Conducting Oxides

Session Chair: **David Look**, Wright State Univ. (USA)

2:10 pm: **Debye-tail mobility enhancement (DTME) in semiconductors: application to Ga-doped ZnO**, David Look, Wright State Univ. (USA); Eric R. Heller, Air Force Research Lab. (USA); Yu-Feng Yao, Chih-Chung Yang, National Taiwan Univ. (Taiwan) ..... [9749-1]

2:35 pm: **The role of yttrium in zinc-oxide and zinc-tin-oxide (Invited Paper)**, Rebecca L. Peterson, Wenbing Hu, Univ. of Michigan (USA) ..... [9749-2]

3:00 pm: **Doping and transport of ZnO: an overview and implications for other oxide semiconductors (Invited Paper)**, Klaus Ellmer, Andre Bikowski, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (Germany) [9749-3]

Coffee Break ..... Sun 3:25 pm to 3:55 pm

3:55 pm: **Growth of highly conductive Ga-doped ZnO and its applications (Invited Paper)**, Yu-Feng Yao, Chang-Gan Tu, Chun-Han Lin, Chieh Hsieh, Chia-Ying Su, Erwin Zhu, Shaobo Yang, Chi-Ming Weng, Ming-Yen Su, Meng-Che Tsai, Shang-Syuan Wu, Sheng-Hung Chen, Hao-Tsung Chen, Yean-Woei Kiang, Chih-Chung Yang, National Taiwan Univ. (Taiwan) ..... [9749-4]

4:20 pm: **The dynamic interplay between intrinsic defects and shallow donor dopants (Al and Ga) in ZnO (Invited Paper)**, Klaus Magnus Johansen, Thomas Neset Sky, Lasse Vines, Ymir Kalmann Frodason, Heine Nygaard Riise, Tor Svendsen Bjørheim, Bengt G. Svensson, Univ. I Oslo (Norway) ..... [9749-5]

4:45 pm: **High-performance nano-thin films of transparent conducting oxides by ESAVD (Invited Paper)**, Kwang-Leong Choy, Univ. College London (United Kingdom) ..... [9749-72]

5:10 pm: **Electrical and optical properties of ZnO:Ga bulk crystals with high gallium ions doping amount**, Yunfeng Ma, Beijing Univ. of Technology (China) and Lawrence Berkeley National Lab. (USA); Yijian Jiang, Beijing Univ. of Technology (China) ..... [9749-6]

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative, Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break ..... Mon 10:10 am to 10:30 am

### SESSION 2

LOCATION: ROOM 2004 (WEST LEVEL 2) . MON 10:30 AM TO 2:15 PM

## Light Emission and Management

Session Chair: **David J. Rogers**, Nanovation (France)

10:30 am: **Efficient light emission from inorganic/organic semiconductor hybrid structures by energy-level tuning (Invited Paper)**, Norbert Koch, Humboldt-Univ. zu Berlin (Germany) and Helmholtz-Zentrum Berlin (Germany) ..... [9749-7]

10:55 am: **Optical properties of GaN fabricated by chemical lift-off using sacrificial ZnO layers (Invited Paper)**, Cuong Ton-That, Liangchen Zhu, Matthew R. Phillips, Univ. of Technology, Sydney (Australia); A. Rajan, Heriot-Watt Univ. (United Kingdom); David J. Rogers, Nanovation (France); Simon Gautier, Tarik Moudakir, Youssef El Gmili, Abdallah Ougazzaden, Georgia Tech-Lorraine (France); Vinod Eric Sandana, Ferechteh H. Teherani, Philippe Bove, Nanovation (France); K. A. Prior, Heriot-Watt Univ. (United Kingdom); Ryan McClintock, Manijeh Razeghi, Northwestern Univ. (USA) ..... [9749-8]

OPTO



# CONFERENCE 9749

LOCATION: ROOM 2004 (WEST LEVEL 2)

11:20 am: **Toward a new generation of white phosphors for solid-state lighting using glassy yttrium aluminoborates powders** (*Invited Paper*), Alain Ibanez, Pauline Burner, Vinicius Guimaraes, CNRS (France); Lauro J.Q. MAIA, University Federal de Goais (Brazil); Alban Ferrier, Chimie ParisTech, CNRS, UPMC (France); Bruno Viana, Ecole Nationale Supérieure de Chimie de Paris (France); Isabelle Gautier-Luneau, CNRS (France) and University J. Fourier (France) . . . . . [9749-9]

11:45 am: **Efficiency enhancement by growing highly-conductive Ga-doped ZnO nanoneedles on a light-emitting diode**, Yu-Feng Yao, Chun-Han Lin, Chieh Hsieh, Chia-Ying Su, Erwin Zhu, Shaobo Yang, Chi-Ming Weng, Ming-Yen Su, Meng-Che Tsai, Shang-Syuan Wu, Sheng-Hung Chen, Charn-Gan Tu, Hao-Tsung Chen, Yean-Woei Kiang, Chih-Chung Yang, National Taiwan Univ. (Taiwan) . . . . . [9749-10]

Lunch Break . . . . . Mon 12:00 pm to 1:10 pm

1:10 pm: **Enhanced photoluminescence and Raman scattering by self-assembled SiO<sub>2</sub> dielectric microsphere monolayer arrays**, Yinzhou Yan, Yijian Jiang, Yan Zhao, Beijing Univ. of Technology (China) . . . . . [9749-11]

1:25 pm: **Charging/relaxation features and multimodal uses of persistent luminescent materials** (*Invited Paper*), Cyrille Richard, Elliot Teston, Thomas Maldiney, Bich-Thuy Doan, Daniel Scherman, Suchinder Sharma, Didier Gourier, Bruno Viana, Ecole Nationale Supérieure de Chimie de Paris (France) . . . . . [9749-12]

1:50 pm: **Oxide sacrificial layers for MOCVD GaN LED applications** (*Invited Paper*), Sin-Liang Ou, Chi-Tsung Tsai, Tsung-Yen Tsai, Dong-Sing Wu, National Chung Hsing Univ. (Taiwan) . . . . . [9749-69]

## SESSION 3

LOCATION: ROOM 2004 (WEST LEVEL 2) . . . MON 2:15 PM TO 3:15 PM

### Nanomaterials and Related Devices

Session Chair: **Tatsuo Okada**, Kyushu Univ. (Japan)

2:15 pm: **Surface oxygen vacancies in ZnO nanorods.**, Matthew R. Phillips, Univ. of Technology, Sydney (Australia); Suranan Anantachaisilp, Mahidol Univ. (Thailand) and Univ. of Technology, Sydney (Australia); Siwaporn Meejoo Smith, Mahidol Univ. (Thailand); Anthony Moon, Cuong Ton-That, Univ. of Technology, Sydney (Australia) . . . . . [9749-14]

2:30 pm: **Optical and electrical properties of nanostructured indium tin oxide fabricated by oblique-angle deposition**, Kyurin Kim, Chonbuk National Univ. (Korea, Republic of); Jun Hyuk Park, Pohang Univ. of Science and Technology (Korea, Republic of); Hyunsoo Kim, Chonbuk National Univ. (Korea, Republic of); Jong Kyu Kim, Pohang Univ. of Science and Technology (Korea, Republic of); E. Fred Schubert, Rensselaer Polytechnic Institute (USA); Jaehee Cho, Chonbuk National Univ. (Korea, Republic of) . . . . . [9749-15]

2:45 pm: **Research of controlling ZnO nanowire growth using several steps of UV-laser processing**, Tetsuya Shimogaki, Masahiro Takahashi, Taichi Fukuda, Masaaki Yamasaki, Hiroshi Ikenoue, Daisuke Nakamura, Kyushu Univ. (Japan); Yoshiki Nakata, Osaka Univ. (Japan); Tatsuo Okada, Kyushu Univ. (Japan) . . . . . [9749-16]

3:00 pm: **Photoabsorption cross-section in the frame of local plasma frequency model for semiconductor nanoparticles on example of In<sub>2</sub>O<sub>3</sub>**, Valerie A. Astapenko, Sergey V. Sakhno, Moscow Institute of Physics and Technology (Russian Federation); Mark Kozhusner, Leonid I. Trakhtenberg, N.N. Semenov Institute of Chemical Physics (Russian Federation) . . . . . [9749-17]

Coffee Break . . . . . Mon 3:15 pm to 3:45 pm

## SESSION 4

LOCATION: ROOM 2004 (WEST LEVEL 2) . . . MON 3:45 PM TO 6:20 PM

### Optical/Photonic Materials, Properties, and Devices

Session Chair: **Ching-Ting Lee**, National Cheng Kung Univ. (Taiwan)

3:45 pm: **Rydberg excitons in Cu<sub>2</sub>O** (*Invited Paper*), Marc Assmann, Johannes Thewes, Julian Heckötter, Technische Univ. Dortmund (Germany); Tomasz Kazmierczuk, Univ. of Warsaw (Poland); Dietmar Fröhlich, Technische Univ. Dortmund (Germany); Stefan Scheel, Heinrich Stolz, Univ. Rostock (Germany); Marina A. Semina, Mikhail M. Glazov, Ioffe Physical-Technical Institute (Russian Federation); Manfred Bayer, Technische Univ. Dortmund (Germany) . . . [9749-18]

4:10 pm: **Development of low loss tellurite glass fibers for optical applications in the mid-IR** (*Invited Paper*), Arturo Chavez-Pirson, NP Photonics, Inc. (USA) . . . . . [9749-19]

4:35 pm: **Optical and vibrational spectroscopy of (ZnO)kIn<sub>2</sub>O<sub>3</sub> superlattice** (*Invited Paper*), Samuel Margueron, Univ. de Lorraine (France) and Harvard Univ. (USA) and Univ. de Franche-Comté (France); Stella Skiadopoulou, Jan Pokorný, Stanislav Kamba, Institute of Physics of the ASCR, v.v.i. (Czech Republic); David R. Clarke, Harvard Univ. (USA) . . . . . [9749-20]

5:00 pm: **Large persistent photoconductivity in strontium titanate single crystals**, Violet M. Poole, Matthew D. McCluskey, Washington State Univ. (USA) . . . . . [9749-21]

5:15 pm: **Temperature-induced changes in optical properties of thin film TiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub> bi-layer structures grown by atomic layer deposition**, Rizwan Ali, Univ. of Eastern Finland (Finland); Muhammad R. Saleem, Univ. of Eastern Finland (Finland) and National Univ. of Sciences and Technology (Pakistan); Seppo Honkanen, Univ. of Eastern Finland (Finland) . . . . . [9749-22]

5:30 pm: **The development of thin film metrology by coherence scanning interferometry** (*Invited Paper*), Hirokazu Yoshino, Loughborough Univ. (United Kingdom); Daniel Mansfield, AMETEK Taylor Hobson Ltd. (United Kingdom); Roger M. Smith, J. M. Walls, Loughborough Univ. (United Kingdom) . . [9749-23]

5:55 pm: **ZnO-based multiple channel and multiple gate FinMOSFETs** (*Invited Paper*), Ching-Ting Lee, Hung-Lin Huang, Chun-Yen Tseng, Hsin-Ying Lee, National Cheng Kung Univ. (Taiwan) . . . . . [9749-24]

## TUESDAY 16 FEBRUARY

### SESSION 5

LOCATION: ROOM 2004 (WEST LEVEL 2) . . TUE 8:10 AM TO 9:55 AM

### P-type ZnO

Session Chair: **Bruno Viana**, Ecole Nationale Supérieure de Chimie de Paris (France)

8:10 am: **Nitrogen diffusion in ZnO** (*Invited Paper*), Norbert H. Nickel, Nicole Karpensky, Marc A. Gluba, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (Germany) . . . . . [9749-25]

8:35 am: **Electrical properties of columnar-structured p-type MgZnO:Sb film grown by metalorganic chemical vapor deposition** (*Invited Paper*), ByeongHyeok Kim, Yong-Seok Choi, Jang-Won Kang, Seong-Ju Park, Gwangju Institute of Science and Technology (Korea, Republic of) . . . . . [9749-26]

9:00 am: **Optical and structural properties of P-doped ZnO microsphere synthesized by pulsed laser ablation**, Yuki Fujiwara, Tatsuya Ikebuchi, Takeshi Ueyama, Toshihito Tanaka, Fumiaki Nagasaki, Mitsuhiro Higashihata, Daisuke Nakamura, Tatsuo Okada, Kyushu Univ. (Japan) . . . . . [9749-27]

9:15 am: **Low temperature preparation of Ag-doped ZnO nanowire arrays for sensor and light-emitting diode application**, Bruno Viana, Ecole Nationale Supérieure de Chimie de Paris (France); Oleg Lupan, Technical Univ. of Moldova (Moldova); Thierry Pauporté, Ecole Nationale Supérieure de Chimie de Paris (France) . . . . . [9749-28]

9:30 am: **P-type ZnO based films and their optoelectronic applications** (*Invited Paper*), Chong-Xin Shan, CIOMP, Chinese Academy of Sciences (China) . . . . . [9749-29]

Coffee Break . . . . . Tue 9:55 am to 10:20 am

### SESSION 6

LOCATION: ROOM 2004 (WEST LEVEL 2) . TUE 10:20 AM TO 12:15 PM

### Band Gap Engineering and Photodetectors

Session Chairs: **Adrián Hierro**, Univ. Politécnica de Madrid (Spain); **Michael D. Gerhold**, U.S. Army Research Office (USA)

10:20 am: **ZnMgO-based UV photodiodes: a comparison of films grown by spray pyrolysis and MBE** (*Invited Paper*), Adrián Hierro, Gema Tabares, Manuel Lopez-Ponce, Jose María M. Ulloa, Alejandro Kurtz, Elias Muñoz, Univ. Politécnica de Madrid (Spain); Vicente Marin-Borras, Vicente Muñoz-Sanjose, Univ. de València (Spain); Jean-Michel Chauveau, Ctr. de Recherche sur l'Hétéro-Epitaxie et ses Applications (France) and Univ. de Nice Sophia Antipolis (France) . . . . . [9749-31]

10:45 am: **Controlled tailoring of thermal conductivity and optical properties of nonpolar ZnMgO/ZnO multi quantum well heterostructures** (*Invited Paper*), Markus R. Wagner, Juan S. Reparaz, Bartłomiej Graczykowski, Francesc Alzina, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain); Clivia M. Sotomayor Torres, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain) and Institució Catalana de Recerca i Estudis Avançats (Spain); Maxime Hugues, Monique Teyssie, Ctr. de Recherche sur l'Hétéro-Epitaxie et ses Applications (France); Jean-Michel Chauveau, Ctr. de Recherche sur l'Hétéro-Epitaxie et ses Applications (France) and Univ. de Nice Sophia Antipolis (France); Alexander Franke, Technische Univ. Berlin (Germany); Gordon Callsen, Christian Nenstiel, Felix Nippert, Axel Hoffmann, Technische Univ. Berlin (Germany) . . . . . [9749-32]



# CONFERENCE 9749

LOCATION: ROOM 2004 (WEST LEVEL 2)

WEDNESDAY 17 FEBRUARY

## SESSION 8

LOCATION: ROOM 2004 (WEST LEVEL 2) WED 8:05 AM TO 10:35 AM

### Photovoltaics I:

#### P-Type Dye-Sensitized Solar Cells

Session Chair: **Fabrice Odobel**, Univ. de Nantes (France)

8:05 am: **New electrolytes and semiconductors for dye-sensitized photocathodes** (*Invited Paper*), Udo Bach, Monash Univ. (Australia) and Commonwealth Scientific and Industrial Research Organization (Australia) . . . . . [9749-76]

8:30 am: **Development of new nanocrystalline semiconductors for p-type dye-sensitized solar cells** (*Invited Paper*), Fabrice Odobel, Yoann Farré, Tengfei Jiang, Univ. de Nantes (France); Vinod Eric Sandana, Nanovation (France); Yann Pellegrin, Laurent Cario, Stéphane Jobic, Univ. de Nantes (France); David J. Rogers, Nanovation (France) . . . . . [9749-41]

8:55 am: **Delafossites for p-type dye-sensitized solar cells** (*Invited Paper*), Yiyang Wu, The Ohio State Univ. (USA) . . . . . [9749-68]

9:20 am: **Emerging oxide materials for solar energy conversion applications** (*Invited Paper*), Andriy Zakutayev, National Renewable Energy Lab. (USA) . . . . . [9749-70]

9:45 am: **Recent progress in p-DSSCs** (*Invited Paper*), Dirk M. Guldi, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany) . . . . . [9749-73]

10:10 am: **Fabrication of nanoporous p-NiO by chemical lift-off from sacrificial ZnO nanoarray templates**, David J. Rogers, Vinod Eric Sandana, Ferechteh H. Teherani, Philippe Bove, Nanovation (France); Ryan McClintock, Manijeh Razeghi, Northwestern Univ. (USA) . . . . . [9749-30]

Coffee Break . . . . . Wed 10:35 am to 11:00 am

## SESSION 9

LOCATION: ROOM 2004 (WEST LEVEL 2) . WED 11:00 AM TO 2:55 PM

### Photovoltaics II

Session Chairs: **Fabrice Odobel**, Univ. de Nantes (France); **Philippe Bove**, Nanovation (France)

11:00 am: **Solution synthesis of metal oxide nanoparticles for interfacial contact layers in organic photovoltaics** (*Invited Paper*), Jian Wang, Yun-Ju Lee, Diego Barrera, Julia W. P. Hsu, The Univ. of Texas at Dallas (USA) . . . . . [9749-42]

11:25 am: **Planer heterojunction type perovskite solar cells based on TiO<sub>x</sub> compact layer fabricated by chemical bath deposition** (*Invited Paper*), Tetsuya Taima, Md Shahiduzzaman, Kouhei Yamamoto, Yoshikazu Furumoto, Takayuki Kuwabara, Kohshin Takahashi, Kanazawa Univ. (Japan) . . . . . [9749-44]

11:50 am: **Electrodeposition of ZnO-doped films as window layer for Cd-free CIGS-based solar cells**, Fabien Tsin, EDF R&D (France); Amélie Vénérosy, Ctr. National de la Recherche Scientifique (France); Thibaud Hildebrandt, EDF R&D (France); Laurent Lombez, Ctr. National de la Recherche Scientifique (France); Cédric Broussillou, NEXCIS (France); Salvador Jaime, EDF R&D (France) and NEXCIS (France); Pierre-Philippe Grand, EDF R&D (France); Dimitrios Hariskos, Zentrum für Sonnenenergie- und Wasserstoff-Forschung (Germany); Negar Naghavi, Institut de Recherche et Développement sur l'Energie Photovoltaïque (France); Daniel Lincot, Ctr. National de la Recherche Scientifique (France); Jean Rousset, EDF R&D (France) . . . . . [9749-45]

Lunch/Exhibition Break . . . . . Wed 12:05 pm to 2:00 pm

2:00 pm: **Impact of the deposition conditions of buffer and windows layers on lowering the metastability effects in Cu(In,Ga)Se<sub>2</sub>/Zn(S,O)-based solar cell** (*Invited Paper*), Negar Naghavi, Thibaud Hildebrandt, Daniel Lincot, Institut de Recherche et Développement sur l'Energie Photovoltaïque (France) [9749-49]

2:25 pm: **Titanium oxide: electron-selective layers for contact passivation of thin-film crystalline silicon solar cells**, Yi Liu, Peking Univ. (China); Yusi Chen, Yangsen Kang, Huiyang Deng, Jieyang Jia, Li Zhao, David T. LaFehr, Stanford Univ. (USA); Mengyang Yuan, Zheng Lyu, Tsinghua Univ. (China); Daniel DeWitt, Max A. Vilgalys, Kai Zang, Xiaochi Chen, Ching-Ying Lu, Yijie Huo, Stanford Univ. (USA); James S. Harris, Stanford Univ. (USA) and Stanford Univ. (USA) . . . . . [9749-46]

2:40 pm: **High-efficiency PTB7-based inverted organic photovoltaics on nano-ridged and planar zinc-oxide electron transport layers**, Beau J. Richardson, Xuezheng Wang, Abdulrahman Almutairi, Qiuming Yu, Univ. of Washington (USA) . . . . . [9749-48]

Coffee Break . . . . . Wed 2:55 pm to 3:30 pm

11:10 am: **High Mg content wurtzite phase Mg<sub>x</sub>Zn<sub>1-x</sub>O epitaxial film grown via pulsed-metal organic chemical vapor deposition (PMOCVD)** (*Invited Paper*), Fikadu Alema, Oleg Ledyayev, Ross Miller, Valeria Beletsky, Brian Hertog, Andrei V. Osinsky, Agnitron Technology, Inc. (USA); Winston V. Schoenfeld, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9749-33]

11:35 am: **Quasi-white light emission from the m-plane n-ZnO/AIN/p-Si heterojunction** (*Invited Paper*), Chao Chen, Ti Wang, Ying Lin, Hao Wu, Chang Liu, Wuhan Univ. (China) . . . . . [9749-74]

12:00 pm: **Exciton localization and large Stokes shift in quaternary BeMgZnO grown by molecular beam epitaxy**, Mykyta Toporkov, MD Barkat Ullah, Shopan D. Hafiz, Vitaliy Avrutin, Hadis Morkoc, Umit Ozgur, Virginia Commonwealth Univ. (USA) . . . . . [9749-34]

Lunch/Exhibition Break . . . . . Tue 12:15 pm to 1:45 pm

## SESSION 7

LOCATION: ROOM 2004 (WEST LEVEL 2) . . . TUE 1:45 PM TO 5:30 PM

### Functional Oxides and Spintronics

Session Chair: **Jean Fompeyrine**, IBM Research - Zürich (Switzerland)

1:45 pm: **Functional oxides for integrated photonics** (*Invited Paper*), Stefan Abel, Thilo Stöferle, Chiara Marchiori, Daniele Caimi, Lukas Czornomaz, IBM Research - Zürich (Switzerland); Marta D. Rossell, EMPA (Switzerland); Rolf Erni, FEI Co. (Netherlands); Marilyne Sousa, Heinz Siegwart, Bert-Jan Offrein, Jean Fompeyrine, IBM Research - Zürich (Switzerland) . . . . . [9749-35]

2:10 pm: **Oxide-based flexible flash memories** (*Invited Paper*), Suting Han, Li Zhou, Ye Zhou, Jiaqing Zhuang, City Univ. of Hong Kong (Hong Kong, China); Zong-Xiang Xu, South Univ. of Science and Technology of China (China) and City Univ. of Hong Kong (China); Arul Lenus Roy Vellaisamy, City Univ. of Hong Kong (Hong Kong, China) . . . . . [9749-36]

2:35 pm: **Multifunctional materials for electronics and photonics** (*Invited Paper*), Federico Rosei, Univ. du Québec (Canada) . . . . . [9749-37]

3:00 pm: **Thermoelectric behavior of ZnO and GaN-based wide bandgap semiconductors** (*Invited Paper*), Bahadır Kucukgok, Purdue Univ. (USA); Ian T. Ferguson, Missouri Univ. of Science and Technology (USA); Na Lu, Purdue Univ. (USA) . . . . . [9749-71]

Coffee Break . . . . . Tue 3:25 pm to 4:00 pm

4:00 pm: **Pulsed laser deposited functional oxide thin films from the lab into the fab**, Matthijn Dekkers, SolMateS B.V. (Netherlands) . . . . . [9749-38]

4:15 pm: **Reversible switching of optoelectric and electromagnetic properties of functional oxides using water-infiltrated glass** (*Invited Paper*), Takayoshi Katase, Hiromichi Ohta, Hokkaido Univ. (Japan) . . . . . [9749-39]

4:40 pm: **Structural and magnetic properties of Fe<sub>3</sub>O<sub>4</sub>/NiO bilayers on MgO(001) and SrTiO<sub>3</sub>(001)** (*Invited Paper*), Joachim Wollschläger, Univ. Osnabrück (Germany) . . . . . [9749-40]

5:05 pm: **RRAM-based hardware implementations of artificial neural networks: progress update and challenges ahead** (*Invited Paper*), Mirko Prezioso, F. Merrikh-Bayat, B. Chakrabarti, D. Strukov, Univ. of California, Santa Barbara (USA) . . . . . [9749-75]



# CONFERENCE 9749

LOCATION: ROOM 2004 (WEST LEVEL 2)

## SESSION 10

LOCATION: ROOM 2004 (WEST LEVEL 2) . . WED 3:30 PM TO 5:20 PM

### Oxides as Environmental Catalysts and Sensors

Session Chair: **Magnus Willander**, Linköping Univ. (Sweden)

3:30 pm: **Comparison between different metal oxide nanostructures and nanocomposites for sensing, energy generation, and energy harvesting** (*Invited Paper*), Magnus Willander, Linköping Univ. (Sweden) . . . . . [9749-51]

3:55 pm: **Luminescence thermometry and nanothermometry** (*Invited Paper*), Miroslav D Dramicanin, University of Belgrade (Serbia) . . . . . [9749-53]

4:20 pm: **Climate engineering with oxide photocatalysts**, Hal Gokturk, Ecoken (USA) . . . . . [9749-54]

4:35 pm: **Zinc-oxide optical sensor for highly sensitive refractive index sensing**, Jing Liu, Qiankun Zhang, Tianjin Univ. (China) . . . . . [9749-55]

4:50 pm: **Impact of glycerol on zinc-oxide-based thin film transistors with indium molybdenum oxide transparent electrodes**, Mateusz T. Madzik, Elangovan Elamurugu, Raquel Flores, Jaime Viegas, Masdar Institute of Science & Technology (United Arab Emirates) . . . . . [9749-56]

5:05 pm: **Low-cost flexible thin-film sensor devices from bacteria-synthesized nanoparticles**, Christopher Jacobs, Eric S. Muckley, Christopher M. Rouleau, Pooran C. Joshi, Beth L. Armstrong, David E. Graham, Ji Won Moon, Iliia N. Ivanov, Oak Ridge National Lab. (USA) . . . . . [9749-57]

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.*

**Low-temperature and UV-irradiation treatments of porous titania-capped silica GNRs for dye solar cells (DSCs)**, Sarah Lai, Sonia Centi, Marina Mazzoni, Fulvio Ratto, Consiglio Nazionale delle Ricerche (Italy) and Istituto di Fisica Applicata "Nello Carrara" (Italy); Roberto Pini, Istituto di Fisica Applicata "Nello Carrara" (Italy); Andrea Ienco, Lorenzo Zani, Gianna Reginato, Consiglio Nazionale delle Ricerche (Italy) and Istituto di Chimica dei Composti Organometallici (Italy) . . . . . [9749-43]

**Indium oxide-based perovskite solar cells**, Qi Dong, Fangzhou Liu, Man Kwong Wong, Aleksandra B. Djurišić, The Univ. of Hong Kong (Hong Kong, China); Zhiwei Ren, Annie Ng, Qian Shen, Charles Surya, The Hong Kong Polytechnic Univ. (Hong Kong, China); Wai Kin Chan, The Univ. of Hong Kong (Hong Kong, China) . . . . . [9749-47]

**A novel flexible C<sub>2</sub>H<sub>2</sub> gas sensor based on Ag-ZnO nanorods on PI/PTFE substrate**, A. S. M. Iftekhar Uddin, Gwiye-Sang Chung, Univ. of Ulsan (Korea, Republic of) . . . . . [9749-58]

**Highly flexible room temperature NO<sub>2</sub> sensor based on WO<sub>3</sub> nanoparticles loaded MWCNTs-RGO hybrid**, Usman Yaqoob, Gwiye-Sang Chung, Univ. of Ulsan (Korea, Republic of) . . . . . [9749-59]

**Effects of palladium nanocrystal morphologies on hydrogen sensors based on palladium-graphene hybrid**, Duy-Thach Phan, Gwiye-Sang Chung, Univ. of Ulsan (Korea, Republic of) . . . . . [9749-60]

**Performance improvement of ZnO-nanorod-structured pressure sensors using photo-assisted method**, Ching-Ting Lee, National Cheng Kung Univ. (Taiwan) . . . . . [9749-61]

**Integration of ZnO-based surface acoustic wave devices on steel substrates through use of an insulating a-SiO<sub>2</sub> underlayer**, David J. Rogers, Vinod Eric Sandana, Philippe Bove, Ferechteh H. Teherani, Nanovation (France) . . . . . [9749-62]

**Magnetic-field-enhanced mid-infrared photovoltaic spectral of LaAlO<sub>3</sub>/SrTiO<sub>3</sub> interface**, Xin Feng, Kun Zhao, Wen Feng Xiang, Zhi Qing Lu, China Univ. of Petroleum (China) . . . . . [9749-63]

**Oxide nano-ions for carbon dioxide sequestration**, Hal Gokturk, Ecoken (USA) . . . . . [9749-64]

**Enhancement in optical and structural properties of Zn<sub>0.85</sub>Mg<sub>0.15</sub>O nanorods over thin films synthesized by hydrothermal chemical treatment**, Subhananda Chakrabarti, Punam Murkute, Navneet Sehara, Hemant Jagannath Ghadi, Sushil Pandey, Indian Institute of Technology Bombay (India); Santanu Maity, National Institute of Technology, Arunachal Pradesh (India); Shantanu Saha, Indian Institute of Technology Bombay (India) . . . . . [9749-65]

**Influence of oxygen partial pressure on optical and structural properties of RF sputtered ZnO thin films**, Punam Murkute, Shantanu Saha, Sushil Pandey, Indian Institute of Technology Bombay (India); Anwesha Chatterjee, Jadavpur Univ. (India); Diptesh Datta, Heritage Institute of Technology (India); Subhananda Chakrabarti, Indian Institute of Technology Bombay (India) . . . . . [9749-66]

**Temperature sensing using a Cr:ZnGa<sub>2</sub>O<sub>4</sub> new phosphor**, Bruno Viana, Suchinder K. Sharma, Didier Gourier, Ecole Nationale Supérieure de Chimie de Paris (France) . . . . . [9749-67]

# CONFERENCE 9750

LOCATION: ROOM 125 (NORTH EXHIBIT LEVEL)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9750

# Integrated Optics: Devices, Materials, and Technologies XX

Conference Chairs: **Jean-Emmanuel Broquin**, IMEP-LAHC (France); **Gualtiero Nunzi Conti**, Istituto di Fisica Applicata Nello Carrara (Italy)

Conference Co-Chairs: **Christoph M. Greiner**, LightSmyth Technologies, Inc. (USA); **Sonia M. García-Blanco**, Univ. Twente (Netherlands)

Program Committee: **Pierre Berini**, Univ. of Ottawa (Canada); **Romeo Bernini**, Istituto per il Rilevamento Elettromagnetico dell’Ambiente (Italy); **Pavel Cheben**, National Research Council Canada (Canada); **Xudong Fan**, Univ. of Michigan (USA); **Robert A. Norwood**, College of Optical Sciences, The Univ. of Arizona (USA); **Min-Cheol Oh**, Pusan National Univ. (Korea, Republic of); **François Royer**, Univ. Jean Monnet Saint-Etienne (France); **Jens H. Schmid**, National Research Council Canada (Canada); **Yakov Sidorin**, Quarles & Brady LLP (USA); **Christoph A. Wächter**, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative,  
Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break . . . . . Mon 10:10 am to 10:30 am

### SESSION 1

LOCATION: RM 125 (NORTH EXHIBIT LEVEL) MON 10:30 AM TO 12:30 PM

### Waveguide Engineering I

Session Chair: **Jean-Emmanuel Broquin**, IMEP-LAHC (France)

- 10:30 am: **Less is more: extreme optics with zero refractive index** (*Invited Paper*), **Eric Mazur**, Harvard School of Engineering and Applied Sciences (USA) . . . . . [9750-1]
- 11:00 am: **high-performance silicon photonics devices fabricated by using ArF immersion lithography technology** (*Invited Paper*), **Tsuyoshi Horikawa**, National Institute of Advanced Industrial Science and Technology (Japan); **Daisuke Shimura**, **Seok-Hwan Jeong**, **Masatoshi Tokushima**, **Keizo Kinoshita**, **Tohru Mogami**, Photonics Electronics Technology Research Association (Japan) . . . . . [9750-2]
- 11:30 am: **Low-loss polymer optical waveguides with graded-index perfect circular cores for on-board interconnection**, **Yuki Saito**, **Takaaki Ishigure**, **Keio Univ.** (Japan) . . . . . [9750-3]

11:50 am: **Strip-loaded waveguides and strip-loaded structures on lithium niobate thin films**, **Matthieu Roussey**, Univ. of Eastern Finland (Finland); **Petri Karvinen**, Finlitho Ltd. (Finland) and Univ. of Eastern Finland (Finland); **Markus Häyrynen**, **Markku Kuittinen**, **Seppo Honkanen**, Univ. of Eastern Finland (Finland) . . . . . [9750-4]

12:10 pm: **Ge-on-Nitride membrane waveguide technology for mid-infrared photonic integrated circuit platform**, **Awanish Pandey**, **Saloni Chaurasia**, **Sushobhan Avasthi**, **Shankar Kumar Selvaraja**, Indian Institute of Science (India). [9750-5]

Lunch Break . . . . . Mon 12:30 pm to 1:40 pm

### SESSION 2

LOCATION: ROOM 125 (NORTH EXHIBIT LEVEL) . . . MON 1:40 TO 3:00 PM

### Polarization Management

Session Chair: **Pavel Cheben**, National Research Council Canada (Canada)

1:40 pm: **ZnO-diffused lithium niobate waveguide polarization controller**, **James E. Toney**, **Andrea Pollick**, **Jason Retz**, **Vincent E. Stenger**, **Sri Sriram**, **SRICO Inc.** (USA) . . . . . [9750-6]

2:00 pm: **Design of a 45° polarization rotator based on mode evolution and realized by ion-exchange on glass technology**, **Elodie Jordan**, **Elise Ghibaudo**, **Aude Bouchard**, IMEP-LAHC (France) and Univ. Grenoble Alpes (France); **Damien Jamon**, **François Royer**, **Marie-Françoise Blanc-Mignon**, Univ. Jean Monnet Saint-Etienne (France); **Jean-Emmanuel Broquin**, IMEP-LAHC (France) and Univ. Grenoble Alpes (France) . . . . . [9750-7]

2:20 pm: **Compact polarizer in interconnect band based on TiO2 waveguides**, **Mei Yin**, Peking Univ. (China); **Michael G. Moebius**, **Orad Reshet**, **Sarah Griesse-Nascimento**, **Olivia Mello**, Harvard School of Engineering and Applied Sciences (USA); **Yanping Li**, **Xingjun Wang**, **Hongbin Li**, Peking Univ. (China); **Eric Mazur**, Harvard School of Engineering and Applied Sciences (USA). [9750-8]

2:40 pm: **Birefringence measurement of glass ion-exchanged waveguides: burying depth or cover layer influence**, **Damien Jamon**, **Jean Philippe Garayt**, Univ. de Lyon (France); **Elodie Jordan**, **François Parsy**, **Elise Ghibaudo**, **Jean-Emmanuel Broquin**, IMEP-LAHC (France); **François Royer**, Univ. de Lyon (France) . . . . . [9750-9]

Coffee Break . . . . . Mon 3:00 pm to 3:30 pm



# CONFERENCE 9750

LOCATION: ROOM 125 (NORTH EXHIBIT LEVEL)

## SESSION 3

LOCATION: RM 125 (NORTH EXHIBIT LEVEL) .. MON 3:30 TO 5:20 PM

### Plasmonics

Session Chair: **Pierre Berini**, Univ. of Ottawa (Canada)

3:30 pm: **Modeling plasmonic nanoresonators with methods from integrated optics** (*Invited Paper*), Carsten Rockstuhl, Karlsruher Institut für Technologie (Germany); Shakeeb B. Hasan, Jing Qi, Falk L. Lederer, Thomas Kaiser, Angela Klein, Michael Steinert, Matthias Falkner, Christoph Menzel, Thomas Pertsch, Friedrich-Schiller-Univ. Jena (Germany) . . . . . [9750-10]

4:00 pm: **Hybrid-plasmonic three-terminal travelling-wave modulator with dynamic reconfigurability**, Charles Lin, Amr S. Helmy, Univ. of Toronto (Canada) . . . . . [9750-11]

4:20 pm: **Integrated angular tracking and plasmonic membrane surfaces for a point of a care refractive index sensor**, Andrea Dunbar, Rolf Eckert, Eric Grenet, Ross P. Stanley, Edo Franzi, Harry Heinzelmann, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland) . . . . . [9750-12]

4:40 pm: **Near Infrared Plasmonic Sensor Based on Fano Resonance**, Sherif Sherif, Qatar Univ. (Qatar); Dimitrios C. Zografopoulos, Consiglio Nazionale delle Ricerche (Italy); Lamees Shahada, Qatar Univ. (Qatar); Romeo Beccherelli, Istituto per la Microelettronica e Microsistemi (Italy); Mohamed A. Swillam, The American Univ. in Cairo (Egypt) . . . . . [9750-13]

5:00 pm: **Unidirectional reflectionless propagation in plasmonic waveguide-cavity devices**, Yin Huang, Central South Univ. (China); Georgios Veronis, Louisiana State Univ. (USA); Changjun Min, Shenzhen Univ. (China) . . . [9750-14]

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: RM 125 (NORTH EXHIBIT LEVEL) .. TUE 8:10 TO 10:00 AM

### Waveguide Engineering II

Session Chair: **Yakov Sidorin**, Quarles & Brady LLP (USA)

8:10 am: **Microwave and RF Applications for Micro-resonator Frequency Combs** (*Invited Paper*), David J. Moss, Arnan Mitchell, RMIT Univ. (Australia); Roberto Morandotti, Institut National de la Recherche Scientifique (Canada); Thach Nguyen, Mehrdad Shoeiby, RMIT Univ. (Australia); Alessia Pasquazi, Marco Peccianti, Univ. of Sussex (United Kingdom); Sai Tak Chu, City Univ. of Hong Kong (China); Brent E. Little, Xi'an Institute of Optics and Precision Mechanics (China) . . . . . [9750-15]

8:40 am: **Densely-aligned multilayered polymer optical waveguide with low interchannel crosstalk**, Yusuke Kogo, Keio Univ. (Japan) . . . . . [9750-16]

9:00 am: **Functionalization of UV-curing adhesives for surface-integrated micro-polymer optical fibers**, Bechir M. Hachicha, Ludger Overmeyer, Leibniz Univ. Hannover (Germany) . . . . . [9750-17]

9:20 am: **Switchable ferroelectrically-fixed refractive index structures in nonlinear photonic crystals**, Mousa Ayoub, Hannes Futterlieb, Jörg Imbrock, Cornelia Denz, Westfälische Wilhelms-Univ. Münster (Germany) . . . . . [9750-18]

9:40 am: **Monolithic integration of GaAs/AlGaAs waveguides**, Zhongfa Liao, Univ. of Toronto (Canada); Muhammad Z. Alam, California Institute of Technology (USA); James S. Aitchison, Univ. of Toronto (Canada) . . . [9750-19]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

## SESSION 5

LOCATION: RM 125 (NORTH EXHIBIT LEVEL) .. TUE 10:30 AM TO 12:10 PM

### On-Chip Active Devices

Session Chair: **Sonia M. Garcia-Blanco**, Univ. Twente (Netherlands)

10:30 am: **Monolithic integration of a microlaser with a passive waveguide via selective quantum well etching**, Hwi-Min Kim, Hoon Jang, Yong-Hee Lee, KAIST (Korea, Republic of) . . . . . [9750-20]

10:50 am: **Controllable red and blue bandgap energy shifted LEDs and modulators on InGaAsP quantum well platform**, Parinaz Aleahmad, Demetrios N. Christodoulides, Patrick L. LiKamWa, Univ. of Central Florida (USA); Thamer Tabbakh, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9750-21]

11:10 am: **Realization of back-side heterogeneous hybrid III-V/Si DBR lasers for silicon photonics**, Jocelyn Durel, STMicroelectronics (France) and CEA-LETI (France) and IMEP-LAHC (France); Thomas Ferrotti, STMicroelectronics (France) and CEA-LETI (France); Alain Chantre, Sébastien Cremer, STMicroelectronics (France); Julie Harduin, CEA-LETI (France); Jean-Emmanuel Broquin, IMEP-LAHC (France); Badhise Ben Bakir, CEA-LETI (France) . . . . . [9750-22]

11:30 am: **Enhancement of the photoluminescence in Er-doped Al<sub>2</sub>O<sub>3</sub> fabricated by atomic layer deposition**, John Roenn, Lasse Karvonen, Aalto Univ. School of Science and Technology (Finland); Antti Säynätjoki, Aalto Univ. School of Science and Technology (Finland) and Univ. of Eastern Finland (Finland); Alexander Pyymäki Perros, Aalto Univ. School of Science and Technology (Finland); Nasser N. Peyghambarian, College of Optical Sciences, The Univ. of Arizona (USA) and Aalto Univ. School of Science and Technology (Finland) and Univ. of Eastern Finland (Finland); Harri Lipsanen, Zhipei Sun, Aalto Univ. School of Science and Technology (Finland) . . . . . [9750-23]

11:50 am: **Developing the OEIC solutions using two section light-emitting transistor**, Shan-Fong Liang, Yuan-Fu Hsu, Gong-Sheng Cheng, Chao-Hsin Wu, National Taiwan Univ. (Taiwan) . . . . . [9750-37]

Lunch/Exhibition Break . . . . . Tue 12:10 pm to 1:40 pm

## SESSION 6

LOCATION: RM 125 (NORTH EXHIBIT LEVEL) . . . TUE 1:40 TO 3:10 PM

### On-Chip Quantum Optics

Session Chair: **Jean-Emmanuel Broquin**, IMEP-LAHC (France)

1:40 pm: **Integrated optical combs: towards quantum optical applications** (*Invited Paper*), Roberto Morandotti, Piotr Roztock, Christian Reimer, Michael Kues, Benjamin Wetzel, Lucia Caspani, Institut National de la Recherche Scientifique (Canada); Fabio Grazioso, Univ. of Oxford (United Kingdom); Yaron Bromberg, Yale Univ. (USA); Matteo Clerici, Marcello Ferrara, Heriot-Watt Univ. (United Kingdom); Marco Peccianti, Alessia Pasquazi, Univ. of Sussex (United Kingdom); Luca Razzari, Institut National de la Recherche Scientifique (Canada); Brent E. Little, Xi'an Institute of Optics and Precision Mechanics (China); Sai Tak Chu, City Univ. of Hong Kong (Hong Kong, China); David J. Moss, RMIT Univ. (Australia) . . . . . [9750-25]

2:10 pm: **Background-free phase-preserving upconversion of faint near-infrared light**, Sergey V. Polyakov, Yu-Hsiang Cheng, Tim O. Thomay, Glenn S. Solomon, Alan L. Migdall, National Institute of Standards and Technology (USA) . . . . . [9750-26]

2:30 pm: **Travelling wave single-photon detectors integrated with diamond photonic circuits**, Patrik Rath, Simone Ferrari, Oliver Kahl, Karlsruher Institut für Technologie (Germany); Christoph Nebel, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); Wolfram H. P. Pernice, Karlsruher Institut für Technologie (Germany) . . . . . [9750-27]

2:50 pm: **Engineering reconfigurable laser-written circuits for practical quantum metrology**, Zachary J. Chaboyer, Ctr. for Ultrahigh bandwidth Devices for Optical Systems (Australia) and MQ Photonics Research Ctr. (Australia) and Macquarie Univ. (Australia); Alex Stokes, Macquarie Univ. (Australia) and Australian National Fabrication Facility (Australia); Michael J. Steel, Michael J. Withford, Ctr. for Ultrahigh bandwidth Devices for Optical Systems (Australia) and MQ Photonics Research Ctr. (Australia) and Macquarie Univ. (Australia) . . . . . [9750-28]

Coffee Break . . . . . Tue 3:10 pm to 3:40 pm



# CONFERENCE 9750

LOCATION: ROOM 125 (NORTH EXHIBIT LEVEL)

## SESSION 7

LOCATION: RM 125 (NORTH EXHIBIT LEVEL) . . TUE 3:40 TO 5:00 PM

### Magneto-Optics

Session Chair: **François Royer**,  
Univ. Jean Monnet Saint-Etienne (France)

3:40 pm: **Faraday polarisation mode conversion in semiconductor waveguides incorporating periodic garnet claddings** (*Invited Paper*), David C. Hutchings, Cui Zhang, Barry M. Holmes, Univ. of Glasgow (United Kingdom); Prabesh Dulal, Andrew D. Block, Bethanie J. H. Stadler, Univ. of Minnesota, Twin Cities (USA) . . . . . [9750-29]

4:10 pm: **Monolithic on-chip nonreciprocal photonics based on cerium/bismuth substituted yttrium iron garnet thin films** (*Invited Paper*), Juejun Hu, Massachusetts Institute of Technology (USA); Xueyin Sun, Massachusetts Institute of Technology (USA) and Harbin Institute of Technology (China); Qingyang Du, Massachusetts Institute of Technology (USA); Taichi Goto, Toyohashi Univ. of Technology (Japan); Mehmet Onbasli, Caroline A. Ross, Massachusetts Institute of Technology (USA) . . . . . [9750-30]

4:40 pm: **Nanocomposite magnetic material embedded on TiO<sub>2</sub> pillars to realize magneto-optical resonant guided-mode gratings**, Bobin Varghese, Emilie Gamet, Damien Jamon, Lab. Hubert Curien (France); Sophie Neveu, UPMC Sorbonne Univ. (France); Loïc Berthod, Olga Shavdina, Stéphanie Reynaud, François Royer, Lab. Hubert Curien (France) . . . . . [9750-31]

## WEDNESDAY 17 FEBRUARY

## SESSION 8

LOCATION: RM 125 (NORTH EXHIBIT LEVEL) . WED 8:20 TO 10:10 AM

### Photonic Integration

Session Chair: **Jens H. Schmid**,  
National Research Council Canada (Canada)

8:20 am: **High-efficiency subwavelength index engineered fibre-chip couplers for photonics integration and sensing** (*Invited Paper*), Pavel Cheben, Danxia Xu, Jens Schmid, Siegfried Janz, Shurui Wang, Martin Vachon, National Research Council Canada (Canada); Gonzalo Wanguemert-Perez, Robert Halir, Alejandro Ortega-Monux, Iñigo Molina-Fernández, Univ. de Málaga (Spain); Milan Dado, Daniel Benedikovic, Jarmila Müllerová, Univ. of Žilina (Slovakia); Carlos Alonso Ramos, Univ. Paris-Sud 11 (France); Martin Papes, Vladimír Vasinek, VŠB-Technical Univ. of Ostrava (Czech Republic); Yves Painchaud, Marie-Josée Picard, Martin Guy, TeraXion Inc. (Canada); Mohamed Rahim, National Research Council Canada (Canada) . . . . . [9750-32]

8:50 am: **Compact two-mode (de)multiplexer based on MMI couplers with different core thickness on InP Substrate**, Guo Fei, Dan Lu, Ruikang Zhang, Huitao Wang, Chen Ji, Institute of Semiconductors (China) . . . . . [9750-33]

9:10 am: **Quasicrystal photonic crystal optic coupler and power splitter**, Jingxing Shi, Michael E. Pollard, Martin D. B. Charlton, Univ. of Southampton (United Kingdom) . . . . . [9750-34]

9:30 am: **Design and fabrication of adiabatic vertical couplers for hybrid integration by flip-chip bonding**, Jinfeng Mu, Meindert Dijkstra, Sonia M. Garcia-Blanco, MESA+ Institute for Nanotechnology (Netherlands) . . . [9750-35]

9:50 am: **Ferroelectric-oxide-based slot waveguides monolithically integrated on silicon for optoelectronics**, Sebastien Cueff, Regis Orbotchouk, Pedro Rojo-Romeo, Baba Wague, Xuan Hu, Romain Bachelet, Philippe Régreny, Bertrand Vilquin, Guillaume Saint-Girons, Institut des Nanotechnologies de Lyon (France) . . . . . [9750-36]

Coffee Break . . . . . Wed 10:10 am to 10:40 am

## SESSION 9

LOCATION: RM 125 (NORTH EXHIBIT LEVEL) . . . . WED 10:40 TO 11:50 AM

### Optofluidics

Session Chair: **Romeo Bernini**, Istituto per il Rilevamento  
Elettromagnetico dell'Ambiente (Italy)

10:40 am: **Integrated optofluidic label-free biosensors using a silicon-nitride-based coupled-resonator optical waveguide** (*Invited Paper*), Jiawei Wang, Zhanshi Yao, Andrew W. Poon, Hong Kong Univ. of Science and Technology (Hong Kong, China) . . . . . [9750-38]

11:10 am: **Integrated optics for sensing applications in lithium niobate based microfluidic systems**, Cinzia Sada, Giacomo Bettella, Gianluca Pozza, Annamaria Zaltron, Univ. degli Studi di Padova (Italy); Mathieu Chauvet, Blandine Guichardaz, Univ. de Franche-Comté (France) . . . . . [9750-39]

11:30 am: **Complex manipulation of single microparticles in air by fiber-based compact optical tweezers**, Sudipta K. Bera, Avinash K. Gupta, Souvik Sil, Tanumoy Saha, Ayan Banerjee, Indian Institute of Science Education and Research Kolkata (India) . . . . . [9750-40]

Lunch/Exhibition Break . . . . . Wed 11:50 am to 1:20 pm

## SESSION 10

LOCATION: ROOM 125 (NORTH EXHIBIT LEVEL) . . . WED 1:20 TO 3:20 PM

### Modelling

Session Chair: **Christoph A. Wächter**, Fraunhofer-Institut für  
Angewandte Optik und Feinmechanik (Germany)

1:20 pm: **Design and optimization of silicon photonic devices** (*Invited Paper*), B. M. Azizur Rahman, City Univ. London (United Kingdom) . . . . . [9750-41]

1:50 pm: **Wave-interaction in photonic integrated circuits: hybrid analytical/numerical coupled mode modeling** (*Invited Paper*), Manfred Hammer, Univ. Paderborn (Germany) . . . . . [9750-42]

2:20 pm: **Leaky waveguides for low k-measurement: From structure design to loss evaluation**, Christoph A. Wächter, Riccardo Rizzo, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Francesco Michelotti, Sapienza Univ. di Roma (Italy); Peter Munzert, Norbert Danz, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [9750-43]

2:40 pm: **Modeling graphene based surface plasmon waveguides and devices**, James Pond, Federico Duque-Gomez, Ahsan Alam, Jens Niegemann, Dylan McGuire, Adam Reid, Lumerical Solutions, Inc. (Canada) . . . . . [9750-44]

3:00 pm: **Oblique incidence of semi-guided waves on step-like folds in planar dielectric slabs: Lossless vertical interconnects in 3D integrated photonic circuits**, Andre Hildebrandt, Samer Alhaddad, Manfred Hammer, Jens Förstner, Univ. Paderborn (Germany) . . . . . [9750-45]

Coffee Break . . . . . Wed 3:20 pm to 3:50 pm

OPTO

# CONFERENCE 9750

LOCATION: ROOM 125 (NORTH EXHIBIT LEVEL)

## SESSION 11

LOCATION: RM 125 (NORTH EXHIBIT LEVEL) . . WED 3:50 TO 6:10 PM

### Sensors

Session Chair: **Gualtiero Nunzi Conti**,  
Istituto di Fisica Applicata "Nello Carrara" (Italy)

3:50 pm: **WGM resonator based integrated optical circuits for lab-on-chip sensors at ~0.85 micron** (*Invited Paper*), Georg Pucker, Fondazione Bruno Kessler (Italy); Alina Samusenko, Fondazione Bruno Kessler (Italy) and Univ. degli Studi di Trento (Italy); Mher Ghulinyan, Laura Pasquardini, Fondazione Bruno Kessler (Italy); Tatevi Chalyan, Romain Guider, Davide Gandolfi, Univ. degli Studi di Trento (Italy); Andrea Adami, Leandro Lorenzelli, Fondazione Bruno Kessler (Italy); Lorenzo Pavesi, Univ. degli Studi di Trento (Italy). [9750-46]

4:20 pm: **Label-free and fluorescence biosensing platform using one-dimensional photonic crystal chips** (*Invited Paper*), Francesco Michelotti, Alberto Sinibaldi, Aleksei Anopchenko, Sapienza Univ. di Roma (Italy); Peter Munzert, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Stefan Schmieder, Fraunhofer IWS Dresden (Germany); Rona Chandrawati, Subinoy Rana, Imperial College London (United Kingdom); Frank Sonntag, Fraunhofer IWS Dresden (Germany); Agostino Occhicone, Sapienza Univ. di Roma (Italy); Lucia Napione, Univ. degli Studi di Torino (Italy); Molly M. Stevens, Imperial College London (United Kingdom); Norbert Danz, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany). [9750-47]

4:50 pm: **Fabrication of scattering source for an optical fiber sensor using femtosecond laser internal processing**, Naoki Chinen, Soka Univ. (Japan). [9750-48]

5:10 pm: **Enhanced electro-optical Fano-based photonic crystal-on-fiber E-field sensor**, Maria-Pilar Bernal, Abdoulaye Ndao, Wentao Qiu, Venancio Calero, Roland Salut, Nadège Courjal, Fadi I. Baida, FEMTO-ST (France) and Ctr. National de la Recherche Scientifique (France). [9750-49]

5:30 pm: **On-chip spectrometer based on an evanescently coupled multimode spiral waveguide**, Brandon Redding, U.S. Naval Research Lab. (USA); Seng Fatt Liew, Raktim Sarma, Yaron Bromberg, Hui Cao, Yale Univ. (USA). [9750-50]

5:50 pm: **Whispering gallery modes in self-assembled bottle microresonators coupled to planar waveguide**, Immacolata A. Grimaldi, Istituto per il Rilevamento Elettromagnetico dell'Ambiente (Italy); Simone Berneschi, Istituto di Fisica Applicata "Nello Carrara" (Italy); Genni Testa, Istituto per il Rilevamento Elettromagnetico dell'Ambiente (Italy); Francesco Baldini, Gualtiero Nunzi Conti, Istituto di Fisica Applicata "Nello Carrara" (Italy); Romeo Bernini, Istituto per il Rilevamento Elettromagnetico dell'Ambiente (Italy). [9750-51]

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Integrated-optic tunable chromatic dispersion compensator composed of lattice-form circuit with interleave filter**, Koichi Takiguchi, Ritsumeikan Univ. (Japan). [9750-52]

**Integrated-optic spectrum synthesizer with simple loop-back configuration**, Koichi Takiguchi, Ritsumeikan Univ. (Japan). [9750-53]

**High-precision opto-mechanical lens system for space applications assembled by innovative local soldering technique**, Pol Ribes Pleguezuelo, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Charlie Koechlin, SODERN (France); Thomas Burkhardt, Marcel Hornaff, Diana Burkhardt, Andreas Kamm, Steffen Gramens, Erik Beckert, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Guillaume Fiault, SODERN (France). [9750-54]

**An LSPR fiber optic sensor based on in-line micro-holes fabricated by a second harmonic 400-nm femtosecond laser**, Masahiko Shiraiishi, Kazuhiro Watanabe, Atsushi Seki, Kenji Goya, Soka Univ. (Japan). [9750-55]

**Quadrature phase-shifted integrated optical current sensors based on polymer waveguide MMI coupler**, Sung-Moon Kim, Woo-Sung Chu, Min-Cheol Oh, Pusan National Univ. (Korea, Republic of). [9750-56]

**Tunable channel-drop filters with tilted Bragg reflector and mode sorting branch**, Tae-Hyun Park, Jin-Soo Shin, Guanghao Huang, Min-Cheol Oh, Pusan National Univ. (Korea, Republic of). [9750-57]

**Advances in spun multicore fiber technology**, Andrew Webb, Laurence J. Cooper, Mark D. Hill, Aurélien Bergonzo, Fibercore Ltd. (United Kingdom). [9750-58]

**Design of a silicon polarization grating with a sub-wavelength anisotropic structure**, Koji Anju, Hiroyuki Tsuda, Keio Univ. (Japan); Hisato Uetsuka, National Institute of Advanced Industrial Science and Technology (Japan). [9750-59]

**Polymer waveguide tunable filters with a surface relief apodized grating**, Guanghao Huang, Jin-Soo Shin, Won-Joon Lee, Tae-Hyun Park, Woo-Sung Chu, Min-Cheol Oh, Pusan National Univ. (Korea, Republic of). [9750-60]

**A novel high-sensitive laser diode sensor based on micro-cavity**, Hong-Seung Kim, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of); Jung-Min Park, Sung-Bok Kim, Electronics and Telecommunications Research Institute (Korea, Republic of); Chil-Min Kim, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of); Kwang Ryong Oh, Electronics and Telecommunications Research Institute (Korea, Republic of). [9750-61]

**Polymer waveguide polarization splitters based on total internal reflection for quantum communication systems**, Jin-Soo Shin, Min-Cheol Oh, Woo-Sung Chu, Sung-Moon Kim, Pusan National Univ. (Korea, Republic of) [9750-62]

**A compact and high-speed plasmonic slot waveguide coupled with photonic waveguide based 2x2 electro-optic switch**, Aditya Arya, Manivasakan R., Indian Institute of Technology Madras (India). [9750-63]

**Packaged integrated opto-fluidic solution for harmful fluid analysis**, Timothée Allenet, Davide Bucci, Jean-Emmanuel Broquin, IMEP-LaHC (France); Fabien Geoffroy, Fabrice Canto, Laurent Coustou, Commissariat à l'Énergie Atomique (France); Elsa Jardinier, IMEP-LAHC (France). [9750-64]

**Ferrofluid-based optical fiber magnetic field sensor fabricated by femtosecond laser irradiation and chemical etching**, Yang Song, Lei Yuan, Clemson Univ. (USA); Jie Huang, Missouri Univ. of Science and Technology (USA); Liwei Hua, Hai Xiao, Clemson Univ. (USA). [9750-65]

**Integrated all-polymer Mach-Zehnder interferometers without interaction window in asymmetric configuration**, Yanfen Xiao, Meike Hofmann, Ziyu Wang, Stanislav Sherman, Hans Zappe, Pei Li, Univ. of Freiburg (Germany). [9750-66]

**Enhancing the resonance stability of a high-Q micro/nanoresonator by an optical means**, Xuan Betty Sun, Rui Luo, Xi-Cheng Zhang, Qiang Lin, Univ. of Rochester (USA). [9750-68]

# CONFERENCE 9751

LOCATION: ROOM 110 (NORTH EXHIBIT LEVEL)

Tuesday–Thursday 16–18 February 2016 • Proceedings of SPIE Vol. 9751

# Smart Photonic and Optoelectronic Integrated Circuits XVIII

Conference Chairs: **Sailing He**, KTH Royal Institute of Technology (Sweden); **El-Hang Lee**, Inha Univ. (Korea, Republic of); **Louay A. Eldada**, Quanergy Systems, Inc. (USA)

Program Committee: **Ray T. Chen**, The Univ. of Texas at Austin (USA); **Shanhui Fan**, Stanford Univ. (USA); **Chennupati Jagadish**, The Australian National Univ. (Australia); **Jürgen Jahns**, FernUniv. Hagen (Germany); **Stefan A. Maier**, Imperial College London (United Kingdom); **Joachim Piprek**, NUSOD Institute LLC (USA); **David V. Plant**, McGill Univ. (Canada); **Andrew W. Poon**, Hong Kong Univ. of Science and Technology (Hong Kong, China); **Ali Serpengüzel**, Koç Univ. (Turkey); **Qian Wang**, A\*STAR - Data Storage Institute (Singapore); **Michael R. Watts**, Massachusetts Institute of Technology (USA); **Dan-Xia Xu**, National Research Council Canada (Canada); **Lin Yang**, Institute of Semiconductors (China)

## TUESDAY 16 FEBRUARY

### WELCOME AND OPENING REMARKS

LOCATION: ROOM 110 (NORTH EXHIBIT LEVEL) . 1:30 PM TO 1:40 PM

**Sailing He**, KTH Royal Institute of Technology (Sweden)

### SESSION 1

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) ... TUE 1:40 TO 3:10 PM

### Advances in Silicon Photonics

Session Chairs: **Lin Yang**, Institute of Semiconductors (China);

**Sailing He**, KTH Royal Institute of Technology (Sweden)

1:40 pm: **Silicon photonics: some remaining challenges** (*Invited Paper*), Graham T. Reed, Optoelectronics Research Ctr. (United Kingdom) . . . . [9751-1]

2:10 pm: **Schematic-driven silicon photonics design** (*Invited Paper*), Lukas Chrostowski, The Univ. of British Columbia (Canada) . . . . . [9751-2]

2:40 pm: **From materials to devices to systems: the development of silicon photonics for advanced communications** (*Invited Paper*), Andrew P. Knights, McMaster Univ. (Canada) . . . . . [9751-3]

Coffee Break . . . . . Tue 3:10 pm to 3:40 pm

### SESSION 2

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) .. TUE 3:40 TO 5:40 PM

### Plasmonic Nano-Lasers, Antennas, and Structures

Session Chair: **Sailing He**, KTH Royal Institute of Technology (Sweden)

3:40 pm: **Nanolasers and related issues for integrated photonics applications** (*Invited Paper*), Cun-Zheng Ning, Arizona State Univ. (USA) . . . . . [9751-4]

4:10 pm: **Nano-antennas from the visible to the mid-infrared: material considerations and applications** (*Invited Paper*), Stefan A. Maier, Imperial College London (United Kingdom) . . . . . [9751-5]

4:40 pm: **Efficient optical coupling into ultra-compact plasmonic slot waveguide using dipole nanoantennas** (*Invited Paper*), Qian Gao, Fanghui Ren, Alan X. Wang, Oregon State Univ. (USA) . . . . . [9751-6]

5:10 pm: **Ultrafast generation and relaxation of non-equilibrium carriers in plasmonic nanostructures** (*Invited Paper*), Prineha Narang, California Institute of Technology (USA) and Northrop Grumman Corp. (USA) . . . . . [9751-7]

## WEDNESDAY 17 FEBRUARY

### SESSION 3

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) ..... WED 8:10 TO 10:20 AM

### Smart Structures for Photonic Integration

Session Chair: **Andrew W. Poon**, Hong Kong Univ. of Science and Technology (Hong Kong, China)

8:10 am: **Polarization diversity circuit for a silicon optical switch using silica waveguides integrated with photonic crystal thin film waveplates**, Koki Sugiyama, Keio Univ. (Japan); Takafumi Chiba, Takayuki Kawashima, Shojiro Kawakami, Photonic Lattice Inc. (Japan); Hiroshi Takahashi, Sophia Univ. (Japan); Hiroyuki Tsuda, Keio Univ. (Japan) . . . . . [9751-8]

8:30 am: **Resolving the controversy in the physical origin of enhanced optical gain/absorption in micro/nano waveguiding dielectric or plasmonic structures in photonic integrated circuits via the concept of geometrical energy velocity** (*Invited Paper*), Seng-Tiong Ho, Xi Chen, Northwestern Univ. (USA); Yingyan Huang, OptoNet, Inc. (USA) . . . . . [9751-9]

9:00 am: **Development of broadband antireflection of high-index substrate using SiN<sub>x</sub>/SiO<sub>2</sub>**, Kim Peng Lim, Keh Ting D. Ng, Qian Wang, A\*STAR - Data Storage Institute (Singapore) . . . . . [9751-10]

9:20 am: **Silicon-nanodisk-based metasurface for subwavelength phase and polarization control**, Ye Feng Yu, Ramón Paniagua-Domínguez, Alexander Y. Zhu, Yuan Hsing Fu, Boris Luk'yanchuk, Arseniy I. Kuznetsov, A\*STAR - Data Storage Institute (Singapore) . . . . . [9751-11]

9:40 am: **Photonic-crystal-based visible-light optical filter**, Swati Rawal, Brahm Raj Singh, Jaypee Institute of Information Technology (India) . . [9751-12]

10:00 am: **Bandgap engineering of InGaAsP/InP laser structure by photo-absorption-induced point defects**, Mohammad Kaleem, COMSATS Institute of Information Technology (Pakistan); Sajid Nazir, London South Bank Univ. (United Kingdom) . . . . . [9751-45]

Coffee Break . . . . . Wed 10:20 am to 10:50 am



# CONFERENCE 9751

LOCATION: ROOM 110 (NORTH EXHIBIT LEVEL)

## SESSION 4

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) WED 10:50 AM TO 12:00 PM

### Advanced Hybrid PICs

Session Chair: **Yong-Zhen Huang**, Institute of Semiconductors (China)

10:50 am: **Integration of two-dimensional semiconductors with photonic structures** (*Invited Paper*), Vinod Menon, The City College of New York (USA) . . . . . [9751-13]

11:20 am: **Ultra-thin oxide interlayer wafer bonding for heterogeneous III-V/Si photonics integration**, Chee-Wei Lee, Ying Shun Liang, Keh Ting D. Ng, Yi Yang, Hnin Yu Yu Ko, Qian Wang, A\*STAR - Data Storage Institute (Singapore) . . . . . [9751-14]

11:40 am: **All-optical SR flip-flop based on SOA-MZI switches monolithically integrated on a generic InP platform**, Stelios Pitris, Christos Vagionas, Ctr. for Research and Technology Hellas (Greece) and Aristotle Univ. of Thessaloniki (Greece); George T. Kanellos, Ctr. for Research and Technology Hellas (Greece); Rifat Kisacik, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); Tolga Tekin, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany) and Technische Univ. Berlin (Germany); Ronald Broeke, Bright Photonics B.V. (Netherlands); Nikos Pleros, Ctr. for Research and Technology Hellas (Greece) and Aristotle Univ. of Thessaloniki (Greece) . . . . . [9751-15]

Lunch/Exhibition Break . . . . . Wed 12:00 pm to 1:30 pm

## SESSION 5

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) . . WED 1:30 TO 3:20 PM

### Smart Light Sources I

Session Chair: **Qian Wang**, A\*STAR - Data Storage Institute (Singapore)

1:30 pm: **Broadband SLED-based light source and spectrometer**, Yonathan Dattner, Orly Yadid-Pecht, Luxmux Technology Corp. (Canada) . . . . . [9751-16]

1:50 pm: **Lasering characteristics of integrated lasers with whispering-gallery mode microresonator** (*Invited Paper*), Yong-Zhen Huang, Xiu-Wen Ma, Yue-De Yang, Jin-Long Xiao, Yun Du, Institute of Semiconductors (China) . . . . [9751-17]

2:20 pm: **Integration of mode-locked diode lasers** (*Invited Paper*), Ann C. Coleman, The Univ. of Texas at Dallas (USA) . . . . . [9751-18]

2:50 pm: **Ultra-high-Q silicon nitride microresonators for on-chip frequency comb generation** (*Invited Paper*), Minghao Qi, Yi Xuan, Yang Liu, Xiaoxiao Xue, Andrew J. Metcalf, Pei-Hsun Wang, Jian Wang, Ben Niu, Kyunghun Han, Min Teng, Daniel E. Leaird, Andrew M. Weiner, Purdue Univ. (USA) . . . [9751-19]

Coffee Break . . . . . Wed 3:20 pm to 3:50 pm

## SESSION 6

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) . WED 3:50 TO 5:40 PM

### Smart Light Sources II

Session Chair: **Qian Wang**, A\*STAR - Data Storage Institute (Singapore)

3:50 pm: **Generic heterogeneously integrated III-V lasers on silica with metal-coated high-reflectance etched mirror** (*Invited Paper*), Chee-Wei Lee, Keh Ting D. Ng, Qian Wang, Min Ren, Yuan Hsing Fu, Anthony Yew Seng Kay, Jing Pu, Vivek Krishnamurthy, Ai Ling Tan, Febiana Tjiptoharsono, Soo Bin Choo, A\*STAR - Data Storage Institute (Singapore) . . . . . [9751-20]

4:20 pm: **Patterned semiconductor inverted quantum-dot photonic devices** (*Invited Paper*), James J. Coleman, The Univ. of Texas at Dallas (USA). [9751-21]

4:50 pm: **Tunable on-chip light sources using III-N nanowire arrays and two-dimensional atomic crystals** (*Invited Paper*), Zetian Mi, Songrui Zhao, Yong-Ho Ra, Xianhe Liu, Binh Le, Renjie Wang, McGill Univ. (Canada). [9751-22]

5:20 pm: **High-efficiency and compact semiconductor lasers with monolithically integrated switches for generation of high-power nanosecond pulses in time-of-flight (TOF) systems**, Sergey O. Slipchenko, Aleksandr A. Podoskin, Olga S. Soboleva, Maxim S. Zakharov, Kirill V. Bakhvalov, Dmitrii N. Romanovich, Nikita A. Pikhtin, Il'ya S. Tarasov, Ioffe Physical-Technical Institute (Russian Federation); Timur A. Bagaev, Maxim A. Ladugin, Aleksandr A. Marmalyuk, Vladimir A. Simakov, JSC "Research Institute" POLYUS "them. M.F. Stelmaha" (Russian Federation) . . . . . [9751-23]

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Compact transverse-magnetic mode-pass polarizer based on one-dimensional photonic crystal waveguide**, Dong Wook Kim, Moon Hyeok Lee, Yudeuk Kim, Inha Univ. (Korea, Republic of); Kyong-Hon Kim, Inha Univ. (Korea, Republic of) . . . . . [9751-43]

**A compact picosecond-pulsed laser source using a fully integrated CMOS driver circuit**, Yuting He, Yuhua Li, Orly Yadid-Pecht, Univ. of Calgary (Canada) . . . . . [9751-44]

## THURSDAY 18 FEBRUARY

### SESSION 7

LOCATION: ROOM 110 (NORTH EXHIBIT LEVEL) . . . THU 8:00 AM TO 10:30 AM

### Signal Processing and Optical Interconnects

Session Chair: **Ray T. Chen**, The Univ. of Texas at Austin (USA)

8:00 am: **Actively stabilized silicon microring resonator switch arrays for optical interconnects** (*Invited Paper*), Li Yu, Andrew Poon, Hong Kong Univ. of Science and Technology (Hong Kong, China) . . . . . [9751-24]

8:30 am: **On-chip optical matrix processor for parallel computing** (*Invited Paper*), Lin Yang, Jianfeng Ding, Lei Zhang, Ruiqiang Ji, Institute of Semiconductors (China) . . . . . [9751-25]

9:00 am: **Ultrafast optical signal processing on silicon-based platforms** (*Invited Paper*), Dawn Tan, Singapore Univ. of Technology & Design (Singapore) . . . . . [9751-26]

9:30 am: **Recent advances in strained silicon photonics** (*Invited Paper*), Pedro Damas, Xavier Le Roux, Mathias Berciano, Delphine Marris-Morini, Eric Cassan, Laurent Vivien, Institut d'Électronique Fondamentale (France). [9751-27]

10:00 am: **Whispering gallery microresonators at exceptional points** (*Invited Paper*), Sahin Kaya Ozdemir, Lan Yang, Washington Univ. in St. Louis (USA) . . . . . [9751-46]

Coffee Break . . . . . Thu 10:30 am to 11:00 am

### SESSION 8

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) . THU 11:00 AM TO 12:20 PM

### Optoelectronic Integrated Circuits

Session Chair: **Lin Yang**, Institute of Semiconductors (China)

11:00 am: **Design and optimization of photolithography friendly photonic components**, James Pond, Xu Wang, Jonas Flückiger, Adam Reid, Jens Niegemann, Lumerical Solutions, Inc. (Canada) . . . . . [9751-28]

11:20 am: **Verilog-A passive and active components modeling for silicon photonic circuits process design kit (PDK) assembly**, Bayram Karakus, Fabien Gays, André Myko, Thomas Anfray, Christophe Kopp, CEA-LETI (France) . . . . . [9751-29]

11:40 am: **An integrated Mach-Zehnder modulator bias controller based on eye-amplitude monitoring**, Min-Hyeon Kim, Hyun-Yong Jung, Yonsei Univ. (Korea, Republic of); Lars Zimmermann, IHP GmbH (Germany); Woo-Young Choi, Yonsei Univ. (Korea, Republic of) . . . . . [9751-30]

12:00 pm: **Tunable arrayed waveguide grating driven by surface acoustic waves**, Antonio Crespo-Poveda, Univ. de València (Spain); Alberto Hernández-Minguez, Paul-Drude-Institut für Festkörperelektronik (Germany); Bernardo Gargallo, Univ. Politècnica de València (Spain); Klaus Biermann, Abbes Tahraoui, Paulo V. Santos, Paul-Drude-Institut für Festkörperelektronik (Germany); Pascual Muñoz, Univ. Politècnica de València (Spain); Andrés Cantarero, Mauricio M. de Lima Jr., Univ. de València (Spain) . [9751-31]

Lunch/Exhibition Break . . . . . Thu 12:20 pm to 1:30 pm



# CONFERENCE 9751

LOCATION: ROOM 110 (NORTH EXHIBIT LEVEL)

## SESSION 9

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) ... THU 1:30 TO 3:20 PM

### Optical Sensing and Imaging I

Session Chairs: **Qian Wang**, A\*STAR - Data Storage Institute (Singapore); **Sailing He**, KTH Royal Institute of Technology (Sweden)

1:30 pm: **Gas sensors using single layer patterned interference optical filters**, Thomas D. Rahmlow Jr., Robert L. Johnson, Kieran Gallagher, Omega Optical, Inc. (USA) ..... [9751-32]

1:50 pm: **Integrated microsystems for optical sensing and imaging applications (Invited Paper)**, Stefan Sinzinger, Roman Kleindienst, Technische Univ. Ilmenau (Germany) ..... [9751-33]

2:20 pm: **Vertical split-ring resonators apply on sensing and metasurface**, Wei-Lun Hsu, Pin Chieh Wu, Jia Wern Chen, Ting-Yu Chen, National Taiwan Univ. (Taiwan); Bo Han Cheng, Academia Sinica (Taiwan); Wei Ting Chen, National Taiwan Univ. (Taiwan); Greg Sun, Univ. of Massachusetts Boston (USA); Din Ping Tsai, Research Ctr. for Applied Sciences - Academia Sinica (Taiwan) ..... [9751-34]

2:40 pm: **Low-cost fabrication of optical waveguides, interconnects, and sensing structures on all-polymer-based thin foils**, Maher Rezem, Christian Kelb, Axel Günther, Maik Rahlves, Eduard Reithmeier, Bernhard Roth, Leibniz Univ. Hannover (Germany) ..... [9751-35]

3:00 pm: **Frequency range selection method of trans-impedance amplifier for high-sensitivity lock-in amplifier used in the optical sensors**, Chang-In Park, Su-Jin Jeon, Tae-Ryong Kim, Myung-Gi Ji, Byung-Hee Son, Mi Jung, Young-Wan Choi, Chung-Ang Univ. (Korea, Republic of) ..... [9751-36]

Coffee Break ..... Thu 3:20 pm to 3:50 pm

## SESSION 10

LOCATION: RM 110 (NORTH EXHIBIT LEVEL) .. THU 3:50 TO 5:50 PM

### Optical Sensing and Imaging II

Session Chair: **Sailing He**, KTH Royal Institute of Technology (Sweden)

3:50 pm: **4D light-field sensing system for people counting**, Guangqi Hou, Institute of Automation (China); Chi Zhang, Institute of Automation (China) and Univ. of Chinese Academy of Sciences (China); Zhenan Sun, Institute of Automation (China) ..... [9751-37]

4:10 pm: **Super-resolution PMD cameras for applied metrology**, Henrik Lietz, Jörg Eberhardt, Hochschule Ravensburg-Weingarten (Germany) ..... [9751-38]

4:30 pm: **Analysis of position error by time constant in read-out resistive network for gamma-ray imaging detection system**, Su-Jin Jeon, Chang-In Park, Byung-Hee Son, Mi Jung, Teak-Jin Jang, Chun-Sik Lee, Young-Wan Choi, Chung-Ang Univ. (Korea, Republic of) ..... [9751-39]

4:50 pm: **Modeling and calibration of pulse-modulation based ToF imaging systems**, Andreas Süss, Fraunhofer-Institut für Mikroelektronische Schaltungen und Systeme (Germany) and IMEC (Belgium); Gabor Varga, Fraunhofer-Institut für Mikroelektronische Schaltungen und Systeme (Germany) and RWTH Aachen Univ. (Germany); Michael Marx, Peter Fürst, Stefan Gläsener, Fraunhofer-Institut für Mikroelektronische Schaltungen und Systeme (Germany); Wolfram Tiedke, TriDiCam GmbH (Germany); Melanie Jung, Andreas Spickermann, Bedrich J. Hosticka, Fraunhofer-Institut für Mikroelektronische Schaltungen und Systeme (Germany) ..... [9751-40]

5:10 pm: **Benchmarking time-of-flight based depth measurement techniques**, Andreas Süss, Véronique Rochus, Maarten Rosmeulen, Xavier Rottenberg, IMEC (Belgium) ..... [9751-41]

5:30 pm: **A hybrid 3D LIDAR imager based on pixel-by-pixel scanning and DS-OCDMA**, Gunzung Kim, Jeongsook Eom, Yongwan Park, Yeungnam Univ. (Korea, Republic of) ..... [9751-42]

OPTO

# CONFERENCE 9752

LOCATION: ROOM 124 (NORTH EXHIBIT LEVEL)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9752

# Silicon Photonics XI

Conference Chairs: **Graham T. Reed**, Optoelectronics Research Ctr. (United Kingdom); **Andrew P. Knights**, McMaster Univ. (Canada)

Program Committee: **Laurence W. Cahill**, La Trobe Univ. (Australia); **Philippe M. Fauchet**, Vanderbilt Univ. (USA); **L. Cary Gunn**, Genalyte, Inc. (USA); **Siegfried Janz**, National Research Council Canada (Canada); **Joel Kubby**, Univ. of California, Santa Cruz (USA); **Laura Maria Lechuga**, CIN2 (Spain); **Sebania Libertino**, Istituto per la Microelettronica e Microsistemi (Italy); **Goran Z. Mashanovich**, Univ. of Southampton (United Kingdom); **Ching Eng Jason Png**, A\*STAR Institute of High Performance Computing (Singapore); **Andrew W. Poon**, Hong Kong Univ. of Science and Technology (Hong Kong, China); **Haisheng Rong**, Intel Corp. (USA); **Holger Schmidt**, Univ. of California, Santa Cruz (USA); **Dan-Xia Xu**, National Research Council Canada (Canada); **Shui-Qing Yu**, Univ. of Arkansas (USA); **Zhiping Zhou**, Peking Univ. (China)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative,  
Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break . . . . . Mon 10:10 am to 10:30 am

### SESSION 1

LOCATION: RM 124 (NORTH EXHIBIT LEVEL) MON 10:30 AM TO 12:00 PM

### Modulators

Session Chair: **Graham T. Reed**,  
Optoelectronics Research Ctr. (United Kingdom)

- 10:30 am: **Silicon-based phase shifters for high figure of merit in optical modulation** (*Invited Paper*), Kensuke Ogawa, Fujikura Ltd. (Japan) . . . . . [9752-1]
- 11:00 am: **Hybrid silicon-vanadium dioxide electro-optic modulators**, Kevin J. Miller, Petr Markov, Robert E. Marvel, Richard F. Haglund, Sharon M. Weiss, Vanderbilt Univ. (USA) . . . . . [9752-2]
- 11:20 am: **Analysis of Depletion Silicon Phase Shifter Based on Computer Simulation**, Ching Eng Png, A\*STAR Institute of High Performance Computing (Singapore) and Optic2Connect Pte Ltd (Singapore); Min Jie Sun, Optic2Connect Pte Ltd. (Singapore); Soon Thor Lim, A\*STAR Institute of High Performance Computing (Singapore); Kensuke Ogawa, Fujikura Ltd. (Japan) . . . . . [9752-3]
- 11:40 am: **Stacked double-layer nanomembrane Fano Modulators**, Yi-Chen Shuai, National Institute of Standards and Technology (USA); Deyin Zhao, The Univ. of Texas at Arlington (USA); Corey Stambaugh, National Institute of Science and Technology (USA); John R. Lawall, Neil Zimmerman, National Institute of Standards and Technology (USA); Weidong Zhou, The Univ. of Texas at Arlington (USA) . . . . . [9752-4]
- Lunch Break . . . . . Mon 12:00 pm to 1:20 pm

### SESSION 2

LOCATION: RM 124 (NORTH EXHIBIT LEVEL) . . MON 1:20 TO 3:20 PM

### Waveguide-based Devices

Session Chair: **Andrew P. Knights**, McMaster Univ. (Canada)

- 1:20 pm: **Erbium Compound Nanowires as High Gain Amplifiers and Lasers for Potential Silicon Photonics Applications** (*Invited Paper*), Cun-Zheng Ning, Arizona State Univ. (USA) and Tsinghua Univ. (China); Leijun Yin, Zhicheng Liu, Arizona State Univ. (USA); Hao Sun, Yongzhuo Li, Jianxing Zhang, Tsinghua Univ. (China) . . . . . [9752-5]
- 1:50 pm: **Large bandwidth and high power Germanium photodetector** (*Invited Paper*), Yu Yu, Wuhan National Lab. for Optoelectronics (China) and Huazhong Univ. of Science and Technology (China); Guanyu Chen, Xinliang Zhang, Wuhan National Lab. for Optoelectronics (China) and Huazhong Univ. of Science and Technology (China) . . . . . [9752-6]
- 2:20 pm: **Silicon dual-ring resonator-based push-pull modulators**, Xiaomeng Sun, Technische Univ. Berlin (Germany); Linjie Zhou, Shanghai Jiao Tong Univ. (China); Matthias Jäger, Technische Univ. Berlin (Germany); Despoina Petousi, IHP GmbH (Germany); Lars Zimmermann, Klaus Petermann, Technische Univ. Berlin (Germany) . . . . . [9752-7]
- 2:40 pm: **SWIR InGaAs/GaAsSb type-II quantum-well photodetectors and spectrometers integrated on SOI**, Ruijun Wang, Muhammad Muneeb, Univ. Gent (Belgium); Stephan Sprengel, Gerhard Boehm, Technische Univ. München (Germany); Roel G. Baets, Univ. Gent (Belgium); Markus-Christian Amann, Technische Univ. München (Germany); Gunther Roelkens, Univ. Gent (Belgium) . . . . . [9752-8]
- 3:00 pm: **CMOS-compatible polarization rotator design based on asymmetrical periodic loaded waveguide structure**, Yao Sun, Winnie N. Ye, Carleton Univ. (Canada) . . . . . [9752-9]
- Coffee Break . . . . . Mon 3:20 pm to 3:50 pm

### SESSION 3

LOCATION: RM 124 (NORTH EXHIBIT LEVEL) . . MON 3:50 TO 5:40 PM

### Light Emission

Session Chair: **Jonathan Bradley**, McMaster Univ. (Canada)

- 3:50 pm: **Tunable direct bandgap GeSn lasers for monolithic integration on Si platform** (*Invited Paper*), Dan Mihai Buca, Stephan Wirths, Forschungszentrum Jülich GmbH (Germany); Richard Geiger, Paul Scherrer Institut (Switzerland); Christian Schulte-Braucks, Nils von den Driesch, Daniela Stange, Forschungszentrum Jülich GmbH (Germany); Thomas Zabel, Paul Scherrer Institut (Switzerland); Bahareh Marzban, RWTH Aachen Univ. (Germany); Zoran Ikonc, Univ. of Leeds (United Kingdom); Jean-Michel Hartmann, CEA-LETI (France); Siegfried Mantl, Forschungszentrum Jülich GmbH (Germany); Jeremy Witzens, RWTH Aachen Univ. (Germany); Hans C. Sigg, Paul Scherrer Institut (Switzerland); Detlev Grützmacher, Forschungszentrum Jülich GmbH (Germany) . . . . . [9752-10]
- 4:20 pm: **Direct bandgap GeSn light-emitting diodes for short-wave infrared applications grown on Si**, Nils von den Driesch, Daniela Stange, Stephan Wirths, Denis Rainko, Gregor Mussler, Forschungszentrum Jülich GmbH (Germany); Zoran Ikonc, Univ. of Leeds (United Kingdom); Jean-Michel Hartmann, CEA-LETI (France) and Univ. of Grenoble Alpes (France); Detlev Grützmacher, Siegfried Mantl, Dan M. Buca, Forschungszentrum Jülich GmbH (Germany) . . . . . [9752-11]

# CONFERENCE 9752

LOCATION: ROOM 124 (NORTH EXHIBIT LEVEL)

## SESSION 5

LOCATION: RM 124 (NORTH EXHIBIT LEVEL) . TUE 10:40 AM TO 12:10 PM

### Waveguide-based Systems

Session Chair: **Ching Eng Png**,

A\*STAR Institute of High Performance Computing (Singapore)

10:40 am: **New approaches for energy saving in silicon photonics** (*Invited Paper*), Zhiping Zhou, Qingzhong Deng, Tiantian Li, Xinbai Li, Peking Univ. (China) . . . . . [9752-20]

11:10 am: **Nucleic acids optical biosensors based on SiPM technology**, Maria Francesca Santangelo, Consiglio Nazionale delle Ricerche (Italy) and Univ. degli Studi di Palermo (Italy); Emanuele Luigi Sciuto, Univ. degli Studi di Catania (Italy); Alessandro C. Busacca, Univ. degli Studi di Palermo (Italy); Salvatore Petralia, Maria Eloisa Castagna, Sabrina Conoci, STMicroelectronics (Italy); Sebania Libertino, Consiglio Nazionale delle Ricerche (Italy) . . . . . [9752-21]

11:30 am: **Monolithically-integrated young interferometers for label-free and multiplexed detection of biomolecules**, E. Savra, Antonia Malainou, Alexandros Salapatas, National Ctr. for Scientific Research Demokritos (Greece); Athanasios Botsialas, ThetaMetrisis S.A. (Greece); Panagiota Petrou, National Ctr. for Scientific Research Demokritos (Greece); Ioannis Raptis, ThetaMetrisis S.A. (Greece); Eleni Makarona, Sotirios E. Kakabakos, Konstantinos Misiakos, National Ctr. for Scientific Research Demokritos (Greece) . . . . . [9752-22]

11:50 am: **Synchrotron-based Laue micro-diffraction and Raman spectroscopy investigation of highly-strained GeOI micro-bridges for photonics applications**, Alban Gassenq, Samuel Tardif, Ivan Duchemin, Kevin Guillo, CEA-INAC (France); Guilherme Osvaldo Dias, Denis Rouchon, Jean-Michel Hartmann, Julie Widiez, CEA-LETI (France); Jose Maria Escalante Fernandez, CEA-INAC (France); Daivid Fowler, CEA-LETI (France); Yann-Michel Niquet, CEA-INAC (France); Jérôme Faist, ETH Zürich (Switzerland); Richard Geiger, Thomas Zabel, Hans C. Sigg, Paul Scherrer Institut (Switzerland); Nicolas Pauc, Francois Rieutord, Alexei Chelnokov, CEA-INAC (France); Vincent Reboud, CEA-LETI (France); Vincent Calvo, CEA-INAC (France) . . . . . [9752-23]

Lunch/Exhibition Break . . . . . Tue 12:10 pm to 1:30 pm

**PANEL DISCUSSION**  
**LOCATION: RM 103 (SOUTH EXHIBIT LEVEL) . . . 1:30 TO 3:00 PM**

**Integrated Photonics Panel:  
An Industry Perspective**

Demand for smaller and cheaper optical interconnections inside networks and computers will create a new market of miniaturized, low-cost photonic components that can leverage the scale of CMOS manufacturing. Learn what industry leaders have developed at the frontier of the silicon photonics market.

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

## SESSION 6

LOCATION: RM 124 (NORTH EXHIBIT LEVEL) . . . TUE 3:30 TO 5:20 PM

### Mid IR Silicon Photonics

Session Chair: **Graham T. Reed**,

Optoelectronics Research Ctr. (United Kingdom)

3:30 pm: **High-speed resonant detection via defect states in silicon disk resonators** (*Invited Paper*), Andrew P. Knights, Jason J Ackert, McMaster Univ. (Canada) . . . . . [9752-24]

4:00 pm: **Dispersion engineering of silicon-on-sapphire (SoS) waveguides for mid-infrared applications**, Raghi S. El Shamy, Hany Mossad, Mohamed A. Swillam, The American Univ. in Cairo (Egypt) . . . . . [9752-25]

4:20 pm: **Keeping 2D materials visible even buried in sol wafers**, Ergun Simsek, Bablu Mukherjee, The George Washington Univ. (USA) . . . . . [9752-26]

4:40 pm: **Mid-infrared silicon-on-sapphire waveguide-coupled photonic crystal microcavities**, Yi Zou, The Univ. of Texas at Austin (USA); Swapnajit Chakravarty, Omega Optics, Inc. (USA); Ray T. Chen, The Univ. of Texas at Austin (USA) . . . . . [9752-27]

5:00 pm: **Nanoscale confinement of silicon slot waveguides in the MIR**, Rania Gamal, Yehia Ismaiel, Mohamed A. Swillam, The American Univ. in Cairo (Egypt) . . . . . [9752-28]

4:40 pm: **Hybrid integration of carbon nanotubes into silicon slot photonic structures**, Elena Durán-Valdeiglesias, Weiwei Zhang, Thi Hong Cam Hoang, Carlos Alonso-Ramos, Univ. Paris-Sud 11 (France); Adrien Noury, Univ. Paris-Sud 11 (France) and ICFO-Institut de Ciencias Fotoniques (Spain); Samuel Serna, Xavier Le Roux, Eric Cassan, Univ. Paris-Sud 11 (France); Nicolas Izard, Univ. Paris-Sud 11 (France) and Univ. Montpellier 2 (France); Laurent Vivien, Univ. Paris-Sud 11 (France); Francesco Sarti, Ughetta Torrini, Anna Vinattieri, Massimo Gurioli, Univ. degli Studi di Firenze (Italy); Matteo Balestrieri, Al-Saleh Keita, Arianna Filoramo, Commissariat à l'Énergie Atomique (France); Hongliu Yang, Viktor Bezugly, Gianarelio Cuniberti, TU Dresden (Germany) . . . [9752-12]

5:00 pm: **Black silicon-based infrared radiation source**, Momen Anwar, Si-Ware Systems (Egypt) and Ain-Shams Univ. (Egypt); Yasser M. Sabry, Ain-Shams Univ. (Egypt) and Si-Ware Systems (Egypt); Philippe Basset, Frédéric Marty, Univ. Paris-EST (France); Tarik Bourouina, Univ. Paris-EST (France) and Si-Ware Systems (France); Diaa A. Khalil, Ain-Shams Univ. (Egypt) and Si-Ware Systems (Egypt) . . . . . [9752-13]

5:20 pm: **Ultra-high amplified strains in 200-mm optical germanium-on-insulator (GeOI) substrates: towards CMOS-compatible Ge lasers**, Vincent Reboud, Alban Gassenq, Guilherme Osvaldo Dias, CEA-LETI (France); Kevin Guillo, Jose Maria Escalante Fernandez, Samuel Tardif, CEA-INAC (France); Daivid Fowler, Denis Rouchon, Ivan Duchemin, CEA-LETI (France); Yann-Michel Niquet, CEA-INAC (France); Jérôme Faist, ETH Zürich (Switzerland); Richard Geiger, Thomas Zabel, Hans C. Sigg, Paul Scherrer Institut (Switzerland); Francois Rieutord, Nicolas Pauc, CEA-INAC (France); Julie Widiez, Jean-Michel Hartmann, Alexei Chelnokov, CEA-LETI (France); Vincent Calvo, CEA-INAC (France) . . . . . [9752-14]

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: RM 124 (NORTH EXHIBIT LEVEL) . .TUE 8:00 TO 10:10 AM

### Systems

Session Chair: **Zhiping Zhou**, Peking Univ. (China)

8:00 am: **100-Gb/s photoreceiver module based on 4ch x 25 Gb/s vertical-illumination-type Ge-on-Si photodetectors and amplifier circuits**, Jiho Joo, Ki-Seok Jang, Sang Hoon Kim, ETRI (Korea, Republic of); In Gyoo Kim, Electronics and Telecommunications Research Institute (Korea, Republic of); Jin Hyuk Oh, Sun Ae Kim, Gyungock Kim, ETRI (Korea, Republic of); Gyu-Seob Jeong, Hankyu Chi, Deog-Kyoon Jeong, Seoul National Univ. (Korea, Republic of) . . . . . [9752-15]

8:20 am: **Photonics meets a modern transistor: building high-performance electronic-photonics systems with integrated silicon-photonics** (*Invited Paper*), Vladimir M. Stojanovic, Univ. of California, Berkeley (USA) . . . . . [9752-16]

8:50 am: **Simplified architecture for photonic analog-to-digital conversion utilizing an array of optical modulators**, Hayk Gevorgyan, Anatoly M. Khilo, Masdar Institute of Science & Technology (United Arab Emirates) . . . . . [9752-17]

9:10 am: **CMOS-compatible transmitters and short-reach data link power efficiency** (*Invited Paper*), Douglas M. Gill, Chi Xiong, Jonathan E. Proesel, Jessie C. Rosenberg, Jason S. Orcutt, Marwan H. Khater, John J. Ellis-Monaghan, Andreas D. Stricker, Edward Kiewra, Yves C. Martin, Wilfried Haensch, William M. J. Green, IBM Thomas J. Watson Research Ctr. (USA) . . . . . [9752-18]

9:40 am: **Silicon large-scale optical switches using MZIs and dual-ring assisted MZIs** (*Invited Paper*), Linjie Zhou, Shanghai Jiao Tong Univ. (China) . . . . . [9752-19]

Coffee Break . . . . . Tue 10:10 am to 10:40 am

OPTO

# CONFERENCE 9752

LOCATION: ROOM 124 (NORTH EXHIBIT LEVEL)

WEDNESDAY 17 FEBRUARY

## SESSION 7

LOCATION: RM 124 (NORTH EXHIBIT LEVEL) . WED 8:30 TO 10:10 AM

### Waveguide Devices I

Session Chair: **Andrew P. Knights**, McMaster Univ. (Canada)

8:30 am: **Subwavelength grating waveguide-integrated athermal Mach-Zehnder interferometer with enhanced fabrication error tolerance and wide stable spectral range**, Peng Xing, Jaime Viegas, Masdar Institute of Science & Technology (United Arab Emirates) . . . . . [9752-29]

8:50 am: **Design and characterization of low-loss 2D grating couplers for silicon photonics integrated circuits**, Cosimo Lacava, Univ. degli Studi di Pavia (Italy) and Optoelectronics Research Ctr. (United Kingdom); Lee Carrol, Univ. degli Studi di Pavia (Italy) and Tyndall National Institute (Ireland); Angelo Bozzola, Univ. degli Studi di Pavia (Italy) and Istituto Italiano di Tecnologia (Italy); Riccardo Marchetti, Paolo Minzioni, Ilaria Cristiani, Univ. degli Studi di Pavia (Italy); Maryse Fournier, Stéphane Bernabé, CEA-LETI (France); Dario Gerace, Lucio C. Andreani, Univ. degli Studi di Pavia (Italy) . . . . . [9752-30]

9:10 am: **CMOS-compatible spot-size converter for optical fiber to sub- $\mu$ m silicon waveguide coupling with low-loss low-wavelength dependence and high tolerance to alignment**, Marie-Josée Picard, Christine Latrasse, Carl Larouche, TeraXion Inc. (Canada); Yves Painchaud, TeraXion Inc. (Canada); Michel Poulin, Francois Pelletier, Martin Guy, TeraXion Inc. (Canada) . . . . . [9752-31]

9:30 am: **Ultrafast all-optical adders based on hydrogenated amorphous silicon microring resonators**, Dusan Gostimirovic, Winnie N. Ye, Carleton Univ. (Canada) . . . . . [9752-36]

9:50 am: **A low-cost technique for adding microlasers to a silicon photonic platform**, Joan Juvert, Univ. of Glasgow (United Kingdom); Iain Eddie, Compound Semiconductor Technologies Global Ltd. (United Kingdom); Colin Mitchell, Graham T. Reed, James S. Wilkinson, Univ. of Southampton (United Kingdom); Anthony Kelly, Steven L. Neale, Univ. of Glasgow (United Kingdom) . . . . . [9752-33]

Coffee Break . . . . . Wed 10:10 am to 10:40 am

## SESSION 8

LOCATION: RM 124 (NORTH EXHIBIT LEVEL) WED 10:40 AM TO 12:10 PM

### Waveguide Devices II

Session Chair: **Graham T. Reed**,  
Optoelectronics Research Ctr. (United Kingdom)

10:40 am: **Diamond quantum nanophotonics (Invited Paper)**, Marko Loncar, Harvard School of Engineering and Applied Sciences (USA) . . . . . [9752-34]

11:10 am: **Flat-top MZI filters: a novel robust design based on MMI splitters**, Matteo Cherchi, Sami Ylinen, Mikko Harjanne, Markku Kapulainen, Tapani Vehmas, Timo Aalto, VTT Technical Research Ctr. of Finland Ltd. (Finland) . . . . . [9752-35]

11:30 am: **Ultra-low-power silicon photonics wavelength converter for phase-encoded telecommunication signals**, Cosimo Lacava, Mohamed A. Ettabib, Univ. of Southampton (United Kingdom); Ilaria Cristiani, Univ. degli Studi di Pavia (Italy); Jean-Marc Fédéli, CEA-LETI (France); David J. Richardson, Periklis Petropoulos, Univ. of Southampton (United Kingdom) . . . . . [9752-32]

11:50 am: **Ultra-low-loss fully-etched grating couplers for perfectly-vertical coupling compatible with DUV lithography tools**, George Dabos, Aristotle Univ. of Thessaloniki (Greece); Nikos Pleros, Aristotle Univ. of Thessaloniki (Greece) and Informatics and Telematics Institute (Greece); Dimitris M. Tsiokos, Aristotle Univ. of Thessaloniki (Greece) and Informatics and Telematics Institute (Greece) . . . . . [9752-37]

Lunch/Exhibition Break . . . . . Wed 12:10 pm to 1:40 pm

## SESSION 9

LOCATION: RM 124 (NORTH EXHIBIT LEVEL) . . WED 1:40 TO 3:30 PM

### Waveguide Devices III

Session Chair: **Pavel Cheben**,  
National Research Council Canada (Canada)

1:40 pm: **Subwavelength suspended structures in silicon (Invited Paper)**, Alejandro Ortega-Moñux, Univ. de Málaga (Spain); Jordi Soler-Penadés, Milos Nedeljkovic, Univ. of Southampton (United Kingdom); J. Gonzalo Wangüermert-Pérez, Univ. de Málaga (Spain); Ali Z. Khokhar, Univ. of Southampton (United Kingdom); Carlos Alonso-Ramos, Univ. de Málaga (Spain) and Univ. Paris-Sud (France); Robert Halir, Univ. de Málaga (Spain); Goran Z. Mashanovich, Univ. of Southampton (United Kingdom); Iñigo Molina-Fernández, Univ. de Málaga (Spain); Pavel Cheben, National Research Council Canada (Canada) . . [9752-38]

2:10 pm: **Microheater-integrated silicon coupled photonic crystal microcavities for low-power thermo-optic switching over a wide spectrum**, Xingyu Zhang, The Univ. of Texas at Austin (USA) and Hewlett-Packard Co. (USA); Swapnajit Chakravarty, Omega Optics, Inc. (USA); Chi-Jui Chung, Zeyu Pan, The Univ. of Texas at Austin (USA); Ray T. Chen, The Univ. of Texas at Austin (USA) and Omega Optics, Inc. (USA) . . . . . [9752-40]

2:30 pm: **Chiral spiral waveguides based on MMI crossings: theory and experiments**, Matteo Cherchi, Sami Ylinen, Mikko Harjanne, Markku Kapulainen, Tapani Vehmas, Timo Aalto, VTT Technical Research Ctr. of Finland Ltd. (Finland) . . . . . [9752-41]

2:50 pm: **Nonlinear distortions in silicon microring resonator filters and their impact on integrated photonic ADCs**, Kenaish Al Qubaisi, Anatoly M. Khilo, Masdar Institute of Science & Technology (United Arab Emirates) . . . . . [9752-42]

3:10 pm: **Novel spot size converter for coupling standard single mode fibers to SOI waveguides**, Marco Michele Sisto, Bruno Fisette, Jacques-Edmond E. Paultre, Alex Paquet, Yan Desroches, INO (Canada) . . . . . [9752-50]

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Generation of tunable high-repetition-rate frequency combs with equalized spectra using carrier-injection-based silicon modulators**, Nagarjun K.P., Shankar Kumar Selvaraja, V. R. Supradeepa, Indian Institute of Science (India) . . . . . [9752-43]

**Improving the opto-microwave performance of SiGe/Si phototransistor through edge-illuminated structure**, Zerihun G. Tegegne, ESIEE Paris (France); Carlos Viana, Univ. Paris-Est Marne-la-Vallée (France) and ESIEE Paris (France); Jean-Luc Polleux, ESIEE Paris (France) and Univ. Paris-EST (France); Marjorie Grzeskowiak, Elodie Richalot, Univ. Paris-EST (France) and ESIEE Paris (France) . . . . . [9752-44]

**Device characterization of the VCSEL-on-silicon as an on chip light source**, Myung-Joon Kwack, Ki-Seok Jang, Jiho Joo, Hyundai Park, Jin Hyuk Oh, Jaegyung Park, Sanggi Kim, Gyungock Kim, Electronics and Telecommunications Research Institute (Korea, Republic of) . . . . . [9752-45]

**Resonance-spacing tuning over whole free spectral range in a single microring resonator**, Ge Gao, Jinsong Xia, Huazhong Univ. of Science and Technology (China) . . . . . [9752-46]

**Inverse design of non-periodic components for silicon photonics**, Imanol Andonegui, Ibon Alonso, Angel J. Garcia-Adeva, Univ. del País Vasco (Spain) . . . . . [9752-47]

**Si photonics expands to mid-wave and long-wave infrared: fundamentals and applications**, Volodymyr K. Maluytenko, V.E. Lashkaryov Institute of Semiconductor Physics (Ukraine) . . . . . [9752-48]

**MEMS-based IR-sources**, Sebastian J. Weise, Micro-Hybrid Electronic GmbH (Germany) . . . . . [9752-49]



# CONFERENCE 9753

LOCATION: ROOM 308 (SOUTH ESPLANADE)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9753

## Optical Interconnects XVI

Conference Chairs: **Henning Schröder**, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); **Ray T. Chen**, The Univ. of Texas at Austin (USA)

Program Committee: **Bill Blubaugh**, US Conec Ltd. (USA); **Patrick B. Chu**, Sandia National Labs. (USA); **Alan F. Evans**, Corning Incorporated (USA); **Alexei L. Glebov**, OptiGrate Corp. (USA); **Ruth Houbertz**, Multiphoton Optics GmbH (Germany); **Marika P. Immonen**, TTM Technologies, Inc. (Finland); **Takaaki Ishigure**, Keio Univ. (Japan); **Wei Jiang**, Rutgers, The State Univ. of New Jersey (USA); **Mikko Karppinen**, VTT Technical Research Ctr. of Finland (Finland); **Christian Koos**, Karlsruhe Institut für Technologie (Germany); **Bert-Jan Offrein**, IBM Research – Zürich (Switzerland); **Hyo-Hoon Park**, KAIST (Korea, Republic of); **Nikos Pleros**, Aristotle Univ. of Thessaloniki (Greece); **Richard C. Pitwon**, Xyratex Technology Ltd. (United Kingdom); **Richard Soref**, Univ. of Massachusetts Boston (USA); **David J. Thomson**, Univ. of Southampton (United Kingdom); **Peter Van Daele**, Univ. Gent (Belgium); **Alan X. Wang**, Oregon State Univ. (USA); **Michael R. Wang**, Univ. of Miami (USA); **Ian H. White**, Univ. of Cambridge (United Kingdom); **Chris Q. Wu**, Corning Incorporated (USA); **Xiaochuan Xu**, Omega Optics, Inc. (USA)

### MONDAY 15 FEBRUARY

#### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative, Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break . . . . . Mon 10:10 am to 10:30 am

#### SESSION 1

LOCATION: RM 308 (SOUTH ESPLANADE) .. MON 10:30 AM TO 12:30 PM

#### Novel Optical Waveguide and Interconnect Technologies

Session Chair: **Henning Schröder**, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany)

- 10:30 am: **GI-core polymer waveguide based on polynorborene for optical interconnection** (*Invited Paper*), Katsuma Kitazoe, Ryota Kinoshita, Akihiro Horimoto, SUMITOMO BAKELITE Co., Ltd. (Japan) . . . . . [9753-1]
- 11:00 am: **High-precision 3D printing: fabrication of micro-optics and integrated optical packages**, Ruth Houbertz, Moritz Esslinger, Multiphoton Optics GmbH (Germany); Sönke Steenhusen, Fraunhofer-Institut für Siliciumforschung (Germany); Gianni Preve, Consorzio Nazionale Interuniversitario per le Telecomunicazioni (Italy) . . . . . [9753-2]
- 11:20 am: **High-bandwidth and low-loss multimode polymer waveguides and waveguide components for high-speed board-level optical interconnects** (*Invited Paper*), Nikos Bamiedakis, Jian Chen, Richard V. Penty, Ian H. White, Univ. of Cambridge (United Kingdom) . . . . . [9753-3]
- 11:50 am: **Low-Loss Graded Index Multimode Polymer Crossed Waveguides Fabricated Using the Imprint Method**, Yutaro Oizumi, Takaaki Ishigure, Keio Univ. (Japan) . . . . . [9753-4]
- 12:10 pm: **Comparison of self-written waveguide techniques and bulk index matching for low-loss polymer waveguide interconnects**, Derek Burrell, Christopher T. Middlebrook, Michigan Technological Univ. (USA) . . . . . [9753-5]
- Lunch Break . . . . . Mon 12:30 pm to 1:30 pm

#### SESSION 2

LOCATION: RM 308 (SOUTH ESPLANADE) . . . . MON 1:30 TO 3:30 PM

#### Nanophotonics for Optical Interconnects

Session Chair: **Ray T. Chen**, The Univ. of Texas at Austin (USA)

- 1:30 pm: **A chip scale optical Tx/Rx based on silicon photonics from views of multi-mode transmission** (*Invited Paper*), Ichiro Ogura, Photonics Electronics Technology Research Association (Japan) . . . . . [9753-6]
- 2:00 pm: **Silicon photonics for 100 Gbit/s intra-data center optical interconnects** (*Invited Paper*), Stefan Meister, Hanjo Rhee, Christoph Theiss, Technische Univ. Berlin (Germany) and Sicoya GmbH (Germany); Sebastian Kupijai, Aws Al-Saadi, Danilo Bronzi, Marvin Henniges, David Selicke, Muhammad Atif, Milan Gajewski, Technische Univ. Berlin (Germany); David Stolarek, Andreas Mai, Mehmet Kaynak, Stefan Lischke, Harald H. Richter, Lars Zimmermann, Bernd Tillack, IHP GmbH (Germany) . . . . . [9753-7]
- 2:30 pm: **Silicon germanium on graded buffer as a new platform for optical interconnects on silicon**, Vladyslav Vakarin, Institut d'Électronique Fondamentale (France); Papichaya Chaisakul, Institut d'Électronique Fondamentale (France) and The Univ. of Tokyo (Japan); Jacopo Frigerio, Andrea Ballabio, Politecnico di Milano (Italy); Xavier Le Roux, Jean-René Coudeville, Laurent Vivien, Institut d'Électronique Fondamentale (France); Giovanni Isella, Politecnico di Milano (Italy); Delphine Marris-Morini, Institut d'Électronique Fondamentale (France) . . . . . [9753-8]
- 2:50 pm: **Low latency, area, and energy efficient hybrid photonic plasmonic on-chip interconnects**, Shuai Sun, The George Washington Univ. (USA); Abdel-Hameed A. Badaway, The George Washington Univ. (USA) and Arkansas Tech Univ. (USA); Tarek El-Ghazawi, Volker J. Sorger, The George Washington Univ. (USA) . . . . . [9753-9]
- 3:10 pm: **An efficient total-internal-reflection optical switch based on reverse breakdown of pn junction and thermo-optic effect in silicon**, Jong-hun Kim, Hyo-Hoon Park, KAIST (Korea, Republic of) . . . . . [9753-10]
- Coffee Break . . . . . Mon 3:30 pm to 4:00 pm

#### SESSION 3

LOCATION: RM 308 (SOUTH ESPLANADE) . . . . MON 4:00 TO 5:50 PM

#### Hybrid Integrated Optical Link Modules

Session Chair: **Alan F. Evans**, Corning Incorporated (USA)

- 4:00 pm: **Technical and economic challenges and opportunities for optical interconnect technologies** (*Invited Paper*), Daniel Mahgerefteh, Craig Thompson, Finisar Corp. (USA) . . . . . [9753-11]
- 4:30 pm: **Integrating III-V, Si, and polymer waveguides for optical interconnects: RAPIDO** (*Invited Paper*), Timo Aalto, Mikko Harjanne, VTT Technical Research Ctr. of Finland Ltd. (Finland); Bert-Jan Offrein, Charles Caër, IBM Research - Zürich (Switzerland); Christian Neumeyer, Vertilas GmbH (Germany); Antonio Malacarne, Consorzio Nazionale Interuniversitario per le Telecomunicazioni (Italy) and Scuola Superiore Sant'Anna (Italy); Mircea Guina, Tampere Univ. of Technology (Finland); Frank Hudson Peters, Tyndall National Institute (Ireland); Petri Melanen, Modulight, Inc. (Finland) . . . . . [9753-12]
- 4:50 pm: **Extended temperature performance of 120 Gb/s midboard optical engine**, Josh Cornelius, Samtec Optical Group (USA); Aaron Baumer, SAMTEC USA (USA); Eric Zbinden, David Langsam, Marc Verdiell, Samtec Optical Group (USA) . . . . . [9753-13]

OPTO

# CONFERENCE 9753

LOCATION: ROOM 308 (SOUTH ESPLANADE)

5:10 pm: **A novel method for optical engine testing**, Bo Lin, Jeffrey DeMeritt, Randall Harrison, Craig Strause, Nicholas Hein, Corning Incorporated (USA) ..... [9753-14]

5:30 pm: **Scalable electro-photonics integration concept based on polymer waveguides**, Erwin Bosman, Geert Van Steenberge, Univ. Gent (Belgium); Arjen Boersma, Sjoukje Wieggersma, TNO (Netherlands); Mikko Karppinen, Tia Korhonen, VTT Technical Research Ctr. of Finland Ltd. (Finland); Bert-Jan Offrein, Roger F. Dangel, IBM Research - Zürich (Switzerland); Markus Ortsiefer, Aydan Daily, Vertilas GmbH (Germany); John Justice, Brian Corbett, Tyndall National Institute (Ireland); Jeroen Duis, Sander Dorrestein, TE Connectivity Ltd. (Switzerland) ..... [9753-50]

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: RM 308 (SOUTH ESPLANADE) ... TUE 8:00 TO 10:00 AM

#### Electrical-Optical PCB Technologies

Session Chair: **Marika P. Immonen**, TTM Technologies, Inc. (Finland)

8:00 am: **Multilayer optical interconnects using ultrafast laser direct written 3D waveguides and ion exchange surface waveguides** (*Invited Paper*), Kevin Chen, Yawen Huang, Sheng Huang, Rongtao Cao, Univ. of Pittsburgh (USA); Ming-Jun Li, Corning Incorporated (USA) ..... [9753-15]

8:30 am: **Planar polymer and glass graded index waveguides for data centre applications**, Richard C. Pitwon, Seagate Systems (UK) Ltd. (United Kingdom); Akira Yamauchi, Keio Univ. (Japan); Lars Brusberg, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); Kai Wang, Seagate Systems (UK) Ltd. (United Kingdom); Takaaki Ishigure, Keio Univ. (Japan); Henning Schröder, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); Alex Worrall, Seagate Systems (UK) Ltd. (United Kingdom). [9753-16]

8:50 am: **Electro-optical circuit board with single-mode glass waveguide optical interconnects**, Lars Brusberg, Dominik Pernthaler, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); Daniel Weber, Technische Univ. Berlin (Germany); Bogdan Sirbu, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); Christian Herbst, Technische Univ. Berlin (Germany); Christopher Frey, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); Marco Queisser, Markus Wöhrmann, Dionysios Manassis, Beatrice Schild, Technische Univ. Berlin (Germany); Hermann Oppermann, Yann Eichhammer, Henning Schröder, Andreas Hakansson, Tolga Tekin, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany) ..... [9753-17]

9:10 am: **Assembly and performance of silicone polymer waveguides** (*Invited Paper*), Brandon W. Swatowski, Dow Corning Corp. (USA); Calob K. Lostutter, Molex, Incorporated (USA); W. K. Weidner, Dow Corning Corp. (USA); Malcolm H. Hodge, Molex, Incorporated (USA); Thomas R. Marrapode, Molex Fiber Optics (USA) ..... [9753-18]

9:40 am: **Low-loss optical coupling between waveguide and optical modules via 45-degree mirrors realized with graded-index core structure**, Yoshie Morimoto, Takaaki Ishigure, Keio Univ. (Japan) ..... [9753-19]

Coffee Break ..... Tue 10:00 am to 10:30 am

### SESSION 5

LOCATION: RM 308 (SOUTH ESPLANADE) TUE 10:30 AM TO 12:20 PM

#### Optical Interconnect Devices and Modulators

Session Chair: **Nikos Pleros**, Aristotle Univ. of Thessaloniki (Greece)

10:30 am: **Light emitters and modulators on SOI for optical interconnects** (*Invited Paper*), Yikai Su, Ciyuan Qiu, Yong Zhang, Ruili Liu, Shanghai Jiao Tong Univ. (China) ..... [9753-20]

11:00 am: **Design of ultra-compact plasmonic-organic waveguide modulator**, Qian Gao, Alan X. Wang, Oregon State Univ. (USA) ..... [9753-21]

11:20 am: **Low-loss hybrid ultra-thin silicon and polymer waveguide and modulator application**, Shiyoshi Yokoyama, Feng Qiu, Andrew M. Spring, Kyushu Univ. (Japan) ..... [9753-22]

11:40 am: **High quality factor trapezoid subwavelength grating waveguide micro-ring resonator**, Zheng Wang, The Univ. of Texas at Austin (USA); Xiaochuan Xu, Omega Optics, Inc. (USA); D. L. Fan, Yaguo Wang, Ray T. Chen, The Univ. of Texas at Austin (USA) ..... [9753-23]

12:00 pm: **Miniature mid-infrared thermo-optic switch with photonic crystal waveguide-based silicon-on-sapphire Mach-Zehnder interferometers**, Yi Zou, The Univ. of Texas at Austin (USA); Swapnajit Chakravarty, Omega Optics, Inc. (USA); Chi-Jui Chung, Ray T. Chen, The Univ. of Texas at Austin (USA) ..... [9753-24]

Lunch/Exhibition Break ..... Tue 12:20 pm to 1:50 pm

### SESSION 6

LOCATION: RM 308 (SOUTH ESPLANADE) ..... TUE 1:50 TO 3:20 PM

#### Fiber Optics and Micro-Optics Integration

Session Chair: **Bill Blubaugh**, US Conec Ltd. (USA)

1:50 pm: **Multimode and single-mode fibers for data center and high-performance computing applications** (*Invited Paper*), Scott Bickham, Corning Optical Communications (USA) ..... [9753-25]

2:20 pm: **Integration of 150-Gbps/fiber optical engines based on multicore fibers and 6-channel VCSELs and PDs**, Mikko Karppinen, Antti Tanskanen, Veli Heikkinen, Petri Myöhänen, Noora Salminen, Jyrki Ollila, Olli Tapaninen, VTT Technical Research Ctr. of Finland Ltd. (Finland); Petter Westberg, Johan Gustavsson, Anders Larsson, Chalmers Univ. of Technology (Sweden); Rashid Safaisini, Roger King, Philips GmbH U-L-M Photonics (Germany); Minsu Ko, Dietmar Kissinger, Ahmet Çağrı Ulusoy, IHP GmbH (Germany); Thierry F. Taunay, Lalitkumar Bansal, OFS Fitel LLC (USA); Lars Grüner-Nielsen, OFS (Denmark); Efstratios Kehayas, James Edmunds, Leontios Stampoulidis, Gooch & Housego Systems Technology Group (United Kingdom) ..... [9753-26]

2:40 pm: **Full-mesh optical backplane with standard MM fiber ribbons**, Maddalena Ferrario, Domenico Coviello, Pierpaolo Boffi, Mario Martinelli, Politecnico di Milano (Italy); Vito Basile, Irene Fassi, Istituto di Tecnologie Industriali e Automazione (Italy); Matteo Falucci, Compel Electronics S.p.A. (Italy) ..... [9753-27]

3:00 pm: **Analysis of multi-mode to single-mode conversion at 635 nm and 1550 nm**, Alethea Vanessa Zamora Gomez, Norbert Arndt-Staufenbiel, Jens Hofmann, Angelina Bogatzki, Henning Schröder, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany) ..... [9753-28]

Coffee Break ..... Tue 3:20 pm to 3:50 pm

### SESSION 7

LOCATION: RM 308 (SOUTH ESPLANADE) ..... TUE 3:50 TO 5:40 PM

#### Optical Interconnect Systems

Session Chair: **Richard C. Pitwon**, Seagate Systems (UK) Ltd. (United Kingdom)

3:50 pm: **Exabits/s integrated photonic interconnection technology for flexible data-centric optical networks** (*Invited Paper*), Le N. Binh, Thomas T. Wang, Huawei Technologies Duesseldorf GmbH (Germany); Gordon Liu Ning, Huawei Technologies Co., Ltd. (China) ..... [9753-29]

4:20 pm: **High-performance flat datacenter network architecture based on scalable and flow-controlled optical switching system** (*Invited Paper*), Nicola Calabretta, Wang Miao, Harmen J. S. Dorren, Technische Univ. Eindhoven (Netherlands) ..... [9753-30]

4:50 pm: **Optical circuit switches in computing systems: hype or reality?** (*Invited Paper*), Laurent Schares, IBM Thomas J. Watson Research Ctr. (USA) ..... [9753-32]

5:20 pm: **Printed electro-optic polymer-based reconfigurable logic devices for optical interconnects**, Harish Subbaraman, Omega Optics, Inc. (USA); Zeyu Pan, The Univ. of Texas at Austin (USA); Cheng Zhang, Qiaochu Li, Univ. of Michigan (USA); Chi-Jui Chung, Xingyu Zhang, The Univ. of Texas at Austin (USA); L. Jay Guo, Univ. of Michigan (USA); Ray T. Chen, The Univ. of Texas at Austin (USA) ..... [9753-33]

# CONFERENCE 9753

LOCATION: ROOM 308 (SOUTH ESPLANADE)

## WEDNESDAY 17 FEBRUARY

### SESSION 8

LOCATION: RM 308 (SOUTH ESPLANADE) . . . WED 8:10 TO 10:00 AM

### PICs for Optical Interconnects

Session Chair: **Alan X. Wang**, Oregon State Univ. (USA)

8:10 am: **Silicon optical routers for photonic networks-on-chip** (*Invited Paper*), Lin Yang, Yuhao Xia, Yunchou Zhao, Qiaoshan Chen, Institute of Semiconductors (China) . . . . . [9753-34]

8:40 am: **SiN-assisted flip-chip adiabatic coupler between SiPh and Glass OPCBs**, Giannis N. Pouloupoulos, Catherine Baskiotis, Dimitrios Kalavrouziotis, National Technical Univ. of Athens (Greece); Lars Brusberg, Henning Schröder, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); Dimitrios Apostolopoulos, Hercules Avramopoulos, National Technical Univ. of Athens (Greece) . . . . . [9753-35]

9:00 am: **Bimorph actuators in thick silicon dioxide for photonic active alignment**, Kai Wu, Tjitte-Jelte Peters, Marcel Tichem, Technische Univ. Delft (Netherlands) . . . . . [9753-36]

9:20 am: **Experimental study of silicon ring resonators and ultra-low losses waveguides for efficient silicon optical interposers**, Vincent Reboud, Benjamin Blampey, Paul Gindre, Olivier Dubray, David Fowler, Olivier Lemonnier, Edouard Grellier, Maryse Fournier, Yvain Thonnart, Stéphane Bernabé, CEA-LETI (France) . . . . . [9753-37]

9:40 am: **Reduced nonlinearities in 100-nm high SOI waveguides**, Cosimo Lacava, Univ. degli Studi di Pavia (Italy) and Optoelectronics Research Ctr. (United Kingdom); Riccardo Marchetti, Valerio Vitali, Ilaria Cristiani, Guido Giuliani, Univ. degli Studi di Pavia (Italy); Maryse Fournier, Stéphane Bernabé, CEA-LETI (France); Paolo Minzioni, Univ. degli Studi di Pavia (Italy) . . . [9753-38]

Coffee Break . . . . . Wed 10:00 am to 10:30 am

### SESSION 9

LOCATION: RM 308 (SOUTH ESPLANADE) .. WED 10:30 AM TO 12:20 PM

### Hybrid Device Integration Approaches for Silicon Photonics Chips

Session Chair: **Patrick B. Chu**, Sandia National Labs. (USA)

10:30 am: **Si-based light-emitting devices based on Ge quantum dots in optical microcavities** (*Invited Paper*), Jinsong Xia, Cheng Zeng, Yong Zhang, Huazhong Univ. of Science and Technology (China); Zuimin Jiang, Fudan Univ. (China) . . . . . [9753-39]

11:00 am: **Low-power chip-level optical interconnects based on bulk-silicon single-chip photonic transceivers**, Gyungock Kim, Hyundai Park, Jiho Joo, Ki-Seok Jang, Myung-Joon Kwack, Sang Hoon Kim, In Gyoo Kim, Sun Ae Kim, Jin Hyuk Oh, Jaegyu Park, Sanggi Kim, Electronics and Telecommunications Research Institute (Korea, Republic of) . . . . . [9753-40]

11:20 am: **Integration of InAs quantum-dot comb lasers with silicon photonics components**, Ruizhe Yao, Univ. of Massachusetts Lowell (USA); Zihao Wang, Stefan F. Preble, Rochester Institute of Technology (USA); Chi-Sen Lee, Wei Guo, Univ. of Massachusetts Lowell (USA) . . . . . [9753-41]

11:40 am: **Wavelength-tunable external-cavity laser with silicon photonic crystal (PhC) cavity-based resonant reflector**, Liam O'Faolain, Alexandros A. Liles, Univ. of St. Andrews (United Kingdom) . . . . . [9753-42]

12:00 pm: **Low-loss curved subwavelength grating waveguide based on index engineering**, Zheng Wang, The Univ. of Texas at Austin (USA); Xiaochuan Xu, Omega Optics, Inc. (USA); D. L. Fan, Yaguo Wang, Ray T. Chen, The Univ. of Texas at Austin (USA) . . . . . [9753-43]

### POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Suspended mid-infrared fiber-to-chip grating couplers for SiGe waveguides**, Julien Favreau, Cédric Durantin, Salim Boutami, Jean-Marc Fédéli, CEA-LETI (France); Guang-Hua Duan, III-V Lab. (France) . . . . . [9753-44]

**A new design for coupling light between silicon strip waveguide and plasmonic slot waveguide**, Bingqing Zhu, Hon Ki Tsang, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . [9753-45]

**Simulation, fabrication, and characterization of a multimode SUB waveguide bend integrated with plano-convex lenses in a novel design**, Zahra Abdolahi, Hao Jiang, Bozena Kaminska, Simon Fraser Univ. (Canada) . . . . . [9753-46]

**High-performance Ge-on-Si avalanche photodetector**, Ki-Seok Jang, Sang Hoon Kim, In Gyoo Kim, Jin Hyuk Oh, Sun Ae Kim, Gyungock Kim, Electronics and Telecommunications Research Institute (Korea, Republic of) . . . . . [9753-47]

**Composite axilens-axicon diffractive optical elements for generation of ring patterns with high focal depth**, Anand Vijayakumar, Raghu Dharmavarapu, Indian Institute of Technology Madras (India); Robert Brunner, Ernst-Abbe-Hochschule Jena (Germany); Shanti Bhattacharya, Indian Institute of Technology Madras (India) . . . . . [9753-48]

**Design and process consideration for minimizing optical loss in lens-based connector assemblies**, Xin Liu, Corning Optical Communications (USA) . . . . . [9753-49]

OPTO

# CONFERENCE 9754

LOCATION: ROOM 123 (NORTH EXHIBIT LEVEL)

Wednesday–Thursday 17–18 February 2016 • Proceedings of SPIE Vol. 9754

# Photonic Instrumentation Engineering III

Conference Chairs: **Yakov G. Soskind**, DHPC Technologies (USA); **Craig Olson**, L-3 Communications (USA)

Program Committee: **James B. Breckinridge**, California Institute of Technology (USA); **Lynda E. Busse**, U.S. Naval Research Lab. (USA); **James T. A. Carriere**, Ondax, Inc. (USA); **John D. Corless**, Verity Instruments, Inc. (USA); **David G. Fischer**, NASA Glenn Research Ctr. (USA); **Filipp V. Ignatovich**, Lumetrics, Inc. (USA); **Jacob B. Khurgin**, Johns Hopkins Univ. (USA); **Antti Johannes Makinen**, U.S. Naval Research Lab. (USA); **Patrick C. Mock**, Ziva Corp. (USA); **Nada A. O'Brien**, JDSU (USA); **Daniel J. Reiley**, California Institute of Technology (USA); **Jeff Throckmorton**, Avo Photonics, Inc. (USA); **Alain Villeneuve**, Genia Photonics Inc. (Canada)

## WEDNESDAY 17 FEBRUARY

### SESSION 1

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) .WED 8:30 TO 10:20 AM

### Applications of Photonic Instruments I

Session Chair: **Yakov G. Soskind**, DHPC Technologies (USA)

8:30 am: **Optical metrology for the Prime Focus instrument**, Daniel J. Reiley, Peter H. Mao, California Institute of Technology (USA) ..... [9754-1]

8:50 am: **A high-precision six-degree-of-freedom relative position sensor**, Claudia A. Sison, Gary B. Hughes, California Polytechnic State Univ., San Luis Obispo (USA); Philip M. Lubin, Peter Meinhold, Jonathan Y. Suen, Univ. of California, Santa Barbara (USA) ..... [9754-2]

9:10 am: **Low-cost facile interferometer for displacement mapping of harmonically-excited MEMS**, Mateusz T. Madzik, Jaime Viegas, Masdar Institute of Science & Technology (United Arab Emirates) ..... [9754-3]

9:30 am: **Extraction of natural weight shift and foot rolling in gait based on hetero-core optical fiber load sensor**, Yudai Otsuka, Yuya Koyama, Michiko Nishiyama, Kazuhiro Watanabe, Soka Univ. (Japan) ..... [9754-4]

9:50 am: **Surface-enhanced spectroscopy: comparison of different methods (Invited Paper)**, Jacob B. Khurgin, Johns Hopkins Univ. (USA) [9754-5]

Coffee Break ..... Wed 10:20 am to 10:50 am

### SESSION 2

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) WED 10:50 TO 11:50 AM

### Applications of Photonic Instruments II

Session Chair: **Yakov G. Soskind**, DHPC Technologies (USA)

10:50 am: **Spatially-resolved spectroscopy using swept-source optical interferometry**, Ryoma Onita, Tatsutoshi Shioda, Saitama Univ. (Japan) [9754-6]

11:10 am: **Mini and micro spectrometers pave the way to on-field advanced analytics**, Clémentine Bouyé, Benoît d'Humières, Hugo Kolb, TEMATYS (France) ..... [9754-7]

11:30 am: **Photonics in advanced driver assistance systems: adoption rates and market forecasts**, Clémentine Bouyé, Jacques Cochard, Benoît d'Humières, TEMATYS (France) ..... [9754-8]

Lunch/Exhibition Break ..... Wed 11:50 am to 1:20 pm

### SESSION 3

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) . . WED 1:20 TO 3:00 PM

### Photonic Instrumentation Design, Development, and Fabrication I

Session Chair: **James T. A. Carriere**, Ondax, Inc. (USA)

1:20 pm: **Design and optimization of indoor optical wireless positioning systems**, Mark Bergen, The Univ. of British Columbia (Canada); Daniel Guerrero, Xian Jin, UBC Okanagan (Canada); Blago A. Hristovski, The Univ. of British Columbia (Canada); Hugo Chaves, Richard Klukas, Jonathan Holzman, UBC Okanagan (Canada) ..... [9754-9]

1:40 pm: **Smart slit assembly for high-resolution spectrometers in space**, Benedikt J. Guldimann, European Space Research and Technology Ctr. (Netherlands) ..... [9754-10]

2:00 pm: **Linear rotary optical delay lines**, Hang Qu, Hichem Guerboukha, Maksim Skorobogatiy, Ecole Polytechnique de Montréal (Canada) . . . [9754-11]

2:20 pm: **Coated fiber tips for optical instrumentation**, Gary E. Carver, John B. Barton, Sheetal Chanda, Sarah A. Locknar, Omega Optical, Inc. (USA) ..... [9754-12]

2:40 pm: **Fast and accurate read-out of interferometric optical fiber sensors**, Dag R. Hjelme, Hogskolen i Sor-Trondelag (Norway) and Norwegian Univ. of Science and Technology (Norway); Ingebrigt Barthol森, Norwegian Univ. of Science and Technology (Norway) ..... [9754-13]

Coffee Break ..... Wed 3:00 pm to 3:30 pm

### SESSION 4

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) . . WED 3:30 TO 5:30 PM

### Photonic Instrumentation Design, Development, and Fabrication II

Session Chair: **James T. A. Carriere**, Ondax, Inc. (USA)

3:30 pm: **Optical fiber oxygen sensor using layer-by-layer stacked porous composite membranes**, Sayuri Ban, Ai Hosoki, Michiko Nishiyama, Atsushi Seki, Kazuhiro Watanabe, Soka Univ. (Japan) ..... [9754-14]

3:50 pm: **Characterizing distributed piezo-electret sensors and actuators by using a real-time electronic speckle pattern interferometry system**, Ya-Ling Chang, Kuan Yu Hsu, Chih-Kung Lee, National Taiwan Univ. (Taiwan) ..... [9754-15]

4:10 pm: **Measurement of surface topographies for power chip technologies in the nm-range by a modified low-coherence interferometer**, Christopher Taudt, Tobias Baselt, Westsächsische Hochschule Zwickau (Germany) and TU Dresden (Germany) and Fraunhofer IWS Dresden (Germany); Bryan Nelsen, Westsächsische Hochschule Zwickau (Germany); Heiko Assmann, Infineon Dresden GmbH (Germany); Andreas Greiner, Infineon Technologies Dresden (Germany); Edmund Koch, TU Dresden (Germany); Peter Hartmann, Westsächsische Hochschule Zwickau (Germany) and Fraunhofer IWS Dresden (Germany) ..... [9754-16]

4:30 pm: **Low-cost miniature spectrometer using mold plastic with air cavities**, Yu Wang, AMS-TAOS USA Inc. (USA) ..... [9754-17]

4:50 pm: **Innovative fiber-laser-architecture-based compact wind lidar**, Narasimha S. Prasad, NASA Langley Research Ctr. (USA); Steve Vettorino, Allen Tracy, Rich Higgins, Russ Sibell, Sibelloptics, LLC (USA) ..... [9754-18]

5:10 pm: **A device based on the Shack-Hartmann wavefront sensor for testing wide aperture optics**, Alexander N. Nikitin, Julia V. Sheldakova, Alexis V. Kudryashov, Active Optics Night N Ltd. (Russian Federation); Gilles Borsoni, AKA Optics SAS (France); Dmitrii Denisov, Valerii Karasik, Alexey Sakharov, Bauman Moscow State Technical Univ. (Russian Federation) ..... [9754-19]



# CONFERENCE 9754

LOCATION: ROOM 123 (NORTH EXHIBIT LEVEL)

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 ... WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Prototype of VNIR/SWIR hyperspectral imager based on curved prism,** Yueming Wang, Shanghai Institute of Technical Physics (China) . . . . . [9754-37]

**High-temperature monitoring of an oxy-fuel fluidized bed combustor using femtosecond infrared laser-written fiber Bragg gratings,** Robert B. Walker, Huimin Ding, David Coulas, Dan Grobnic, Ping Lu, Stephen J. Mihailov, National Research Council Canada (Canada); Marc A. Duchesne, Robin W. Hughes, David J. McCalden, Ryan Burchat, Natural Resources Canada (Canada) . . . . . [9754-38]

**Challenges of demonstrating quantum entanglement on board sounding rockets,** Patrick Wade, Ctr. for Quantum Technologies (Singapore) . . . [9754-39]

**Long-term measurements of SPR hydrogen sensor based on hetero-core optical fiber with Au/Ta<sub>2</sub>O<sub>5</sub>/Pd/Au multilayers,** Ken Takahashi, Ai Hosoki, Michiko Nishiyama, Soka Univ. (Japan); Hirota Igawa, Japan Aerospace Exploration Agency (Japan); Kazuhiro Watanabe, Soka Univ. (Japan) . . [9754-40]

**Temperature-stable LED-based light source without temperature control,** Marko Bosiljevac, Dubravko I. Babic, Univ. of Zagreb (Croatia) . . . . . [9754-41]

**SFFT-based phase unwrapping for faster interference fringe analysis,** Chen-Yu Lee, National Taiwan Univ. (Taiwan) . . . . . [9754-42]

**Fiber optics sensor interrogated in both microwave and optics frequency for simultaneous measurement of refractive index, temperature, and strain,** Baokai Cheng, Liwei Hua, Wenge Zhu, Lei Yuan, Jie Liu, Yang Song, Clemson Univ. (USA) . . . . . [9754-43]

**A pseudo optical frequency comb interferometry by an optical resonator and a high-speed swept-source for 2D single-shot tomography and profilometry,** Tuan Q. Anh, Saitama Univ. (Japan) and SevenSix, Inc. (Japan); Tatsutoshi Shioda, Saitama Univ. (Japan) . . . . . [9754-44]

**Fiber-Bragg-grating-based tunable sensitivity goniometer,** Umesh Sharath, Srivani Padma, Shweta Pant, Talabattula Srinivas, S. Asokan, Indian Institute of Science (India) . . . . . [9754-45]

**Development of SPR temperature sensor using Au/TiO<sub>2</sub> on hetero-core optical fiber,** Sho Kitagawa, Hiroshi Yamazaki, Ai Hosoki, Michiko Nishiyama, Kazuhiro Watanabe, Soka Univ. (Japan) . . . . . [9754-46]

**Ellipsometry-like analysis of polarization state for micro cracks using stress-induced light scattering method,** Yoshitaro Sakata, Kazufumi Sakai, Kazuhiro Nonaka, Nao Terasaki, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [9754-47]

**The authenticity in art: analysis of the optical characteristics of paintings,** Seonhee Hwang, Eunhee Kim, Kyujung Kim, Pusan National Univ. (Korea, Republic of) . . . . . [9754-48]

**Remote sensing solutions of oil and gas exploration by hyperspectral Raman lidar,** Aleksandr S. Grishkanich, Valentin Elizarov, Sergey Kascheev, Aleksandr Zhevlakov, ITMO Univ. (Russian Federation); Igor Sidorov, Univ. of Eastern Finland (Finland); Aleksandr Il'inskiy, All Russian Petroleum Research Exploration Institute (Russian Federation); Dmitriy Kosachiov, Gazprom (Russian Federation); Igor Sidorov, Univ. of Eastern Finland (Finland) . . . . . [9754-50]

## THURSDAY 18 FEBRUARY

### SESSION 5

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) . THU 8:30 TO 10:00 AM

## Light Sources in Photonic Instrumentation I

Session Chair: **Jeff Throckmorton**, Avo Photonics, Inc. (USA)

8:30 am: **High-power quantum cascade lasers and their use in intracavity nonlinear generation** (*Invited Paper*), Mariano Troccoli, AdTech Optics, Inc. (USA) . . . . . [9754-20]

9:00 am: **Propagation characteristics and characterization challenges of complex laser field distributions,** Yakov G. Soskind, DHPC Technologies (USA) . . . . . [9754-21]

9:20 am: **Optical dispersion spectroscopy using optical frequency comb applied to dual-heterodyne mixing,** Kaishu Kasuga, Takayuki Miyamoto, Tatsutoshi Shioda, Saitama Univ. (Japan) . . . . . [9754-22]

9:40 am: **Stabilization of two frequency combs with a small relative fceo jitter using diode laser injection locking,** Young-Jin Kim, Byung Jae Chun, Nanyang Technological Univ. (Singapore) . . . . . [9754-23]

Coffee Break . . . . . Thu 10:00 am to 10:30 am

### SESSION 6

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) . THU 10:30 AM TO 12:00 PM

## Light Sources in Photonic Instrumentation II

Session Chair: **Lynda E. Busse**, U.S. Naval Research Lab. (USA)

10:30 am: **Structured illumination employing coherent radiation** (*Invited Paper*), Yakov G. Soskind, DHPC Technologies (USA); Michael Soskind, Rose Soskind, Rutgers, The State Univ. of New Jersey (USA) . . . . . [9754-24]

11:00 am: **High-speed universal polarization state generator,** Alan She, Federico Capasso, Harvard Univ. (USA) . . . . . [9754-25]

11:20 am: **Low-spatial-coherence broadband fiber source for speckle free imaging,** Brandon Redding, Yale Univ. (USA); Peyman Ahmadi, Vadim Mogan, Martin F. Seifert, Nufern (USA); Michael A. Choma M.D., Hui Cao, Yale Univ. (USA) . . . . . [9754-26]

11:40 am: **Compact high-performance metasurface polarimeter,** Jan Philipp Balthasar Mueller, Harvard Univ. (USA); Kristjan Leosson, Univ. of Iceland (Iceland) and Innovation Ctr. Iceland (Iceland); Federico Capasso, Harvard Univ. (USA) . . . . . [9754-27]

Lunch/Exhibition Break . . . . . Thu 12:00 pm to 1:30 pm

### SESSION 7

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) . . . THU 1:30 TO 2:50 PM

## Sensors and Ruggedized Systems I

Session Chair: **Craig Olson**, L-3 Communications (USA)

1:30 pm: **Frequency-domain single-shot optical frequency comb tomography using VIPA,** Takumi Miyaoka, Tatsutoshi Shioda, Saitama Univ. (Japan) . . . . . [9754-28]

1:50 pm: **90km distributed optical fiber disturbance sensing in OFDR,** Tiegeng Liu, Yang Du, Zhenyang Ding, Kun Liu, Junfeng Jiang, Tianjin Univ. (China) . . . . . [9754-29]

2:10 pm: **Femtosecond laser fabricated multimode fiber sensors interrogated by optical-carrier-based microwave interferometry technique for distributed strain sensing,** Liwei Hua, Yang Song, Jie Huang, Xiao Hai, Clemson Univ. (USA) . . . . . [9754-30]

2:30 pm: **Silicon plasmonic-integrated interferometer sensor,** Ahmad Bassam, The American Univ. in Cairo (Egypt); Qiaoqiang Gan, Univ. at Buffalo (USA); Mohamed A. Swillam, The American Univ. in Cairo (Egypt) . . . . . [9754-31]

Coffee Break . . . . . Thu 2:50 pm to 3:20 pm

### SESSION 8

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) . . THU 3:20 TO 5:00 PM

## Sensors and Ruggedized Systems II

Session Chair: **Craig Olson**, L-3 Communications (USA)

3:20 pm: **A hemispheric hetero-core fiber optic tactile sensor for texture and hardness detection,** Hiroshi Yamazaki, Michiko Nishiyama, Kazuhiro Watanabe, Soka Univ. (Japan) . . . . . [9754-32]

3:40 pm: **Simultaneous measurement of concentration of CO and temperature using an asymmetric microfiber incorporating a microfiber knot resonator,** Min-Seok Yoon, Young-Guen Han, Hanyang Univ. (Korea, Republic of) . . . . . [9754-33]

4:00 pm: **Relative humidity sensor based on a micro-tapered long-period fiber grating,** Jong Cheol Shin, Min-Seok Yoon, Young-Geun Han, Hanyang Univ. (Korea, Republic of) . . . . . [9754-34]

4:20 pm: **Fiber-optic vibration sensor for high-power electric machines realized using 3D printing technology,** Marko Bosiljevac, Bojan Igrec, Zvonimir Sipus, Dubravko I. Babic, Smiljko Rudan, Univ. of Zagreb (Croatia) . . . . . [9754-35]

4:40 pm: **New dynamic system for measuring Stokes vectors and an application for low concentration glucose sensing,** Yu-Lung Lo, Quoc-Hung Phan, National Cheng Kung Univ. (Taiwan) . . . . . [9754-36]

OPTO

# CONFERENCE 9755

LOCATION: ROOM 2008 (WEST LEVEL 2)

Sunday–Thursday 14–18 February 2016 • Proceedings of SPIE Vol. 9755

# Quantum Sensing and Nano Electronics and Photonics XIII

Conference Chair: **Manijeh Razeghi**, Northwestern Univ. (USA)

Conference Co-Chairs: **Gail J. Brown**, Air Force Research Lab. (USA); **Jay S. Lewis**, Defense Advanced Research Projects Agency (USA)

Program Committee: **Jong Hyeob Baek**, Korea Photonics Technology Institute (Korea, Republic of); **Sumith Bandara**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Can Bayram**, Univ. of Illinois at Urbana-Champaign (USA); **David A. Cardimona**, Air Force Research Lab. (USA); **Philippe Christol**, Institut d'Electronique du Sud (France); **Jérôme Faist**, ETH Zürich (Switzerland); **Siamak Forouhar**, Jet Propulsion Lab. (USA); **Michael D. Gerhold**, U.S. Army Research Office (USA); **Frédéric Grillot**, Télécom ParisTech (France); **Yasar Gurbuz**, Sabanci Univ. (Turkey); **Sven Höfling**, Univ. of St. Andrews (United Kingdom); **Jean-Pierre Huignard**, Jphopto (France); **Woo-Gwang Jung**, Kookmin Univ. (Korea, Republic of); **Tsukuru Katsuyama**, Sumitomo Electric Industries, Ltd. (Japan); **Jean F. Kelly**, Pacific Northwest National Lab. (USA); **Michel Krakowski**, Thales Research & Technology (France); **Kwok Keung Law**, Naval Air Warfare Ctr. Weapons Div. (USA); **Giuseppe Leo**, Univ. Paris 7-Denis Diderot (France); **Amy W. K. Liu**, IQE Inc. (USA); **Jerry R. Meyer**, U.S. Naval Research Lab. (USA); **Maya Mikhaliyova**, Ioffe Physico-Technical Institute (Russian Federation); **Jan Misiewicz**, Wroclaw Univ. of Technology (Poland); **Oleg Mitrofanov**, Univ. College London (United Kingdom); **Ekmel Özbay**, Bilkent Univ. (Turkey); **Shanee Pacley**, Air Force Research Lab. (USA); **Dimitris Pavlidis**, Boston Univ. (USA); **Mark C. Phillips**, Pacific Northwest National Lab. (USA); **Divyang Shah**, National Reconnaissance Office (USA); **Carlo Sirtori**, Univ. Paris 7-Denis Diderot (France); **Marija Strojnik Scholl**, Ctr. de Investigaciones en Óptica, A.C. (Mexico); **Meimei Tidrow**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Eric Tournié**, Univ. Montpellier 2 (France); **Alessandro Tredecucci**, Lab. NEST (Italy); **Miriam Serena Vitiello**, Consiglio Nazionale delle Ricerche (Italy); **Sheng Wu**, California Institute of Technology (USA); **Rui Q. Yang**, The Univ. of Oklahoma (USA); **John M. Zavada**, National Science Foundation (USA)

## SUNDAY 14 FEBRUARY

### SESSION 1

LOCATION: ROOM 2008 (WEST LEVEL 2) . SUN 8:30 AM TO 10:30 AM

### Keynote Session I

Session Chair: **Manijeh Razeghi**, Northwestern Univ. (USA)

8:30 am: **Advanced EO/IR technologies at DARPA MTO** (*Keynote Presentation*), Jay S. Lewis, Defense Advanced Research Projects Agency (USA) ..... [9755-1]

9:00 am: **New metrics for economic complexity: Measuring the intangible fitness of countries and complexity of products** (*Keynote Presentation*), Luciano Pietronero, Sapienza Univ. di Roma (Italy) .. [9755-2]

9:30 am: **Superfluid <sup>3</sup>He at microkelvin temperatures: the quasiparticle spectrometer and the vortex video camera** (*Keynote Presentation*), George Pickett, Lancaster Univ. (United Kingdom) ..... [9755-3]

10:00 am: **Sensors, nano-electronics and photonics for the Army of 2030 and beyond**, Philip Perconti, W.C. Kirkpatrick Alberts II, Jagmohan Bajaj, Jonathan Schuster, Meredith Reed, U.S. Army Research Lab. (USA) [9755-4]

Coffee Break ..... Sun 10:30 am to 11:00 am

### SESSION 2

LOCATION: ROOM 2008 (WEST LEVEL 2) . SUN 11:00 AM TO 12:20 PM

### Quantum Cascade Lasers for Gas Sensing I

Session Chairs: **Jérôme Faist**, ETH Zürich (Switzerland); **Maurice S. Skolnick**, The Univ. of Sheffield (United Kingdom)

11:00 am: **Real-time spectroscopic sensing using a widely tunable external cavity-QCL with MOEMS diffraction grating** (*Invited Paper*), Ralf Ostendorf, Lorenz Butschek, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); André Merten, Jan Grahmann, Fraunhofer-Institut für Photonische Mikrosysteme (Germany); Jan P. Jarvis, Stefan Hugger, Frank Fuchs, Joachim Wagner, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany) ..... [9755-5]

11:20 am: **Detection of hydrogen peroxide based on long-path absorption spectroscopy using a CW EC-QCL** (*Invited Paper*), Nancy P. Sanchez, Yajun Yu, Lei Dong, Robert J. Griffin, Frank K. Tittel, Rice Univ. (USA) .. [9755-6]

11:40 am: **Demonstration of a rapidly-swept external cavity quantum cascade laser for rapid and sensitive quantification of chemical mixtures** (*Invited Paper*), Brian E. Brumfield, Matthew S. Taubman, Mark C. Phillips, Pacific Northwest National Lab. (USA) ..... [9755-7]

12:00 pm: **Quantum Cascade Laser based active hyperspectral imaging for standoff detection of chemicals on surfaces** (*Invited Paper*), Stefan Hugger, Frank Fuchs, Jan P. Jarvis, Quankui K. Yang, Marcel Rattunde, Ralf Ostendorf, Christian Schilling, Rachid Driad, Wolfgang Bronner, Rolf Aidam, Joachim Wagner, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); Thorsten Tybussek, Klaus Rieblinger, Fraunhofer Inst. for Process Engineering and Packaging IVV (Germany) ..... [9755-8]

Lunch Break ..... Sun 12:20 pm to 1:50 pm

### SESSION 3

LOCATION: ROOM 2008 (WEST LEVEL 2) .. SUN 1:50 PM TO 3:30 PM

### Quantum Cascade Lasers for Gas Sensing II

Session Chairs: **Jerry R. Meyer**, U.S. Naval Research Lab. (USA); **Frédéric Grillot**, Télécom ParisTech (France)

1:50 pm: **High-power single-mode multiwavelength quantum cascade lasers** (*Invited Paper*), Jérôme Faist, ETH Zürich (Switzerland) ..... [9755-9]

2:10 pm: **High-power electrically-tunable quantum cascade lasers** (*Invited Paper*), Steven Slivken, Manijeh Razeghi, Northwestern Univ. (USA) .. [9755-10]

2:30 pm: **Quartz enhanced photoacoustic leak sensor for mechatronic components** (*Invited Paper*), Angelo Sampaolo, Pietro Patimisco, Marilena Giglio, Univ. degli Studi di Bari Aldo Moro (Italy); Paolo Pietro Calabrese, CNR IFN Bari (Italy); Leonardo Chieco, MASMEC S.p.A. (Italy); Gaetano Scarmarcio, Univ. degli Studi di Bari Aldo Moro (Italy); Frank K. Tittel, Rice Univ. (USA); Vincenzo Spagnolo, Politecnico di Bari (Italy) ..... [9755-11]

2:50 pm: **Timing-frequency-modulated combs in Mid-IR and THz ranges** (*Invited Paper*), Jacob B. Khurgin, Johns Hopkins Univ. (USA) ..... [9755-12]

3:10 pm: **Linewidth broadening factor and gain compression in quantum cascade lasers** (*Invited Paper*), Louise Jumpertz, Télécom ParisTech (France); Wolfgang E. Elsässer, Technische Univ. Darmstadt (Germany); Mathieu Carras, mirSense (France); Kevin Schires, Frédéric Grillot, Télécom ParisTech (France) ..... [9755-13]

Coffee Break ..... Sun 3:30 pm to 4:00 pm

# CONFERENCE 9755

## LOCATION: ROOM 2008 (WEST LEVEL 2)

### SESSION 4

LOCATION: ROOM 2008 (WEST LEVEL 2) . . SUN 4:00 PM TO 5:20 PM

## Mid-Infrared Interband Lasers and Applications

Session Chairs: **Rui Q. Yang**, The Univ. of Oklahoma (USA);  
**Siamak Forouhar**, Jet Propulsion Lab. (USA)

4:00 pm: **Interband cascade lasers with CW wallplug efficiency higher than 40% at low temperatures** (*Invited Paper*), Charles D. Merritt, William W. Bewley, Chadwick L. Canedy, Chul S. Kim, U.S. Naval Research Lab. (USA); Mijin Kim, Sotera Defense Solutions (USA); Igor Vurgaftman, Jerry R. Meyer, U.S. Naval Research Lab. (USA) . . . . . [9755-14]

4:20 pm: **Tunable mid-infrared single-mode interband cascade lasers** (*Invited Paper*), Sven Höfling, Julius-Maximilians-Univ. Würzburg (Germany) and Univ. of St Andrews (United Kingdom); Robert Weih, Matthias Dallner, Julius-Maximilians-Univ. Würzburg (Germany); Julian Scheuermann, Michael von Edlinger, Lars Nähle, Marc O. Fischer, Johannes Koeth, nanoplus GmbH (Germany); Martin Kamp, Julius-Maximilians-Univ. Würzburg (Germany) . . . . . [9755-15]

4:40 pm: **High-power CW GaSb type-I gain chips as single-frequency sources for widely-tunable spectroscopy in the mid-infrared** (*Invited Paper*), Leva Šimonytė, Edgaras Dvinelis, Ramūnas Songaila, Augustinas Trinkūnas, Mindaugas Greibus, Kristijonas Vizbaras, Augustinas Vizbaras, Broilis Semiconductors UAB (Lithuania) . . . . . [9755-17]

5:00 pm: **Compact, low power consumption methane sensor based on a novel miniature multipass gas cell and a CW, room temperature interband cascade laser emitting at 3.3 μm** (*Invited Paper*), Lei Dong, Rice Univ. (USA) and Shanxi Univ. (China); Chunguang Li, Nancy P. Sanchez, Aleksander K. Gluszek, Robert J. Griffin, Frank K. Tittel, Rice Univ. (USA) . . . . . [9755-16]

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative, Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break . . . . . Mon 10:10 am to 10:30 am

### SESSION 5

LOCATION: ROOM 2008 (WEST LEVEL 2) MON 10:30 AM TO 11:00 AM

## Keynote Session II

Session Chair: **Manijeh Razeghi**, Northwestern Univ. (USA)

10:30 am: **Towards low-loss, infrared, and THz nanophotonics and metamaterials: surface phonon polariton modes in polar dielectric crystals** (*Keynote Presentation*), Joshua D. Caldwell, U.S. Naval Research Lab. (USA) . . . . . [9755-18]

### SESSION 6

LOCATION: ROOM 2008 (WEST LEVEL 2) MON 11:00 AM TO 12:20 PM

## Terahertz Spectroscopy

Session Chairs: **Miriam S. Vitiello**, Consiglio Nazionale delle Ricerche (Italy); **Alessandro Tredicucci**, NEST (Italy)

11:00 am: **Broadband terahertz time-domain spectroscopy with diffraction-limited spatial resolution** (*Invited Paper*), Matthieu Baillergeau, Thomas Nirrangen, José Palomo, Sukhdeep Dhillon, Jérôme Tignon, Kenneth Maussang, Juliette Mangeney, Lab. Pierre Aigrain (France) . . . . . [9755-19]

11:20 am: **Advances in THz quantum cascade lasers for on-chip frequency combs** (*Invited Paper*), Markus Roesch, Giacomo Scaliari, Christopher B. Bonzon, Mattias Beck, Jérôme Faist, ETH Zürich (Switzerland) . . . . . [9755-20]

11:40 am: **Terahertz homodyne self-mixing as a new tomographic tool** (*Invited Paper*), Till Mohr, Stefan Breuer, Dominik Blömer, Technische Univ. Darmstadt (Germany); Marcello Simonetta, Univ. degli Studi di Pavia (Italy); Sanketkumar Patel, Malte Schlosser, Technische Univ. Darmstadt (Germany); Anselm J. Deninger, TOPTICA Photonics AG (Germany); Gerhard Birkel, Wolfgang E. Elsässer, Technische Univ. Darmstadt (Germany); Guido Giuliani, Univ. degli Studi di Pavia (Italy) and Jlight S.r.l. (Italy) . . . . . [9755-21]

12:00 pm: **Plasmonic resonances in carbon fibers observed with terahertz near-field microscopy** (*Invited Paper*), Irina A. Khromova, Univ. College London (United Kingdom) and ITMO Univ. (Russian Federation); Miguel Navarro-Cia, Imperial College London (United Kingdom); Igal Brenner, John L. Reno, Sandia National Labs. (USA) and The Ctr. for Integrated Nanotechnologies (USA); Andrey Ponomarev, Saint-Petersburg State Polytechnical Univ. (Russian Federation); Oleg Mitrofanov, Univ. College London (United Kingdom) and The Ctr. for Integrated Nanotechnologies (USA) . . . . . [9755-22]

Lunch Break . . . . . Mon 12:20 pm to 1:50 pm

### SESSION 7

LOCATION: ROOM 2008 (WEST LEVEL 2) . . MON 1:50 PM TO 3:10 PM

## Terahertz Detectors

Session Chairs: **Michael D. Gerhold**, U.S. Army Research Office (USA); **Carlo Sirtori**, Univ. Paris 7-Denis Diderot (France)

1:50 pm: **Antenna-coupled microcavity THz photodetectors** (*Invited Paper*), Carlo Sirtori, Daniele Palaferri, Yanko Todorov, Angela Vasaneli, Univ. Paris 7-Denis Diderot (France); Lianhe H. Li, Edmund H. Linfield, Univ. of Leeds (United Kingdom) . . . . . [9755-23]

2:10 pm: **Black-phosphorus terahertz photo-detectors with selective and controllable plasmonic, bolometric, and thermoelectric response** (*Invited Paper*), Miriam S. Vitiello, Consiglio Nazionale delle Ricerche (Italy) . . . [9755-24]

2:30 pm: **Nanoplasmonics for enhanced terahertz technologies, single protein trapping and analysis, and quantum limits** (*Invited Paper*), Reuven Gordon, Univ. of Victoria (Canada) . . . . . [9755-25]

2:50 pm: **The role of plasma waves in FET-based terahertz detectors** (*Invited Paper*), Alvydas Lisauskas, Vilnius Univ. (Lithuania) and Ctr. for Physical Sciences and Technology (Lithuania); Dovilė Čibiraitė, Kęstutis Ikamas, Vilnius Univ. (Lithuania); Jingshui Zhang, Maris Bauer, Hartmut G. Roskos, Johann Wolfgang Goethe-Univ. Frankfurt am Main (Germany) . . . . . [9755-26]

Coffee Break . . . . . Mon 3:10 pm to 3:40 pm

### SESSION 8

LOCATION: ROOM 2008 (WEST LEVEL 2) . MON 3:40 PM TO 6:00 PM

## Silicon Photonics

Session Chairs: **Kwok Keung Law**, Naval Air Warfare Ctr. Weapons Div. (USA); **Can Bayram**, Univ. of Illinois at Urbana-Champaign (USA)

3:40 pm: **On-chip microscopy, sensing and diagnostics** (*Invited Paper*), Aydogan Ozcan, Univ. of California, Los Angeles (USA) . . . . . [9755-27]

4:00 pm: **Hybrid integrated photonic and plasmonic structures for sensing applications** (*Invited Paper*), Ali A. Eftekhar, Hamed Mousavi, Georgia Institute of Technology (USA); Maysamreza Chamanzar, Univ. of California, Berkeley (USA); Ye Luo, Ali Adibi, Georgia Institute of Technology (USA) . . . . . [9755-28]

4:20 pm: **Recent advances in silicon photonics** (*Invited Paper*), Laurent Vivien, Delphine Marris-Morini, Institut d'Électronique Fondamentale (France); Leopold Virost, MINATEC (France); Diego Pérez-Galacho, Pedro Damas, Carlos Alonso-Ramos, Institut d'Électronique Fondamentale (France); Jean-Michel Hartmann, CEA-LETI (France); Eric Cassan, Paul Crozat, Xavier Le Roux, Institut d'Électronique Fondamentale (France); Charles Baudot, Frederic Boeuf, STMicroelectronics (France); Jean-Marc Fédéli, CEA-LETI (France) . . . [9755-29]

OPTO



# CONFERENCE 9755

LOCATION: ROOM 2008 (WEST LEVEL 2)

4:40 pm: **Silicon and germanium mid-infrared photonics** (*Invited Paper*), Goran Z. Mashanovich, Graham T. Reed, Milos Nedeljkovic, Jordi Soler Penadés, Colin J. Mitchell, Ali Z. Khokhar, Callum J. Littlejohns, Stevan Stankovic, Xia Chen, Li Shen, Noel Healy, Anna C. Peacock, Univ. of Southampton (United Kingdom); Carlos Alonso-Ramos, Univ. Paris-Sud 11 (France); Alejandro Ortega-Moñux, Juan Gonzalo Wangüemert-Pérez, Iñigo Molina-Fernández, Univ. de Málaga (Spain); Pavel Cheben, National Research Council Canada (Canada); Jason J. Ackert, Andrew P. Knights, McMaster Univ. (Canada); Frederic Y. Gardes, David J. Thomson, Univ. of Southampton (United Kingdom) . . . . . [9755-30]

5:00 pm: **A Si-based plasmonic light-emitting tunnel junction source**, Hasan Goktas, Volker J. Sorger, The George Washington Univ. (USA) . . . . . [9755-31]

5:20 pm: **Heterogeneously-grown tunable group-IV laser on silicon**, Mantu K. Hudait, Michael Clavel, Luke F. Lester, Virginia Polytechnic Institute and State Univ. (USA); Dzianis Saladukha, Tomasz J. Ochalski, Felipe Murphy-Armando, Cork Institute of Technology (Ireland) . . . . . [9755-32]

5:40 pm: **Ultra broadband excitation of plasmons using metallic self-organized crystal** (*Invited Paper*), Agnès Maître, Guillaume Binard, Univ. Pierre et Marie Curie (France); Clotilde M. Lethiec, Univ. Pierre et Marie Curie (France) and Northwestern Univ. (USA); Hugo Frederich, Univ. Pierre et Marie Curie (France); Eduardo Yraola, Univ. Autónoma de Madrid (Spain); Céline Bourdillon, Catherine Schwob, Univ. Pierre et Marie Curie (France); Fabrice Charra, Commissariat à l'Énergie Atomique (France); Laurent Coolen, Univ. Pierre et Marie Curie (France); Ludovic Douillard, Commissariat à l'Énergie Atomique (France) . . . . . [9755-95]

## TUESDAY 16 FEBRUARY

### SESSION 9

LOCATION: ROOM 2008 (WEST LEVEL 2) . . TUE 8:00 AM TO 8:30 AM

#### Keynote Session III

Session Chair: **Manijeh Razeghi**, Northwestern Univ. (USA)

8:00 am: **Imperceptible active sensors for cyber-physical systems** (*Keynote Presentation*), Tsuyoshi Sekitani, Osaka Univ. (Japan) . . . [9755-33]

### SESSION 10

LOCATION: ROOM 2008 (WEST LEVEL 2) . TUE 8:30 AM TO 10:10 AM

#### Infrared Detection I

Session Chairs: **Philippe Christol**, Institut d'Electronique du Sud (France); **Michel Krakowski**, III-V Lab. (France)

8:30 am: **Radiation tolerance studies of long wavelength infrared InAs/GaSb detectors** (*Invited Paper*), Alexander Soibel, Sir Rafol, Arezou Khoshakhlagh, Jean Nguyen, Linda Höglund, Anita Fisher, Sam Keo, David Ting, Sarath Gunapala, Jet Propulsion Lab. (USA) . . . . . [9755-34]

8:50 am: **Mid-infrared interband cascade photodetectors with high quantum efficiency** (*Invited Paper*), Zhao-Bing Tian, The Univ. of New Mexico (USA); Anjali Singh, Kevin Rigg, Northrop Grumman Electronic Systems (USA); Sanjay Krishna, The Univ. of New Mexico (USA) . . . . . [9755-35]

9:10 am: **Recent progress in interband cascade IR photodetectors** (*Invited Paper*), Rui Q. Yang, The Univ. of Oklahoma (USA) . . . . . [9755-36]

9:30 am: **A low effective mass material system for quantum cascade detectors** (*Invited Paper*), Peter Reininger, Tobias Zederbauer, Benedikt Schwarz, Hermann Detz, Donald MacFarland, Aaron M. Andrews, Werner Schrenk, Gottfried Strasser, Technische Univ. Wien (Austria) . . . . . [9755-37]

9:50 am: **Radiometric and radiation tolerance characterization of IR photodiodes employing unipolar barrier detector architectures with bulk and T<sub>2</sub>SLS III-V absorbers** (*Invited Paper*), Vincent M. Cowan, Christian P. Morath, Eli Garduno, Geoffrey D. Jenkins, John E. Hubbs, Air Force Research Lab. (USA) . . . . . [9755-38]

Coffee Break . . . . . Tue 10:10 am to 10:40 am

### SESSION 11

LOCATION: ROOM 2008 (WEST LEVEL 2) TUE 10:40 AM TO 12:00 PM

#### Infrared Detection II

Session Chairs: **Gail J. Brown**, Air Force Research Lab. (USA); **Jan Misiewicz**, Wroclaw Univ. of Technology (Poland)

10:40 am: **Metamorphic InAsSb<sub>x</sub>/InAsSb<sub>y</sub> heterostructures: new materials for infrared photonics** (*Invited Paper*), Gregory Belenky, Youxi Lin, Leon Shterengas, Dmitry V. Donetsky, Gela Kipshidze, Sergey Suchalkin, Stony Brook Univ. (USA); Wendy L. Sarney, Stefan P. Svensson, U.S. Army Research Lab. (USA) . . . . . [9755-39]

11:00 am: **Surface plasmonic resonance enhanced type II strain-layer superlattice photodetector** (*Invited Paper*), Guiru Gu, Stonehill College (USA); Jarrod N. Vaillancourt, Applied NanoFemto Technologies LLC (USA); Xuejun Lu, Univ. of Massachusetts Lowell (USA) . . . . . [9755-40]

11:20 am: **Photoluminescence studies of InAs/InAsSb type-II infrared superlattices** (*Invited Paper*), Elizabeth H. Steenbergen, Air Force Research Lab. (USA); Jeremy A. Massengale, The Univ. of Oklahoma (USA); Yong-Hang Zhang, Arizona State Univ. (USA) . . . . . [9755-41]

11:40 am: **InAs-based type-II superlattice long wavelength photodetectors** (*Invited Paper*), Fangfang Wang, Jianxin Chen, Zhicheng Xu, Yi Zhou, Li He, Shanghai Institute of Technical Physics (China) . . . . . [9755-42]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:30 pm

### SESSION 12

LOCATION: ROOM 2008 (WEST LEVEL 2) . . . TUE 1:30 PM TO 3:30 PM

#### Nanophotonics and Plasmonics I

Session Chairs: **John M. Zavada**, Polytechnic Institute of New York Univ. (USA); **Jean-Pierre Huignard**, Jphopto (France)

1:30 pm: **Metamaterial-based nanobiosensors and nanophotodetectors** (*Invited Paper*), Ekmel Ozbay, Bilkent Univ. (Turkey) . . . . . [9755-43]

1:50 pm: **Optimization of plasmonic grating resonators based on highly-doped semiconductors for sensing applications using 2D finite-difference time-domain simulations** (*Invited Paper*), Franziska B. Barho, Maria Jose Milla Rodrigo, Fernando Gonzalez-Posada Florès, Thierry Taliercio, Univ. Montpellier 2 (France) . . . . . [9755-44]

2:10 pm: **Tuning of the localized surface plasmon wavelength in highly-doped InAsSb/GaSb nanostructures** (*Invited Paper*), Maria José Milla Rodrigo, Franziska B. Barho, Institut d'Electronique du Sud (France); Fernando González-Posada Florès, Commissariat à l'Énergie Atomique (France); Laurent Cerutti, Univ. Montpellier 2 (France); Jean-Baptiste Rodriguez, Eric Tournie, Thierry Taliercio, Institut d'Electronique du Sud (France) . . . . . [9755-45]

2:30 pm: **Spontaneous mirror-symmetry breaking in two coupled nanolasers** (*Invited Paper*), Philippe Hamel, Fabrice Raineri, Paul Monnier, Isabelle Sagnes, Juan Ariel Levenson, Alejandro M. Giacomotti, Lab. de Photonique et de Nanostructures (France) . . . . . [9755-46]

2:50 pm: **Theoretical and experimental investigation of optically spin-injected VECSEL** (*Invited Paper*), Alexandre Joly, Thales Research & Technology (France); Julien Frougier, Unité Mixte de Physique CNRS/Thales (France); Ghaya Baili, Thales Research & Technology (France); Mehdi Alouini, Institut de Physique de Rennes (France); Jean-Marie George, Unité Mixte de Physique CNRS/Thales (France); Isabelle Sagnes, Lab. de Photonique et de Nanostructures (France); Daniel Dolfi, Thales Research & Technology (France) . . . . . [9755-47]

3:10 pm: **Dynamic control of chaotic resonators** (*Invited Paper*), Andrea Di Falco, Univ. of St. Andrews (United Kingdom); Roman Bruck, Univ. of Southampton (United Kingdom); Changxu Liu, King Abdullah Univ. of Science and Technology (Saudi Arabia); Otto L. Muskens, Univ. of Southampton (United Kingdom); Andrea Fratallocchi, King Abdullah Univ. of Science and Technology (Saudi Arabia) . . . . . [9755-48]

Coffee Break . . . . . Tue 3:30 pm to 4:00 pm



# CONFERENCE 9755

LOCATION: ROOM 2008 (WEST LEVEL 2)

WEDNESDAY 17 FEBRUARY

## SESSION 13

LOCATION: ROOM 2008 (WEST LEVEL 2) . . TUE 4:00 PM TO 6:00 PM

### Nanophotonics and Plasmonics II

Session Chairs: **Ekmel Ozbay**, Bilkent Univ. (Turkey);  
**Dimitris Pavlidis**, Boston Univ. (USA)

4:00 pm: **Quantum photonics with color centers in diamond and nanophotonic structures** (*Invited Paper*), Simeon Bogdanov, Mikhail Y. Shalaginov, Jing Liu, Purdue Univ. (USA); Vadim V. Vorobyov, Photonic Nano-Meta Technologies (Russian Federation); Polina V. Kapitanova, ITMO Univ. (Russian Federation); Marcello Ferrera, Heriot-Watt Univ. (United Kingdom); Alexei Lagutchev, Purdue Univ. (USA); Alexey V. Akimov, Russian Quantum Ctr. (Russian Federation); Pavel A. Belov, ITMO Univ. (Russian Federation); Alexander V. Kildishev, Joseph M. Irudayaraj, Alexandra Boltasseva, Vladimir M. Shalaev, Purdue Univ. (USA) . . . . . [9755-49]

4:20 pm: **Is super-Planckian thermal emission possible in the far field?** (*Invited Paper*), François Marquier, Jean-Jacques Greffet, Institut d'Optique Graduate School (France); Patrick Bouchon, ONERA (France); Giovanni Brucoli, Institut d'Optique Graduate School (France) . . . . . [9755-50]

4:40 pm: **Integrated spectral and displacement sensors based on nanomechanical photonic crystals** (*Invited Paper*), Zarko Zobenica, Rob W. van der Heijden, Maurangelo Petruzzella, Francesco M. Pagliano, Tian Xia, Leonardo Midolo, Yongjin Cho, Frank W. M. van Otten, Andrea Fiore, Technische Univ. Eindhoven (Netherlands) . [9755-51]

5:00 pm: **Analytical treatment of the interaction between light, plasmonic and quantum resonances: quasi-normal mode expansion** (*Invited Paper*), Mathias Perrin, Jianji Yang, Univ. Bordeaux 1 (France); Philippe Lalanne, Lab. Charles Fabry (France) and Univ. Bordeaux 1 (France) . . . . . [9755-52]

5:20 pm: **Optical Helmholtz resonators** (*Invited Paper*), Patrick Bouchon, Paul Chevalier, ONERA (France); Fabrice Pardo, Lab. de Photonique et de Nanostructures (France); Riad Haïdar, ONERA (France) . . . . . [9755-53]

5:40 pm: **Enhanced second-harmonic generation from magnetic resonance in AlGaAs nanoantennas** (*Invited Paper*), Costantino De Angelis, Andrea Locatelli, Luca Carletti, Davide Rocco, Univ. degli Studi di Brescia (Italy); Oleksandr Stepanenko, Giuseppe Leo, Ivan Favero, Univ. Paris 7-Denis Diderot (France); Aristide Lemaitre, Lab. de Photonique et de Nanostructures (France); Giuseppe Marino, Nicolas Olivier, Anatoly V. Zayats, King's College London (United Kingdom) . . . . . [9755-54]

### Late-Breaking Results and Awards for Breakthroughs in Human-Centered Research

7:30 PM TO 9:00 PM

LOCATION: INTERCONTINENTAL HOTEL, HOWARD ROOM

Session Chairs: **Jay S. Lewis**,  
Defense Advanced Research Projects Agency (USA);  
**Philip Perconti**, U.S. Army Research Lab. (USA)

SPIE announces the continuation of the Awards for Breakthroughs in Human-Centered Research. The awards will recognize the scientific contributions of the best student(s) who present the most notable recent discoveries with broad impact to benefit our understanding of the human body, its diagnosis, or its medical treatment, in the fields of biosensing, spectroscopy, nanomedicine, and related fields. Presentations will be given and the winner(s) will be announced and awarded a commemorative plaque as well as a cash prize.

## SESSION 14

LOCATION: ROOM 2008 (WEST LEVEL 2) . WED 8:00 AM TO 8:30 AM

### Keynote Session IV

Session Chair: **Manijeh Razeghi**, Northwestern Univ. (USA)

8:00 am: **Hot carriers in graphene for terahertz emission and absorption** (*Keynote Presentation*), Samwel K. Sekwao, Jean-Pierre Leburton, Beckman Institute for Advanced Science and Technology (USA) and Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9755-55]

## SESSION 15

LOCATION: ROOM 2008 (WEST LEVEL 2) WED 8:30 AM TO 10:10 AM

### 2D Materials I

Session Chairs: **Jong Hyeob Baek**,  
Korea Photonics Technology Institute (Korea, Republic of);  
**Shanee Pacley**, Air Force Research Lab. (USA)

8:30 am: **Synthesis, doping and properties of two-dimensional materials** (*Invited Paper*), Rui Zhao, Shruti Subramanian, Joshua A. Robinson, The Pennsylvania State Univ. (USA) . . . . . [9755-56]

8:50 am: **Electrical and thermal transport in two-dimensional (2D) materials and devices** (*Invited Paper*), Eric Pop, Stanford Univ. (USA) . . . . . [9755-57]

9:10 am: **Structural and electrical properties of MoS<sub>2</sub> grown by sulfurization of PVD sputtered MoO<sub>3</sub> and Mo precursor films** (*Invited Paper*), Shane Pacley, Air Force Research Lab. (USA); Jianjun Hu, Michael Jespersen, Univ. of Dayton Research Institute (USA); Albert Hilton, Wyle Aerospace (USA); Adam R. Waite, Univ. of Dayton Research Institute (USA); Elizabeth A. Moore, Wyle Aerospace (USA); Jacob Brausch, Air Force Research Lab. (USA) and Univ. of Dayton Research Institute (USA); Emory Beck-Millerton, Andrey A. Voevodin, Air Force Research Lab. (USA) . . . . . [9755-58]

9:30 am: **Development of a research platform for uniform, large-area transition metal dichalcogenides** (*Invited Paper*), Jacob H. Leach, Gregg Dodson II, Paul Gentry, Eugene Shishkin, Robert Metzger, Keith R. Evans, Kyma Technologies, Inc. (USA) . . . . . [9755-59]

9:50 am: **Probing topological insulators surface states via plasma-wave terahertz detection** (*Invited Paper*), Leonardo Viti, Consiglio Nazionale delle Ricerche (Italy); Dominique Coquillat, Univ. Montpellier 2 (France); Antonio Politano, Univ. della Calabria (Italy); Konstantin A. Kokh, V. S. Sobolev Institute of Geology and Mineralogy (Russian Federation); Ziya S. Aliev, Mahammad B. Babanly, Azerbaijan National Academy of Sciences (Azerbaijan); Oleg E. Tereshchenko, Institute of Semiconductor Physics (Russian Federation) and Novosibirsk State Univ. (Russian Federation); Wojciech Knap, Univ. Montpellier 2 (France) and Institute of High Pressure Physics (Poland); Evgueni V. Chulkov, Ctr. de Fisica de Materiales (Spain) and National Research Tomsk State Univ. (Russian Federation) and Saint Petersburg State Univ. (Russian Federation); Miriam S. Vitiello, Consiglio Nazionale delle Ricerche (Italy) . . . . . [9755-60]

Coffee Break . . . . . Wed 10:10 am to 10:40 am

## SESSION 16

LOCATION: ROOM 2008 (WEST LEVEL 2) WED 10:40 AM TO 12:20 PM

### 2D Materials II

Session Chairs: **Eric Tournié**, Univ. Montpellier 2 (France);  
**Woo-Gwang Jung**, Kookmin Univ. (Korea, Republic of)

10:40 am: **From black phosphorus to phosphorene** (*Invited Paper*), Peide Ye, Purdue Univ. (USA) . . . . . [9755-61]

11:00 am: **Bridging the gap: layered black phosphorus for electronics and optoelectronics** (*Invited Paper*), Fengnian Xia, Yale Univ. (USA) . . . . . [9755-62]

11:20 am: **Theory of 2D lateral semiconductor heterojunctions** (*Invited Paper*), Henry Yu, Alex Kutana, Boris I. Yakobson, Rice Univ. (USA) . . . [9755-63]

11:40 am: **Spin filtering and magnetic coupling across ferromagnet-graphene-ferromagnet heterostructures** (*Invited Paper*), Enrique Cobas, U.S. Naval Research Lab. (USA) . . . . . [9755-64]

12:00 pm: **Atomic layer epitaxy for quantum well nitride-based devices** (*Invited Paper*), Jennifer K. Hite, Neeraj Nepal, Virginia R. Anderson, Jaime A. Freitas, Michael A. Mastro, Charles R. Eddy, U.S. Naval Research Lab. (USA) . . . . . [9755-65]

Lunch/Exhibition Break . . . . . Wed 12:20 pm to 1:50 pm



# CONFERENCE 9755

LOCATION: ROOM 2008 (WEST LEVEL 2) AND ROOM 309 (SOUTH ESPLANADE)

## SESSION 17

LOCATION: ROOM 2008 (WEST LEVEL 2) . . WED 1:50 PM TO 2:50 PM

### Infrared Detection III

Session Chairs: **Meimei Tidrow**, U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Maya P. Mikhailova**, Ioffe Physical-Technical Institute (Russian Federation)

1:50 pm: **Recent advances in Sofradir IR on II-VI photodetectors for HOT applications** (*Invited Paper*), Laurent Rubaldo, Alexandre Brunner, Pierre Guinedor, Rachid Taalat, Jocelyn Berthoz, Diane Sam-Giao, Alexandre Kerlain, Loïc Dargent, Nicolas Péré-laperme, Vincent Chaffraix, Marie-Lise Bourqui, Yannick Loquet, Jérôme Coussment, SOFRADIR (France) . . . . . [9755-66]

2:10 pm: **Optically-addressed visible/MWIR two-color photodetectors based on monolithically-integrated CdTe nBn and InSb PIN sub-photodetectors** (*Invited Paper*), Zhao-Yu He, Shi Liu, Calli Campbell, Maxwell B. Lassise, Ying-Shen Kuo, Zhi-Yuan Lin, Yong-Hang Zhang, Arizona State Univ. (USA) . . . . . [9755-67]

2:30 pm: **Stray light suppression in InGaAs/GaAsSb type-II FPA** (*Invited Paper*), Sundararajan Balasekaran, Masaki Migita, Takahiko Kawahara, Kenichi Machinaga, Kouhei Miura, Hiroshi Inada, Yasuhiro Iguchi, Tsukuru Katsuyama, Sumitomo Electric Industries, Ltd. (Japan) . . . . . [9755-69]

Coffee Break . . . . . Wed 2:50 pm to 3:30 pm

## SESSION 18

LOCATION: ROOM 2008 (WEST LEVEL 2) . WED 3:30 PM TO 4:00 PM

### Keynote Session V

Session Chair: **Manijeh Razeghi**, Northwestern Univ. (USA)

3:30 pm: **Monolithic quantum cascade lasers** (*Keynote Presentation*), Kwok Keung Law, Naval Air Warfare Ctr. Weapons Div. (USA) . . . [9755-70]

## SESSION 19

LOCATION: ROOM 2008 (WEST LEVEL 2) . WED 4:00 PM TO 5:20 PM

### Quantum Cascade Laser Development

Session Chairs: **Sven Höfling**, Julius-Maximilians-Univ. Würzburg (Germany); **Tsukuru Katsuyama**, Sumitomo Electric Industries, Ltd. (Japan)

4:00 pm: **Deterministic temporal chaos from a mid-infrared quantum cascade laser subjected to external optical feedback** (*Invited Paper*), Frédéric Grillot, Louise Jumpertz, Kevin Schires, Télécom ParisTech (France); Mathieu Carras, mirSense (France); Marc Sciamanna, CentraleSupélec (France) . . . . . [9755-71]

4:20 pm: **Mid-infrared near-field investigations of semiconductor multilayers and of quantum cascade lasers coupled to metal nanostructures for single-mode emission** (*Invited Paper*), Yannick De Wilde, Institut Langevin (France) . . . . . [9755-72]

4:40 pm: **Room-temperature continuous-wave operation of a terahertz molecular laser optically pumped by a quantum cascade laser** (*Invited Paper*), Jean-François Lampin, Institut d'Electronique de Microélectronique et de Nanotechnologie (France); Antoine Pagies, Guillaume Ducournau, Institut d'Electronique de Microélectronique et de Nanotechnologie (France) . . [9755-73]

5:00 pm: **THz nonlinear optics with quantum cascade lasers: optical sideband generation up to room temperature** (*Invited Paper*), Sarah Houver, Armand Lebreton, Lab. Pierre Aigrain (France); Maria Amanti, Carlo Sirtori, Univ. Paris 7-Denis Diderot (France); Lianhe H. Li, Edmund H. Linfield, Giles Davies, Univ. of Leeds (United Kingdom); Jérôme Tignon, Sukhdeep Dhillon, Lab. Pierre Aigrain (France) . . . . . [9755-74]

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Microwave radiation absorption and Shubnikov: de Haas oscillations in semi-metal InAs/GaSb/AlSb composite quantum wells**, Maya P. Mikhailova, Anatoly I. Veinger, Igor V. Kochman, Petr V. Semenikhin, Ioffe Physical-Technical Institute (Russian Federation); Karina V. Kalinina, Ioffe Institute (Russian Federation); Robert V. Parfeniev, Vyacheslav A. Berezovets, Ioffe Physical-Technical Institute (Russian Federation); Alice Hospodková, Jiří Pangrác, Eduard Hulicius, Institute of Physics of the ASCR, v.v.i. (Czech Republic) . . . . . [9755-96]

**Superconducting single-photon detector with the capability of photon-number resolving and photon positioning**, La Bao Zhang, Pen Gu, Xu Tao, Chao Wan, Min Gu, Lin Kang, Pei Heng Wu, Nanjing Univ. (China) . . . [9755-98]

**Dark current analysis in InGaAs-based mesa structured photodiode arrays**, Halit Dolas, Serdar Kocaman, Middle East Technical Univ. (Turkey) . . [9755-99]

**Diamond-based field sensor for nEDM experiment**, Sarvagya Sharma, Univ. of Illinois at Urbana-Champaign (USA); David C. Hovde, Southwest Sciences, Inc. (USA); Douglas Beck, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9755-100]

**Mid-infrared quantum cascade laser integrated with distributed Bragg reflector**, Hiroyuki Yoshinaga, Jun-ichi Hashimoto, Hiroki Mori, Yukihiro Tsuji, Makoto Murata, Mitsuru Ekawa, Tsukuru Katsuyama, Sumitomo Electric Industries, Ltd. (Japan) . . . . . [9755-101]

**Optimization of the epitaxial design of high current density resonant tunneling diodes for terahertz emitters**, Razvan Baba, Univ. of Glasgow (United Kingdom); Ben J. Stevens, The Univ. of Sheffield (United Kingdom); Toshikazu Mukai, ROHM Co., Ltd. (Japan); Richard A. Hogg, Univ. of Glasgow (United Kingdom) . . . . . [9755-102]

**Wide-field imaging of magnetic devices using solid state spins in diamond**, Robert E. Scholten, David A. Simpson, The Univ. of Melbourne (Australia); Jean-Philippe Tetienne, The Univ. of Melbourne (France); Julia McCoe, Kumaravelu Ganesan, Liam Thomas Hall, Steve Petrou, Lloyd C. L. Hollenberg, The Univ. of Melbourne (Australia) . . . . . [9755-105]

## THURSDAY 18 FEBRUARY

### SESSION 20

LOCATION: ROOM 309 (SOUTH ESPLANADE) . THU 8:00 TO 8:30 AM

#### NOTE ROOM CHANGE

### Keynote Session VI

Session Chairs: **Manijeh Razeghi**, Northwestern Univ. (USA); **Sumith Bandara**, U.S. Army Night Vision & Electronic Sensors Directorate (USA)

8:00 am: **Quantum dots for quantum science and technology** (*Keynote Presentation*), Maurice S. Skolnick, The Univ. of Sheffield (United Kingdom) . . . . . [9755-75]

### SESSION 21

LOCATION: ROOM 309 (SOUTH ESPLANADE) . THU 8:30 TO 10:10 AM

### Quantum Dots and Nanostructures I

Session Chairs: **Divyang Shah**, National Reconnaissance Office (USA); **Amy W. K. Liu**, IQE Inc. (USA)

8:30 am: **Additional compound semiconductor nanowires for photonics** (*Invited Paper*), Fumitaro Ishikawa, Ehime Univ. (Japan) . . . . . [9755-76]

8:50 am: **InAs/GaAs quantum dot infrared photodetectors monolithically grown on silicon substrates** (*Invited Paper*), Jiang Wu, Qi Jiang, Siming Chen, Mingchu Tang, Univ. College London (United Kingdom); Yuriy I. Mazur, Gregory J. Salamo, Univ. of Arkansas (USA); Huiyun Liu, Univ. College London (United Kingdom) . . . . . [9755-77]

# CONFERENCE 9755

LOCATION: ROOM 309 (SOUTH ESPLANADE)

9:10 am: **Miniature multispectral quantum-dot infrared photodetector for optical remote chemical sensing** (*Invited Paper*), Xuejun Lu, Univ. of Massachusetts Lowell (USA); Jarrod N. Vaillancourt, Applied NanoFemto Technologies LLC (USA) . . . . . [9755-78]

9:30 am: **Performance analysis of polarization sensitive mid-infrared photodetector using anisotropic quantum dot** (*Invited Paper*), Jitendra Kumar, Satish K. Singh, Indian School of Mines (India) . . . . . [9755-79]

9:50 am: **Hybrid-cavity quantum electrodynamics with quantum-dot circuits** (*Invited Paper*), Takis Kontos, Jérémie J. Viennot, Matthieu C. Dartiailh, Ctr. National de la Recherche Scientifique (France); Laure E. Bruhat, Ecole Normale Supérieure (France); Matthieu P. Desjardins, Audrey Cottet, Ctr. National de la Recherche Scientifique (France) . . . . . [9755-80]

Coffee Break . . . . . Thu 10:10 am to 10:40 am

## SESSION 22

LOCATION: RM 309 (SOUTH ESPLANADE) THU 10:40 AM TO 12:00 PM

### Quantum Dots and Nanostructures II

Session Chairs: **Oleg Mitrofanov**, Univ. College London (United Kingdom); **Yasar Gurbuz**, Sabanci Univ. (Turkey)

10:40 am: **CdSe and CdSe/CdS/Au heterostructures: in situ synthesis and self-assembly** (*Invited Paper*), Elena Shevchenko, Richard D. Schaller, Argonne National Lab. (USA) . . . . . [9755-81]

11:00 am: **Photoluminescence of sequential infiltration synthesized ZnO nanostructures** (*Invited Paper*), Leonidas E. Ocola, Argonne National Lab. (USA); David J Gosztola, Angel Yanguas-Gil, Hyo Seon Suh, Argonne National Laboratory (USA); Aine Connolly, Vassar College (USA) . . . . . [9755-82]

11:20 am: **CdTe quantum dots fluorescent probes for determination of 2,4-dichlorophenol compounds based on the Fe(III)PcTs-BuOOH catalysis system** (*Invited Paper*), Yilin Tong, Xuecai Han, Hongqi Li, Hankou Univ. (China) . . . . . [9755-83]

11:40 am: **Operation of molecular devices and machines on surfaces** (*Invited Paper*), Saw Wai Hla, Argonne National Lab. (USA) . . . . . [9755-84]

Lunch/Exhibition Break . . . . . Thu 12:00 pm to 1:30 pm

## SESSION 23

LOCATION: ROOM 309 (SOUTH ESPLANADE) . THU 1:30 TO 2:00 PM

### Keynote Session VII

Session Chairs: **Manijeh Razeghi**, Northwestern Univ. (USA); **Sumith Bandara**, U.S. Army Night Vision & Electronic Sensors Directorate (USA)

1:30 pm: **Semiconductor nanocrystals: energy transfer and biosensing applications** (*Keynote Presentation*), Richard D. Schaller, Argonne National Lab. (USA) . . . . . [9755-85]

## SESSION 24

LOCATION: ROOM 309 (SOUTH ESPLANADE) . THU 2:00 TO 3:40 PM

### Frontiers in Quantum Sensing

Session Chairs: **David A. Cardimona**, Air Force Research Lab. (USA); **Marija Strojnik Scholl**, Ctr. de Investigaciones en Óptica, A.C. (Mexico)

2:00 pm: **Examples of modern quantum sensing and metrology with new results on photon-added coherent states** (*Invited Paper*), Jerome A. Luine, Northrop Grumman Aerospace Systems (USA); Anjali Singh, Northrop Grumman Electronic Systems (USA); Bryan Gard, Louisiana State Univ. (USA); Jonathan Olson, Louisiana State Univ. (USA) . . . . . [9755-86]

2:20 pm: **Quantum state engineering and measurement with AlGaAs devices** (*Invited Paper*), Sara Ducci, Claire Autebert, Guillaume Boucher, Yacine Halioua, Qifeng Yao, Univ. Paris 7-Denis Diderot (France); Aristide Lemaitre, Carmen Gomez Carbonell, Ivan Favero, Giuseppe Leo, Lab. de Photonique et de Nanostructures (France) . . . . . [9755-87]

2:40 pm: **Light-matter interaction: conversion of optical energy and momentum to mechanical vibrations and phonons** (*Invited Paper*), Masud Mansuripur, College of Optical Sciences, The Univ. of Arizona (USA) . . [9755-88]

3:00 pm: **Technology study of quantum remote sensing imaging** (*Invited Paper*), Siwen Bi, Institute of Remote Sensing and Digital Earth (China) [9755-89]

3:20 pm: **DFB-ridge laser diodes at 894nm for cesium atomic clocks** (*Invited Paper*), Nicolas von Bandel, Michel Garcia, Michel Lecomte, Alexandre Larrue, Yannick Robert, Olivier Driss, III-V Lab. (France); Florian Gruet, Univ. of Neuchâtel (Switzerland); Renaud Matthey, Univ. of Neuchâtel (Switzerland); Gaetano Mileti, Univ. of Neuchâtel (Switzerland); Michel Krakowski, III-V Lab. (France) . . . . . [9755-90]

Coffee Break . . . . . Thu 3:40 pm to 4:10 pm

## SESSION 25

LOCATION: ROOM 309 (SOUTH ESPLANADE) . THU 4:10 TO 5:05 PM

### Advanced Optical Spectroscopy Techniques

Session Chairs: **Sheng Wu**, California Institute of Technology (USA); **Mark C. Phillips**, Pacific Northwest National Lab. (USA)

4:10 pm: **Quartz tuning forks with novel geometries for optoacoustic gas sensing** (*Invited Paper*), Vincenzo Spagnolo, Politecnico di Bari (Italy); Angelo Sampaolo, Pietro Patimisco, Univ. degli Studi di Bari Aldo Moro (Italy); Lei Dong, Yatee Gupta, Yajun Yu, Antonina Geras, Rice Univ. (USA); Marilena Giglio, Univ. degli Studi di Bari Aldo Moro (Italy); Pietro Paolo Calabrese, CNR INF BARI (Italy); Tomasz Starecki, Warsaw Univ. of Technology (Poland); Gaetano Scamarcio, Univ. degli Studi di Bari Aldo Moro (Italy); Frank K. Tittel, Rice Univ. (USA) . . . . . [9755-91]

4:30 pm: **Hollow-core waveguide for single-mode laser beam propagation in the spectral range of 3.7-7.3  $\mu\text{m}$**  (*Invited Paper*), Pietro Patimisco, Univ. degli Studi di Bari Aldo Moro (Italy); Laura Mihai, National Institute for Laser, Plasma and Radiation Physics (Romania); Marilena Giglio, Angelo Sampaolo, Univ. degli Studi di Bari Aldo Moro (Italy); P. P. Calabrese, Politecnico di Bari (Italy); Jason M. Kriesel, Opto-Knowledge Systems, Inc. (USA); Dan Sporea, National Institute for Laser, Plasma and Radiation Physics (Romania); Gaetano Scamarcio, Univ. degli Studi di Bari Aldo Moro (Italy); Frank K. Tittel, Rice Univ. (USA); Vincenzo Spagnolo, Politecnico di Bari (Italy) . . . . . [9755-92]

4:50 pm: **Mid-infrared dual-comb spectrometer based on QCL technology**, Andreas Hugi, IRsweep GmbH (Switzerland); Markus Mangold, ETH Zürich (Switzerland); Markus Geiser, IRsweep GmbH (Switzerland) and ETH Zürich (Switzerland); Gustavo F. Villares, ETH Zürich (Switzerland); Stéphane Blaser, Alpes Lasers SA (Switzerland); Jérôme Faist, ETH Zürich (Switzerland) [9755-93]

## SESSION 26

LOCATION: ROOM 309 (SOUTH ESPLANADE) . THU 5:05 TO 6:00 PM

### Nanophotonics and Plasmonics III

Session Chairs: **Maurice S. Skolnick**, The Univ. of Sheffield (United Kingdom); **Jean-Pierre Leburton**, Univ. of Illinois at Urbana-Champaign (USA)

5:05 pm: **Design and fabrication of Fe<sub>2</sub>O<sub>3</sub> plasmonic nanostructures** (*Invited Paper*), Naresh C. Das, Joshua MacClure, Kyle Grew, Deryn D. Chu, U.S. Army Research Lab. (USA) . . . . . [9755-94]

5:25 pm: **Optomechanical sensing of forces and liquids with miniature disk resonators** (*Invited Paper*), Biswarup Guha, Eduardo Gil Santos, Univ. Paris 7-Denis Diderot (France); Aristide Lemaitre, C. Gomez, Lab. de Photonique et de Nanostructures (France); Giuseppe Leo, Sara Ducci, Ivan Favero, Univ. Paris 7-Denis Diderot (France) . . . . . [9755-104]

5:45 pm: **Circular multipass reflection cells for optical gas sensing**, Andreas Hugi, Markus Mangold, IRsweep GmbH (Switzerland); Markus Geiser, IRsweep GmbH (Switzerland) and ETH Zürich (Switzerland); Belá Tuzson, Lukas Emmenegger, Empa (Switzerland) . . . . . [9755-103]

OPTO

# CONFERENCE 9756

LOCATION: ROOM 2005 (WEST LEVEL 2)

Monday–Thursday 15–18 February 2016 • Proceedings of SPIE Vol. 9756

# Photonic and Phononic Properties of Engineered Nanostructures VI

Conference Chairs: **Ali Adibi**, Georgia Institute of Technology (USA); **Shawn-Yu Lin**, Rensselaer Polytechnic Institute (USA); **Axel Scherer**, California Institute of Technology (USA)

Program Committee: **Andrea Alù**, The Univ. of Texas at Austin (USA); **William L. Barnes**, Univ. of Exeter (United Kingdom); **Ali Asghar Eftekhari**, Georgia Institute of Technology (USA); **Reginald K. Lee**, California Institute of Technology (USA); **Marko Loncar**, Harvard School of Engineering and Applied Sciences (USA); **Susumu Noda**, Kyoto Univ. (Japan); **Masaya Notomi**, NTT Basic Research Labs. (Japan); **Ekmel Özbay**, Bilkent Univ. (Turkey); **Yong Xu**, Virginia Polytechnic Institute and State Univ. (USA); **Eli Yablonovitch**, Univ. of California, Berkeley (USA); **Rashid Zia**, Brown Univ. (USA)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM  
LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative, Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break . . . . . Mon 10:10 am to 10:30 am

### SESSION 1

LOCATION: ROOM 2005 (WEST LEVEL 2) MON 10:30 AM TO 12:00 PM

### Recent Advances in Engineered Nanostructures

Session Chair: **Ali Adibi**, Georgia Institute of Technology (USA)

- 10:30 am: **Optical antennas: spontaneous emission faster than stimulated emission** (*Invited Paper*), **Eli Yablonovitch**, Univ. of California, Berkeley (USA) . . . . . [9756-1]
- 11:00 am: **Electrically tunable metafilm devices** (*Invited Paper*), **Mark L. Brongersma**, Geballe Lab. for Advanced Materials (GLAM) (USA) . . . . . [9756-2]
- 11:30 am: **Recent advances in cavity optomechanics** (*Invited Paper*), **Tobias J. Kippenberg**, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9756-3]
- Lunch Break . . . . . Mon 12:00 pm to 1:30 pm

### SESSION 2

LOCATION: ROOM 2005 (WEST LEVEL 2) . . MON 1:30 PM TO 3:00 PM

### Properties and Applications of Metasurfaces I

Session Chair: **Tobias J. Kippenberg**, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

- 1:30 pm: **Graphene-based active metasurfaces and their applications** (*Invited Paper*), **Gennady B. Shvets**, The Univ. of Texas at Austin (USA) . [9756-4]
- 2:00 pm: **Dispersion-free metasurface based holograms with chiral functionality**, **Mohammadreza Khorasaninejad**, **Antonio Ambrosio**, **Pritpal Kanhaiya**, **Federico Capasso**, Harvard School of Engineering and Applied Sciences (USA) . . . . . [9756-5]
- 2:20 pm: **Controlling scattering direction at an interface using oxide thickness**, **David Sell**, **Kai Zhang**, **Sage Doshay**, **Jonathan A. Fan**, Stanford Univ. (USA) . . . . . [9756-6]
- 2:40 pm: **Design and characterization of dielectric subwavelength focusing lens with polarization dependence**, **Sung Woon Kim**, **Lin Pang**, **Yeshiaahu Fainman**, Univ of California San Diego (USA) . . . . . [9756-7]
- Coffee Break . . . . . Mon 3:00 pm to 3:30 pm

### SESSION 3

LOCATION: ROOM 2005 (WEST LEVEL 2) . . MON 3:30 PM TO 5:30 PM

### Properties and Applications of Metasurfaces II

Session Chair: **Gennady B. Shvets**, The Univ. of Texas at Austin (USA)

- 3:30 pm: **Quasi-normal modes of high-index dielectric meta-atoms**, **David A. Powell**, The Australian National Univ. (Australia) . . . . . [9756-8]
- 3:50 pm: **Controlling the spatial and spectral emissivity at the diffraction limit**, **Mathilde Makhsiyani**, ONERA (France) and Lab. de Photonique et de Nanostructures (France); **Patrick Bouchon**, **Julien Jaeck**, ONERA (France); **Jean-Luc Pelouard**, Lab. de Photonique et de Nanostructures (France); **Riad Haïdar**, ONERA (France) . . . . . [9756-9]
- 4:10 pm: **Quarter-wavelength metamaterial antireflection coating**, **Wonkyu Kim**, The Univ. of Alabama in Huntsville (USA); **Joshua Hendrickson**, Air Force Research Lab. (USA); **Junpeng Guo**, The Univ. of Alabama in Huntsville (USA) . . . . . [9756-10]
- 4:30 pm: **Modeling refractive metasurfaces in series as a single metasurface**, **Fatima Toor**, **Ananda C. Guneratne**, The Univ. of Iowa (USA) . . . . . [9756-11]
- 4:50 pm: **Ultrafast switching in nonlinear dielectric metasurfaces with magnetic resonances**, **Polina P. Vabishchevich**, **Maxim R. Shcherbakov**, **Alexander S. Shorokhov**, Lomonosov Moscow State Univ. (Russian Federation); **Katie E. Chong**, **Duk-Yong Choi**, **Isabelle Staude**, **Andrey E. Miroshnichenko**, **Dragomir N. Neshev**, The Australian National Univ. (Australia); **Andrey A. Fedyanin**, Lomonosov Moscow State Univ. (Russian Federation); **Yuri S. Kivshar**, The Australian National Univ. (Australia) . . . . . [9756-12]
- 5:10 pm: **Phase-matching for nonlinear optical generation in zero-index material**, **Xianglong Miao**, **Jian Wang**, **Huazhong Univ. of Science and Technology** (China) . . . . . [9756-13]



# CONFERENCE 9756

LOCATION: ROOM 2005 (WEST LEVEL 2)

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: ROOM 2005 (WEST LEVEL 2) .TUE 8:00 AM TO 10:00 AM

#### Novel Nanophotonic Materials

Session Chair: **Chee Wei Wong**, Univ. of California, Los Angeles (USA)

8:00 am: **2D material nanophotonics for optical information science** (*Invited Paper*), Arka Majumdar, Univ. of Washington (USA) . . . . . [9756-14]

8:30 am: **A wide-range tunable reconfigurable graphene-based THz nanpatch Antenna** (*Invited Paper*), Hasan Goktas, Yuming Ren, Volker J. Sorger, The George Washington Univ. (USA) . . . . . [9756-15]

9:00 am: **Enhanced light collection of photons by all solid-state architectures** (*Invited Paper*), Oliver Benson, Humboldt-Univ. zu Berlin (Germany) . . . . . [9756-16]

9:30 am: **Hybrid multilayer nanophotonic material platform and devices** (*Invited Paper*), Ali Asghar Eftekhar, A. H. Hosseininia, Majid Sodagar, Hesam Moradinejad, Amir H. Atabaki, Ali Adibi, Georgia Institute of Technology (USA) . . . . . [9756-17]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

### SESSION 5

LOCATION: ROOM 2005 (WEST LEVEL 2) TUE 10:30 AM TO 12:30 PM

#### Optomechanical Structures

Session Chair: **Volker J. Sorger**, The George Washington Univ. (USA)

10:30 am: **Precision measurements in optomechanical photonic crystal cavities** (*Invited Paper*), Chee Wei Wong, Yongjun Huang, Jaime G. F. Flores, Jinkang Lim, Shu-Wei Huang, Univ. of California, Los Angeles (USA) . . [9756-18]

11:00 am: **Optomechanics in single-crystal diamond** (*Invited Paper*), Paul E. Barclay, Univ. of Calgary (Canada) . . . . . [9756-19]

11:30 am: **Integrated III-V photonic crystal-Si waveguide platform with tailored optomechanical coupling**, Viktor Tsvirkun, Alessendro Surrente, Ctr. National de la Recherche Scientifique (France); Fabrice Raineri, Lab. de Photonique et de Nanostructures (France) and Univ. Paris 7-Denis Diderot (France); Grégoire Beaudoin, Rama Raj, Isabelle Sagnes, Isabelle Robert-Philip, Lab. de Photonique et de Nanostructures (France); Rémy Braive, Lab. de Photonique et de Nanostructures (France) and Univ. Paris 7-Denis Diderot (France) . . . . . [9756-20]

11:50 am: **Demonstration of hetero-optomechanical crystal nanobeam cavities with high mechanical frequency**, Zhilei Huang, Kaiyu Cui, Guoren Bai, Yongzhuo Li, Xue Feng, Fang Liu, Wei Zhang, Yidong Huang, Tsinghua Univ. (China) . . . . . [9756-21]

12:10 pm: **Diamond optomechanical crystals**, Michael J. Burek, Harvard Univ. (USA); Justin D. Cohen, Sean M. Meenehan, California Institute of Technology (USA); Thibaud Ruelle, Srujan Meesala, Harvard Univ. (USA); Oskar J. Painter, California Institute of Technology (USA); Marko Loncar, Harvard Univ. (USA) . . . . . [9756-80]

Lunch/Exhibition Break . . . . . Tue 12:30 pm to 1:30 pm

### SESSION 6

LOCATION: ROOM 2005 (WEST LEVEL 2) . . .TUE 1:30 PM TO 3:00 PM

#### Phononic Crystal Structures

Session Chair: **Paul E. Barclay**, Univ. of Calgary (Canada)

1:30 pm: **Confinement and interaction of elastic and electromagnetic waves in phononic crystal cavities** (*Invited Paper*), Yan Pennec, Said El Jallal, Bahram Djafari-Rouhani, Univ. des Sciences et Technologies de Lille (France) . . [9756-22]

2:00 pm: **Thermal and mechanical features of Si-based 2D phononic crystal membranes**, Bartłomiej Graczkowski, Markus R. Wagner, Marianna Sledzinska, Juan S. Reparaz, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain); Alexandros El Sachat, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain) and Univ. Autònoma de Barcelona (Spain); Francesc Alzina, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain); Clivia M. Sotomayor Torres, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain) and Catalana de Recerca i Estudis Avançats (Spain) . . . [9756-23]

2:20 pm: **Design of high-quality pillar-based phononic crystal structures**, Razi Dehghannasiri, Reza Pourabolghasem, Ali Asghar Eftekhar, Ali Adibi, Georgia Institute of Technology (USA) . . . . . [9756-24]

2:40 pm: **Integrated phononic crystal structures using surface acoustic waves**, Reza Pourabolghasem, Razi Dehghannasiri, Ali Asghar Eftekhar, Ali Adibi, Georgia Institute of Technology (USA) . . . . . [9756-25]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

### SESSION 7

LOCATION: ROOM 2005 (WEST LEVEL 2) . . TUE 3:30 PM TO 5:40 PM

#### Novel Phenomena and Applications in Engineered Nanostructures

Session Chair: **Arka Majumdar**, Univ. of Washington (USA)

3:30 pm: **Fundamental bounds for nonlinearity-based optical isolation** (*Invited Paper*), Dimitrios Sounas, Andrea Alù, The Univ. of Texas at Austin (USA) . . . . . [9756-26]

4:00 pm: **Net on-chip Brillouin continuous wave gain based on suspended silicon photonic nanowires**, Alexandre Bazin, Raphaël Van Laer, Bart Kuyken, Roel G. Baets, Dries Van Thourhout, Univ. Gent (Belgium) . . . . . [9756-27]

4:20 pm: **Observation of integer pseudospin conical diffraction in photonic Lieb lattices**, Falko Diebel, Westfälische Wilhelms-Univ. Münster (Germany); Daniel Leykam, The Australian National Univ. (Australia); Sebastian Kroesen, Cornelia Denz, Westfälische Wilhelms-Univ. Münster (Germany); Anton S. Desyatnikov, The Australian National Univ. (Australia) . . . . . [9756-28]

4:40 pm: **Polarized nonlinear nanoscopy in metal and ferroelectric nanostructures**, Carolina Rendon Barraza, Naveen K. Balla, Institut Fresnel (France); Esteban Bermudez-Urena, ICFO - Institut de Ciències Fotòniques (Spain); Flavia Timpu, Rachel Grange, ETH Zürich (Switzerland); Romain Quidant, ICFO - Institut de Ciències Fotòniques (Spain); Sophie Brasselet, Institut Fresnel (France) . . . . . [9756-29]

5:00 pm: **Time-harmonic optical chirality in inhomogeneous space**, Philipp Gutsche, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany); Lisa V. Poulikakos, ETH Zürich (Switzerland); Martin Hammerschmidt, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany); Sven Burger, Frank Schmidt, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany) and JCMwave GmbH (Germany) [9756-30]

5:20 pm: **Inverse design engineering of all-silicon polarization beam splitter**, Lars H. Frandsen, Ole Sigmund, Technical Univ. of Denmark (Denmark) . . . . . [9756-31]

## WEDNESDAY 17 FEBRUARY

### SESSION 8

LOCATION: ROOM 2005 (WEST LEVEL 2) WED 8:20 AM TO 10:10 AM

#### Plasmonic Nanostructures I

Session Chair: **Stefan A. Maier**, Imperial College London (United Kingdom)

8:20 am: **In-situ visualization of intercalation-driven nanoparticle phase transitions using plasmon-EELS** (*Invited Paper*), Jennifer A. Dionne, Stanford Univ. (USA) . . . . . [9756-32]

8:50 am: **Optical properties of bi-metal nanoparticles prepared by a magneto-sputtering**, Igor V. Melnikov, National Research Univ. of Electronic Technology (Russian Federation) and Univ. of Illinois in Urbana-Champaign (USA) and Moscow Institute of Physics and Technology (Russian Federation); Dmitry G. Gromov, Andrey I. Savitsky, National Research Univ. of Electronic Technology (Russian Federation) . . . . . [9756-36]

9:10 am: **Enhanced spontaneous emission from individual quantum dots coupled to lithographically defined metallic nano-antennas**, Armin Regler, Technische Univ. München (Germany); Konrad Schraml, Walter Schottky Institut (Germany) and Technische Univ. München (Germany); Anna A. Lyamkina, A.V. Ryzhanov Institute of Semiconductor Physics (Russian Federation); Glenn Glashagen, Technische Univ. München (Germany); Michael Kaniber, Walter Schottky Institut (Germany) and Technische Univ München (Germany); Jelena Vučkovic, Stanford Univ. (USA); Jonathan J. Finley, Walter Schottky Institut (Germany) and Technische Univ München (Germany) . . . . . [9756-33]

9:30 am: **Nanometres to centimetres: Novel optical nano-antennas with an eye to scaled production**, Timothy D. James, The Univ. of Melbourne (Australia) and Australian National Fabrication Facility (Australia); Jasper J. Cadusch, Stuart K. Earl, Evgeniy Panchenko, Paul Mulvaney, The Univ. of Melbourne (Australia); Timothy J. Davis, Commonwealth Scientific and Industrial Research Organisation (Australia); Ann Roberts, The Univ. of Melbourne (Australia) . . . . . [9756-35]

9:50 am: **Enhanced nonlinear optical effects in the presence of Tamm plasmon-polaritons**, Boris I. Afanogenov, Vladimir O. Bessonov, Andrey A. Fedyanin, Lomonosov Moscow State Univ. (Russian Federation) . . . . [9756-37]

Coffee Break . . . . . Wed 10:10 am to 10:30 am

OPTO

# CONFERENCE 9756

LOCATION: ROOM 2005 (WEST LEVEL 2)

## SESSION 9

LOCATION: ROOM 2005 (WEST LEVEL 2) WED 10:30 AM TO 12:00 PM

### Plasmonic Nanostructures II

Session Chair: **Jennifer A. Dionne**, Stanford Univ. (USA)

10:30 am: **Latest progress in spaser and its biomedical applications** (*Invited Paper*), Mark I. Stockman, Georgia State Univ. (USA) . . . . . [9756-38]

11:00 am: **Design of a plasmonic-organic hybrid slot waveguide integrated with a bowtie-antenna for terahertz wave detection**, Xingyu Zhang, Univ. of Texas at Austin (USA) and Hewlett-Packard Labs. (USA); Chi-Jui Chung, The Univ. of Texas at Austin (USA); Harish Subbaraman, Omega Optics, Inc. (USA); Zeyu Pan, Chin-Ta Chen, The Univ. of Texas at Austin (USA); Ray T. Chen, The Univ. of Texas at Austin (USA) and Omega Optics, Inc. (USA) . . . . . [9756-39]

11:20 am: **Complex dielectric and geometry influences on plasmon excitation and energy transfer in nanocomposite systems**, Gregory T. Forcherio, Phillip Blake, Manoj Seeram, Univ. of Arkansas (USA); Drew DeJarnette, The Univ. of Tulsa (USA); D. Keith Roper, Univ. Arkansas (USA) . . . . . [9756-40]

11:40 am: **Plasmon-induced sub-bandgap photodetection with organic schottky diodes**, Ji-Ling Hou, Axel Fischer, Sheng-Chieh Yang, Daniel Kasemann, Karl Leo, TU Dresden (Germany) . . . . . [9756-41]

Lunch/Exhibition Break . . . . . Wed 12:00 pm to 1:30 pm

## SESSION 10

LOCATION: ROOM 2005 (WEST LEVEL 2) . . WED 1:30 PM TO 3:00 PM

### Plasmonic Nanostructures III

Session Chair: **Luca Dal Negro**, Boston Univ. (USA)

1:30 pm: **Hybrid nanoantennas for nonlinear optics and biosensing** (*Invited Paper*), Stefan A. Maier, Imperial College London (United Kingdom) . . . [9756-42]

2:00 pm: **Experimental investigation on the lensing and Talbot effects of finite-sized 2D periodic metallic nanoaperture arrays**, Yiting Yu, Northwestern Polytechnical Univ. (China); Hans Zappe, Univ. of Freiburg (Germany); Weizheng Yuan, Northwestern Polytechnical Univ. (China) . [9756-43]

2:20 pm: **Polarization switchable two-color plasmonic nano-pixels for creating optical surfaces encoded with dual information states**, Alasdair W. Clark, Esmail Heydari, Zhibo Li, Jonathan M. Cooper, Univ. of Glasgow (United Kingdom) . . . . . [9756-44]

2:40 pm: **Nanoscale highly selective plasmonic multi-channel demultiplexer**, Mohamed A. Swillam, Abdullilah A. Azzazi, The American Univ. in Cairo (Egypt) . . . . . [9756-45]

Coffee Break . . . . . Wed 3:00 pm to 3:30 pm

## SESSION 11

LOCATION: ROOM 2005 (WEST LEVEL 2) . . WED 3:30 PM TO 5:30 PM

### Photonic and Plasmonic Metamaterials

Session Chair: **Ali Asghar Eftekhar**, Georgia Institute of Technology (USA)

3:30 pm: **Refractory plasmonics: new material platforms for nanophotonics** (*Invited Paper*), Vladimir M. Shalaev, Nathaniel Kinsey, Purdue Univ. (USA); Urcan Guler, Nano-Meta Technologies, Inc. (USA); Jongbum Kim, Alexandra Boltasseva, Purdue Univ. (USA) . . . . . [9756-46]

4:00 pm: **Engineering novel low-loss metamaterials on the Si platform** (*Invited Paper*), Luca Dal Negro, Boston Univ. (USA) . . . . . [9756-47]

4:30 pm: **Giant cross polarization in a nanoimprinted metamaterial combining a fishnet with its Babinet complement**, Lin Dong, Johannes Kepler Univ. Linz (Austria); Michael J. Haslinger, Jürgen Danzberger, Iris Bergmaier, PROFACTOR GmbH (Austria); Kurt Hingerl, Calin Hrelescu, Thomas A. Klar, Johannes Kepler Univ. Linz (Austria) . . . . . [9756-48]

4:50 pm: **Polaritonic -plasmonic optical switching in metamaterial nanostructures**, Alexander Cuadrado, Johann Toudert, Rosalia Serna, Consejo Superior de Investigaciones Científicas (Spain) . . . . . [9756-49]

5:10 pm: **Making dichroic and diffractive optical elements in metal-glass nanocomposites**, Amin Abdolvand, Stefan Wackerow, Univ. of Dundee (United Kingdom) . . . . . [9756-50]

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Structural dark metamaterial based on optical illusions and application on black-body lasers**, Changxu Liu, Jianfeng Huang, Yihan Zhu, Silvia Masala, Erkki Alarousu, Han Yu, Andrea Fratallocchi, King Abdullah Univ. of Science and Technology (Saudi Arabia) . . . . . [9756-68]

**Extraordinary optical transmission through nanohole arrays blocked by gold umbrella-like tap**, Youwen Liu, Huidan Xue, Jiming Wang, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [9756-69]

**Broadband meta-hologram composed of Z-shaped nano-antennas**, Sang-Eun Mun, Yohan Lee, Joonsoo Kim, Seoul National Univ. (Korea, Republic of) . . . . . [9756-70]

**Enhanced low-absorptive molecular detection by using metal slot antenna arrays**, Kwang Jun Ahn, Fabian Rotermund, Ajou Univ. (Korea, Republic of) . . . [9756-71]

**The optical characteristics of 1D lamellar photonic crystal with PS-b-P2VP block copolymer**, Jin Youb Lim, Dong-Myung Shin, Hongik Univ. (Korea, Republic of) . . . . . [9756-72]

**Directional switching of surface plasmon polaritons by vanadium dioxide-gold hybrid antennas**, ByoungHo Lee, Sun-Je Kim, Kyookyeun Lee, Seoul National Univ. (Korea, Republic of); Seung Yeol Lee, Seoul National Univ (Korea, Republic of) . . . . . [9756-73]

**Light coupling from free space to slab waveguide by two-dimensional triangle photonic crystal coupler**, Jingxing Shi, Michael E. Pollard, Martin D. B. Charlton, Univ. of Southampton (United Kingdom) . . . . . [9756-74]

**Fabrication of two-dimensional visible wavelength nanoscale plasmonic structures using hydrogen silsesquioxane-based resist for use in optical biosensing systems**, Kyle Smith, Akshitha Gadde, Anand Kadiyala, Jeremy M. Dawson, West Virginia Univ. (USA) . . . . . [9756-76]

**Surface-enhanced Raman scattering in *C. wailesii* diatom frustules**, Christine E. Alvarez, Robert A. Norwood, Khanh Q. Kieu, Gregory A. Cohoon, The Univ. of Arizona (USA); Olga Kropacheva, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9756-77]

**Modulation of surface plasmon polaritons with metal and alloy nanofilms**, Benjamin D. Hall, Heesoo Park, Azad Siahmakoun, Rose-Hulman Institute of Technology (USA) . . . . . [9756-78]

**Observation of resonance of Au single block with finite width by using a near-field scanning optical microscope**, Hong-Gyu Ahn, Chang Hyun Park, Yonsei Univ. (Korea, Republic of); Kyong Seok Kim, Daeyeon Kim, Yonsei Univ (Korea, Republic of); Seung-Han Park, Yonsei Univ. (Korea, Republic of) . . . . . [9756-79]

**Polarimetric techniques for determining morphology and optical features of high refractive index dielectric nanoparticles**, Ángela I. Barreda Gomez, Juan M. Sanz, Rodrigo Alcaraz de la Osa, José M. Saiz, Fernando Moreno, Francisco González, Univ. de Cantabria (Spain) . . . . . [9756-81]

**Spectral response of dielectric nano-antennas in the far- and near-field regimes**, Yael Gutiérrez Vela, Ángela I. Barreda Gomez, Francisco González, Fernando Moreno, Univ. de Cantabria (Spain) . . . . . [9756-82]

# CONFERENCE 9756

LOCATION: ROOM 307 (SOUTH ESPLANADE)

## THURSDAY 18 FEBRUARY

### SESSION 12

LOCATION: ROOM 307 (SOUTH ESPLANADE) THU 8:00 TO 10:10 AM

#### NOTE ROOM CHANGE

### Photonic Crystal Structures I

Session Chair: **Shawn-Yu Lin**, Rensselaer Polytechnic Institute (USA)

- 8:00 am: **Graded photonic crystal structures for single-pass all-angle light extraction from light-emitting diodes** (*Invited Paper*), Martin F. Schumann, Aimi Abass, Guillaume Gomard, Karlsruher Institut für Technologie (Germany); Samuel Wiesendanger, Friedrich-Schiller-Univ. Jena (Germany); Uli Lemmer, Martin Wegener, Carsten Rockstuhl, Karlsruher Institut für Technologie (Germany) . . . . . [9756-51]
- 8:30 am: **Active disorder counteraction in photonic crystal cavity arrays**, Sergei Sokolov, Jin Lian, Emre Yüce, Univ. Twente (Netherlands); Alfredo De Rossi, Thales Research and Technology (France); Sylvain Combré, Thales Research & Technology (France); Allard P. Mosk, Univ. Twente (Netherlands) . . . . . [9756-52]
- 8:50 am: **Visible to near-infrared narrow-band thermal emitters based on silicon-rod photonic crystals**, Masahiro Suemitsu, Osaka Gas Co., Ltd. (Japan); Tatsunori Tsutsumi, Kyoto Univ. Graduate School of Engineering (Japan); Takashi Asano, Kyoto Univ. (Japan); Menaka De Zoysa, Susumu Noda, Kyoto Univ. Graduate School of Engineering (Japan) . . . . . [9756-53]
- 9:10 am: **Fiber-coupled photonic crystal nanocavity for reconfigurable formation of coupled cavity system**, Tomohiro Tetsumoto, Yuta Ooka, Takasumi Tanabe, Keio Univ. (Japan) . . . . . [9756-54]
- 9:30 am: **Chalcogenide glass photonic crystals by solution processing**, Tingyi Gu, Chao Lu, Alejandro W. Rodriguez, Craig B. Arnold, Princeton Univ. (USA) . . . . . [9756-55]
- 9:50 am: **Self-assembled photonic crystals for a chemical sensing**, Céline Bourdillon, Catherine Schwob, Agnès Maitre, Laurent Coolen, Sarra Gam Derouich, Univ. Pierre et Marie Curie (France); Claire Mangeney, Univ. Paris 7-Denis Diderot (France) . . . . . [9756-56]
- Coffee Break . . . . . Thu 10:00 am to 10:30 am

### SESSION 13

LOCATION: RM 307 (SOUTH ESPLANADE) . . . THU 10:30 AM TO 12:00 PM

### Photonic Crystal Structures II

Session Chair: **Martin F. Schumann**,  
Karlsruher Institut für Technologie (Germany)

- 10:30 am: **Resonant mode emission from an active three-dimensional photonic crystal** (*Invited Paper*), Shawn-Yu Lin, Rensselaer Polytechnic Institute (USA); Mei-Li Hsieh, National Chiao Tung Univ. (Taiwan) . . . . . [9756-57]
- 11:00 am: **Controlled point and line defects in 3D silicon inverse woodpile photonic band gap crystals**, Diana A. Grishina, Univ. Twente (Netherlands); Jorge Pérez Vizcaino, Univ. Jaume I (Spain); Oluwafemi Ojambati, Ad Lagendijk, Willem L. Vos, Univ. Twente (Netherlands) . . . . . [9756-58]
- 11:20 am: **Optical correlations in 2D and 3D photonic crystals with weak and strong disorder**, Oluwafemi Ojambati, Elahe Yeganegi, Allard P. Mosk, Willem L. Vos, Univ. Twente (Netherlands) . . . . . [9756-59]
- 11:40 am: **Compound grating structures in photonic crystals for resonant excitation of azobenzene**, Sabrina Jahns, Christine Kallweit, Christian-Albrechts-Univ. zu Kiel (Germany); Jost Adam, Univ. of Southern Denmark (Denmark); Martina Gerken, Christian-Albrechts-Univ. zu Kiel (Germany) . . . . . [9756-60]
- Lunch/Exhibition Break . . . . . Thu 12:00 pm to 1:00 pm

### SESSION 14

LOCATION: ROOM 307 (SOUTH ESPLANADE) . THU 1:00 TO 3:00 PM

### Modeling and Simulation of Nanophotonic Structures

Session Chair: **Ali Adibi**, Georgia Institute of Technology (USA)

- 1:00 pm: **Mechanically tunable optical response of large-area stretchable plasmonic arrays**, Sage Doshay, Stanford Univ. (USA); Li Gao, Univ. of Illinois at Urbana-Champaign (USA); Yihui Zhang, Yonggang Hong, Northwestern Univ. (USA); John A. Rogers, Univ. of Illinois at Urbana-Champaign (USA); Jonathan A. Fan, Stanford Univ. (USA) . . . . . [9756-61]
- 1:20 pm: **Reconstruction of photonic crystal geometries using a reduced basis method for nonlinear outputs**, Martin Hammerschmidt, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany); Carlo Barth, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (Germany) and Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany); Jan Pomplun, JCMwave GmbH (Germany); Sven Burger, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany) and JCMwave GmbH (Germany); Christiane Becker, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH (Germany); Frank Schmidt, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany) and JCMwave GmbH (Germany) . . . . . [9756-62]
- 1:40 pm: **Metal-dielectric frequency-selective surface for high-performance solar window coatings**, Fatima Toor, Ananda C. Guneratne, The Univ. of Iowa (USA) . . . . . [9756-63]
- 2:00 pm: **Strong optically induced magnetic response for a dipole-fiber system**, Shaghik Atakaramians, The Univ. of Sydney (Australia); Andrey E. Miroshnichenko, Ilya V. Shadrivov, The Australian National Univ. (Australia); Tanya M. Monro, The Univ. of Adelaide (Australia); Yuri S. Kivshar, The Australian National Univ. (Australia); Shahraam V. Afshar, Univ. of South Australia (Australia) . . . . . [9756-64]
- 2:20 pm: **Analysis of dispersion relation in three-dimensional single gyroid**, Yu-Chueh Hung, Pei-Lun Jheng, National Tsing Hua Univ. (Taiwan) . . . [9756-65]
- 2:40 pm: **Regular coined metal nanosphere trimer: Simple and efficient polarization-independent SERS nanostructure**, Chao Feng, Yan Zhao, Yijian Jiang, Beijing Univ. of Technology (China) . . . . . [9756-66]

OPTO

# CONFERENCE 9757

LOCATION: ROOM 2014 (WEST LEVEL 2) AND ROOM 303 (SOUTH ESPLANADE)

Wednesday–Thursday 17–18 February 2016 • Proceedings of SPIE Vol. 9757

# High Contrast Metastructures V

Conference Chairs: **Connie J. Chang-Hasnain**, Univ. of California, Berkeley (USA); **David Fattal**, LEIA Inc. (USA); **Fumio Koyama**, Tokyo Institute of Technology (Japan); **Weimin Zhou**, U.S. Army Research Lab. (USA)

Program Committee: **Markus-Christian Amann**, Walter Schottky Institut (Germany); **Il-Sug Chung**, Technical Univ. of Denmark (Denmark); **Ernst-Bernhard Kley**, Friedrich-Schiller-Univ. Jena (Germany); **Philippe Lalanne**, Institut d'Optique Graduate School (France); **John R. Lawall**, National Institute of Standards and Technology (USA); **Tien-Chang Lu**, National Chiao Tung Univ. (Taiwan); **Rainer F. Mahrt**, IBM Research – Zürich (Switzerland); **Gunther Roelkens**, Univ. Gent (Belgium); **Pierre Viktorovitch**, Ecole Centrale de Lyon (France); **Alan E. Willner**, The Univ. of Southern California (USA); **Ming C. Wu**, Univ. of California, Berkeley (USA); **Anshi Xu**, Peking Univ. (China)

## WEDNESDAY 17 FEBRUARY

### SESSION 1

LOCATION: ROOM 2014 (WEST LEVEL 2) . . . . WED 9:00 TO 10:30 AM

#### Harnessing Light I

Session Chair: **Weimin Zhou**, U.S. Army Research Lab. (USA)

9:00 am: **Flat high-contrast metastructures** (*Invited Paper*), Connie J. Chang-Hasnain, Univ. of California, Berkeley (USA) . . . . . [9757-1]

9:30 am: **Widened photonic functionality of asymmetric high-index contrast/photonic crystal gratings** (*Invited Paper*), Hai Son Nguyen, Xavier Letartre, Jean Louis Leclercq, Christian Seassal, Pierre Viktorovitch, Univ. de Lyon (France) . . . . . [9757-2]

10:00 am: **Flat free-space optical components and systems based on sub-wavelength high-contrast gratings** (*Invited Paper*), Andrei Faraon, California Institute of Technology (USA) . . . . . [9757-3]

Coffee Break . . . . . Wed 10:30 am to 11:00 am

### SESSION 2

LOCATION: ROOM 2014 (WEST LEVEL 2) . WED 11:00 AM TO 12:30 PM

#### Harnessing Light II

Session Chair: **Pierre Viktorovitch**, Ecole Centrale de Lyon (France)

11:00 am: **Guided-mode resonance nanophotonics in materially sparse architectures** (*Invited Paper*), Robert Magnusson, Manoj Niraula, Jae W. Yoon, Yeong H. Ko, Kyu J. Lee, The Univ. of Texas at Arlington (USA) . . . . . [9757-4]

11:30 am: **Dielectric nanoantennas and metasurfaces for control of light at the nanoscale** (*Invited Paper*), Arseniy I. Kuznetsov, A\*STAR - Data Storage Institute (Singapore) . . . . . [9757-5]

12:00 pm: **Dielectric metasurfaces on thin flexible substrates**, Seyedeh Mahsa Kamali, Amir Arbabi, Ehsan Arbabi, Yu Horie, Andrei Faraon, California Institute of Technology (USA) . . . . . [9757-6]

12:15 pm: **High-efficiency aperiodic two-dimensional high-contrast-grating hologram**, Pengfei Qiao, Li Zhu, Connie J. Chang-Hasnain, Univ. of California, Berkeley (USA) . . . . . [9757-7]

Lunch/Exhibition Break . . . . . Wed 12:30 pm to 2:00 pm

### SESSION 3

LOCATION: ROOM 2014 (WEST LEVEL 2) . . . . . WED 2:00 TO 3:30 PM

#### VCSELs

Session Chair: **Tien-Chang Lu**, National Chiao Tung Univ. (Taiwan)

2:00 pm: **Multi-mode rate-equation analysis of VCSELs with >30GHz bandwidth** (*Invited Paper*), Werner H. Hofmann, Technische Univ. Berlin (Germany) . . . . . [9757-8]

2:30 pm: **Hybrid III-V on Si grating as a broadband reflector and a high-Q resonator** (*Invited Paper*), Il-Sug Chung, Alireza Taghizadeh, Supannee Learkthanakhachon, Gyeong Cheol Park, Technical Univ. of Denmark (Denmark) . . . . . [9757-9]

3:00 pm: **Heterogeneously-integrated InP HCG-VCSEL for flexible optoelectronics**, Li Zhu, James E. Ferrara, Connie J. Chang-Hasnain, Univ. of California, Berkeley (USA) . . . . . [9757-10]

3:15 pm: **Two-dimensional designed fabrication of subwavelength grating HCG mirror on silicon-on-insulator**, Shen-Che Huang, Kuo-Bin Hong, Tien-Chang Lu, National Chiao Tung Univ. (Taiwan); Sailing He, KTH Royal Institute of Technology (Sweden) . . . . . [9757-11]

Coffee Break . . . . . Wed 3:30 pm to 4:00 pm

### SESSION 4

LOCATION: ROOM 2014 (WEST LEVEL 2) . . WED 4:00 PM TO 5:30 PM

#### VCSELs and Slow Light

Session Chair: **Andrei Faraon**, California Institute of Technology (USA)

4:00 pm: **Multi-parameter optimization of monolithic high-index contrast grating reflectors** (*Invited Paper*), Magdalena Marciniak, Marcin GebSKI, Maciej Dems, Michal Wasiak, Tomasz G. Czynszanowski, Lodz Univ. of Technology (Poland) . . . . . [9757-12]

4:30 pm: **Design of athermal and tunable MEMS VCSELs with a thermally-actuated HCG mirror**, Shunya Inoue, Masanori Nakahama, Fumio Koyama, Tokyo Institute of Technology (Japan) and Precision and Intelligence Lab. (Japan) . . . . . [9757-13]

4:45 pm: **Beam engineering of VCSELs using high-contrast grating and coupled cavities** (*Invited Paper*), Fumio Koyama, Tokyo Institute of Technology (Japan) . . . . . [9757-14]

5:15 pm: **Active tunable high contrast metastructure Si waveguide**, Lingjun Jiang, Hussein Taleb, Z. Rena Huang, Rensselaer Polytechnic Institute (USA); Weimin Zhou, U.S. Army Research Lab. (USA) . . . . . [9757-15]

## THURSDAY 18 FEBRUARY

### SESSION 5

LOCATION: ROOM 303 (SOUTH ESPLANADE) THU 9:00 TO 10:30 AM

#### NOTE ROOM CHANGE

#### Metasurfaces

Session Chair: **Werner H. Hofmann**, Technische Univ. Berlin (Germany)

9:00 am: **Advanced photonic orbital angular momentum devices based on silicon photonics high-contrast gratings** (*Invited Paper*), Xinlun Cai, Sun Yat-Sen Univ. (China); Ning Zhang, Univ. of Bristol (United Kingdom); Siyuan Yu, Sun Yat-Sen Univ. (China) and Univ. of Bristol (United Kingdom) . . . . . [9757-16]

9:30 am: **Experimental demonstration of a metasurface planar retroreflector**, Amir Arbabi, Ehsan Arbabi, Yu Horie, Seyedeh Mahsa Kamali, Andrei Faraon, California Institute of Technology (USA) . . . . . [9757-17]

9:45 am: **Broadband flat optics with metasurfaces and applications in computational imaging**, Francesco Aieta, Hewlett-Packard Labs. (USA) . . . . . [9757-18]

10:00 am: **Polarization insensitive multi-wavelength metasurface lens**, Ehsan Arbabi, Amir Arbabi, Seyedeh Mahsa Kamali, Yu Horie, Andrei Faraon, California Institute of Technology (USA) . . . . . [9757-19]

10:15 am: **Planar lens with a quasi-periodic circular design**, Thaibao Q. Phan, Li Zhu, Pengfei Qiao, Connie J. Chang-Hasnain, Univ. of California, Berkeley (USA) . . . . . [9757-20]

Coffee Break . . . . . Thu 10:30 am to 11:00 am



**SESSION 6**

**LOCATION: ROOM 303 (SOUTH ESPLANADE) THU 11:00 AM TO 12:30 PM**

**Resonators and Plasmonics**

Session Chair: **John R. Lawall**,  
National Institute of Standards and Technology (USA)

- 11:00 am: **Quantum dot cavity quantum electrodynamics with photonic crystals** (*Invited Paper*), Satoshi Iwamoto, Yasutomo Ota, Shun Takahashi, Kazuhiko Kurum, Yasuhiko Arakawa, The Univ. of Tokyo (Japan) . . . . . [9757-21]
- 11:30 am: **A coherent polariton laser using a high-contrast grating-based microcavity** (*Invited Paper*), Hui Deng, Seonghoon Kim, Bo Zhang, Zhaorong Wang, Univ. of Michigan (USA); Sebastian Brodbeck, Christian Schneider, Martin Kamp, Sven Höfling, Julius-Maximilians-Univ. Würzburg (Germany) . . . . . [9757-22]
- 12:00 pm: **Transparent sub-diffraction optics: nanoscale light confinement without metal**, Saman Jahani, Zubin Jacob, Univ. of Alberta (Canada) [9757-23]
- 12:15 pm: **Integrated plasmonic refractive index sensor based on grating/metal film resonant structure**, Mingze Sun, Tsinghua Univ. (China); Tianbo Sun, Univ. of California, Berkeley (USA); Youhai Liu, Tsinghua Univ. (China); Li Zhu, Univ. of California, Berkeley (USA); Fang Liu, Yidong Huang, Tsinghua Univ. (China); Connie J. Chang-Hasnain, Univ. of California, Berkeley (USA) . . . . . [9757-24]
- Lunch/Exhibition Break . . . . . Thu 12:30 pm to 2:00 pm

**SESSION 7**

**LOCATION: ROOM 303 (SOUTH ESPLANADE) . THU 2:00 TO 3:30 PM**

**Optomechanics and Phased Arrays**

Session Chair: **Hui Deng**, Univ. of Michigan (USA)

- 2:00 pm: **Optomechanical applications of high-contrast gratings** (*Invited Paper*), John R. Lawall, Yi-Chen Shuai, Navin Lingaraju, National Institute of Standards and Technology (USA); Haitan Xu, Yale Univ. (USA); Utku Kemiktarak, Avago Technologies Ltd. (USA); Jacob M. Taylor, National Institute of Standards and Technology (USA) . . . . . [9757-25]
- 2:30 pm: **Optical and mechanical design of metastructures for optomechanical VCSELs**, Stephen A. Gerke, Weijian Yang, Connie J. Chang-Hasnain, Univ. of California, Berkeley (USA) . . . . . [9757-26]
- 2:45 pm: **Cavity optomechanics with 2D photonic crystal membrane reflectors**, Navin Lingaraju, Yi-Chen Shuai, John R. Lawall, National Institute of Standards and Technology (USA) . . . . . [9757-27]
- 3:00 pm: **Progress and prospects of silicon-based design for optical phased array** (*Invited Paper*), Weiwei Hu, Chao Peng, Peking Univ. (China); Connie J. Chang-Hasnain, Univ. of California, Berkeley (USA) . . . . . [9757-28]
- Coffee Break . . . . . Thu 3:30 pm to 4:00 pm

**SESSION 8**

**LOCATION: ROOM 303 (SOUTH ESPLANADE) . . THU 4:00 TO 5:15 PM**

**Novel Devices**

Session Chair: **Arseniy I. Kuznetsov**,  
A\*STAR - Data Storage Institute (Singapore)

- 4:00 pm: **High-contrast subwavelength grating-based smart power window** (*Invited Paper*), Ameen Elikkottil, Mallikarjun Bhavanari, Academy of Scientific & Innovative Research (India) and CSIR Madras Complex (India); Bala Pesala, CSIR Madras Complex (India) and Academy of Scientific & Innovative Research (India) . . . . . [9757-29]
- 4:30 pm: **Photonic-crystal slab for terahertz-wave technology platform** (*Invited Paper*), Masayuki Fujita, Osaka Univ. (Japan) . . . . . [9757-30]
- 5:00 pm: **Slow-light effect via Rayleigh anomaly in high-contrast gratings**, Kyoung-Youm Kim, Xinyuan Chong, Fanghui Ren, Alan X. Wang, Oregon State Univ. (USA) . . . . . [9757-31]



# CONFERENCE 9758

LOCATION: ROOM 2007 (WEST LEVEL 2)

Monday–Tuesday 15–16 February 2016 • Proceedings of SPIE Vol. 9758

# Quantum Dots and Nanostructures: Growth, Characterization, and Modeling XIII

Conference Chairs: **Diana L. Huffaker**, Univ. of California, Los Angeles (USA); **Holger Eisele**, Technische Univ. Berlin (Germany); **Kimberly A. Dick**, Lund Univ. (Sweden)

Program Committee: **Minjoo Larry Lee**, Yale Univ. (USA); **Baolai L. Liang**, Univ. of California, Los Angeles (USA); **Huiyun Liu**, Univ. College London (United Kingdom); **Zetian Mi**, McGill Univ. (Canada); **Jeffrey C. Owrutsky**, U.S. Naval Research Lab. (USA); **Adriana Passaseo**, Univ. del Salento (Italy); **Qi Hua Xiong**, Nanyang Technological Univ. (Singapore)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative, Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break ..... Mon 10:10 am to 10:30 am

### SESSION 1

LOCATION: ROOM 2007 (WEST LEVEL 2) ... MON 10:30 AM TO 12:00 PM

#### InAs Quantum Dots

Session Chair: **Jonathan R. Orchard**, The Univ. of Sheffield (United Kingdom)

- 10:30 am: **A detailed investigation of strain-patterning effect on bilayer InAs/GaAs quantum dot with varying GaAs barrier thickness** (*Invited Paper*), **Binita Tongbram**, **Navneet Sehara**, **Jashan Singhal**, **Debi P. Panda**, **Subhananda Chakrabarti**, Indian Institute of Technology Bombay (India) ..... [9758-1]
- 11:00 am: **Continuous-wave InAs/GaAs quantum-dot laser monolithically-grown on silicon substrate**, **Siming Chen**, **Jiang Wu**, **Qi Jiang**, **Mingchu Tang**, **Alwyn J. Seeds**, **Huiyun Liu**, Univ. College London (United Kingdom); **Wei Li**, **Ian M. Ross**, The Univ. of Sheffield (United Kingdom) ..... [9758-2]
- 11:20 am: **Dual-band sub-monolayer InAs quantum-dot infrared photo-detector for mid- and long-wavelength infrared detection**, **Yao Zhai**, Univ. of Massachusetts Lowell (USA); **Guiru Gu**, Stonehill College (USA); **Xuejun Lu**, Univ. of Massachusetts Lowell (USA) ..... [9758-3]
- 11:40 am: **Structural and optical properties of GaAs quantum dots grown on GaP (100) substrate**, **Shabnam Dadgostar**, Humboldt-Univ. zu Berlin (Germany); **Alfredo Torres Perez**, **Oscar Martinez**, **Juan Jimenez**, Univ. de Valladolid (Spain); **Jan Schmidbauer**, **Torsten Boeck**, Leibniz-Institut für Kristallzüchtung (Germany); **Anna Mogilatenko**, **W. Ted T. Masselink**, **Fariba Hatami**, Humboldt-Univ. zu Berlin (Germany) ..... [9758-4]
- Lunch Break ..... Mon 12:00 pm to 1:30 pm

### SESSION 2

LOCATION: ROOM 2007 (WEST LEVEL 2) .. MON 1:30 PM TO 3:00 PM

#### Large Quantum Dots

Session Chair: **Anthony J. Bennett**, Toshiba Research Europe Ltd. (United Kingdom)

- 1:30 pm: **Towards 1.55  $\mu\text{m}$  single-photon sources on Si substrates using GaAsSb-capped InAs quantum dots** (*Invited Paper*), **Jonathan R. Orchard**, The Univ. of Sheffield (United Kingdom); **Jiang Wu**, Univ. College London (United Kingdom); **Chris Woodhead**, **Robert J. Young**, Lancaster Univ. (United Kingdom); **Richard Beanland**, The Univ. of Warwick (United Kingdom); **Huiyun Liu**, Univ. College London (United Kingdom); **David J. Mowbray**, The Univ. of Sheffield (United Kingdom) ..... [9758-5]
- 2:00 pm: **Effects of high-energy proton implantation on the luminescence properties of InAs sub-monolayer quantum dots**, **Sourabh Upadhyay**, **Arjun Mandal**, Indian Institute of Technology Bombay (India); **Pitamber Singh**, **Nagaraju B. V. Subrahmanyam**, **Bhabha Atomic Research Ctr.** (India); **Subhananda Chakrabarti**, Indian Institute of Technology Bombay (India) [9758-6]
- 2:20 pm: **AC electroluminescence of doped semiconductor nanocrystals**, **Young-Kuk Kim**, **Jong-Woo Moon**, **Eun-Jin Lee**, Korea Institute of Materials Science (Korea, Republic of) ..... [9758-7]
- 2:40 pm: **Analysing radiative and non-radiative recombination in InAs quantum dots grown on Si substrates for integrated laser applications**, **Jonathan R. Orchard**, The Univ. of Sheffield (United Kingdom); **Chris Woodhead**, Lancaster Univ. (United Kingdom); **Samuel Shutts**, Cardiff Univ. (United Kingdom); **Jiang Wu**, Univ. College London (United Kingdom); **Angela D. Sobiesierski**, Cardiff Univ. (United Kingdom); **Robert J. Young**, Lancaster Univ. (United Kingdom); **Richard Beanland**, The Univ. of Warwick (United Kingdom); **Huiyun Liu**, Univ. College London (United Kingdom); **Peter M. Smowton**, Cardiff Univ. (United Kingdom); **David J. Mowbray**, The Univ. of Sheffield (United Kingdom) ..... [9758-8]
- Coffee Break ..... Mon 3:00 pm to 3:30 pm

### SESSION 3

LOCATION: ROOM 2007 (WEST LEVEL 2) .. MON 3:30 PM TO 5:40 PM

#### Photonics Applications and Nanowires

Session Chair: **Subhananda Chakrabarti**, Indian Institute of Technology Bombay (India)

- 3:30 pm: **Quantum-dot optics with integrated photonic circuits** (*Invited Paper*), **Anthony J. Bennett**, Toshiba Research Europe Ltd. (United Kingdom) ..... [9758-9]
- 4:00 pm: **Surface-plasmon-enhanced photoluminescence of quantum dots based on open-ring nanostructure array**, **Akash Kannegulla**, **Ye Liu**, **Li-Jing Cheng**, Oregon State Univ. (USA) ..... [9758-10]
- 4:20 pm: **Brewster mode: optical monitoring of the semiconductor doping level**, **Maria Jose Milla Rodrigo**, **Thierry Taliercio**, Institut d'Electronique du Sud (France); **Laurent Cerutti**, **Fernando Gonzalez-Posada Florès**, Univ. Montpellier 2 (France); **Franziska B. Barho**, **Jean-Baptiste Rodriguez**, Institut d'Electronique du Sud (France); **Eric Tournié**, Univ. Montpellier 2 (France); **Jean-Jacques Greffet**, Lab. Charles Fabry (France) ..... [9758-11]

# CONFERENCE 9758

LOCATION: ROOM 2007 (WEST LEVEL 2)

WEDNESDAY 17 FEBRUARY

4:40 pm: **Low-threshold wavelength-tunable organo-metal lead halide perovskites nanolasers**, Qi Hua Xiong, Qing Zhang, Jun Xing, Nanyang Technological Univ. (Singapore) . . . . . [9758-12]

5:00 pm: **Growth and applications of self-catalyzed high-quality core-shell GaAsP nanowires on patterned and unpatterned Si**, Yunyan Zhang, Jiang Wu, Univ. College London (United Kingdom); Martin Aagesen, Gasp Solar ApS (Denmark); Mingchu Tang, Univ. College London (United Kingdom); Jeppe Holm, Gasp Solar ApS (Denmark); Suguo Huo, London Ctr. for Nanotechnology (United Kingdom); Huiyun Liu, Univ. College London (United Kingdom) [9758-13]

5:20 pm: **Violation of Bell's inequality with a nanowire quantum dot**, Klaus D. Joens, Technische Univ. Delft (Netherlands); Marijn A. M. Versteegh, Technische Univ. Delft (Netherlands) and Univ. Wien (Austria) and Austrian Academy of Sciences (Austria); Michael E. Reimer, Technische Univ. Delft (Netherlands) and Univ. of Waterloo (Canada); Lucas Schweickert, Technische Univ. Delft (Netherlands); Dan Dalacu, Philip J. Poole, National Research Council of Canada (Canada); Angelo Gulnatti, Politecnico di Milano (Italy); Andrea Giudice, Micro Photon Devices S.r.l. (Italy); Valery Zwiller, Technische Univ. Delft (Netherlands) and Royal Institute of Technology (Sweden) . . . . . [9758-14]

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: ROOM 2007 (WEST LEVEL 2) . TUE 9:10 AM TO 10:00 AM

### Nanoparticles

Session Chair: **Daniel Nascimento Duplat**,  
Technische Univ. Delft (Netherlands)

9:10 am: **Enhanced absorption with quantum dots, metal nanoparticles, and 2D materials** (*Invited Paper*), Ergun Simsek, Bablu Mukherjee, The George Washington Univ. (USA); Asim Guchhait, Yin Thai Chan, National Univ. of Singapore (Singapore) . . . . . [9758-15]

9:40 am: **Two-dimensional photonic crystal band-edge laser using colloidal quantum dots as gain material**, Hojun Chang, Myungjae Lee, Minsu Kang, Kyungtaek Min, Seoul National Univ. (Korea, Republic of); Yeonsang Park, Kyung-Sang Cho, Samsung Advanced Institute of Technology (Korea, Republic of); Heonsu Jeon, Seoul National Univ. (Korea, Republic of) . . . . . [9758-16]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

### SESSION 5

LOCATION: ROOM 2007 (WEST LEVEL 2) TUE 10:30 AM TO 12:00 PM

### Nanomaterials

Session Chair: **Ergun Simsek**, The George Washington Univ. (USA)

10:30 am: **Engineering and spectrophotometry characterization of gold/silver core-shell nanoparticles with tunable frequency response** (*Invited Paper*), Daniel Nascimento Duplat, Technische Univ. Delft (Netherlands); Daniel Mann, DWI an der RWTH Aachen e.V. (Germany); Max Kraan, Univ. of Cambridge (Netherlands); Helmut Keul, Martin Möller, DWI an der RWTH Aachen e.V. (Germany); Marcel A. Verheijen, Philips Innovation Services (Netherlands) and Technische Univ. Eindhoven (Netherlands); Man Xu, Technische Univ. Delft (Netherlands) and TNO (Netherlands); Pascal Buskens, DWI an der RWTH Aachen e.V. (Germany) and TNO (Netherlands); Aurèle J. L. Adam, H. Paul Urbach, Technische Univ. Delft (Netherlands) . . . . . [9758-21]

11:00 am: **Plasmonically enhanced photoluminescence of nanoscale semiconductors**, Gabrielle Abraham, Alejandro Tejerina, Hugh Churchill, Pooja Bajwa, Colin D. Heyes, Joseph B. Herzog, Univ. of Arkansas (USA) . . . . . [9758-22]

11:20 am: **Alkali quantum dots as nanophosphors**, Hal Gokturk, Ecoken (USA) . . . . . [9758-23]

11:40 am: **Characterisation of high current density resonant tunnelling diodes for THz emission using photoluminescence spectroscopy**, Kristof J. P. Jacobs, The Univ. of Sheffield (United Kingdom); Razvan Baba, Univ. of Glasgow (United Kingdom); Ben J. Stevens, The Univ. of Sheffield (United Kingdom); Toshikazu Mukai, Dai Ohnishi, ROHM Co., Ltd. (Japan); Richard A. Hogg, Univ. of Glasgow (United Kingdom) . . . . . [9758-24]

### POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 ... WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Crystalline phase destruction in silicon films by applied external electrical field and detected by using the laser spectroscopy**, Dmitry E. Milovzorov, Ryazan State Radio Engineering Univ. (Russian Federation) . . . . . [9758-25]

**Structural characteristics of Au-GaAs nanostructures for increased plasmonic optical enhancement**, Grant P. Abbey, Univ. of Arkansas (USA) and Mississippi State Univ. (USA); Ahmad I. Nusir, Omar Manasreh, Joseph B. Herzog, Univ. of Arkansas (USA) . . . . . [9758-26]

**Magneto-optic evaluation of antiferromagnetic  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> nanoparticles coated on a quartz substrate**, Srinath Balasubramanian, Tennessee Technological Univ. (USA); Rajendra P. Panmand, Ctr. for Materials for Electronics Technology (India); Ganapathy Kumar, Satish M. Mahajan, Tennessee Technological Univ. (USA); Bharat B. Kale, Ctr. for Materials for Electronics Technology (India) . . . . . [9758-27]

**Short-wavelength infrared InAs nanowire photodetector on Si**, Jae Cheol Shin, Chanho Choi, Minhyeok Jo, Jong goo Jeon, Ji Yeong Hwang, Donghwan Kim, Byeong min Ahn, Yeungnam Univ. (Korea, Republic of) . . . . . [9758-28]

**Effect of varying capping composition and number of strain-coupled stacks on In<sub>0.5</sub>Ga<sub>0.5</sub>As quantum dot infrared photodetectors**, Debi Prasad Panda, Saikalash Shetty, Akshay Balgarkashi, Hemant J. Ghadi, Navneet Sehara, Subhananda Chakrabarti, Indian Institute of Technology Bombay (India) . . . . . [9758-29]

**Photoluminescence blinking and spectral diffusion of single CdSe/ZnS nanocrystals: charge fluctuation effects**, Hiroto Ibuki, Toshiyuki Ihara, Yoshihiko Kanemitsu, Kyoto Univ. (Japan) . . . . . [9758-30]

**Growth strategy to achieve mono-modal quantum-dot size distribution in InAs/GaAs multi-stack-coupled heterostructures**, Aijaz Ahmad, Debi Prasad Panda, Saikalash Shetty, Akshay Balgarkashi, Subhananda Chakrabarti, Indian Institute of Technology Bombay (India) . . . . . [9758-31]

**Diffusion impact on thermal stability in self-assembled bilayer InAs/GaAs quantum dots (QDs)**, Binita Tongbram, Navneet Sehara, Jashan Singhal, Debabrata Das, Debi Prasad Panda, Subhananda Chakrabarti, Indian Institute of Technology Bombay (India) . . . . . [9758-32]

**Interaction of evanescent field superposition on nanoparticles**, María C. Blázquez Villalobos, Jesús Manuel Muñoz Pacheco, Erwin A Martí Panameño, Benemérita Univ. Autónoma de Puebla (Mexico) . . . . . [9758-33]

**Fabrication of distributed-Bragg-reflector cavity with InAs quantum dots grown on InP(311)B substrate for improvement of photon echo generation efficiency**, Hoshihiko Kanazawa, Yoshitaka Sato, Keio Univ. (Japan); Kouichi Akahane, National Institute of Information and Communications Technology (Japan); Junko Ishi-Hayase, Keio Univ. (Japan) . . . . . [9758-35]

**Local trapping and recombination of charge carriers in heterostructures with Ge nanoclusters**, Anastasiia A. Mykytiuk, Sergiy V. Kondratenko, National Taras Shevchenko Univ. of Kyiv (Ukraine) . . . . . [9758-36]

**Optical and electrical properties of plasmonic metal nanostructures at percolation threshold obtained by laser annealing**, Igor Gladskikh, Anton A. Starovoytov, Artur Ayvazyan, ITMO Univ. (Russian Federation) . . . . . [9758-37]

**Coincident donor decay and acceptor rise in "visible" FRET between multicolor QD**, Wenping Yin, Namhun Kim, Dasom Kim, Hee Won Shin, Heeyeop Chae, Tae Kyu Ahn, Sungkyunkwan Univ. (Korea, Republic of) . . . . . [9758-38]

OPTO

# Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX

*Conference Chairs:* **Georg von Freymann**, Technische Univ. Kaiserslautern (Germany); **Winston V. Schoenfeld**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); **Raymond C. Rumpf**, The Univ. of Texas at El Paso (USA)

*Program Committee:* **Cornelia Denz**, Münster Univ. (Germany); **Ruth Houbertz**, Multiphoton Optics GmbH (Germany); **Saulius Juodkazis**, Swinburne Univ. of Technology (Australia); **Stephen M. Kuebler**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); **Akhlesh Lakhtakia**, The Pennsylvania State Univ. (USA); **Robert R. McLeod**, Univ. of Colorado at Boulder (USA); **Hernán R. Míguez**, Institute of Materials Science of Seville (Spain); **Dennis W. Prather**, Univ. of Delaware (USA); **Aaron J. Pung**, Clemson Univ. (USA); **John A. Rogers**, Univ. of Illinois at Urbana-Champaign (USA); **Thomas J. Suleski**, The Univ. of North Carolina at Charlotte (USA); **Michael Thiel**, Nanoscribe GmbH (Germany); **Sandra Wolff**, Technische Univ. Kaiserslautern (Germany)

## SUNDAY 14 FEBRUARY

### SESSION 1

**LOCATION: ROOM 2007 (WEST LEVEL 2) . SUN 8:00 AM TO 10:10 AM**

#### Advanced Fabrication Methods for Nanoplasmonics

Session Chair: **Georg von Freymann**,  
Technische Univ. Kaiserslautern (Germany)

8:00 am: **Active 3D DNA plasmonics** (*Invited Paper*), Na Liu, Max-Planck-Institut für Intelligente Systeme (Germany) . . . . . [9759-1]

8:30 am: **Observation of topological edge states in plasmonic waveguide arrays** (*Invited Paper*), Stefan Linden, Felix Bleckmann, Andrea Alberti, Rheinische Friedrich-Wilhelms-Univ. Bonn (Germany) . . . . . [9759-2]

9:00 am: **Tuning chiroptical response in chiral metamaterials** (*Invited Paper*), Vivian E. Ferry, Univ. of Minnesota, Twin Cities (USA) . . . . . [9759-3]

9:30 am: **Two-dimensional silver nanodot array fabricated using nanoporous alumina for a chemical sensor platform of localized surface plasmon resonance**, Mi Jung, Tae-Ryong Kim, Myung-Gi Ji, Chung-Ang Univ. (Korea, Republic of); Seok Lee, Deokha Woo, Korea Institute of Science and Technology (Korea, Republic of); Young-Wan Choi, Chung-Ang Univ. (Korea, Republic of) . . . . . [9759-4]

9:50 am: **Structural color printing using pixelated nanostructures in RGB primary colors**, Hao Jiang, Bozena Kaminska, Simon Fraser Univ. (Canada) . . . . . [9759-5]

Coffee Break . . . . . Sun 10:10 am to 10:40 am

### SESSION 2

**LOCATION: ROOM 2007 (WEST LEVEL 2) SUN 10:40 AM TO 12:20 PM**

#### Ion-Beam Fabrication for Nanophotonics

Session Chair: **Sandra Wolff**,  
Technische Univ. Kaiserslautern (Germany)

10:40 am: **Large area and high accuracy FIB nanofabrication for photonic and plasmonic devices** (*Invited Paper*), Sven Bauerdick, Achim Nadzeyka, Raith GmbH (Germany); Andre Linden, Joel Fridmann, Raith America, Inc. (USA) . . . . . [9759-6]

11:10 am: **Ultrafast third-harmonic spectroscopy of single nanoantennas fabricated using helium-ion beam lithography** (*Invited Paper*), Martin Sillies, Heiko Kollmann, Martin Esmann, Simon F. Becker, Carl von Ossietzky Univ. Oldenburg (Germany); Xianji Piao, Seoul National Univ. (Korea, Republic of); Guido Boesker, Lars-Oliver Kautschor, Carl Zeiss Microscopy GmbH (Germany); Chuong Huynh, Carl Zeiss Microscopy, LLC (Germany); Henning Vieker, Andre Beyer, Armin Götzhäuser, Univ. Bielefeld (Germany); Namkyoo Park, Seoul National Univ. (Korea, Republic of); Christoph Lienau, Carl von Ossietzky Univ. Oldenburg (Germany) . . . . . [9759-7]

11:40 am: **Nanoscale engineering of resonant open cavities using ion beam milled templates**, Jason M. Smith, Aurélien A. P. Trichet, Philip R. Dolan, David M. Coles, Lucas Flatten, Sam Johnson, Anais Gouesmel, Claire Alice Hebert, Robin Patel, Claire Vallance, Dean James, Univ. of Oxford (United Kingdom) . . . . . [9759-8]

12:00 pm: **Investigation and optimization of grating ghosts in high efficiency spectrometer gratings fabricated by e-beam lithography**, Martin Heusinger, Friedrich-Schiller-Univ. Jena (Germany); Michael Banasch, Vistec Electron Beam GmbH (Germany); Uwe D. Zeitner, Friedrich-Schiller-Univ. Jena (Germany) and Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . [9759-9]

Lunch Break . . . . . Sun 12:20 pm to 1:30 pm

### SESSION 3

**LOCATION: ROOM 2007 (WEST LEVEL 2) . . SUN 1:30 PM TO 3:40 PM**

#### Light Extraction and Guiding

Session Chair: **Stefan Linden**,  
Rheinische Friedrich-Wilhelms-Univ. Bonn (Germany)

1:30 pm: **Optical design in perovskite solar cells** (*Invited Paper*), Miguel Anaya, Gabriel Lozano, Sol Carretero-Palacios, Mauricio E. Calvo, Hernán Ruy Míguez, Consejo Superior de Investigaciones Científicas (Spain) . . . . . [9759-10]

2:00 pm: **Controlled guidance of light through a flexible optical waveguide sheet**, Chloë Nicholson-Smith, George K. Knopf, The Univ. of Western Ontario (Canada); Evgueni Bordatchev, National Research Council Canada (Canada) . . . . . [9759-11]

2:20 pm: **Polymer strip-loaded waveguides on ALD-TiO<sub>2</sub> films**, Leila Ahmadi, Ville Kontturi, Janne Laukkanen, Markku Kuitinen, Jyrki Saarinen, Seppo Honkanen, Matthieu Roussey, Univ. of Eastern Finland (Finland) . . . . . [9759-12]

2:40 pm: **Fabrication of low-loss ridge waveguides in z-cut lithium niobate by combination of ion implantation and UV picosecond laser micromachining**, Mareike Stolze, Thomas Herrmann, Johannes A. L'huillier, Photonik-Zentrum Kaiserslautern e.V. (Germany) . . . . . [9759-13]

3:00 pm: **Packaging and micro-structuring for enabling multi-functional fiber-cladding photonics and lab-in-fiber**, Moez Haque, Stephen Ho, Erden Ertorer, Kevin A. J. Joseph, Jianzhao Li, Peter R. Herman, Univ. of Toronto (Canada) . . . . . [9759-14]

3:20 pm: **Integrated nanophotonics in bulk single-crystal diamond substrates**, Michael J. Burek, Charles Meuwly, Harvard Univ. (USA); Jake Rochman, Univ. of Waterloo (Canada); Vivek Venkataraman, Marko Loncar, Harvard School of Engineering and Applied Sciences (USA) . . . . . [9759-21]

Coffee Break . . . . . Sun 3:40 pm to 4:10 pm



# CONFERENCE 9759

LOCATION: ROOM 2007 (WEST LEVEL 2) AND ROOM 123 (NORTH EXHIBIT LEVEL)

## SESSION 4

LOCATION: ROOM 2007 (WEST LEVEL 2) .. SUN 4:10 PM TO 5:30 PM

### 3D Photonic Structures

Session Chair: **Saulius Juodkazis**,  
Swinburne Univ. of Technology (Australia)

4:10 pm: **Holographic fabrication of 3D photonic crystal templates with 4, 5, and 6-fold rotational symmetry using a single beam and single exposure**, David Lowell, David George, Jeffery R. Lutkenhaus, Usha Philipose, Hualiang Zhang, Univ. of North Texas (USA); Kevin P. Chen, Univ. of Pittsburgh (USA); Yuankun Lin, Univ. of North Texas (USA) . . . . . [9759-15]

4:30 pm: **Single-step etch mask for 3D monolithic nanostructures**, Diana A. Grishina, Cornelis A. Hartevelde, Léon A. Woldering, Willem L. Vos, Univ. Twente (Netherlands) . . . . . [9759-16]

4:50 pm: **Photonic crystal fiber long-period grating sensors with nanocoatings for ammonia gas detection**, Shijie Zheng, Harbin Institute of Technology (China) . . . . . [9759-17]

5:10 pm: **Stacking of polymer nano-gratings by electron beam writing to form 3-level diffractive optical elements for 3D holographic lithography**, Leon Yuan, Peter R. Herman, Univ. of Toronto (Canada) . . . . . [9759-18]

## SESSION 6

LOCATION: ROOM 123 (NORTH EXHIBIT LEVEL) MON 1:20 TO 3:30 PM

### Advanced Manufacturing using a DMD or other SLM

Joint Session with Conferences 9759 and 9761

Session Chairs: **Philip S. King**, Texas Instruments Inc. (USA); **Georg von Freymann**, Technische Univ. Kaiserslautern (Germany)

1:20 pm: **The next generation of maskless lithography** (*Invited Paper*), Steffen Diez, Heidelberg Instruments Mikrotechnik GmbH (Germany) . . . [9761-1]

1:50 pm: **Metal powder laser melting with variable mask image amplification systems using TI DMD, pulsed Nd:YAG lasers, and amplifiers**, Farzan N. Ghauri, Vardex Laser Solutions LLC (USA) . . . . . [9761-2]

2:10 pm: **Size scaling with light patterned dielectrophoresis in an optoelectronic tweezers device**, Angel Fuentes, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Juan Carlos Rodríguez Luna, Joan Juvert, Univ. of Glasgow (United Kingdom); Ruben Ramos-García, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Steven L. Neale, Univ. of Glasgow (United Kingdom) . . . . . [9759-23]

2:30 pm: **High-throughput depth-resolved parallel laser machining based on temporal focusing**, Dapeng Zhang, Chenglin Gu, Shih-Chi Chen, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . [9759-24]

2:50 pm: **Fabrication of waveguide spatial light modulators via femtosecond laser micromachining**, Nickolaos Savidis, Bianca Datta, Sundeep Jolly, V. Michael Bove Jr., MIT Media Lab. (USA) . . . . . [9759-25]

3:10 pm: **Assembling silver nanowires using optoelectronic tweezers**, Shuailong Zhang, Steven L. Neale, Jonathan M. Cooper, Univ. of Glasgow (United Kingdom) . . . . . [9759-26]

Coffee Break . . . . . Mon 3:30 pm to 4:00 pm

## SESSION 7

LOCATION: ROOM 123 (NORTH EXHIBIT LEVEL) .. MON 4:00 TO 5:50 PM

### Large Area Fabrication

Session Chair: **Ruth Houbertz**, Multiphoton Optics GmbH (Germany)

4:00 pm: **Large-area fabrication of nanoscale features by R2R-UV nanoimprint lithography** (*Invited Paper*), Dieter Nees, Ursula Palfinger, Stephan Ruttloff, Maria Beleggratis, Volker Schmidt, Christian Sommer, JOANNEUM RESEARCH Forschungsgesellschaft mbH (Austria) . . . . . [9759-27]

4:30 pm: **Fabrication of large area flexible PDMS waveguide sheets**, Robert Green, George K. Knopf, The Univ. of Western Ontario (Canada); Evgueni Bordatchev, National Research Council Canada (Canada) . . . [9759-28]

4:50 pm: **Soft mold-based nanomanufacturing process for fabricating photonic devices on nonplanar substrates**, Jianwei Chen, Shih-Chi Chen, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . [9759-29]

5:10 pm: **Tunable Fabry-Pérot interferometer with subwavelength grating reflectors for MWIR microspectrometers**, Marco Meinig, Steffen Kurth, Fraunhofer-Institut für Elektronische Nanosysteme (Germany); Mario Seifert, Karla Hiller, Julia Wecker, Technische Univ. Chemnitz (Germany); Martin Ebermann, Norbert Neumann, InfraTec GmbH (Germany); Thomas Gessner, Fraunhofer-Institut für Elektronische Nanosysteme (Germany) and Technische Univ. Chemnitz (Germany) . . . . . [9759-30]

5:30 pm: **Fabrication of high-aspect-ratio wire-grid polarizers by displacement Talbot lithography**, Harun H. Solak, Christian Dais, Francis Clube, Li Wang, Eulitha AG (Switzerland) . . . . . [9759-31]

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

8:00 am: **Welcome and Opening Remarks**

**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)

8:05 am: **Announcement of the Green Photonics Awards**

**Stephen J. Eglash**, Stanford Data Science Initiative,  
Stanford Univ. (USA)

8:10 am: **Parity-time symmetry photonics**

**Xiang Zhang**, Univ. of California, Berkeley (USA)

8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**

**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of  
Rochester (USA)

9:30 am: **Merging photonics with nanoelectronics**

**Michael Liehr**, American Institute for Manufacturing of Integrated  
Photonics (USA) and Colleges of Nanoscale Science and  
Engineering, SUNY Polytechnic Institute (USA)

Coffee Break . . . . . Mon 10:10 am to 10:30 am

## SESSION 5

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) .... MON 10:30 TO 11:30 AM

### NOTE ROOM CHANGE

### Novel Approaches for Sensing

Session Chair: **Miguel Anaya**,  
Consejo Superior de Investigaciones Científicas (Spain)

10:30 am: **Innovative plasmonic active TopUp substrate for surface enhanced Raman spectroscopy**, Sophie Patze, Friedrich-Schiller-Univ. Jena (Germany) and Leibniz-Institut für Photonische Technologien e.V. (Germany); Uwe Huebner, Leibniz-Institut für Photonische Technologien e.V. (Germany); Karina Weber, Leibniz-Institut für Photonische Technologien e.V. (Germany) and Friedrich-Schiller-Univ. Jena (Germany); Dana Cialla-May, Friedrich-Schiller-Univ. Jena (Germany) and Leibniz-Institut für Photonische Technologien e.V. (Germany); Juergen Popp, Leibniz-Institut für Photonische Technologien e.V. (Germany) and Friedrich-Schiller-Univ. Jena (Germany) . . . . . [9759-19]

10:50 am: **Texturing using metal oxide nano-structures for high efficient light extraction and absorption**, Hak Ki Yu, Ajou Univ. (Korea, Republic of) . . . . . [9759-20]

11:10 am: **Azimuth orientation method of a photonic crystal fiber based on side image**, Zhe Chen, Yunhan Luo, Jieyuan Tang, Jun Zhang, Jinan Univ. (China) . . . . . [9759-22]

Lunch Break . . . . . Mon 11:30 am to 1:20 pm

OPTO

# CONFERENCE 9759

LOCATION: ROOM 123 (NORTH EXHIBIT LEVEL)

TUESDAY 16 FEBRUARY

## SESSION 8

LOCATION: ROOM 123 (NORTH EXHIBIT LEVEL) . . TUE 8:00 TO 10:00 AM

### 3D Laser Structuring Devices and Lithography I

Joint Session with Conferences 9738 and 9759

Session Chair: **Stephen M. Kuebler**, Univ. of Central Florida (USA)

8:00 am: **Photonics walking up a human hair** (*Invited Paper*), Diederik S. Wiersma, Hao Zeng, Camilla Parmeggiani, Daniele Martella, Matteo Burresi, European Lab. for Non-linear Spectroscopy (Italy); Piotr Wasylczyk, Univ. of Warsaw (Poland) . . . . . [9759-32]

8:30 am: **Complex micro-optics fabricated by femtosecond 3D direct laser writing** (*Invited Paper*), Harald Giessen, Univ. Stuttgart (Germany) . . . . . [9759-33]

9:00 am: **Study of 3D printing method for GRIN micro-optics devices**, Pei-Jen Wang, Jer-Liang A. Yeh, National Tsing Hua Univ. (Taiwan); Yuan-Chieh Cheng, Instrument Technology Research Ctr. (Taiwan); Rong-Jie Chang, National Tsing Hua Univ. (Taiwan). . . . . [9759-34]

9:20 am: **Beam-bending in spatially variant photonic crystals at telecommunications wavelengths**, Rashi Sharma, Univ. of Central Florida (USA); Jennefir L. Digaum, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Daniel Batista, Univ. of Central Florida (USA); Javier J. Pazos, Raymond C. Rumpf, The Univ. of Texas at El Paso (USA); Stephen M. Kuebler, Univ. of Central Florida (USA) . . . . . [9759-35]

9:40 am: **Realization of photonic quantum simulators with direct laser writing**, Christina Joerg, Technische Univ. Kaiserslautern (Germany); Fabian Letscher, Technische Univ. Kaiserslautern (Germany) and Exzellenz-Graduiertenschule "Materials Science in Mainz" (MAINZ) (Germany); Michael Fleischhauer, Technische Univ. Kaiserslautern (Germany); Georg von Freymann, Technische Univ. Kaiserslautern (Germany) and Fraunhofer-Institut für Physikalische Messtechnik (Germany) . . . . . [9759-36]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

## SESSION 9

LOCATION: RM 123 (NORTH EXHIBIT LEVEL) . TUE 10:30 AM TO 12:00 PM

### 3D Laser Structuring Devices and Lithography II

Joint Session with Conferences 9738 and 9759

Session Chair: **Georg von Freymann**, Technische Univ. Kaiserslautern (Germany)

10:30 am: **Hybrid integration approaches for functional nanophotonic circuits** (*Invited Paper*), Wolfram Pernice, Westfälische Wilhelms-Univ. Münster (Germany) . . . . . [9759-38]

11:00 am: **STED lithography for applications in biology**, Richard Wollhofen, Johannes Kepler Univ. Linz (Austria); Jaroslav Jacak, Johannes Kepler Univ. Linz (Austria) and Fachhochschule Oberösterreich (Austria); Thomas A. Klar, Johannes Kepler Univ. Linz (Austria). . . . . [9759-39]

11:20 am: **3D SLM-based STED-lithography**, Julian Hering, Erik H. Waller, Technische Univ. Kaiserslautern (Germany); Georg von Freymann, Technische Univ. Kaiserslautern (Germany) and Fraunhofer-Institut für Physikalische Messtechnik (Germany). . . . . [9759-40]

11:40 am: **Multi-photon lithography of 3D micro-structures in  $As_2S_3$  and  $Ge_5(As_2Se_3)_{95}$  chalcogenide glasses**, Casey M. Schwarz, Shreya Labh, Jayk E. Barker, Ryan J. Sapia, Gerald D. Richardson III, Univ. of Central Florida (USA); Clara Rivero-Baleine, Lockheed Martin Missiles and Fire Control (USA); Kathleen A. Richardson, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Alexej Pogrebnjakov, Theresa S. Mayer, The Pennsylvania State Univ. (USA); Stephen M. Kuebler, Univ. of Central Florida (USA) . . . . . [9759-41]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:30 pm

## SESSION 10

LOCATION: ROOM 123 (NORTH EXHIBIT LEVEL) TUE 1:30 TO 3:00 PM

### 3D Laser Structuring Devices and Lithography III

Joint Session with Conferences 9738 and 9759

Session Chair: **Winston V. Schoenfeld**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

1:30 pm: **Cloaked contact fingers on solar cells enabled by 3D laser lithography** (*Invited Paper*), Martin F. Schumann, Karlsruher Institut für Technologie (Germany); Samuel Wiesendanger, Friedrich-Schiller-Univ. Jena (Germany); Jan Christoph Goldschmidt, Benedikt Bläsi, Fraunhofer-Institut für Solare Energiesysteme (Germany); Karsten Bittkau, Ulrich W. Paetzold, Forschungszentrum Jülich GmbH (Germany); Alexander N. Sprafke, Martin-Luther Univ. Halle-Wittenberg (Germany); Ralf B. Wehrspohn, Martin-Luther Univ. Halle-Wittenberg (Germany) and Fraunhofer-Institut für Werkstoffmechanik (Germany); Carsten Rockstuhl, Martin Wegener, Karlsruher Institut für Technologie (Germany) . . . . . [9738-5]

2:00 pm: **Fabrication of metamaterial-based infrared perfect absorber structures using direct laser write lithography**, Ihar Fanyaeu, Vyngantas Mizeikis, Shizuoka Univ. (Japan). . . . . [9759-42]

2:20 pm: **Precise 3D printing of micro/nanostructures using highly conductive carbon nanotube-acrylate composites**, Ying Liu, Wei Xiong, Li Jia Jiang, Yunshen Zhou, Yongfeng Lu, Univ. of Nebraska-Lincoln (USA) . . [9738-6]

2:40 pm: **Potential for GPC-based laser direct writing**, Silvia Saldaña Cercós, Technical Univ. of Denmark (Denmark); Andrew R. Bañas, OptoRobotix ApS (Denmark); Jesper Glückstad, Technical Univ. of Denmark (Denmark) . . [9738-7]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

## SESSION 11

LOCATION: ROOM 123 (NORTH EXHIBIT LEVEL) TUE 3:30 TO 5:40 PM

### 3D Laser Structuring Devices and Lithography IV

Joint Session with Conferences 9738 and 9759

Session Chair: **Michael Thiel**, Nanoscribe GmbH (Germany)

3:30 pm: **3D light robotics** (*Invited Paper*), Jesper Glückstad, Technical Univ. of Denmark (Denmark). . . . . [9738-8]

4:00 pm: **3D direct laser writing of metal structures for novel optical applications** (*Invited Paper*), Michael G. Moebius, SeungYeon Kang, Kevin Vora, Philip A. Muñoz, Yang Li, Guoliang Deng, Eric Mazur, Harvard School of Engineering and Applied Sciences (USA) . . . . . [9759-43]

4:30 pm: **Manufacturing of functional micro/nano structures by fs-laser microfabrication**, Cleber R. Mendonça, Nathália B. Tomazio, Franciele Henrique, Adriano J. G. Otuka, Juliana M. P. Almeida, Instituto de Física de São Carlos (Brazil); Carla R. Fontana, Univ. Estadual Paulista "Júlio de Mesquita Filho" (Brazil) . . . . . [9738-9]

4:50 pm: **Femtosecond laser direct-write of lab-in-fiber sensors through polymer-coated optical fiber**, Kevin A. J. Joseph, Moez Haque, Stewart J. Aitchison, Peter R. Herman, Univ. of Toronto (Canada) . . . . . [9759-44]

5:10 pm: **Advanced two-photon photolithography for patterning of transparent, electrically conductive ionic liquid-polymer nanostructures** (*Invited Paper*), Natalia A. Bakhtina, Neil MacKinnon, Jan G. Korvink, Karlsruher Institut für Technologie (Germany) . . . . . [9738-10]

### WEDNESDAY 17 FEBRUARY

#### POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 ... WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

- Novel fabrication technique of hybrid structure lens array for 3D images,** Junsik Lee, Junoh Kim, CheolJoong Kim, DooSeub Shin, Gyohyun Koo, Yonghyub Won, KAIST (Korea, Republic of) . . . . . [9759-46]
- Slanted liquid microlens array by using diffuser,** DooSeub Shin, Junoh Kim, CheolJoong Kim, JunSik Lee, GyoHyun Koo, YongHyub Won, KAIST (Korea, Republic of) . . . . . [9759-47]
- Nanoimprint of large-area optical gratings on a conventional photoresist using a Teflon-coated nanoimprint mold,** Aju S. Jugessur, Anthony Zhang, Yiman Lyu, The Univ. of Iowa (USA) . . . . . [9759-48]
- Fabrication of liquid-filled square lens array with hemispherical partition walls,** Gyohyun Koo, Junoh Kim, CheolJoong Kim, DooSeub Shin, JunSik Lee, Yong Hyub Won, KAIST (Korea, Republic of) . . . . . [9759-49]
- WGP structures patterned by Lloyd's mirror laser interference lithography system integrate into MEMS physical sensor device,** Kuo-Chun Tseng, Shuo-Ting Hong, Te-Hsun Lin, Chien-Chung Fu, National Tsing Hua Univ. (Taiwan) . . . . . [9759-50]
- Simple micro-lens array fabrication using partially expanding PDMS using volume expansion property,** Wonjae Jang, Junoh Kim, Yonghyub Won, KAIST (Korea, Republic of) . . . . . [9759-51]
- Programmable nanoreplica molding process for plasmonic and photonic crystal slabs,** Longju Liu, Jingxiang Zhang, Meng Lu, Iowa State Univ. of Science and Technology (USA) . . . . . [9759-52]
- Rate controlled metal assisted chemical etching for vertical and uniform Si nanowire,** Ari Song, Seokhun Yun, Taeksoo Ji, Chonnam National Univ. (Korea, Republic of) . . . . . [9759-53]

- Surface-enhanced Raman spectroscopy substrate fabricated via nanomasking technique for biological sensor applications,** Stephen J. Bauman, Ahmad Darweesh, Joseph B. Herzog, Univ. of Arkansas (USA) . . . . . [9759-55]
- Optical and magneto-optical properties in Fe-doped silica glasses irradiated with oscillator-only femtosecond laser,** Isabela de Carvalho Martins, Kevin De Mello Santamaria, Paulo S. Pizani, Edgar D. Zanotto, UFSCAR (Brazil); Cleber R. Mendonça, Instituto de Física de São Carlos (Brazil) and Univ. de São Paulo (Brazil); Paulo Henrique D. Ferreira, Univ. Federal de São Carlos (Brazil) . . . . . [9759-56]
- Diffusive multi-scale spheres based on composite polymer systems,** Felix A. Tan, Roxana Rezvani Naraghi, Marielena Burdge, Sergey Sukhov, Aristide Dogariu, Ayman F. Abouraddy, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9759-57]
- Phase photon sieve inscribed on an optical fiber tip by focused ion beam milling,** Ricardo Janeiro, Raquel Flores, Pabitra Dahal, Jaime Viegas, Masdar Institute of Science & Technology (United Arab Emirates) . . . . . [9759-59]
- Designed local fill fraction in photonic crystal templates using a spatial light modulator,** Jeffrey R. Lutkenhaus, David George, David Lowell, Usha Philipose, Hualiang Zhang, Yuankun Lin, Univ. of North Texas (USA) . . [9759-60]
- Fabrication of period-gradient gratings by laser interference lithography,** Hanbit Kim, Hyunho Jung, Heonsu Jeon, Seoul National Univ. (Korea, Republic of) . . . . . [9759-61]
- Direct write grayscale lithography as a fabrication technology for deep micro-optical freeform surfaces,** Hans-Christoph Eckstein, Fraunhofer-IOF/Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany); Robert Leitel, Uwe D. Zeitner, Andreas Tünnermann, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [9759-62]

OPTO

# CONFERENCE 9760

LOCATION: ROOM 3012 (WEST LEVEL 3) AND ROOM 121 (NORTH EXHIBIT LEVEL)

Monday–Wednesday 15–17 February 2016  
Proceedings of SPIE Vol. 9760

COSPONSOR:



# MOEMS and Miniaturized Systems XV

Conference Chairs: **Wibool Piyawattanametha**, KMITL (Thailand) and Chulalongkorn Univ. (Thailand); **Yong-Hwa Park**, Samsung Advanced Institute of Technology (Korea, Republic of)

Program Committee: **Wyatt O. Davis**, MicroVision, Inc. (USA); **David L. Dickensheets**, Montana State Univ. (USA); **Jean-Christophe Eloy**, Yole Développement (France); **Jan Grahmann**, Fraunhofer-Institut für Photonische Mikrosysteme (Germany); **Jason C. Heikenfeld**, Univ. of Cincinnati (USA); **Ulrich Hofmann**, Fraunhofer-Institut für Siliziumtechnologie (Germany); **Il-Woong Jung**, Argonne National Lab. (USA); **David G. Lishan**, Plasma-Therm LLC (USA); **Jonathan T. Liu**, Stony Brook Univ. (USA); **Veljko Milanovic**, Mirrorcle Technologies, Inc. (USA); **Harald Schenk**, Fraunhofer Institute for Photonic Microsystems (Germany); **Jason B. Stewart**, MIT Lincoln Lab. (USA); **WanJun Wang**, Louisiana State Univ. (USA); **Guangya Zhou**, National Univ. of Singapore (Singapore)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: ROOM 3012 (WEST LEVEL 3) . . . MON 1:20 PM TO 2:20 PM

### Miniature Instruments for Endoscopic Microscopy

Joint Session with Conferences 9691A and 9760

Session Chair: **Wibool Piyawattanametha**, King Mongkut's Institute of Technology Ladkrabang (Thailand)

1:20 pm: **Development of a MEMS-based endoscopic OCT probe to detect bladder cancer**, Liliانا M. Peinado, Academisch Medisch Centrum (Netherlands); Jaap P. Verheggen, Innoluce BV (Netherlands); Paul R. Bloemen, Xu U. Zhang, Anouk L. Post, Ton G. van Leeuwen, Dirk J. Faber, Academisch Medisch Centrum (Netherlands) . . . . . [9691-25]

1:40 pm: **A microfabricated water-immersible scanning mirror with a small form factor for handheld ultrasound and photoacoustic microscopic imaging applications**, Song Xu, Chih-Hsien Huang, Jun Zou, Texas A&M Univ. (USA) . . . . . [9760-1]

2:00 pm: **A microfabricated two-axis water-immersible scanning mirror for scanning optical and acoustic microscopy**, Song Xu, Chih-Hsien Huang, Jun Zou, Texas A&M Univ. (USA) . . . . . [9760-2]

## TUESDAY 16 FEBRUARY

### SESSION 2

LOCATION: ROOM 121 (NORTH EXHIBIT LEVEL) . . TUE 10:30 TO 11:40 AM

### NOTE ROOM CHANGE

### Spatial Light Modulator Technologies for 3D Applications

Joint Session with Conferences 9760 and 9761

Session Chairs: **Benjamin L. Lee**, Texas Instruments Inc. (USA); **Badia Koudsi**, Optecks, LLC (USA)

10:30 am: **Wearable and augmented reality displays using MEMS and SLMs (Invited Paper)**, Hakan Urey, Erdem Ulusoy, SeyedMahdi M. K. KazempourRadi, Deniz Mengu, Selim Olcer, Sven T. Holmstrom, Koç Univ. (Turkey) . . . . . [9760-3]

11:00 am: **3D micro/nano manufacturing of spatial light modulators for highly compact spectroscopy systems**, Sascha P. Heussler, National Univ. of Singapore (Singapore); Herbert O. Moser, Karlsruher Institut für Technologie (Germany); Alok Pathak, Daniel Schmidt, National Univ. of Singapore (Singapore); Eric Tang, A\*STAR Institute of Materials Research and Engineering (Singapore); Emma Sparrow, The Univ. of Manchester (United Kingdom); Shuvan Prashant Turaga, Jianfeng Wu, Mark Breese, National Univ. of Singapore (Singapore) . . . . . [9760-4]

11:20 am: **A comparison of DLP-based 3D scanning methods to traditional methods**, Badia Koudsi, Hakki H. Refai, Optecks, LLC (USA) . . . . . [9761-3]

Lunch/Exhibition Break . . . . . Tue 11:40 am to 1:30 pm

### SESSION 3

LOCATION: ROOM 121 (NORTH EXHIBIT LEVEL) . TUE 1:30 TO 3:00 PM

### Microscanner

Session Chair: **Yong-Hwa Park**,

Samsung Advanced Institute of Technology (Korea, Republic of)

1:30 pm: **MEMS-mirror based trajectory resolution and precision enabled by two different piezoresistive sensor technologies (Invited Paper)**, Jan Grahmann, André Dreyhaupt, Christian Drabe, Richard Schroedter, Jörg Kamenz, Andreas Herrmann, Thilo Sandner, Fraunhofer-Institut für Photonische Mikrosysteme (Germany) . . . . . [9760-5]

2:00 pm: **MEMS scanner integrating a position control system**, Sebastien Lani, Yves-Julien Regamey, Dara Z. Bayat, Emmanuel Onillon, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland) . . . . . [9760-6]

2:20 pm: **Modelling of biaxial gimbal-less MEMS scanning mirrors**, Thomas von Wantoch, Frank Senger, Shanshan Gu-Stoppel, Christian Mallas, Ulrich Hofmann, Fraunhofer-Institut für Siliziumtechnologie (Germany); Thomas Meurer, Christian-Albrechts-Univ. zu Kiel (Germany); Wolfgang Benecke, Fraunhofer-Institut für Siliziumtechnologie (Germany) . . . . . [9760-7]

2:40 pm: **Real-time control for micro mirrors with quasistatic comb drives**, Richard Schroedter, Thilo Sandner, Fraunhofer-Institut für Photonische Mikrosysteme (Germany); Klaus Janschek, TU Dresden (Germany) . . . . . [9760-8]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

### SESSION 4

LOCATION: ROOM 121 (NORTH EXHIBIT LEVEL) TUE 3:30 TO 6:00 PM

### MOEMS Components and Systems

Session Chair: **Jan Grahmann**,

Fraunhofer-Institut für Photonische Mikrosysteme (Germany)

3:30 pm: **MOEMS fabrication using integrated optical fiber (Invited Paper)**, Christopher Holmes, Lewis G. Carpenter, Alexander Jantzen, Peter A. Cooper, James C. Gates, Peter G. R. Smith, Univ. of Southampton (United Kingdom) . . . . . [9760-10]

4:00 pm: **Synchronization dynamics of a 2D hybrid photonic-crystal nano-electro-optomechanical oscillator**, Avishek Chowdhury, Inah Yeo, Viktor Tsvirkun, Ctr. National de la Recherche Scientifique (France); Fabrice Raineri, Ctr. National de la Recherche Scientifique (France) and Univ. Paris 7-Denis Diderot (France); Grégoire Beaudoin, Isabelle Sagnes, Rama Raj, Isabelle Robert-Philip, Ctr. National de la Recherche Scientifique (France); Rémy Braive, Ctr. National de la Recherche Scientifique (France) and Univ. Paris 7-Denis Diderot (France) . . . . . [9760-12]

4:20 pm: **On-board misalignment compensation using a deformable mirror for large aperture telescopes**, Norihide Miyamura, Meisei Univ. (Japan) . . . . . [9760-13]

4:40 pm: **Mechanically flexible waveguide arrays for optical chip-to-chip coupling**, Tjitte-Jelte Peters, Marcel Tichem, Technische Univ. Delft (Netherlands) . . . . . [9760-14]

5:00 pm: **Design of mechanically-tunable photonic crystal split-beam nanocavity**, Tong Lin, Guangya Zhou, Fook Siong Chau, Yongchao Zou, National Univ. of Singapore (Singapore) . . . . . [9760-15]



# CONFERENCE 9760

LOCATION: ROOM 121 (NORTH EXHIBIT LEVEL)

5:20 pm: **Narrowband MEMS thermal emitters for IR applications**, Ross P. Stanley, Branislav D. Timotijevic, Rolf Eckert, Andrea L. Dunbar, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland) . . . . . [9760-16]

5:40 pm: **Physical and geometrical optics simulation approaches for MOEMS and hybrid optical systems**, Daniel Asoubar, LightTrans International UG (Germany); Frank Wyrowski, Friedrich-Schiller-Univ. Jena (Germany); Christian Hellmann, Wyrowski Photonics UG (Germany); Hagen Schweitzer, Michael Kuhn, LightTrans International UG (Germany) . . . . . [9760-11]

## WEDNESDAY 17 FEBRUARY

### SESSION 5

LOCATION: ROOM 121 (NORTH EXHIBIT LEVEL) . . WED 8:00 TO 10:10 AM

### Microspectrometer and Optical Filters

Session Chair: **David G. Lishan**, Plasma-Therm LLC (USA)

8:00 am: **Tunable MEMS Fabry-Pérot filters for infrared microspectrometers: a review** (*Invited Paper*), Martin Ebermann, Norbert Neumann, InfraTec GmbH (Germany); Karla Hiller, Mario Seifert, Technische Univ. Chemnitz (Germany); Marco Meinig, Steffen Kurth, Fraunhofer-Institut für Elektronische Nanosysteme (Germany) . . . . . [9760-18]

8:30 am: **VIS Fabry-Pérot-interferometer with (LH)<sub>4</sub> PE-SiO<sub>2</sub>/PE-Si<sub>3</sub>N<sub>4</sub> reflectors on freestanding LP-Si<sub>3</sub>N<sub>4</sub> membranes for surface enhanced Raman spectroscopy**, Christian Helke, Technische Univ. Chemnitz (Germany); Marco Meinig, Fraunhofer-Institut für Elektronische Nanosysteme (Germany); Mario Seifert, Jan Seiler, Karla Hiller, Technische Univ. Chemnitz (Germany); Steffen Kurth, Thomas Gessner, Fraunhofer-Institut für Elektronische Nanosysteme (Germany) . . . . . [9760-19]

8:50 am: **Deeply-etched micromirror with vertical slit and metallic coating enabling transmission-type optical MEMS filters**, Muhammad A. Othman, Ain Shams Univ. (Egypt); Yasser M. Sabry, Ain Shams Univ. (Egypt) and Si-Ware Systems (Egypt); Mohamed Sadek, Si-Ware Systems (Egypt); Ismail M. Nassar, Ain Shams Univ. (Egypt); Diaa A. Khalil, Ain Shams Univ. (Egypt) and Si-Ware Systems (Egypt) . . . . . [9760-20]

9:10 am: **Mid infrared MEMS FTIR spectrometer**, Mazen Erfan, Ain Shams Univ. (Egypt); Yasser M. Sabry, Ain Shams Univ. (Egypt) and Si-ware Systems (Egypt); Bassem Mortada, Si-ware Systems (Egypt); Khaled Sharaf, Ain Shams Univ. (Egypt); Diaa A. Khalil, Ain Shams Univ. (Egypt) and Si-ware Systems (Egypt) . . . . . [9760-21]

9:30 am: **Novel Fourier transform infrared spectrometer architecture based on cascaded Fabry-Perot interferometers**, Yomna Eltagoury, Ain Shams Univ. (Egypt); Yasser M. Sabry, Diaa A. Khalil, Ain Shams Univ. (Egypt) and Si-ware Systems (Egypt) . . . . . [9760-22]

9:50 am: **MOEMS FPI sensors for NIR: MIR microspectrometer applications**, Anna Rissanen, Bin Guo, Aitti Akujärvi, Rami Mannila, VTT Technical Research Ctr. of Finland Ltd. (Finland) . . . . . [9760-23]

Coffee Break . . . . . Wed 10:10 am to 10:40 am

### SESSION 6

LOCATION: RM 121 (NORTH EXHIBIT LEVEL) WED 10:40 AM TO 12:10 PM

### MOEMS for Sensing and Imaging Applications I

Session Chair: **Ulrich Hofmann**, Fraunhofer-Institut für Siliziumtechnologie (Germany)

10:40 am: **Ultra-slim 2D- and depth-imaging camera modules for mobile imaging** (*Invited Paper*), Andreas Brückner, Alexander Oberdörster, Jens Dunkel, Andreas Reimann, Frank C. Wippermann, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [9760-24]

11:10 am: **Micro Fabry-Perot cavities for self-calibrating accelerometers**, Thomas W. LeBrun, National Institute of Standards and Technology (USA) . . . . . [9760-25]

11:30 am: **Study on sputtered a-Si:H for micro optical diffusion sensor using laser-induced dielectrophoresis**, Makoto Kamata, Keio Univ. (Japan); Kan Yamada, Kyodo International Inc. (Japan); Yoshihiro Taguchi, Yuji Nagasaka, Keio Univ. (Japan) . . . . . [9760-26]

11:50 am: **Low power and highly precise closed-loop driving circuit for piezoelectric micromirrors with embedded capacitive position sensors**, Stefan Rombach, Maximilian Marx, Univ. of Freiburg (Germany); Shanshan Gu-Stoppel, Fraunhofer-Institut für Siliziumtechnologie (Germany); Yiannos Manoli, Univ. of Freiburg (Germany) . . . . . [9760-27]

Lunch/Exhibition Break . . . . . Wed 12:10 pm to 1:40 pm

### SESSION 7

LOCATION: ROOM 121 (NORTH EXHIBIT LEVEL) . . . WED 1:40 TO 3:50 PM

### MOEMS for Sensing and Imaging Applications II

Session Chair: **Guangya Zhou**, National Univ. of Singapore (Singapore)

1:40 pm: **Large arrays of micro-mirrors in future space instruments for universe and Earth observation** (*Invited Paper*), Frédéric Zamkotsian, Patrick Lanzoni, Lab. d'Astrophysique de Marseille (France) . . . . . [9760-28]

2:10 pm: **Novel multi-aperture approach for miniaturized imaging systems**, Frank C. Wippermann, Andreas Brückner, Alexander Oberdörster, Andreas Reimann, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany) . . . . . [9760-29]

2:30 pm: **Two-fluid variable focus micro-lens with a large deflection polymer actuator**, Florenta A. Costache, Boscij Pawlik, Christian Schirrmann, Kirstin Bornhorst, Andreas Rieck, Fraunhofer-Institut für Photonische Mikrosysteme (Germany) . . . . . [9760-30]

2:50 pm: **Miniature electrically tunable rotary dual-focus lenses**, Yongchao Zou, Wei Zhang, Fook Siong Chau, Guangya Zhou, National Univ. of Singapore (Singapore) . . . . . [9760-31]

3:10 pm: **NanoPlasmonics tunable filter using NEMS technology**, Mohamed A. Swillam, Kareem Khirallah, The American Univ. in Cairo (Egypt) . . . . . [9760-32]

3:30 pm: **Transition of optical regime in miniaturized optical systems: Light interactions beyond the refraction limit**, Myun-Sik Kim, Ecole Polytechnique Fédérale de Lausanne (Switzerland) and SUSS MicroOptics SA (Switzerland); Toralf Scharf, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Carsten Rockstuhl, Karlsruhe Institute of Technology (Germany); Wataru Nakagawa, Montana State Univ. (USA); Reinhard Völkel, SUSS MicroOptics SA (Switzerland); Hans Peter Herzig, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9760-35]

### POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Optically pumped 1550nm wavelength tunable MEMS VCSEL**, Hitesh Kumar Sahoo, Thor Ansbaek, Luisa Ottaviano, Elizaveta S. Semenova, DTU Fotonik (Denmark); Ole Hansen, DTU Nanotech (Denmark); Kresten Yvind, DTU Fotonik (Denmark) . . . . . [9760-17]

**Analysis in effects of aperture size and applied voltage on the response time**, Yookwang Kim, Jin Su Lee, Yong Hyub Won, KAIST (Korea, Republic of) . . . . . [9760-33]

**A handheld confocal microscope for 3D biopsies**, Wibool Piyawattanametha, King Mongkut's Institute of Technology Ladkrabang (Thailand) . . . . . [9760-34]

OPTO

# CONFERENCE 9761

LOCATION: ROOM 123 AND 121 (NORTH EXHIBIT LEVEL) AND ROOM 2018 (WEST LEVEL 2)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9761

# Emerging Digital Micromirror Device Based Systems and Applications VIII

COSPONSOR:



Conference Chairs: **Michael R. Douglass**, Texas Instruments Inc. (USA); **Philip S. King**, Texas Instruments Inc. (USA); **Benjamin L. Lee**, Texas Instruments Inc. (USA)

Program Committee: **Vikram V. Appia**, Texas Instruments Inc. (USA); **Sara L. Best**, Univ. of Wisconsin School of Medicine and Public Health (USA); **Roland Höfling**, ViALUX GmbH (Germany); **Alfred Jacobsen**, Visitech AS (Norway); **Yuval Kapellner Rabinovitz**, EKB Technologies Ltd. (Israel); **Badia Koudsi**, Optecks, LLC (USA); **Jinyang Liang**, Washington Univ. in St. Louis (USA); **Srinivasa G. Narasimhan**, Carnegie Mellon Univ. (USA); **Michael W. O’Keefe**, Greenlight Optics, LLC (USA); **Hakki H. Refai**, Optecks, LLC (USA); **David Smith**, Wintech Digital Systems Technology Corp. (USA); **Ivo M. Vellekoop**, Univ. Twente (Netherlands); **Karel J. Zuzak**, Univ. of Texas Southwestern Medical Ctr. (USA), The Lab. of Biomedical Imaging and Engineering, LBI-51, LLC (USA)

## MONDAY 15 FEBRUARY

### SESSION 1

LOCATION: ROOM 123 (NORTH EXHIBIT LEVEL) MON 1:20 TO 3:30 PM

### Advanced Manufacturing using a DMD or other SLM

Joint Session with Conferences 9759 and 9761

Session Chairs: **Philip S. King**, Texas Instruments Inc. (USA); **Georg von Freymann**, Technische Univ. Kaiserslautern (Germany)

1:20 pm: **The next generation of maskless lithography** (*Invited Paper*), Steffen Diez, Heidelberg Instruments Mikrotechnik GmbH (Germany) . . . . . [9761-1]

1:50 pm: **Metal powder laser melting with variable mask image amplification systems using TI DMD, pulsed Nd:YAG lasers, and amplifiers**, Farzan N. Ghauri, Vardex Laser Solutions LLC (USA). . . . . [9761-2]

2:10 pm: **Size scaling with light patterned dielectrophoresis in an optoelectronic tweezers device**, Angel Fuentes, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Juan Carlos Rodríguez Luna, Joan Juvert, Univ. of Glasgow (United Kingdom); Ruben Ramos-García, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Steven L. Neale, Univ. of Glasgow (United Kingdom) . . . . . [9759-23]

2:30 pm: **High-throughput depth-resolved parallel laser machining based on temporal focusing**, Dapeng Zhang, Chenglin Gu, Shih-Chi Chen, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . [9759-24]

2:50 pm: **Fabrication of waveguide spatial light modulators via femtosecond laser micromachining**, Nickolaos Savidis, Bianca Datta, Sundeep Jolly, V. Michael Bove Jr., MIT Media Lab. (USA) . . . . . [9759-25]

3:10 pm: **Assembling silver nanowires using optoelectronic tweezers**, Shuailong Zhang, Steven L. Neale, Jonathan M. Cooper, Univ. of Glasgow (United Kingdom). . . . . [9759-26]

## TUESDAY 16 FEBRUARY

### SESSION 2

LOCATION: ROOM 121 (NORTH EXHIBIT LEVEL) . . TUE 10:30 TO 11:40 AM

**NOTE ROOM CHANGE**

### Spatial Light Modulator Technologies for 3D Applications

Joint Session with Conferences 9760 and 9761

Session Chairs: **Benjamin L. Lee**, Texas Instruments Inc. (USA); **Badia Koudsi**, Optecks, LLC (USA)

10:30 am: **Wearable and augmented reality displays using MEMS and SLMs** (*Invited Paper*), Hakan Urey, Erdem Ulusoy, SeyedMahdi M. K. KazempourRadi, Deniz Mengü, Selim Olcer, Sven T. Holmstrom, Koç Univ. (Turkey). . . . . [9760-3]

11:00 am: **3D micro/nano manufacturing of spatial light modulators for highly compact spectroscopy systems**, Sascha P. Heussler, National Univ. of Singapore (Singapore); Herbert O. Moser, Karlsruher Institut für Technologie (Germany); Alok Pathak, Daniel Schmidt, National Univ. of Singapore (Singapore); Eric Tang, A\*STAR Institute of Materials Research and Engineering (Singapore); Emma Sparrow, The Univ. of Manchester (United Kingdom); Shuvan Prashant Turaga, Jianfeng Wu, Mark Breese, National Univ. of Singapore (Singapore). . . . . [9760-4]

11:20 am: **A comparison of DLP-based 3D scanning methods to traditional methods**, Badia Koudsi, Hakki H. Refai, Optecks, LLC (USA) . . . . . [9761-3]

Lunch/Exhibition Break . . . . . Tue 11:40 am to 1:30 pm

### SESSION 3

LOCATION: ROOM 2018 (WEST LEVEL 2) . . . TUE 1:30 PM TO 3:30 PM

**NOTE ROOM CHANGE**

### Biomedical Imaging using a DMD or Other Light Structuring Devices

Joint Session with Conferences 9711 and 9761

Session Chairs: **Michael R. Douglass**, Texas Instruments Inc. (USA); **Robert C. Leif**, Newport Instruments (USA)

1:30 pm: **Wavefront shaping optical coherence tomography using a digital micromirror device for enhancing penetration depth in biological tissues** (*Invited Paper*), YongKeun Park, KAIST (Korea, Republic of) . . . . . [9761-4]

2:00 pm: **Digital micromirror device (DMD) based fast digital optical phase conjugation (DOPC) system**, Haojiang Zhou, California Institute of Technology (USA); Daifa Wang, California Institute of Technology (USA) and BeiHang Univ. (China); Joshua Brake, Changhui Yang, California Institute of Technology (USA) . . . . . [9761-5]

# CONFERENCE 9761

**LOCATION: ROOM 2007 (WEST LEVEL 2) AND ROOM 307 (SOUTH ESPLANADE)**

2:20 pm: **Digital micromirror device based multispectral retinal imaging using optimized illumination schemes**, Mathi Damodaran, Vrije Univ. Amsterdam (Netherlands); Kari V. Vienola, Vrije Univ. Amsterdam (Netherlands) and Rotterdam Ophthalmic Institute (Netherlands); Boy Braaf, Vrije Univ. Amsterdam (Netherlands); Koenraad A. Vermeer, Rotterdam Ophthalmic Institute (Netherlands); Johannes F. de Boer, Vrije Univ. Amsterdam (Netherlands) . . . . . [9761-6]

2:40 pm: **Contrast enhancement using differential spinning disc structured illumination in high resolution microendoscopy for imaging nuclear morphology in tissue** (*Invited Paper*), Pelham Keahey, Rebecca Richards-Kortum, Rice Univ. (USA) . . . . . [9711-28]

3:10 pm: **Melanoma detection using smartphone and multimode hyperspectral imaging**, Nicholas B. MacKinnon, Fartash Vasefi, Spectral Molecular Imaging Inc. (USA); Daniel L. Farkas, Spectral Molecular Imaging, Inc. (USA) and Univ. of Southern California, Los Angeles (USA) . . . . . [9711-29]

Coffee Break . . . . . Tue 3:30 pm to 4:00 pm

## SESSION 4

**LOCATION: ROOM 2007 (WEST LEVEL 2) . . TUE 4:00 PM TO 5:00 PM**

**NOTE ROOM CHANGE**

### DLP® System Prototyping and DMD Characterization

Session Chair: **Michael R. Douglass**, Texas Instruments Inc. (USA)

4:00 pm: **Heavy ion radiation testing of a digital micromirror device for performance in space**, Anton Travinsky, Dmitry Vorobiev, Zoran Ninkov, Rochester Institute of Technology (USA) . . . . . [9761-7]

4:20 pm: **Electromagnetic simulation concepts for DLP projector systems**, Daniel Asoubar, Hartwig Crailsheim, Hagen Schweitzer, LightTrans International UG (Germany); Frank Wyrowski, Friedrich-Schiller-Univ. Jena (Germany); Christian Hellmann, Wyrowski Photonics UG (Germany); Michael Kuhn, LightTrans International UG (Germany) . . . . . [9761-8]

4:40 pm: **Active modulation of laser systems using near infrared video projection system based on digital micromirror device (DMD)**, Aly Ahmed A. Khalifa, Hussein A. Aly, Ashraf F. El-Sherif, Military Technical College (Egypt) . . . . . [9761-9]

## WEDNESDAY 17 FEBRUARY

## SESSION 5

**LOCATION: ROOM 307 (SOUTH ESPLANADE) WED 8:50 TO 10:10 AM**

**NOTE ROOM CHANGE**

### Spectroscopy and Hyperspectral Imaging

Session Chairs: **Benjamin L. Lee**, Texas Instruments Inc. (USA); **Hakki H. Refai**, Optecks, LLC (USA)

8:50 am: **DLP NIRscan Nano: an ultra-mobile DLP-based near-infrared Bluetooth spectrometer**, Pedro Gelabert, Eric Pruett, Gavin Perrella, Sreeram Subramanian, Aravind Lakshminarayanan, Texas Instruments Inc. (USA) . . . . . [9761-26]

9:10 am: **Real-time video imaging of gas plumes using a DMD-enabled full-frame programmable spectral filter**, David L. Graff, Steven P. Love, Los Alamos National Lab. (USA) . . . . . [9761-11]

9:30 am: **DLP-based system for flexible and portable spectroscopic measurements**, Badia Koudsi, Hakki H. Refai, Optecks, LLC (USA) . . [9761-12]

9:50 am: **Powerful DMD-based light sources with a high throughput virtual slit**, Arsen Hajjan, Edward A. Gooding, Thomas V. Gunn, Steven Bradbury, Christopher Babayan, Hindsight Imaging, Inc. (USA) . . . . . [9761-13]

Coffee Break . . . . . Wed 10:10 am to 10:40 am

## SESSION 6

**LOCATION: ROOM 307 (SOUTH ESPLANADE) WED 10:40 TO 11:50 AM**

### Computational Imaging for Spectral Applications

Session Chairs: **Ivo M. Vellekoop**, Univ. Twente (Switzerland); **Roland Höfling**, ViALUX GmbH (Germany)

10:40 am: **Adaptive, direct spectral imaging classification** (*Invited Paper*), Michael E. Gehm, Duke Univ. (USA) . . . . . [9761-14]

11:10 am: **Imaging spectrometer built using the compressive sensing single-pixel camera architecture**, Lenore McMackin, Matthew A. Herman, Tyler Weston, InView Technology Corp. (USA) . . . . . [9761-15]

11:30 am: **Hyperspectral scanning white light interferometry based on compressive imaging**, Mohammad Azari, Nasim Habibi, The Univ. of North Carolina at Charlotte (USA); Mehrdad Abolbashari, Optoniks Corp. (USA); Faramarz Farahi, The Univ. of North Carolina at Charlotte (USA) . . . . . [9761-16]

Lunch/Exhibition Break . . . . . Wed 11:50 am to 1:20 pm

## SESSION 7

**LOCATION: ROOM 307 (SOUTH ESPLANADE) . WED 1:20 TO 3:00 PM**

### Computational Imaging for Advanced Applications

Session Chair: **Yuval Kapellner Rabinovitz**, EKB Technologies Ltd. (Israel)

1:20 pm: **Time-of-flight compressed ultrafast photography for encrypted three-dimensional dynamic imaging** (*Invited Paper*), Jinyang Liang, Liang S. Gao, Pengfei Hai, Chiye Li, Lihong V. Wang, Washington Univ. in St. Louis (USA) . . . . . [9761-17]

1:50 pm: **Computational imaging expansion from visible to infrared and to THz systems** (*Invited Paper*), Zeev Zalevsky, Alex Zlotnik, Yuval Kapellner Rabinovitz, Amir Shemer, Ariel Schwarz, Bar-Ilan Univ. (Israel) . . . . . [9761-18]

2:20 pm: **Experimental study of a DMD based compressive line sensing imaging system in the turbulence environment**, Bing Ouyang, Harbor Branch Oceanographic Institute (USA); Weilin W. Hou, U.S. Naval Research Lab. (USA); Cuiling Gong, Texas Christian Univ. (USA); Frank M. Caimi, Fraser R. Dalgleish, Anni K. Vuorenkoski, Harbor Branch Oceanographic Institute (USA); Xifeng Xiao, David G. Voelz, New Mexico State Univ. (USA) . . . . . [9761-19]

2:40 pm: **Reference-less measurement of the transmission matrix of a highly scattering material using a DMD and phase retrieval techniques**, Angélique Drèmeau, Ecole Nationale Supérieure de Techniques Avancées Bretagne (France); Antoine Liutkus, INRIA Nancy - Grand Est (France); David Martina, Ori Katz, Lab. Kastler Brossel (France); Christophe Schülke, Florent Krzakala, Ecole Normale Supérieure (France) and Univ. Pierre et Marie Curie (France); Laurent Daudet, Institut Langevin (France); Sylvain Gigan, Lab. Kastler Brossel (France) . . . . . [9761-20]

Coffee Break . . . . . Wed 3:00 pm to 3:30 pm

## SESSION 8

**LOCATION: ROOM 307 (SOUTH ESPLANADE) . WED 3:30 TO 4:50 PM**

### Beam Shaping

Session Chair: **Jinyang Liang**, Washington Univ. in St. Louis (USA)

3:30 pm: **Experimental demonstration of precise holograms using complex light modulation**, Vik Parthiban, Rudolph N. Kohn Jr., The Univ. of Texas at Austin (USA); Jinyang Liang, Washington Univ. in St. Louis (USA); Michael F. Becker, The Univ. of Texas at Austin (USA) . . . . . [9761-21]

3:50 pm: **Spatial and temporal control of thermal waves by using DMDs for interference based crack detection**, Erik Thiel, Bundesanstalt für Materialforschung und -prüfung (Germany); Marc Kreutzbruck, Univ. Stuttgart (Germany); Mathias Ziegler, Bundesanstalt für Materialforschung und -prüfung (Germany) . . . . . [9761-22]

4:10 pm: **Shaping non-diffracting beams with a digital micromirror device**, Yuxuan Ren, Zhaoxiang Fang, Rongde Lu, Univ. of Science and Technology of China (China) . . . . . [9761-23]

4:30 pm: **Femtosecond laser pulse shaping at megahertz rate via a digital micromirror device**, Chenglin Gu, Dapeng Zhang, Jiyi Cheng, Shih-Chi Chen, The Chinese Univ. of Hong Kong (Hong Kong, China) . . . . . [9761-24]

## POSTERS-WEDNESDAY

**LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM**

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Generation of autofocusing vortex airy beam with a digital micromirror device**, Zhaoxiang Fang, Univ. of Science and Technology of China (China); Yuxuan Ren, Institute of Biochemistry and Cell Biology (China); Rongde Lu, Univ. of Science and Technology of China (China) . . . . . [9761-25]

OPTO

# CONFERENCE 9762

LOCATION: ROOM 3010 (WEST LEVEL 3) AND ROOM 2016 (WEST LEVEL 2)

Tuesday–Thursday 16–18 February 2016 • Proceedings of SPIE Vol. 9762

# Advances in Photonics of Quantum Computing, Memory, and Communication IX

*Conference Chairs:* **Zameer Ul Hasan**, Temple Univ. (USA); **Philip R. Hemmer**, Texas A&M Univ. (USA); **Hwang Lee**, Louisiana State Univ. (USA); **Alan L. Migdall**, National Institute of Standards and Technology (USA)

*Program Committee:* **Dmitry Budker**, Univ. of California, Berkeley (USA); **Alan E. Craig**, Montana State Univ. (USA); **Jonathan P. Dowling**, Louisiana State Univ. (USA); **Gurudev Dutt**, Univ. of Pittsburgh (USA); **Geoff J. Pryde**, Griffith Univ. (Australia); **David H. Hughes**, Air Force Research Lab. (USA); **Fedor Jelezko**, Univ. Stuttgart (Germany); **Marko Loncar**, Harvard School of Engineering and Applied Sciences (USA); **Aleksander K. Rebane**, Montana State Univ. (USA); **Matthew J. Sellars**, The Australian National Univ. (Australia); **Selim M. Shahrir**, Northwestern Univ. (USA); **Alan E. Willner**, The Univ. of Southern California (USA); **Jörg Wrachtrup**, Univ. Stuttgart (Germany); **Horace P. Yuen**, Northwestern Univ. (USA); **M. Suhail Zubairy**, Texas A&M Univ. (USA)

## TUESDAY 16 FEBRUARY

### SESSION 1

LOCATION: ROOM 3010 (WEST LEVEL 3) . . . TUE 1:40 PM TO 3:00 PM

### Non-Bleaching and Ultra-Small Fluorescent Probes I

Joint Session with Conferences 9723 and 9762

Session Chairs: **Ramesh Raghavachari**, U.S. Food and Drug Administration (USA); **Philip R. Hemmer**, Texas A&M Univ. (USA)

1:40 pm: **Intraneuronal traffic readout with fluorescent nanodiamonds**, François Treussart, Lab. Aimé Cotton (France); Simon Haziza, Lab. Aimé Cotton (France) and Ctr. de Psychiatrie et Neurosciences (France); Michel Simonneau, Yann Loe-Mie, Aude-Marie Lepagnol-Bestel, Ctr. de Psychiatrie et Neurosciences (France); Nitin Mohan, Lab. Aimé Cotton (France); Huan-Cheng Chang, Institute of Atomic and Molecular Science (Taiwan). . . . . [9762-1]

2:00 pm: **Multifunctional intracellular sensing with biologically-responsive nanodiamonds**, Zhiqin Chu, Univ. Stuttgart (Germany). . . . . [9762-2]

2:20 pm: **Nanodiamond as a multi-role fluorescent marker for bioimaging**, Brian R. Patton, Martin J. Booth, Univ. of Oxford (United Kingdom) . . . [9723-25]

2:40 pm: **Single-protein spin resonance spectroscopy and imaging under ambient conditions**, Jiangfeng Du, Univ. of Science and Technology of China (China) . . . . . [9762-3]

Coffee Break . . . . . Tue 3:00 pm to 3:30 pm

### SESSION 2

LOCATION: ROOM 3010 (WEST LEVEL 3) . . . TUE 3:30 PM TO 5:20 PM

### Non-Bleaching and Ultra-Small Fluorescent Probes II

Joint Session with Conferences 9723 and 9762

Session Chairs: **Ramesh Raghavachari**, U.S. Food and Drug Administration (USA); **Philip R. Hemmer**, Texas A&M Univ. (USA)

3:30 pm: **Kilograms of bright nanodiamonds and bio-functionalization** (*Invited Paper*), Arfaan Rampersaud, Columbus NanoWorks (USA) . . . . [9762-4]

4:00 pm: **Fluorescent silica nanoparticles containing covalently bound dyes for reporter, marker and sensor applications**, Gabor Patonay, Maged M. Henary, Gala Chapman, Kyle Emer, Georgia State Univ. (USA) . . . . . [9723-26]

4:20 pm: **Synthesis and energy transfer within carbon-based fluorescent rare earth nanoparticles and nanocomposites**, Brian G. Yust, Mircea Chipara, Aaron Saenz, The Univ. of Texas Rio Grande Valley (USA) . . . . . [9723-27]

4:40 pm: **Nanoparticle-enhanced x-ray therapy for cancer**, Renat R. Letfullin, Rose-Hulman Institute of Technology (USA); Colin E. W. Rice, Univ. of Minnesota, Twin Cities (USA); Thomas F. George, Univ. of Missouri-St. Louis (USA) . . . . . [9723-28]

5:00 pm: **Anisotropic silver nanoparticles: sorption and desorption of cationic porphyrins**, Anna G. Gyulkhandanyan, Anna A. Zakoyan, Institute of Biochemistry (Armenia); Robert K. Ghazaryan, Yerevan State Medical Univ. (Armenia); Aram G. Gyulkhandanyan, Institute of Biochemistry (Armenia); Marina A. Sheyryanyan, Yerevan State Univ. (Armenia); Grigor V. Gyulkhandanyan, Institute of Biochemistry (Armenia) . . . . . [9723-29]

## WEDNESDAY 17 FEBRUARY

### SESSION 3

LOCATION: ROOM 2016 (WEST LEVEL 2) . WED 8:00 AM TO 10:00 AM

### NOTE ROOM CHANGE

### Quantum Optical Entanglement for Computational and Communication Links I

Session Chair: **Hwang Lee**, Louisiana State Univ. (USA)

8:00 am: **Optical quantum information with and without control** (*Invited Paper*), Geoff J. Pryde, Griffith Univ. (Australia) . . . . . [9762-5]

8:30 am: **Long distance compensation of nonlocal dispersion in frequency domain two-photon Bessel interferences scheme using WDM synchronization**, Batiste Galmes, Luca Furfaro, Kien Phan Huy, Laurent Larger, John M. Dudley, Jean-Marc Merolla, FEMTO-ST (France) . . . . . [9762-6]

8:50 am: **Photoelectrical detection of nitrogen-vacancy centre electron spin states in diamond** (*Invited Paper*), Milos Nesladek, Univ. Hasselt (Belgium) . . . . . [9762-7]

9:20 am: **The next iteration of the small photon entangling quantum system (SPEQS-2.0)**, Kadir Durak, Aitor Villar, Patrick C. Wade, Rakhitha Chandrasekara, Zhongkan K. Tang, Alexander Ling, Ctr. for Quantum Technologies (Singapore) . . . . . [9762-8]

9:40 am: **Integrated quantum key distribution sender unit for daily-life implementations**, Gwenaëlle Mélen, Tobias Vogl, Markus Rau, Ludwig-Maximilians-Univ. München (Germany); Giacomo Corrielli, Andrea Crespi, CNR-Istituto di Fotonica e Nanotecnologie (Italy); Roberto Osellame, CNR-Istituto di Fotonica e Nanotecnologie (Italy) and Politecnico di Milano (Italy); Harald Weinfurter, Ludwig-Maximilians-Univ. München (Germany) and Max-Planck-Institut für Quantenoptik (Germany) . . . . . [9762-9]

Coffee Break . . . . . Wed 10:00 am to 10:30 am



# CONFERENCE 9762

LOCATION: ROOM 2016 (WEST LEVEL 2) AND ROOM 124 (NORTH EXHIBIT LEVEL)

## SESSION 4

LOCATION: ROOM 2016 (WEST LEVEL 2) WED 10:30 AM TO 12:00 PM

### Quantum Optical Entanglement for Computational and Communication Links II

Session Chair: **Geoff J. Pryde**, Griffith Univ. (Australia)

10:30 am: **Realization of a quantum controlled-SWAP gate with photonic circuits** (*Invited Paper*), Shigeki Takeuchi, Kyoto Univ. (Japan); Takafumi Ono, Hokkaido Univ. (Japan); Ryo Okamoto, Kyoto Univ. (Japan); Masato Tanida, Osaka Univ. (Japan); Holger F. Hofmann, Hiroshima Univ. (Japan) . . . . [9762-10]

11:00 am: **Engineering frequency-time quantum correlation of narrow-band biphotons from cold atoms** (*Invited Paper*), Yoon-Ho Kim, Pohang Univ. of Science and Technology (Korea, Republic of) . . . . . [9762-11]

11:30 am: **One-way quantum computing with arbitrary-scale continuous-variable cluster states extending over time and frequency** (*Invited Paper*), Rafael Alexander, The Univ. of Sydney (Australia); Pei Wang, Niranjan Sridhar, Moran Chen, Olivier Pfister, Univ. of Virginia (USA); Nicolas Menicucci, The Univ. of Sydney (Australia) . . . . . [9762-12]

Lunch/Exhibition Break . . . . . Wed 12:00 pm to 1:30 pm

## SESSION 5

LOCATION: ROOM 2016 (WEST LEVEL 2) . . . WED 1:30 PM TO 3:10 PM

### Quantum Metrology

Session Chair: **Olivier Pfister**, Univ. of Virginia (USA)

1:30 pm: **Adaptive Gaussian quadrature detection for continuous-variable quantum key distribution**, Laszlo Gyongyosi, Sandor Imre, Budapest Univ. of Technology and Economics (Hungary) . . . . . [9762-13]

1:50 pm: **Quantum properties of twisted light** (*Invited Paper*), Robert W. Boyd, Univ. of Ottawa (Canada) . . . . . [9762-14]

2:20 pm: **Parity detection achieves Heisenberg limit in an SU(1,1) interferometer with coherent and squeezed vacuum input states**, Dong Li, East China Normal Univ. (China) and Louisiana State Univ. (USA); Bryan Gard, Louisiana State Univ. (USA); Chun-Hua Yuan, Weiping Zhang, East China Normal Univ. (China); Hwang Lee, Jonathan P. Dowling, Louisiana State Univ. (USA) . . . . . [9762-15]

2:40 pm: **High-dimensional entanglement: measures and applications** (*Invited Paper*), John C. Howell, Daniel Lum, James Schaefer, Samuel Knarr, Univ. of Rochester (USA); Gregory A. Howland, Air Force Research Lab. (USA) . . . . . [9762-16]

Coffee Break . . . . . Wed 3:10 pm to 3:40 pm

## SESSION 6

LOCATION: ROOM 2016 (WEST LEVEL 2) . . WED 3:40 PM TO 5:40 PM

### Hybrid Systems and Quantum Technologies

Session Chair: **David Zueco**, Univ. de Zaragoza (Spain)

3:40 pm: **Reconfigurable photonic chips based on lithium niobate waveguide circuits** (*Invited Paper*), Ping Xu, Hua Jin, Marlin Zhong, Nanjing Univ. (China); Yanxiao Gong, Southeast Univ. (China); Ye Yuan, Changwei Sun, Nanjing Univ. (China); Fumin Liu, Junlei Xia, Jianwei Zhou, Wei Wang, Beijing Institute of Aerospace Control Devices (China); Shining Zhu, Nanjing Univ. (China) . . . . . [9762-17]

4:10 pm: **On-chip quantum storage in a rare-earth-doped photonic nanocavity**, Tian Zhong, Jonathan M. Kindem, Jake Rochman, Evan Miyazono, California Institute of Technology (USA); Alban Ferrier, Philippe Goldner, Institut de Chimie et des Matériaux Paris-Est (France) and Univ. Pierre et Marie Curie (France); Andrei Faraon, California Institute of Technology (USA) . . . . . [9762-18]

4:30 pm: **On-chip generation and sparsity tomography of entangled photons** (*Invited Paper*), Andrey A. Sukhorukov, The Australian National Univ. (Australia) . . . . . [9762-19]

5:00 pm: **On the addressing of quantum emitters using nanophotonics**, Christophe Couteau, Univ. de Technologie Troyes (France) . . . . . [9762-20]

5:20 pm: **Experimental demonstration of long-range quantum interactions in hyperbolic media**, Ward D. Newman, Cristian L. Cortes, Zubin Jacob, Univ. of Alberta (Canada) . . . . . [9762-21]

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Ultrathin fiber-taper coupling with nitrogen vacancy centers in nanodiamonds at cryogenic temperatures**, Masazumi Fujiwara, Kwansei Gakuin Univ. (Japan) and Hokkaido Univ. (Japan) and Osaka Univ. (Japan); Hong-Quan Zhao, Hokkaido Univ. (Japan); Tetsuya Noda, Osaka Univ. (Japan) and Hokkaido Univ. (Japan); Kazuhiro Ikeda, Hitoshi Sumiya, Sumitomo Electric Industries Ltd. (Japan); Shigeki Takeuchi, Kyoto Univ. (Japan) and Hokkaido Univ. (Japan) and Osaka Univ. (Japan) . . . . . [9762-32]

**Photonic crystal resonators in erbium-doped crystals for on-chip optical quantum memories**, Evan Miyazono, Tian Zhong, Ioana Craiciu, Jonathan M. Kindem, Andrei Faraon, California Institute of Technology (USA) . . . . . [9762-33]

**Fabrication of high-quality nanobeam photonic crystals in 4H silicon carbide**, David O. Bracher, Evelyn L. Hu, Harvard Univ. (USA) . . . . . [9762-34]

**Coherent addressing, switching, and signal processing in a Raman-active array of waveguides**, Igor V. Melnikov, National Research Univ. of Electronic Technology (Russian Federation) and Univ. of Illinois in Urbana-Champaign (USA) and Moscow Institute of Physics and Technology (Russian Federation); Georgy L. Alfimov, Svetlana V. Nazarenko, National Research Univ. of Electronic Technology (Russian Federation) . . . . . [9762-36]

**Characterization of type-II spontaneous parametric down-conversion in domain-engineered PPLN**, Paulina Kuo, Oliver Slattery, Lijun Ma, Xiao Tang, National Institute of Standards and Technology (USA) . . . . . [9762-37]

## THURSDAY 18 FEBRUARY

### SESSION 7

LOCATION: ROOM 124 (NORTH EXHIBIT LEVEL) . . THU 8:30 TO 10:10 AM

#### NOTE ROOM CHANGE

### Photonics-based Physics Simulations and Few Photon Nonlinearities I

Session Chair: **Hannah M. Price**, Univ. degli Studi di Trento (Italy)

8:30 am: **Exploring many-body physics with light** (*Invited Paper*), Jacob Taylor, Joint Quantum Institute (USA) . . . . . [9762-22]

9:00 am: **quantum nonlinear optics with one photon** (*Invited Paper*), David Zueco, Luis Martín-Moreno, Eduardo Sánchez-Burillo, Univ. de Zaragoza (Spain); Juanjo García-Ripoll, Consejo Superior de Investigaciones Científicas (Spain) . . . . . [9762-23]

9:30 am: **Quantum phenomena in ultra-high Q whispering gallery mode resonators and applications to quantum information systems**, Yanne K. Chembo, FEMTO-ST (France) . . . . . [9762-24]

9:50 am: **Multiplexing single-photon orbital angular momentum states in fiber: limits to dephasing correction via dynamical decoupling**, Manish Kumar Gupta, Jonathan P. Dowling, Louisiana State Univ. (USA) . . . . . [9762-25]

Coffee Break . . . . . Thu 10:10 am to 10:40 am

# CONFERENCE 9762

LOCATION: ROOM 124 (NORTH EXHIBIT LEVEL)

## SESSION 8

LOCATION: RM 124 (NORTH EXHIBIT LEVEL) . THU 10:40 AM TO 12:10 PM

### Photonics-based Physics Simulations and Few Photon Nonlinearities II

Session Chair: **Alberto Amo**,  
Lab. de Photonique et de Nanostructures (France)

10:40 am: **Few-photon control in nanometer-scale engineered fiber devices** (*Invited Paper*), Stojan Radic, Univ. of California, San Diego (USA) . . . . [9762-26]

11:10 am: **Gravity in the quantum lab** (*Invited Paper*), Ivette Fuentes Guridi, Vienna Ctr. for Quantum Science and Technology (Austria). . . . . [9762-27]

11:40 am: **Realization of topological Anderson insulators** (*Invited Paper*), Alexander Szameit, Simon Stützer, Friedrich-Schiller-Univ. Jena (Germany); Yonatan Plotnik, Technion-Israel Institute of Technology (Israel); Julia M. Zeuner, Friedrich-Schiller-Univ. Jena (Germany); Yaakov Lumer, Miguel A. Bandres, Mordechai Segev, Technion-Israel Institute of Technology (Israel); Mikael C. Rechtsman, The Pennsylvania State Univ. (USA) . . . . . [9762-28]

Lunch/Exhibition Break . . . . . Thu 12:10 pm to 1:40 pm

## SESSION 9

LOCATION: ROOM 124 (NORTH EXHIBIT LEVEL) THU 1:40 TO 3:10 PM

### Photonics-based Physics Simulations and Few Photon Nonlinearities III

Session Chair: **Andrey A. Sukhorukov**,  
The Australian National Univ. (Australia)

1:40 pm: **Polariton lattices for photonic simulation** (*Invited Paper*), Alberto Amo, Lab. de Photonique et de Nanostructures (France) . . . . [9762-29]

2:10 pm: **Towards four-dimensional photonics** (*Invited Paper*), Hannah M. Price, Tomoki Ozawa, Univ. degli Studi di Trento (Italy); Nathan Goldman, Univ. Libre de Bruxelles (Belgium); Oded Zilberberg, ETH Zürich (Switzerland); Iacopo Carusotto, Univ. degli Studi di Trento (Italy) . . . . . [9762-30]

2:40 pm: **Momentum-space Landau levels in arrays of coupled ring resonators** (*Invited Paper*), Hannah M. Price, Univ. degli Studi di Trento (Italy); Andrei Berceanu, Univ. Autónoma de Madrid (Spain); Tomoki Ozawa, Iacopo Carusotto, Univ. degli Studi di Trento (Italy) . . . . . [9762-31]

# CONFERENCE 9763

LOCATION: ROOM 2003 (WEST LEVEL 2)

Monday–Thursday 15–18 February 2016 • Proceedings of SPIE Vol. 9763

# Slow Light, Fast Light, and Opto-Atomic Precision Metrology IX

Conference Chairs: **Selim M. Shahriar**, Northwestern Univ. (USA); **Jacob Scheuer**, Tel Aviv Univ. (Israel)

Program Committee: **John H. Burke**, Air Force Research Lab. (USA); **Shanhui Fan**, Stanford Univ. (USA); **Daniel Joseph Gauthier**, Duke Univ. (USA); **Kohzo Hakuta**, The Univ. of Electro-Communications (Japan); **Ortwin Hess**, Imperial College London (United Kingdom); **John C. Howell**, Univ. of Rochester (USA); **Jacob B. Khurgin**, Johns Hopkins Univ. (USA); **Uriel Levy**, The Hebrew Univ. of Jerusalem (Israel); **Frank A. Narducci**, Naval Air Systems Command (USA); **Irina Novikova**, The College of William & Mary (USA); **Gour S. Pati**, Delaware State Univ. (USA); **Stefania Residori**, Institut Non Linéaire de Nice Sophia Antipolis (France); **Yuri Rostovtsev**, Univ. of North Texas (USA); **David D. Smith**, NASA Marshall Space Flight Ctr. (USA); **Yanhong Xiao**, Fudan Univ. (China)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative,  
Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of  
Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated  
Photonics (USA) and Colleges of Nanoscale Science and  
Engineering, SUNY Polytechnic Institute (USA)

Coffee Break . . . . . Mon 10:10 am to 10:30 am

### SESSION 1

LOCATION: ROOM 2003 (WEST LEVEL 2) MON 10:30 AM TO 12:40 PM

### Atomic Clocks, Magnetometers, and Related Technology I

Session Chair: **Yanhong Xiao**, Fudan Univ. (China)

- 10:30 am: **Optical system for precision atomic clocks and stable oscillators** (*Invited Paper*), **Nasser N. Peyghambarian**, College of Optical Sciences, The Univ. of Arizona (USA); **Arturo Chavez-Pirson**, NP Photonics, Inc. (USA); **R. Jason Jones**, College of Optical Sciences, The Univ. of Arizona (USA); **Dan Trung Nguyen**, NP Photonics, Inc. (USA); **Xochitl Cooper**, Ivan Hromada, College of Optical Sciences, The Univ. of Arizona (USA); **Jie Zong**, NP Photonics, Inc. (USA) . . . . . [9763-1]
- 11:00 am: **Robust optical clocks based on alkaline-Earth vapor cells**, **Christopher Erickson**, Air Force Research Lab. (USA) . . . . . [9763-2]
- 11:20 am: **A compact optical atomic clock using a warm vapor cell** (*Invited Paper*), **John H. Burke**, Air Force Research Lab. (USA) . . . . . [9763-3]
- 11:50 am: **Scalar and vector magnetometry with coherent population trapping**, **Ren Peng Fang**, **May Kim**, **Zifan Zhou**, **Selim M. Shahriar**, Northwestern Univ. (USA) . . . . . [9763-4]
- 12:10 pm: **Compact clocks and sensors based on laser-cooled atoms** (*Invited Paper*), **Elizabeth Donley**, National Institute of Standards and Technology (USA) . . . . . [9763-5]
- Lunch/Exhibition Break . . . . . Mon 12:40 pm to 1:40 pm

### SESSION 2

LOCATION: ROOM 2003 (WEST LEVEL 2) . . MON 1:40 PM TO 3:40 PM

### Atomic Clocks, Magnetometers, and Related Technology II

Session Chair: **Elizabeth Donley**,  
National Institute of Standards and Technology (USA)

- 1:40 pm: **Magnetometer using weak measurement enhanced slow light**, **Weizhi Qu**, Fudan Univ. (China); **Jianming Wen**, **Liang Jiang**, Yale Univ. (USA); **Yanhong Xiao**, Fudan Univ. (China) . . . . . [9763-6]
- 2:00 pm: **Synchronization of remote clocks over kilometer-scale turbulent air paths** (*Invited Paper*), **Laura C. Sinclair**, National Institute of Science and Technology (USA) . . . . . [9763-7]
- 2:30 pm: **Atomic magnetometer based on sub-coherence-lifetime resonance**, **Jian Sun**, **Weizhi Qu**, **Pengxiong Li**, **Yanhong Xiao**, Fudan Univ. (China) . . . . . [9763-8]
- 2:50 pm: **Effect of electromagnetically-induced transparency delay generated by dynamic coherent population trapping in Rb vapour**, **Sergey M. Kobtsev**, **Sergey A. Khripunov**, **Daba A. Radnatarov**, Novosibirsk State Univ. (Russian Federation); **Valeriy I. Yudin**, **Aleksei V. Taichenachev**, Novosibirsk State Univ. (Russian Federation) and Institute of Laser Physics SB RAS (Russian Federation); **Maxim Y. Basalaev**, Novosibirsk State Technical Univ. (Russian Federation) and Institute of Laser Physics SB RAS (Russian Federation) [9763-9]
- 3:10 pm: **Anti-parity-time symmetric optics using EIT in an atomic vapor** (*Invited Paper*), **Yanhong Xiao**, Fudan Univ. (China) . . . . . [9763-10]
- Coffee Break . . . . . Mon 3:40 pm to 4:10 pm

### SESSION 3

LOCATION: ROOM 2003 (WEST LEVEL 2) . . MON 4:10 PM TO 6:30 PM

### Atomic Clocks, Magnetometers, and Related Technology III

Session Chair: **Laura C. Sinclair**,  
National Institute of Science and Technology (USA)

- 4:10 pm: **Entangled states for quantum metrology** (*Invited Paper*), **Vladan Vuletic**, Massachusetts Institute of Technology (USA) . . . . . [9763-62]
- 4:40 pm: **Efficient polarization of high-angular-momentum systems** (*Invited Paper*), **Dmitry Budker**, Univ. of California, Berkeley (USA) . . . . . [9763-12]
- 5:10 pm: **Cold atom for precision metrology: recent advances**, **Matthew B. Squires**, Air Force Research Lab. (USA) . . . . . [9763-13]
- 5:30 pm: **Ultra-high resolution spectroscopy of optical frequency combs** (*Invited Paper*), **Thomas Schneider**, Technische Univ. Braunschweig (Germany) . . . . . [9763-14]
- 6:00 pm: **Effects of coherent population trapping in vibrational levels on group velocity and Raman scattering** (*Invited Paper*), **Pooja Singh**, **Yuri V. Rostovtsev**, Univ. of North Texas (USA) . . . . . [9763-11]

OPTO

# CONFERENCE 9763

LOCATION: ROOM 2003 (WEST LEVEL 2)

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: ROOM 2003 (WEST LEVEL 2) . TUE 8:00 AM TO 10:20 AM

#### Atomic Interferometry and Spin Squeezing

Session Chair: **Vladan Vuletic**,  
Massachusetts Institute of Technology (USA)

8:00 am: **Matter wave and light fields for precision measurements of inertial effects** (*Invited Paper*), Philippe Bouyer, Institut d'Optique Graduate School (France) and CNRS (France) and Universite de Bordeaux (France) . . . . [9763-15]

8:30 am: **Microwave stimulated Raman adiabatic passage between hyperfine ground states of Rubidium 87 for chip-based atom interferometry** (*Invited Paper*), Sylvain Schwartz, Matthieu Dupont-Nivet, Christoph I. Westbrook, Massachusetts Institute of Technology (USA) . . . . . [9763-16]

9:00 am: **Coherent matter wave circuits for atom interferometry** (*Invited Paper*), Malcom Boshier, Los Alamos National Lab. (USA) . . . . . [9763-17]

9:30 am: **Spin squeezed collective state atomic interferometer and clock**, Resham Sarkar, May Kim, Ren Peng Fang, Selim M. Shahriar, Northwestern Univ. (USA) . . . . . [9763-18]

9:50 am: **Breaking quantum and thermal limits for precision measurements** (*Invited Paper*), James K. Thompson, JILA (USA) . . . . . [9763-19]

Coffee Break . . . . . Tue 10:20 am to 10:50 am

### SESSION 5

LOCATION: ROOM 2003 (WEST LEVEL 2) . TUE 10:50 AM TO 2:50 PM

#### Quantum Information Processing, Quantum Optics, and Quantum Memory

Session Chair: **Philippe Bouyer**,  
Lab. Photonique, Numérique et Nanosciences (France)

10:50 am: **Future quantum sensing and computing applications of diamond color centers** (*Invited Paper*), Philip R. Hemmer, Texas A&M Univ. (USA) . . . . . [9763-20]

11:20 am: **Interacting cold atoms with tightly guided light** (*Invited Paper*), Julien Laurat, Lab. Kastler Brossel (France) . . . . . [9763-21]

11:50 am: **Quantum optics in photonic band-gap fibers** (*Invited Paper*), Alexander L. Gaeta, Columbia Univ. (USA) . . . . . [9763-22]

Lunch/Exhibition Break . . . . . Tue 12:20 pm to 1:50 pm

1:50 pm: **Experimental demonstration of spinor slow light** (*Invited Paper*), Ite A. Yu, National Tsing Hua Univ. (Taiwan) . . . . . [9763-23]

2:20 pm: **Highly efficient photon-echo-based quantum memory using a persistent spectral hole burning induced slow light** (*Invited Paper*), Byoung Seung Ham, Gwangju Institute of Science and Technology (Korea, Republic of) . . . . . [9763-24]

### SESSION 6

LOCATION: ROOM 2003 (WEST LEVEL 2) . . . TUE 2:50 PM TO 6:10 PM

#### Fast Light Generation and Sensing Applications

Session Chair: **Philip R. Hemmer**, Texas A&M Univ. (USA)

2:50 pm: **Temperature sensitivity of the optical cavity scale factor enhancement for a fast light gyroscope** (*Invited Paper*), Krishna Myneni, U.S. Army Research, Development and Engineering Command (USA); David D. Smith, NASA Marshall Space Flight Ctr. (USA); Hongrok Chang, Ducommun Miltec (USA); Heather A. Luckay, The Univ. of Alabama in Huntsville (USA) . . . . . [9763-25]

Coffee Break . . . . . Tue 3:20 pm to 3:50 pm

3:50 pm: **Gain in EIT system for broadband gravitational wave detection** (*Invited Paper*), Minchuan Zhou, Zifan Zhou, Selim M. Shahriar, Northwestern Univ. (USA) . . . . . [9763-26]

4:20 pm: **Progress towards a passive superluminal gyroscope** (*Invited Paper*), David D. Smith, NASA Marshall Space Flight Ctr. (USA); Hongrok Chang, Ducommun Miltec (USA); Heather A. Luckay, The Univ. of Alabama in Huntsville (USA); Krishna Myneni, U.S. Army Research, Development and Engineering Command (USA) . . . . . [9763-27]

4:50 pm: **Studies of fast light and interferometry using a phase-sensitive amplifier** (*Invited Paper*), Brian E. Anderson, Paul D. Lett, National Institute of Standards and Technology (USA) . . . . . [9763-28]

5:20 pm: **Long-distance superluminal propagation in optical fibers: recent advances** (*Invited Paper*), Li Zhan, Shanghai Jiao Tong Univ. (China) . . [9763-29]

5:50 pm: **Experimental study of induced transparency or absorption and slow or fast light using orthogonally-polarized whispering-gallery modes of a single microresonator**, Albert T. Rosenberger, Oklahoma State Univ. (USA); Khoa Bui, Fairchild Imaging (USA) . . . . . [9763-30]

## WEDNESDAY 17 FEBRUARY

### SESSION 7

LOCATION: ROOM 2003 (WEST LEVEL 2) . . . WED 8:00 TO 10:00 AM

#### Plasmonics, Metamaterials, and Graphene I

Session Chair: **Zheng Wang**, The Univ. of Texas at Austin (USA)

8:00 am: **How to deal with loss in plasmonics and metamaterials** (*Invited Paper*), Jacob B. Khurgin, Johns Hopkins Univ. (USA) . . . . . [9763-31]

9:00 am: **Interplay of nonlocal response, damping, and low group velocity in surface-plasmon polaritons** (*Invited Paper*), Søren Raza, Technical Univ. of Denmark (Denmark); N. Asger Mortensen, DTU Fotonik (Denmark) . . . . [9763-32]

9:30 am: **Slow plasmons in grating cavities** (*Invited Paper*), Atilla Aydinli, Bilkent Univ. (Turkey) . . . . . [9763-33]

Coffee Break . . . . . Wed 10:00 am to 10:30 am

### SESSION 8

LOCATION: ROOM 2003 (WEST LEVEL 2) WED 10:30 AM TO 12:00 PM

#### Plasmonics, Metamaterials, and Graphene II

Session Chair: **Uriel Levy**, The Hebrew Univ. of Jerusalem (Israel)

10:30 am: **Slow plasmonic and diamond NV centers for delicate metrology** (*Invited Paper*), Meir Orenstein, Technion-Israel Institute of Technology (Israel) . . . . . [9763-34]

11:00 am: **Slow-light in graphene waveguides: recent advances** (*Invited Paper*), Zheng Wang, The Univ. of Texas at Austin (USA) . . . . . [9763-35]

11:30 am: **Slow light, Purcell factor, and losses in hyperbolic metamaterials and surface plasmon polaritons: a critical assessment** (*Invited Paper*), Jacob B. Khurgin, Johns Hopkins Univ. (USA) . . . . . [9763-36]

Lunch/Exhibition Break . . . . . Wed 12:00 pm to 1:30 pm

### SESSION 9

LOCATION: ROOM 2003 (WEST LEVEL 2) . . WED 1:30 PM TO 3:30 PM

#### Waveguides, Microresonators, Nanophotonics, and Photonic Crystals I

Session Chair: **Meir Orenstein**,  
Technion-Israel Institute of Technology (Israel)

1:30 pm: **Nanophotonics for controlling the response of atomic vapors** (*Invited Paper*), Uriel Levy, Liron Stern, The Hebrew Univ. of Jerusalem (Israel) . . . . . [9763-37]

2:00 pm: **Nanophotonic magnetic resonance spectrometer for trace chemical and biomolecular sensing** (*Invited Paper*), Victor M. Acosta, The Univ. of New Mexico (USA) . . . . . [9763-38]

2:30 pm: **Parametric interactions in dispersion-engineered photonic crystal waveguides** (*Invited Paper*), Gadi Eisenstein, Technion-Israel Institute of Technology (Israel) . . . . . [9763-39]

3:00 pm: **Photonic crystal Fano lasers** (*Invited Paper*), Jesper Mork, Technical Univ. of Denmark (Denmark) . . . . . [9763-40]

Coffee Break . . . . . Wed 3:30 pm to 4:00 pm



# CONFERENCE 9763

LOCATION: ROOM 2003 (WEST LEVEL 2) AND ROOM 125 (NORTH EXHIBIT LEVEL)

## SESSION 10

LOCATION: ROOM 2003 (WEST LEVEL 2) . WED 4:00 PM TO 6:20 PM

### Fiberoptic and Holographic Techniques, and Sensors

Session Chair: **Gadi Eisenstein**,  
Technion-Israel Institute of Technology (Israel)

- 4:00 pm: **Measuring attostrains in a slow-light fiber Bragg grating** (*Invited Paper*), Michel D. F. Dignonnet, Stanford Univ. (USA) . . . . . [9763-41]  
4:30 pm: **Tunable photonic crystals by holographic optical tweezers**, Maya Yevnin, Yael Roichman, Jacob Scheuer, Tel Aviv Univ. (Israel) . . [9763-42]  
4:50 pm: **Miniature slow light optical buffers** (*Invited Paper*), Misha Sumetsky, Aston Univ. (United Kingdom) . . . . . [9763-43]  
5:20 pm: **Adaptive holography for optical sensing applications** (*Invited Paper*), Stefania Residori, Umberto Bortolozzo, Institut Non Linéaire de Nice Sophia Antipolis (France) . . . . . [9763-44]  
5:50 pm: **Spectroscopy of atoms confined in hollow-core photonic crystal fibers** (*Invited Paper*), Fetah Benabid, Univ. de Limoges (France) . . . . [9763-61]

## THURSDAY 18 FEBRUARY

### SESSION 11

LOCATION: ROOM 125 (NORTH EXHIBIT LEVEL) . . THU 8:00 TO 10:00 AM

**NOTE ROOM CHANGE**

### Waveguides, Microresonators, Nanophotonics, and Photonic Crystals II

Session Chair: **Jacob Scheuer**, Tel Aviv Univ. (Israel)

- 8:00 am: **Recent progress in slow light devices** (*Invited Paper*), Toshihiko Baba, Yokohama National Univ. (Japan) . . . . . [9763-45]  
8:30 am: **Tunable optical delay line based on micro-ring resonators** (*Invited Paper*), Yundong Zhang, Harbin Institute of Technology (China) . . . . . [9763-46]  
9:00 am: **Comparison of methods for achieving induced transparency or absorption with pulse delay or advancement in a single microresonator** (*Invited Paper*), Albert T. Rosenberger, Oklahoma State Univ. (USA) . . [9763-47]  
9:30 am: **Rotation rate optimization by nonlinear phase shift in optical resonant microring waveguide** (*Invited Paper*), Hao Zhang, Junjie Jin, Jian Lin, Jiayang Chen, Anping Huang, Zhisong Xiao, BeiHang Univ. (China) . . [9763-48]  
Coffee Break . . . . . Thu 10:00 am to 10:30 am

### SESSION 12

LOCATION: RM 125 (NORTH EXHIBIT LEVEL) . THU 10:30 AM TO 12:20 PM

### Emerging Concepts and Effects in Slow Light, Fast Light, and Metrology I

Session Chair: **David D. Smith**, NASA Marshall Space Flight Ctr. (USA)

- 10:30 am: **Slow and fast light through Brillouin scattering-induced transparency** (*Invited Paper*), Gaurav Bahl, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9763-53]  
11:00 am: **Photon drag effects in a slow-light medium: recent progress** (*Invited Paper*), Robert W. Boyd, Univ. of Ottawa (Canada) . . . . . [9763-50]  
11:30 am: **Optical nonlinearities using lossy resonances** (*Invited Paper*), Michelle L. Povinelli, The Univ. of Southern California (USA) . . . . . [9763-51]  
12:00 pm: **Optical properties of NaLuF<sub>4</sub>: Yb: Er/Ho rare earth nanocrystals in microstructure hollow fiber**, Yundong Zhang, Harbin Institute of Technology (China) . . . . . [9763-52]  
Lunch/Exhibition Break . . . . . Thu 12:20 pm to 1:50 pm

### SESSION 13

LOCATION: ROOM 125 (NORTH EXHIBIT LEVEL) THU 1:50 TO 3:20 PM

### Emerging Concepts and Effects in Slow Light, Fast Light, and Metrology II

Session Chair: **Michelle L. Povinelli**,  
The Univ. of Southern California (USA)

- 1:50 pm: **Employing biological matter as active optical elements: a new route in nanophotonics** (*Invited Paper*), Pietro Ferraro, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) . . . . . [9763-49]  
2:20 pm: **Rydberg polariton in a thermal vapor** (*Invited Paper*), Yi-Hsin Chen, Fabian Ripka, Robert Löw, Tilman Pfau, 5. Physikalisches Institut, Universität Stuttgart (Germany) . . . . . [9763-54]  
2:50 pm: **Scanning-free characterization of local Brillouin spectra based on transient analysis** (*Invited Paper*), Avinoam Zadok, Eyal Preter, Bar-Ilan Univ. (Israel) . . . . . [9763-55]  
Coffee Break . . . . . Thu 3:20 pm to 3:50 pm

### SESSION 14

LOCATION: ROOM 125 (NORTH EXHIBIT LEVEL) THU 3:50 TO 6:00 PM

### Theoretical Developments in Slow and Fast Light

Session Chair: **Robert W. Boyd**, Univ. of Ottawa (Canada)

- 3:50 pm: **Light pulse slowing down using backward-wave four-wave mixing** (*Invited Paper*), Konstantin Shcherbin, The Institute of Physics (Ukraine); Pierre Mathey, Univ. de Bourgogne (France) . . . . . [9763-56]  
4:20 pm: **Transmission matrix approach to light control in diffusive media** (*Invited Paper*), Sylvain Gigan, Lab. Kastler Brossel (France) . . . . . [9763-57]  
4:50 pm: **Classical, semi-classical, and quantized-field descriptions of light propagation in general non-local and non-stationary dispersive and absorbing media** (*Invited Paper*), Verne L. Jacobs, U.S. Naval Research Lab. (USA) . . . . . [9763-58]  
5:20 pm: **Influence of nanorod absorption spectrum width on superluminality effect for laser pulse propagation**, Vyacheslav A. Trofimov, Tatiana M. Lysak, Lomonosov Moscow State Univ. (Russian Federation) . . . . . [9763-59]  
5:40 pm: **Photon probability control**, Benjamin T. Solomon, Xodus One Foundation (USA) . . . . . [9763-60]

OPTO

# CONFERENCE 9764

LOCATION: ROOM 2000 (WEST LEVEL 2)

Tuesday–Thursday 16–18 February 2016  
Proceedings of SPIE Vol. 9764

COSPONSOR:



# Complex Light and Optical Forces X

*Conference Chairs:* **Jesper Glückstad**, Technical Univ. of Denmark (Denmark); **David L. Andrews**, Univ. of East Anglia (United Kingdom); **Enrique J. Galvez**, Colgate Univ. (USA)

*Program Committee:* **Robert R. Alfano**, The City College of New York (USA); **Cornelia Denz**, Westfälische Wilhelms-Univ. Münster (Germany); **Kishan Dholakia**, Univ. of St. Andrews (United Kingdom); **Wolfgang A. Ertmer**, Leibniz Univ. Hannover (Germany); **Andrew Forbes**, Univ. of the Witwatersrand (South Africa); CSIR National Laser Ctr. (South Africa); **Jörg B. Götte**, Max-Planck-Institut für Physik komplexer Systeme (Germany); **David G. Grier**, New York Univ. (USA); **Rüdiger Grunwald**, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany); **Jandir M. Hickmann**, Univ. Federal do Rio Grande do Sul (Brazil); **Thomas R. Huser**, Univ. Bielefeld (Germany); **Lorenzo Marrucci**, Univ. degli Studi di Napoli Federico II (Italy); **Miles J. Padgett**, Univ. of Glasgow (United Kingdom); **Darwin Palima**, Technical Univ. of Denmark (Denmark); **Monika Ritsch-Marte**, Medizinische Univ. Innsbruck (Austria); **Halina H. Rubinsztein-Dunlop**, The Univ. of Queensland (Australia); **Marat S. Soskin**, Institute of Physics (Ukraine); **Grover A. Swartzlander Jr.**, Rochester Institute of Technology (USA); **Nirmal K. Viswanathan**, Univ. of Hyderabad (India)

## TUESDAY 16 FEBRUARY

### WELCOME AND OPENING REMARKS

LOCATION: ROOM 2000 (WEST LEVEL 2) . . . . . 8:20 AM TO 8:30 AM

David L. Andrews, Univ. of East Anglia (United Kingdom)

### SESSION 1

LOCATION: ROOM 2000 (WEST LEVEL 2) . TUE 8:30 AM TO 10:30 AM

## Toast to 10th Year of Complex Light and Optical Forces

Session Chair: **David L. Andrews**, Univ. of East Anglia (United Kingdom)

8:30 am: **Selective seminal optics and photonics processes** (*Invited Paper*), Robert R. Alfano, The City College of New York (USA) and Institute for Ultrafast Spectroscopy and Lasers (USA) . . . . . [9764-1]

9:00 am: **Extraordinary momentum and spin in structured light** (*Invited Paper*), Konstantin Y. Bliokh, RIKEN (Japan) . . . . . [9764-2]

9:30 am: **Optical angular momentum transfer to trapped particles in vacuum** (*Invited Paper*), Kishan Dholakia, Univ. of St. Andrews (United Kingdom) . . . . . [9764-3]

10:00 am: **High-resolution optical imaging and control using speckle patterns and photonic force microscopy with nanostructures** (*Invited Paper*), Yong-Hoon Cho, KAIST (Korea, Republic of) . . . . . [9764-4]

Coffee Break . . . . . Tue 10:30 am to 11:00 am

### SESSION 2

LOCATION: ROOM 2000 (WEST LEVEL 2) . TUE 11:00 AM TO 12:30 PM

## Quantum Aspects

Session Chair: **Enrique J. Galvez**, Colgate Univ. (USA)

11:00 am: **Waveguide quantum electrodynamics with spin-orbit coupling of light** (*Invited Paper*), Sahand Mahmoodian, Immo Söllner, Sofie Lindskov Hansen, Alisa Javadi, Leonardo Midolo, Gabija Kirsanke, Tommaso Pregolato, Søren Stobbe, Peter Lodahl, Niels Bohr Institute (Denmark) . . . . . [9764-6]

11:30 am: **Quantum issues with structured light**, Mathew D. Williams, David L. Andrews, Univ. of East Anglia (United Kingdom) . . . . . [9764-7]

11:50 am: **Massive particles meet the Einstein-Podolsky-Rosen criterion**, Wolfgang A. Ertmer, Ilka Kruse, Karsten Lange, Bernd Luecke, Leibniz Univ. Hannover (Germany); Lucca Pezzè, Consiglio Nazionale delle Ricerche (Italy); Jan J. Arit, Aarhus Univ. (Denmark); Klemens Hammerer, Luis Santos, Leibniz Univ. Hannover (Germany); Augusto Smerzi, Consiglio Nazionale delle Ricerche (Italy); Carsten Klempt, Leibniz Univ. Hannover (Germany) . . . . . [9764-8]

12:10 pm: **Violation of Bell's inequality in a double-wedge depolarizer**, Samlan CT, Nirmal K. Viswanathan, Univ. of Hyderabad (India) . . . . . [9764-9]

Lunch/Exhibition Break . . . . . Tue 12:30 pm to 2:00 pm

### SESSION 3

LOCATION: ROOM 2000 (WEST LEVEL 2) . . TUE 2:00 PM TO 3:20 PM

## Microfabrication for Beam Engineering

Session Chair: **Mark Jayson Morella Villangca**, DTU Fotonik (Denmark)

2:00 pm: **A platform for lab-scale replication of phase optics and microfluidics** (*Invited Paper*), Lars R. Lindvold, Stensborg A/S (Denmark) . . . . . [9764-10]

2:30 pm: **Structured amplitude and phase fields behind microstructures: The quest for high contrast modulation at proximity**. (*Invited Paper*), Toralf Scharf, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . [9764-11]

3:00 pm: **Compact solutions for optical fiber tweezers using Fresnel zone and phase plates fabricated using focused ion beam milling**, Ana Rita S. Rodrigues Ribeiro, INESC TEC (Portugal); Pabitra Dahal, Masdar Institute of Science & Technology (United Arab Emirates); Ariel R. N. S. Guerreiro, Pedro A. S. Jorge, INESC TEC (Portugal); Jaime Viegas, Masdar Institute of Science & Technology (United Arab Emirates) . . . . . [9764-12]

Coffee Break . . . . . Tue 3:20 pm to 3:50 pm

### SESSION 4

LOCATION: ROOM 2000 (WEST LEVEL 2) . . . TUE 3:50 PM TO 6:10 PM

## Beam Engineering and Applications

Session Chair: **Lars R. Lindvold**, DTU Risø Campus (Denmark)

3:50 pm: **Simultaneous spatial frequency modulation imaging and micromachining with a femtosecond laser** (*Invited Paper*), Michael D. Young, Erica K. Block, Colorado School of Mines (USA); David G. Winters, Jeffrey J. Field, Keith Wernsing, Randy A. Bartels, Colorado State Univ. (USA); Jeffrey A. Squier, Colorado School of Mines (USA) . . . . . [9764-13]

4:20 pm: **Spatial coherence engineering of optical beams** (*Invited Paper*), Laura Waller, Univ. of California, Berkeley (USA) . . . . . [9764-14]

4:50 pm: **Cell sorting using efficient light shaping approaches**, Andrew R. Bañas, OptoRobotix ApS (Denmark); Darwin Palima, Mark Jayso M. Villangca, DTU Fotonik (Denmark); Jesper Glückstad, DTU Fotonik (Denmark) and OptoRobotix ApS (Denmark) . . . . . [9764-15]

5:10 pm: **Holo-GPC**, Jesper Glückstad, Technical Univ. of Denmark (Denmark) . . . . . [9764-16]

5:30 pm: **Dark-GPC**, Jesper Glückstad, Technical Univ. of Denmark (Denmark) . . . . . [9764-17]

5:50 pm: **Generation of complex light using uniaxial or biaxial crystals: an efficient and accurate vectorial simulation technique**, Site Zhang, Zongzhao Wang, Frank Wyrowski, Friedrich-Schiller-Univ. Jena (Germany) . . . . . [9764-59]

# CONFERENCE 9764

## LOCATION: ROOM 2000 (WEST LEVEL 2)

### WEDNESDAY 17 FEBRUARY

#### SESSION 5

LOCATION: ROOM 2000 (WEST LEVEL 2) WED 8:00 AM TO 10:10 AM

### Measurements and Calibration

Session Chair: **Tomáš Čižmár**, Univ. of Dundee (United Kingdom)

8:00 am: **Optical quantification of forces at play during stem cell differentiation** (*Invited Paper*), Lene B. Oddershede, Niels Bohr Institute (Denmark) . . . . . [9764-18]

8:30 am: **Time domain analysis of the Brownian motion of trapped particles in optical tweezers**, Sudipta K. Bera, Indian Institute of Science Education and Research Kolkata (India); Ronojoye Adhikari, Institute of Mathematical Sciences (India); Rajesh K. Nayak, Ayan Banerjee, Indian Institute of Science Education and Research Kolkata (India). . . . . [9764-19]

8:50 am: **Measurement and accumulation of electric charge on a single dielectric particle trapped in air**, Haesung Park, Thomas W. LeBrun, National Institute of Standards and Technology (USA). . . . . [9764-20]

9:10 am: **Wavelength detection with sub femtometer resolution**, Nikolaus Metzger, Kishan Dholakia, Michael Mazilu, Univ. of St. Andrews (United Kingdom). . . . . [9764-21]

9:30 am: **Calibration of non-optical forces in optical tweezers**, Ann A. Bui, Anatolii Kashchuk, Alexander B. Stilgoe, Timo A. Nieminen, Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia). . . . . [9764-22]

9:50 am: **Mapping the spectral twist of few cycle vortex pulses**, Martin Bock, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany); Jürgen Jahns, FernUniv. in Hagen (Germany); Manfred Musigmann, FernUniv. Hagen (Germany); Ruediger Grunwald, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany) . . . . . [9764-23]

Coffee Break . . . . . Wed 10:10 am to 10:40 am

#### SESSION 6

LOCATION: ROOM 2000 (WEST LEVEL 2) WED 10:40 AM TO 12:10 PM

### Superposition Effects

Session Chair: **Ruediger Grunwald**, Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie (Germany)

10:40 am: **Single-beam interference from plain Gaussian and OAM wavefronts** (*Invited Paper*), Sergei Popov, KTH Royal Institute of Technology (Sweden); Maxime Favier, Observatoire de Paris (France) . . . . . [9764-24]

11:10 am: **Optical vortex dipole from superposition of two Gaussian beams**, Dinesh N. Naik, T. Pradeep Chakravarthy, Nirmal K. Viswanathan, Univ. of Hyderabad (India) . . . . . [9764-25]

11:30 am: **Space-variant polarization of collinear and non-collinear optical beams**, Enrique J. Galvez, Joshua Jones, Behzad Khajavi, Colgate Univ. (USA) . . . . . [9764-26]

11:50 am: **Soliton formation by interacting Airy beams**, Falko Diebel, Westfälische Wilhelms-Univ. Münster (Germany); Bojana M. Bokic, Dejan V. Timotijevic, Dragana M. Jović Savić, Univ. of Belgrade (Serbia); Cornelia Denz, Westfälische Wilhelms-Univ. Münster (Germany). . . . . [9764-27]

Lunch/Exhibition Break . . . . . Wed 12:10 pm to 1:40 pm

#### SESSION 7

LOCATION: ROOM 2000 (WEST LEVEL 2) . . WED 1:40 PM TO 3:10 PM

### Chirality

Session Chair: **Lene B. Oddershede**, Niels Bohr Institute (Denmark)

1:40 pm: **Liquid crystals as a test-bed for chiral optomechanics** (*Invited Paper*), Etienne Brasselet, Univ. Bordeaux 1 (France) . . . . . [9764-28]

2:10 pm: **Circular dichroism in topological Floquet insulators: Implications for polarization sensitive devices and topologically protected quantum information processing**, Parijat Sengupta, Enrico Bellotti, Boston Univ. (USA) . . . . . [9764-29]

2:30 pm: **Chiral separation and twin-beam photonics**, David S. Bradshaw, David L. Andrews, Univ. of East Anglia (United Kingdom) . . . . . [9764-30]

2:50 pm: **The spatial distribution of forces in highly focused beams**, Daryl Preece, Univ. of California, San Diego (USA); Alexander B. Stilgoe, Timo A. Nieminen, Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia). . . . . [9764-31]

Coffee Break . . . . . Wed 3:10 pm to 3:40 pm

#### SESSION 8

LOCATION: ROOM 2000 (WEST LEVEL 2) . WED 3:40 PM TO 5:30 PM

### Modes, Propagation, and Transmission

Session Chair: **Sergei Popov**, KTH Royal Institute of Technology (Sweden)

3:40 pm: **Untangled modes in multimode waveguides** (*Invited Paper*), Tomáš Čižmár, Univ. of Dundee (United Kingdom) . . . . . [9764-32]

4:10 pm: **Fiber communication using vector vortex beams**, Bienvenu I. Ndagano, Melanie G. McLaren, Andrew Forbes, Univ. of the Witwatersrand (South Africa). . . . . [9764-33]

4:30 pm: **Transmission of optical vortex beams with different OAM in scattering beads and brain tissue media**, Wubao B. Wang, Lingyan Shi, The City College of New York (USA); Lukas Lindwasser, The City Univ. of New York (USA); Paulo Marque, The City College of New York (USA); Martin P. Lavery, Univ. of Glasgow (United Kingdom); Robert R. Alfano, The City College of New York (USA). . . . . [9764-34]

4:50 pm: **Resilience of vector vortex beams to atmospheric turbulence**, Bienvenu I. Ndagano, Othmane Mouane, Melanie G. McLaren, Andrew Forbes, Univ. of the Witwatersrand (South Africa) . . . . . [9764-35]

5:10 pm: **Controlling quantum interference in highly multimodal systems**, Tom A. W. Wolterink, Ravitej Uppu, Univ. Twente (Netherlands); Georgios Ctistis, Univ. Twente (Netherlands) and Saxion Univ. of Applied Sciences (Netherlands); Allard P. Mosk, Pepijn W. H. Pinkse, Univ. Twente (Netherlands) . . . . . [9764-36]

#### POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Photo-induced force microscopy and spectroscopy at nanoscale**, Jungheon Jahng, Eric O. Potma, Hemantha K Wickramasinghe, Univ. of California, Irvine (USA); Sung Park, Molecular Vista, Inc. (USA); Dmitry Fishman, Univ. of California, Irvine (USA) . . . . . [9764-53]

**Mueller matrix of an entangling device**, Samlan CT, Nirmal K Viswanathan, Univ. of Hyderabad (India). . . . . [9764-54]

**Novel Dielectric Totally Internally Reflecting Concentrator (DTIRC) design for uniform illumination**, Sina Babadi, Roberto Ramirez-Iniguez, Tuleen Boutaleb, Glasgow Caledonian Univ. (United Kingdom); Tapas Mallick, Univ. of Exeter (United Kingdom) . . . . . [9764-55]

**Propagation of vector vortex beams through turbulence**, Bienvenu I. Ndagano, Othmane Mouane, Melanie G. McLaren, Andrew Forbes, Univ. of the Witwatersrand (South Africa). . . . . [9764-56]

**Propagation of vector vortex modes through fibers**, Bienvenu I Ndagano, Melanie G McLaren, Andrew Forbes, Univ of the Witwatersrand (South Africa). . . . . [9764-57]

**Generation of Laguerre Gaussian beams using spiral phase diffractive elements fabricated on optical fibers tips using focused ion beam milling**, Ana Rita S. Rodrigues Ribeiro, INESC TEC (Portugal); Pabitra Dahal, Masdar Institute of Science & Technology (United Arab Emirates); Ariel R. N. S. Guerreiro, Pedro A. S. Jorge, INESC TEC (Portugal); Jaime Viegas, Masdar Institute of Science & Technology (United Arab Emirates) . . . . [9764-58]

OPTO

# CONFERENCE 9764

LOCATION: ROOM 274 (SOUTH MEZZANINE)

THURSDAY 18 FEBRUARY

## SESSION 9

LOCATION: ROOM 274 (SOUTH MEZZANINE) . THU 8:30 TO 10:00 AM

### NOTE ROOM CHANGE

#### Nanostructures and Near-field

Session Chair: **Craig B. Arnold**, Princeton Univ. (USA)

8:30 am: **Optical binding between nanowires** (*Invited Paper*), Simon Hanna, Univ. of Bristol (United Kingdom); Stephen H. Simpson, Academy of Sciences of the Czech Republic (Czech Republic) . . . . . [9764-37]

9:00 am: **Visualizing surface plasmon polaritons in photo-induced force microscopy**, Junghoon Jahng, Eric O. Potma, Faezeh Ladani, Ryan M. Khan, Univ. of California, Irvine (USA) . . . . . [9764-38]

9:20 am: **Nanoscale optical vortex and double super-oscillations on silicon planar waveguides**, Asaf David, Bergin Gjonaj, Guy Bartal, Technion-Israel Institute of Technology (Israel) . . . . . [9764-39]

9:40 am: **Quantum interference of engineered states of light through the interaction with plasmonic nanostructures**, Alexander Büse, Mathieu L. Juan, Gabriel Molina-Terriza, Macquarie Univ. (Australia) . . . . . [9764-41]

Coffee Break . . . . . Thu 10:00 am to 10:30 am

## SESSION 10

LOCATION: RM 274 (SOUTH MEZZANINE) . THU 10:30 AM TO 12:10 PM

#### Particle Trapping, Manipulation, and Tracking

Session Chair: **Simon Hanna**, Univ. of Bristol (United Kingdom)

10:30 am: **3D particle tracking in microfluidic flows using ultra-high-speed variable focus optics** (*Invited Paper*), Craig B. Arnold, Princeton Univ. (USA) . . . . . [9764-42]

11:00 am: **Optical diffraction tomography for simultaneous 3D visualization and tracking of optically trapped particles** (*Invited Paper*), YongKeun Park, KAIST (Korea, Republic of) . . . . . [9764-43]

11:30 am: **Tractor beams for optical micromanipulation**, Aaron Yevick, David G. Grier, New York Univ. (USA) . . . . . [9764-44]

11:50 am: **Rotation of rotating light**, Daryl Preece, Univ. of California, San Diego (USA); Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia) . . . . . [9764-45]

Lunch/Exhibition Break . . . . . Thu 12:10 pm to 1:40 pm

## SESSION 11

LOCATION: ROOM 274 (SOUTH MEZZANINE) . . THU 1:40 TO 3:00 PM

#### Laser Microfabrication and Microassembly

Session Chair: **Kishan Dholakia**, Univ. of St. Andrews (United Kingdom)

1:40 pm: **Holographic vector-wave femtosecond laser processing** (*Invited Paper*), Yoshio Hayasaki, Utsunomiya Univ. (Japan) . . . . . [9764-46]

2:10 pm: **Complex light in 3D printing** (*Invited Paper*), Christophe Moser, Paul Delrot, Damien Loterie, Edgar E. Morales Delgado, Miguel A. Modestino, Demetri Psaltis, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9764-47]

2:40 pm: **Optical screw-wrench for 2PP-microstructure interlocking**, Jannis Köhler, Gordon Zyla, Sarah I. Ksouri, Cemal Esen, Andreas Ostendorf, Ruhr-Univ. Bochum (Germany) . . . . . [9764-48]

Coffee Break . . . . . Thu 3:00 pm to 3:30 pm

## SESSION 12

LOCATION: ROOM 274 (SOUTH MEZZANINE) . . THU 3:30 TO 5:00 PM

#### Optical Forces: Enhancement and Other Effects

Session Chair: **David L. Andrews**, Univ. of East Anglia (United Kingdom)

3:30 pm: **Plasmon-assisted material transport using optically actuated microtools** (*Invited Paper*), Mark Jayson M. Villangca, Darwin Palima, Andrew R. Bañas, Jesper Glückstad, DTU Fotonik (Denmark) . . . . . [9764-49]

4:00 pm: **The role of light's angular momentum in plasmonic optical tweezers using stochastic optical beams: a statistical Maxwell's stress tensor approach**, Shaloo Rakheja, New York Univ. (USA) . . . . . [9764-50]

4:20 pm: **Slow light for enhancement of optical forces in a photonic crystal waveguide**, Mark Scullion, The Univ. of York (United Kingdom); Yoshihiko Arita, Univ. of St. Andrews (United Kingdom); Thomas F. Krauss, The Univ. of York (United Kingdom); Kishan Dholakia, Univ. of St. Andrews (United Kingdom) . . . . . [9764-51]

4:40 pm: **Understanding photophoretic forces from the Brownian motion of trapped absorbing particles in air**, Sudipta K. Bera, Avinash K. Gupta, Ayan Banerjee, Indian Institute of Science Education and Research Kolkata (India) . . . . . [9764-52]



# CONFERENCE 9765

LOCATION: ROOM 2009 (WEST LEVEL 2) AND ROOM 276 (SOUTH MEZZANINE)

Wednesday–Thursday 17–18 February 2016 • Proceedings of SPIE Vol. 9765

# Optical and Electronic Cooling of Solids

Conference Chairs: **Richard I. Epstein**, The Univ. of New Mexico (USA); **Denis V. Seletskiy**, Univ. Konstanz (Germany); **Mansoor Sheik-Bahae**, The Univ. of New Mexico (USA)

Program Committee: **Daniel A. Bender**, Sandia National Labs. (USA); **Steven Bowman**, U.S. Naval Research Lab. (USA); **Tal Eliezer Carmon**, Technion-Israel Institute of Technology (Israel); **Joaquín Fernández**, Univ. del País Vasco (Spain); **Thomas Fraser**, Air Force Research Lab. (USA); **Zameer Ul Hasan**, Temple Univ. (USA); **Raman Kashyap**, Ecole Polytechnique de Montréal (Canada); **Paul D. LeVan**, Air Force Research Lab. (USA); **Mauro Tonelli**, Univ. di Pisa (Italy); **Qihua Xiong**, Nanyang Technological Univ. (Singapore)

## WEDNESDAY 17 FEBRUARY

### SESSION 1

LOCATION: ROOM 2009 (WEST LEVEL 2) . . WED 1:20 PM TO 3:30 PM

### Cryogenic Refrigeration in Rare-Earth Doped Systems

Session Chair: **Raman Kashyap**, Ecole Polytechnique de Montréal (Canada)

1:20 pm: **Increasing cooling efficiency in co-doped fluorides** (*Invited Paper*), Mauro Tonelli, Alberto Di Lieto, Univ. di Pisa (Italy); Azzurra Volpi, Univ. di Pisa (Italy) and Istituto Nanoscienze (Italy); Gianni Cittadino, Univ. di Pisa (Italy); Seth D. Melgaard, The Univ. of New Mexico (USA) and Air Force Research Labs. (USA) and Sandia National Labs. (USA); Mansoor Sheik-Bahae, The Univ. of New Mexico (USA) . . . . . [9765-1]

1:50 pm: **Progress in the spectroscopic and thermal studies of Er-doped oxysulfide crystal powders** (*Invited Paper*), Joaquín Fernández, Rolindes Balda, Macarena Barredo-Zuriarrain, Univ. del País Vasco (Spain); Odile Merdrignac-Conanec, Noha Hakmeh, Univ. de Rennes 1 (France); Sara García-Revilla, Univ. del País Vasco (Spain) . . . . . [9765-2]

2:20 pm: **Optical cryo-cooling of devices**, Aram Gragossian, Mohammadreza R. Ghasemkhani, The Univ. of New Mexico (USA); Seth D. Melgaard, Sandia National Labs. (USA); Alexander R. Albrecht, The Univ. of New Mexico (USA); Markus P. Hehlen, Los Alamos National Lab. (USA); Bernardo G. Farfan, Guy Symonds, Richard I. Epstein, Thermodynamic Films (USA); Mansoor Sheik-Bahae, The Univ. of New Mexico (USA) . . . . . [9765-3]

2:40 pm: **Coupled-cavity-enhanced laser cooling in Yb:YLF crystals using VECSELS**, Mohammadreza R. Ghasemkhani, Alexander R. Albrecht, Seth D. Melgaard, The Univ. of New Mexico (USA); Denis V. Seletskiy, Univ. Konstanz (Germany); Jeffrey G. Cederberg, Sandia National Labs. (USA); Mansoor Sheik-Bahae, The Univ. of New Mexico (USA) . . . . . [9765-4]

3:00 pm: **Laser cooling performance of Yb<sup>3+</sup>-doped LuLiF<sub>4</sub> crystal** (*Invited Paper*), Biao Zhong, Hao Luo, Lin Chen, Yanling Shi, Jianping Yin, East China Normal Univ. (China) . . . . . [9765-5]

Coffee Break . . . . . Wed 3:30 pm to 4:00 pm

### SESSION 2

LOCATION: ROOM 2009 (WEST LEVEL 2) . WED 4:00 PM TO 5:30 PM

### Thermoelectric Coolers

Session Chair: **Steven R. Bowman**, U.S. Naval Research Lab. (USA)

4:00 pm: **Thermoelectric and spin-caloritronic coolers: from basics to recent developments** (*Keynote Presentation*), Joseph P. Heremans, The Ohio State Univ. (USA) . . . . . [9765-6]

4:40 pm: **Enhancing the transverse Seebeck coefficient for p x n transverse thermoelectric cooling** (*Invited Paper*), Matthew Grayson, Yang Tang, Northwestern Univ. (USA); Hubert Riedl, Gregor Koblmüller, Walter Schottky Institut (Germany) and Technische Univ. München (Germany) . . . . . [9765-7]

5:10 pm: **High-performance bulk thermoelectric nanocomposites from solution-grown Bi chalcogenide 2D crystals**, Qi Hua Xiong, Chaozhua Zhang, Nanyang Technological Univ. (Singapore) . . . . . [9765-8]

### POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**Optical refrigeration in Tm:YLF crystals**, Saeid Rostami, Mohammadreza R. Ghasemkhani, Alexander R. Albrecht, The Univ. of New Mexico (USA); Seth D. Melgaard, The Univ. of New Mexico (USA) and Sandia National Labs. (USA); Aram Gragossian, The Univ. of New Mexico (USA); Mauro Tonelli, Univ. di Pisa (Italy); Mansoor Sheik-Bahae, The Univ. of New Mexico (USA) . . . . . [9765-24]

**Non-resonant optical cavity design for optical refrigeration**, Bernardo G. Farfan, Guy Symonds, Thermodynamic Films (USA) and The Univ. of New Mexico (USA); Mohammad R. Ghasemkhani, Alexander R. Albrecht, Mansoor Sheik-Bahae, The Univ. of New Mexico (USA); Richard I. Epstein, Thermodynamic Films (USA) . . . . . [9765-26]

## THURSDAY 18 FEBRUARY

### SESSION 3

LOCATION: ROOM 276 (SOUTH MEZZANINE) . . THU 8:10 TO 10:30 AM

### NOTE ROOM CHANGE

### Laser Cooling in Semiconductors

Session Chair: **Denis V. Seletskiy**, Univ. Konstanz (Germany)

8:10 am: **Recent progress of laser cooling in semiconductors** (*Invited Paper*), Qi Hua Xiong, Nanyang Technological Univ. (Singapore) . . . . . [9765-9]

8:40 am: **Resonant Stokes and anti-Stokes Raman scattering in semiconductors and its application to optical refrigeration** (*Invited Paper*), Jacob B. Khurgin, Johns Hopkins Univ. (USA) . . . . . [9765-10]

9:10 am: **Principle of optical cooling by exciton-polariton anti-Stokes scattering** (*Invited Paper*), Maxime Richard, Institut NÉEL (France) . . . [9765-11]

9:40 am: **Probing dynamics of laser cooling cycle in III-V semiconductor heterostructures**, Jan F. Schmidt, Jannis Oelmann, Denis V. Seletskiy, Univ. Konstanz (Germany) . . . . . [9765-12]

10:00 am: **CdTe/MgCdTe double heterostructures with ultra-long lifetime and ultra-low interface recombination velocity and their potential for luminescence refrigeration** (*Invited Paper*), Shi Liu, Xin-Hao Zhao, Calli Campbell, Maxwell B. Lassise, Yuan Zhao, Yong-Hang Zhang, Arizona State Univ. (USA) . . . . . [9765-13]

Coffee Break . . . . . Thu 10:30 am to 11:00 am

OPTO

# CONFERENCE 9765

LOCATION: ROOM 276 (SOUTH MEZZANINE)

## SESSION 4

LOCATION: ROOM 276 (SOUTH MEZZANINE) THU 11:00 AM TO 12:00 PM

### Novel Aspects in Optical Refrigeration I

Session Chair: **Qi Hua Xiong**, Nanyang Technological Univ. (Singapore)

11:00 am: **Realistic modeling of low quantum defect lasers** (*Invited Paper*), Steven R. Bowman, U.S. Naval Research Lab. (USA) ..... [9765-14]

11:30 am: **Analytical predictions of the temperature profile within semiconductor nanostructures for solid-state laser refrigeration** (*Invited Paper*), Peter J. Pauzauskie, Univ. of Washington (USA) and Pacific Northwest National Lab. (USA); Bennett E. Smith, Xuezhe Zhou, E. James Davis, Univ. of Washington (USA) ..... [9765-15]

Lunch/Exhibition Break ..... Thu 12:00 pm to 1:30 pm

## SESSION 5

LOCATION: ROOM 276 (SOUTH MEZZANINE) ..... THU 1:30 TO 3:00 PM

### Novel Aspects in Optical Refrigeration II

Session Chair: **Qi Hua Xiong**, Nanyang Technological Univ. (Singapore)

1:30 pm: **Spectroscopy and thermalization of dense atomic gases in redistributional laser cooling** (*Invited Paper*), Stavros Christopoulos, Rheinische Friedrich-Wilhelms-Univ. Bonn (Germany); Lars Weller, Rheinische Friedrich Wilhelms Univ Bonn (Germany); Peter Moroshkin, RIKEN (Japan); Dominik Möller, Vladimir Djokic, Rheinische Friedrich Wilhelms Univ Bonn (Germany); Martin Weitz, Rheinische Friedrich-Wilhelms-Univ. Bonn (Germany) ..... [9765-16]

2:00 pm: **Brillouin and Raman cooling in resonant and non-resonant systems** (*Invited Paper*), Yin-Chung Chen, Gaurav Bahl, Univ. of Illinois at Urbana-Champaign (USA) ..... [9765-17]

2:30 pm: **Observation of excitonic super-radiance in quantum well structures and its application for laser cooling of solids** (*Invited Paper*), Iman Hassani Nia, David J. Weinberg, Emily Weiss, Hooman Mohseni, Northwestern Univ. (USA) ..... [9765-18]

Coffee Break ..... Thu 3:00 pm to 3:30 pm

## SESSION 6

LOCATION: ROOM 276 (SOUTH MEZZANINE) .. THU 3:30 TO 5:40 PM

### Applications and Device Concepts

Session Chair: **Aram Gragossian**, The Univ. of New Mexico (USA)

3:30 pm: **Optical losses of high-reflectivity substrate-transferred crystalline coatings** (*Invited Paper*), Garrett D. Cole, Crystalline Mirror Solutions, LLC (USA) ..... [9765-19]

4:00 pm: **Progress in rare-earth-doped nanocrystalline glass-ceramics for laser cooling** (*Invited Paper*), Venkata Krishnaiah, Ecole Polytechnique de Montréal (Canada) and Ctr. d'Optique, Photonique et Laser (Canada); Yannick Ledemi, Ctr. d'Optique, Photonique et Laser (Canada); Elton Soares de Lima Filho, Sébastien Loranger, Galina A. Nemova, Ecole Polytechnique de Montréal (Canada); Younès Messaddeq, Ctr. d'Optique, Photonique et Laser (Canada); Raman Kashyap, Ecole Polytechnique de Montréal (Canada) ..... [9765-20]

4:30 pm: **Bottle micro-resonator temperature sensors for laser coolers** (*Invited Paper*), Galina A. Nemova, Raman Kashyap, Ecole Polytechnique de Montréal (Canada) ..... [9765-21]

5:00 pm: **Thermal management and design for optical refrigeration**, Guy Symonds, Thermodynamic Films (USA) and The Univ. of New Mexico (USA); Alexander R. Albrecht, Mohammad R. Ghasemkhani, Mansoor Sheik-Bahae, Richard I. Epstein, The Univ. of New Mexico (USA) ..... [9765-22]

5:20 pm: **Raman cooling in silicon photonic crystals**, Yin-Chung Chen, Gaurav Bahl, Univ. of Illinois at Urbana-Champaign (USA) ..... [9765-25]

# CONFERENCE 9766

LOCATION: ROOM 308 (SOUTH ESPLANADE)

Wednesday–Thursday 17–18 February 2016 • Proceedings of SPIE Vol. 9766

# Vertical-Cavity Surface-Emitting Lasers XX

Conference Chairs: **Kent D. Choquette**, Univ. of Illinois at Urbana-Champaign (USA); **James K. Guenter**, Finisar Corp. (USA)

Program Committee: **Nicolae Chitica**, TE Connectivity Ltd. (Sweden); **Aaron James Danner**, National Univ. of Singapore (Singapore); **Kent M. Geib**, Sandia National Labs. (USA); **Martin Grabherr**, Philips Technologie GmbH U-L-M Photonics (Germany); **Anders Larsson**, Chalmers Univ. of Technology (Sweden); **Chun Lei**, EMCORE Corp. (USA); **James A. Lott**, Technische Univ. Berlin (Germany); **M. V. Ramana Murthy**, Avago Technologies Ltd. (USA); **Krassimir Panajotov**, Vrije Univ. Brussel (Belgium); **Jean-Francois Seurin**, Princeton Optronics, Inc. (USA); **Noriyuki Yokouchi**, Furukawa Electric Co., Ltd. (Japan); **Jongseung Yoon**, The Univ. of Southern California (USA); **Mial E. Warren**, TriLumina Corp. (USA)

## WEDNESDAY 17 FEBRUARY

### SESSION 1

LOCATION: ROOM 308 (SOUTH ESPLANADE) . WED 1:30 TO 3:00 PM

### Celebration of 20 Years of VCSELs at Photonics West

Session Chair: **Chun Lei**, EMCORE Corp. (USA)

1:30 pm: **What makes VCSELs so special?** (*Invited Paper*), Jack Jewell, Consultant (USA) . . . . . [9766-1]

2:00 pm: **Twenty years of VCSEL technical and industrial development at SPIE Photonics West** (*Invited Paper*), Kent D. Choquette, Univ. of Illinois at Urbana-Champaign (USA); James Guenter, Finisar Corp. (USA) . . . . . [9766-2]

2:30 pm: **Beam steering and vortex beam creation in VCSEL photonics** (*Invited Paper*), Fumio Koyama, Tokyo Institute of Technology (Japan) . . [9766-3]

Coffee Break . . . . . Wed 3:00 pm to 3:30 pm

### SESSION 2

LOCATION: ROOM 308 (SOUTH ESPLANADE) . WED 3:30 TO 5:30 PM

### Novel VCSEL Structures

Session Chair: **Jack Jewell**, TJ Optics Inc. (USA)

3:30 pm: **780nm-range VCSEL array for laser printer system and other applications in Ricoh** (*Invited Paper*), Naoto Jikutani, Akihiro Itoh, Kazuhiro Harasaka, Toshihide Sasaki, Shunichi Sato, Ricoh Co., Ltd. (Japan) . . . [9766-4]

4:00 pm: **VCSELs for interferometric readout of MEMS sensors** (*Invited Paper*), Darwin K. Serkland, Kent M. Geib, Gordon A. Keeler, Gregory M. Peake, Michael S. Baker, Michael J. Shaw, Bion J. Merchant, Brian D. Homeijer, Matthew Eichenfield, Sandia National Labs. (USA); Murat Okandan, EIOS, Inc. (USA) . . . . . [9766-5]

4:30 pm: **Dynamic properties of silicon-integrated short-wavelength hybrid-cavity VCSEL**, Emanuel P. Haglund, Chalmers Univ. of Technology (Sweden); Sulakshna Kumari, Univ. Gent (Belgium); Petter Westbergh, Johan S. Gustavsson, Chalmers Univ. of Technology (Sweden); Gunther Roelkens, Roel G. Baets, Univ. Gent (Belgium); Anders Larsson, Chalmers Univ. of Technology (Sweden) . . . . . [9766-6]

4:50 pm: **Direct visualization of the in-plane leakage of high-order transverse modes in vertical-cavity surface-emitting lasers mediated by oxide-aperture engineering**, Nikolay N. Ledentsov Jr., Vitaly A. Shchukin, Joerg Kropp, VI Systems GmbH (Germany); Sven Burger, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany); Frank Schmidt, Konrad-Zuse-Zentrum für Informationstechnik Berlin (Germany); Nikolay N. Ledentsov Jr., VI Systems GmbH (Germany) . . . . . [9766-7]

5:10 pm: **Passive cavity surface-emitting lasers: option of temperature-insensitive lasing wavelength for uncooled dense wavelength division multiplexing systems**, Vitaly A. Shchukin, Nikolay N. Ledentsov Jr., VI Systems GmbH (Germany); Thomas Slight, Wyn Meredith, Compound Semiconductor Technologies Global Ltd. (United Kingdom); Nikita Gordeev, Alexei M. Nadochty, Alexey S. Payusov, Mikhail V. Maximov, Ioffe Physical-Technical Institute (Russian Federation); Kent D. Choquette, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9766-8]

## THURSDAY 18 FEBRUARY

### SESSION 3

LOCATION: ROOM 308 (SOUTH ESPLANADE) THU 8:10 TO 10:00 AM

### Emerging VCSEL Applications

Session Chair: **Darwin K. Serkland**, Sandia National Labs. (USA)

8:10 am: **VCSEL-based sensors for distance and velocity** (*Invited Paper*), Holger Moench, Philips Technologie GmbH (Germany); Mark Carpaij, Philips Research (Netherlands); Philipp Gerlach, Philips GmbH U-L-M Photonics (Germany); Stephan Gronenbron, Philips GmbH (Germany); Ralph Gudde, Jochen Hellmig, Philips Research (Netherlands); Johanna Kolb, Philips Technologie GmbH (Germany); Alexander van der Lee, Philips Research (Netherlands) . . . . . [9766-9]

8:40 am: **Progress in high-power high-speed VCSEL arrays** (*Invited Paper*), Richard F. Carson, Mial E. Warren, Preethi Dacha, Thomas Wilcox, David J. Abell, Kirk J. Otis, TriLumina Corp. (USA); James A. Lott, Technische Univ. Berlin (Germany) . . . . . [9766-10]

9:10 am: **Developments of VCSELs for printers and optical communications at Fuji Xerox** (*Invited Paper*), Takashi Kondo, Kazutaka Takeda, Hiromi Otoma, Akemi Murakami, Jun Sakurai, Hideo Nakayama, Fuji Xerox Co., Ltd. (Japan); Fumio Koyama, Tokyo Institute of Technology (Japan) . . . . . [9766-11]

9:40 am: **High-efficiency VCSEL arrays for illumination and sensing in consumer applications**, Jean-Francois Seurin, Delai Zhou, Guoyang Xu, Alexander Miglo, Daizong Li, Tong Chen, Baiming Guo, Chuni L. Ghosh, Princeton Optronics, Inc. (USA) . . . . . [9766-12]

Coffee Break . . . . . Thu 10:00 am to 10:30 am

### SESSION 4

LOCATION: ROOM 308 (SOUTH ESPLANADE) THU 10:30 AM TO 12:00 PM

### VCSEL Reliability and Manufacture

Session Chair: **Kent D. Choquette**, Univ. of Illinois at Urbana-Champaign (USA)

10:30 am: **Reliability requirements for VCSELs in engineered computer systems** (*Invited Paper*), David K. McElfresh, John E. Cunningham, Xueze Zheng, Kannan Raj, Oracle (USA) . . . . . [9766-13]

11:00 am: **Failure mode analysis of degraded InGaAs-AlGaAs strained quantum-well multi-mode vertical-cavity surface-emitting lasers**, Yongkun Sin, Nathan Presser, Michael Huang, Zachary Lingley, Miles Brodie, Jesse Theiss, Mark Peterson, Stephen L. LaLumondiere, Brendan Foran, Steven C. Moss, The Aerospace Corp. (USA) . . . . . [9766-14]

11:20 am: **Flexible opto-fluidic fluorescence sensors on plastics based on heterogeneously assembled arrays of micro-VCSELs and silicon photodiodes**, Jongseung Yoon, The Univ. of Southern California (USA) . . . . . [9766-15]

11:40 am: **Controlling the parameters of wet lateral oxidation for VCSEL fabrication**, Majid Riaziat, Dave Reed, Alex Kor, California Scientific, Inc. (USA) . . . . . [9766-16]

Lunch/Exhibition Break . . . . . Thu 12:00 pm to 1:30 pm



# CONFERENCE 9766

LOCATION: ROOM 308 (SOUTH ESPLANADE)

## SESSION 5

LOCATION: ROOM 308 (SOUTH ESPLANADE) . . THU 1:30 TO 3:20 PM

### VCSEL Modulation and Characteristics

Session Chair: **James Guenter**, Finisar Corp. (USA)

1:30 pm: **Beam quality study for single-mode oxide-confined and photonic crystal VCSELs** (*Invited Paper*), Janice T. Blane, William K. North, Jonathan B. Dencker, Peter R. Zeidler, Brian Souhan, U.S. Military Academy (USA); Kirk A. Ingold, Stanford Univ. (USA); James J. Raftery Jr., U.S. Military Academy (USA) . . . . . [9766-17]

2:00 pm: **Low-dispersion ultra-high-bandwidth vertical-cavity surface-emitting laser arrays**, Kent D. Choquette, Stewart T. Frysliie, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [9766-18]

2:20 pm: **Close to 100Gb/s discrete multitone transmission over 100-m of multimode fibre using a single transverse mode 850nm VCSEL**, Bo Wu, Zhou Xian, Ma Yanan, Luo Jun, Huawei Technologies Co., Ltd. (China); Zhong Kangping, The Hong Kong Polytechnic Univ. (China); Shaofeng Qiu, Feng Zhiyong, Huawei Technologies Co., Ltd. (China); Luo Yazhi, The Hong Kong Polytechnic Univ. (China); Joerg Kropp, Vitaly A. Shchukin, Nikolay N. Ledentsov Jr., VI Systems GmbH (Germany); Lu Chao, The Hong Kong Polytechnic Univ. (China) . . . . . [9766-19]

2:40 pm: **Influence of birefringence splitting on ultrafast polarization oscillations in VCSELs**, Markus Lindemann, Nils C. Gerhardt, Martin R. Hofmann, Ruhr-Univ. Bochum (Germany); Tobias Pusch, Rainer Michalzik, Univ. Ulm (Germany) . . . . . [9766-20]

3:00 pm: **Monolithic high-index contrast grating VCSEL**, Marcin Gebiski, Maciej Dems, Lodz Univ. of Technology (Poland); James A. Lott, Technische Univ. Berlin (Germany); Tomasz G. Czynszanowski, Lodz Univ. of Technology (Poland) . . . . . [9766-21]



**Visit the Photonics West Exhibition Tuesday through Thursday to discuss products and possibilities with the best suppliers from around the world.**



# CONFERENCE 9767

LOCATION: ROOM 310 (SOUTH ESPLANADE)

Monday–Thursday 15–18 February 2016 • Proceedings of SPIE Vol. 9767

# Novel In-Plane Semiconductor Lasers XV

Conference Chairs: **Alexey A. Belyanin**, Texas A&M Univ. (USA); **Peter M. Smowton**, Cardiff Univ. (United Kingdom)

Program Committee: **Yasuhiko Arakawa**, The Univ. of Tokyo (Japan); **Mikhail A. Belkin**, The Univ. of Texas at Austin (USA); **Dan Botez**, Univ. of Wisconsin-Madison (USA); **Federico Capasso**, Harvard School of Engineering and Applied Sciences (USA); **Gary A. Evans**, Southern Methodist Univ. (USA); **Michael Kneissl**, Technische Univ. Berlin (Germany); **Luke F. Lester**, Virginia Polytechnic Institute and State Univ. (USA); **Shinji Matsuo**, NTT Photonics Labs. (Japan); **Luke J. Mawst**, Univ. of Wisconsin-Madison (USA); **Jerry R. Meyer**, U.S. Naval Research Lab. (USA); **Roberto Paiella**, Boston Univ. (USA); **Richard V. Penty**, Univ. of Cambridge (United Kingdom); **Johann Peter Reithmaier**, Univ. Kassel (Germany); **Haisheng Rong**, Intel Corp. (USA); **Gary M. Smith**, MIT Lincoln Lab. (USA); **Nelson Tansu**, Lehigh Univ. (USA); **Miriam Serena Vitiello**, Consiglio Nazionale delle Ricerche (Italy); **Qi Jie Wang**, Nanyang Technological Univ. (Singapore)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative, Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated Photonics (USA) and Colleges of Nanoscale Science and Engineering, SUNY Polytechnic Institute (USA)

Coffee Break . . . . . Mon 10:10 am to 10:30 am

### SESSION 1

LOCATION: RM 310 (SOUTH ESPLANADE) . . MON 10:30 AM TO 12:40 PM

### Structure and Cavity Developments

Session Chair: **Johann P. Reithmaier**, Univ. Kassel (Germany)

- 10:30 am: **Relative merits and prospects of metal-clad (plasmonic) semiconductor lasers from UV to far IR** (*Invited Paper*), Jacob B. Khurgin, Johns Hopkins Univ. (USA) . . . . . [9767-1]
- 11:00 am: **Type-I QW cascade diode lasers for spectral region above 3  $\mu$ m**, Leon Shterengas, Takashi Hosoda, Meng Wang, Tao Feng, Gela Kipshidze, Gregory Belenky, Stony Brook Univ. (USA) . . . . . [9767-2]
- 11:20 am: **Electronic control of coherence in a two-dimensional array of photonic crystal surface-emitting lasers**, Richard J. E. Taylor, David T. D. Childs, Pavlo I. Ivanov, Ben J. Stevens, Nasser Babazadeh, Guangrui Li, The Univ. of Sheffield (United Kingdom); Gary Ternett, Stephen Thoms, Haiping Zhou, Univ. of Glasgow (United Kingdom); Richard A. Hogg, The Univ. of Sheffield (United Kingdom) . . . . . [9767-3]
- 11:40 am: **Generation of 7 W nanosecond pulses with 670-nm ridge-waveguide lasers**, Andreas Klehr, Thomas Prziwarka, Armin Liero, Thomas Hoffmann, Johannes Pohl, Jörg Fricke, Hans-Jürgen Wünsche, Hans Wenzel, Wolfgang Heinrich, Götz Erbert, Ferdinand-Braun-Institut (Germany) . . . . . [9767-4]
- 12:00 pm: **GaAs-based superluminescent diodes with window-like facet structure for low spectral modulation at high powers**, Omar Ghazal, Danqi Lei, David T. D. Childs, Ben J. Stevens, Nasser Babazadeh, Richard A. Hogg, Kristian M. Groom, The Univ. of Sheffield (United Kingdom) . . . . . [9767-5]

- 12:20 pm: **Monolithically integrated laser-detector arrays for chip-based sensing applications**, Robert Thomas, Angela D. Sobiesierski, Cardiff Univ. (United Kingdom); Mark D. Holton, Justyna Piasecka, Swansea Univ. (United Kingdom); Sara-Jayne Gillgrass, Huw D. Summers, David Barrow, Peter M. Smowton, Cardiff Univ. (United Kingdom) . . . . . [9767-6]

Lunch Break . . . . . Mon 12:40 pm to 1:50 pm

### SESSION 2

LOCATION: ROOM 310 (SOUTH ESPLANADE) . . MON 1:50 TO 3:30 PM

### Materials Developments

Session Chair: **Luke J. Mawst**, Univ. of Wisconsin-Madison (USA)

- 1:50 pm: **Highly strained type-I diode lasers on GaSb** (*Invited Paper*), Seth R. Bank, Scott D. Sifferman, Hari P. Nair, Nathaniel T. Sheehan, Rodolfo Salas, Scott J. Maddox, Adam M. Crook, The Univ. of Texas at Austin (USA) . . [9767-7]
- 2:20 pm: **Microscopic modelling of opto-electronic properties of dilute bismide materials for the mid-IR**, Jörg Hader, Jerome V. Moloney, Nonlinear Control Strategies, Inc. (USA) and College of Optical Sciences, The Univ. of Arizona (USA); Oleg Rubel, McMaster Univ. (Canada); Catalin Badescu, Wyle Aerospace (USA); Shane R. Johnson, Arizona State Univ. (USA); Stephan W. Koch, Philipps-Univ. Marburg (Germany) . . . . . [9767-8]
- 2:40 pm: **First demonstration of orange-yellow light-emitter devices in InGaP/InAlGaP laser structure using strain-induced quantum well intermixing technique**, Mohammed A. Majid, King Abdullah Univ. of Science and Technology (Saudi Arabia) and Effat Univ. (Saudi Arabia); Ahmad Al-Jabr, Rami T. ElAfandy, Hassan M. Oubei, Mohd Sharizal Alias, King Abdullah Univ. of Science and Technology (Saudi Arabia); B. A. Alnahhas, M. Shehata, Effat Univ. (Saudi Arabia); Dalaver H. Anjum, Tien Khee Ng, Boon S. S. Ooi, King Abdullah Univ. of Science and Technology (Saudi Arabia) . . . . . [9767-9]
- 3:00 pm: **Dilute-As GaNAs quantum wells for visible lasers with reduced Auger recombination** (*Invited Paper*), Chee-Keong Tan, Nelson Tansu, Lehigh Univ. (USA) . . . . . [9767-10]
- Coffee Break . . . . . Mon 3:30 pm to 4:00 pm

### SESSION 3

LOCATION: ROOM 310 (SOUTH ESPLANADE) . MON 4:00 TO 6:00 PM

### Blue/Green Emitters

Session Chair: **Michael Kneissl**, Technische Univ. Berlin (Germany)

- 4:00 pm: **Room-temperature continuous-wave operation of BeZnCdSe quantum-well green-to-yellow laser diodes with sub-10 mA threshold current**, Jijun Feng, Univ. of Shanghai for Science and Technology (China) and National Institute of Advanced Industrial Science and Technology (Japan); Ryoichi Akimoto, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [9767-11]
- 4:20 pm: **CW blue lasing in III-nitride nanobeam cavities on silicon substrate** (*Invited Paper*), Noelia Vico Triviño, Raphaël Butté, Jean-François Barin, Nicolas Grandjean, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9767-12]
- 4:50 pm: **Studies on 405 nm blue-violet diode laser with external grating cavity**, Bin Li, Jun Gao, Jun Zhao, Huazhong Univ. of Science and Technology (China); Anlan Yu, Shiwen Luo, Huazhong Univ. of Science and Technology (China) and Wuhan National Lab. for Optoelectronics (China); Dongsheng Xiong, Huazhong Univ. of Science and Technology (China) and Wuhan National Lab. for Optoelectronics (China); Xinbing Wang, Duluo Zuo, Wuhan National Lab. for Optoelectronics (China) and Huazhong Univ. of Science and Technology (China) . . . . . [9767-13]

OPTO

# CONFERENCE 9767

LOCATION: ROOM 310 (SOUTH ESPLANADE)

5:10 pm: **Large TE-polarized optical gain from AlInN-delta-GaN quantum well for ultraviolet lasers**, Cheng Liu, Yu Kee Ooi, Jing Zhang, Rochester Institute of Technology (USA) . . . . . [9767-14]

5:30 pm: **Electrically injected AlGaIn nanowire deep ultraviolet lasers on Si** (*Invited Paper*), Zetian Mi, Songrui Zhao, Xianhe Liu, McGill Univ. (Canada); Steffi Woo, Gianluigi A. Botton, McMaster Univ. (Canada) . . . . . [9767-15]

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: ROOM 310 (SOUTH ESPLANADE) . TUE 8:20 TO 10:00 AM

#### Quantum Dots

Session Chair: **Samuel Shutts**, Cardiff Univ. (United Kingdom)

8:20 am: **Effect of pumping delay on modulation response of double tunneling-injection quantum dot lasers**, Levon V. Asryan, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9767-16]

8:40 am: **1.5  $\mu\text{m}$  quantum dot laser material with high temperature stability of threshold current density and slope efficiency**, Saddam Banyoudeh, Alireza Abdollahinia, Vitalii Sichkovskiy, Johann P. Reithmaier, Univ. Kassel (Germany) . . . . . [9767-17]

9:00 am: **High-temperature continuous wave operation (up to 100°C) of InAs/InGaAs quantum dot electrically-injected microdisk lasers**, Natalia Kryzhanovskaya, Eduard Moiseev, Yulia Kudashova, Fedor Zubov, St. Petersburg Academic Univ. (Russian Federation); Andrey Lipovskii, Saint-Petersburg State Polytechnical Univ. (Russian Federation); Marina Kulagina, Sergey Troshkov, Yuri Zadiranov, Ioffe Physical-Technical Institute (Russian Federation); Daniil Livshits, Innolume GmbH (Germany); Mikhail V. Maximov, Alexey Zhukov, St. Petersburg Academic Univ. (Russian Federation) . . . [9767-18]

9:20 am: **Wavelength tunability of a two-mode semiconductor quantum dot laser in the telecom band**, Kouichi Akahane, Toshimasa Umezawa, Atsushi Kanno, Atsushi Matsumoto, Naokatsu Yamamoto, National Institute of Information and Communications Technology (Japan); Tetsuya Kawanishi, Waseda Univ. (Japan) . . . . . [9767-19]

9:40 am: **High-speed directly modulated 1.5  $\mu\text{m}$  quantum dot lasers**, Saddam Banyoudeh, Alireza Abdollahinia, Univ. Kassel (Germany); Ori Eyal, Technion-Israel Institute of Technology (Israel); Florian Schnabel, Vitalii Sichkovskiy, Univ. Kassel (Germany); Gadi Eisenstein, Technion-Israel Institute of Technology (Israel); Johann P. Reithmaier, Univ. Kassel (Germany) . [9767-20]

Coffee Break . . . . . Tue 10:00 am to 10:30 am

### SESSION 5

LOCATION: ROOM 310 (SOUTH ESPLANADE) .TUE 10:30 AM TO 12:10 PM

#### Cavity Effects and Mode-Locking

Session Chair: **Luke F. Lester**,  
Virginia Polytechnic Institute and State Univ. (USA)

10:30 am: **Non-linear phenomena in quantum-dot lasers** (*Invited Paper*), Boguslaw Tykalewicz, Cork Institute of Technology (Ireland) and Tyndall National Institute (Ireland); David Goulding, Tyndall National Institute (Ireland) and Cork Institute of Technology (Ireland); Bryan Kelleher, Tyndall National Institute (Ireland) and Univ. College Cork (Ireland); Evgeny A. Viktorov, Univ. Libre de Bruxelles (Belgium) and ITMO Univ. (Russian Federation); Stephen P. Hegarty, Cork Institute of Technology (Ireland) and Tyndall National Institute (Ireland); Guillaume Huyet, Cork Institute of Technology (Ireland) and Tyndall National Institute (Ireland) and ITMO Univ. (Russian Federation) . . . . . [9767-21]

11:00 am: **Timing jitter performance of mode-locked external cavity multi-quantum-well semiconductor lasers**, Benjamin Döpke, Rouven H. Pilny, Heiko Horstkemper, Carsten Brenner, Ruhr-Univ. Bochum (Germany); Andreas Klehr, Götz Erbert, Günther Tränkle, Ferdinand-Braun-Institut (Germany); Martin R. Hofmann, Ruhr-Univ. Bochum (Germany) . . . . . [9767-22]

11:20 am: **Interaction of phase and amplitude shaping in an external cavity semiconductor laser**, Rouven H. Pilny, Benjamin Döpke, Ruhr-Univ. Bochum (Germany); Jan C. Balzer, Philipps-Univ. Marburg (Germany); Carsten Brenner, Ruhr-Univ. Bochum (Germany); Andreas Klehr, Günther Tränkle, Ferdinand-Braun-Institut (Germany); Martin R. Hofmann, Ruhr-Univ. Bochum (Germany) . . . . . [9767-23]

11:40 am: **Mid-IR lasers based on Cr- and Fe-doped ZnSe and ZnS polycrystals** (*Invited Paper*), Sergey B. Mirov, Vladimir V. Fedorov, The Univ. of Alabama at Birmingham (USA); Dmitry V. Martyshkin, The Univ. of Alabama at Birmingham (USA) and IPG Photonics - Mid-Infrared Lasers (USA); Igor S. Moskalev, IPG Photonics - Mid-Infrared Lasers (USA); Mikhail S. Mirov, Sergey Vasilyev, IPG Photonics - Mid-Infrared Lasers (USA); Valentin P. Gapontsev, IPG Photonics Corp. (USA) . . . . . [9767-24]

Lunch/Exhibition Break . . . . . Tue 12:10 pm to 1:20 pm

### SESSION 6

LOCATION: ROOM 310 (SOUTH ESPLANADE) TUE 1:20 PM TO 3:30 PM

#### DFB and DBRs

Session Chair: **Shinji Matsuo**, NTT Photonics Labs. (Japan)

1:20 pm: **Narrow-linewidth 1.5  $\mu\text{m}$  quantum-dot distributed feedback lasers**, Annette Becker, Vitalii Sichkovskiy, Marko Bjelica, Univ. Kassel (Germany); Ori Eyal, Technion-Israel Institute of Technology (Israel); Philipp Baum, Anna Rippien, Florian Schnabel, Bernd Witzigmann, Univ. Kassel (Germany); Gadi Eisenstein, Technion-Israel Institute of Technology (Israel); Johann P. Reithmaier, Univ. Kassel (Germany) . . . . . [9767-25]

1:40 pm: **Pulsed hybrid dual wavelength Y-branch-DFB laser-tapered amplifier system suitable for water vapor detection at 965 nm with 16 W peak power**, Thi Nghiem Vu, Ferdinand-Braun-Institut (Germany) and Vietnam Academy of Science and Technology (Viet Nam); Andreas Klehr, Bernd Sumpf, Thomas Hoffmann, Armin Liero, Günther Tränkle, Ferdinand-Braun-Institut (Germany) . . . . . [9767-26]

2:00 pm: **Fast difference frequency tuning of multi-section dual-mode lasers with nanoscale surface gratings**, Mihail M. Dumitrescu, Topi Uusitalo, Heikki A. Virtanen, Jukka Viheriälä, Joel Salmi, Antti T. Aho, Tampere Univ. of Technology (Finland) . . . . . [9767-27]

2:20 pm: **5,000 h reliable operation of 785-nm dual-wavelength DBR-RW diode lasers suitable for Raman spectroscopy and SERDS**, Bernd Sumpf, André Müller, Martin Maiwald, Ferdinand-Braun-Institut (Germany) . . . [9767-28]

2:40 pm: **First demonstration of single-mode distributed feedback type-I GaSb-based cascade diode laser emitting near 2.9  $\mu\text{m}$** , Mathieu Fradet, Clifford F. Frez, Jet Propulsion Lab. (USA); Leon Shterengas, Takashi Hosoda, Stony Brook Univ. (USA); Stanley P. Sander, Siamak Forouhar, Jet Propulsion Lab. (USA); Gregory Belenky, Stony Brook Univ. (USA) . . . . . [9767-29]

3:00 pm: **Integrated membrane-based DFB and DR lasers** (*Invited Paper*), Shigehisa Arai, Nobuhiko Nishiyama, Tomohiro Amemiya, Takuo Hiratani, Daisuke Inoue, Tokyo Institute of Technology (Japan) . . . . . [9767-30]

Coffee Break . . . . . Tue 3:30 pm to 4:00 pm

### SESSION 7

LOCATION: ROOM 310 (SOUTH ESPLANADE) . TUE 4:00 TO 6:00 PM

#### Lasers on Silicon

Session Chair: **Haisheng Rong**, Intel Corp. (USA)

4:00 pm: **Road to group IV photonics** (*Invited Paper*), Detlev Grützmacher, Dan M. Buca, Stephan Wirths, Daniela Stange, Nils von den Driesch, Christian Schulte-Braucks, Siegfried Mantl, Forschungszentrum Jülich GmbH (Germany) . . . . . [9767-31]

4:30 pm: **Performance and reliability of III-V quantum-dot lasers grown directly on Si substrates**, Samuel Shutts, Stella N. Elliott, Angela D. Sobiesierski, Peter M. Smowton, Cardiff Univ. (United Kingdom); Jiang Wu, Mingchu Tang, Huiyun Liu, Univ. College London (United Kingdom); Richard Beanland, The Univ. of Warwick (United Kingdom) . . . . . [9767-32]

4:50 pm: **1.55  $\mu\text{m}$  InGaAsP edge-emitting laser with a silicon hole injector**, Dong Liu, Zhenyang Xia, Zhenqiang Ma, Univ. of Wisconsin-Madison (USA); Weidong Zhou, The Univ. of Texas at Arlington (USA); Munho Kim, Sang June Cho, Univ. of Wisconsin-Madison (USA) . . . . . [9767-33]

5:10 pm: **Electrically-driven 1D photonic crystal nanolaser integrated on silicon waveguides**, Guillaume Crosnier, Lab. de Photonique et de Nanostructures (France) and STMicroelectronics SA (France); Dorian Sanchez, Paul Monnier, Sophie Bouchoule, Grégoire Beaudoin, Isabelle Sagnes, Rama Raj, Fabrice Raineri, Lab. de Photonique et de Nanostructures (France)[9767-34]

5:30 pm: **Photonic-crystal lasers on silicon for chip-scale optical interconnects** (*Invited Paper*), Koji Takeda, Takuro Fujii, NTT Photonics Labs. (Japan); Akihiko Shinya, Eiichi Kuramochi, Masaya Notomi, NTT Basic Research Labs. (Japan); Koichi Hasebe, Takaaki Kakitsuka, Shinji Matsuo, NTT Photonics Labs. (Japan) . . . . . [9767-35]

# CONFERENCE 9767

LOCATION: ROOM 310 (SOUTH ESPLANADE)

## WEDNESDAY 17 FEBRUARY

### SESSION 8

LOCATION: ROOM 310 (SOUTH ESPLANADE) . WED 8:20 TO 10:10 AM

#### Interband and Quantum Cascade Lasers

Session Chair: **Jerry R. Meyer**, U.S. Naval Research Lab. (USA)

8:20 am: **Recent progress in interband cascade lasers** (*Invited Paper*), Rui Q. Yang, The Univ. of Oklahoma (USA) . . . . . [9767-36]

8:50 am: **Interband cascade laser sources in the mid-infrared for green photonics**, Johannes Koeth, Michael von Edlinger, Julian Scheuermann, Steffen Becker, nanoplus GmbH (Germany); Robert Weih, Julius-Maximilians-Univ. Würzburg (Germany); Lars Nähle, Marc O. Fischer, nanoplus GmbH (Germany); Martin Kamp, Sven Höfling, Julius-Maximilians-Univ. Würzburg (Germany) . . . . . [9767-37]

9:10 am: **Step-taper active-region quantum cascade lasers for carrier-leakage suppression and high internal differential efficiency**, Jeremy D. Kirch, Chun-Chieh Chang, Colin Boyle, Luke J. Mawst, Univ. of Wisconsin-Madison (USA); Don Lindberg III, Thomas Earles, Intraband LLC (USA); Dan Botez, Univ. of Wisconsin-Madison (USA) . . . . . [9767-38]

9:30 am: **Surface-emitting quantum cascade laser with 2nd-order metal-semiconductor gratings for single-lobe emission**, Colin Boyle, Chris Sigler, Jeremy D. Kirch, Univ. of Wisconsin-Madison (USA); Don Lindberg III, Thomas Earles, Intraband LLC (USA); Dan Botez, Luke J. Mawst, Univ. of Wisconsin-Madison (USA) . . . . . [9767-39]

9:50 am: **Mid-IR coupled-cavity quantum cascade lasers**, Kamil Pierscinski, Dorota Pierscińska, Mariusz Pluska, Piotr Gutowski, Piotr Karbownik, Andrzej Czerwinski, Maciej Bugajski, Institute of Electron Technology (Poland) . . . . . [9767-40]

Coffee Break . . . . . Wed 10:10 am to 10:40 am

### SESSION 9

LOCATION: RM 310 (SOUTH ESPLANADE) .. WED 10:40 AM TO 12:30 PM

#### QCLs: Combs and Mode-Locking I

Session Chair: **Sukhdeep Dhillon**, Lab. Pierre Aigrain (France)

10:40 am: **Broadband quantum cascade laser frequency combs: physics and systems** (*Keynote Presentation*), Jérôme Faist, ETH Zürich (Switzerland) . . . . . [9767-41]

11:20 am: **Dispersion engineering of MIR QCL frequency combs**, Gustavo F. Villares, Johanna Wolf, Martin J. Süess, Dmitry Kazakov, ETH Zürich (Switzerland); Andreas Hugi, IRsweep GmbH (Switzerland); Mattias Beck, Jérôme Faist, ETH Zürich (Switzerland) . . . . . [9767-42]

11:40 am: **Single-mode to multimode transition in quantum cascade lasers caused by the dynamic Stark effect**, Tobias S. Mansuripur, Harvard Univ. (USA); Camille Vernet, Ecole Polytechnique (France); Guillaume Aoust, Harvard School of Engineering and Applied Sciences (USA) and ONERA (France); Benedikt Schwarz, Technische Univ. Wien (Austria); Yongrui Wang, Alexey A. Belyanin, Texas A&M Univ. (USA); Federico Capasso, Harvard School of Engineering and Applied Sciences (USA) . . . . . [9767-43]

12:00 pm: **External cavity quantum cascade lasers operating under resonant pumping modulation** (*Invited Paper*), Dmitry G. Revin, Michael Hemingway, John W. Cockburn, The Univ. of Sheffield (United Kingdom); Yongrui Wang, Alexey A. Belyanin, Texas A&M Univ. (USA) . [9767-44]

Lunch/Exhibition Break . . . . . Wed 12:30 pm to 2:00 pm

### SESSION 10

LOCATION: ROOM 310 (SOUTH ESPLANADE) . . WED 2:00 TO 3:20 PM

#### QCLs: Combs and Mode-Locking II

Session Chair: **Gustavo F. Villares**, ETH Zürich (Switzerland)

2:00 pm: **Frequency comb operation of terahertz quantum-cascade lasers: fundamental aspects and practical applications** (*Invited Paper*), Martin Wienold, Humboldt-Univ. zu Berlin (Germany) and Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Benjamin Röben, Lutz Schrottke, Holger T. Grahn, Paul-Drude-Institut für Festkörperelektronik (Germany) . . . . . [9767-45]

2:30 pm: **Terahertz pulse generation from quantum cascade lasers** (*Invited Paper*), Sukhdeep S. Dhillon, Feihu Wang, Kenneth Maussang, Juliette Mangeney, Jérôme Tignon, Lab. Pierre Aigrain (France) . . . . . [9767-46]

3:00 pm: **Active mode-locking in quantum cascade lasers with monolithic and external cavities**, Yongrui Wang, Alexey A. Belyanin, Texas A&M Univ. (USA) . . . . . [9767-47]

Coffee Break . . . . . Wed 3:20 pm to 3:50 pm

### SESSION 11

LOCATION: ROOM 310 (SOUTH ESPLANADE) . . WED 3:50 TO 5:20 PM

#### New Device Concepts

Session Chair: **Andreas Wacker**, Lund Univ. (Sweden)

3:50 pm: **Superradiant emission from electronic excitations in semiconductors** (*Invited Paper*), Carlo Sirtori, Angela Vasanelli, Yanko Todorov, Simon Huppert, Thibault Laurent, Giulia Pegolotti, Univ. Paris 7-Denis Diderot (France) . . . . . [9767-48]

4:20 pm: **Theoretical analysis of quantum-dot quantum cascade lasers: design considerations and current requirements**, Stephan Michael, Technische Univ. Kaiserslautern (Germany); Weng W. Chow, Sandia National Labs. (USA); Hans Christian Schneider, Technische Univ. Kaiserslautern (Germany) . . . . . [9767-50]

4:40 pm: **An optimized bi-functional material for integrated mid-infrared quantum cascade based sensors**, Andreas Harrer, Benedikt Schwarz, Peter Reiningger, Rolf Szedlak, Tobias Zederbauer, Hermann Detz, Donald MacFarland, Aaron M. Andrews, Werner Schrenk, Gottfried Strasser, Technische Univ. Wien (Austria) . . . . . [9767-49]

5:00 pm: **Continuous-wave terahertz lasing in graphene**, Alexey A. Belyanin, Yongrui Wang, Texas A&M Univ. (USA); Mikhail Tokman, Institute of Applied Physics of the RAS (Russian Federation) . . . . . [9767-51]

### POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 ... WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.*

**Simulation of broad spectral bandwidth emitters at 1060nm for optical coherence tomography and exploration of epitaxy limitations**, Ian G. Tooley, The Univ. of Sheffield (United Kingdom) . . . . . [9767-67]

**Characterization of bending loss in tunable Y-junction lasers for gas sensing applications**, Nam T. Tran, Saroj K. Patra, Kjetil Haddeland, Bjorn-Ove Fimland, Norwegian Univ. of Science and Technology (Norway) . . . . . [9767-68]

**Optimisation of photonic crystal coupling through waveguide design**, Richard J. E. Taylor, Pavlo I. Ivanov, Guangrui Li, Tim S. Roberts, David T. D. Childs, Richard A. Hogg, The Univ. of Sheffield (United Kingdom) . . . . [9767-69]

**TEM Study of the effect of ex-situ and in-situ rapid thermal annealing on threading dislocations in GaAs monolithically grown on Si by MBE**, Wei Li, The Univ. of Sheffield (United Kingdom); Siming Chen, Jiang Wu, Huiyun Liu, Univ. College London (United Kingdom); Richard A. Hogg, Ian M. Ross, The Univ. of Sheffield (United Kingdom) . . . . . [9767-70]

**High-performance room temperature InGaAs/AlGaAs/GaAs quantum cascade lasers**, Dorota Pierscińska, Kamil Pierscinski, Piotr Gutowski, Magdalena Morawiec, Maciej Bugajski, Institute of Electron Technology (Poland) . . . . . [9767-71]

**Three-dimensional finite-difference time-domain modelling of photonic crystal surface-emitting lasers**, Pavlo I. Ivanov, Richard J. E. Taylor, Guangrui Li, David T. D. Childs, Salam Khamas, Jayanta Sarma, Robertus Erdelyi, Richard A. Hogg, The Univ. of Sheffield (United Kingdom) . . . . . [9767-72]

# CONFERENCE 9767

LOCATION: ROOM 310 (SOUTH ESPLANADE)

THURSDAY 18 FEBRUARY

## SESSION 12

LOCATION: ROOM 310 (SOUTH ESPLANADE) . THU 8:00 TO 10:00 AM

### High-Brightness Lasers

Session Chair: **Gary M. Smith**, MIT Lincoln Lab. (USA)

8:00 am: **Design and simulation of high-brightness diode lasers for operation in the presence of external feedback** (*Invited Paper*), Eric Larkins, Mohamad A. Helal, Simeon Kaunga-Nyirenda, Steve Bull, Daniel Moss, The Univ. of Nottingham (United Kingdom) . . . . . [9767-52]

8:30 am: **DBR tapered diode laser at 1030 nm with nearly diffraction-limited narrowband emission and 12.7 W of optical output power**, André Müller, Jörg Fricke, Frank Bugge, Olaf Brox, Götz Erbert, Bernd Sumpf, Ferdinand-Braun-Institut (Germany) . . . . . [9767-53]

8:50 am: **High performances of very long (13.5mm) tapered laser emitting at 975 nm**, Patrick Resneau, Michel Garcia, Michel Lecomte, Yannick Robert, Eric Vinet, Olivier Parillaud, Michel Krakowski, III-V Lab. (France); Dmitri L. Boiko, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland) . . . . [9767-54]

9:10 am: **Three-section master oscillator power amplifier at 1.57  $\mu$ m for LIDAR measurements of atmospheric carbon dioxide**, Maria Fernanda Vilerá Suárez, Univ. Politécnic de Madrid (Spain); Mickael Faugeron, III-V Lab. (France); Antonio Perez-Serrano, José Manuel Garcia Tijero, Univ. Politécnic de Madrid (Spain); Michel Krakowski, Frédéric Van Dijk, III-V Lab. (France); Ignacio Esquivias, Univ. Politécnic de Madrid (Spain) . . . . . [9767-55]

9:30 am: **Novel approaches to increasing the brightness of broad area lasers** (*Invited Paper*), Paul Crump, Martin Winterfeldt, Jonathan Decker, Michael Ekterai, Jörg Fricke, Steffen Knigge, Andre Maassdorf, Götz Erbert, Ferdinand-Braun-Institut (Germany) . . . . . [9767-56]

Coffee Break . . . . . Thu 10:00 am to 10:30 am

## SESSION 13

LOCATION: ROOM 310 (SOUTH ESPLANADE) THU 10:30 AM TO 12:40 PM

### Terahertz Quantum Cascade Lasers

Session Chair: **Miriam S. Vitiello**,  
Consiglio Nazionale delle Ricerche (Italy)

10:30 am: **THz quantum cascade laser systems** (*Invited Paper*), Michael Krall, Martin Brandstetter, Dominic Bachmann, Christoph Deutsch, Juraj Darmo, Maxwell A. Andrews, Werner Schrenk, Gottfried Strasser, Karl Unterrainer, Technische Univ. Wien (Austria) . . . . . [9767-57]

11:00 am: **Modeling quantum cascade lasers under operation** (*Invited Paper*), Andreas Wacker, Martin Franckie, David O. Winge, Lund Univ. (Sweden) . . . . . [9767-58]

11:30 am: **Coherent imaging and sensing using the self-mixing effect in THz quantum cascade lasers** (*Invited Paper*), Paul Dean, Edmund H. Linfield, Giles Davies, Univ. of Leeds (United Kingdom) . . . . . [9767-59]

12:00 pm: **Microwave self-modulation of THz quantum cascade lasers**, Fabrizio Castellano, Consiglio Nazionale delle Ricerche (Italy); Lianhe H. Li, Edmund H. Linfield, Giles Davies, Univ. of Leeds (United Kingdom); Miriam S. Vitiello, Consiglio Nazionale delle Ricerche (Italy) . . . . . [9767-60]

12:20 pm: **Broad continuous tuning of single-mode terahertz quantum cascade lasers operating at 50 K**, Chongzhao Wu, Lehigh Univ. (USA); John L. Reno, Sandia National Labs. (USA); Sushil Kumar, Lehigh Univ. (USA) . [9767-61]

Lunch/Exhibition Break . . . . . Thu 12:40 pm to 2:00 pm

## SESSION 14

LOCATION: ROOM 310 (SOUTH ESPLANADE) . . THU 2:00 TO 3:40 PM

### QCLs: Cavities, Integration, and Applications

Session Chair: **Dan Botez**, Univ. of Wisconsin-Madison (USA)

2:00 pm: **Monolithic integration of a quantum cascade laser array and an echelle grating multiplexer for widely-tunable mid-infrared sources**, Clément Gilles, mirSense (France) and III-V Lab. (France); Luis Jorge Orbe Nava, Guillermo Carpintero del Barrio, Univ. Carlos III de Madrid (Spain); Johan Abautret, Gregory Maisons, Mathieu Carras, mirSense (France) . . . . . [9767-62]

2:20 pm: **Regrowth-free mid-infrared distributed feedback quantum cascade lasers with sub-watt power consumption**, Ryan M. Briggs, Clifford F. Frez, Mathieu Fradet, Siamak Forouhar, Jet Propulsion Lab. (USA); Romain Blanchard, Christian J. Pfluegl, Pendar Technologies (USA) . . [9767-63]

2:40 pm: **Spectroscopic benzene detection using a broadband monolithic DFB-QCL array**, Rafal Lewicki, Princeton Univ. (USA); Mark F. Witinski, Pendar Technologies (USA) and Harvard Univ. (USA); Biao Li, Pendar Technologies (USA); Gerard Wysocki, Princeton Univ. (USA) . . . . . [9767-64]

3:00 pm: **Cascade laser applications: trends and challenges**, Eric Margoto, Yves Fazilleau, Arclès (France); Benoît d'Humières, TEMATYS (France) [9767-65]

3:20 pm: **Single-mode enhancement in coupled-cavity quantum cascade lasers**, Maciej Kuc, Robert P. Sarzala, Tomasz G. Czystanowski, Lodz Univ. of Technology (Poland); Maciej Bugajski, Institute of Electron Technology (Poland) . . . . . [9767-66]



# CONFERENCE 9768

LOCATION: ROOM 309 (SOUTH ESPLANADE)

Monday–Wednesday 15–17 February 2016 • Proceedings of SPIE Vol. 9768

# Light-Emitting Diodes: Materials, Devices, and Applications for Solid State Lighting XX

Conference Chairs: **Heonsu Jeon**, Seoul National Univ. (Korea, Republic of); **Li-Wei Tu**, National Sun Yat-Sen Univ. (Taiwan); **Michael R. Krames**, Arkesso (USA); **Martin Strassburg**, OSRAM Opto Semiconductors GmbH (Germany)

Program Committee: **Gerd Bacher**, Univ. Duisburg-Essen (Germany); **Mitch M. C. Chou**, National Sun Yat-Sen Univ. (Taiwan); **Michael Heuken**, AIXTRON SE (Germany); **Christoph Hoelen**, Philips Lighting B.V. (Netherlands); **Satoshi Kamiyama**, Meijo Univ. (Japan); **Jong Kyu Kim**, Pohang Univ. of Science and Technology (Korea, Republic of); **Markus Klein**, OSRAM Opto Semiconductors GmbH (Germany); **Kei May Lau**, Hong Kong Univ. of Science and Technology (Hong Kong, China); **Kurt J. Linden**, N2 Biomedical (USA); **Tien-Chang Lu**, National Chiao Tung Univ. (Taiwan); **Joongseo Park**, LG Electronics Inc. (Korea, Republic of); **E. Fred Schubert**, Rensselaer Polytechnic Institute (USA); **Ross P. Stanley**, Ctr. Suisse d'Electronique et de Microtechnique SA (Switzerland); **Klaus P. Streubel**, OSRAM AG (Germany); **Tetsuya Takeuchi**, Meijo Univ. (Japan); **Dong-Sing Wu**, National Chung Hsing Univ. (Taiwan)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative,  
Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of  
Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated  
Photonics (USA) and Colleges of Nanoscale Science and  
Engineering, SUNY Polytechnic Institute (USA)

Coffee Break ..... Mon 10:10 am to 10:30 am

### SESSION 1

LOCATION: RM 309 (SOUTH ESPLANADE) .. MON 10:30 AM TO 12:20 PM

### Nanomaterials and Nanostructures for LEDs I

Session Chair: **Martin Strassburg**,  
OSRAM Opto Semiconductors GmbH (Germany)

- 10:30 am: **Novel III-nitride-based nanostructure LEDs: nano-scale correlation of the optical, structural, and chemical properties** (*Invited Paper*), Jürgen H. Christen, Otto-von-Guericke-Univ. Magdeburg (Germany) ..... [9768-1]
- 11:00 am: **Estimation of free carrier concentrations in high-quality heavily doped GaN:Si micro-rods**, Matin Mohajerani, Technische Univ. Braunschweig (Germany); Sevak Khachadorian, Christian Nienstiel, Technische Univ. Berlin (Germany); Jana Hartmann, Hao Zhou, Hergo-Heinrich Wehmann, Technische Univ. Braunschweig (Germany); Tilman Schimpke, Martin Strassburg, OSRAM Opto Semiconductors GmbH (Germany); Axel Hoffmann, Technische Univ. Berlin (Germany); Andreas Waag, Technische Univ. Braunschweig (Germany) ..... [9768-2]

11:20 am: **GaN-based devices for new gas sensor technologies** (*Invited Paper*), J. Daniel Prades, Univ. de Barcelona (Spain) ..... [9768-3]

11:50 am: **Single-crystal phosphors for high-brightness white LEDs/LDs** (*Invited Paper*), Encarnación G. Villora, Stelian Arjoca, National Institute for Materials Science (Japan); Daisuke Inomata, Tamura Corp. (Japan); Kiyoshi Shimamura, National Institute for Materials Science (Japan) ..... [9768-4]

Lunch Break ..... Mon 12:20 pm to 1:20 pm

### SESSION 2

LOCATION: ROOM 309 (SOUTH ESPLANADE) . MON 1:20 TO 3:20 PM

### UV/DUV-Emitting LEDs

Session Chair: **Hans-Jürgen Lugauer**,  
OSRAM Opto Semiconductors GmbH (Germany)

1:20 pm: **Development of AlGaIn-based UVC emitters** (*Invited Paper*), Zlatko Sitar, Ramon Collazo, Zachary Bryan, Isaac S. Bryan, Ronny Kirste, North Carolina State Univ. (USA) ..... [9768-5]

1:50 pm: **Status of DUV LED on sapphire** (*Invited Paper*), Cyril Pernot, Tetsuhiko Inazu, Tetsumi Ochi, Hiroyasu Ichinokura, Hideki Asano, Hidemasa Tomozawa, Nikkiso Co., Ltd. (Japan); Hiroshi Amano, Nagoya Univ. (Japan); Isamu Akasaki, Meijo Univ. (Japan) ..... [9768-6]

2:20 pm: **UV LEDs: the next solid-state revolution**, Robert C. Walker, RayVio (USA) ..... [9768-7]

2:40 pm: **Enhancement of light emission-localized surface plasmon using Pt nanorings in deep UV-emitting AlGaIn quantum wells**, KyungRock Son, HeeWoong Shin, Kyeong Heon Kim, Tae Hoon Park, Byeong Ryong Lee, Tae Geun Kim, Korea Univ. (Korea, Republic of) ..... [9768-8]

3:00 pm: **Investigation of light output uniformity and performance using a UV transmitting glass optic for a multi-UV LED array**, Brian S. Jasenak, Adam Willsey, James Forish, Rachel Willsey, Kopp Glass, Inc. (USA) . . . [9768-9]

Coffee Break ..... Mon 3:20 pm to 3:50 pm

# CONFERENCE 9768

LOCATION: ROOM 309 (SOUTH ESPLANADE)

## SESSION 3

LOCATION: ROOM 309 (SOUTH ESPLANADE) . MON 3:50 TO 6:20 PM

### High Current Performance and Droop in InGaN LEDs

Session Chair: **Mike R. Krames**, Arkesso, LLC (USA)

3:50 pm: **Radiative and non-radiative processes in InGaN quantum well LEDs** (*Invited Paper*), Axel Hoffmann, Felix Nippert, Technische Univ. Berlin (Germany); Ines Pietzonka, OSRAM Opto Semiconductors GmbH (Germany); Sergey Y. Karpov, STR Group-Soft Impact Ltd. (Russian Federation); Bastian Galler, Alexander Wilm, Martin Strassburg, OSRAM Opto Semiconductors GmbH (Germany) . . . . . [9768-10]

4:20 pm: **LEDs for solid-state lighting: searching room for improvements** (*Invited Paper*), Sergey Y. Karpov, STR Group-Soft Impact Ltd. (Russian Federation) . . . . . [9768-11]

4:50 pm: **Thermal droop in InGaN-based LEDs: physical origin and dependence on material properties**, Matteo Meneghini, Carlo De Santi, Marco La Grassa, Univ. degli Studi di Padova (Italy); Bastian Galler, Roland Zeisel, Berthold Hahn, OSRAM Opto Semiconductors GmbH (Germany); Michele Goano, Francesco Bertazzi, Politecnico di Torino (Italy); Stefano Dominici, Politecnico di Torino (Italy) and Univ. degli Studi di Padova (Italy); Gaudenzio Meneghesso, Enrico Zanoni, Univ. degli Studi di Padova (Italy) . . . . . [9768-12]

5:10 pm: **Improvement of internal quantum efficiency and efficiency droop in GaN-based flip-chip light-emitting diode structures via the Purcell effect**, Han-Youl Ryu, Inha Univ. (Korea, Republic of) . . . . . [9768-13]

5:30 pm: **3D numerical modeling of the carrier transport and radiative efficiency for InGaN/GaN light-emitting diodes with V-shaped pits**, Chi-Kang Li, Li-Shuo Lu, Chen-Kuo Wu, Chung-Cheng Hsu, Yuh-Renn Wu, National Taiwan Univ. (Taiwan) . . . . . [9768-14]

5:50 pm: **3D modeling of intrinsic disorder in InGaN/GaN heterostructures** (*Invited Paper*), Claude Weisbuch, Ecole Polytechnique (France) and Univ. of California, Santa Barbara (USA); Marco Piccardo, Marcel Filoche, Ecole Polytechnique (France); Chi-Kang Li, Yuh-Renn Wu, National Taiwan Univ. (Taiwan); Lucio Martinelli, Ecole Polytechnique (France); J. Perretti, Ecole Polytechnique (France); James S. Speck, Univ. of California, Santa Barbara (USA) . . . . . [9768-15]

## TUESDAY 16 FEBRUARY

### SESSION 4

LOCATION: ROOM 309 (SOUTH ESPLANADE) . TUE 8:00 TO 9:50 AM

### Novel Technologies for LED Design and Fabrication I

Session Chair: **Aurelien David**, Soraa, Inc. (USA)

8:00 am: **Recent advances in pulsed sputtering techniques for fabrication of nitride LEDs** (*Invited Paper*), Hiroshi Fujioka, The Univ. of Tokyo (Japan) and JST-ACCEL (Japan); Kohei Ueno, Astushi Kobayashi, Jitsuo Ohta, The Univ. of Tokyo (Japan) . . . . . [9768-16]

8:30 am: **3-pad flip chip COB LED: Novel approach in lowering thermal resistance thus enabling smaller heat sink on super high-power LEDs**, Dongwook Noh, Pao Chen, Flip Chip Opto Inc. (USA) . . . . . [9768-17]

8:50 am: **General principles of light out-coupling from trapped modes and the application for GaN LED using dynamic nano-inscribing patterning technique**, Long Chen, Ashwin Panday, Shengjun Zhou, Chad Huard, Xi Chen, L. Jay Guo, Univ. of Michigan (USA) . . . . . [9768-18]

9:10 am: **Emission characteristics of light-emitting diodes by confocal microscopy**, Wing Shing Cheung, Hoi Wai Choi, The Univ. of Hong Kong (Hong Kong, China) . . . . . [9768-19]

9:30 am: **Increased light extraction efficiency of flip-chip light-emitting diode using anodic aluminum oxide**, Zone-Lin Wu, Cheng-Hsun Chu, National Chung Cheng Univ. (Taiwan); Kuan-Chieh Huang, Shao-Ying Ting, Yi-Ru Huang, Jing-En Huang, Genesis Photonics Inc. (Taiwan); Chien-Chao Tsiang, Hsiang-Chen Wang, National Chung Cheng Univ. (Taiwan) . . . . . [9768-19]

Coffee Break . . . . . Tue 9:50 am to 10:20 am

## SESSION 5

LOCATION: ROOM 309 (SOUTH ESPLANADE) . TUE 10:20 AM TO 12:10 PM

### Novel Technologies for LED Design and Fabrication II

Session Chairs: **Tien-Chang Lu**, National Chiao Tung Univ. (Taiwan); **Li-Wei Tu**, National Sun Yat-Sen Univ. (Taiwan)

10:20 am: **P-doped (Al)GaIn layers by MBE: applications to long-wavelength lasers and tunnel junctions** (*Invited Paper*), Marco Malinverni, Denis Martin, Nicolas Grandjean, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [9768-20]

10:50 am: **Correlation between p-GaN growth environment with electrical and optical properties of blue LEDs**, Modestas Zulonas, Ilya E. Titkov, Amit Yadav, Ksenia A. Fedorova, Edik U. Rafailov, Aston Univ. (United Kingdom); Andrei F. Tsatsulnikov, W. V. Lunding, Alexey V. Sakharov, Ioffe Physical-Technical Institute (Russian Federation); Thomas J. Slight, Wyn Meredith, Compound Semiconductor Technologies Global Ltd. (United Kingdom) . . . . . [9768-21]

11:10 am: **Practical issues of surface plasmon coupled light-emitting diodes**, Chun-Han Lin, Hao-Tsung Chen, Chang-Gan Tu, Chieh Hsieh, Chia-Ying Su, Yu-Feng Yao, Yang Kuo, Yean-Woei Kiang, Chih-Chung Yang, National Taiwan Univ. (Taiwan) . . . . . [9768-22]

11:30 am: **Blue resonant-cavity light-emitting diode with half milliwatt output power**, Pinghui S. Yeh, Chi-Chieh Chang, Yu-Ting Chen, National Taiwan Univ. of Science and Technology (Taiwan); Da-Wei Lin, Chun Chia Wu, Jhao Hang He, Hao-Chung Kuo, National Chiao Tung Univ. (Taiwan) . . [9768-23]

11:50 am: **Fabrication and characterization of superluminescent diodes for 2-3  $\mu\text{m}$  wavelength range**, Nouman Zia, Jukka Viherälä, Riku Koskinen, Mervi Koskinen, Soile Suomalainen, Mircea Guina, Tampere Univ. of Technology (Finland) . . . . . [9768-24]

Lunch/Exhibition Break . . . . . Tue 12:10 pm to 1:30 pm

## SESSION 6

LOCATION: ROOM 309 (SOUTH ESPLANADE) . TUE 1:30 TO 3:30 PM

### Nanomaterials and Nanostructures for LEDs II

Session Chair: **Andreas Waag**, Technische Univ. Braunschweig (Germany)

1:30 pm: **GaN-nanowire-based light-emitting diodes** (*Invited Paper*), Lars Samuelson, Lund Univ. (Sweden) and Glo AB (Sweden); Bo Monemar, Lund Univ. (Sweden); Jonas B. Ohlsson, Lund Univ. (Sweden) and QuNano AB (Sweden); Nathan F. Gardner, GLO-USA, Inc. (USA) . . . . . [9768-25]

2:00 pm: **Broad emission spectra of multi-section core-shell InGaIn/GaN quantum-well nanorod light-emitting diode arrays** (*Invited Paper*), Chang-Gan Tu, Yu-Feng Yao, Chia-Ying Su, Chieh Hsieh, Chi-Ming Weng, Chun-Han Lin, Hao-Tsung Chen, Yean-Woei Kiang, Chih-Chung Yang, National Taiwan Univ. (Taiwan) . . . . . [9768-26]

2:30 pm: **Position-controlled MOVPE growth and electro-optical characterization of core-shell InGaIn/GaN microrod LEDs** (*Invited Paper*), Hans-Jürgen Lugauer, Tilman Schimpke, Adrian Avramescu, Tansen Varghese, OSRAM Opto Semiconductors GmbH (Germany); Jana Hartmann, Andreas Waag, Technische Univ. Braunschweig (Germany); Martin Strassburg, OSRAM Opto Semiconductors GmbH (Germany) . . . . . [9768-27]

3:00 pm: **Nitride nanowires for new functionalities: from single wire properties to flexible light-emitting diodes** (*Invited Paper*), Maria Tchernycheva, Dai Xing, Hezhi Zhang, Agnès Messanvi, Vladimir Neplok, Pierre Lavenus, Nan Guan, Jianchang Yan, François H. Julien, Univ. Paris-Sud 11 (France); Lorenzo Rigutti, Institut d'Astrophysique Spatiale (France); Andrey Babichev, Ioffe Physical-Technical Institute (Russian Federation); Gwénoél Jacopin, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Ludovic Largeau, Lab. de Photonique et de Nanostructures (France); Rafal Ciechonski, Giuliano Vescovi, Glo AB (Sweden); Olga Kryliouk, GLO-USA, Inc. (USA); Martin Foldyna, Ecole Polytechnique (France); Joël Eymery, Christophe Durand, CEA-INAC (France) . . . . . [9768-28]

Coffee Break . . . . . Tue 3:30 pm to 4:00 pm

# CONFERENCE 9768

LOCATION: ROOM 309 (SOUTH ESPLANADE)

## SESSION 7

LOCATION: ROOM 309 (SOUTH ESPLANADE) . TUE 4:00 TO 6:30 PM

### LED Manufacturing I

Session Chair: **Chih-Chung Yang**, National Taiwan Univ. (Taiwan)

4:00 pm: **Advances in solid-state lighting** (*Invited Paper*), John Edmond, Cree, Inc. (USA); Sten Heikman, Cree Santa Barbara Technology Ctr. (USA) . . . . . [9768-29]

4:30 pm: **Progress and challenges in GaN-on-Si LEDs** (*Invited Paper*), William Fenwick, Toshiba America Electronic Components, Inc. (USA). [9768-30]

5:00 pm: **Monolithic LED arrays: next-generation sources for smart lighting applications** (*Invited Paper*), Alexandre Lagrange, CEA-LETI (France) . [9768-31]

5:30 pm: **High-brightness low-power consumption microLED arrays**, James R. Bonar, Gareth J. Valentine, Zheng Gong, James Small, Steve Gorton, mLED Ltd. (United Kingdom) . . . . . [9768-32]

5:50 pm: **Fabrication of white flip-chip light-emitting diodes by substrate transferring technique**, Ray-Hua Horng, Ching-Ho Tien, Kuo-Wei Ho, Dong-Sing Wu, National Chung Hsing Univ. (Taiwan) . . . . . [9768-33]

6:10 pm: **LED light engine concept with ultra-high scalable luminance**, Christoph Hoelen, Philips Lighting B.V. (Netherlands) . . . . . [9768-63]

## WEDNESDAY 17 FEBRUARY

## SESSION 8

LOCATION: ROOM 309 (SOUTH ESPLANADE) WED 8:00 TO 10:10 AM

### LED Applications and Solid-State Lighting

Session Chair: **Mike R. Krames**, Arkeso (USA)

8:00 am: **Advances in LEDs for automotive applications** (*Invited Paper*), Jy Bhardwaj, S. Rao Peddada, Philips Lumileds Lighting Co. (USA) . . . [9768-34]

8:30 am: **Progress in GaN-on-GaN LEDs and their applications** (*Invited Paper*), Aurelien David, Soraa, Inc. (USA) . . . . . [9768-35]

9:00 am: **3D structural construction of GaN-based light-emitting diode by confocal micro-Raman spectroscopy** (*Invited Paper*), Tien-Chang Lu, Heng Li, Chiao-Yun Chang, National Chiao Tung Univ. (Taiwan); Hui-Yu Cheng, Wei-Liang Chen, Yi-Hsin Huang, Yu-Ming Chang, National Taiwan Univ. (Taiwan) . . . . . [9768-36]

9:30 am: **Progress in characterizing the multidimensional color quality properties of white LED light sources**, Kees Teunissen, Philips Research (Netherlands) . . . . . [9768-37]

9:50 am: **Adaptive multi-wavelength LED star simulator for space life studies**, Nicola Trivellin, LightCube SRL (Italy); Diego Barbisan, Marco Ferretti, Univ. degli Studi di Padova (Italy); Matteo Dal Lago, LightCube SRL (Italy); Matteo Meneghini, Univ. degli Studi di Padova (Italy); Marco S. Erculiani, INAF - Osservatorio Astronomico di Padova (Italy) and Univ. degli Studi di Padova (Italy); Riccardo U. Claudi, Enrico Giro, INAF - Osservatorio Astronomico di Padova (Italy); Matteo Bonato, Tufts Univ. (USA); Lorenzo Cocola, Luca Poletto, IFN-CNR LUXOR Lab. (Italy); Bernardo Salasnich, INAF - Osservatorio Astronomico di Padova (Italy); Gaudenzio Meneghesso, Enrico Zanoni, Univ. degli Studi di Padova (Italy) . . . . . [9768-38]

Coffee Break . . . . . Wed 10:10 am to 10:30 am

## SESSION 9

LOCATION: RM 309 (SOUTH ESPLANADE) . WED 10:30 AM TO 12:00 PM

### Nanomaterials and Nanostructures for LEDs III

Session Chair: **Heonsu Jeon**, Seoul National Univ. (Korea, Republic of)

10:30 am: **InGaN-based orderly-arranged-nanocolumn light-emitters** (*Invited Paper*), Katsumi Kishino, Koji Yamano, Tatsuya Kano, Shunsuke Ishizawa, Kai Motoyama, Hiroaki Hayashi, Daishi Fukushima, Daijiro Shiba, Takao Oto, Sophia Univ. (Japan) . . . . . [9768-39]

11:00 am: **Lateral thin-film photonic crystal phosphor structure for enhanced color-conversion efficiency**, Kyungtaek Min, Hyunho Jung, Heonsu Jeon, Seoul National Univ. (Korea, Republic of) . . . . . [9768-40]

11:20 am: **Plasmon-coupled CdSe quantum dots for solid-state lighting**, Quinton Rice, Jaetae Seo, Hampton Univ. (USA); Sangram Raut, Rahul Chib, Univ. of North Texas Health Science Ctr. at Fort Worth (USA); Anderson Hayes, Hampton Univ. (USA); Andrew Y. Wang, Ocean NanoTech (USA); Hyoyoung Cho, Electronics and Telecommunications Research Institute (USA); Wanjoong Kim, Electronics and Telecommunications Research Institute (Korea, Republic of); Zygmunt K. Gryczynski, Texas Christian Univ. (USA); Ignacy Gryczynski, Univ. of North Texas Health Science Ctr. at Fort Worth (USA); Bagher Tabibi, Hampton Univ. (USA) . . . . . [9768-41]

11:40 am: **Near-infrared light source composed of nitride-based light-emitting diode and Pr<sup>3+</sup>-doped glass phosphor**, Yuya Ishinaga, Motoaki Iwaya, Tetsuya Takeuchi, Satoshi Kamiyama, Isamu Akasaki, Meijo Univ. (Japan); Shingo Fuchi, Aoyama Gakuin Univ. (Japan) . . . . . [9768-42]

Lunch/Exhibition Break . . . . . Wed 12:00 pm to 1:20 pm

## SESSION 10

LOCATION: ROOM 309 (SOUTH ESPLANADE) . WED 1:20 TO 3:10 PM

### LED Manufacturing II

Session Chair: **William Fenwick**,

Toshiba America Electronic Components, Inc. (USA)

1:20 pm: **State of the art process control of MOCVD growth for LEDs and other devices** (*Invited Paper*), Kolja Haberland, LayTec AG (Germany) [9768-43]

1:50 pm: **Blue LED manufacturing optimization based on a MOCVD growth parameter sensitivity study**, E. Sakalauskas, X. Chen, O. Feron, H. Behmenburg, R. Leiers, Markus Luenenburger, P. Lauffer, A. R. Boyd, J. Lindner, Michael Heuken, AIXTRON SE (Germany) . . . . . [9768-44]

2:10 pm: **Enhanced optical layers for LED manufacturing using pulsed laser deposition production equipment**, Matthijn Dekkers, SolMateS B.V. (Netherlands) . . . . . [9768-45]

2:30 pm: **Significant Improvement of GaN crystal quality with ex-situ Sputtered AlN nucleation layers**, Shuo-Wei Chen, National Chiao Tung Univ. (Taiwan) and Epistar Corp. (Taiwan); Young Yang, Wei-Chih Wen, Epistar Corp. (Taiwan); Tien-Chang Lu, National Chiao Tung Univ. (Taiwan) . . . . . [9768-46]

2:50 pm: **Aging behavior, reliability and failure physics of GaN-based optoelectronic components** (*Invited Paper*), Enrico Zanoni, Matteo Meneghini, Gaudenzio Meneghesso, Univ. degli Studi di Padova (Italy) . . . . . [9768-64]

Coffee Break . . . . . Wed 3:10 pm to 3:30 pm

## SESSION 11

LOCATION: ROOM 309 (SOUTH ESPLANADE) . WED 3:30 TO 6:10 PM

### Novel Substrates for LED Epistucture Growth and Green to Red LEDs

Session Chair: **Axel Hoffmann**, Technische Univ. Berlin (Germany)

3:30 pm: **Semipolar GaN on patterned-sapphire substrates: towards exploitable LED substrates** (*Invited Paper*), Jesus Zuniga-Perez, Lars Kappel, Philippe De Mierry, Florian Tendille, Ctr. de Recherche sur l'Hétéro-Epitaxie et ses Applications (France); Maxim Korytov, Nikolay Cherkashin, Ctr. d'Elaboration de Matériaux et d'Etudes Structurales (France); Philippe Vennéguès, Mathieu Leroux, Ctr. de Recherche sur l'Hétéro-Epitaxie et ses Applications (France) . . . . . [9768-47]

4:00 pm: **Development of (11-22) semipolar LEDs on GaN templates** (*Invited Paper*), Brian Corbett, Zhiheng Quan, Duc V. Dinh, Donagh O'Mahony, Tyndall National Institute (Ireland) and Univ. College Cork (Ireland); Marian Caliebe, Klaus Thonke, Ferdinand Scholz, Univ. Ulm (Germany); Markus Pristovsek, Yisong Han, Colin J. Humphreys, Univ. of Cambridge (United Kingdom); Frank Brunner, Ferdinand-Braun-Institut (Germany); Tobias M. Meyer, OSRAM Opto Semiconductors GmbH (Germany); Liverios Lymperakis, Max-Planck-Institut für Eisenforschung GmbH (Germany); Pleun Maaskant, Tyndall National Institute (Ireland) and Univ. College Cork (Ireland) . . . . [9768-48]

4:30 pm: **I-to- $\chi$  bandgap cross-over in (In,Ga,Al)P epilayers grown on (100) and high-index GaAs substrates**, Sarah Schlichting, Christian Nienstiel, Felix Nippert, Technische Univ. Berlin (Germany); Nikolay N. Ledentsov, Vitaly A. Shchukin, VI Systems GmbH (Germany); Jari Lyytikäinen, Oleg G. Okhotnikov, Tampere Univ. of Technology (Finland); Yuri M. Shernyakov, Alexey S. Payusov, Nikita Y. Gordeev, Mikhail V. Maximov, Ioffe Physical-Technical Institute (Russian Federation); Axel Hoffmann, Technische Univ. Berlin (Germany) . . . . . [9768-49]

4:50 pm: **Room temperature green to red electroluminescence from (Al,Ga)As/GaP QDs and QWs**, Christian Golz, Shabnam Dadgostar, W. Ted Masselink, Fariba Hatami, Humboldt-Univ. zu Berlin (Germany) . . . . . [9768-50]

OPTO

# CONFERENCE 9768

LOCATION: ROOM 309 (SOUTH ESPLANADE)

5:10 pm: **Red and yellow-green InGaP light-emitting diodes epitaxially grown on Ge-on-Si and SiGe/Si substrates**, Bing Wang, Singapore-MIT Alliance (Singapore); Cong Wang, Nanyang Technological Univ. (Singapore); Kwang Hong Lee, Singapore-MIT Alliance (Singapore); Shuyu Bao, Nanyang Technological Univ. (Singapore); Kenneth Eng Kian Lee, Singapore-MIT Alliance (Singapore); Chuan Seng Tan, Soon Fatt Yoon, Nanyang Technological Univ. (Singapore); Eugene A. Fitzgerald, Jurgen Michel, Massachusetts Institute of Technology (USA) . . . . . [9768-51]

5:30 pm: **InAlGaP red-emitting LEDs under extremely high-pulsed pumping**, Ilya E. Titkov, Aston Univ. (United Kingdom); Grigorii S. Sokolovskii, Ioffe Physical-Technical Institute (Russian Federation); Sergey Y. Karpov, STR Group-Soft Impact Ltd. (Russian Federation); Vladislav V. Dudevlev, Ioffe Physical-Technical Institute (Russian Federation); Ksenya K. Soboleva, Saint-Petersburg State Polytechnical Univ. (Russian Federation); Amit Yadav, Aston Univ. (United Kingdom); Martin Strassburg, Ines Pietzonka, Hans-Jürgen Lugauer, OSRAM Opto Semiconductors GmbH (Germany); Edik U. Rafailov, Aston Univ. (United Kingdom) . . . . . [9768-52]

5:50 pm: **Efficiency improvement of AlGaInP-based LEDs via hollow hemisphere polystyrene array**, Ray-Hua Horng, Wen-Ching Cheng, Dong-Sing Wu, National Chung Hsing Univ. (Taiwan) . . . . . [9768-53]

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Design and implementation of a deception jamming system for laser receivers**, Ahmed S. Bahgat, Ashraf F. El-Sherif, Yaser H. El-Sharkawy, Military Technical College (Egypt) . . . . . [9768-54]

**Do we need to recalibrate our strategy in LED technology given its low efficiency?**, Volodymyr K. Malyutenko, Oleg Y. Malyutenko, V.E. Lashkaryov Institute of Semiconductor Physics (Ukraine) . . . . . [9768-55]

**Theoretical simulations of GaN-based tunnel-junction light-emitting diodes**, Jih-Yuan Chang, National Changhua Univ. of Education (Taiwan); Ya-Hsuan Shih, National Cheng Kung Univ. (Taiwan); Fang-Ming Chen, Yen-Kuang Kuo, National Changhua Univ. of Education (Taiwan) . . . . . [9768-56]

**Improved performance of AlGaIn-based ultraviolet light-emitting diodes with conducting filament-embedded AlN/ITO hybrid electrodes**, Kyeong Heon Kim, Ju Hyun Park, Byeong Ryong Lee, Tae Ho Lee, Tae Geun Kim, Korea Univ. (Korea, Republic of) . . . . . [9768-57]

**Growth and photoluminescence properties of Au- or N-doped iron disilicide**, Kensuke Akiyama, Kanagawa Industrial Technology Ctr. (Japan); Hiroshi Funakubo, Tokyo Institute of Technology (Japan) . . . . . [9768-58]

**Modeling of novel hybrid photonic crystal structures involving cured hydrogen silsesquioxane pillars for improving the light extraction in light-emitting diodes**, Anand Kadiyala, Jeremy M. Dawson, West Virginia Univ. (USA) . . . . . [9768-60]

**Defect-mediated Purcell enhancement of plasmon-coupled CuInS<sub>2</sub> and CuInS<sub>2</sub>/ZnS**, Quinton Rice, Jaetae Seo, Hampton Univ. (USA); Sangram Raut, Rahul Chib, Univ. of North Texas Health Science Ctr. at Fort Worth (USA); Anderson Hayes, Hampton Univ. (USA); Zygmunt K. Gryczynski, Texas Christian Univ. (USA); Ignacy Gryczynski, Univ. of North Texas Health Science Ctr. at Fort Worth (USA); Young-Kuk Kim, Korea Institute of Materials Science (Korea, Republic of); Bagher Tabibi, Hampton Univ. (USA) . . . . . [9768-61]

**Interfacial coatings and glass modification for highly luminescent phosphor glass composite plates in white LEDs**, Young-Kuk Kim, Jong-Woo Moon, Young-Jo Park, Jin-Myung Kim, Korea Institute of Materials Science (Korea, Republic of) . . . . . [9768-62]



# CONFERENCE 9769

LOCATION: ROOM 305 (SOUTH ESPLANADE)

Tuesday–Wednesday 16–17 February 2016 • Proceedings of SPIE Vol. 9769

# Emerging Liquid Crystal Technologies XI

Conference Chair: **Liang-Chy Chien**, Kent State Univ. (USA)

Conference Co-Chairs: **Dick J. Broer**, Technische Univ. Eindhoven (Netherlands); **Hirotsugu Kikuchi**, Kyushu Univ. (Japan); **Nelson V. Tabiryan**, BEAM Engineering for Advanced Measurements Co. (USA)

Program Committee: **Vladimir G. Chigrinov**, Hong Kong Univ. of Science and Technology (Hong Kong, China); **Harry J. Coles**, Univ. of Cambridge (United Kingdom); **Antonio Martins Figueiredo Neto**, Univ. de São Paulo (Brazil); **Andy Y. G. Fuh**, National Cheng Kung Univ. (Taiwan); **Heinz S. Kitzerow**, Univ. Paderborn (Germany); **Jan P. Lagerwall**, Univ. du Luxembourg (Luxembourg); **Yi-Hsin Lin**, National Chiao Tung Univ. (Taiwan); **Kristiaan Neyts**, Univ. Gent (Belgium); **Masanori Ozaki**, Osaka Univ. (Japan); **Ci-Ling Pan**, National Tsing Hua Univ. (Taiwan); **Miha Ravnik**, Univ. of Ljubljana (Slovenia); **Ivan I. Smalyukh**, Univ. of Colorado at Boulder (USA); **Timothy J. White**, Air Force Research Lab. (USA); **Ming Hsien Wu**, Hamamatsu Corp. (USA); **Shin-Tson Wu**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); **Huai Yang**, Peking Univ. (China); **Tae-Hoon Yoon**, Pusan National Univ. (Korea, Republic of); **Yanlei Yu**, Fudan Univ. (China)

## TUESDAY 16 FEBRUARY

### SESSION 1

LOCATION: ROOM 305 (SOUTH ESPLANADE) . TUE 8:30 TO 10:10 AM

### Optical Control and Modulation

Session Chairs: **Cesare Umeton**, Univ. della Calabria (Italy); **Antonio M. Figueiredo Neto**, Univ. de São Paulo (Brazil)

8:30 am: **Fast and ultrafast all-optical control of light in nematic liquid crystals** (*Keynote Presentation*), Igor Muševič, Jožef Stefan Institute (Slovenia), Univ. of Ljubljana (Slovenia) . . . . . [9769-1]

9:05 am: **Smart optical vortex coronagraphy from liquid crystal defects** (*Invited Paper*), Etienne Brasselet, Artur Aleksanyan, Univ. Bordeaux 1 (France) . . . . . [9769-2]

9:30 am: **Plasmonic color tuning** (*Invited Paper*), Byoung-ho Lee, Hansik Yun, Seung-Yeol Lee, Seoul National Univ. (Korea, Republic of); Hwi Kim, Korea Univ. Sejong Campus (Korea, Republic of) . . . . . [9769-3]

9:55 am: **Application of resonant soft x-ray scattering at carbon edge in liquid crystals**, Chenhui Zhu, Anthony Young, Cheng Wang, Alexander Hexemer, Lawrence Berkeley National Lab. (USA); David Walba, Noel Clark, Univ. of Colorado at Boulder (USA); Quan Li, Oleg D. Lavrentovich, Liquid Crystal Institute (USA) . . . . . [9769-4]

Coffee Break . . . . . Tue 10:10 am to 10:30 am

### SESSION 2

LOCATION: ROOM 305 (SOUTH ESPLANADE) TUE 10:30 AM TO 12:00 PM

### Blue Phases and Applications

Session Chairs: **Dirk J. Broer**, Technische Univ. Eindhoven (Netherlands); **Jan P. F. Lagerwall**, Univ. du Luxembourg (Luxembourg)

10:30 am: **Calculation of confocal microscope images of cholesteric blue phases** (*Invited Paper*), Jun-ichi Fukuda, National Institute of Advanced Industrial Science and Technology (Japan); Yasushi Okumura, Hirotsugu Kikuchi, Kyushu Univ. (Japan) . . . . . [9769-5]

10:55 am: **Photonic band-gap manipulation of blue phase liquid crystal** (*Invited Paper*), Tsung-Hsien Lin, National Sun Yat-Sen Univ. (Taiwan) . . . . . [9769-6]

11:20 am: **Real-space observation of cholesteric blue phase structure carried out by transmission electron microscopy** (*Invited Paper*), Masanori Ozaki, Shu Tanaka, Yuto Kawata, Ryusuke Kuwahara, Ryuji Nishi, Hiroyuki Yoshida, Osaka Univ. (Japan) . . . . . [9769-7]

11:45 am: **Visualization of topological defects in wide-temperature amorphous blue phase enabled by polymer molding**, Min Su Kim, Liang-Chy Chien, Liquid Crystal Institute (USA) . . . . . [9769-8]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:30 pm

### SESSION 3

LOCATION: ROOM 305 (SOUTH ESPLANADE) . . TUE 1:30 TO 3:20 PM

### Optical Manipulation and Imaging

Session Chairs: **Etienne Brasselet**, Univ. Bordeaux 1 (France); **Masanori Ozaki**, Osaka Univ. (Japan)

1:30 pm: **Light-modulated patterns of plasmonic, upconversion, and graphene nanoparticles in liquid crystals** (*Keynote Presentation*), Ivan I. Smalyukh, Univ. of Colorado at Boulder (USA) . . . . . [9769-9]

2:05 pm: **Photonic crystals from regular nematic superstructures** (*Invited Paper*), Miha Ravnik, Univ. of Ljubljana (Slovenia) and Jožef Stefan Institute (Slovenia); Mitja Stimulak, Univ. of Ljubljana (Slovenia) . . . . . [9769-10]

2:30 pm: **Nematic liquid crystals used to control photo-thermal effects in gold nanoparticles** (*Invited Paper*), Cesare Umeton, Univ. della Calabria (Italy) . . . . . [9769-11]

2:55 pm: **Nanoscale imaging of defects in layered liquid crystals** (*Invited Paper*), Antal I. Jákli, Liquid Crystal Institute (USA); Cuiyu Zhang, Kent State Univ. (USA); Oleg D. Lavrentovich, Liquid Crystal Institute (USA) . . . . . [9769-12]

Coffee Break . . . . . Tue 3:20 pm to 3:50 pm

### SESSION 4

LOCATION: ROOM 305 (SOUTH ESPLANADE) . . TUE 3:50 TO 5:45 PM

### Lenses and Spatial Light Modulators

Session Chairs: **Vladimir Grigorievich Chigrinov**, Hong Kong Univ. of Science and Technology (Hong Kong, China); **Slobodan Žumer**, Univ. of Ljubljana (Slovenia)

3:50 pm: **Liquid crystals enable adaptive imaging with miniature cameras** (*Invited Paper*), Tigran Galstian, Univ. Laval (Canada) . . . . . [9769-13]

4:15 pm: **LC-lens array with light field algorithm for 3D biomedical applications** (*Invited Paper*), Yi-Pai Huang, Po-Yuan Hsieh, Amir Hassanfiroozi, National Chiao Tung Univ. (Taiwan); Manuel Martinez, Univ. de València (Spain); Bahram Javidi, Univ. of Connecticut (USA) . . . . . [9769-14]

4:40 pm: **Superlens in the skies: Liquid crystal polymer telescope technology development** (*Invited Paper*), Nelson V. Tabiryan, Svetlana V. Serak, David Roberts, Zhi Liao, BEAM Engineering For Advanced Measurements Co. (USA); Eugene Serabyn, Jet Propulsion Lab. (USA); Diane M. Steeves, Brian R. Kimball, U.S. Army Natick Soldier Research, Development and Engineering Ctr. (USA) . . . . . [9769-15]

5:05 pm: **liquid crystal polymer optics in astronomy** (*Invited Paper*), Eugene Serabyn, Jet Propulsion Lab. (USA) . . . . . [9769-16]

5:30 pm: **Field-induced diffraction in polymer-stabilized in-plane switching liquid crystals with vertical alignment**, Libo Weng, Liquid Crystal Institute (USA); Seung Hee Lee, Chonbuk National Univ. (Korea, Republic of); Liang-Chy Chien, Kent State Univ. (USA) . . . . . [9769-17]

OPTO

# CONFERENCE 9769

LOCATION: ROOM 305 (SOUTH ESPLANADE)

WEDNESDAY 17 FEBRUARY

## SESSION 5

LOCATION: ROOM 305 (SOUTH ESPLANADE) WED 8:30 TO 10:20 AM

### Photo-Alignment and Photo-active Materials

Session Chairs: **Igor Muševic**, Jožef Stefan Institute (Slovenia);  
**Ivan I. Smalyukh**, Univ. of Colorado at Boulder (USA)

8:30 am: **Photo-aligning and photo-patterning technology: applications in displays and photonics** (*Keynote Presentation*), Vladimir G. Chigrinov, Hong Kong Univ. of Science and Technology (Hong Kong, China). [9769-18]

9:05 am: **Morphing dynamics in light-triggered liquid crystal network coatings** (*Invited Paper*), Dirk J. Broer, Danqing Liu, Technische Univ. Eindhoven (Netherlands) . . . . . [9769-19]

9:30 am: **New architecture of liquid crystal-based lenticular lenses in index matching approach for display applications** (*Invited Paper*), Sin-Doo Lee, Jiyeon Kim, Hyungjin Kim, Chiwoo Kim, Seoul National Univ. (Korea, Republic of) . . . . . [9769-20]

9:55 am: **Liquid crystal photo-alignment technology for singular optics applications** (*Invited Paper*), Yan-Qing Lu, Wei Hu, Nanjing Univ. (China) . . . . . [9769-21]

Coffee Break . . . . . Wed 10:20 am to 10:50 am

## SESSION 6

LOCATION: RM 305 (SOUTH ESPLANADE) . . WED 10:50 AM TO 12:20 PM

### Electro-Optical Processes

Session Chairs: **Tae-Hoon Yoon**, Pusan National Univ. (Korea, Republic of); **Yi-Hsin Lin**, National Chiao Tung Univ. (Taiwan)

10:50 am: **Transiently separable high-speed response component in cholesteric liquid crystals** (*Invited Paper*), Yo Inoue, Hiroshi Moritake, National Defense Academy (Japan) . . . . . [9769-22]

11:15 am: **Light guiding, reshaping, and imaging of complex nematic structures** (*Invited Paper*), Slobodan Žumer, Univ. of Ljubljana (Slovenia), Jožef Stefan Institute (Slovenia); Miha Cancula, Simon Čopar, Univ. of Ljubljana (Slovenia); Miha Ravnik, Univ. of Ljubljana (Slovenia), Jožef Stefan Institute (Slovenia) . . . . . [9769-23]

11:40 am: **Liquid crystal devices with continuous phase variation based on high-permittivity dielectrics** (*Invited Paper*), Oliver Willekens, John P. George, Jeroen Beeckman, Kristiaan Neys, Univ. Gent (Belgium) . . . . . [9769-24]

12:05 pm: **Confinement-sensitive optical response of cholesteric liquid crystals in electrospun fibers**, Eva Enz, Martin-Luther-Univ. Halle-Wittenberg (Germany); Vera LaFerrara, ENEA (Italy); Jan P. F. Lagerwall, Giusy Scalia, Univ. du Luxembourg (Luxembourg) . . . . . [9769-25]

Lunch/Exhibition Break . . . . . Wed 12:20 pm to 1:50 pm

## SESSION 7

LOCATION: ROOM 305 (SOUTH ESPLANADE) . WED 1:50 TO 3:10 PM

### Novel Photonic Materials I

Session Chairs: **Yan-Qing Lu**, Nanjing Univ. (China); **Jun-ichi Fukuda**, National Institute of Advanced Industrial Science and Technology (Japan)

1:50 pm: **Crossover positive biaxial nematic to negative biaxial nematic phase in lyotropic liquid crystals** (*Invited Paper*), Antonio M. Figueiredo Neto, Univ. de São Paulo (Brazil); Erol Akpınar, Abant İzzet Baysal Univ. (Turkey); Dennys Reis, Univ. de São Paulo (Brazil) . . . . . [9769-26]

2:15 pm: **Highly anisotropic nanowires from the self-assembly of discotic liquid crystals** (*Invited Paper*), Ji Hyun Park, Seoul National Univ. (Korea, Republic of); Yoichi Takanishi, Kyoto Univ. (Japan); Massimiliano Labardi, Univ. di Pisa (Italy); Kyung Ho Kim, Youn Sang Kim, Yung Woo Park, Seoul National Univ. (Korea, Republic of); Jan P. F. Lagerwall, Univ. du Luxembourg (Luxembourg) and Seoul National Univ. (Korea, Republic of); Jun Yamamoto, Kyoto Univ. (Japan); Giusy Scalia, Univ. du Luxembourg (Luxembourg) and Seoul National Univ. (Korea, Republic of) . . . . . [9769-27]

2:40 pm: **Optimizing cholesteric liquid crystal shells for photonic applications**, Yong Geng, JungHyun Noh, Jan P. F. Lagerwall, Univ. du Luxembourg (Luxembourg) . . . . . [9769-28]

2:55 pm: **Templated chiral liquid crystalline structures for lasers and stretchable gels**, Stephen Morris, Univ. of Oxford (United Kingdom) . . [9769-29]

Coffee Break . . . . . Wed 3:10 pm to 3:40 pm

LOCATION: ROOM 305 (SOUTH ESPLANADE) .WED 3:40 TO 6:05 PM

### Novel Photonic Materials II

Session Chairs: **Timothy J. White**, Air Force Research Lab. (USA);  
**Giusy Scalia**, Univ. du Luxembourg (Luxembourg)

3:40 pm: **Liquid crystal light shutters for simultaneous control of haze and transmittance** (*Invited Paper*), Tae-Hoon Yoon, Jae-Won Huh, Joon Heo, Byeong-Hun Yu, Pusan National Univ. (Korea, Republic of) . . . . . [9769-30]

4:05 pm: **Liquid crystal alignment on ZnO nanostructure films** (*Invited Paper*), Shie-Chang Jeng, Mu-Zhe Chen, Yueh-Feng Chung, Jia-Wei Hu, Sheng-Hsiung Yang, National Chiao Tung Univ. (Taiwan) . . . . . [9769-31]

4:30 pm: **Actuators and sensors based on polymerized liquid crystal monomers** (*Invited Paper*), Albert Schenning, Technische Univ. Eindhoven (Netherlands) . . . . . [9769-32]

4:55 pm: **Optical polymers with negative photo-elastic property for display applications**, Weijun Zhou, The Dow Chemical Co. (USA); Shih-Wei Chang, Dow Electronic Materials (USA); Jie Feng, The Dow Chemical Co. (USA); Kathleen O'Connell, Dow Chemical Korea Ltd (Korea, Republic of) . . . [9769-33]

5:10 pm: **Electrical control of reflection wavelength and bandwidth in cholesteric liquid crystals**, Timothy J. White, Kyung Min Lee, Vincent P. Tondiglia, Air Force Research Lab. (USA) . . . . . [9769-34]

5:25 pm: **Spontaneous slippery interfaces created by the interface melting effect**, Masumi Yamashita, Yoichi Takanishi, Jun Yamamoto, Kyoto Univ. (Japan) . . . . . [9769-35]

5:40 pm: **Continuous phase modulation in polymer-stabilized liquid crystals** (*Invited Paper*), Alexander Lorenz, Univ. Paderborn (Germany); L. Braun, V. Kolosova, Technische Univ. Berlin (Germany); R. Hyman, Timothy D. Wilkinson, Univ. of Cambridge (United Kingdom) . . . . . [9769-36]

## POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.

**Photo-electrically tunable liquid-crystal Fresnel lens with Sagnac interferometer**, Chie-Tong Kuo, Shih-Hung Lin, Bing-Yau Huang, Jian-Yu Lee, Chun-Lung Chen, National Sun Yat-Sen Univ. (Taiwan) . . . . . [9769-38]

**Bistable light shutter using dye-doped liquid crystals for a see-through display**, Jae-Won Huh, Tae-Hoon Yoon, Joon Heo, Byeong-Hun Yu, Pusan National Univ. (Korea, Republic of) . . . . . [9769-39]

**Observation of thermally induced movement of a beam deflected by a liquid crystal spatial light modulator**, Bosanta R. Boruah, Santanu Konwar, Indian Institute of Technology Guwahati (India) . . . . . [9769-40]

**Electro-magnetic simulation of image quality of near-eye displays containing surface gratings or holographic gratings**, Hagen Schweitzer, Daniel Asoubar, Michael Kuhn, LightTrans GmbH (Germany); Christian Hellmann, Wyrowski Photonics UG (Germany); Frank Wyrowski, Friedrich-Schiller-Univ. Jena (Germany) . . . . . [9769-41]

**Design and synthesis of temperature-independent zero-birefringence polymer**, Mio D. Shikanai, Akihiro Tagaya, Yasuhiro Koike, Keio Univ. (Japan) . . . . . [9769-42]

**Nanotube networks in liquid crystals**, Stefan Schymura, Helmholtz-Zentrum Dresden-Rossendorf e. V. (Germany) and Martin-Luther-Univ. Halle-Wittenberg (Germany); Jan P. F. Lagerwall, Giusy Scalia, Univ. du Luxembourg (Luxembourg) . . . . . [9769-43]

**Numerical analysis of polarization gratings using the rigorous coupled wave analysis method**, Xiao Xiang, North Carolina State Univ. (USA) . [9769-44]

**Dielectrophoretic manipulation of nematic and isotropic droplets**, Bomi Lee, Jang-Kun Song, Sungkyunkwan Univ. (Korea, Republic of) . . . . . [9769-45]

**Narrow band pass filter using Birefringence film and quarter-wave film**, Dong-Kun Lee, Jang-Kun Song, Sungkyunkwan Univ. (Korea, Republic of) . . . . . [9769-46]

# CONFERENCE 9770

LOCATION: ROOM 305 (SOUTH ESPLANADE)

Thursday 18 February 2016 • Proceedings of SPIE Vol. 9770

# Advances in Display Technologies VI

Conference Chairs: **Liang-Chy Chien**, Kent State Univ. (USA); **Sin-Doo Lee**, Seoul National Univ. (Korea, Republic of); **Ming Hsien Wu**, Hamamatsu Corp. (USA)

Program Committee: **Karlheinz Blankenbach**, Pforzheim Univ. (Germany); **Pierre M. Boher**, ELDIM (France); **Cheng-Huan Chen**, National Tsing Hua Univ. (Taiwan); **Chin Hsin Chen**, National Chiao Tung Univ. (Taiwan); **Janglin Chen**, Industrial Technology Research Institute (Taiwan); **Jurgen H. Daniel**, PARC, A Xerox Co. (USA); **Paul S. Drzaic**, Apple Inc. (USA); **Mark Fihn**, Veritas et Visus (USA); **Norbert Fruehauf**, Univ. Stuttgart (Germany); **Nobuyuki Hashimoto**, Citizen Holdings Co., Ltd. (Japan); **Klaus Hecker**, VDMA (Germany); **Jason C. Heikenfeld**, Univ. of Cincinnati (USA); **Alex Henzen**, IRX-Innovations B.V. (Netherlands); **Yi-Pai Huang**, National Chiao Tung Univ. (Taiwan); **Lachezar Komitov**, Univ. of Gothenburg (Sweden); **ByoungHo Lee**, Seoul National Univ. (Korea, Republic of); **Kars-Michiel H. Lenssen**, Philips Research Nederland B.V. (Netherlands); **Akihiro Mochizuki**, i-CORE Technology, LLC (USA); **Keith Rollins**, DuPont Teijin Films U.K. Ltd. (United Kingdom); **Ryo Sakurai**, Bridgestone Corp. (Japan); **Robert A. Sprague**, Amazon Lab126 (USA); **Andrew J. Stecki**, Univ. of Cincinnati (USA); **Yikai Su**, Shanghai Jiao Tong Univ. (China); **Qiong-Hua Wang**, Sichuan Univ. (China); **Michael Wittek**, Merck KGaA (Germany); **Tae-Hoon Yoon**, Pusan National Univ. (Korea, Republic of)

## THURSDAY 18 FEBRUARY

### SESSION 1

LOCATION: ROOM 305 (SOUTH ESPLANADE) THU 8:00 TO 10:10 AM

### New Display Technologies

Session Chair: **Akihiro Mochizuki**, i-CORE Technology, LLC (USA)

8:00 am: **Emissive and reflective properties of curved displays in relation to image quality** (*Invited Paper*), Pierre M. Boher, Thierry Leroux, Thibault Bignon, Véronique Collomb-Patton, ELDIM (France); Pierre Blanc, Labs. d'Essai de la FNAC (France); Etienne Sandré-Chardonnel, Eclat Digital Recherche (France) . . . . . [9770-1]

8:30 am: **See-through autostereoscopic 3D display with visual tracking**, Jong-Young Hong, Soon-gi Park, Jonghyun Kim, Chang-Kun Lee, Seoul National Univ. (Korea, Republic of); Kyung-Hoon Cha, Ki Hyung Kang, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); ByoungHo Lee, Seoul National Univ. (Korea, Republic of) . . . . . [9770-2]

8:50 am: **Feasibility study on the use of liquid crystal/dye cells for digital signage**, Shunsuke Itaya, Nada Dianah Binti M. Azumi, Masamichi Ohta, Shintaro Ozawa, Ichiro Fujieda, Ritsumeikan Univ. (Japan) . . . . . [9770-3]

9:10 am: **Autostereoscopic display concept with time-sequential wavelength-selective filter barrier**, Silvio Jurk, Mathias Kuhlmeier, Roland Bartmann, Bernd Duckstein, René de la Barré, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut (Germany) . . . . . [9770-4]

9:30 am: **Super multi-view display for analyze human cognition**, Chulwoong Lee, Sung-Jin Lim, Hosung Jeon, Joonku Hahn, Kyungpook National University (Korea, Republic of) . . . . . [9770-5]

9:50 am: **The synthesis and display of digital stereoscopic wayang kulit shadow images**, Gea O. Parikesit, Univ. Gadjah Mada (Indonesia) . . . . . [9770-6]  
Coffee Break . . . . . Thu 10:10 am to 10:40 am

### SESSION 2

LOCATION: RM 305 (SOUTH ESPLANADE) . . . THU 10:40 AM TO 12:00 PM

### Projection Screen and Moire Reduction

Session Chair: **Ming Hsien Wu**, Hamamatsu Corp. (USA)

10:40 am: **Brightness property of micro-capsules diffuser screen in laser projection display**, Jun Kondo, Satoru Okagaki, Kuniko Kojima, Yuzo Nakano, Akihisa Miyata, Mitsubishi Electric Corp. (Japan) . . . . . [9770-7]

11:00 am: **A novel screen design for anti-ambient light front projection display with angle-selective absorber**, Tianju Liao, Peking Univ. (China); Weigang Chen, Kebo He, The Chinese Univ. of Hong Kong, Shenzhen (China); Zhaoyu Zhang, Chinese Univ. of Hong Kong, Shenzhen (China) . . . . . [9770-8]

11:20 am: **Moiré reducing two-dimensional diffractive optical low-pass filter made from molded plastic**, Yosuke Sakohira, Kazuya Yamamoto, Makoto Okada, Nalux Co., Ltd. (Japan) . . . . . [9770-9]

11:40 am: **Moiré pattern visibility of touch sensor module with electrode mesh structure in oblique view**, Marzieh Pournoury, Samsung Electro-Mechanics (Korea, Republic of); Ali Zamiri, Korea Univ. (Korea, Republic of); Taeyoung Kim, Victor Yurlov, SAMSUNG Electro-Mechanics (Korea, Republic of); Kyunghwan K. Oh, Yonsei Univ. (Korea, Republic of) . . . . . [9770-10]

Lunch/Exhibition Break . . . . . Thu 12:00 pm to 1:30 pm

### SESSION 3

LOCATION: ROOM 305 (SOUTH ESPLANADE) . . THU 1:30 TO 2:50 PM

### 3D, Holographic, and HM Displays

Session Chairs: **Ming Hsien Wu**, Hamamatsu Corp. (USA); **Liang-Chy Chien**, Kent State Univ. (USA)

1:30 pm: **Dual-view 3D displays based on integral imaging** (*Invited Paper*), Qiong-Hua Wang, Huan Deng, Sichuan Univ. (China); Fei Wu, Chengdu Univ. of Technology (China) . . . . . [9770-11]

1:50 pm: **Fourier holographic display for augmented reality using holographic optical element**, ByoungHo Lee, Gang Li, Jinsoo Jeong, Jiwoon Yeom, Seoul National Univ. (Korea, Republic of) . . . . . [9770-12]

2:10 pm: **Master-oscillator power-amplifier in the red spectral range for holographic displays**, Gunnar Blume, Johannes Pohl, David Feise, Jörg Wiedmann, Peter Ressel, Bernd Eppich, Alexander Sahn, Arnim Ginolas, Oliver Nedow, Maik Jendrzewski, Pia Johne, Julian Hofmann, Bernd Sumpf, Götz Erbert, Katrin Paschke, Ferdinand-Braun-Institut (Germany) . . . . . [9770-13]

2:30 pm: **Lightweight high-brightness helmet-mounted head-up display system**, Mathieu Wagner, Thibault North, Stéphane Bourquin, Haute Ecole Spécialisée de Suisse occidentale (Switzerland); Lucio Kilcher, Lemoptix (Switzerland) . . . . . [9770-14]

Coffee Break . . . . . Thu 2:50 pm to 3:20 pm

### SESSION 4

LOCATION: ROOM 305 (SOUTH ESPLANADE) . . THU 3:20 TO 4:20 PM

### Driving Algorithm and Electronics

Session Chair: **Qiong-Hua Wang**, Sichuan Univ. (China)

3:20 pm: **A portable intra-oral scanner based on sine-wave phase-shifting digital projection from MIRDC**, Chia-Ming Jan, Metal Industries Research & Development Ctr. (Taiwan) . . . . . [9770-15]

3:40 pm: **Fully transparent thin film transistors based on zinc oxide channel layer and molybdenum doped indium oxide electrodes**, Mateusz T. Madzik, Elangovan Elamurugu, Jaime Viegas, Masdar Institute of Science & Technology (United Arab Emirates) . . . . . [9770-16]

4:00 pm: **Additive direct printing for silver nanowire electrode array**, Yeongjun Lee, Sung-Yong Min, Su-Hun Jeong, Tae-Sik Kim, POSTECH (Korea, Republic of); Ju Yeon Won, Inha University (Korea, Republic of); Hobeom Kim, POSTECH (Korea, Republic of); Jae Kyeong Jeong, Inha University (Korea, Republic of); Tae-Woo Lee, POSTECH (Korea, Republic of) . . . . . [9770-17]



# CONFERENCE 9771

LOCATION: ROOM 307 (SOUTH ESPLANADE)

Monday–Tuesday 15–16 February 2016 • Proceedings of SPIE Vol. 9771

# Practical Holography XXX: Materials and Applications

Conference Chairs: **Hans I. Bjelkhagen**, Glyndwr Univ. (United Kingdom), Hansholo Consulting Ltd. (United Kingdom);  
**V. Michael Bove Jr.**, MIT Media Lab. (USA)

Program Committee: **Frank C. Fan**, Shenzhen AFC Technology Co., Ltd. (China); **Gerald L. Heidt**, Wasatch Photonics, Inc. (USA);  
**Toshio Honda**, Toppan Printing Co., Ltd. (Japan); **Fujio Iwata**, Toppan Printing Co., Ltd. (Japan); **Michael A. Klug**, Magic Leap, Inc. (USA);  
**Alkiviadis Lembessis**, The Hellenic Institute of Holography (Greece); **Martina L. Mrongovius**, RMIT Univ. (Australia), Ctr. for the Holographic  
Arts (USA), Academy of Media Arts, Cologne KHM (Germany); **Martin J. Richardson**, De Montfort Univ. (United Kingdom);  
**Hiroshi Yoshikawa**, Nihon Univ. (Japan); **David Brotherton-Ratcliffe**, Geola Technologies Ltd. (United Kingdom)

## MONDAY 15 FEBRUARY

### OPTO Plenary Session

MON 8:00 AM TO 10:10 AM

LOCATION: ROOM 3009 (WEST LEVEL 3)

- 8:00 am: **Welcome and Opening Remarks**  
**Jean Emmanuel Broquin** IMEP-LAHC (France)  
**Shibin Jiang**, AdValue Photonics, Inc. (USA)
- 8:05 am: **Announcement of the Green Photonics Awards**  
**Stephen J. Eglash**, Stanford Data Science Initiative,  
Stanford Univ. (USA)
- 8:10 am: **Parity-time symmetry photonics**  
**Xiang Zhang**, Univ. of California, Berkeley (USA)
- 8:50 am: **Quantum nonlinear optics: nonlinear optics meets the quantum world**  
**Robert W. Boyd**, Univ. of Ottawa (Canada) and Univ. of  
Rochester (USA)
- 9:30 am: **Merging photonics with nanoelectronics**  
**Michael Liehr**, American Institute for Manufacturing of Integrated  
Photonics (USA) and Colleges of Nanoscale Science and  
Engineering, SUNY Polytechnic Institute (USA)

Coffee Break ..... Mon 10:10 am to 10:30 am

### SESSION 1

LOCATION: ROOM 307 (SOUTH ESPLANADE) MON 10:30 TO 11:50 AM

### Materials and Processes

Session Chair: **Hans I. Bjelkhagen**, Glyndwr Univ. (United Kingdom),  
Hansholo Consulting Ltd. (United Kingdom)

- 10:30 am: **Single-beam Denisyuk holograms recording with pulsed 30Hz RGB laser** (*Invited Paper*), Stanislovas J. Zacharovas, Ramunas Bakanas, Algimantas Stankauskas, Geola Digital uab (Lithuania) ..... [9771-1]
- 11:00 am: **Precision holographic optical elements in Bayfol® HX photopolymer** (*Invited Paper*), Friedrich-Karl Bruder, Thomas P. Fäcke, Rainer Hagen, Dennis Hönel, Enrico Orselli, Christian Rewitz, Thomas Rölle, Günther Walze, Bayer MaterialScience AG (Germany) ..... [9771-2]
- 11:30 am: **Dual-page reproduction with the reusing of a transmitted reference beam in holographic data storage**, Yutaro Katano, Tetsuhiko Muroi, Nobuhiro Kinoshita, Norihiko Ishii, Nobuo Saito, NHK Japan Broadcasting Corp. (Japan) ..... [9771-3]
- Lunch Break ..... Mon 11:50 am to 12:50 pm

### SESSION 2

LOCATION: ROOM 307 (SOUTH ESPLANADE) MON 12:50 TO 2:40 PM

### Holography, Art and Perception

Session Chair: **Hiroshi Yoshikawa**, Nihon Univ. (Japan)

- 12:50 pm: **Ultra-realistic imaging and OptoClones™**, Hans I. Bjelkhagen, Glyndwr Univ. (United Kingdom); Alkiviadis Lembessis, Andreas Sarakinos, The Hellenic Institute of Holography (Greece) ..... [9771-4]
- 1:20 pm: **holographic vision as an approach to reinterpret the concepts of the contemporary vision in sciences of visual arts**, Diaa Ahmed Mohamed Ahmedien, Univ. Bern (Switzerland) and Helwan Univ. (Egypt) ..... [9771-5]
- 1:40 pm: **Concurrent studies on artworks by digital speckle pattern interferometry and thermographic analysis**, Giovanni Arena, Pasquale Memmolo, Istituto di Scienze applicata e Sistemi Intelligenti (Italy); Giancarlo Fatigati, Mariangela Grilli, Univ. degli Studi Suor Orsola Benincasa (Italy); Melania Paturzo, Massimo Rippa, Pasquale Mormile, Pietro Ferraro, Istituto di Scienze applicata e Sistemi Intelligenti (Italy) ..... [9771-6]
- 2:00 pm: **Silent images in dialogue**, Maria Isabel Azevedo, Elizabeth Sandford-Richardson, Martin J. Richardson, De Montfort Univ. (United Kingdom); Luis Miguel Bernardo, Helder M. Crespo, Univ. do Porto (Portugal) ..... [9771-7]
- 2:20 pm: **The floating 3D language**, Yin-Ren Chang, Martin J. Richardson, De Montfort Univ. (United Kingdom) ..... [9771-8]

### SESSION 3

LOCATION: ROOM 307 (SOUTH ESPLANADE) .MON 2:40 TO 3:40 PM

### Applications I

Session Chair: **Gerald L. Heidt**, Wasatch Photonics, Inc. (USA)

- 2:40 pm: **Volume holographic optics for compressive imaging**, Sehoon Lim, Mark A. Neifeld, The Univ. of Arizona (USA) ..... [9771-9]
- 3:00 pm: **Development of 3D holographic endoscope**, Meriç Özcan, Sabanci Univ. (Turkey); Duygu O. Tayyar, Sabanci Univ. (Turkey) and Gebze Teknik Üniv. (Turkey) ..... [9771-10]
- 3:20 pm: **Virtual interferogram-generation algorithm for phase measurement using two interferograms**, Jin Nozawa, Atsushi Okamoto, Hokkaido Univ. (Japan); Masataka Toda, Yasuyuki Kuno, AISIN SEIKI Co., Ltd. (Japan); Akihisa Tomita, Hokkaido Univ. (Japan) ..... [9771-11]
- Coffee Break ..... Mon 3:40 pm to 4:00 pm



# CONFERENCE 9771

LOCATION: ROOM 307 (SOUTH ESPLANADE)

WEDNESDAY 17 FEBRUARY

## SESSION 4

LOCATION: ROOM 307 (SOUTH ESPLANADE) . MON 4:00 TO 6:10 PM

### Applications II

Session Chair: **Gerald L. Heidt**, Wasatch Photonics, Inc. (USA)

- 4:00 pm: **Holographic topography using acousto-optically-generated large synthetic wavelengths** (*Invited Paper*), Ujitha A. Abeywickrema, Diane Beamer, Partha P. Banerjee, Univ. of Dayton (USA); Ting-Chung Poon, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [9771-12]
- 4:30 pm: **Enhancing phase retrieval speed for real-time interferometer and ESPI by a continuous wavelet transform**, Chun-Hsiung Wang, Kuan-Yu Hsu, Chih-Kung Lee, National Taiwan Univ. (Taiwan) . . . . . [9771-13]
- 4:50 pm: **Holographic storage system based on digital holography for recording a phase data page in a compact optical setup**, Teruyoshi Nobukawa, Wakayama Univ. (Japan) and Japan Society for the Promotion of Science (Japan); Takanori Nomura, Wakayama Univ. (Japan) . . . . . [9771-14]
- 5:10 pm: **Holographic imaging through a scattering medium by diffuser assisted statistical averaging**, Michael Purcell, Manish Kumar, Stephen C. Rand, Univ. of Michigan (USA) . . . . . [9771-15]
- 5:30 pm: **Common path depth-filtered digital holography for high-resolution imaging of buried semiconductor structures**, Markus Finkeldey, Falk Schellenberg, Nils C. Gerhardt, Christof Paar, Martin R. Hofmann, Ruhr-Univ. Bochum (Germany) . . . . . [9771-16]
- 5:50 pm: **Investigation of particles located in the water by digital holography**, Victor V. Dyomin, Denis V. Kamenev, National Research Tomsk State Univ. (Russian Federation) . . . . . [9771-17]

## TUESDAY 16 FEBRUARY

### SESSION 5

LOCATION: ROOM 307 (SOUTH ESPLANADE) . TUE 8:30 TO 10:10 AM

### Digital Holography I

Session Chair: **V. Michael Bove Jr.**, MIT Media Lab. (USA)

- 8:30 am: **Study on the diffraction pattern and micro-mirror angle of digital micro-mirror device (DMD) for collinear holographic data storage system**, Yong Huang, Xiao Lin, Xiaotong Li, Yabin Cheng, Ke Xu, Guoguo Kang, Beijing Institute of Technology (China); Hideyoshi Horimai, Toyohashi Univ. of Technology (Japan); Xiaodi Tan, Beijing Institute of Technology (China) [9771-18]
- 8:50 am: **Invisibilization of speckles for computer-generated holographic stereogram-based on multi-view display**, Kengo Taira, Yasuhiro Takaki, Tokyo Univ. of Agriculture and Technology (Japan) . . . . . [9771-19]
- 9:10 am: **Gaze contingent hologram synthesis for holographic head-mounted-display**, Jisoo Hong, Youngmin Kim, Sunghye Hong, Hoonjong Kang, Korea Electronics Technology Institute (Korea, Republic of) . . . . . [9771-20]
- 9:30 am: **Progress in off-plane computer-generated waveguide holography for near-to-eye 3D display**, Sundeep Jolly, Nickolaos Savidis, Bianca Datta, V. Michael Bove Jr., MIT Media Lab. (USA); Daniel Smalley, Brigham Young Univ. (USA) . . . . . [9771-21]
- 9:50 am: **Practical issues in the application of phase-only computer generated hologram**, Yuanbo Deng, Univ. of Cambridge (United Kingdom); Daping Chu, Univ. of Cambridge (United Kingdom) . . . . . [9771-22]
- Coffee Break . . . . . Tue 10:00 am to 10:30 am

### SESSION 6

LOCATION: ROOM 307 (SOUTH ESPLANADE) TUE 10:30 AM TO 12:00 PM

### Digital Holography II

Session Chair: **Hiroshi Yoshikawa**, Nihon Univ. (Japan)

- 10:30 am: **Image quality evaluation and control of computer-generated holograms** (*Invited Paper*), Hiroshi Yoshikawa, Takeshi Yamaguchi, Hiroki Uetake, Nihon Univ. (Japan) . . . . . [9771-23]
- 11:00 am: **Efficient calculation method for realistic deep 3D scene hologram using orthographic projection**, Shunsuke Igarashi, Tomoya Nakamura, Tokyo Institute of Technology (Japan); Kyoji Matsushima, Kansai Univ. (Japan); Masahiro Yamaguchi, Tokyo Institute of Technology (Japan) . . . . . [9771-24]
- 11:20 am: **Decomposition method for acceleration of large scale CGH calculation on distributed computing machines**, Jackin Boaz Jessie, Shinpei Watanabe, Takeshi Ohkawa, Kanemitsu Ootsu, Takashi Yokota, Yoshio Hayasaki, Toyohiko Yatagai, Takanobu Baba, Utsunomiya Univ. (Japan) . . . . . [9771-25]
- 11:40 am: **Static and dynamic holographic 3D display based on large size materials**, Hongyue Gao, Jicheng Liu, Yingjie Yu, Shanghai Univ. (China) . . [9771-27]

### POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 ... WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

- Study of gratings with variable periods**, Arturo Olivares-Pérez, Israel Fuentes-Tapia, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Santa Toxqui-López, Benemérita Univ. Autónoma de Puebla (Micronesia, Federated States of); Mauricio Ortiz-Gutiérrez, Univ. Michoacana de San Nicolás de Hidalgo (Mexico); Jorge Ordóñez-Padilla, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Hildia Y. Mejias-Brisuela, Univ. Politécnica de Sinaloa (Mexico) . . . . . [9771-28]
- Holographic cells with random distribution and determined orientation**, Arturo Olivares-Pérez, Israel Fuentes-Tapia, Villa H. Joan-Manuel, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [9771-29]
- Holographic recording physicochemical mechanism for PVA-FeCl<sub>3</sub> + hv**, Jorge Ordóñez-Padilla, Arturo Olivares-Pérez, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [9771-30]
- Dynamic gratings recording in liquid crystal light valve in the infrared**, Konstantin Shcherbin, Igor A. Gvozdevskyy, The Institute of Physics (Ukraine); Dean R. Evans, Air Force Research Lab. (USA) . . . . . [9771-31]
- Preparation and characterization hexoses for holographic recording**, Nidia Y. Mejias-Brizuela, Univ. Politécnica de Sinaloa (Mexico); Arturo Olivares-Pérez, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [9771-32]
- Imaging polarimetry for phase change measurements of the cellophane film**, Mauricio Ortiz-Gutiérrez, Univ. Michoacana de San Nicolás de Hidalgo (Mexico); Arturo Olivares-Pérez, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Mario Pérez-Cortés, Univ. Autónoma de Yucatán (Mexico); Marco Antonio Salgado-Verduzco, Univ. Michoacana de San Nicolás de Hidalgo (Mexico) . . . . . [9771-33]
- Measurement of optical activity of honey bee**, Mauricio Ortiz-Gutiérrez, Univ. Michoacana de San Nicolás de Hidalgo (Mexico); Arturo Olivares-Pérez, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Juan Carlos Ibarra-Torres, Univ. de Guadalajara (Mexico); Marco Antonio Salgado-Verduzco, Univ. Michoacana de San Nicolás de Hidalgo (Mexico) . . . . . [9771-34]
- Optical design of cipher block chaining(CBC) encryption mode by using digital holography**, Sangkeun Gil, Univ. of Suwon (Korea, Republic of); Seok-Hee Jeon, Incheon National Univ. (Korea, Republic of); Jong-Rae Jung, Suwon Science College (Korea, Republic of) . . . . . [9771-35]
- Diffraction efficiency as function of temperature of holographic gratings into ethyl acetate as material holographic replication**, Santa Toxqui-López, Benemérita Univ. Autónoma de Puebla (Mexico); Arturo Olivares-Pérez, Israel Fuentes-Tapia, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [9771-36]
- 3D fingerprint analysis using transmission-mode multi-wavelength digital holographic topography**, Ujitha A. Abeywickrema, Partha P. Banerjee, Akash Kota, Univ. of Dayton (USA); Akhlesh Lakhtakia, Stephen E. Swiontek, The Pennsylvania State Univ. (USA) . . . . . [9771-37]

OPTO

# CONFERENCE 9772

LOCATION: ROOM 122 (NORTH EXHIBIT LEVEL)

Tuesday–Wednesday 16–17 February 2016 • Proceedings of SPIE Vol. 9772

# Broadband Access Communication Technologies X

Conference Chairs: **Benjamin B. Dingel**, Nasfine Photonics, Inc. (USA); **Katsutoshi Tsukamoto**, Osaka Institute of Technology (Japan)

Program Committee: **Frank Deicke**, Fraunhofer-Institut für Photonische Mikrosysteme (Germany); **David W. Faulkner**, British Telecom Research Labs. (United Kingdom); **Harald Haas**, The Univ. of Edinburgh (United Kingdom); **Mohsen Kavehrad**, The Pennsylvania State Univ. (USA); **Rangaraj Madabhushi**, Madabhushi Consultants, LLC (USA); **Nicholas Madamopoulos**, The City College of New York (USA); **Spiros Mikroulis**, Univ. College London (United Kingdom); **Ken-ichi Sato**, Nagoya Univ. (Japan); **Chakchai So-In**, Khon Kaen Univ. (Thailand); **Atul K. Srivastava**, NEL America, Inc. (USA); **Peter Van Daele**, Univ. Gent (Belgium)

## TUESDAY 16 FEBRUARY

### SESSION 1

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . . . . . TUE 8:00 TO 10:00 AM

### Optical Communication Plenary Session

Joint Session with Conferences 9772, 9774, and 9775

Session Chairs: **Benjamin B. Dingel**, Nasfine Photonics, Inc. (USA); **Guifang Li**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

8:00 am: **Recent advances in silicon photonic integrated circuits** (*Invited Paper*), John E Bowers, Tin Komljenovic, Mike Davenport, Jared Hulme, Alan Y Liu, Christos Santis, Alex Spott, Sudharsanan Srinivasan, Eric J. Stanton, Chong Zhang, Univ. of California, Santa Barbara (USA) . . . . . [9774-1]

8:30 am: **Economics of data center optics** (*Invited Paper*), Lisa Huff, Discerning Analytics, LLC (USA) . . . . . [9775-2]

9:00 am: **Silicon-photonics-based optical transceivers for high-speed interconnect applications** (*Invited Paper*), Peter M. De Dobbelaere, Luxtera, Inc. (USA) . . . . . [9775-1]

9:30 am: **The American Institute for Manufacturing Integrated Photonics: advancing the ecosystem** (*Invited Paper*), Thomas L. Koch, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9772-1]

Coffee Break . . . . . Tue 10:00 am to 10:10 am

### SESSION 2

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . TUE 10:10 AM TO 12:00 PM

### Coherent Access Networks and Advanced Modulation Formats

Joint Session with Conferences 9772 and 9774

Session Chairs: **Katsumi Iwatsuki**, Tohoku Univ. (Japan); **Xiang Zhou**, Google (USA)

10:10 am: **Optical and wireless-integrated next-generation access network based on coherent technologies** (*Invited Paper*), Toshihiko Hirooka, Masato Yoshida, Keisuke Kasai, Masataka Nakazawa, Tohoku Univ. (Japan) . . . [9772-2]

10:40 am: **Sub-THz photonic frequency conversion using optoelectronic transistors for future fully coherent access network systems** (*Invited Paper*), Taiichi Otsuji, Kenta Sugawara, Gen Tamamushi, Adrian Dobroiu, Tetsuya Suemitsu, Victor Ryzhii, Katsumi Iwatsuki, Tohoku Univ. (Japan); Shigeru Kuwano, Jun-ichi Kani, Jun Terada, NTT Access Network Service Systems Labs. (Japan) . . . . . [9772-3]

11:10 am: **Multidimensional modulation formats for coherent optical communications** (*Invited Paper*), Tobias A. Eriksson, Erik Agrell, Magnus Karlsson, Chalmers Univ. of Technology (Sweden) . . . . . [9774-2]

11:40 am: **Comparison of cost and complexity for various 16-QAM transmitter structures in coherent optical systems**, Ali M. Al-Bermani, Memorial Univ. of Newfoundland (Canada); Reinhold Noé, Univ. Paderborn (Germany) . . . . . [9774-3]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:00 pm

### SESSION 3

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . . . TUE 1:00 TO 3:30 PM

### Advanced Fibers and Amplifiers for Data Center, SDM, and Metro Applications

Joint Session with Conferences 9772, 9773, 9774, and 9775

Session Chairs: **Atul K. Srivastava**, NEL America, Inc. (USA); **Guifang Li**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

1:00 pm: **Novel optical fibers for data center applications** (*Invited Paper*), Ming-Jun Li, Corning Incorporated (USA) . . . . . [9772-4]

1:30 pm: **Next-generation wideband multimode fiber for data centers** (*Invited Paper*), Kasyapa Balemarthy, OFS (India) . . . . . [9775-3]

2:00 pm: **Multicore erbium doped fiber amplifiers** (*Invited Paper*), Koichi Maeda, Yukihiro Tsuchida, Ryuichi Sugizaki, Furukawa Electric Co., Ltd. (Japan); Hiroshi Matsuura, Tohoku Gakuin Univ. (Japan) . . . . . [9773-1]

2:30 pm: **New fibers for high-density space-division-multiplexed transmissions** (*Invited Paper*), Pierre Sillard, Prysmian Group (France) . [9774-4]

3:00 pm: **Four-mode semiconductor optical amplifier** (*Invited Paper*), He Wen, Tianjin Univ. (China); Yousef Alahmadi, Patrick L. LiKamWa, Cen Xia, Christian Carboni, Guifang Li, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9774-5]

Coffee Break . . . . . Tue 3:30 pm to 3:40 pm

### SESSION 4

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . . . TUE 3:40 TO 6:10 PM

### Special Workshop on Key Devices and Components for Datacenters and Short Hauls

Joint Session with Conferences 9772, 9773, and 9774

Session Chairs: **Youichi Akasaka**, Fujitsu Network Communications Inc. (USA); **Benjamin B. Dingel**, Nasfine Photonics, Inc. (USA)

3:40 pm: **100-Gb/s InP DP-IQ modulator for small-form-factor pluggable coherent transceivers** (*Invited Paper*), Nobuhiro Kikuchi, Yoshihiro Ogiso, Eiichi Yamada, Nippon Telegraph and Telephone Corp. (Japan) . . . . . [9773-2]

4:10 pm: **Challenges in the implementation of dense wavelength division multiplexed (DWDM) optical interconnects using resonant silicon photonics** (*Invited Paper*), Anthony Lentine, Sandia National Labs. (USA) . . . . . [9772-5]

4:40 pm: **Next-generation-VCSELs as an enabling technology for green access networks and data centers** (*Invited Paper*), Werner H. Hofmann, Technische Univ. Berlin (Germany) . . . . . [9772-6]

5:10 pm: **Silicon photonic Mach Zehnder modulators for next-generation short-reach optical communication networks** (*Invited Paper*), Cosimo Lacava, Zhixin Liu, Dave Thomson, Optoelectronics Research Ctr. (United Kingdom); Li Ke, Univ. of Southampton (United Kingdom); Jean-Marc Fédéli, CEA-LETI (France); David J. Richardson, Optoelectronics Research Ctr. (United Kingdom); Graham T. Reed, Univ. of Southampton (United Kingdom); Periklis Petropoulos, Optoelectronics Research Ctr. (United Kingdom) . . . . . [9772-7]

# CONFERENCE 9772

LOCATION: ROOM 303 (SOUTH ESPLANADE)

5:40 pm: **On-chip mode division multiplexing technologies** (*Invited Paper*), Yunhong Ding, Louise F. Frellsen, Xiaowei Guan, Technical Univ. of Denmark (Denmark); Jing Xu, Huazhong Univ. of Science and Technology (China); Francesco Da Ros, DTU Fotonik (Denmark); Haiyan Ou, Technical Univ. of Denmark (Denmark); Christophe Peucheret, Univ. de Rennes 1 (France); Lars H. Frandsen, Leif K. Oxenlowe, Technical Univ. of Denmark (Denmark); Kresten Yvind, DTU Fotonik (Denmark) . . . . . [9774-6]

## WEDNESDAY 17 FEBRUARY

### SESSION 5

LOCATION: ROOM 303 (SOUTH ESPLANADE) WED 8:00 TO 10:10 AM

**NOTE ROOM CHANGE**

### Special Session on Millimeter-Wave Technologies and Radio-Over Fiber Systems for Access I

Session Chairs: **Spiros Mikroulis**, Univ. College London (United Kingdom); **Manoj Thakur**, Univ. College London (United Kingdom)

8:00 am: **Radio-over-fiber technology and devices for 5G: An overview** (*Invited Paper*), Stavros Iezekiel, Univ. of Cyprus (Cyprus) . . . . . [9772-8]

8:30 am: **Multi terabits/s optical access transport technologies** (*Invited Paper*), Le Nguyen Binh, Thomas T. Wang, Huawei Technologies Duesseldorf GmbH (Germany); Daniil Livshits, Alexey E. Gubenko, Innolume GmbH (Germany); Fotini Karinou, Huawei Technologies Duesseldorf GmbH (Germany); Gordon Liu Ning, Huawei Technologies Co., Ltd. (China); Alexey S. Shkolnik, Innolume GmbH (Germany) . . . . . [9772-9]

9:00 am: **Offset-frequency-spaced two-tone coherent transmission of radio-over-fiber signal with recovered-constellation combining technique**, Toshiaki Kuri, Takahide Sakamoto, Naokatsu Yamamoto, National Institute of Information and Communications Technology (Japan) . . . . . [9772-10]

9:20 am: **Low-latency fiber-millimeter-wave system for future mobile fronthauling** (*Invited Paper*), Pham Tien Dat, Atsushi Kanno, Naokatsu Yamamoto, National Institute of Information and Communications Technology (Japan); Tetsuya Kawanishi, Waseda Univ. (Japan) . . . . . [9772-11]

9:50 am: **Evaluation of quadrature-phase-shift-keying signal characteristics in W-band radio-over-fiber transmission using direct in-phase/quadrature-phase conversion technique**, Meisaku Suzuki, Aoyama Gakuin Univ. (Japan); Atsushi Kanno, Naokatsu Yamamoto, National Institute of Information and Communications Technology (Japan); Hideyuki Sotobayashi, Aoyama Gakuin Univ. (Japan) . . . . . [9772-12]

Coffee Break . . . . . Wed 10:10 am to 10:30 am

### SESSION 6

LOCATION: ROOM 303 (SOUTH ESPLANADE) WED 10:30 AM TO 12:10 PM

### Special Session on Millimeter-Wave Technologies and Radio-Over Fiber Systems for Access II

Session Chairs: **Spiros Mikroulis**, Univ. College London (United Kingdom); **Manoj Thakur**, Univ. College London (United Kingdom)

10:30 am: **Multimode fibers in millimeter-wave evolution for 5G cellular networks** (*Invited Paper*), Carmen Vazquez, David Montero, Wendy Ponce, Pedro Contreras Lallana, D. Larrabeiti, Univ. Carlos III de Madrid (Spain); Julio Montalvo, Telefonica (Spain); Alberto Tapetado Moraleda, Plinio Jesús Pinzón Castillo, Univ. Carlos III de Madrid (Spain) . . . . . [9772-13]

11:00 am: **Analog and digital transport of RF channels over converged 5G wireless-optical networks**, Le N. Binh, Huawei Technologies Duesseldorf GmbH (Germany) . . . . . [9772-14]

11:20 am: **An analog fronthaul scheme for future wireless access based on hybrid time/frequency domain multiplexing**, Chenhui Ye, Xiaofeng Hu, Xiaolan Huang, Qingjiang Chang, Zhensen Gao, Xiao Sun, Simiao Xiao, Kaibin Zhang, Alcatel-Lucent Shanghai Bell Co. Ltd. (China) . . . . . [9772-15]

11:40 am: **Practical demonstration of spectrally efficient FDM millimeter-wave radio over fiber systems for 5G cellular networking** (*Invited Paper*), Spiros Mikroulis, Tongyang Xu, Izzat Darwazeh, Univ. College London (United Kingdom) . . . . . [9772-16]

Lunch/Exhibition Break . . . . . Wed 12:10 pm to 1:10 pm

### SESSION 7

LOCATION: ROOM 303 (SOUTH ESPLANADE) . WED 1:10 TO 3:50 PM

### Resilient Communication Networks: Radio-over-Fiber, Mobile Wireless Access

Session Chairs: **Katsutoshi Tsukamoto**, Osaka Institute of Technology (Japan); **Spiros Mikroulis**, Univ. College London (United Kingdom)

1:10 pm: **Cyber physical system based on resilient ICT** (*Invited Paper*), Katsumi Iwatsuki, Tohoku Univ. (Japan) . . . . . [9772-17]

1:40 pm: **Multi-port power router and its impact on resilient power grid systems** (*Invited Paper*), Yuichi Kado, Kyoto Institute of Technology (Japan); Katsumi Iwatsuki, Tohoku University (Japan); Keiji Wada, Tokyo Metropolitan Univ. (Japan) . . . . . [9772-18]

2:10 pm: **Blind post processed nonlinearity mitigation in multiband OFDM radio over fiber optical transmission**, Hyoung-Joon Park, Sun-Young Jung, Sang-Kook Han, Yonsei Univ. (Korea, Republic of) . . . . . [9772-19]

2:30 pm: **Multicore fronthaul and backhaul provision in next-generation optical access networks** (*Invited Paper*), Roberto Llorente Sáez, Maria Morant, Andrés Macho Ortiz, Univ. Politècnica de València (Spain) . . . . . [9772-20]

3:00 pm: **Photonics aided ultra-wideband W-band signal generation and air space transmission** (*Invited Paper*), Xinying Li, Georgia Institute of Technology (USA); Jianjun Yu, ZTE (TX) Inc. (USA) and Fudan University (China) . . . [9772-21]

3:30 pm: **Impact of inter-core crosstalk in radio-over-fiber transmission on multi-core optical media**, Andrés Macho Ortiz, Univ. Politècnica de València (Spain); Maria Morant, Roberto Llorente Sáez, Univ. Politècnica de València (Spain) . . . . . [9772-22]

Coffee Break . . . . . Wed 3:50 pm to 4:00 pm

### SESSION 8

LOCATION: ROOM 303 (SOUTH ESPLANADE) WED 4:00 TO 6:00 PM

### Optical Wireless Communications and PON Systems for Access

Session Chairs: **Manoj Thakur**, Univ. College London (United Kingdom); **Katsutoshi Tsukamoto**, Osaka Institute of Technology (Japan)

4:00 pm: **Integrating free-space optical communication links with existing WiFi (WiFO) network**, Spencer Liverman, Qiwei Wang, Yu-Jung Chu, Thai Duong, Duong Nguyen, Songtao Wang, Thinh Nguyen, Alan X. Wang, Oregon State Univ. (USA) . . . . . [9772-23]

4:20 pm: **Point-to-multipoint holographic beamsteering techniques for indoor optical wireless communications**, Ariel Gomez Diaz, Crisanto Quintana, Grahame Faulkner, Dominic O'Brien, Univ. of Oxford (United Kingdom) . . . . . [9772-24]

4:40 pm: **Error performance analysis of FSO links with equal gain diversity receivers over double generalized gamma fading channels**, Mohammadreza Aminikashani, Mohsen Kavehrad, The Pennsylvania State Univ. (USA); Wenjun Gu, The Pennsylvania State University (USA) . . . . . [9772-25]

5:00 pm: **A wavelength tunable ONU transmitter based on multi-mode Fabry-Perot laser and micro-ring resonator for bandwidth symmetric TWDM-PON**, Zhensen Gao, Xiao Sun, Kaibin Zhang, Alcatel-Lucent Shanghai Bell Co. Ltd. (China) . . . . . [9772-26]

5:20 pm: **Demonstration of quantum dot SOA based colorless ONU transmitter for symmetric 40 Gb/s TWDM PON**, Xiao Sun, Qingjiang Chang, Zhensen Gao, Chenhui Ye, Simiao Xiao, Xiaolan Huang, Xiaofeng Hu, Kaibin Zhang, Alcatel-Lucent Shanghai Bell Co. Ltd. (China) . . . . . [9772-27]

5:40 pm: **Advanced SDN control for NG-EPON**, Jung-Yeol Oh, Electronics and Telecommunications Research Institute (Korea, Republic of) . . . . . [9772-28]

OPTO

# CONFERENCE 9772

**LOCATION: MOSCONE WEST LEVELS 2 AND 3**

## **POSTERS-WEDNESDAY**

**LOCATION: MOSCONE WEST LEVELS 2 AND 3 . . . WED 6:00 TO 8:00 PM**

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions.

*Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPPosterGuidelines>.*

**Three-dimensional indoor light positioning algorithm based on nonlinear estimation**, Wenjun Gu, Mohsen Kavehrad, The Pennsylvania State Univ. (USA); Mohammadreza Aminikashani, Pennsylvania State Univ (USA) . . . . . [9772-29]

**Universal filtered multi-carrier system for asynchronous uplink transmission in optical access network**, Soo-Min Kang, Chang-Hun Kim, Sang-Kook Han, Yonsei Univ. (Korea, Republic of) . . . . . [9772-30]

**Hybrid analog-digital transmission scheme for flexible and cost-effective mobile fronthaul network**, Xiaofeng Hu, Chenhui Ye, Kaibin Zhang, Alcatel-Lucent Shanghai Bell Co. Ltd. (China) . . . . . [9772-31]

**Analysis of bend insensitive liquid core optical fiber for broadband network and fiber-to-the-home applications**, Vikram Palodiya, Sanjeev K. Raghuvanshi, Indian School of Mines (India) . . . . . [9772-32]

**The influence of atmospheric random channel on the performance of optical communication systems based on supercontinuum source**, Yu Liao, Sichuan Univ. (China) . . . . . [9772-33]



# CONFERENCE 9773

LOCATION: ROOM 122 (NORTH EXHIBIT LEVEL)

Tuesday -Thursday 16-18 February 2016 • Proceedings of SPIE Vol. 9773

# Optical Metro Networks and Short-Haul Systems VIII

Conference Chairs: **Atul K. Srivastava**, NEL America, Inc. (USA); **Werner Weiershausen**, Deutsche Telekom AG (Germany); **Benjamin B. Dingel**, Nasfine Photonics, Inc. (USA); **Achyut K. Dutta**, Banpil Photonics, Inc. (USA)

Program Committee: **Youichi Akasaka**, Fujitsu Network Communications Inc. (USA); **Júlio César R. F. de Oliveira**, CpqD (Brazil); **Ivan B. Djordjevic**, The Univ. of Arizona (USA); **Ronald Freund**, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut (Germany); **Kiyo Ishii**, National Institute of Advanced Industrial Science and Technology (Japan); **Franco Küppers**, Technische Univ. Darmstadt (Germany); **Bishnu P. Pal**, Mahindra École Centrale (India); **Takashi Saida**, NTT Photonics Labs. (Japan); **Krishna Swaminathan**, Intel Corp. (USA); **Idelfonso Tafur Monroy**, DTU Fotonik (Denmark); **Toshiki Tanaka**, Fujitsu Labs., Ltd. (Japan); **Jianjun Yu**, ZTE USA (USA)

## TUESDAY 16 FEBRUARY

### SESSION 1

LOCATION: ROOM 122 (NORTH EXHIBIT LEVEL) . . TUE 8:00 TO 10:00 AM

### Optical Communication Plenary Session

Joint Session with Conferences 9772, 9774, and 9775

Session Chairs: **Benjamin B. Dingel**, Nasfine Photonics, Inc. (USA); **Guifang Li**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

8:00 am: **Recent advances in silicon photonic integrated circuits** (*Invited Paper*), John E Bowers, Tin Komljenovic, Mike Davenport, Jared Hulme, Alan Y Liu, Christos Santis, Alex Spott, Sudharsanan Srinivasan, Eric J. Stanton, Chong Zhang, Univ. of California, Santa Barbara (USA) . . . . . [9774-1]

8:30 am: **Economics of data center optics** (*Invited Paper*), Lisa Huff, Discerning Analytics, LLC (USA) . . . . . [9775-2]

9:00 am: **Silicon-photonics-based optical transceivers for high-speed interconnect applications** (*Invited Paper*), Peter M. De Dobbelaere, Luxtera, Inc. (USA) . . . . . [9775-1]

9:30 am: **The American Institute for Manufacturing Integrated Photonics: advancing the ecosystem** (*Invited Paper*), Thomas L. Koch, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9772-1]

Coffee Break . . . . . Tue 10:00 am to 10:10 am

### SESSION 2

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . TUE 10:10 AM TO 12:00 PM

### Coherent Access Networks and Advanced Modulation Formats

Joint Session with Conferences 9772 and 9774

Session Chairs: **Katsumi Iwatsuki**, Tohoku Univ. (Japan); **Xiang Zhou**, Google (USA)

10:10 am: **Optical and wireless-integrated next-generation access network based on coherent technologies** (*Invited Paper*), Toshiniko Hirooka, Masato Yoshida, Keisuke Kasai, Masataka Nakazawa, Tohoku Univ. (Japan) . . . [9772-2]

10:40 am: **Sub-THz photonic frequency conversion using optoelectronic transistors for future fully coherent access network systems** (*Invited Paper*), Taiichi Otsuji, Kenta Sugawara, Gen Tamamushi, Adrian Dobroiu, Tetsuya Suemitsu, Victor Ryzhii, Katsumi Iwatsuki, Tohoku Univ. (Japan); Shigeru Kuwano, Jun-ichi Kani, Jun Terada, NTT Access Network Service Systems Labs. (Japan) . . . . . [9772-3]

11:10 am: **Multidimensional modulation formats for coherent optical communications** (*Invited Paper*), Tobias A. Eriksson, Erik Agrell, Magnus Karlsson, Chalmers Univ. of Technology (Sweden) . . . . . [9774-2]

11:40 am: **Comparison of cost and complexity for various 16-QAM transmitter structures in coherent optical systems**, Ali M. Al-Bermani, Memorial Univ. of Newfoundland (Canada); Reinhold Noé, Univ. Paderborn (Germany) . . . . . [9774-3]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:00 pm

### SESSION 3

LOCATION: ROOM 122 (NORTH EXHIBIT LEVEL) TUE 1:00 TO 3:30 PM

### Advanced Fibers and Amplifiers for Data Center, SDM, and Metro Applications

Joint Session with Conferences 9772, 9773, 9774, and 9775

Session Chairs: **Atul K. Srivastava**, NEL America, Inc. (USA); **Guifang Li**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

1:00 pm: **Novel optical fibers for data center applications** (*Invited Paper*), Ming-Jun Li, Corning Incorporated (USA) . . . . . [9772-4]

1:30 pm: **Next-generation wideband multimode fiber for data centers** (*Invited Paper*), Kasyapa Balemorthy, OFS (India) . . . . . [9775-3]

2:00 pm: **Multicore erbium doped fiber amplifiers** (*Invited Paper*), Koichi Maeda, Yukihiro Tsuchida, Ryuichi Sugizaki, Furukawa Electric Co., Ltd. (Japan); Hiroshi Matsuura, Tohoku Gakuin Univ. (Japan) . . . . . [9773-1]

2:30 pm: **New fibers for high-density space-division-multiplexed transmissions** (*Invited Paper*), Pierre Sillard, Prysmian Group (France) . [9774-4]

3:00 pm: **Four-mode semiconductor optical amplifier** (*Invited Paper*), He Wen, Tianjin Univ. (China); Yousef Alahmadi, Patrick L. LiKamWa, Cen Xia, Christian Carboni, Guifang Li, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9774-5]

Coffee Break . . . . . Tue 3:30 pm to 3:40 pm

### SESSION 4

LOCATION: ROOM 122 (NORTH EXHIBIT LEVEL) TUE 3:40 TO 6:10 PM

### SPECIAL WORKSHOP ON Key Devices and Components for Datacenters and Short Hauls

Joint Session with Conferences 9772, 9773, and 9774

Session Chairs: **Youichi Akasaka**, Fujitsu Network Communications Inc. (USA); **Benjamin B. Dingel**, Nasfine Photonics, Inc. (USA)

3:40 pm: **100-Gb/s InP DP-IQ modulator for small-form-factor pluggable coherent transceivers** (*Invited Paper*), Nobuhiro Kikuchi, Yoshihiro Ogiso, Eiichi Yamada, Nippon Telegraph and Telephone Corp. (Japan) . . . . . [9773-2]

4:10 pm: **Challenges in the implementation of dense wavelength division multiplexed (DWDM) optical interconnects using resonant silicon photonics** (*Invited Paper*), Anthony Lentine, Christopher T DeRose, Sandia National Labs. (USA) . . . . . [9772-5]

4:40 pm: **Next-generation-VCSELs as an enabling technology for green access networks and data centers** (*Invited Paper*), Werner H. Hofmann, Technische Univ. Berlin (Germany) . . . . . [9772-6]

5:10 pm: **Silicon photonic Mach Zehnder modulators for next-generation short-reach optical communication networks** (*Invited Paper*), Cosimo Lacava, Zhixin Liu, Dave Thomson, Optoelectronics Research Ctr. (United Kingdom); Li Ke, Univ. of Southampton (United Kingdom); Jean-Marc Fédéli, CEA-LETI (France); David J. Richardson, Optoelectronics Research Ctr. (United Kingdom); Graham T. Reed, Univ. of Southampton (United Kingdom); Periklis Petropoulos, Optoelectronics Research Ctr. (United Kingdom) . . . . . [9772-7]

OPTO

# CONFERENCE 9773

LOCATION: ROOM 122 (NORTH EXHIBIT LEVEL)

5:40 pm: **On-chip mode division multiplexing technologies** (*Invited Paper*), Yunhong Ding, Louise F. Frelsen, Xiaowei Guan, Technical Univ. of Denmark (Denmark); Jing Xu, Huazhong Univ. of Science and Technology (China); Francesco Da Ros, DTU Fotonik (Denmark); Haiyan Ou, Technical Univ. of Denmark (Denmark); Christophe Peucheret, Univ. de Rennes 1 (France); Lars H. Frandsen, Leif K. Oxenlowe, Technical Univ. of Denmark (Denmark); Kresten Vvind, DTU Fotonik (Denmark) ..... [9774-6]

## WEDNESDAY 17 FEBRUARY

### SESSION 5

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) ..... WED 8:00 TO 10:10 AM

#### Advanced Modulation Format and DSP I

Joint Session with Conferences 9774 and 9775

Session Chairs: **Guifang Li**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); **Juliano Oliveira**, CpqD (Brazil)

8:00 am: **Ultra-long-haul optical transmissions based on coded modulation** (*Invited Paper*), Jin-Xing Cai, TE SubCom (USA) ..... [9774-7]

8:30 am: **Massive eigenvalue modulated optical transmission systems**, Akihiro Maruta, Osaka Univ. (Japan) ..... [9774-8]

8:50 am: **Smoothly clipped root raised cosine waveforms for an effective loading of a coherent optical M-QAM modulator** (*Invited Paper*), Bishara Shamee, Morteza Ziyadi, Amirhossein Mohajerin-Ariaei, Ahmed Almainan, Yinwen Cao, Nisar Ahmed, The Univ. of Southern California (USA); Steven R. Wilkinson, Raytheon Space and Airborne Systems (USA); Alan E. Willner, The Univ. of Southern California (USA) ..... [9774-9]

9:20 am: **Short-haul transmission links based on 25- and 50-Gbaud PAM4 modulation** (*Invited Paper*), Winston I. Way, NeoPhotonics Corp. (USA) [9775-4]

9:50 am: **Scaling single-wavelength optical interconnects to 180 Gb/s with PAM-M and pulse shaping**, Stefanos Dris, Paraskevas Bakopoulos, Nikolaos Argyris, Christos Spatharakis, Hercules Avramopoulos, National Technical Univ. of Athens (Greece) ..... [9775-5]

Coffee Break ..... Wed 10:10 am to 10:20 am

### SESSION 6

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . WED 10:20 AM TO 12:10 PM

#### Advanced Modulation Format and DSP II

Joint Session with Conferences 9774 and 9775

Session Chairs: **Hideki Isono**, Fujitsu Optical Components Ltd. (Japan); **Xiang Zhou**, Google (USA)

10:20 am: **Recent advances of emerging PAM4 signaling with real-time processing for 100/400Gbps intra data center connectivity** (*Invited Paper*), Frank Chang, Inphi Corp. (USA) ..... [9775-6]

10:50 am: **Power penalties for multi-level PAM modulation formats at arbitrary bit error rates**, Nikolay A. Kaliteevskiy, Corning Scientific Ctr. (Russian Federation); William Wood, John D. Downie, Jason E. Hurley, Corning Incorporated (USA); Petr M. Sterlingov, Corning Scientific Ctr. (Russian Federation) ..... [9775-7]

11:10 am: **Performance analysis of low-complexity adaptive frequency-domain equalization and MIMO signal processing for compensation of differential mode group delay in mode-division multiplexing communication systems using few-mode fibers**, Yi Weng, Xuan He, Zhongqi Pan, Univ. of Louisiana at Lafayette (USA) ..... [9774-10]

11:30 am: **20-Gb/s QPSK transmission over 4km-long holey fiber using a wavelength tunable quantum dot light laser in T-band**, Akihiro Murano, Shoko Yamada, Aoyama Gakuin Univ. (Japan); Atsushi Kanno, Naokatsu Yamamoto, National Institute of Information and Communications Technology (Japan); Hideyuki Sotobayashi, Aoyama Gakuin Univ. (Japan) ..... [9774-11]

11:50 am: **Improved pilot-tone technique for inter- and intra-channel nonlinearity compensation in long-haul CO-OFDM systems**, Ali M. Al-Bermani, Memorial Univ. of Newfoundland (Canada) ..... [9774-12]

Lunch/Exhibition Break ..... Wed 12:10 pm to 1:10 pm

### SESSION 7

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) .. WED 1:10 TO 3:30 PM

#### Advanced Modulation Format and DSP III

Joint Session with Conferences 9773, 9774, and 9775

Session Chairs: **Benny Mikkelsen**, Mintera Corp. (USA); **Idelfonso Tafur Monroy**, DTU Fotonik (Denmark)

1:10 pm: **High-speed real-time OFDM transmission based on FPGA** (*Invited Paper*), Xin Xiao, ZTE USA (USA); Fan Li, Jianjun Yu, ZTE TX (USA) ..... [9773-3]

1:40 pm: **High-capacity modulation for data center applications using silicon photonic integrated circuits** (*Invited Paper*), Po Dong, Jeffrey Lee, Alcatel-Lucent Bell Labs. (USA) ..... [9775-8]

2:10 pm: **112 Gb/s sub-cycle 16-QAM nyquist-SCM for intra-datacenter connectivity**, Paraskevas Bakopoulos, Stefanos Dris, Nikolaos Argyris, Christos Spatharakis, Hercules Avramopoulos, National Technical Univ. of Athens (Greece) ..... [9775-9]

2:30 pm: **Comparison of advanced DSP techniques for spectrally efficient Nyquist-WDM signal generation using digital FIR filters at transmitters based on higher-order modulation formats**, Yi Weng, Univ. of Louisiana at Lafayette (USA); Junyi Wang, Qualcomm Technologies, Inc. (USA); Zhongqi Pan, Univ. of Louisiana at Lafayette (USA) ..... [9773-4]

2:50 pm: **Detection and alignment of XY skew for dual-polarization optical quadrature amplitude transmitter using reconfigurable interference**, Yang Yue, Bo Zhang, Qiang Wang, Rob Lofland, Jason O'Neil, Jon Anderson, Juniper Networks, Inc. (USA) ..... [9774-13]

3:10 pm: **Secured optical fiber communication using polarization restoration technique and channel characterization**, Nikhil V. Puneekar, Bhagyashri A. Darunkar, Pramode K. Verma, The Univ. of Oklahoma - Tulsa (USA) ..... [9774-14]

### POSTERS-WEDNESDAY

LOCATION: MOSCONE WEST LEVELS 2 AND 3 WED 6:00 TO 8:00 PM

Conference attendees are invited to attend the OPTO poster session on Wednesday evening. Come view the posters, enjoy light refreshments, ask questions, and network with colleagues in your field. Authors of poster papers will be present to answer questions concerning their papers. Attendees are required to wear their conference registration badges to the poster sessions

Poster authors, view poster presentation guidelines and set-up instructions at <http://spie.org/PWPosterGuidelines>.

**An upstream burst-mode equalization scheme for 40 Gb/s TWDM PON based on optimized SOA cascade**, Xiao Sun, Qingjiang Chang, Zhensen Gao, Chenhui Ye, Simiao Xiao, Xiaohan Huang, Xiaofeng Hu, Kaibin Zhang, Alcatel-Lucent Shanghai Bell Co. Ltd. (China) ..... [9773-15]

**Efficient eNB inter-communication scheme in converged mobile and NG-PON2 system**, Simiao Xiao, Alcatel-Lucent Shanghai Bell Co. Ltd. (China); Xiao Sun, Alcatel-Lucent Shanghai Bell Co., Ltd. (China); Kaibin Zhang, Alcatel-Lucent Shanghai Bell Co. Ltd. (China) ..... [9773-16]

**Photodetector sensitivity improvement for bending loss detection in optical fiber**, Jaeyul Lee, Jaewon Song, Jeehyun Kim, Mansik Jeon, Kyungpook National Univ. (Korea, Republic of) ..... [9773-17]

**Real-time optical path control method that utilizes multiple support vector machines for traffic prediction**, Hiroshi Kawase, Yojiro Mori, Hiroshi Hasegawa, Ken-ichi Sato, Nagoya Univ. (Japan) ..... [9773-18]

**Architecture and design of optical path networks utilizing waveband virtual links**, Yusaku Ito, Yojiro Mori, Hiroshi Hasegawa, Ken-ichi Sato, Nagoya Univ. (Japan) ..... [9773-19]

**Physical layer one-time-pad data encryption through synchronized semiconductor laser networks**, Apostolos Argyris, Evangelos Pikasis, Dimitris Syvridis, National and Kapodistrian Univ. of Athens (Greece) .. [9773-20]

**Automated and comprehensive link engineering supporting branched, ring, and mesh network topologies**, Jim Farina, VPIphotonics (USA); Dmitry Khomchenko, Dmitry Yevseyenko, VPI Development Ctr. (Belarus); Judith Meester, VPIphotonics (USA); André Richter, VPIphotonics GmbH (Germany) ..... [9773-21]

**An FPGA design of generalized low-density parity-check codes for rate-adaptive optical transport networks**, Ding Zou, Ivan B. Djordjevic, The Univ. of Arizona (USA) ..... [9773-22]

**THURSDAY 18 FEBRUARY**

**SESSION 8**

**LOCATION: RM 120 (NORTH EXHIBIT LEVEL) . THU 8:00 TO 10:00 AM**

**NOTE ROOM CHANGE**

**Architecture and Transmission  
Technologies for Short-Haul Networks**

Session Chairs: **Youichi Akasaka**, Fujitsu Network Communications Inc. (USA); **Ivan B. Djordjevic**, The Univ. of Arizona (USA)

8:00 am: **New value added to network services through software-defined optical core networking** (*Invited Paper*), Akiko Yamada, Keiichi Nakatsugawa, Shinji Yamashita, Toshio Soumiya, Fujitsu Ltd. (Japan) . . . . . [9773-5]

8:30 am: **SDN architecture for optical packet and circuit integrated networks** (*Invited Paper*), Hideaki Furukawa, Takaya Miyazawa, National Institute of Information and Communications Technology (Japan) . . . . . [9773-6]

9:00 am: **Advanced digital signal processing for short-haul and access network** (*Invited Paper*), Junwen Zhang, Fudan Univ. (China); jianjun yu, ZTE (Tx) (USA); nan chi, Fudan Univ. (China) . . . . . [9773-7]

9:30 am: **FPGA implementation of advanced FEC schemes for intelligent aggregation networks** (*Invited Paper*), Ding Zou, Ivan B. Djordjevic, The Univ. of Arizona (USA) . . . . . [9773-8]

Coffee Break . . . . . Thu 10:00 am to 10:20 am

**SESSION 9**

**LOCATION: RM 120 (NORTH EXHIBIT LEVEL) . THU 10:20 AM TO 12:40 PM**

**Component Technologies  
for Short-Haul Networks**

Session Chairs: **Achyut K. Dutta**, Banpil Photonics, Inc. (USA); **Jianjun Yu**, ZTE USA (USA)

10:20 am: **High-power and narrow-linewidth tunable distributed-reflector laser** (*Invited Paper*), Toshimitsu Kaneko, Sumitomo Electric Industries, Ltd. (Japan); Hiroyuki Matsuura, Ken Tanizawa, National Institute of Advanced Industrial Science and Technology (Japan); Katsumi Uesaka, Sumitomo Electric Industries, Ltd. (Japan) . . . . . [9773-9]

10:50 am: **Spatial and planar optical circuit for flexible ROADM** (*Invited Paper*), Kota Shikama, Yuichiro Ikuma, Nippon Telegraph and Telephone Corp. (Japan); Kenya Suzuki, NTT Photonics Labs. (Japan); Tetsuo Takahashi, NTT Network Innovation Labs. (Japan) . . . . . [9773-10]

11:20 am: **Lossless photonic switched networks for metro-access**, Yara Martins, LGE Corp. (Brazil); Felipe Rudge Barbosa, Indayara B. Martins, Univ. Estadual de Campinas (Brazil); Edson Moschim, University of Campinas - Unicamp (Brazil) . . . . . [9773-11]

11:40 am: **Beam steering by computer generated hologram for optical switches** (*Invited Paper*), Keita Yamaguchi, Kenya Suzuki, NTT Device Technology Labs. (Japan); Joji Yamaguchi, NTT Device Innovation Center. (Japan) . . . . . [9773-12]

12:10 pm: **Terahertz zero-bias Schottky detectors for communications** (*Invited Paper*), Andreas Penirschke, Technische Hochschule Mittelhessen (Germany) . . . . . [9773-13]

**OPTO**

# CONFERENCE 9774

LOCATION: ROOM 122 (NORTH EXHIBIT LEVEL)

Tuesday–Thursday 16–18 February 2016 • Proceedings of SPIE Vol. 9774

# Next-Generation Optical Communication: Components, Sub-Systems, and Systems V

Conference Chairs: **Guifang Li**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); **Xiang Zhou**, Google (USA)

Program Committee: **Kazi S. Abedin**, OFS Fitel LLC (USA); **Yi Cai**, ZTE USA (USA); **Hwan Seok Chung**, Electronics and Telecommunications Research Institute (Korea, Republic of); **Gabriella Cincotti**, Univ. degli Studi di Roma Tre (Italy); **Benjamin B. Dingel**, Nasfinc Photonics, Inc. (USA); **John D. Downie**, Corning Incorporated (USA); **Ronald Freund**, Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut (Germany); **Ezra Ip**, NEC Labs. America, Inc. (USA); **Inuk Kang**, Alcatel-Lucent Bell Labs. (USA); **Takahiro Kodama**, Mitsubishi Electric Corp. (Japan); **Tsuyoshi Konishi**, Osaka Univ. (Japan); **Chao Lu**, The Hong Kong Polytechnic Univ. (Hong Kong, China); **Zhongqi Pan**, Univ. of Louisiana at Lafayette (USA); **Jayanta K. Sahu**, Univ. of Southampton (United Kingdom); **Kunimasa Saitoh**, Hokkaido Univ. (Japan); **Junqiang Sun**, Huazhong Univ. of Science and Technology (China), Wuhan National Lab. for Optoelectronics (China); **Xinliang Zhang**, Wuhan National Lab. for Optoelectronics (China); **Yanjun Zhu**, Huawei Technologies Co., Ltd. (USA)

## TUESDAY 16 FEBRUARY

### SESSION 1

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . TUE 8:00 TO 10:00 AM

### Optical Communication Plenary Session

Joint Session with Conferences 9772, 9774, and 9775

Session Chairs: **Benjamin B. Dingel**, Nasfinc Photonics, Inc. (USA);  
**Guifang Li**, CREOL, The College of Optics and Photonics,  
Univ. of Central Florida (USA)

8:00 am: **Recent advances in silicon photonic integrated circuits** (*Invited Paper*), John E Bowers, Tin Komljenovic, Mike Davenport, Jared Hulme, Alan Y Liu, Christos Santis, Alex Spott, Sudharsanan Srinivasan, Eric J. Stanton, Chong Zhang, Univ. of California, Santa Barbara (USA) . . . . . [9774-1]

8:30 am: **Economics of data center optics** (*Invited Paper*), Lisa Huff, Discerning Analytics, LLC (USA) . . . . . [9775-2]

9:00 am: **Silicon-photonics-based optical transceivers for high-speed interconnect applications** (*Invited Paper*), Peter M. De Dobbelaere, Luxtera, Inc. (USA) . . . . . [9775-1]

9:30 am: **The American Institute for Manufacturing Integrated Photonics: advancing the ecosystem** (*Invited Paper*), Thomas L. Koch, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9772-1]

Coffee Break . . . . . Tue 10:00 am to 10:10 am

### SESSION 2

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . TUE 10:10 AM TO 12:00 PM

### Coherent Access Networks and Advanced Modulation Formats

Joint Session with Conferences 9772 and 9774

Session Chairs: **Katsumi Iwatsuki**, Tohoku Univ. (Japan);  
**Xiang Zhou**, Google (USA)

10:10 am: **Optical and wireless-integrated next-generation access network based on coherent technologies** (*Invited Paper*), Toshihiko Hirooka, Masato Yoshida, Keisuke Kasai, Masataka Nakazawa, Tohoku Univ. (Japan) . . . . . [9772-2]

10:40 am: **Sub-THz photonic frequency conversion using optoelectronic transistors for future fully coherent access network systems** (*Invited Paper*), Taiichi Otsuji, Kenta Sugawara, Gen Tamamushi, Adrian Dobroiu, Tetsuya Suemitsu, Victor Ryzhii, Katsumi Iwatsuki, Tohoku Univ. (Japan); Shigeru Kuwano, Jun-ichi Kani, Jun Terada, NTT Access Network Service Systems Labs. (Japan) . . . . . [9772-3]

11:10 am: **Multidimensional modulation formats for coherent optical communications** (*Invited Paper*), Tobias A. Eriksson, Erik Agrell, Magnus Karlsson, Chalmers Univ. of Technology (Sweden) . . . . . [9774-2]

11:40 am: **Comparison of cost and complexity for various 16-QAM transmitter structures in coherent optical systems**, Ali M. Al-Bermani, Memorial Univ. of Newfoundland (Canada); Reinhold Noé, Univ. Paderborn (Germany) . . . . . [9774-3]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:00 pm

### SESSION 3

LOCATION: ROOM 122 (NORTH EXHIBIT LEVEL) TUE 1:00 TO 3:30 PM

### Advanced Fibers and Amplifiers for Data Center, SDM, and Metro Applications

Joint Session with Conferences 9772, 9773, 9774, and 9775

Session Chairs: **Atul K. Srivastava**, NEL America, Inc. (USA);  
**Guifang Li**, CREOL, The College of Optics and Photonics,  
Univ. of Central Florida (USA)

1:00 pm: **Novel optical fibers for data center applications** (*Invited Paper*), Ming-Jun Li, Corning Incorporated (USA) . . . . . [9772-4]

1:30 pm: **Next-generation wideband multimode fiber for data centers** (*Invited Paper*), Kasyapa Balemarthy, OFS (India) . . . . . [9775-3]

2:00 pm: **Multicore erbium doped fiber amplifiers** (*Invited Paper*), Koichi Maeda, Yukihiro Tsuchida, Ryuichi Sugizaki, Furukawa Electric Co., Ltd. (Japan); Hiroshi Matsuura, Tohoku Gakuin Univ. (Japan) . . . . . [9773-1]

2:30 pm: **New fibers for high-density space-division-multiplexed transmissions** (*Invited Paper*), Pierre Sillard, Prysmian Group (France) . [9774-4]

3:00 pm: **Four-mode semiconductor optical amplifier** (*Invited Paper*), He Wen, Tianjin Univ. (China); Yousef Alahmadi, Patrick L. LiKamWa, Cen Xia, Christian Carboni, Guifang Li, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9774-5]

Coffee Break . . . . . Tue 3:30 pm to 3:40 pm



# CONFERENCE 9774

LOCATION: RM 122 (NORTH EXHIBIT LEVEL)

## SESSION 4

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . . . TUE 3:40 TO 6:10 PM

### Special Workshop on Key Devices and Components for Datacenters and Short Hauls

Joint Session with Conferences 9772, 9773, and 9774

Session Chairs: **Youichi Akasaka**, Fujitsu Network Communications Inc. (USA); **Benjamin B. Dingel**, Nasfinc Photonics, Inc. (USA)

3:40 pm: **100-Gb/s InP DP-IQ modulator for small-form-factor pluggable coherent transceivers** (*Invited Paper*), Nobuhiro Kikuchi, Yoshihiro Ogiso, Eichichi Yamada, Nippon Telegraph and Telephone Corp. (Japan) . . . . . [9773-2]

4:10 pm: **Challenges in the implementation of dense wavelength division multiplexed (DWDM) optical interconnects using resonant silicon photonics** (*Invited Paper*), Anthony Lentine, Christopher T DeRose, Sandia National Labs. (USA) . . . . . [9772-5]

4:40 pm: **Next-generation-VCSELs as an enabling technology for green access networks and data centers** (*Invited Paper*), Werner H. Hofmann, Technische Univ. Berlin (Germany) . . . . . [9772-6]

5:10 pm: **Silicon photonic Mach Zehnder modulators for next-generation short-reach optical communication networks** (*Invited Paper*), Cosimo Lacava, Zhixin Liu, Dave Thomson, Optoelectronics Research Ctr. (United Kingdom); Li Ke, Univ. of Southampton (United Kingdom); Jean-Marc Fédéli, CEA-LETI (France); David J. Richardson, Optoelectronics Research Ctr. (United Kingdom); Graham T. Reed, Univ. of Southampton (United Kingdom); Periklis Petropoulos, Optoelectronics Research Ctr. (United Kingdom) . . . . . [9772-7]

5:40 pm: **On-chip mode division multiplexing technologies** (*Invited Paper*), Yunhong Ding, Louise F. Frellsen, Xiaowei Guan, Technical Univ. of Denmark (Denmark); Jing Xu, Huazhong Univ. of Science and Technology (China); Francesco Da Ros, DTU Fotonik (Denmark); Haiyan Ou, Technical Univ. of Denmark (Denmark); Christophe Peucheret, Univ. de Rennes 1 (France); Lars H. Frandsen, Leif K. Oxenløwe, Technical Univ. of Denmark (Denmark); Kresten Yvind, DTU Fotonik (Denmark) . . . . . [9774-6]

## WEDNESDAY 17 FEBRUARY

## SESSION 5

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . WED 8:00 TO 10:10 AM

### Advanced Modulation Format and DSP I

Joint Session with Conferences 9774 and 9775

Session Chairs: **Guifang Li**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); **Juliano Oliveira**, CpQD (Brazil)

8:00 am: **Ultra-long-haul optical transmissions based on coded modulation** (*Invited Paper*), Jin-Xing Cai, TE SubCom (USA) . . . . . [9774-7]

8:30 am: **Massive eigenvalue modulated optical transmission systems**, Akihiro Maruta, Osaka Univ. (Japan) . . . . . [9774-8]

8:50 am: **Smoothly clipped root raised cosine waveforms for an effective loading of a coherent optical M-QAM modulator** (*Invited Paper*), Bishara Shamee, Morteza Ziyadi, Amirhossein Mohajerin-Ariaei, Ahmed Almainan, Yinwen Cao, Nisar Ahmed, The Univ. of Southern California (USA); Steven R. Wilkinson, Raytheon Space and Airborne Systems (USA); Alan E. Willner, The Univ. of Southern California (USA) . . . . . [9774-9]

9:20 am: **Short-haul transmission links based on 25- and 50-Gbaud PAM4 modulation** (*Invited Paper*), Winston I. Way, NeoPhotonics Corp. (USA) . . . . . [9774-10]

9:50 am: **Scaling single-wavelength optical interconnects to 180 Gb/s with PAM-M and pulse shaping**, Stefanos Dris, Paraskevas Bakopoulos, Nikolaos Argyris, Christos Spatharakis, Hercules Avramopoulos, National Technical Univ. of Athens (Greece) . . . . . [9775-5]

Coffee Break . . . . . Wed 10:10 am to 10:20 am

## SESSION 6

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . WED 10:20 AM TO 12:10 PM

### Advanced Modulation Format and DSP II

Joint Session with Conferences 9774 and 9775

Session Chairs: **Hideki Isono**, Fujitsu Optical Components Ltd. (Japan); **Xiang Zhou**, Google (USA)

10:20 am: **Recent advances of emerging PAM4 signaling with real-time processing for 100/400Gbps intra data center connectivity** (*Invited Paper*), Frank Chang, Inphi Corp. (USA) . . . . . [9775-6]

10:50 am: **Power penalties for multi-level PAM modulation formats at arbitrary bit error rates**, Nikolay A. Kaliteevskiy, Corning Scientific Ctr. (Russian Federation); William Wood, John D. Downie, Jason E. Hurley, Corning Incorporated (USA); Petr M. Sterlingov, Corning Scientific Ctr. (Russian Federation) . . . . . [9775-7]

11:10 am: **Performance analysis of low-complexity adaptive frequency-domain equalization and MIMO signal processing for compensation of differential mode group delay in mode-division multiplexing communication systems using few-mode fibers**, Yi Weng, Xuan He, Zhongqi Pan, Univ. of Louisiana at Lafayette (USA) . . . . . [9774-10]

11:30 am: **20-Gb/s QPSK transmission over 4km-long holey fiber using a wavelength tunable quantum dot light laser in T-band**, Akihiro Murano, Shoko Yamada, Aoyama Gakuin Univ. (Japan); Atsushi Kanno, Naokatsu Yamamoto, National Institute of Information and Communications Technology (Japan); Hideyuki Sotobayashi, Aoyama Gakuin Univ. (Japan) . . . . . [9774-11]

11:50 am: **Improved pilot-tone technique for inter- and intra-channel nonlinearity compensation in long-haul CO-OFDM systems**, Ali M. Al-Bermani, Memorial Univ. of Newfoundland (Canada) . . . . . [9774-12]

Lunch/Exhibition Break . . . . . Wed 12:10 pm to 1:10 pm

## SESSION 7

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . . WED 1:10 TO 3:30 PM

### Advanced Modulation Format and DSP III

Joint Session with Conferences 9773, 9774, and 9775

Session Chairs: **Benny Mikkelsen**, Mintera Corp. (USA); **Idefonso Tafur Monroy**, DTU Fotonik (Denmark)

1:10 pm: **High-speed real-time OFDM transmission based on FPGA** (*Invited Paper*), Xin Xiao, ZTE USA (USA); Fan Li, Jianjun Yu, ZTE TX (USA) . . . . . [9773-3]

1:40 pm: **High-capacity modulation for data center applications using silicon photonic integrated circuits** (*Invited Paper*), Po Dong, Jeffrey Lee, Alcatel-Lucent Bell Labs. (USA) . . . . . [9775-8]

2:10 pm: **112 Gb/s sub-cycle 16-QAM nyquist-SCM for intra-datacenter connectivity**, Paraskevas Bakopoulos, Stefanos Dris, Nikolaos Argyris, Christos Spatharakis, Hercules Avramopoulos, National Technical Univ. of Athens (Greece) . . . . . [9775-9]

2:30 pm: **Comparison of advanced DSP techniques for spectrally efficient Nyquist-WDM signal generation using digital FIR filters at transmitters based on higher-order modulation formats**, Yi Weng, Univ. of Louisiana at Lafayette (USA); Junyi Wang, Qualcomm Technologies, Inc. (USA); Zhongqi Pan, Univ. of Louisiana at Lafayette (USA) . . . . . [9773-4]

2:50 pm: **Detection and alignment of XY skew for dual-polarization optical quadrature amplitude transmitter using reconfigurable interference**, Yang Yue, Bo Zhang, Qiang Wang, Rob Lofland, Jason O'Neil, Jon Anderson, Juniper Networks, Inc. (USA) . . . . . [9774-13]

3:10 pm: **Secured optical fiber communication using polarization restoration technique and channel characterization**, Nikhil V. Puneekar, Bhagyashri A. Darunkar, Pramode K. Verma, The Univ. of Oklahoma - Tulsa (USA) . . . . . [9774-14]

Coffee Break . . . . . Wed 3:30 pm to 3:50 pm

OPTO

# CONFERENCE 9774

LOCATION: RM 122 (NORTH EXHIBIT LEVEL)

## SESSION 8

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . . WED 3:50 TO 6:10 PM

### SDM, Coherent Components, and Subsystems I

Session Chairs: **Xiang Zhou**, Google (USA);  
**Robert R. Thomson**, Heriot-Watt Univ. (United Kingdom)

3:50 pm: **High-speed coherent transceiver technologies enabled by silicon photonic integrated circuits** (*Invited Paper*), Benny Mikkelsen, Acacia Communications Inc. (USA) . . . . . [9774-15]

4:20 pm: **Ultra-compact integrated silicon photonics balanced coherent photodetector**, Jason T. Meyer, Mahmoud Fallahi, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9774-16]

4:40 pm: **Spatial-mode conversion using random diffuser and spatial light modulator for reduction of modal crosstalk**, Koki Ishii, Atsushi Okamoto, Hokkaido Univ. (Japan); Takehiro Tsuritani, Yuta Wakayama, KDDI R&D Labs., Inc. (Japan); Yuta Goto, Akihisa Tomita, Hokkaido Univ. (Japan) . . . . . [9774-17]

5:00 pm: **Frequency noise of quantum-dash DFB laser**, Omar M. Sahní, Stéphane Trebaol, Yohann Léguillon, Christelle Pareige, Pascal Besnard, CNRS-Fonctions Optiques pour les Technologistes de l'information (France); Liam Barry, Dublin City Univ. (Ireland) and The RINCE Institute (Ireland) . . . . . [9774-18]

5:20 pm: **Highly accurate spatial mode generation using spatial cross modulation method for mode division multiplexing**, Hiroki Sakuma, Atsushi Okamoto, Hokkaido Univ. (Japan); Atsushi Shibukawa, California Institute of Technology (USA); Yuta Goto, Akihisa Tomita, Hokkaido Univ. (Japan) . . . . . [9774-19]

5:40 pm: **SDM transmission using FMF with large number of modes** (*Invited Paper*), Chigo Okonkwo, Eindhoven University of Technology (Netherlands) . . . . . [9774-20]

## THURSDAY 18 FEBRUARY

### SESSION 9

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . . . . . THU 8:00 TO 10:40 AM

### SDM, Coherent Components, and Subsystems II

Session Chairs: **Chigo Okonkwo**, Technische Univ. Eindhoven (Netherlands); **Benny Mikkelsen**, Acacia Communications Inc. (USA)

8:00 am: **Low insertion loss highly-mode-selective spatial multiplexers using multi-plane light conversion** (*Invited Paper*), Jean-François Morizur, Nicolas Barré, Olivier Pinel, Kevin Lenglé, Lionel Garcia, Lionel Jaffres, Pu Jian, Guillaume Labroille, CAILabs (France) . . . . . [9774-21]

8:30 am: **Advanced S2 imaging spatial mode analysis: furthering modal characterization** (*Invited Paper*), Benoit Sevigny, Guillaume Le Cocq, Lab. de Physique des Lasers, Atomes et Molécules (France); Géraud Bouwmans, Univ. des Sciences et Technologies de Lille (France); Yves Quiquempois, Lab. de Physique des Lasers, Atomes et Molécules (France); Carmen C. Castiñeiras Carrero, Lab. de Physique des Lasers, Atomes et Molécules (France) and Prismsian Group (France); Pierre Sillard, Prismsian Group (France) . . . . . [9774-22]

9:00 am: **Ultrafast laser inscription of 3D components for spatial multiplexing** (*Invited Paper*), Robert R. Thomson, Heriot-Watt Univ. (United Kingdom) . . . . . [9774-23]

9:30 am: **Gain-controlled erbium-doped fiber amplifier using mode-selective photonic lantern**, Gisela López-Galmiche, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) and CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Zeinab Sanjabi Eznaveh, J. E. Antonio Lopez, Amado M. Velazquez Benitez, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Jorge Rodriguez Asomoza, Univ. de las Américas Puebla (Mexico); Luis A. Herrera Piad, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) and Univ. de Guanajuato (Mexico); Jose J. Sánchez-Mondragón, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); C. Gonent, Pierre Sillard, Prismsian Group (France); Guifang Li, Axel Schülzgen, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Chigo Okonkwo, Technische Univ. Eindhoven (Netherlands); Rodrigo Amezcua Correa, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9774-24]

9:50 am: **Connectivity technologies of MCF: readiness for field deployment** (*Invited Paper*), Kengo Watanabe, Furukawa Electric Co., Ltd. (Japan) . [9774-25]

10:20 am: **Photochromic glass optical fiber**, Bilal A. Alvi, Hamdard Univ. (Pakistan); Amber Israr, Muhammad Asif, Muhammad Aamir, Muhammad Rehan, Sir Syed Univ. of Engineering & Technology (Pakistan) . . . . . [9774-26]

# CONFERENCE 9775

LOCATION: ROOM 122 (NORTH EXHIBIT LEVEL)

Tuesday–Thursday 16–18 February 2016 • Proceedings of SPIE Vol. 9775

# Next-Generation Optical Networks for Data Centers and Short-Reach Links III

Conference Chair: **Atul K. Srivastava**, NEL America, Inc. (USA)

Program Committee: **Philippe P Absil**, IMEC (Belgium); **Juliano Rodrigues Fernandes de Oliveira**, CpqD (Brazil); **Benjamin B. Dingel**, Nasfine Photonics, Inc. (USA); **Mitchell H. Fields**, Avago Technologies Ltd. (USA); **Hideki Isono**, Fujitsu Ltd. (Japan); **Hai-Feng Liu**, Intel Corp. (USA); **B. Jonathan Luff**, Mellanox Technologies, Inc. (USA); **Takahiro Nakamura**, Photonics Electronics Technology Research Association (Japan); **Takashi Saida**, NTT Photonics Labs. (Japan); **Ivan Shubin**, Oracle (USA); **Takashi Takemoto**, Hitachi, Ltd. (Japan)

## TUESDAY 16 FEBRUARY

### SESSION 1

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . TUE 8:00 TO 10:00 AM

### Optical Communication Plenary Session

Joint Session with Conferences 9772, 9774, and 9775

Session Chairs: **Benjamin B. Dingel**, Nasfine Photonics, Inc. (USA); **Guifang Li**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

8:00 am: **Recent advances in silicon photonic integrated circuits** (*Invited Paper*), John E Bowers, Tin Komljenovic, Mike Davenport, Jared Hulme, Alan Y Liu, Christos Santis, Alex Spott, Sudharsanan Srinivasan, Eric J. Stanton, Chong Zhang, Univ. of California, Santa Barbara (USA) . . . . . [9774-1]

8:30 am: **Economics of data center optics** (*Invited Paper*), Lisa Huff, Discerning Analytics, LLC (USA) . . . . . [9775-2]

9:00 am: **Silicon-photonics-based optical transceivers for high-speed interconnect applications** (*Invited Paper*), Peter M. De Dobbelaere, Luxtera, Inc. (USA) . . . . . [9775-1]

9:30 am: **The American Institute for Manufacturing Integrated Photonics: advancing the ecosystem** (*Invited Paper*), Thomas L. Koch, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [9772-1]

Coffee Break . . . . . Tue 10:00 am to 10:10 am

### SESSION 2

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . TUE 10:10 AM TO 12:00 PM

### Coherent Access Networks and Advanced Modulation Formats

Joint Session with Conferences 9772 and 9774

Session Chairs: **Katsumi Iwatsuki**, Tohoku Univ. (Japan); **Xiang Zhou**, Google (USA)

10:10 am: **Optical and wireless-integrated next-generation access network based on coherent technologies** (*Invited Paper*), Toshihiko Hirooka, Masato Yoshida, Keisuke Kasai, Masataka Nakazawa, Tohoku Univ. (Japan) . . . [9772-2]

10:40 am: **Sub-THz photonic frequency conversion using optoelectronic transistors for future fully coherent access network systems** (*Invited Paper*), Taiichi Otsuji, Kenta Sugawara, Gen Tamamushi, Adrian Dobroiu, Tetsuya Suemitsu, Victor Ryzhii, Katsumi Iwatsuki, Tohoku Univ. (Japan); Shigeru Kuwano, Jun-ichi Kani, Jun Terada, NTT Access Network Service Systems Labs. (Japan) . . . . . [9772-3]

11:10 am: **Multidimensional modulation formats for coherent optical communications** (*Invited Paper*), Tobias A. Eriksson, Erik Agrell, Magnus Karlsson, Chalmers Univ. of Technology (Sweden) . . . . . [9774-2]

11:40 am: **Comparison of cost and complexity for various 16-QAM transmitter structures in coherent optical systems**, Ali M. Al-Bernani, Memorial Univ. of Newfoundland (Canada); Reinhold Noé, Univ. Paderborn (Germany) . . . . . [9774-3]

Lunch/Exhibition Break . . . . . Tue 12:00 pm to 1:00 pm

### SESSION 3

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . . . TUE 1:00 TO 3:30 PM

### Advanced Fibers and Amplifiers for Data Center, SDM, and Metro Applications

Joint Session with Conferences 9772, 9773, 9774, and 9775

Session Chairs: **Atul K. Srivastava**, NEL America, Inc. (USA); **Guifang Li**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

1:00 pm: **Novel optical fibers for data center applications** (*Invited Paper*), Ming-Jun Li, Corning Incorporated (USA) . . . . . [9772-4]

1:30 pm: **Next-generation wideband multimode fiber for data centers** (*Invited Paper*), Kasyapa Balemarthy, OFS (India) . . . . . [9775-3]

2:00 pm: **Multicore erbium doped fiber amplifiers** (*Invited Paper*), Koichi Maeda, Yukihiko Tsuchida, Ryuichi Sugizaki, Furukawa Electric Co., Ltd. (Japan); Hiroshi Matsuura, Tohoku Gakuin Univ. (Japan) . . . . . [9773-1]

2:30 pm: **New fibers for high-density space-division-multiplexed transmissions** (*Invited Paper*), Pierre Sillard, Prysmian Group (France) . [9774-4]

3:00 pm: **Four-mode semiconductor optical amplifier** (*Invited Paper*), He Wen, Tianjin Univ. (China); Yousef Alahmadi, Patrick L. LiKamWa, Cen Xia, Christian Carboni, Guifang Li, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [9774-5]

Coffee Break . . . . . Tue 3:30 pm to 3:40 pm

### SESSION 4

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . . . TUE 3:40 TO 6:10 PM

### Special Workshop on Key Devices and Components for Datacenters and Short Hauls

Joint Session with Conferences 9772, 9773, and 9774

Session Chairs: **Youichi Akasaka**, Fujitsu Network Communications Inc. (USA); **Benjamin B. Dingel**, Nasfine Photonics, Inc. (USA)

3:40 pm: **100-Gb/s InP DP-IQ modulator for small-form-factor pluggable coherent transceivers** (*Invited Paper*), Nobuhiro Kikuchi, Yoshihiro Ogiso, Eiichi Yamada, Nippon Telegraph and Telephone Corp. (Japan) . . . . . [9773-2]

4:10 pm: **Challenges in the implementation of dense wavelength division multiplexed (DWDM) optical interconnects using resonant silicon photonics** (*Invited Paper*), Anthony Lentine, Christopher T DeRose, Sandia National Labs. (USA) . . . . . [9772-5]

4:40 pm: **Next-generation-VCSELs as an enabling technology for green access networks and data centers** (*Invited Paper*), Werner H. Hofmann, Technische Univ. Berlin (Germany) . . . . . [9772-6]

5:10 pm: **Silicon photonic Mach Zehnder modulators for next-generation short-reach optical communication networks** (*Invited Paper*), Cosimo Lacava, Zhixin Liu, Dave Thomson, Optoelectronics Research Ctr. (United Kingdom); Li Ke, Univ. of Southampton (United Kingdom); Jean-Marc Fédéli, CEA-LETI (France); David J. Richardson, Optoelectronics Research Ctr. (United Kingdom); Graham T. Reed, Univ. of Southampton (United Kingdom); Periklis Petropoulos, Optoelectronics Research Ctr. (United Kingdom) . . . . . [9772-7]

OPTO

# CONFERENCE 9775

LOCATION: ROOM 122 (NORTH EXHIBIT LEVEL) AND ROOM 270 (SOUTH MEZZANINE)

5:40 pm: **On-chip mode division multiplexing technologies** (*Invited Paper*), Yunhong Ding, Louise F. Frelsen, Xiaowei Guan, Technical Univ. of Denmark (Denmark); Jing Xu, Huazhong Univ. of Science and Technology (China); Francesco Da Ros, DTU Fotonik (Denmark); Haiyan Ou, Technical Univ. of Denmark (Denmark); Christophe Peucheret, Univ. de Rennes 1 (France); Lars H. Frandsen, Leif K. Oxenlowe, Technical Univ. of Denmark (Denmark); Kresten Yvind, DTU Fotonik (Denmark) . . . . . [9774-6]

## WEDNESDAY 17 FEBRUARY

### SESSION 5

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . WED 8:00 TO 10:10 AM

#### Advanced Modulation Format and DSP I

Joint Session with Conferences 9774 and 9775

Session Chairs: **Guifang Li**, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA);  
**Juliano Oliveira**, CpqD (Brazil)

8:00 am: **Ultra-long-haul optical transmissions based on coded modulation** (*Invited Paper*), Jin-Xing Cai, TE SubCom (USA) . . . . . [9774-7]

8:30 am: **Massive eigenvalue modulated optical transmission systems**, Akihiro Maruta, Osaka Univ. (Japan) . . . . . [9774-8]

8:50 am: **Smoothly clipped root raised cosine waveforms for an effective loading of a coherent optical M-QAM modulator** (*Invited Paper*), Bishara Shamee, Morteza Ziyadi, Amirhossein Mohajerin-Ariaei, Ahmed Almainan, Yinwen Cao, Nisar Ahmed, The Univ. of Southern California (USA); Steven R. Wilkinson, Raytheon Space and Airborne Systems (USA); Alan E. Willner, The Univ. of Southern California (USA) . . . . . [9774-9]

9:20 am: **Short-haul transmission links based on 25- and 50-Gbaud PAM4 modulation** (*Invited Paper*), Winston I. Way, NeoPhotonics Corp. (USA) [9775-4]

9:50 am: **Scaling single-wavelength optical interconnects to 180 Gb/s with PAM-M and pulse shaping**, Stefanos Dris, Paraskevas Bakopoulos, Nikolaos Argyris, Christos Spatharakis, Hercules Avramopoulos, National Technical Univ. of Athens (Greece) . . . . . [9775-5]

Coffee Break . . . . . Wed 10:10 am to 10:20 am

### SESSION 6

LOCATION: RM 122 (NORTH EXHIBIT LEVEL) . WED 10:20 AM TO 12:10 PM

#### Advanced Modulation Format and DSP II

Joint Session with Conferences 9774 and 9775

Session Chairs: **Hideki Isono**, Fujitsu Optical Components Ltd. (Japan);  
**Xiang Zhou**, Google (USA)

10:20 am: **Recent advances of emerging PAM4 signaling with real-time processing for 100/400Gbps intra data center connectivity** (*Invited Paper*), Frank Chang, Inphi Corp. (USA) . . . . . [9775-6]

10:50 am: **Power penalties for multi-level PAM modulation formats at arbitrary bit error rates**, Nikolay A. Kaliteevskiy, Corning Scientific Ctr. (Russian Federation); William Wood, John D. Downie, Jason E. Hurley, Corning Incorporated (USA); Petr M. Sterlingov, Corning Scientific Ctr. (Russian Federation) . . . . . [9775-7]

11:10 am: **Performance analysis of low-complexity adaptive frequency-domain equalization and MIMO signal processing for compensation of differential mode group delay in mode-division multiplexing communication systems using few-mode fibers**, Yi Weng, Xuan He, Zhongqi Pan, Univ. of Louisiana at Lafayette (USA) . . . . . [9774-10]

11:30 am: **20-Gb/s QPSK transmission over 4km-long holey fiber using a wavelength tunable quantum dot light laser in T-band**, Akihiro Murano, Shoko Yamada, Aoyama Gakuin Univ. (Japan); Atsushi Kanno, Naokatsu Yamamoto, National Institute of Information and Communications Technology (Japan); Hideyuki Sotobayashi, Aoyama Gakuin Univ. (Japan) . . . . . [9774-11]

11:50 am: **Improved pilot-tone technique for inter- and intra-channel nonlinearity compensation in long-haul CO-OFDM systems**, Ali M. Al-Bermani, Memorial Univ. of Newfoundland (Canada) . . . . . [9774-12]

Lunch/Exhibition Break . . . . . Wed 12:10 pm to 1:10 pm

### SESSION 7

LOCATION: ROOM 122 (NORTH EXHIBIT LEVEL) . . . . WED 1:10 TO 3:30 PM

#### Advanced Modulation Format and DSP III

Joint Session with Conferences 9773, 9774, and 9775

Session Chairs: **Benny Mikkelsen**, Mintera Corp. (USA);  
**Idelfonso Tafur Monroy**, DTU Fotonik (Denmark)

1:10 pm: **High-speed real-time OFDM transmission based on FPGA** (*Invited Paper*), Xin Xiao, ZTE USA (USA); Fan Li, Jianjun Yu, ZTE TX (USA) . . . . . [9773-3]

1:40 pm: **High-capacity modulation for data center applications using silicon photonic integrated circuits** (*Invited Paper*), Po Dong, Jeffrey Lee, Alcatel-Lucent Bell Labs. (USA) . . . . . [9775-8]

2:10 pm: **112 Gb/s sub-cycle 16-QAM nyquist-SCM for intra-datacenter connectivity**, Paraskevas Bakopoulos, Stefanos Dris, Nikolaos Argyris, Christos Spatharakis, Hercules Avramopoulos, National Technical Univ. of Athens (Greece) . . . . . [9775-9]

2:30 pm: **Comparison of advanced DSP techniques for spectrally efficient Nyquist-WDM signal generation using digital FIR filters at transmitters based on higher-order modulation formats**, Yi Weng, Univ. of Louisiana at Lafayette (USA); Junyi Wang, Qualcomm Technologies, Inc. (USA); Zhongqi Pan, Univ. of Louisiana at Lafayette (USA) . . . . . [9773-4]

2:50 pm: **Detection and alignment of XY skew for dual-polarization optical quadrature amplitude transmitter using reconfigurable interference**, Yang Yue, Bo Zhang, Qiang Wang, Rob Lofland, Jason O'Neil, Jon Anderson, Juniper Networks, Inc. (USA) . . . . . [9774-13]

3:10 pm: **Secured optical fiber communication using polarization restoration technique and channel characterization**, Nikhil V. Puneekar, Bhagyashri A. Darunkar, Pramode K. Verma, The Univ. of Oklahoma - Tulsa (USA) . . . . . [9774-14]

Coffee Break . . . . . Wed 3:30 pm to 3:50 pm

### SESSION 8

LOCATION: RM 270 (SOUTH MEZZANINE) . . . . WED 3:50 TO 6:00 PM

#### NOTE ROOM CHANGE

#### Datacenter Network Trends

Session Chairs: **Philippe P. Absil**, IMEC (Belgium);  
**Hai-Feng Liu**, Intel Corp. (USA)

3:50 pm: **Trends in higher speed interconnects for data center networking** (*Invited Paper*), Kapil Shrikhande, Dell (USA) . . . . . [9775-10]

4:20 pm: **Recent standardization directions for high-speed client and line side components** (*Invited Paper*), Hideki Isono, Fujitsu Optical Components Ltd. (Japan) . . . . . [9775-11]

4:50 pm: **Optical interconnect technologies for high-bandwidth ICT systems**, Norio Chujo, Naoki Matsushima, Toshiaki Takai, Hideo Arimoto, Yasunobu Matsuoka, Hiroki Yamashita, Hitachi, Ltd. (Japan) . . . . . [9775-12]

5:10 pm: **High-baud rate coherent optical solutions for emerging data center interconnect** (*Invited Paper*), Juliano Oliveira, Jacklyn D. Reis, Sandro Rossi, Andrea Chiuchiarelli, Andre Souza, CpqD (Brazil) . . . . . [9775-13]

5:40 pm: **100 Gb/s optical discrete multi-tone transceivers for intra- and inter-datacenter networks**, Ryo Okabe, Toshiaki Tanaka, Masato Nishihara, Tomoo Takahara, Fujitsu Labs., Ltd. (Japan); Bo Liu, Lei Li, Zhenning Tao, Fujitsu Research and Development Center Co., Ltd. (China); Jens C. Rasmussen, Fujitsu Labs., Ltd. (Japan) . . . . . [9775-14]



**THURSDAY 18 FEBRUARY**

**SESSION 9**

**LOCATION: ROOM 270 (SOUTH MEZZANINE) . THU 8:00 TO 10:30 AM**

**Components for Datacenter Networks**

Session Chairs: **Hideki Isono**, Fujitsu Optical Components Ltd. (Japan);  
**Juliano Oliveira**, CpqD (Brazil)

8:00 am: **Silicon photonics for high-data-rate link applications** (*Invited Paper*), Jonathan Luff, Mehdi Asghari, Dazeng Feng, Mellanox Technologies, Inc. (USA). . . . . [9775-15]

8:30 am: **Silicon photonics switches for energy-efficient flexible networking** (*Invited Paper*), Kazuhiro Ikeda, Keijiro Suzuki, Ken Tanizawa, G. W. Cong, Shu Namiki, Hitoshi Kawashima, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [9775-16]

9:00 am: **Isipp-200: a silicon photonics platform supporting optical data rates beyond 50Gb/s** (*Invited Paper*), Philippe P. Absil, Peter De Heyn, IMEC (Belgium); Hongtao Chen, Ashwyn Srinivasan, IMEC (Belgium) and Univ. Gent (Belgium); Peter Verheyen, Sathishkumar Balakrishnan, Guy Lepage, Marianna Pantouvaki, Jeroen De Coster, IMEC (Belgium); Gunther Roelkens, Dries Van Thourhout, IMEC (Belgium) and Univ. Gent (Belgium); Joris Van Campenhout, IMEC (Belgium) . . . . . [9775-17]

9:30 am: **Demonstration of 720x720 optical fast circuit switch for intra-datacenter networks**, Koh Ueda, Yojiro Mori, Hiroshi Hasegawa, Nagoya Univ. (Japan); Hiroyuki Matsuura, Kiyo Ishii, Haruhiko Kuwatsuka, Shu Namiki, National Institute of Advanced Industrial Science and Technology (Japan); Ken-ichi Sato, Nagoya Univ. (Japan) . . . . . [9775-18]

9:50 am: **Adaptive gain, equalization, and wavelength stabilization techniques for silicon photonic microring resonator-based optical receivers**, Samuel Palermo, Texas A&M Univ. (USA); Patrick Chiang, Oregon State Univ. (USA) and Fudan Univ. (China); Kunzhi Yu, Texas A&M Univ. (USA); Rui Bai, Oregon State Univ. (USA); Cheng Li, Chin-Hui Chen, Marco Fiorentino, Raymond G. Beausoleil, Hewlett-Packard Co. (USA); Hao Li, Oregon State Univ. (USA); Binhao Wang, Ayman Shafik, Alex Titriku, Texas A&M Univ. (USA) . . . . . [9775-19]

10:10 am: **Hybrid optical amplifier in high-speed duo-binary modulated hybrid DWDM-OTDM system**, Yugnanda Malhotra, Amity School of Engineering and Technology, Delhi (India) . . . . . [9775-20]



# GREEN PHOTONICS TRACK

## **SPIE.** PHOTONICS WEST GREEN PHOTONICS

### SYMPOSIUM CHAIRS



**Stephen J. Eglash**  
Stanford Data Science Initiative,  
Stanford Univ. (USA)

You will find presentation days and times below; rooms for these presentations can be found on conference detail pages (listed numerically in the program).

SPIE Green Photonics 2016 highlights papers from OPTO and LASE that showcase the latest photonics and optoelectronic tools and materials that will reduce power consumption, enable cleaner manufacturing, and create new energy generation for a broad range of applications.

### TOPIC AREAS .....370-373

**Laser-assisted Manufacturing and Micro/Nano Fabrication**

**Renewable Energy Generation: Fusion and Photovoltaics**

**Environmental Monitoring and Sensing**

**Solid State Lighting and Displays**

**Communications**

## Laser-assisted Manufacturing and Micro/Nano Fabrication

(ordered chronologically by start date and time)

### Mid-IR laser source using hollow waveguide beam combining

Paper 9726-1 • Monday 15 Feb. 2016 • 8:00 AM  
**Ian F. Elder**, Selex ES Ltd. (United Kingdom), et al.  
Conference 9726: Solid State Lasers XXV: Technology and Devices  
SESSION 1: Eyesafe and Mid-IR Lasers I

### High throughput laser scribing of Cu(In,Ga)Se<sub>2</sub> thin-film solar cells

Paper 9735-3 • Monday 15 Feb. 2016 • 9:10 AM  
**Andreas Burn**, Berner Fachhochschule Technik und Informatik (Switzerland), et al.  
Conference 9735: Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) XXI  
SESSION 1: Lasers in Photovoltaics

### Comparative study of broadband, narrowband, and multi-wavelength resonant pumping of Er:YAG lasers

Paper 9726-6 • Monday 15 Feb. 2016 • 9:40 AM  
**Haro Fritsche**, DirectPhotonics Industries GmbH (Germany), et al.  
Conference 9726: Solid State Lasers XXV: Technology and Devices  
SESSION 1: Eyesafe and Mid-IR Lasers I

### Room-temperature continuous-wave operation of BeZnCdSe quantum-well green-to-yellow laser diodes with sub-10 mA threshold current

Paper 9767-11 • Monday 15 Feb. 2016 • 4:00 PM  
**Jijun Feng**, Univ. of Shanghai for Science and Technology (China), et al.  
Conference 9767: Novel In-Plane Semiconductor Lasers XV  
SESSION 3: Blue/Green Emitters

### Ultrafast laser drilling of injector nozzles

Paper 9740-35 • Monday 15 Feb. 2016 • 4:10 PM  
**Eric P. Mottay**, Amplitude Systèmes (France), et al.  
Conference 9740: Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XVI  
SESSION 8: Ultrashort Pulse Laser Processing

### Green microfabrication for flexible electronics by laser direct synthesis and patterning technology

Paper 9735-14 • Monday 15 Feb. 2016 • 5:10 PM  
**Ming-Tsang Lee**, National Chung Hsing Univ. (Taiwan), et al.  
Conference 9735: Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) XXI  
SESSION 4: Laser Direct Writing: Joint SESSION with Conferences 9735 and 9738

### Ultrafast laser direct micro-/nano-fabrication: Towards 4D optical printing

Paper 9736-6 • Tuesday 16 Feb. 2016 • 10:30 AM  
**Mangirdas Malinauskas**, Vilnius Univ. (Lithuania), et al.  
Conference 9736: Laser-based Micro- and Nanoprocessing X  
SESSION 2: Laser Nano-Structuring and Processing

### Cloaked contact fingers on solar cells enabled by 3D laser lithography

Paper 9738-5 • Tuesday 16 Feb. 2016 • 1:30 PM  
**Martin F. Schumann**, Karlsruher Institut für Technologie (Germany), et al.  
Conference 9738: Laser 3D Manufacturing III  
SESSION 5: 3D Laser Structuring Devices and Lithography III: Joint SESSION with Conferences 9738 and 9759

### Electrically-driven 1D photonic crystal nanolaser integrated on silicon waveguides

Paper 9767-34 • Tuesday 16 Feb. 2016 • 5:10 PM  
**Guillaume Crosnier**, Lab. de Photonique et de Nanostructures (France), et al.  
Conference 9767: Novel In-Plane Semiconductor Lasers XV  
SESSION 7: Lasers on Silicon

### Ultrashort pulse written volume-Bragg-gratings in fused silica for external stabilization of diode lasers with ultra-low spectral-drift

Paper 9730-19 • Wednesday 17 Feb. 2016 • 9:20 AM  
**Daniel Richter**, Friedrich-Schiller-Univ. Jena (Germany), et al.  
Conference 9730: Components and Packaging for Laser Systems II  
SESSION 5: Laser Diode Packaging III

### Pulsed laser deposition of ultrasmall nanoparticles: Transformation into photosensitive black-TiO<sub>2</sub> core-shell nanostructures

Paper 9737-21 • Wednesday 17 Feb. 2016 • 5:30 PM  
**David B. Geohagan**, Oak Ridge National Lab. (USA), et al.  
Conference 9737: Synthesis and Photonics of Nanoscale Materials XIII  
SESSION 6: Laser-induced Nanostructures II: Joint SESSION with Conferences 9735 and 9737

## High-temperature monitoring of an oxy-fuel fluidized bed combustor using femtosecond infrared laser-written fiber Bragg gratings

Paper 9754-38 • Wednesday 17 Feb. 2016 • 6:00 PM

**Robert B. Walker**, National Research Council Canada (Canada), et al.  
Conference 9754: Photonic Instrumentation Engineering III  
SESSION PWed: Posters-Wednesday

## Laser-assisted reduction of graphene oxide for paper based large area flexible electronics

Paper 9736-35 • Thursday 18 Feb. 2016 • 9:10 AM

**Enkeleda Balliu**, Mid Sweden Univ. (Sweden), et al.  
Conference 9736: Laser-based Micro- and Nanoprocessing X  
SESSION 8: Large Area Micro/Nano Structuring, Laser Interference Patterning

## Repurposing mainstream CNC machine tools for laser-based additive manufacturing

Paper 9738-31 • Thursday 18 Feb. 2016 • 2:20 PM

**Jason B. Jones**, Hybrid Manufacturing Technologies (USA), et al.  
Conference 9738: Laser 3D Manufacturing III  
SESSION 11: Applications, Systems, Process Developments for Additive Manufacturing I

## Post-mortem characterization of fs laser-generated micro-pillars in Li(Ni<sub>1/3</sub>Mn<sub>1/3</sub>Co<sub>1/3</sub>)O<sub>2</sub> electrodes by laser-induced breakdown spectroscopy

Paper 9736-47 • Thursday 18 Feb. 2016 • 4:20 PM

**Peter Smyrek**, Karlsruhe Institute of Technology (Germany), et al.  
Conference 9736: Laser-based Micro- and Nanoprocessing X  
SESSION 11: Advanced Laser Structuring for Energy Storage and Conversion

## High speed, high quality Li-ion battery foil cutting using nanosecond lasers

Paper 9736-49 • Thursday 18 Feb. 2016 • 5:00 PM

**Jim M. Bovatsek**, Spectra-Physics (USA), et al.  
Conference 9736: Laser-based Micro- and Nanoprocessing X  
SESSION 11: Advanced Laser Structuring for Energy Storage and Conversion

## Renewable Energy Generation: Fusion and Photovoltaics

(ordered chronologically by start date and time)

### Development of numerical modeling program for organic/inorganic hybrid solar cells by including tail/interfacial states models

Paper 9743-7 • Monday 15 Feb. 2016 • 2:40 PM

**Kuan-Ying Ho**, National Taiwan Univ. (Taiwan), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 2: Advances in Simulation of Photovoltaic Devices

### Organic molecules for photo-isomeric storage

Paper 9745-7 • Monday 15 Feb. 2016 • 2:50 PM

**Hal Gokturk**, Ecoken (USA), et al.  
Conference 9745: Organic Photonic Materials and Devices XVIII  
SESSION 2: Solar Cells

### Nanospectroscopy of PV devices

Paper 9743-8 • Monday 15 Feb. 2016 • 3:30 PM

**Marina S. Leite**, Univ. of Maryland, College Park (USA), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 3: Advances in Characterization of Photovoltaic Devices

### Local transport properties investigation by correlating hyperspectral and confocal luminescence images

Paper 9743-11 • Monday 15 Feb. 2016 • 4:40 PM

**Gilbert El-Hajje**, Electricité de France (France), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 3: Advances in Characterization of Photovoltaic Devices

### Silicon solar cell using optimized intermediate reflector layer

Paper 9743-18 • Tuesday 16 Feb. 2016 • 9:20 AM

**Mohamed A. Swilam**, The American Univ. in Cairo (Egypt), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 4: Advances in Light Management and Spectral Shaping of Photovoltaic Devices

### Design and fabrication of a micro CPV system based on Cu(In,Ga)Se<sub>2</sub> microcells array

Paper 9743-19 • Tuesday 16 Feb. 2016 • 9:40 AM

**Sebastien Jutteau**, Institut de Recherche et Développement sur l'Energie Photovoltaïque (France), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 4: Advances in Light Management and Spectral Shaping of Photovoltaic Devices

### Design and test of a new facility for assessing spectral normal emittance of solid materials at high temperature

Paper 9744-18 • Tuesday 16 Feb. 2016 • 10:10 AM

**Luca Mercatelli**, Istituto Nazionale di Ottica (Italy), et al.  
Conference 9744: Optical Components and Materials XIII  
SESSION 4: Optical Systems

### Charge-carrier dynamics in perovskite semiconductors and the significance for solar cells and lasers

Paper 9746-21 • Tuesday 16 Feb. 2016 • 10:30 AM

**Michael B. Johnston**, Univ. of Oxford (United Kingdom), et al.  
Conference 9746: Ultrafast Phenomena and Nanophotonics XX  
SESSION 5: Ultrafast Phenomena in Perovskites

### Design optimization of thin-film/wafer-based tandem junction solar cells using analytical modeling

Paper 9743-22 • Tuesday 16 Feb. 2016 • 11:20 AM

**Lauren M. Davidson**, The Univ. of Iowa (USA), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 5: Perovskites and Hybrid Photovoltaic Devices

### Performance impact of luminescent coupling on monolithic 3- to 6-volt phototransducers for photonic power systems

Paper 9743-30 • Tuesday 16 Feb. 2016 • 4:20 PM

**Matthew M. Wilkins**, Univ. of Ottawa (Canada), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 7: Advances in III-V Photovoltaic Materials and Devices

### Thin-film vapor-liquid-solid growth of InP for III-V photovoltaics

Paper 9743-31 • Tuesday 16 Feb. 2016 • 4:40 PM

**Christopher G. Bailey**, Old Dominion Univ. (USA), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 7: Advances in III-V Photovoltaic Materials and Devices

### Modeling of effects of using polycrystalline substrates for low-cost III-V photovoltaics

Paper 9743-33 • Tuesday 16 Feb. 2016 • 5:20 PM

**Zachary S. Bittner**, Rochester Institute of Technology (USA), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 7: Advances in III-V Photovoltaic Materials and Devices

### 1.7eV AlGaAs solar cells epitaxially grown on silicon by SSMBE using a superlattice and dislocation filters

Paper 9743-34 • Tuesday 16 Feb. 2016 • 5:40 PM

**Arthur L. Onno**, Univ. College London (United Kingdom), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 7: Advances in III-V Photovoltaic Materials and Devices

### Power conversion with Gallium Nitride devices

Paper 9748-35 • Wednesday 17 Feb. 2016 • 9:00 AM

**Srabanti Chowdhury**, Arizona State Univ. (USA), et al.  
Conference 9748: Gallium Nitride Materials and Devices XI  
SESSION 8: Electron Devices

### High performance 1 eV dilute nitride solar cells using quantum wells with cascaded thermally-assisted resonant tunneling design

Paper 9743-38 • Wednesday 17 Feb. 2016 • 9:10 AM

**Alexandre Freundlich**, Univ. of Houston (USA), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 8: Advances in Quantum Well and Superlattice-Enhanced Photovoltaic Devices

### Effective drift mobility approximation in multiple quantum-well solar cells

Paper 9743-39 • Wednesday 17 Feb. 2016 • 9:30 AM

**Kasidit Toprasertpong**, The Univ. of Tokyo (Japan), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 8: Advances in Quantum Well and Superlattice-Enhanced Photovoltaic Devices

# GREEN PHOTONICS TRACK

## Quasi-Fermi level splitting evaluation based on electroluminescence analysis in multiple quantum-well solar cells for investigating cell performance under concentrated light

Paper 9743-40 • Wednesday 17 Feb. 2016 • 9:50 AM  
**Tomoyuki Inoue**, The Univ. of Tokyo (Japan), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 8: Advances in Quantum Well and Superlattice-Enhanced Photovoltaic Devices

## Design optimization for two-step photon absorption in quantum dots by infrared photocurrent spectroscopy

Paper 9743-42 • Wednesday 17 Feb. 2016 • 11:10 AM  
**Ryo Tamaki**, RCAST, The Univ. of Tokyo (Japan), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 9: Intermediate Band Solar Cells

## Self-formation of ultrahigh-density InAs quantum dots for intermediate-band solar cell applications

Paper 9743-44 • Wednesday 17 Feb. 2016 • 11:50 AM  
**Koichi Yamaguchi**, The Univ. of Electro-Communications (Japan), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 9: Intermediate Band Solar Cells

## Titanium oxide: electron-selective layers for contact passivation of thin-film crystalline silicon solar cells

Paper 9749-46 • Wednesday 17 Feb. 2016 • 2:25 PM  
**Yi Liu**, Peking Univ. (China), et al.  
Conference 9749: Oxide-based Materials and Devices VII  
SESSION 9: Photovoltaics II

## Exciton-dominated fast recombination in low-temperature CH<sub>3</sub>NH<sub>3</sub>PbCl<sub>2</sub>-x perovskite thin films

Paper 9745-43 • Wednesday 17 Feb. 2016 • 4:50 PM  
**Som Sarang**, Univ. of California, Merced (USA), et al.  
Conference 9745: Organic Photonic Materials and Devices XVIII  
SESSION 11: Organic/Inorganic Hybrids II

## Simulation study of GaAsP/Si tandem cells including the impact of threading dislocations on the luminescent coupling between the cells

Paper 9743-45 • Wednesday 17 Feb. 2016 • 4:50 PM  
**Arthur L. Onno**, Univ. College London (United Kingdom), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION 10: Photovoltaics Modeling: Joint SESSION with Conferences 9742 and 9743

## Down-conversion of solar photons using alkali vapors

Paper 9743-46 • Wednesday 17 Feb. 2016 • 6:00 PM  
**Hal Gokturk**, Ecoken (USA), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION PWed: Posters-Wednesday

## Metal/metal-oxide nanocoatings on black silicon nano-grass for enhanced solar absorption and photochemical activity

Paper 9743-51 • Wednesday 17 Feb. 2016 • 6:00 PM  
**Pabitra Dahal**, Masdar Institute of Science & Technology (United Arab Emirates), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION PWed: Posters-Wednesday

## Green solar cells using natural pigments having complementary absorption spectrum

Paper 9743-55 • Wednesday 17 Feb. 2016 • 6:00 PM  
**Sreeja S.**, C.S.I.R. Madras Complex (India), et al.  
Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
SESSION PWed: Posters-Wednesday

## Low-temperature and UV-irradiation treatments of porous titania-capped silica GNRs for dye solar cells (DSCs)

Paper 9749-43 • Wednesday 17 Feb. 2016 • 6:00 PM  
**Sarah Lai**, Consiglio Nazionale delle Ricerche (Italy), et al.  
Conference 9749: Oxide-based Materials and Devices VII  
SESSION PWed: Posters-Wednesday

## Visible to near-infrared narrow-band thermal emitters based on silicon-rod photonic crystals

Paper 9756-53 • Thursday 18 Feb. 2016 • 8:50 AM  
**Masahiro Suemitsu**, Osaka Gas Co., Ltd. (Japan), et al.  
Conference 9756: Photonic and Phononic Properties of Engineered Nanostructures VI  
SESSION 12: Photonic Crystal Structures I

## High-contrast subwavelength grating-based smart power window

Paper 9757-29 • Thursday 18 Feb. 2016 • 4:00 PM  
**Ameen Elikkottil**, Academy of Scientific & Innovative Research (India), et al.  
Conference 9757: High Contrast Metastructures V  
SESSION 8: Novel Devices

## Environmental Monitoring and Sensing

(ordered chronologically by start date and time)

### Novel label-free biosensing technology for monitoring of aqueous solutions

Paper 9725-23 • Monday 15 Feb. 2016 • 5:00 PM  
**Florian Kehl**, ETH Zürich (Switzerland), et al.  
Conference 9725: Frontiers in Biological Detection: From Nanosensors to Systems  
SESSION 6: New Biosensing Methods

### Interband cascade laser sources in the mid-infrared for green photonics

Paper 9767-37 • Wednesday 17 Feb. 2016 • 8:50 AM  
**Johannes Koeth**, nanoplus GmbH (Germany), et al.  
Conference 9767: Novel In-Plane Semiconductor Lasers XV  
SESSION 8: Interband and Quantum Cascade Lasers

## Fully solution-processed organic light-emitting electrochemical cells (OLEC) with inkjet-printed micro-lenses for disposable lab-on-chip applications at ambient conditions

Paper 9745-30 • Wednesday 17 Feb. 2016 • 9:00 AM  
**Zhe Shu**, Fraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany), et al.  
Conference 9745: Organic Photonic Materials and Devices XVIII  
SESSION 8: OLEDs

## Climate engineering with oxide photocatalysts

Paper 9749-54 • Wednesday 17 Feb. 2016 • 4:20 PM  
**Hal Gokturk**, Ecoken (USA), et al.  
Conference 9749: Oxide-based Materials and Devices VII  
SESSION 10: Oxides as Environmental Catalysts and Sensors

## Theoretical analysis of quantum-dot quantum cascade lasers: design considerations and current requirements

Paper 9767-50 • Wednesday 17 Feb. 2016 • 4:20 PM  
**Stephan Michael**, Technische Univ. Kaiserslautern (Germany), et al.  
Conference 9767: Novel In-Plane Semiconductor Lasers XV  
SESSION 11: New Device Concepts

## Impact of glycerol on zinc-oxide-based thin film transistors with indium molybdenum oxide transparent electrodes

Paper 9749-56 • Wednesday 17 Feb. 2016 • 4:50 PM  
**Mateusz T. Madzik**, Masdar Institute of Science & Technology (United Arab Emirates), et al.  
Conference 9749: Oxide-based Materials and Devices VII  
SESSION 10: Oxides as Environmental Catalysts and Sensors

## Low-cost flexible thin-film sensor devices from bacteria-synthesized nanoparticles

Paper 9749-57 • Wednesday 17 Feb. 2016 • 5:05 PM  
**Christopher Jacobs**, Oak Ridge National Lab. (USA), et al.  
Conference 9749: Oxide-based Materials and Devices VII  
SESSION 10: Oxides as Environmental Catalysts and Sensors

## Effects of UV activation on sorption/desorption kinetics and electronic response of carbon allotropes in humid and oxygen rich environments

Paper 9745-54 • Wednesday 17 Feb. 2016 • 6:00 PM  
**Eric Muckley**, Oak Ridge National Lab. (USA), et al.  
Conference 9745: Organic Photonic Materials and Devices XVIII  
SESSION PWed: Posters-Wednesday

## Oxide nano-ions for carbon dioxide sequestration

Paper 9749-64 • Wednesday 17 Feb. 2016 • 6:00 PM  
**Hal Gokturk**, Ecoken (USA), et al.  
Conference 9749: Oxide-based Materials and Devices VII  
SESSION PWed: Posters-Wednesday



## Solid State Lighting and Displays

(ordered chronologically by start date and time)

### Single-crystal phosphors for high-brightness white LEDs/LDs

Paper 9768-4 • Monday 15 Feb. 2016 • 11:50 AM

**Encarnación G. Villora**, National Institute for Materials Science (Japan), et al.  
Conference 9768: Light-Emitting Diodes: Materials, Devices, and Applications for Solid State Lighting XX  
SESSION 1: Nanomaterials and Nanostructures for LEDs I

### First demonstration of orange-yellow light-emitter devices in InGaP/InAlGaP laser structure using strain-induced quantum well intermixing technique

Paper 9767-9 • Monday 15 Feb. 2016 • 2:40 PM

**Mohammed A. Majid**, King Abdullah Univ. of Science and Technology (Saudi Arabia), et al.  
Conference 9767: Novel In-Plane Semiconductor Lasers XV  
SESSION 2: Materials Developments

### LEDs for solid-state lighting: searching room for improvements

Paper 9768-11 • Monday 15 Feb. 2016 • 4:20 PM

**Sergey Y. Karpov**, STR Group-Soft Impact Ltd. (Russian Federation), et al.  
Conference 9768: Light-Emitting Diodes: Materials, Devices, and Applications for Solid State Lighting XX  
SESSION 3: High Current Performance and Droop in InGaN LEDs

### 3D numerical modeling of the carrier transport and radiative efficiency for InGaN/GaN light-emitting diodes with V-shaped pits

Paper 9768-14 • Monday 15 Feb. 2016 • 5:30 PM

**Chi-Kang Li**, National Taiwan Univ. (Taiwan), et al.  
Conference 9768: Light-Emitting Diodes: Materials, Devices, and Applications for Solid State Lighting XX  
SESSION 3: High Current Performance and Droop in InGaN LEDs

### 3-pad flip chip COB LED: Novel approach in lowering thermal resistance thus enabling smaller heat sink on super high-power LEDs

Paper 9768-16 • Tuesday 16 Feb. 2016 • 8:30 AM

**Dongwook Noh**, Flip Chip Opto Inc. (USA), et al.  
Conference 9768: Light-Emitting Diodes: Materials, Devices, and Applications for Solid State Lighting XX  
SESSION 4: Novel Technologies for LED Design and Fabrication I

### GaN-nanowire-based light-emitting diodes

Paper 9768-25 • Tuesday 16 Feb. 2016 • 1:30 PM

**Lars Samuelson**, Lund Univ. (Sweden), et al.  
Conference 9768: Light-Emitting Diodes: Materials, Devices, and Applications for Solid State Lighting XX  
SESSION 6: Nanomaterials and Nanostructures for LEDs II

### Light emission in the NIR and VIS from SiALON rare-earth-doped thin films for integrated optical devices

Paper 9744-37 • Wednesday 17 Feb. 2016 • 9:40 AM

**Ivan Camps**, Consejo Superior de Investigaciones Científicas (Spain), et al.  
Conference 9744: Optical Components and Materials XIII  
SESSION 9: Optical Properties of Rare-Earth-Doped Materials

### Dislocation-free c-oriented platelets based on GaN nanowire seeds

Paper 9748-48 • Wednesday 17 Feb. 2016 • 4:00 PM

**Lars Samuelson**, Lund Univ. (Sweden), et al.  
Conference 9748: Gallium Nitride Materials and Devices XI  
SESSION 11: Nanostructures

### Fully transparent thin film transistors based on zinc oxide channel layer and molybdenum doped indium oxide electrodes

Paper 9770-16 • Thursday 18 Feb. 2016 • 3:40 PM

**Mateusz T. Madzik**, Masdar Institute of Science & Technology (United Arab Emirates), et al.  
Conference 9770: Advances in Display Technologies VI  
SESSION 4: Driving Algorithm and Electronics

## Communications

(ordered chronologically by start date and time)

### High-precision 3D printing: fabrication of micro-optics and integrated optical packages

Paper 9753-2 • Monday 15 Feb. 2016 • 11:00 AM

**Ruth Houbertz**, Multiphoton Optics GmbH (Germany), et al.  
Conference 9753: Optical Interconnects XVI  
SESSION 1: Novel Optical Waveguide and Interconnect Technologies

### Ultrahigh refractive index chalcogenide based copolymers for infrared optics

Paper 9745-11 • Monday 15 Feb. 2016 • 5:00 PM

**Soha Namnabat**, The Univ. of Arizona (USA), et al.  
Conference 9745: Organic Photonic Materials and Devices XVIII  
SESSION 3: Optical Waveguides

### Planar polymer and glass graded index waveguides for data centre applications

Paper 9753-16 • Tuesday 16 Feb. 2016 • 8:30 AM

**Richard C. Pitwon**, Seagate Systems (UK) Ltd. (United Kingdom), et al.  
Conference 9753: Optical Interconnects XVI  
SESSION 4: Electrical-Optical PCB Technologies

### Optical links sizing for future broadband geostationary satellite feeder

Paper 9739-22 • Tuesday 16 Feb. 2016 • 10:30 AM

**Sylvain Poulenard**, Airbus Defence and Space SAS (France), et al.  
Conference 9739: Free-Space Laser Communication and Atmospheric Propagation XXVIII  
SESSION 7: Systems Engineering II: Analysis

### Nanolasers and related issues for integrated photonics applications

Paper 9751-4 • Tuesday 16 Feb. 2016 • 3:40 PM

**Cun-Zheng Ning**, Arizona State Univ. (USA), et al.  
Conference 9751: Smart Photonic and Optoelectronic Integrated Circuits XVIII  
SESSION 2: Plasmonic Nano-Lasers, Antennas, and Structures

# 3D PRINTING TRACK

## SPIE. PHOTONICS WEST 3D PRINTING

### SYMPOSIUM CHAIR



**Henry Helvajian**  
The Aerospace Corp. (USA)

You will find presentation days and times below; rooms for these presentations can be found on conference detail pages (listed numerically in the program).

SPIE Applications of 3D Printing 2016 highlights papers from BIOS, LASE, and OPTO that showcase innovative ways to apply this multidimensional/multidisciplinary technology.

### TOPIC AREAS .....374-378

**Additive Manufacturing**

**Selective Laser Melting, Maser Sintering, Laser Photopolymerization**

**Novel Materials, Protean Materials, and Laser Interactions**

**Software That Increases Efficiencies and Speed**

**In-situ Sensors or Probes to Verify and Quantify Additive Manufacturing Processes in Real Time**

**Conformal Photonics/Electronics**

## Saturday 13 Feb. 2016

(ordered by day and time)

### Single DNA imaging and length quantification through a mobile-phone microscope

Paper 9699-2 • Saturday 13 Feb 2016, 9:10 AM

**Qingshan Wei**, Univ. of California, Los Angeles (USA), et al.

Conference 9699: Optics and Biophotonics in Low-Resource Settings II

SESSION 1: Lab-On-a-Chip Methods

### Cellphone-based colorimetric microplate reader for point-of-care testing

Paper 9699-4 • Saturday 13 Feb 2016, 9:50 AM

**Qingshan Wei**, Univ. of California, Los Angeles (USA), et al.

Conference 9699: Optics and Biophotonics in Low-Resource Settings II

SESSION 1: Lab-On-a-Chip Methods

### Multimodal, 3D pathology-mimicking bladder phantom for evaluation of cystoscopic technologies

Paper 9689-48 • Saturday 13 Feb 2016, 10:00 AM

**Audrey K. Ellerbee**, Stanford Univ. (USA), et al.  
Conference 9689B: Therapeutics and Diagnostics in Urology

SESSION 1: Advanced Technology in Urology

### Development and bench testing of a multi-spectral imaging technology built on a smartphone platform

Paper 9699-6 • Saturday 13 Feb 2016, 11:00 AM

**David Levitz**, MobileODT Ltd. (Israel), et al.  
Conference 9699: Optics and Biophotonics in Low-Resource Settings II

SESSION 3: Fabrication and 3D Printing in Optical Systems

### Customized three-dimensional printed optical phantoms with user-defined absorption and scattering

Paper 9700-7 • Saturday 13 Feb 2016, 11:10 AM

**Darren M. Roblyer**, Boston Univ. (USA), et al.  
Conference 9700: Design and Quality for Biomedical Technologies IX

SESSION 2: Printed Phantoms

## Sunday 14 Feb. 2016

### Ultra-small 3D printed micro-lens and mirror assembly for endoscopic assessment of the airway

Paper 9691-50 • Sunday 14 Feb 2016, 9:30 AM

**Robert A. McLaughlin**, The Univ. of Western Australia (Australia), et al.

Conference 9691B: Optical Techniques in Pulmonary Medicine III

SESSION 12: New Approaches, Advancements and Techniques

### High-precision 3D printing for biomedical applications

Paper 9740-6 • Sunday 14 Feb 2016, 11:00 AM

**Ruth Houbertz**, Multiphoton Optics GmbH (Germany), et al.

Conference 9740: Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XVI

SESSION 2: New Technologies

### Pyro-EHD ink-jet printing for direct functionalization of 3D lab-on-chip devices

Paper 9705-22 • Sunday 14 Feb 2016, 2:50 PM

**Pietro Ferraro**, Istituto di Cibernetica Eduardo Caianiello (Italy), et al.

Conference 9705: Microfluidics, BioMEMS, and Medical Microsystems XIV

SESSION 5: Manufacturing II

### Packaging and micro-structuring for enabling multi-functional fiber-cladding photonics and lab-in-fiber

Paper 9759-14 • Sunday 14 Feb 2016, 3:00 PM

**Moez Haque**, Univ. of Toronto (Canada), et al.  
Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX

SESSION 3: Light Extraction and Guiding

### Single-step etch mask for 3D monolithic nanostructures

Paper 9759-16 • Sunday 14 Feb 2016, 4:30 PM

**Diana A. Grishina**, Univ. Twente (Netherlands), et al.  
Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX

SESSION 4: 3D Photonic Structures

### The effect of pulse duration, energy deposited and pulse energy on the formation of nanogratings

Paper 9740-54 • Sunday 14 Feb 2016, 4:40 PM

**Yves Bellouard**, Ecole Polytechnique Fédérale de Lausanne (Switzerland), et al.

Conference 9740: Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XVI

SESSION 4: Characterization and Measurement

### Stacking of polymer nano-gratings by electron beam writing to form 3-level diffractive optical elements for 3D holographic lithography

Paper 9759-18 • Sunday 14 Feb 2016, 5:10 PM

**Leon Yuan**, Univ. of Toronto (Canada), et al.  
Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX

SESSION 4: 3D Photonic Structures

### Development of 3D printing probe for dermatological optical coherence tomography

Paper 9689-39 • Sunday 14 Feb 2016, 5:30 PM

**Meng-Tsan Tsai**, Chang Gung Univ. (Taiwan), et al.  
Conference 9689A: Photonics in Dermatology and Plastic Surgery

SESSION PSun: Posters-Sunday

## Monday 15 Feb. 2016

### Mid-IR laser source using hollow waveguide beam combining

Paper 9726-1 • Monday 15 Feb 2016, 8:00 AM  
**Ian F. Elder**, Selex ES Ltd. (United Kingdom), et al.  
 Conference 9726: Solid State Lasers XXV: Technology and Devices  
 SESSION 1: Eyesafe and Mid-IR Lasers I

### All optical fiber polarization controlling devices fabricated by femtosecond laser irradiation

Paper 9740-20 • Monday 15 Feb 2016, 8:50 AM  
**Lei Yuan**, Clemson Univ. (USA), et al.  
 Conference 9740: Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XVI  
 SESSION 5: Novel Processing for Advanced Devices

### Fluorescent detection of C - reactive protein from blood plasma on a 3D-printed device

Paper 9715-4 • Monday 15 Feb 2016, 9:20 AM  
**Shreesha Jagadeesh**, Univ. of Toronto (Canada), et al.  
 Conference 9715: Optical Diagnostics and Sensing XVI: Toward Point-of-Care Diagnostics  
 SESSION 1: Point-of-Care Diagnostics I

### Progress on femtosecond laser-based system-materials: three-dimensional monolithic electrostatic micro-actuator for optomechanics

Paper 9740-23 • Monday 15 Feb 2016, 9:50 AM  
**Tao Yang**, Ecole Polytechnique Fédérale de Lausanne (Switzerland), et al.  
 Conference 9740: Frontiers in Ultrafast Optics: Biomedical, Scientific, and Industrial Applications XVI  
 SESSION 5: Novel Processing for Advanced Devices

### Laser nanofabrication for advanced micro-cavities

Paper 9727-7 • Monday 15 Feb 2016, 10:50 AM  
**Hong-Bo Sun**, Jilin Univ. (China), et al.  
 Conference 9727: Laser Resonators, Microresonators, and Beam Control XVIII  
 SESSION 2: Novel Microresonator Optics II

### High-precision 3D printing: fabrication of micro-optics and integrated optical packages

Paper 9753-2 • Monday 15 Feb 2016, 11:00 AM  
**Ruth Houbertz**, Multiphoton Optics GmbH (Germany), et al.  
 Conference 9753: Optical Interconnects XVI  
 SESSION 1: Novel Optical Waveguide and Interconnect Technologies

### Estimation of free carrier concentrations in high-quality heavily doped GaN:Si micro-rods

Paper 9768-2 • Monday 15 Feb 2016, 11:00 AM  
**Matin Mohajerani**, Technische Univ. Braunschweig (Germany), et al.  
 Conference 9768: Light-Emitting Diodes: Materials, Devices, and Applications for Solid State Lighting XX  
 SESSION 1: Nanomaterials and Nanostructures for LEDs I

### The floating 3D language

Paper 9771-8 • Monday 15 Feb 2016, 2:20 PM  
**Yin-Ren Chang**, De Montfort Univ. (United Kingdom), et al.  
 Conference 9771: Practical Holography XXX: Materials and Applications  
 SESSION 2: Holography, Art and Perception

### A cantilever based optical fiber acoustic sensor fabricated by femtosecond laser micromachining

Paper 9738-2 • Monday 15 Feb 2016, 2:30 PM  
**Jie Liu**, Clemson Univ. (USA), et al.  
 Conference 9738: Laser 3D Manufacturing III  
 SESSION 1: Laser 3D Micro/Nano Structuring: Joint Session with Conferences 9735 and 9738

### Fabrication of waveguide spatial light modulators via femtosecond laser micromachining

Paper 9759-25 • Monday 15 Feb 2016, 2:50 PM  
**V. Michael Bove**, MIT Media Lab. (USA), et al.  
 Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX  
 SESSION 6: Advanced Manufacturing using a DMD or other SLM: Joint Session with Conferences 9759 and 9761

### Laser-assisted morphing of complex three dimensional objects

Paper 9735-12 • Monday 15 Feb 2016, 3:10 PM  
**Jakub Drs**, Ecole Polytechnique Fédérale de Lausanne (Switzerland), et al.  
 Conference 9735: Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) XXI  
 SESSION 3: Laser 3D Micro/Nano Structuring: Joint Session with Conferences 9735 and 9738

### Laser-assisted inkjet printing of highly viscous fluids with sub-nozzle resolution

Paper 9738-3 • Monday 15 Feb 2016, 4:00 PM  
**Paul Delrot**, Ecole Polytechnique Fédérale de Lausanne (Switzerland), et al.  
 Conference 9738: Laser 3D Manufacturing III  
 SESSION 2: Laser Direct Writing: Joint Session with Conferences 9735 and 9738

### Laser induced forward transfer: a novel tool for printing sensors and characterizing surface wetting properties

Paper 9735-13 • Monday 15 Feb 2016, 4:20 PM  
**Ioanna Zergioti**, National Technical Univ. of Athens (Greece), et al.  
 Conference 9735: Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) XXI  
 SESSION 4: Laser Direct Writing: Joint Session with Conferences 9735 and 9738

### Two-axis gimbal for stratospheric air-to-air and air-to-ground laser communication

Paper 9739-15 • Monday 15 Feb 2016, 4:20 PM  
**Amnon G. Talmor**, Facebook, Inc. (USA), et al.  
 Conference 9739: Free-Space Laser Communication and Atmospheric Propagation XXVIII  
 SESSION 4: Beam Control

### Laser-printing and femtosecond laser-structuring of electrode materials for the manufacturing of 3D lithium-ion micro-batteries

Paper 9738-4 • Monday 15 Feb 2016, 4:40 PM  
**Peter Smyrek**, Karlsruher Institut für Technologie (Germany), et al.  
 Conference 9738: Laser 3D Manufacturing III  
 SESSION 2: Laser Direct Writing: Joint Session with Conferences 9735 and 9738

## Tuesday 16 Feb. 2016

### 3D printing of natural organic materials by photochemistry

Paper 9745-13 • Tuesday 16 Feb 2016, 8:00 AM  
**Patrice L. Baldeck**, Ecole Normale Supérieure de Lyon (France), et al.  
 Conference 9745: Organic Photonic Materials and Devices XVIII  
 SESSION 4: Materials I

### Multilayer optical interconnects using ultrafast laser direct written 3D waveguides and ion exchange surface waveguides

Paper 9753-15 • Tuesday 16 Feb 2016, 8:00 AM  
**Kevin Chen**, Univ. of Pittsburgh (USA), et al.  
 Conference 9753: Optical Interconnects XVI  
 SESSION 4: Electrical-Optical PCB Technologies

### Complex micro-optics fabricated by femtosecond 3D direct laser writing

Paper 9759-33 • Tuesday 16 Feb 2016, 8:30 AM  
**Harald Giessen**, Univ. Stuttgart (Germany), et al.  
 Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX  
 SESSION 8: 3D Laser Structuring Devices and Lithography I: Joint Session with Conferences 9738 and 9759

### Multi-acoustic lens design methodology for a low cost C-scan photoacoustic imaging camera

Paper 9708-60 • Tuesday 16 Feb 2016, 9:00 AM  
**Bhargava Kumar Chinni**, Univ. of Rochester Medical Ctr. (USA), et al.  
 Conference 9708: Photons Plus Ultrasound: Imaging and Sensing 2016  
 SESSION 9: Novel Methods and Systems

### Study of 3D printing method for GRIN micro-optics devices

Paper 9759-34 • Tuesday 16 Feb 2016, 9:00 AM  
**Pei-Jen Wang**, National Tsing Hua Univ. (Taiwan), et al.  
 Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX  
 SESSION 8: 3D Laser Structuring Devices and Lithography I: Joint Session with Conferences 9738 and 9759

### Ultrafast laser direct micro-/nano-fabrication: Towards 4D optical printing

Paper 9736-6 • Tuesday 16 Feb 2016, 10:30 AM  
**Mangirdas Malinauskas**, Vilnius Univ. (Lithuania), et al.  
 Conference 9736: Laser-based Micro- and Nanoprocessing X  
 SESSION 2: Laser Nano-Structuring and Processing

### STED lithography for applications in biology

Paper 9759-39 • Tuesday 16 Feb 2016, 11:00 AM  
**Thomas A. Klar**, Johannes Kepler Univ. Linz (Austria), et al.  
 Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX  
 SESSION 9: 3D Laser Structuring Devices and Lithography II: Joint Session with Conferences 9738 and 9759

# 3D PRINTING TRACK

## 3D micro/nano manufacturing of spatial light modulators for highly compact spectroscopy systems

Paper 9760-4 • Tuesday 16 Feb 2016, 11:00 AM

**Sascha P. Heussler**, National Univ. of Singapore (Singapore), et al.

Conference 9760: MOEMS and Miniaturized Systems XV

SESSION 2: Spatial Light Modulator Technologies for 3D Applications: Joint Session with Conferences 9760 and 9761

## Waveguides and nonlinear refractive index in chalcogenide glass containing Ag<sub>2</sub>S nanocrystals

Paper 9736-8 • Tuesday 16 Feb 2016, 11:20 AM

**Juliana M. P. Almeida**, Univ. de São Paulo (Brazil), et al.

Conference 9736: Laser-based Micro- and Nanoprocessing X

SESSION 2: Laser Nano-Structuring and Processing

## 3D SLM-based STED-lithography

Paper 9759-40 • Tuesday 16 Feb 2016, 11:20 AM

**Julian Hering**, Technische Univ. Kaiserslautern (Germany), et al.

Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX

SESSION 9: 3D Laser Structuring Devices and Lithography II: Joint Session with Conferences 9738 and 9759

## Multi-photon lithography of 3D micro-structures in As<sub>2</sub>S<sub>3</sub> and Ge<sub>5</sub>(As<sub>2</sub>Se<sub>3</sub>)<sub>9</sub>S chalcogenide glasses

Paper 9759-41 • Tuesday 16 Feb 2016, 11:40 AM

**Casey M. Schwarz**, Univ. of Central Florida (USA), et al.

Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX

SESSION 9: 3D Laser Structuring Devices and Lithography II: Joint Session with Conferences 9738 and 9759

## Cloaked contact fingers on solar cells enabled by 3D laser lithography

Paper 9738-5 • Tuesday 16 Feb 2016, 1:30 PM

**Martin F. Schumann**, Karlsruhe Institut für Technologie (Germany), et al.

Conference 9738: Laser 3D Manufacturing III

SESSION 5: 3D Laser Structuring Devices and Lithography III: Joint Session with Conferences 9738 and 9759

## Light-modulated patterns of plasmonic, upconversion, and graphene nanoparticles in liquid crystals

Paper 9769-9 • Tuesday 16 Feb 2016, 1:30 PM

**Ivan I. Smalyukh**, Univ. of Colorado at Boulder (USA), et al.

Conference 9769: Emerging Liquid Crystal Technologies XI

SESSION 3: Optical Manipulation and Imaging

## Precise 3D printing of micro/nanostructures using highly conductive carbon nanotube-acrylate composites

Paper 9738-6 • Tuesday 16 Feb 2016, 2:20 PM

**Yongfeng Lu**, Univ. of Nebraska-Lincoln (USA), et al.

Conference 9738: Laser 3D Manufacturing III

SESSION 5: 3D Laser Structuring Devices and Lithography III: Joint Session with Conferences 9738 and 9759

## Engineering reconfigurable laser-written circuits for practical quantum metrology

Paper 9750-28 • Tuesday 16 Feb 2016, 2:50 PM

**Zachary J. Chaboyer**, Ctr. for Ultrahigh bandwidth Devices for Optical Systems (Australia), et al.

Conference 9750: Integrated Optics: Devices, Materials, and Technologies XX

SESSION 6: On-Chip Quantum Optics

## 3D direct laser writing of metal structures for novel optical applications

Paper 9759-43 • Tuesday 16 Feb 2016, 4:00 PM

**Michael G. Moebius**, Harvard School of Engineering and Applied Sciences (USA), et al.

Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX

SESSION 11: 3D Laser Structuring Devices and Lithography IV: Joint Session with Conferences 9738 and 9759

## Manufacturing of functional micro/nano structures by fs-laser microfabrication

Paper 9738-9 • Tuesday 16 Feb 2016, 4:30 PM

**Cleber R. Mendonça**, Instituto de Física de São Carlos (Brazil), et al.

Conference 9738: Laser 3D Manufacturing III

SESSION 6: 3D Laser Structuring Devices and Lithography IV: Joint Session with Conferences 9738 and 9759

## Femtosecond laser direct-write of lab-in-fiber sensors through polymer-coated optical fiber

Paper 9759-44 • Tuesday 16 Feb 2016, 4:50 PM

**Kevin A. J. Joseph**, Univ. of Toronto (Canada), et al.

Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX

SESSION 11: 3D Laser Structuring Devices and Lithography IV: Joint Session with Conferences 9738 and 9759

## Advanced two-photon photolithography for patterning of transparent, electrically conductive ionic liquid-polymer nanostructures

Paper 9738-10 • Tuesday 16 Feb 2016, 5:10 PM

**Natalia A. Bakhina**, Karlsruhe Institut für Technologie (Germany), et al.

Conference 9738: Laser 3D Manufacturing III

SESSION 6: 3D Laser Structuring Devices and Lithography IV: Joint Session with Conferences 9738 and 9759

## Femtosecond laser processing of transparent materials for assembly-free fabrication of photonic microsensors

Paper 9735-47 • Tuesday 16 Feb 2016, 6:00 PM

**Lei Yuan**, Clemson Univ. (USA), et al.

Conference 9735: Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) XXI

SESSION PTue: Posters-Tuesday

## Optically active acrylate/SWCNT composite microdevices produced by multi-photon polymerization

Paper 9738-41 • Tuesday 16 Feb 2016, 6:00 PM

**Adriano Jose Galvani Otuka**, Instituto de Física de São Carlos (Brazil), et al.

Conference 9738: Laser 3D Manufacturing III

SESSION PTue: Posters-Tuesday

## Maskless lithography stage-shutter-free microfabrication based on serial area-controlled hologram

Paper 9738-42 • Tuesday 16 Feb 2016, 6:00 PM

**Chenchu Zhang**, Univ. of Science and Technology of China (China), et al.

Conference 9738: Laser 3D Manufacturing III

SESSION PTue: Posters-Tuesday

## Improving accuracy of overhanging structures for selective laser melting through reliability characterization of single track formation on thick powder beds

Paper 9738-44 • Tuesday 16 Feb 2016, 6:00 PM

**Sankhya Mohanty**, Technical Univ. of Denmark (Denmark), et al.

Conference 9738: Laser 3D Manufacturing III

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## Wednesday 17 Feb. 2016

### The generation of obstructions and sealed micro-cavities during ultrafast laser drilling in glass

Paper 9736-21 • Wednesday 17 Feb 2016, 8:30 AM

**Omer Dolev**, Orbotech Ltd. (Israel), et al.

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SESSION 5: High Speed Laser Beam Engineering Systems for High Power Ultra Short Pulsed Laser I

### Quantized blistering of transparent films with femtosecond laser interference

Paper 9735-28 • Wednesday 17 Feb 2016, 9:10 AM

**Stephen Ho**, Univ. of Toronto (Canada), et al.

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SESSION 9: Thin Film Processing

### Laser printing of 3D metallic interconnects

Paper 9738-12 • Wednesday 17 Feb 2016, 2:30 PM

**Alberto Piqué**, U.S. Naval Research Lab. (USA), et al.

Conference 9738: Laser 3D Manufacturing III

SESSION 7: Laser Induced Forward Transfer (LIFT)

### Sub-diffraction limit nanostructures induced by femtosecond laser direct writing

Paper 9735-31 • Wednesday 17 Feb 2016, 2:40 PM

**Xianfan Xu**, Purdue Univ. (USA), et al.

Conference 9735: Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) XXI

SESSION 10: Laser-induced Nanostructures I: LIPSS: Joint Session with Conferences 9735 and 9737

### 3D fabricated microoptic system for multispectral tissue fluorescence lifetime measurements

Paper 9711-51 • Wednesday 17 Feb 2016, 3:20 PM

**Luwei Zou**, Univ. of Michigan-Dearborn (USA), et al.

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SESSION 8: Instrumentation II

### 3D manufacturing of micro and nano-architected materials

Paper 9738-14 • Wednesday 17 Feb 2016, 3:40 PM

**Lorenzo Valdevit**, Univ. of California, Irvine (USA), et al.

Conference 9738: Laser 3D Manufacturing III

SESSION 8: Materials, Processes, and Post-Printing Processes for Additive Manufacturing



## **Aperiodic mechanical metamaterial: Bridging the gap between matter and machine**

Paper 9738-15 • Wednesday 17 Feb 2016, 4:10 PM  
**Corentin Coulais**, Leiden Univ. (Netherlands), et al.  
 Conference 9738: Laser 3D Manufacturing III  
 SESSION 8: Materials, Processes, and Post-Printing Processes for Additive Manufacturing

## **The TEMPS facility for optical property metrology of materials at high temperatures: Goals and current status**

Paper 9738-16 • Wednesday 17 Feb 2016, 4:40 PM  
**Sergey Mekhontsev**, National Institute of Standards and Technology (USA), et al.  
 Conference 9738: Laser 3D Manufacturing III  
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## **Electrochemistry and corrosion of multi-metal printed structures**

Paper 9738-17 • Wednesday 17 Feb 2016, 5:00 PM  
**Owen Hildreth**, Arizona State Univ. (USA), et al.  
 Conference 9738: Laser 3D Manufacturing III  
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## **Laser powder injection additive manufacturing of novel alloys and composites**

Paper 9738-18 • Wednesday 17 Feb 2016, 5:30 PM  
**Baolong Zheng**, Univ. of California, Irvine (USA), et al.  
 Conference 9738: Laser 3D Manufacturing III  
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## **Dielectric elastomer-based laser beam pointing method with broadband wavelength**

Paper 9742-72 • Wednesday 17 Feb 2016, 6:00 PM  
**Tomohiko Hayakawa**, The Univ. of Tokyo (Japan), et al.  
 Conference 9742: Physics and Simulation of Optoelectronic Devices XXIV  
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## **Organic solar cells with various plasmonic nanostructures using titanium nitride**

Paper 9743-52 • Wednesday 17 Feb 2016, 6:00 PM  
**Mohamed A. Swillam**, The American Univ. in Cairo (Egypt), et al.  
 Conference 9743: Physics, Simulation, and Photonic Engineering of Photovoltaic Devices V  
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## **Planar array antenna with director on Indium phosphide substrate for 300GHz wireless link**

Paper 9747-73 • Wednesday 17 Feb 2016, 6:00 PM  
**Haruichi Kanaya**, Kyushu Univ. (Japan), et al.  
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## **Novel fabrication technique of hybrid structure lens array for 3D images**

Paper 9759-46 • Wednesday 17 Feb 2016, 6:00 PM  
**Junsik Lee**, KAIST (Korea, Republic of), et al.  
 Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX  
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## **Slanted liquid microlens array by using diffuser**

Paper 9759-47 • Wednesday 17 Feb 2016, 6:00 PM  
**DooSeub Shin**, KAIST (Korea, Republic of), et al.  
 Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX  
 SESSION PWed: Posters-Wednesday

## **Direct write grayscale lithography as a fabrication technology for deep micro-optical freeform surfaces**

Paper 9759-62 • Wednesday 17 Feb 2016, 6:00 PM  
**Hans-Christoph Eckstein**, Fraunhofer-IOFFraunhofer-Institut für Angewandte Optik und Feinmechanik (Germany), et al.  
 Conference 9759: Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX  
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## **Thursday 18 Feb. 2016**

### **Modeling the metal additive manufacturing process at the scale of the part and the powder**

Paper 9738-19 • Thursday 18 Feb 2016, 8:00 AM  
**Wayne King**, Lawrence Livermore National Lab. (USA), et al.  
 Conference 9738: Laser 3D Manufacturing III  
 SESSION 9: Modeling, Design, Process Monitoring, and Controls for Additive Manufacturing

### **Graded photonic crystal structures for single-pass all-angle light extraction from light-emitting diodes**

Paper 9756-51 • Thursday 18 Feb 2016, 8:00 AM  
**Martin F. Schumann**, Karlsruher Institut für Technologie (Germany), et al.  
 Conference 9756: Photonic and Phononic Properties of Engineered Nanostructures VI  
 SESSION 12: Photonic Crystal Structures I

### **Towards in-situ process monitoring in selective laser sintering using optical coherence tomography**

Paper 9738-20 • Thursday 18 Feb 2016, 8:30 AM  
**Kristian M. Groom**, The Univ. of Sheffield (United Kingdom), et al.  
 Conference 9738: Laser 3D Manufacturing III  
 SESSION 9: Modeling, Design, Process Monitoring, and Controls for Additive Manufacturing Optical design and initial results from NIST's AMMT/TEMPS Facility

Paper 9738-22 • Thursday 18 Feb 2016, 9:20 AM

**Steven E. Grantham**, National Institute of Standards and Technology (USA), et al.  
 Conference 9738: Laser 3D Manufacturing III  
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### **Super multi-view display for analyze human cognition**

Paper 9770-5 • Thursday 18 Feb 2016, 9:30 AM  
**Joonku Hahn**, Kyungpook National University (Korea, Republic of), et al.  
 Conference 9770: Advances in Display Technologies VI  
 SESSION 1: New Display Technologies

## **Precision laser processing of diamond with 3D resolution**

Paper 9736-37 • Thursday 18 Feb 2016, 9:50 AM  
**Patrick S. Salter**, Univ. of Oxford (United Kingdom), et al.  
 Conference 9736: Laser-based Micro- and Nanoprocessing X  
 SESSION 8: Large Area Micro/Nano Structuring, Laser Interference Patterning

## **Self-assembled photonic crystals for a chemical sensing**

Paper 9756-56 • Thursday 18 Feb 2016, 9:50 AM  
**Céline Bourdillon**, Univ. Pierre et Marie Curie (France), et al.  
 Conference 9756: Photonic and Phononic Properties of Engineered Nanostructures VI  
 SESSION 12: Photonic Crystal Structures I

## **Laser post-processing of Inconel 625 made by selective laser melting**

Paper 9738-26 • Thursday 18 Feb 2016, 11:30 AM  
**David B. Witkin**, The Aerospace Corp. (USA), et al.  
 Conference 9738: Laser 3D Manufacturing III  
 SESSION 10: SLM, DMLS, SLS, SLM with Ultrafast Lasers

## **Observation of melting conditions in selective laser melting of metals (SLM)**

Paper 9741-26 • Thursday 18 Feb 2016, 11:30 AM  
**Ulrich Thombansen**, Fraunhofer-Institut für Lasertechnik (Germany), et al.  
 Conference 9741: High-Power Laser Materials Processing: Lasers, Beam Delivery, Diagnostics, and Applications V  
 SESSION 7: Process Monitoring

## **Fabrication and heat treatment of high strength Al-Cu-Mg alloy processed using selective laser melting**

Paper 9738-27 • Thursday 18 Feb 2016, 11:50 AM  
**Hu Zhang**, Huazhong Univ. of Science and Technology (China), et al.  
 Conference 9738: Laser 3D Manufacturing III  
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## **Additive manufacturing of glass for optical applications**

Paper 9738-28 • Thursday 18 Feb 2016, 1:10 PM  
**Edward C. Kinzel**, Missouri Univ. of Science and Technology (USA), et al.  
 Conference 9738: Laser 3D Manufacturing III  
 SESSION 11: Applications, Systems, Process Developments for Additive Manufacturing I

## **Gas sensors using single layer patterned interference optical filters**

Paper 9751-32 • Thursday 18 Feb 2016, 1:30 PM  
**Thomas D. Rahmlow**, Omega Optical, Inc. (USA), et al.  
 Conference 9751: Smart Photonic and Optoelectronic Integrated Circuits XVIII  
 SESSION 9: Optical Sensing and Imaging I

## **Reducing residual stresses and deformations in selective laser melting through multilevel multiscale optimization of cellular scanning strategy**

Paper 9738-29 • Thursday 18 Feb 2016, 1:40 PM  
**Sankhya Mohanty**, Technical Univ. of Denmark (Denmark), et al.  
 Conference 9738: Laser 3D Manufacturing III  
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# 3D PRINTING TRACK

## **Application of laser ultrasonic non-destructive evaluation technique to additive manufacturing**

Paper 9738-30 • Thursday 18 Feb 2016, 2:00 PM  
**Henry Helvajian**, The Aerospace Corp. (USA), et al.  
Conference 9738: Laser 3D Manufacturing III  
SESSION 11: Applications, Systems, Process Developments for Additive Manufacturing I

## **Repurposing mainstream CNC machine tools for laser-based additive manufacturing**

Paper 9738-31 • Thursday 18 Feb 2016, 2:20 PM  
**Jason B. Jones**, Hybrid Manufacturing Technologies (USA), et al.  
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## **Lightweight high-brightness helmet-mounted head-up display system**

Paper 9770-14 • Thursday 18 Feb 2016, 2:30 PM  
**Thibault North**, Haute Ecole Spécialisée de Suisse occidentale (Switzerland), et al.  
Conference 9770: Advances in Display Technologies VI  
SESSION 3: 3D, Holographic, and HM Displays

## **Optical screw-wrench for 2PP-microstructure interlocking**

Paper 9764-48 • Thursday 18 Feb 2016, 2:40 PM  
**Jannis Köhler**, Ruhr-Univ. Bochum (Germany), et al.  
Conference 9764: Complex Light and Optical Forces X  
SESSION 11: Laser Microfabrication and Microassembly

## **Using optical trapping to incorporate particles with different properties in specific areas of a microstructure fabricated using multi-photon polymerization**

Paper 9738-40 • Thursday 18 Feb 2016, 2:50 PM  
**Meisam Askari**, The Univ. of Nottingham (United Kingdom), et al.  
Conference 9738: Laser 3D Manufacturing III  
SESSION 11: Applications, Systems, Process Developments for Additive Manufacturing I

## **A portable intra-oral scanner based on sine-wave phase-shifting digital projection from MIRDC**

Paper 9770-15 • Thursday 18 Feb 2016, 3:20 PM  
**Chia-Ming Jan**, Metal Industries Research & Development Ctr. (Taiwan), et al.  
Conference 9770: Advances in Display Technologies VI  
SESSION 4: Driving Algorithm and Electronics

## **Femtosecond laser written microresonators and nanophotonic circuitry**

Paper 9738-32 • Thursday 18 Feb 2016, 3:30 PM  
**Robert A. Norwood**, College of Optical Sciences, The Univ. of Arizona (USA), et al.  
Conference 9738: Laser 3D Manufacturing III  
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## **NASA FrankenEye UAS: A scalable, modular aircraft enabled by 3D printing**

Paper 9738-33 • Thursday 18 Feb 2016, 4:00 PM  
**Kevin Reynolds**, NASA AMes Research Ctr. (USA), et al.  
Conference 9738: Laser 3D Manufacturing III  
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## **Inkjet printed 3D micro- and nano-structures for Phased Array Antenna**

Paper 9738-34 • Thursday 18 Feb 2016, 4:20 PM  
**Ray T. Chen**, The Univ. of Texas at Austin (USA), et al.  
Conference 9738: Laser 3D Manufacturing III  
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## **Improving resolution of periodic patterns with three-color photolithography**

Paper 9738-35 • Thursday 18 Feb 2016, 4:50 PM  
**Zuleykhan Tomova**, Univ. of Maryland, College Park (USA), et al.  
Conference 9738: Laser 3D Manufacturing III  
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## **Continuous Liquid Interface Production (CLIP)**

Paper 9738-36 • Thursday 18 Feb 2016, 5:10 PM  
**John Tumbleston**, Carbon3D, Inc. (USA), et al.  
Conference 9738: Laser 3D Manufacturing III  
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## **The application of digital medical 3D printing technology on tumor operation**

Paper 9738-37 • Thursday 18 Feb 2016, 5:40 PM  
**Jimin Chen**, Beijing Univ. of Technology (China), et al.  
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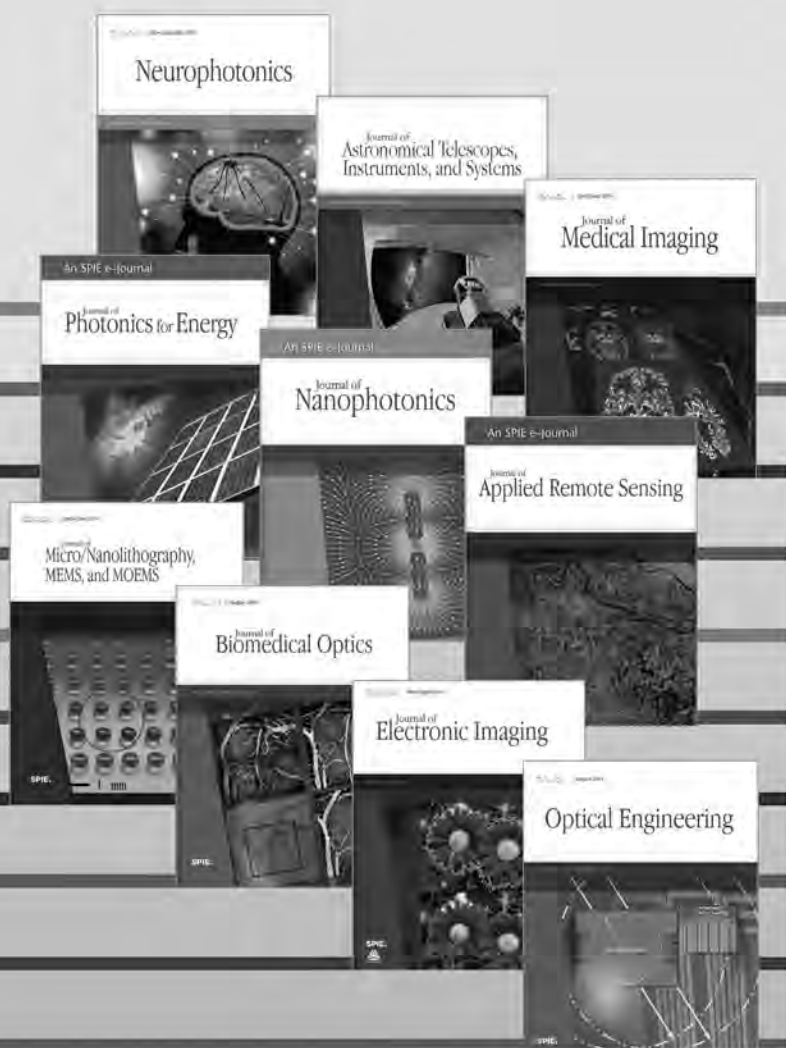
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Sunday 14 February . . . . . 7:15 am to 5:00 pm  
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Tuesday 16 February . . . . . 7:30 am to 5:00 pm  
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Courses and workshops are priced separately. Course-only registration includes your selected course(s), course notes, coffee breaks, and admittance to the exhibition. Course prices include applicable taxes. Onsite, please go to Course Materials Pickup after you pick up your badge.

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### EXHIBITION REGISTRATION

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*Location: Near Moscone Exhibition Hall C on the Exhibit Level  
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The Moscone Business Center provides full service business needs for your convenience. Their services include photocopying, faxing, computer workstations and printing services.

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Saturday and Sunday . . . . . 9:00 am to 5:00 pm  
*Location: Moscone West Level 1 Lobby*

Monday through Wednesday . . . . . 9:00 am to 5:00 pm  
*Location: Moscone South Lobby*

The San Francisco Travel Association will have visitor guides and maps available. Staff will be available during the posted hours to discuss city information including tips on local restaurants, the city's many attractions, sightseeing suggestions and transit information.

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- ABC Bay Area Child Care Agency, San Francisco, CA 94122, Phone: 415.309.5662
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# GENERAL INFORMATION

## AUTHOR / PRESENTER INFORMATION

### Speaker Check-In and Preview Station

*Location: Moscone West Level 2*

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*Moscone South Lobby*

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All conference rooms have a computer workstation, projector, screen, lapel microphone, and laser pointer. All presenters are requested to come to Speaker Check-In with their memory devices or laptops to confirm their presentation display settings.

### Poster Sessions

*Location: Moscone West Level 2 and 3*

To find out which poster session you are scheduled for, check the individual conference programs.


- Sunday 5:30 to 7:30 pm: select BiOS conferences
- Monday 5:30 to 7:30 pm: select BiOS conferences
- Tuesday 6:00 to 8:00 pm: all LASE conferences and select BiOS conferences
- Wednesday 6:00 to 8:00 pm: all OPTO conferences

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- A poster author is required to stand by the poster during the scheduled poster session to answer questions from attendees.
- Presenters who have not placed their poster(s) on their assigned board by 60 minutes prior to the session on the day of their presentation will be considered a “no show” and their manuscript will not be published.
- Presenters must remove their posters immediately after the poster session. Any posters that are not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

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For parking information please check the SPIE website

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Complimentary coffee will be served twice daily, at 10:00 am and 3:00 pm. Check individual conference listings for exact times and locations.

Saturday morning . . . . . Moscone West Level 2 and 3

Saturday afternoon . . . . . Moscone West Exhibition Hall

Sunday . . . . . Moscone West Exhibition Hall

Monday . . . . . Moscone West Level 2 and 3  
Moscone South Esplanade Foyer  
Moscone North Exhibit Level

Tuesday through Thursday . . . . . Moscone North/  
South Exhibition Halls

### Desserts

Saturday and Sunday . . . . . West Exhibition Hall

Tuesday through Thursday . . . . . Exhibition Halls A, B, C, D

Complimentary tickets for dessert snacks are included in course and conference attendee registration packets.

## Food and Refreshments for Purchase

*Various Locations*

Saturday through Thursday

A variety of food outlets will serve hot and cold snacks, espresso, beverages, hot entrees, deli sandwiches, salads, and pastries are available for purchase. Cash and credit cards accepted.

## Food Outlets Open in the Exhibition Halls

*Location: Moscone West Exhibition Hall*

Saturday . . . . . Noon to 3:00 pm

Sunday . . . . . 11:00 am to 3:00 pm

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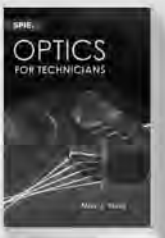


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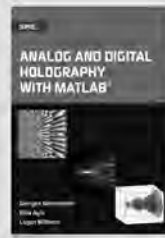


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Use of a personal laser pointer represents user's acceptance of liability for use of a non-SPIE-supplied laser pointer. If you choose to use your own laser pointer, it must be tested to ensure <5 mW power output. Laser pointers in Class II and IIIa (<5mW) are eye safe if power output is correct, but output must be verified because manufacturer labeling may not match actual output. Come to Speaker Check-In and test your laser pointer on our power meter. You are required to sign a waiver releasing SPIE of any liability for use of potentially non-safe, personal laser pointers. Misuse of any laser pointer can lead to eye damage.

## Access to Technical and Networking Events

Persons under the age of 18 including babies, carried or in strollers, and toddlers are not allowed in technical or networking events. Anyone 18 or older must register as an attendee. All technical and networking events require a valid conference badge for admission.

## Underage Persons on Exhibition Floor Policy

For safety and insurance reasons:

- No persons under the age of 18 will be allowed in the exhibition area during move-in and move-out.
- Children 14 and older, accompanied by an adult, will be allowed in the exhibition area during open exhibition hours only.
- All children younger than 14, including babies in strollers and toddlers, are not allowed in the exhibition area at any time.

## Unauthorized Solicitation Policy

Unauthorized solicitation in the Exhibition Hall is prohibited. Any non-exhibiting manufacturer or supplier observed to be distributing information or soliciting business in the aisles, or in another company's booth, will be asked to leave immediately.

## Unsecured Items Policy

Personal belongings should not be left unattended in meeting rooms or public areas. Unattended items are subject to removal by security. SPIE is not responsible for items left unattended.

## Wireless Internet Service Policy

At SPIE events where wireless is included with your registration, SPIE provides wireless access for attendees during the conference and exhibition but cannot guarantee full coverage in all locations, all of the time. Please be respectful of your time and usage so that all attendees are able to access the internet.

Excessive usage (e.g., streaming video, gaming, multiple devices) reduces bandwidth and increases cost for all attendees. No routers may be attached to the network. Properly secure your computer before accessing the public wireless network. Failure to do so may allow unauthorized access to your laptop as well as potentially introduce viruses to your computer and/or presentation. SPIE is not responsible for computer viruses or other computer damage.

## Mobile Phones and Related Devices Policy

Mobile phones, tablets, laptops, pagers, and any similar electronic devices should be silenced during conference sessions. Please exit the conference room before answering or beginning a phone conversation.

## Smoking

For the health and consideration of all attendees, smoking, including e-cigarettes, is not permitted at any event elements, such as but not limited to: plenaries, conferences, workshops, courses, poster sessions, hosted meal functions, receptions, and in the exhibit hall. Most facilities also prohibit smoking and e-cigarettes in all or specific areas. Attendees should obey any signs preventing or authorizing smoking in specified locations.

## Hold Harmless

Attendee agrees to release and hold harmless SPIE from any and all claims, demands, and causes of action arising out of or relating to your participation in the event you are registering to participate in and use of any associated facilities or hotels.

## Event Cancellation

If for some unforeseen reason SPIE should have to cancel the event, registration fees processed will be refunded to registrants. Registrants will be responsible for cancellation of travel arrangements or housing reservations and the applicable fees.

## SPIE International Headquarters

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# NOTES

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## **SPIE.**

The International Society for  
Optics and Photonics

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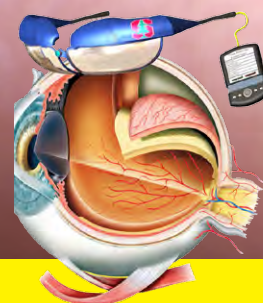


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**Photovoltaic Retinal Prosthesis  
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Proceedings of SPIE: doi:10.1117/12.909104



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