CALL FOR PAPERS

Share your research at the premier event for optical engineering and applications, nanotechnology, quantum science, organic photonics, and astronomical instrumentation.

Nanoscience + Engineering
Organic Photonics + Electronics
Optical Engineering + Applications

Submit abstracts by 3 February 2021

Conferences and Courses: 1–5 August 2021
Exhibition: 3–5 August 2021
San Diego Convention Center
San Diego, California, USA

spie.org/op21call
#SPIEOpticsPhotonics
Present your work
SPIE Optics + Photonics

Contribute to the meeting that offers leading researchers the opportunity to learn, and network with peers. Join other academics, scientists, and engineers as amazing research in optical engineering and applications, nanotechnology, quantum science, organic photonics, and astronomical instrumentations is shared. Browse the conference topics within these three technical areas and determine where your research best fits. Submit an abstract, contribute your research and continue your commitment to advancing science.

Conference topics in three technical areas:

**NANOSCIENCE + ENGINEERING**
Advances in metamaterials, nanophotonic materials, plasmonics, quantum materials and devices, optical trapping, spintronics, nanostructured devices, nanoengineering, nanomaging, nanospectroscopy, low-dimensional materials, and artificial intelligence.

**ORGANIC PHOTONICS + ELECTRONICS**
Comprehensive conference on organic-based materials and devices that advances renewable energy sources and other commercial applications and include OLEDs, OFETS, OHPVs, perovskite PVs, organic and hybrid sensors, bioelectronics, liquid crystals, and molecular machines.

**OPTICAL ENGINEERING + APPLICATIONS**
Developments in optical design, optical alignment, testing, and fabrication, astronomical optics, photonic devices, x-ray, gamma-ray, and particle technologies, image and signal processing, optics and photonics for sustainable energy, remote sensing and atmospheric propagation, and James Wyant tribute.

- Present to experts
- Publish your results internationally
- Gain experience in scientific communication
- Connect with researchers from other disciplines
- See where your work fits into global optics and photonics research

spie.org/op21call
CALL FOR PAPERS

Participate in the premier event for optical engineering and applications, nanotechnology, quantum science, organic photonics, and astronomical optics.

Save the date

ABSTRACTS DUE:
3 February 2021

AUTHOR NOTIFICATION:
5 April 2021

The contact author will be notified of acceptance by email.

MANUSCRIPT DUE DATE:
7 July 2021

PLEASE NOTE: Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.
Nanoscience + Engineering

pages 5–17

Technologies
Explore these technical areas to find the right conference to submit your research.

- Metamaterials
- Nanophotonic Materials
- Plasmonics
- Quantum Materials and Devices
- Optical Trapping
- Spintronics
- Nanostructured Devices
- Nanoengineering
- Nanoimaging
- Nanospectroscopy
- Low-dimensional Materials
- Artificial Intelligence

Save the date

**ABSTRACTS DUE:**
3 February 2021

**AUTHOR NOTIFICATION:**
5 April 2021
The contact author will be notified of acceptance by email.

**MANUSCRIPT DUE DATE:**
7 July 2021

**PLEASE NOTE:** Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.

Submit an abstract: spie.org/op21call
Metamaterials is a paradigm for engineering electromagnetic space and controlling the propagation of waves. The conference agenda is focused on tunable, switchable, nonlinear, quantum, sensing and data processing functionalities as well as control of wave-matter interactions. It is a platform to discuss cutting-edge research on photonic, terahertz, microwave, thermal, acoustic and mechanical metamaterials, metadevices and metasystems with advanced functionalities attained through the exploitation of the entire plethora of quantum and classical mesoscale and nanoscale forces, interactions, strong coupling and application of artificial intelligence techniques.
ACTIVE PHOTONIC PLATFORMS XIII (OP102)

**Conference Chairs:** Ganapathi S. Subramania, Sandia National Labs. (USA); Stavroula Foteinopoulou, The Univ. of New Mexico (USA)

**Program Committee:**
- Andrea Alù, The City Univ. of New York (USA); Koray Aydin, Northwestern Univ. (USA); Harish Bhaskaran, Univ. of Oxford (United Kingdom);
- Paul V. Braun, Univ. of Illinois at Urbana-Champaign (USA); Che Ting Chan, Hong Kong Univ. of Science and Technology (Hong Kong, China); Zhigang Chen, Nankei Univ. (China), San Francisco State Univ. (USA); Dmitry N. Chigrin, RWTH Aachen Univ. (Germany);
- Shanhui Fan, Stanford Univ. (USA); Didier Felbacq, Univ. Montpellier (France); Juejun Hu, Massachusetts Institute of Technology (USA); Stephen Hughes, Queen’s Univ. (Canada); Boubacar Kanté, Univ. of California, San Diego (USA); Meredith Khajavikhan, Univ. of Southern California (USA);
- Alexander V. Kildishev, Purdue Univ. (USA); Nathaniel Kinsey, Virginia Commonwealth Univ. (USA); Yuri S. Kivshar, The Australian National Univ. (Australia); A. Femius Koenderink, AMOLF (Netherlands); Aude L. Lereu, Institut Fresnel (France); Cefe López, Consejo Superior de Investigaciones Científicas (Spain); Liam O’Faolain, Cork Institute of Technology (Ireland), Tyndall National Institute (Ireland); Rupert F. Oulton, Imperial College London (United Kingdom); Nicolae-Coriolan Panoiu, Univ. College London (United Kingdom); Ruwen Peng, Nanjing Univ. (China); Ekaterina Poutrino, Air Force Research Lab. (USA); Michelle L. Povinelli, The Univ. of Southern California (USA); Subramaniam Anantha Ramakrishna, Indian Institute of Technology Kanpur (India); Christophe Sauvan, Lab. Charles Fabry (France); Jörg Schilling, Martin-Luther-Univ. Halle-Wittenberg (Germany); Gennady B. Shvets, Cornell Univ. (USA); Volker J. Sorger, The George Washington Univ. (USA); Isabelle Staude, Friedrich-Schiller-Univ. Jena (Germany); Andrey A. Sukhorukov, The Australian National Univ. (Australia); Philippe Tassin, Chalmers Univ. of Technology (Sweden); Kosmas L. Tsakmakidis, National and Kapodistrian Univ. of Athens (Greece); Georgios Veronis, Louisiana State Univ. (USA); Daniel M. Wasserman, The Univ. of Texas at Arlington (USA); Sharon M. Weiss, Vanderbilt Univ. (USA)

**CALL FOR PAPERS**

Platforms comprising artificially patterned materials exploit the synergy between material photonic responses and structural form to enable transformative light-matter interactions which continually push forward the state-of-the-art in light control capabilities. While tremendous progress has been made with only passive materials, such as metals and dielectrics, the potential of photonic platforms transcends into new unexplored domains when active material and/or material with tunable or dynamic photonic properties are incorporated. Examples of such material are gain or non-linear media, phase-change materials, magneto-photonic material, 2D materials, as well as quantum emitters. Structured material platforms with active components can enable entirely new regimes of light control that is crucial to a wide range of applications including chipscale all-optical computing and communications, nanoscale thresholdless lasers, modulator, thermal management and detector devices, as well as biological/chemical sensors.

The Active Photonic Platforms XIII conference aims to bring together scientists and engineers working in the newest developments in fundamentals and applications of structured-material platforms for active, dynamic, and tunable control of light. Topics will cover active photonic platforms functional across the EM spectrum, from THz to UV frequencies, as well as new exotic types of light propagation, which could open entirely new directions in active photonics. Contributions from academia, government, industry, and other research organizations are solicited in areas including:

- theory and modeling approaches for non-linear and gain photonic media
- non-linear optical phenomena, materials, and devices
- novel harmonic generation and frequency mixing phenomena
- modeling and experimental realization of time-dependent photonic responses
- tunable and dynamically changeable optical properties and photonic devices
- dynamically reconfigurable platforms and photonic effects
- novel lasing platforms, nanolasers; polariton, quantum-dot, and random lasers
- emission control in structured photonic environment, integrable chipscale light sources
- weak and strong coupling: cavity QED; phonon polaritons; exciton polaritons
- physics and applications of nanoscale sources (e.g. quantum dots, quantum wires, NV-centers etc.) for photonic devices
- PT-symmetric, non-Hermitian and pseudo-Hermitian photonic systems
- topological and non-reciprocal photonic platforms
- phase-change materials for photonic devices
- photonic memory and neuromorphic devices
- photonic structures for quantum information: non-classical sources and detectors
- graphene and carbon-based materials for photonic and optoelectronic devices
- photonic platforms with atomically thin materials: hBN, transition metal dichalcogenides, Van der Waals heterostructures, twisted Van der Waals heterostructures
- novel magneto-photonic phenomena and platforms
- advances in fabrication of photonic structures with active materials
- novel absorption and thermal management platforms
- photovoltaics, thermophotovoltaics, and photodetectors
- chemical sensors and biosensors based on active control of light
- opto-fluidic and optomechanical tunable devices.
NANOSCIENCE

PLASMONICS: DESIGN, MATERIALS, FABRICATION, CHARACTERIZATION, AND APPLICATIONS XIX (OP103)

Conference Chairs: Din Ping Tsai, The Hong Kong Polytechnic Univ. (Hong Kong, China); Taku Tanaka, RIKEN (Japan); Yu-Jung Lu, Research Ctr. for Applied Sciences - Academia Sinica (Taiwan), National Taiwan Univ. (Taiwan)

Program Committee: Martin Aeschlimann, Technische Univ. Kaiserslautern (Germany); Hatice Altug, Ecole Polytechnique Federale de Lausanne (Switzerland); Harry A. Atwater Jr., California Institute of Technology (USA); David J. Bergman, Tel Aviv Univ. (Israel); Humeyra Caglayan, Tampere Univ. (Finland); Che Ting Chan, Hong Kong Univ. of Science and Technology (Hong Kong, China); Yun-Chong Chang, Academia Sinica (Taiwan); Harald W. Giessen, Univ. Stuttgart (Germany); Naomi J. Halas, Rice Univ. (USA); Dai-Sik Kim, Seoul National Univ. (Korea, Republic of); Wakana Kubo, Tokyo Univ. of Agriculture and Technology (Japan); Laurens K. Kuipers, FOM Institute for Atomic and Molecular Physics (Netherlands); Mikhail Lapine, The Univ. of Sydney (Australia); Ai Qun Liu, Nanyang Technological Univ. (Singapore); Olivier J. F. Martin, Ecole Polytechnique Federale de Lausanne (Switzerland); Peter Nordlander, Rice Univ. (USA); George C. Schatz, Northwestern Univ. (USA); Tigran V. Shahbabian, Jackson State Univ. (USA); Vladimir M. Shalaev, Purdue Univ. (USA); Gennady B. Shvets, Institute for Fusion Studies (USA); Niek F. van Hulst, ICF - Institut de Ciencies Fotòniques (Spain); Prabhat Verma, Osaka Univ. (Japan); Hongxing Xu, Wuhan Univ. (China); Shumin Xiao, Harbin Institute of Technology Shenzhen Graduate School (China); Nikolay I. Zheludev, Optoelectronics Research Ctr. (United Kingdom), Nanyang Technological Univ. (Singapore)

Plasmonics: Design, Materials, Fabrication, Characterization, and Applications is currently undergoing intense developments. Novel plasmonic materials, structures, and phenomena covered under this topic span a broad multidisciplinary interests from fundamental optics, physics, and chemistry to applications in nanophotonics, biophotonics, green photonics, and biomedical.


Papers are solicited in the following areas:

THEORY, SIMULATION, AND DESIGN ACROSS ALL SUBAREAS
• plasmonic phenomena and effects
• ultrastable plasmonic effects and coherent control
• plasmon polaritonics
• surface-enhanced Raman scattering
• plasmon-enhanced nonlinear phenomena
• luminescence enhancement and quenching
• quantum nanoplasmonics: QED effects, plasmon-assisted quantum information, spasing, and nanolasing in plasmonic nanostructures
• microscopic theory of plasmonic properties
• plasmonic imaging, including probe ultramicroscopies, superlenses, and hyperlenses
• novel plasmonic systems such as graphene
• nanoplasmonic Fano resonances
• electron-plasmon interactions
• active plasmonics theory and design
• plasmonic thermal effects

PLASMONIC MATERIALS AND STRUCTURE FABRICATIONS
• nanofabrication of novel materials
• chemical fabrication (bottom up)
• lithographic and nanofabrication (top down)
• biomimetic and bio-inspired fabrication
• active, tunable, and reconfigurable methods
• rapid and large area fabrication.

PLASMONIC PHENOMENA AND CHARACTERIZATION
• quantum entanglement and interference
• spectroscopies (spectral, time-domain, combined and multidimensional)
• local probes, nano-optics, and near field phenomena
• plasmon-assisted PEEM and energy-loss spectroscopy and visualization of plasmonic phenomena
• nonlinear and coherent optical properties
• plasmonic enhanced phenomena: SERS, SEIRA, nonlinear generation, luminescence, including molecules and nanostructured metals
• extraordinary transmission, diffractive, and refractive phenomena
• novel plasmonic systems such as graphene
• Fano resonances in nanoplasmonic systems
• plasmon polariton propagation in arrays of metal nanoparticles and metal nanoplasmonic waveguides
• semiconductor plasmonics
• fundamental physics of left-handed (negative-refraction) plasmonic materials

• active plasmonics
• topological plasmonics
• plasmonics in 2D materials.

PLASMONICS DEVICES AND SYSTEMS
• plasmonic quantum devices
• plasmonic sensors
• nanoplasmonic waveguides and resonators
• plasmonic nanocircuits; logical nanoscale elements
• plasmonic ultramicroscopies and nanoscopic spectroscopies
• plasmonics-assisted memory
• plasmonic transistors
• plasmonic nanolasers and spasers
• nanoplasmonic antennas and their applications in nanoscopes, photodetectors, solar cells, and lighting devices
• prospective graphene nanoplasmonic devices
• sensing based on Fano resonances
• modulators and switches based on active plasmonics
• low-frequency plasmons and their applications
• solar energy harvesting
• devices for telecommunications
• environmental applications
• medical and health applications.
OPTICAL TRAPPING AND OPTICAL MICROMANIPULATION XVIII (OP104)

Conference Chairs: Kishan Dholakia, Univ. of St. Andrews (United Kingdom); Gabriel C. Spalding, Illinois Wesleyan Univ. (USA)

Program Committee: Ashley R. Carter, Amherst College (USA); Reuven Gordon, Univ. of Victoria (Canada); Catherine M. Herne, State Univ. of New York at New Paltz (USA); Masud Mansuripur, Wyant College of Optical Sciences (USA); James Millen, King’s College London (United Kingdom); David C. Moore, Yale Univ. (USA); Justus C. Ndukaife, Vanderbilt Univ. (USA); Lene Broeng Oddershede, Niels Bohr Institute (Denmark); Daniel H. Ou-Yang, Lehigh Univ. (USA); Daryl Preece, Univ. of California, San Diego (USA); Ruben Ramos-Garcia, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia); Nick Vamivakas, Univ. of Rochester (USA); Yuebing Zheng, The Univ. of Texas at Austin (USA)

Long after his retirement, Arthur Ashkin sent a video saying that this conference was a favorite of his and so this year’s conference will include a memorial session dedicated to Art, who was a hero to many of us. So many of us, around the globe, have been absolutely thrilled by the experience of using light to pick things up, move them around, and even assemble them, or interrogate them with exquisite precision. An incredibly broad scientific community has benefitted from his work, and we are all grateful for what Art Ashkin shared with us.

This conference, each year, draws well over one hundred presentations and an even larger number of participants, and is clearly growing. Even so, our poster sessions have been conducted in a manner to ensure an excellent level of interaction and feedback. Notably, this conference has a truly international character. The proceedings of the conference contain a large collection of relevant papers, making a valuable contribution to the field. Early career researchers are especially encouraged and highlighted.

Joint sessions will be planned with the “Emerging Topics in Artificial Intelligence” conference (OP110).

Papers are solicited on (but not restricted to) the following areas:

- precision measurement, including testing fundamental physics
- “gonzo” trapping (i.e., trapping at extremes)
- cavity optomechanics
- high-sensitivity detectors
- toward (or in) the quantum limit of opto-mechanics
- photonic devices for optically induced forces
- shaping the flow of information: energy and momentum
- systems with broken symmetry, including optical angular momentum
- statistical mechanics of small systems
- virus and single-molecule biophysical studies and technologies
- using the photonic toolbox to study cells and their organelles
- studies of dynamical biophysical systems, including active swimmers and hydrodynamics
- optofluidics and optically shaped structures
- optically driven microrheology, mechanobiology, and micromechanical properties
- enhanced sensitivity and resolution of optical force actuators
- optical manipulation of matter through gaseous media
- approaches to optical force and momentum measurement
- radiation pressure, tractor beams, and solar sails
- near-field micromanipulation, plasmonic, and nanoparticle trapping
- beam shaping and aberration and wavefront correction
- optical sorting, optical lab-on-a-chip, and microfluidics
- optically manipulated robotics and novel samples
- next-generation fabrication technologies, including nanoscale assembly with optical forces
- optical tweezers coupled with novel forms of microscopy
- alternative and hybrid force systems (e.g., hybrid AFM-optical force systems, or combinations with acoustic, magnetic, or other forces)
- nonlinear optical responses mediated through forces (translation, electrostriction)
- optically bound matter
- holographic optical systems: from speckle to studies of neurons
- machine learning for designing relevant systems, for particle tracking, and for data analysis.

CALL FOR PAPERS

ABSTRACTS DUE: 3 February 2021

AUTHOR NOTIFICATION: 5 April 2021

MANUSCRIPT DUE DATE: 7 July 2021

PLEASE NOTE: Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.

Save the date
NANOSCIENCE

PHYSICAL CHEMISTRY OF SEMICONDUCTOR MATERIALS AND INTERFACES XX (OP105)

Conference Co-Chairs: Andrew J. Musser, Cornell Univ. (USA); Derya Baran, King Abdullah Univ. of Science and Technology (Saudi Arabia)

Conference Co-Chairs: Christian Nielsen, Queen Mary Univ. of London (United Kingdom); Daniel Congreve, The Rowland Institute at Harvard (USA)

Program Committee: Artem A. Bakulin, Imperial College London (United Kingdom); Natalie Banerji, Univ. Bern (Switzerland); Hugo A. Bronstein, Univ. of Cambridge (United Kingdom); Jenny Clark, The Univ. of Sheffield (United Kingdom); Felix Deschler, Technische Univ. München (Germany); Alexandre Fürstenberg, Univ. de Genève (Switzerland); David S. Ginger, Univ. of Washington (USA); Naomi S. Ginsberg, Univ. of California, Berkeley (USA); Paul A. Lane, The National Science Foundation (USA); Robert Lovricinc, Technische Univ. Braunschweig (Germany); Paul Meredith, Swansea Univ. (United Kingdom); Linda A. Peteanu, Carnegie Mellon Univ. (USA); Lee J. Richter, National Institute of Standards and Technology (USA); Carlos Silva, Georgia Institute of Technology (USA); Sergei Tretiak, Los Alamos National Lab. (USA); Lauren Webb, The Univ. of Texas at Austin (USA); Omer Yaffe, Weizmann Institute of Science (Israel)

The detailed study of the physics and physical chemistry in nanomaterials and at their interfaces led to the development of specialized experimental and theoretical techniques with increasing complexity. New forms of nonlinear spectroscopy, imaging, and scanning-probe techniques continue to emerge in conjunction with sophisticated theoretical methods capable of treating correlated systems of increasing size and over timescales of femto- to nanoseconds.

The intent of this conference is to bring together an interdisciplinary group of scientists from academia, industry, and government laboratories who study fundamental processes of emerging and established semiconductor materials, and their interfaces, from bulk to the nanoscale.

For 2021 the scope of the conference will focus on the following topics:
- physical chemistry of hybrid perovskite materials
- photophysics of emerging semiconductor materials and nanostructures
- electron and energy transfer mechanisms at interfaces
- physical processes in solar energy conversion
- exciton physics in semiconductors
- properties and dynamics of exciton-polaritons
- carrier transport in complex systems
- confinement effects in nanostructures
- physical understanding of biological and bioelectronics systems
- emerging experimental tools to study interfaces and nanomaterials
- advances in modeling of electronic processes in semiconductors and nanomaterials
- structure-property relations in nanomaterials
- interface engineering.

LOW-DIMENSIONAL MATERIALS AND DEVICES 2021 (OP106)

Conference Chairs: Nobuhiko P. Kobayashi, Univ. of California, Santa Cruz (USA); A. Alec Talin, Sandia National Labs. (USA); Albert V. Davydov, National Institute of Standards and Technology (USA)

Conference Co-Chair: M. Saif Islam, Univ. of California, Davis (USA)

Program Committee: Deji Akinwande, The Univ. of Texas at Austin (USA); Kristine A. Bertness, National Institute of Standards and Technology (USA); Sonia Conesa-Boj, Technische Univ. Delft (Netherlands); Alexey Kaposov, Institute for Energy Technology (Norway); Andrey Krayev, HORIBA Scientific (USA); Marina S. Leite, Univ. of Maryland, College Park (USA); Paola Prete, Istituto per la Microelettronica e Microsistemi (Italy); Volker J. Sorger, The George Washington Univ. (USA); George T. Wang, Sandia National Labs. (USA); Sanshui Xiao, Technical Univ. of Denmark (Denmark)

Low-dimensional material systems possessing at least one of their dimensions in the nanometer scale offer intriguing physical properties and undiscovered pathways toward revolutionary new device concepts for flexible and transparent electronics, photonics, quantum computing, and other advanced applications. Fabrication of quantum dots, nanowires, ultra-thin films, and heterostructures result in building blocks that reveal a wealth of interesting physical properties including quantum phenomena. Control of synthesis and processing at the nanometer scale offers unprecedented opportunities to tailor microscopic and macroscopic physical properties of such material systems. To further pursue these tremendous opportunities, many fundamental questions need to be addressed and technological barriers need to be overcome. This conference provides a forum for the presentation and discussion of synthesis, processing, and characterization of low-dimensional materials tailored to their unique and peculiar physical properties. Design, fabrication, and characterization of novel device platforms that employ low-dimensional materials are also of interest, as well as interfacing and integration of such devices toward novel electronics, photonics, sensors, and energy conversion and storage.

Topics of interest include:
- fabrication of zero-dimensional (core-shell nanoparticles, quantum dots), one-dimensional (nanowires and nanorods), and two-dimensional (van-der-Waals layers such as transition metal dichalcogenides), and their device integration
- templated, catalyzed and uncatalyzed, tip assisted, field induced locally heated synthesis methods of low-dimensional materials
- self-limiting deposition technique such as atomic layer deposition (ALD) that can produce ultrathin and conformal thin film structures for many applications including thin film devices, display technology, energy storage and capture, solid state lighting
- exploration of strain and extended defects effect on synthesis and spatial ordering of nanoscale structures and on their optical and transport properties
- introduction of electrically/optically active impurities and their roles in low-dimensional structures; dopant spatial distributions and segregation
- electrical contact formation and interface properties between nanoscale structures and metal contacts
- nanoscale synthesis compatible to and integral onto CMOS devices; scalable and mass-manufacturable interfacing for electronics, photonics, optoelectronics, sensing and energy conversion
- 3D heterogenous integration, application of advanced patterning techniques for positioning and dimension control of nanostructures, integration with MEMS
- electrical, optical, mechanical and structural characterization, including in-situ and in-operando techniques, of the low-dimensional structures and device platforms; correlation of composition, microstructure, and defects to the material physical properties and device performance.
UV AND HIGHER ENERGY PHOTONICS: FROM MATERIALS TO APPLICATIONS 2021 (OP107)

Conference Chairs: Yong-Hoon Cho, KAIST (Korea, Republic of); Gilles Léondel, Univ. de Technologie Troyes (France); Atsushi Taguchi, Hokkaido Univ. (Japan)

Conference Co-Chair: Satoshi Kawata, Osaka Univ. (Japan)

Program Committee: Sanford A. Asher, Univ. of Pittsburgh (USA); Steve Blair, The Univ. of Utah (USA); Zhanghai Chen, Fudan Univ. (China); Yasin Ekinci, Paul Scherrer Institut (Switzerland); Torsten Frosch, Leibniz-Institut für Photonische Technologien e.V. (Germany); Naomi J. Halas, Rice Univ. (USA); Hans D. Hallen, North Carolina State Univ. (USA); Chennupati Jagadish, The Australian National Univ. (Australia); Junyong Kang, Xiamen Univ. (China); Yoichi Kawakami, Kyoto Univ. (Japan); Jong Kyu Kim, Pohang Univ. of Science and Technology (Korea, Republic of); Paul T. Matsudaira, National Univ. of Singapore (Singapore); Eva Monroy, CEA Grenoble (France); Fernando Moreno, Univ. de Cantabria (Spain); Yukihiro Ozaki, Kwansei Gakuin Univ. (Japan); Sung-Jin Park, Univ. of Illinois (USA); Jérôme Plain, Univ. de Technologie de Troyes (France); Remo Proietti Zaccaria, Istituto Italiano di Tecnologia (Italy); Olivier Soppera, Univ. de Haute Alsace (France); Yunshan Wang, The Univ. of Utah (USA)

Recently, there has been a rapid and significant progress in the field of UV and higher energy photonics (UV to EUV) due to the availability of new UV and high energy light sources. Nano-materials such as nucleotides and proteins known as the essential biomolecules in living cells and semiconducting or plasmonic materials used in advanced nano-devices are analyzed and detected, imaged, and/or manipulated with use of UV and higher energy photons. Starting from the material growth related aspects, this conference includes theories and novel concepts on UV and higher energy photonics. It also includes experiments and developments of methods and instruments, which are used as devices for applications in catalysis, nano-lithography, nano-imaging, disinfection, analytical sensing but also in nano-photonics, bio-medical photonics, materials sciences and green and environmental sciences.

The chairs of the conference proudly announce that the Young-Scientist award will be given to two outstanding presentations respectively in oral and poster sessions. Successful candidates must convey significant scientific content with a demonstrated excellent style of presentation including questions and discussions. In addition, from 2020, potentially four contributed papers are promoted to invited contribution.

UV AND HIGH ENERGY MATERIALS AND LIGHT SOURCES
- high band gap semiconductors
- LEDs and lasers for UV and higher energy
- nonlinear and ultrafast photonics for UV and higher energy
- fiber optics for UV and higher energy
- photonic crystal fibers
- high harmonic generation
- UV to EUV optics and sources.

UV AND HIGHER ENERGY MICROSCOPY AND SPECTROSCOPY
- resonant Raman microscopy
- nonlinear microscopy
- super-resolution microscopy
- plasmonics in UV and DUV
- coherent scattering imaging
- resonance Raman spectroscopy
- absorption spectroscopy
- fluorescence spectroscopy.

APPLICATIONS OF UV, DEEP UV, VACUUM UV, AND EXTREME UV PHOTONICS
- holography
- lithography
- photocatalysis
- decontamination
- material properties
- materials processing
- photoresists
- photodissociation
- photodamage
- environmental analysis
- energy production.

UV AND DEEP UV BIOSENSING AND ANALYSIS WITH UV AND HIGHER ENERGY PHOTONICS
- biosensor and analysis
- structure and dynamics of biomolecules
- native-fluorescence
- photochemical effect on biomolecules.

CALL FOR PAPERS
Submit an abstract: spie.org/op21call
NANOENGINEERING: FABRICATION, PROPERTIES, OPTICS, THIN FILMS, AND DEVICES XVIII (OP108)

Conference Chairs: Balaji Panchapakesan, Worcester Polytechnic Institute (USA); André-Jean Attias, Sorbonne Univ. (France), Yonsei Univ. (Korea, Republic of); Wounjhang Park, Univ. of Colorado Boulder (USA)

Program Committee: Bharat Bhushan, The Ohio State Univ. (USA); Stephane Bruynooghe, Carl Zeiss Jena GmbH (Germany); Francesco Chiadini, Univ. degli Studi di Salerno (Italy); Pankaj Kumar K. Choudhury, Univ. Kebangsaan Malaysia (Malaysia); Luca Dal Negro, Boston Univ. (USA); Elizabeth A. Dobisz, Spin Transfer Technologies, Inc. (USA); Frédéric Guittard, Univ. de Nice Sophia Antipolis (France); Ghassan E. Jabbour, Arizona State Univ. (USA); Yi-Jun Jen, National Taipeh Univ. of Technology (Taiwan); Anders Kristensen, DTU Nanotech (Denmark); Akhlesh Lakhakta, The Pennsylvania State Univ. (USA); Tom G. Mackay, The Univ. of Edinburgh (United Kingdom); H. Angus Macleod, Thin Film Center, Inc. (USA); Robert Magnusson, The Univ. of Texas at Arlington (USA); Dorota A. Pawlik, Institute of Electronic Materials Technology (Poland); Michael T. Postek, Univ. of South Florida (USA); Dianne L. Poster, National Institute of Standards and Technology (USA); Anne E. Sakdinarwat, SLAC National Accelerator Lab. (USA); Geoffery B. Smith, Univ. of Technology, Sydney (Australia); Motofumi Suzuki, Kyoto Univ. (Japan); Tomas Tolenis, Ctr. for Physical Sciences and Technology (Lithuania); Chee Wei Wong, Univ. of California, Los Angeles (USA); Anatoly V. Zayats, King’s College London (United Kingdom)

NANOENGINEERING is an essential bridge that utilizes nanoscience and nanotechnology to enable a broad spectrum of totally new materials, functionalities, applications, devices, and products. Conventional photonic manufacturing technologies have extended well into the nanometer regime. Over-extended technologies are pushing sizes and densities into ranges that challenge reliability and basic physics. Nanoengineering also allows for manipulating matter at the nanoscale. Newly engineered materials, processes, ultrahigh precision and metrologies are emerging. Novel syntheses nanomaterials, based on 1D, 2D, and 3D architectures, nanocomposites and hierarchical assemblies based on such materials offer exciting opportunities. Nanostructured thin films display unique phenomena, thus enabling the improvement of traditional applications or the development of novel applications. Newly attainable design and fabrication of miniature optical elements have enabled the development of micro/nano/quantum-scale optical, near field optics, and optoelectronic elements in ever more diverse application areas. New low power logic and memory devices, expanded functionality, systems on a chip, solar cells, energy storage devices, biotechnology, photonics, photovoltaics, molecular electronics and optics are emerging. Application areas are highly diversified and include telecommunications, data communications, consumer electronics, microwave photonics, optical computing, neural networks, optical storage, non-volatile data storage, information display, optical computing, neural networks, optical electronics, microwave photonics, optical computing, neural networks, optical storage, non-volatile data storage, information display, optical imaging, printing, optical sensing, optical scanning, renewable energy harvest and storage, medical diagnosis, chemical/biological/environmental sensing, new nanomechanic applications, and new medical devices and prosthetic methods.

Critical to this realization of robust nanomanufacturing is the development of appropriate instrumentation, metrology, and standards. As novel applications emerge, the demand for highly sensitive and efficient measurement tools with the capability of rapid, automated, and thorough coverage of large functional areas at high precision is emerging. The newly upcoming nanotechnologies present new opportunities and challenges in materials processing, device design, and integration. Drivers for commercial deployment include increased functionality, small form factor, performance, reliability, cost, as well as renewable energy and climate change mitigation.

Papers are solicited in the areas of:

LIGHT-MATTER INTERACTIONS IN 1D AND 2D NANOMATERIALS
- 1D and 2D photo-physics
- photoconductivity and photocurrents in 1D and 2D nanomaterials and composites
- novel architectures based on 1D and 2D nanomaterials for enhanced light-matter interactions
- photo-thermal phenomenon in nanoscale materials and their composites
- novel devices based on 1D and 2D nanomaterials for photonics.

PHOTON UPCONVERSION
- exploration of new photon upconversion materials, nanomaterials, and nanostructures
- synthesis and surface modification techniques for photon upconversion materials
- nanophotonic approach for photon upconversion enhancement, including but not limited to, plasmonic nanostructures, metamaterials, photonic crystals, and nanocavities
- applications of photon upconversion materials, including, but not limited to, solar energy conversion, imaging, sensing, and therapeutics
- theory and modeling of photon upconversion processes
- advanced spectroscopy and other characterizations of photon upconversion materials.

NANOSTRUCTURED THIN FILMS
- fabrication techniques
- characterization
- homogenization studies and modeling
- hybrid nanostructures
- multifunctionality at the nanoscale
- plasmonics
- organic and inorganic nanostructured thin films
- sculptured thin films
- nanostructured porous thin films
- two-dimensional materials
- carbon-based nanostructures
- topological insulators and photonic topological insulators
- functionalization of nanostructures
- thin-film sensors
- superhydrophobicity
- biomaterials
- bioinspired and biomimetic thin films
- structural evolution.

INNOVATIVE PATTERNING, MATERIALS ENGINEERING, NANOFABRICATION, AND NANOLITHOGRAPHY FOR PHOTONICS APPLICATIONS
- electrospinning, imprinting, and embossing techniques
- fabrication, processing, and replication techniques
- directed self-assembly techniques
- engineered nano- and micro-structured materials
- synthesis of nanotubes, nanowires, and two-dimensional materials such as graphene
- stacked 2D atomic crystals
- molecular patterning and ordering.

Submit an abstract: spie.org/op21call
HIGH PRECISION NANOPOSITIONING AND FEEDBACK, NEW METROLOGIES FOR PHOTONICS
• proximal probe manipulation techniques
• nanomotors and actuators
• nano-alignment techniques, tolerance
• tribology nanotechnologies
• new metrology instrumentation, methods, and standards for measuring nanodevices
• metrology for placement precision
• novel measurement and inspection methodologies
• high resolution optics, including full-field, near-field and scanning probe microscopy, scatterometry, and interferometric techniques
• x-ray techniques
• synchrotron techniques
• optical detectors for state of the art instrumentation
• particle beam (electron, ion) microscopy and elemental analysis
• atomic force microscopy.

NANOMANUFACTURING OF 1D AND 2D NANOMATERIALS FOR PHOTONICS APPLICATIONS
• liquid phase exfoliation of 1D and 2D nanomaterials
• new developments in liquid phase exfoliation for low cost nanomanufacturing
• chemical vapor deposition of 1D and 2D nanomaterials for manufacturing
• new green synthesis methods for low cost manufacturing of 1D and 2D nanomaterials
• scalable manufacturing of nanocomposites based on 1D and 2D nanomaterials
• properties of scalable nanomanufactured products
• scalable nanomanufacturing: innovative device architectures
• scalable nanomanufacturing: what is the road map?

DEVICES AND PROPERTIES OF NANOSTRUCTURES FOR PHOTONICS (EXPERIMENT AND/OR THEORY)
• nanoelectronic and nanomagnetic devices and structures
• waveguiding nanodevices and nanostructures
• nano-MEMS devices and structures
• near field optics based devices
• NOMS: Nano-Opto-Mechanical Systems
• photovoltaic cells and structures
• biological devices and structures
• molecular devices and structures
• atomic devices and structures
• quantum devices and structures
• nanosensors
• smart mechanical actuators
• 1D nanotubes
• stacked 2D atomic crystals.

NANO- AND MICRO-OPTICS
• physics, theory, design, modeling, and numerical simulation of optical nano- and micro-structures
• diffractive and refractive micro-structures for beam shaping and manipulation
• photonic microcircuits in silica, polymer, silicon, compound semiconductors, ferroelectrics, magnets, metals, and biomaterials
• 1D, 2D, and 3D photonic crystals
• quantum dots, wells, and wires
• guided-wave and free-space optical interconnects
• optical alignment, tolerance, and coupling
• characterization (optical, electrical, structural, etc.)
• integration with guided-wave systems
• integration with photonic devices including VCSELs, modulators, and detectors
• nano- and micro-optic-based optical components, modules, subsystems, and systems for communications, information processing, computing, storage, photovoltaic power generation, information display, imaging, printing, scanning, and sensing
• graphene-and transition metal dichalcogenides based devices
• molecular devices.

ENERGY HARVESTING AND STORAGE NANO TECHNOLOGIES
• nanostructured materials for efficient light trapping, photon absorption, charge generation, charge transport, and current collection in photovoltaic cells and modules
• nanostructured solar cells
• polymer solar cells based on 1D and 2D nanomaterials
• solar thermal phenomenon based on 1D and 2D nanomaterials
• nanocomposites, nanocoatings, and nanolubricants for power-generating wind turbines
• nanocomposites for smart behavior: reciprocity in electroactuation
• nanotechnologies for batteries and ultracapacitors, including powder-based, carbon-nanotube-based, silicon-nanowire-based and graphene-based electrodes.

COMMERCIALIZATION OF NANO- AND MICRO-STRUCTURE PHOTO NICS AND OTHER DEVICES, MODULES, AND SYSTEMS
• nanomanufacturing methodology
• in-situ and in-operando inspection
• 3D critical dimension metrology
• characterization of nanostructured functional surfaces
• characterization of nano-objects used in novel devices or products
• assembly and packaging
• reliability
• novel concepts.
ENHANCED SPECTROSCOPIES AND NANOIMAGING 2021 (OP109)

Conference Chairs: Prabhat Verma, Osaka Univ. (Japan); Yung Doug Suh, Korea Research Institute of Chemical Technology (Korea, Republic of), Sungkyunkwan Univ. (Korea, Republic of)

Program Committee: Katrin F. Domke, Max-Planck-Institut für Polymerforschung (Germany); Masayuki Futamata, Saitama Univ. (Japan); Tamitake Itoh, AIST (Japan); Dayong Jin, Univ. of Technology, Sydney (Australia); Satoshi Kawata, Osaka Univ. (Japan); Jung-Hoon Lee, City Univ. of Hong Kong (Hong Kong, China); Dangyuan Lei, City Univ. of Hong Kong (Hong Kong, China); Alfred J. Meixner, Eberhard Karls Univ. Tübingen (Germany); Yukihiro Ozaki, Kwansei Gakuin Univ. (Japan); Matthew A. Pelton, Univ. of Maryland, Baltimore County (USA); Markus B. Raschke, Univ. of Colorado Boulder (USA); Bin Ren, Xiamen Univ. (China); P. James Schuck, Columbia Univ. (USA); Zachary D. Schultz, The Ohio State Univ. (USA); Ze Xiang Shen, Nanyang Technological Univ. (Singapore); Takayuki Umakoshi, Osaka Univ. (Japan); Siva Umapathy, Indian Institute of Science, Bangalore (India); Katherine A. Willets, Temple Univ. (USA); Peng Xi, Peking Univ. (China); Hongxing Xu, Wuhan Univ. (China); Taka-aki Yano, Tokushima Univ. (Japan); Renato Zenobi, ETH Zurich (Switzerland)

There is a huge demand for research tools allowing one to “see” and investigate materials and biological samples at a resolution of true nanoscale and to characterize and sense constituents at molecular levels as well to understand biochemical process at nanoscale. Optical techniques such as nanospectroscopy and nanoimaging make this possible. Tools involving enhanced and confined light in optical spectroscopy and imaging have pushed the spatial resolution far beyond the diffraction limits of light and the detection sensitivity to new scales. Continuous improvements open ways to novel applications at the forefront of scientific knowledge.

The purpose of this interdisciplinary conference is to encompass all aspects of enhanced and confined light for nanospectroscopy and nanoimaging, including theory and novel concepts, experimental demonstration of novel concepts, major developmental progress and applications to any field in science, in particular, biological, medical, chemical, and the material sciences.

Papers are solicited in (but not restricted to) the following areas:

**NANOSPECTROSCOPIC AND SENSING TECHNIQUES**
- surface- and particle-enhanced Raman spectroscopy (SERS, PERS)
- surface-enhanced infrared absorption spectroscopy (SEIRAS)
- shell-isolated nanoparticle-enhanced Raman spectroscopy (SHINERS)
- stimulated Raman spectroscopy (SRS) at high spatial resolution
- dielectric-enhanced spectroscopies
- enhanced spectroscopies for molecular sensing.

**NEAR-FIELD NANOIMAGING TECHNIQUES**
- near-field scanning optical microscopy (NSOM/SNOM)
- tip-enhanced Raman scattering (TERS) microscopy
- tip-enhanced photoluminescence (TE-PL) microscopy
- tip-enhanced coherent anti-Stokes Raman scattering (TE-CARS) microscopy.

**OTHER NANOSCALE OPTICAL SPECTROSCOPIC/SENSING/IMAGING TECHNIQUES**
- new/unconventional experimental techniques for nanospectroscopy and nanoimaging
- new/unconventional techniques for molecular detection and sensing
- growth/fabrication of plasmonic/dielectric materials for nanospectroscopy and nanoimaging
- growth/fabrication of plasmonic devices for molecular sensing
- theoretical/simulation studies in related fields of nanospectroscopy
- other nonlinear optical spectroscopy/microscopy at nanoscale.
EMERGING TOPICS IN ARTIFICIAL INTELLIGENCE (ETAI) 2021 (OP110)

Conference Chairs: Giovanni Volpe, Göteborgs Univ. (Sweden); Joana B. Pereira, Karolinska Institute (Sweden); Daniel Brunner, Institut Franche-Comte Electronique Mecanique Thermique et Optique (France); Aydogan Ozcan, Univ. of California, Los Angeles (USA)

Program Committee: Jonas Andersson, Syntronic (Sweden); Atef Badji, Univ. de Montréal (Sweden); George Barbasta, Massachusetts Institute of Technology (USA); Estella Camara Mancha, Institut d'Investigació Biomèdica de Bellvitge (Spain); Frank Cichos, Univ. Leipzig (Germany); Margareta Colangelo, Deep Knowledge Ventures (USA); Miguel C. Cornelles-Soriano, Instituto de Física Interdisciplinar y Sistemas Complejos (Spain); Joni Dambre, Univ. Ghent (Belgium); Meltem Elitas, Sabanci Univ. (Turkey); Claudio Gallicio, Univ. di Pisa (Italy); Saga Helsgadottir, ill.ai (Sweden); Antoni Homs-Corbera, Cherry Biotech (France); Danny Krautz, Axel Springer hy GmbH (Germany); Pablo Loza-Alvarez, ICFO - Institut de Ciències Fotòniques (Spain); Carlo Manzo, Univ. de Vic (Spain); Alireza Marandi, Caltech (USA); Paula Merino Serrais, Cajal Institute (Spain); Bert Jan Offrein, IBM Research - Zürich (Switzerland); Yair Rivenson, Univ. of California, Los Angeles (USA); Elena Rodriguez-Vieitez, Karolinska Institute (Sweden); Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia); Roser Sala-Llonch, Univ. de Barcelona (Spain); Bhavin J. Shastri, Queen's Univ. (Canada); Guohai Situ, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences (China); Evelyn Tang, Max Planck Institute for Dynamics and Self-Organization (Germany)

The ETAI conference provides a forum for a highly interdisciplinary community combining artificial intelligence with photonics, microscopy, active matter, biomedicine, and brain connectivity. Importantly, this conference includes topics outside the core expertise of optics and photonics. Photonics and machine learning have become decisively interdisciplinary, and we expect additional synergy and inspiration through this open-minded approach.

ETAI actively engages with industry to foster commercialization and provides networking opportunities for young and established researchers. By bringing experts from different fields and backgrounds together, ETAI provides new fundamental insights and identifies technological applications as well as commercialization opportunities.

The topics covered in ETAI include but are not limited to:
- data acquisition and analysis through photonic subsystems, e.g., time series, images, video feature tracking, optical signal processing
- simulation and design of photonic components and circuits
- adaptive control of experimental setups through more robust and resilient feedback cycles
- enhanced computational microscopy using artificial intelligence
- alternative computing concepts such as neural networks and Ising machines to overcome the end of Moore and Dennard scaling
- fundamental aspects of photonic non-digital computing
- integrated photonics and nonlinear optical components for next generation computing
- enhanced precision medicine, e.g., virtual tissue staining, early diagnosis, and personalized treatments
- artificial intelligence for analysis of brain connectivity
- biomimetic and neuromorphic computational architectures
- embodied intelligence in nature and technology
- evolution of adaptive behaviors in biological systems
- engineering collective behaviors in robotic swarms
- human brain haptic device interfaces
- physical insight and interpretability of artificial intelligence models
- limitations and criticism of the use of artificial intelligence.

The keynote and invited presentations will provide an exciting and broad view of this interdisciplinary research effort.

Abstracts are solicited on (but not restricted to) the following areas:

**ARTIFICIAL INTELLIGENCE FOR OPTICAL TRAPPING**
- particle detection
- optical trap calibration
- feedback control.

**ARTIFICIAL INTELLIGENCE FOR SOFT AND ACTIVE MATTER**
- data acquisition using machine learning
- data analysis using machine learning
- de-noising using machine learning
- reinforcement learning in physical systems
- dynamics of complex systems
- intelligent foraging
- navigation and search strategies.

**ARTIFICIAL INTELLIGENCE FOR BIOMEDICINE**
- machine learning-enhanced optical imaging and sensing
- image segmentation
- virtual tissue staining
- artificial intelligence as a tool to enhance decision-making in personalized medicine and drug screening
- multiple-sources data structuring and combination in complex biomedical decision-making
- legal and ethical aspects of the use of artificial intelligence as a tool for decision-making in medicine.

**NEUROMORPHIC COMPUTING**
- next generation materials for optical nonlinearity
- integration of ultra-parallel photonic architectures
- beyond 2D substrates
- physical substrates for machine learning applications.

**OPTICAL NEURAL NETWORKS**
- learning in optical systems
- applications for optical neural networks
- scalability of optical neural networks.

**AUTONOMOUS ROBOTS**
- swarming robots
- feedback control
- elaboration of sensorial inputs
- decision making.

**BIOLOGICAL MODELS FOR ARTIFICIAL INTELLIGENCE**
- physical foundations of biological intelligence
- translation of biological models to artificial intelligence
- collective motion in biological populations.

Continued
MACHINE LEARNING TO STUDY THE BRAIN
• machine learning methods for image segmentation
• supervised and unsupervised models
• multi-voxel pattern analysis
• predictive modelling approaches.

ARTIFICIAL INTELLIGENCE FOR BRAIN CONNECTIVITY
• measurement of brain activity and anatomy in humans and animals
• structural and functional connectomics
• graph theoretical tools
• clusters and subnetwork extraction
• dimensionality reduction techniques to identify brain networks.

MACHINE-BRAIN INTERFACES
• detection of brain activity
• haptic devices
• feedback control through brain waves.

LIMITATIONS OF ARTIFICIAL INTELLIGENCE
• the “black-box problem” of machine learning
• interpretability, explainability and uncertainty quantification of machine-learning models
• generalization power of machine-learning models
• model selection
• development of objective benchmarks.

Submit an abstract: spie.org/op21call
QUANTUM NANO PHOTO NOMIC MATERIALS, DEVICES, AND SYSTEMS 2021 (OP112)

Conference Chairs: Cesare Soci, Nanyang Technological Univ. (Singapore); Matthew T. Sheldon, Texas A&M Univ. (USA); Mario Agio, Univ. Siegen (Germany)

Program Committee: Igor Aharonovich, Univ. of Technology, Sydney (Australia); Vikas Anant, Photon Spot, Inc. (USA); Iñigo Artundo, VLC Photonics (Spain); Jennifer A. Dionne, Stanford Univ. (USA); Andrei Faraon, Caltech (USA); Mohammad Hafezi, Joint Quantum Institute (USA); Zubin Jacob, Purdue Univ. (USA); Christian Kurtsiefer, National Univ. of Singapore (Singapore); Mark Lawrence, Stanford Univ. (USA); Peter Lodahl, Niels Bohr Institute (Denmark); Marko Loncar, Harvard John A. Paulson School of Engineering and Applied Sciences (USA); Chao-Yang Lu, Univ. of Science and Technology of China (China); Patrick Maletinsky, Univ. Basel (Switzerland), Qnami (Switzerland); Maiken H. Mikkelsen, Duke Univ. (USA); Prineha Narang, Harvard Univ. (USA); Kae Nemoto, National Institute of Informatics (Japan); Jeremy L. O’Brien, Univ. of Bristol (United Kingdom); Teri W. Odom, Northwestern Univ. (USA); Jian-Wei Pan, Univ. of Science and Technology of China (China); Pascale Senellart, Lab. de Photonique et de Nanostructures (France); Andrew J. Shields, Toshiba Research Europe Ltd. (United Kingdom); Kartik Srinivasan, National Institute of Standards and Technology (USA); Daniel L. Stick, Sandia National Labs. (USA); Mark Tame, Stellenbosch Univ. (South Africa); Wolfgang Tittel, Univ. of Calgary (Canada); Ewold Verhagen, AMOLF (Netherlands); Ulrike Woggon, Technische Univ. Berlin (Germany)

Optics and photonics enable devices that exploit the laws of quantum physics at a fundamental level, laying the ground for a second quantum revolution. Light is widely used in emerging quantum technologies, for example to control and manipulate quantum states of matter, to generate and transmit qubits, to achieve quantum nonlinearities and many-body effects. In addition, advances in nanofabrication and circuit integration (e.g. silicon photonics, fiber optics, plasmonics) are crucial to translate proof of concepts into technological platforms for quantum simulations, metrology, sensing, imaging, communication and computing.

Quantum nanophotonic materials, devices, and systems aims at establishing a multidisciplinary forum for physicists, material scientists, and optical engineers to discuss the current progress, challenges, and future directions of the burgeoning field of quantum nanophotonics. Contributions are solicited in areas focusing on:

**MATERIAL PLATFORMS FOR QUANTUM PHOTO NOMIC DEVICES**
- wide bandgap materials: diamond, silicon carbide, rare earths
- semiconductors: silicon, III-V and II-V compounds
- two-dimensional materials: graphene, boron-nitride, transition metal dicalcogenides
- plasmonics, metamaterials and metasurfaces
- nanoantennas
- topological materials.

**QUANTUM PHOTO NOMIC DEVICES FOR SIMULATIONS, METROLOGY, SENSING, IMAGING, COMMUNICATION AND COMPUTING**
- nanoscale atom traps
- single-photon sources and modulators
- single-photon and photon-number discriminating detectors
- spin-photon interfaces for sensors and repeaters
- quantum gates
- optomechanical devices
- quantum chemistry.

**QUANTUM NANO PHOTO NOMIC SYSTEMS**
- quantum key distribution and quantum random number generators
- quantum computers and simulators
- quantum sensors based on solid-state systems and atom chips
- quantum engineering, including nanofabrication and integration
- quantum control, including error correction and tolerance
- quantum entanglement and imaging.

Save the date

| **ABSTRACTS DUE:** | 3 February 2021 |
| **AUTHOR NOTIFICATION:** | 5 April 2021 |
| The contact author will be notified of acceptance by email. |
| **MANUSCRIPT DUE DATE:** | 7 July 2021 |
| **PLEASE NOTE:** Submissions imply the intent of at least one author to register, present the paper as scheduled, and submit a full manuscript by the deadline. |
Organic Photonics + Electronics
pages 18–22

Technologies
Explore these technical areas to find the right conference to submit your research.

- OLEDs
- OFETS
- OHPVs
- Perovskite PVs
- Organic and hybrid sensors
- Bioelectronics
- Liquid crystals
- Molecular machines

Save the date

<table>
<thead>
<tr>
<th><strong>ABSTRACTS DUE:</strong></th>
<th>3 February 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AUTHOR NOTIFICATION:</strong></td>
<td>5 April 2021</td>
</tr>
<tr>
<td>The contact author will be notified of acceptance by email.</td>
<td></td>
</tr>
<tr>
<td><strong>MANUSCRIPT DUE DATE:</strong></td>
<td>7 July 2021</td>
</tr>
<tr>
<td><strong>PLEASE NOTE:</strong> Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.</td>
<td></td>
</tr>
</tbody>
</table>

Submit an abstract: spie.org/op21call
LIQUID CRYSTALS XXV (OP211)
Conference Chairs: Iam Choon Khoo, The Pennsylvania State Univ. (USA)
Program Committee: Timothy J. Bunning, Air Force Research Lab. (USA); Julian S. Evans, Zhejiang Univ. (China); Jean-Pierre Huignard, Jphopto (France); Tomiki Ikeda, Chuo Univ. (Japan); Malgosia Kaczmarek, Univ. of Southampton (United Kingdom); Oleg D. Lavrentovich, Kent State Univ. (USA); Sin-Doo Lee, Seoul National Univ. (Korea, Republic of); Tsung-Hsien Lin, National Sun Yat-Sen Univ. (Taiwan); Kenneth L. Marshall, Lab. for Laser Energetics (USA); Francesco Simoni, Univ. Politecnica delle Marche (Italy); Nelson V. Tabiryan, BEAM Engineering For Advanced Measurements Co. (USA); David M. Walba, Univ. of Colorado Boulder (USA); Shin-Tson Wu, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA)

Liquid crystals in their various mesophases are technologically important electro-optic materials. They possess many unique and useful physical and optical properties and are widely used in various optoelectronic display, beam/image, and optical information processing systems, with response times ranging from milli-, through micro-, nano- to pico- and femto-seconds, covering a wide spectral range from near UV to infrared. In recent years, innovation in nanofabrication and development of plasmonic nanostructures have also led to the emergence of liquid crystalline metamaterials and metasurfaces that possess emergent functionalities and properties that hold high promises for applications in advanced optical and photonic devices/systems.

This conference provides a forum for presentations of research results on all aspects of liquid crystal material and optical sciences and technologies. The emphasis is on new, novel, or unique liquid crystalline materials and other soft materials, optical properties and phenomena, and their applications in display, information, and image processing systems, electro-optics and nonlinear optics.

Papers are solicited from the following and related topics:
- new liquid crystalline materials, soft matters and complex fluids, possessing large and broadband birefringence, ferroelectricity, chirality and other characteristics suitable for advanced electro-optical applications
- new optical and electro-optical processes and phenomena of fundamental or applied significance
- advance LC display science and technologies, optical alignment, holography, storage, and switching materials, processes, and devices
- liquid crystal incorporating nano-particulate and nanostructures; tunable metamaterials and metasurfaces
- nonlinear optics: materials, phenomena, and applications

ORGANIC AND HYBRID LIGHT EMITTING MATERIALS AND DEVICES XXV (OP212)
Conference Chairs: Chihaya Adachi, Kyushu Univ. (Japan); Jang-Joo Kim, Seoul National Univ. (Korea, Republic of); Franky So, North Carolina State Univ. (USA)
Program Committee: Wolfgang Brütting, Univ. Augsburg (Germany); Lay Lay Chua, National Univ. of Singapore (Singapore); Malte C. Gather, Univ. of St. Andrews (United Kingdom); Hironori Kaji, Kyoto Univ. (Japan); Ji-Seon Kim, Imperial College London (United Kingdom); Anna Köhler, Univ. Bayreuth (Germany); Tae-Woo Lee, Seoul National Univ. (Korea, Republic of); Jian Li, Arizona State Univ. (USA); Dongge Ma, South China Univ. of Technology (China); Andrew P. Monkman, Durham Univ. (United Kingdom); Jongwook Park, Kyung Hee Univ. (Korea, Republic of); Yong-Jin Pu, RIKEN Ctr. for Emergent Matter Science (Japan); Barry P. Rand, Princeton Univ. (USA); Sebastian Reineke, TU Dresden (Germany); ifor D. W. Samuel, Univ. of St. Andrews (United Kingdom); Joseph Shinar, Iowa State Univ. of Science and Technology (USA); Ken-Tsung Wong, National Taiwan Univ. (Taiwan); Chung-Chih Wu, National Taiwan Univ. (Taiwan); Seunghyup Yoo, KAIST (Korea, Republic of)

This conference centers on the science and technology of organic and hybrid light emitting materials and devices for flat panel displays, solid state lighting and lasers. Applications range from handheld displays to large flat panel screens, large-area distributed light sources, and next-generation organic lasers.

The scope of the conference will cover the following areas:
- highly efficient molecular and polymeric light emitters and devices
- thermally activated delayed fluorescent materials
- 2D and 3D metal-organic perovskites light emitting materials
- quantum dot light emitting materials and devices
- efficient white emitting materials and devices for solid state lighting
- novel light extraction schemes
- microcavity effects for solid state lighting and lasers
- organic laser materials and devices
- device failure mechanisms and durability studies
- novel approaches, patterning, and driving schemes for full color displays and solid state lighting
- novel substrates and electrodes for flexible devices
- physics of carrier injection, transport, and recombination
- photophysics of excited state.

HIGHLIGHTS:
- Special Session on Solid State Lasers based on Organic Thin Films, Molecular, and Photonic Crystals.

Manuscripts for the conference proceedings will be peer-reviewed. Authors are invited to submit an original manuscript to the Journal of Photonics for Energy, which is now covered by all major indexes and Journal Citation Reports.
ORGANIC, HYBRID, AND PEROVSKITE PHOTOVOLTAICS XXII  
(OP213)

Conference Chairs: Zakya H. Kafafi, Lehigh Univ. (USA); Paul A. Lane, NSF (Professional Development) (USA)
Conference Co-Chairs: Gang Li, The Hong Kong Polytechnic Univ. (Hong Kong, China); Ellen Moons, Karlstad Univ. (Sweden); Ana Flávia Nogueira, Univ. of Campinas (Brazil)

Program Committee: Harald W. Ade, North Carolina State Univ. (USA); Derya Baran, King Abdullah Univ. of Science and Technology (Saudi Arabia); Hendrik J. Bolink, Univ. de València (Spain); Paul L. Burn, The Univ. of Queensland (Australia); Alexander Colsmann, Karlsruher Institut für Technologie (Germany); Daniel Congreve, The Rowland Institute at Harvard (USA); Giulia Grancini, Univ. degli Studi di Pavia (Italy); Martin J. Heeney, Imperial College London (United Kingdom); Bumjoon Kim, KAIST (Korea, Republic of); Gang Li, The Hong Kong Polytechnic Univ. (Hong Kong, China); Monica Lira-Cantú, Institut Català de Nanociència i Nanotecnologia (ICN2) (Spain); Thuc-Quyen Nguyen, Univ. of California, Santa Barbara (USA); Ana Flávia Nogueira, Univ. Estadual de Campinas (Brazil); Hideo Ohkita, Kyoto Univ. (Japan); Annamaria Petrozza, Istituto Italiano di Tecnologia (Italy); Barry P. Rand, Princeton Univ. (USA); Ifor D. W. Samuel, Univ. of St. Andrews (United Kingdom); Yana Vaynzof, TU Dresden (Germany); Iris Visoly-Fisher, Ben-Gurion Univ. of the Negev (Israel); Hin-Lap (Angus) Yip, South China Univ. of Technology (China)

The SPIE Conference on Organic, Hybrid and Perovskite Photovoltaics will celebrate its 22nd anniversary in 2021. The aim of this meeting is to bring together scientists, engineers, and technologists from multiple disciplines to report on and discuss the fundamental issues that affect device operation, including efficiency and long-term stability. The theme of the conference will be “state-of-the-art” performance of organic, hybrid and perovskite solar cells and their applications in future technologies. The scope of the conference includes high-performance light-harvesting and carrier transporting materials, highly efficient and stable organic, hybrid and perovskite solar cells, and device physics including interfaces, film structure and morphology, and charge transport. The conference will also cover new techniques for fabrication, encapsulation, and printing of solar cells on large-area flexible substrates. The conference will feature planned joint sessions with the Conferences on Physical Chemistry of Interfaces and Nanomaterials, and New Concepts in Solar and Thermal Radiation Conversion.

The scope of the conference will cover but is not limited to the following areas:

• molecular, macromolecular, and polymeric photovoltaics
• hybrid organic/inorganic photovoltaics
• perovskite-based solar cells
• tandem and multi-absorber solar cells
• plasmonic and photonic structures for light management
• new light-harvesting materials
• new electron and hole transport materials
• new electrode materials
• new flexible substrate materials
• novel contact (e.g. metal oxide) and nanostructured layers
• film structure and morphology
• organic/inorganic interfaces
• physics of exciton diffusion, charge carrier generation, transport, and recombination
• new techniques for fabrication, encapsulation, and printing of solar cells
• large-area processing and fabrication of solar modules
• stability, lifetime, and reliability of modules
• future prospects for organic, hybrid, and perovskite solar cell technology.

HIGHLIGHTS:

• A joint session with Physical Chemistry of Interfaces and Nanomaterials
• A joint session with New Concepts in Solar and Thermal Radiation Conversion.

Manuscripts for the conference proceedings will be peer-reviewed. Authors are invited to submit an original manuscript to the Journal of Photonics for Energy, which is now covered by all major indexes and Journal Citation Reports.
The need for small-size and on-chip integrable and inexpensive detecting systems, including for biological and medical applications, have prompted the development of easily processable organic field-effect transistor (OFET)- and light-emitting diode (OLED)-based sensors integrated with organic or hybrid photodetectors. The growing activity and progress in flexible, organic, printable, and hybrid electronics enable the development of skin display electronic, as well as flexible wearable and implantable sensors. OLEDs and OLED arrays in optogenetics for potential implantable optical-neural interfaces, as well as modulation of neuronal networks activity is a biophotonics platform of growing interest. A better understanding of the organic/living tissue interface, which will lead to the design of better biosensing and biophotonic concepts, remains a challenge.

Overall fast and simultaneous detection of multiple analytes utilizing micro/nano array systems continues to open a plethora of novel applications in key areas such as clinical analysis, environment monitoring, food and beverage safety, and homeland security. Solution or easily processable two-dimensional metal oxides, carbon-based, and hybrid organic/inorganic 2D and 3D materials have proven useful as active layers in chemical and biological transducers. Novel technological approaches that allow the integration of functional bio-receptors into device structures are also critically important to endow such devices with recognition capabilities. Continued research and development efforts are needed, including with newly emerging technologies on hybrid memory devices and logic elements to further improve sensors’ performance level and low-cost manufacturability.

This conference will focus on progress in chemical, biological, medical, and physical sensors and actuators, including image sensors and flexible/stretchable e-skin, and large-scale devices from carbon-based, solution processed metal oxides, and hybrid organic/inorganic 2D and 3D materials have proven useful as active layers in chemical and biological transducers. Novel technological approaches that allow the integration of functional bio-receptors into device structures are also critically important to endow such devices with recognition capabilities. Continued research and development efforts are needed, including with newly emerging technologies on hybrid memory devices and logic elements to further improve sensors’ performance level and low-cost manufacturability.

The conference will focus also on the science and technology of next generation memory and logic devices based on organic, hybrid organic/inorganic, and inorganic materials, which are predominantly fabricated by printing technologies. It will span a broad spectrum from fundamental science related to novel materials development and processing to addressing issues related to organic and inorganic surfaces and interfaces, to device fabrication, system applications, and integration using novel printing methods.

Contributions related (but not limited) to the following topics are solicited:

- Organic electronics in medical treatment for pain relief
- Organic semiconductors in plasmon-based sensors
- Organic and perovskite-based photodetectors in analytical applications
- Organic biocompatible materials in applications such as cell growth, tissue engineering, and drug delivery
- Synthesis, characterization, and optimization of sensor materials
- Flexible electronics for the manufacturing of large-area sensors and actuators
- Conformable and stretchable electronics for sensing applications
- e-skin devices
- Array technologies in organic electronics: microfluidics, nanoscale, and lab-on-a-chip for multiple analyte detection
- Organic, hybrid organic/inorganic, and inorganic materials-based memory and logic devices
- Neuromorphic concepts and applications, including resistive memories and memristors
- Switching mechanisms in resistive memories and memristors
- Interface energetics in resistive memories and memristors
- RFID applications and smart memory devices for flexible integrated systems
- Hybrid heterogeneous integration of printed electronic circuit with conventional Si-electronics
- Emerging materials for printed electronic applications
- Large-area and high resolution S2S and R2R fabrication techniques
- Use of quantum dots and QDLEDs for biosensing applications
- Applications in water and food analysis.

HIGHLIGHT:

- A joint session with the conference on Organic Thin Film Transistors (OTFTs)

Submit an abstract: spie.org/op21call
ORGANIC PHOTONICS + ELECTRONICS

ORGANIC AND HYBRID FIELD-EFFECT TRANSISTORS XX (OP215)

Conference Chairs: Iain McCulloch, King Abdullah Univ. of Science and Technology (Saudi Arabia); Oana D. Jurchescu, Wake Forest Univ. (USA)

The impressive improvement in the performance of organic thin film field-effect transistors (OTFTs) during the last two decades, coupled with the processability advantages offered by organic materials, has attracted the interest of the optoelectronics industry and has opened the way for practical, broad-impact applications of such devices. OTFTs are based on various small organic molecules, conjugated polymers and oligomers, blends of such materials, or organic-inorganic hybrids. Potential applications for organic semiconductors are currently aimed at large-area electronics, which almost always involve intermolecular transport mechanisms. They include flexible active-matrix displays with OTFT backplanes, e-paper, low-cost and low-end printable electronic circuits, devices such as RFID tags and smart cards, and sensors. Knowledge accumulated from the study of these organic materials and devices will in the future aid the design, development, and fabrication of molecular and polymeric devices based on intramolecular transport. This year we will expand from organic transistors to other emerging thin-film transistor technologies, which include oxide, carbon nanotubes (CNTs), hybrid organic/inorganic perovskites, and 2D materials.

This conference is intended to provide a platform for discussions and exchanges between scientists with different backgrounds, all experts in chemistry and physics of organic and hybrid semiconductors to their applications in electronic devices and circuits. Contributed papers are solicited concerning, but not limited to, the following areas:

- organic semiconductor design, synthesis, processing, and characterization
- organic semiconductor growth and morphology
- dielectric materials
- oxide, perovskites, CNTs, 2D semiconductors
- printable electronic materials
- printing and patterning methods
- device physics, modeling, geometric design, and characterization
- ambipolar TFTs
- transparent electronics
- resistive memories and memristor devices
- single-crystal devices
- charge injection and transport properties
- integrated circuits
- neuromorphic concepts and applications
- chemical and biological sensors
- flexible OTFT display backplanes
- other OTFT applications
- device reliability, stability, and degradation
- self-assembly processes in OTFTs
- molecular devices
- integration of OTFTs with other components
- organic light emitting transistors
- memory devices
- stretchable electronic materials and devices
- plastic electronics
- fundamental processes in OTFTs.

MOLECULAR AND NANO MACHINES IV (OP216)

Conference Chairs: Zouheir Sekkat, Univ. Mohamed V (Morocco), MAScIR (Morocco); Takashige Omatsu, Chiba Univ. (Japan)

Program Committee: Christopher J. Barrett, McGill Univ. (Canada); Anna S. Bezryadina, California State Univ., Northridge (USA); Cornelia Denz V, Westfälische Wilhelms-Univ. Münster (Germany); Katsumasa Fujita, Osaka Univ. (Japan); Tigran Galstian, Ctr. d’Optique, phononique et laser (Canada); Shinji Hayashi, Kobe Univ. (Japan); Yasushi Inouye, Osaka Univ. (Japan); Masahiro Irie, Rikkyo Univ. (Japan); Hidekazu Ishitobi, Osaka Univ. (Japan); Peter Karageorgiev, Univ. Regensburg (Germany); Satoshi Kawata, Osaka Univ. (Japan); Kwang-Sup Lee, Hannam Univ. (Korea, Republic of); Keitaro Nakatani, École normale supérieure Paris-Saclay (France); Halina Rubinsztein-Dunlop, The Univ. of Queensland (Australia); Atsushi Shishido, Tokyo Institute of Technology (Japan); Hong-Bo Sun, Tsinghua Univ. (China); Diederik S. Wiersma, LENS - Lab. Europeo di Spettroscopie Non-Lineari (Italy)

Machines have been influencing human development over many millennia, in particular since the industrial revolution, with key discoveries that dramatically changed the world, and mankind has been pushing the limits of machines work and miniaturizing machines, with the ultimate goal of making molecular-sized machines that can perform complex and useful tasks. We are now at the dawn of a new revolution. Even though the field is still in its infancy, scientists for many years have been intrigued by this multidisciplinary research area, including biology and chemistry and physics. Innovative applications of molecular machines, as can be foreseen now, include copying, motion, actuation, energy, memory and sensing. The basic focus of this conference is the study of molecular machines and their response to external stimuli, by light for example, and the macroscopic motion and functions they impart in materials.

Session topics include, but are not limited to:

- Light-activated molecular motors and robots and devices
- DNA copying process and DNA-based nano-machines
- Synthetic and bio-molecular machines
- Nanoparticle probes for molecular machinery
- Molecular shuttles, cars, and lifts, and contraction/extension, and artificial muscles
- Molecular switches and memories, and light-fueled molecules and systems
- Photoactive soft matter
- Two-photon micro/nanofabrication of functional materials and systems
- Microfluidics and (bio)sensing
- Plasmonically-enhanced spectroscopies and functions.

22
Optical Engineering + Applications
pages 23–58

Technologies
Explore these technical areas to find the right conference to submit your research.

Special Program
• Tribute to James C. Wyant
• Light in Nature

Optical Engineering + Applications
• Optical Design
• Optical Alignment, Testing, and Fabrication
• Astronomical Optics and Instrumentation
• Photonic Devices
• X-ray, Gamma-ray, and Particle Technologies
• Image and Signal Processing
• Optics and Photonics for Sustainable Energy
• Remote Sensing and Atmospheric Propagation

Save the date

ABSTRACTS DUE:
3 February 2021

AUTHOR NOTIFICATION:
5 April 2021
The contact author will be notified of acceptance by email.

MANUSCRIPT DUE DATE:
7 July 2021

PLEASE NOTE: Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.
SPECIAL PROGRAM

TRIBUTE TO JAMES C. WYANT: THE EXTRAORDINAIRE IN OPTICAL METROLOGY AND OPTICS EDUCATION (OP301)

Conference Chairs: Virendra N. Mahajan, Wyant College of Optical Sciences (USA); Dae Wook Kim, Wyant College of Optical Sciences (USA)

Program Committee: Katherine Creath, Optineering (USA); John B. Hayes, 4D Technology Corp. (USA); Masud Mansuripur, Wyant College of Optical Sciences (USA); Joseph A. Shaw, Montana State Univ. (USA); Marija Strojnik, Centro de Investigaciones en Óptica, A.C. (Mexico)

This conference is dedicated to celebrate Professor and Dean James C. Wyant’s extraordinary contributions and services to the fields of optical metrology and optics education. The focus of his research has been on applying the science of interferometry to precision metrology and sensing applications in various fields including computer-generated holograms, data storage, wavefront sensors for adaptive optics, optical fabrication, and optical system engineering.

Authors should submit papers they believe have been inspired or enabled by Jim’s work. It is an opportunity to tell him how their lives have been impacted by their coming in contact with him. Anecdotal experiences and observations relating him to their work and life are encouraged.

Suggested topics for papers include, but are certainly not limited to:

- Applied interferometry, holography, and speckle
- Applications: phase-measuring, interferometric fringe analysis
- Absolute calibration: flats, spheres, windows, etc.
- Measurement of aspheres and freeforms
- Diffractive/Holographic null correctors: computer generated hologram
- Wavefront sensors
- Figure, ripple, and roughness: power spectral density measurement and analysis
- Mid-spatial-frequency optics errors: detection, characterization, effects, and mitigation
- Testing in adverse environments: vibration, atmosphere, cryogenic, vacuum, etc.
- Subsurface damage: detection, characterization, effects, and mitigation
- Surface profilometry: optical and scanning probe

LIGHT IN NATURE IX (OP302)

Conference Chairs: Vasudevan Lakshminarayanan, Univ. of Waterloo (Canada); Katherine Creath, Optineering (USA), The Univ. of Arizona (USA); Joseph A. Shaw, Montana State Univ. (USA)

Program Committee: Indrani Bhattacharya, Univ. of Calcutta (India); Maria Luisa Galvo Padilla, Univ. Complutense de Madrid (Spain); Dan Curticapean, Hochschule Offenburg (Germany); Viktoria Greanya, Wright State Research Institute (USA); Akhlesh Lakhtakia, The Pennsylvania State Univ. (USA); Yoko Miyamoto, The Univ. of Electro-Communications (Japan); Sébastien R. Mouchet, Univ. de Namur (Belgium); Lorian Schweikert, Florida International Univ. (USA); Brian Vohnsen, Univ. College Dublin (Ireland); Qiwen Zhan, Univ. of Dayton (USA)

In the field of optical science and engineering there are many aspects of light we take for granted, yet do we truly understand and appreciate the nature of light in the world around us? In the natural world there are many fascinating and beautiful effects involving optics. Our perception of light and color is not always veridical, however, most of the time we take these effects for granted. Each day optical scientists and engineers discover more about the natural world when we see how new technologies such as photonic crystals mimic the natural world. Photonic crystal-like structures in peacock feathers give the plumes their color. Similar structures in butterfly wing scales provide their iridescent colors. We borrow from the natural world ideas and concepts for new technologies, i.e., biomimicry.

Beyond these structures, there are effects in the natural world such as the aurora borealis or things as everyday as rainbows and oil slicks. Polarization and color effects brighten up our world. When we look more closely we notice that plants glow and self-bioluminescence provides information about the state of health of organisms. We may even wonder why it is that parrots have a visual response much further into the ultraviolet than we do. As optical scientists and engineers, each of us became fascinated with light at some point in our lives. We observe things in our everyday life that we don’t often explore or think about, yet there are researchers who spend their careers looking at these effects in nature. This conference invites papers having to do with light in the natural world and research involving practical and experimental aspects of optics in nature broadly defined to include:

- the nature of light
- description /representation of light in nature
- use of light in nature
- optics in nature
- color in nature
- vision in both humans and other species
- bio-inspired optics
- optics in the atmosphere and in water (environmental optics)
- mechanisms behind beautiful effects in nature
- color effects
- polarization effects
- visual response in the natural world
- unusual means of creating and detecting light - such as sonoluminescence
- information transfer in the natural world via light and photons
- photonic crystal-like and similar structures in nature
- light in art and media
- light in biological systems
- self-bioluminescence and biophotonic effects in plants, insects, and animals
- do organisms communicate with light?
- what can we learn from the interaction of light in nature on all scales? - from the macro to the nano?
- innovative use of light in various disciplines, for example, in archeology and art
- what is present in the dark? - astronomical topics such as dark energy?
- dark matter?

We look forward to an opportunity to investigate these questions in a forum uniting all optical scientists and engineers.

Submit an abstract: spie.org/op21call
OPTOMECHANICAL ENGINEERING 2021 (OP303)

Conference Chairs: Keith B. Doyle, MIT Lincoln Lab. (USA); Jonathan D. Ellis, Clario Vision, Inc. (USA)

Program Committee: Anees Ahmad, Raytheon Missile Systems (USA); Laura Coyle, Ball Aerospace (USA); John G. Daly, Vector Engineering (USA); Victor L. Genberg, Sigmadyne, Inc. (USA); Steven R. Gillmer, Univ. of Rochester (USA); Mark J. Hegge, Ball Aerospace & Technologies Corp. (USA); Tony Hull, Univ. of New Mexico at Albuquerque (USA); Frank W. Kan, Simpson Gumpertz & Heger Inc. (USA); Keith J. Kasunic, Optical Systems Group, LLC (USA); William Jeffrey Lees, Johns Hopkins Univ. Applied Physics Lab., LLC (USA); John W. Pepi, LS Technologies, Inc. (USA); John J. Polizotti, BAE Systems (USA); Katie Schertz, Edmund Optics Inc. (USA); Deming Shu, Argonne National Lab. (USA); Daniel Vukobratovich, Raytheon Missile Systems (USA); Carl H. Zweben, Consultant (USA)

The International Technical Group on Optomechanical Engineering is organizing its biennial conference for designers, engineers, and scientists who conceive, design, analyze, and construct optical instruments and other precision devices. This conference will present leading-edge technology and advances in current trends that make products viable and valuable (whether the quantities are individual or mass-produced). Also, mature and tested concepts for existing technologies will be presented as well as novel concepts that are still in development. Specific areas of interest include the following areas.

NOVEL OPTOMECHANICAL DESIGNS

The mounting of lenses, mirrors, windows, domes, gratings, prisms, detectors, diodes, fibers, filters, retarders, etc. and the design of optical benches, metering structures, enclosures, and system packaging is a critical aspect in the design of an optical system. This includes but is not limited to: microscopes, cameras, telescopes, binoculars, projectors, lasers, spectrometers, and interferometers. There is also interest in off-axis and broad-band/multispectral systems, particularly on folding and splitting the optical path to serve multiple sensors.

LIGHTWEIGHT & STIFF OPTICAL SYSTEMS

In this area, there is an emphasis on balancing the often competing requirements to produce lightweight and dynamically stable optical systems. This includes applications of high-performance materials (beryllium, silicon carbide, silicon, metal matrix composites, carbon-fiber composites, etc.) and details on their properties such as fracture toughness, micro-yield, CTE, and fatigue. The Conference has interest in designing, modeling, analyzing, and characterizing their performance for optical systems and support structures. Lastly, the fabrication and assembly methods for these materials can often provide significant advances, particularly if high yields can be achieved at an affordable cost.

ENVIRONMENTAL RESISTANCE

The design of environmentally robust optical systems requires an attention to detail. Particular areas of interest for the Conference are:

• Athermalization: The design of components, systems, and instruments to resist changes or effects from changes in the thermal environment.
• Shock and Vibration Resistance: The design of instruments to operate in high acceleration environments and/or to maintain alignment after launch environments.
• Gravitational Insensitivity: The design of instruments and systems to resist the influences of a changing gravitational vector (changing in both amplitude and direction)
• Aero-Heating and Friction Analysis: This includes mitigation-modeling and simulation of thermal gradients, the performance degradation of sensors and systems, and the design techniques to mitigate the adverse effects of aero-heating under high dynamic conditions.

In these environments, high-temperature and high-velocity flows of compressible fluids (air, methane and exhaust gasses) can have significant impact on systems. Also, the material selection and deployment mechanisms for aero-heating shields for these applications.

• Natural and Nuclear Radiation Resistance: Radiation hard optics materials for prompt and total doses, shielding and circumvention techniques, radiation dose simulation, and modeling techniques
• High-Pressure Environments: The design, analysis, and system impact of high hydraulic-type pressures that occur with some oceanographic and naval applications.

OPTICAL STRUCTURES AND SUPPORTS

This category focuses on the design, analysis, and testing of structures for optical instruments. Areas include stable structures for telescopes, interferometers, spectrometers, coronagraphs, and similar instruments including large terrestrial systems and proposed space instruments. Ad-justable structures for systems and their instruments are often needed to dynamically adapt to environmental and functional changes. Particularly, maintaining the metrology frame beyond the normal limits of stability for the basic structure is important. For portable applications, advances in lightweight structures are needed, particularly for aircraft systems and spacecraft. Lastly, innovative applications of materials, singly or in combination, to achieve stiffness and pointing stability with low-mass structures is of high interest to the Conference.

OPTOMECHANICAL ANALYSIS

The use of analytical solutions, models, simulations, and numerical optimization techniques to analyze and optimize optomechanical designs is mandatory in challenging applications. The intersection between lightweight mirrors, lenses, flexures, optical mounts, adhesives, and metering structures is ripe for advancements. Design optimization techniques and methods that include component and system functional performance analysis are needed. Advanced concepts in the intersection between optical and mechanical engineering are highly welcomed, such as line-of-sight jitter prediction, wavefront error, surface deformation and relaxation, thermo-optical performance, and analysis of stress birefringence.

INTEGRATED AND MULTI-DISCIPLINARY MODELING FOR EVALUATING THE IMPACT OF OTHER DISCIPLINES (THERMAL, STRUCTURES, CONTROLS, AERODYNAMICS ETC.) ON OPTICAL SYSTEM PERFORMANCE

Many groups have participated in the multidisciplinary evaluation of optical systems using a variety of tools. This conference offers engineers an opportunity to present the results of applying their preferred techniques to real design challenges, describe the quality of the results and compare them to test data.

• STOP models: structural, thermal, optical performance models
• coupling of control system algorithms for precision pointing of optical systems in dynamic environments
• effects of aerodynamic flow fields on optical system pointing and wavefront error
• numerical optimization techniques to explore optomechanical design solutions.

COMPACT SYSTEMS AND COMPONENTS

The design of optical systems to fit into uniquely-shaped and/or compact spaces is of interest to many industries. Particular research areas of interest are:

• Fiber Systems: the design, mounting, and alignment of couplings, dividers, multiplexers
• Seeker Heads: the design of compact optics for various search, acquisition and tracking applications including Homeland Defense, missile guidance, baggage screening, battlefield surveillance
• Applications of Lenslets: the design and manufacture of lenslets, their mounting and positioning methods, and their application in components and systems
• Augmented and Virtual Reality Systems: the design of head-up displays and head-mounted displays presents unique challenges for optomechanical engineers.
• Miniaturizing Devices: components which integrate optomechanical functionality with sensing, control, feedback, and device health monitoring are needed, particularly for steering mirrors, focus mechanisms, alignment devices, and stabilizing gimbals.
NOVEL MANUFACTURING, ASSEMBLY, AND INTEGRATION TECHNIQUES
The optomechanical engineer’s art as applied to the manufacturing, assembly, and integration processes. These techniques are the so-called design for manufacturing, design for assembly, and design for testing. Research into strengthening the ties between these sub-disciplines for integrated optimization. Applications of additive manufacturing and 3D printing technologies, particularly where fiducials, alignment features, and novel component mounting is addressed. Always of important is troubleshooting and diagnostics, understanding repair methods for components, assemblies, and systems, as well as disassembly techniques for “permanently assembled” parts. Lastly, the Conference welcomes practical case-studies in the areas of fabrication, mounting, assembly, integration, and alignment.

DESIGN VALIDATION
Mechanical testing of optical instruments to validate their design requires innovative methods to ensure design specifications are met. Areas include methods for simulating zero gravity for large instruments, optical performance measurement in high-G environments, and high- and low-temperature tests of optical materials, mounts, systems, and instruments.

INTEGRATED ALIGNMENT MECHANISMS
The challenges of supplying the necessary alignment degrees of freedom for both factory alignment and operational adjustments such as temperature and pressure focus corrections and boresight shifts. Particularly, in-service correction of focus shifts from pressure and temperature changes, automatic or built-in optical boresight adjustment, and minimizing the factory alignment time are of interest. Also, areas which combine novel fabrication techniques that aid in assembly and alignment steps are ripe for exploration.

EXTREMELY DELICATE COMPONENT HANDLING
The design of ultra-lightweight mirrors, fabrication and mounting of very thin mirrors and lenses, mounting of very soft optical materials all present unique challenges. Materials such as calcium fluoride for lenses, prisms, and windows present novel optical opportunities but pose signification risk for challenging environments. Likely, large meniscus lenses and components with large-aspect ratios and difficult shapes present mounting, alignment, and survivability challenges.

OPTOMECHANICAL AFFORDABILITY, RELIABILITY, AND MISSION ASSURANCE
Applying systems engineering (SE) tools and approaches to the design, development, and construction of optical systems with large optomechanical engineering components. Often, these systems are multi-year endeavors with considerable risk that must be understood and managed. Understanding the safety factor for designs near material survivability limits, designing novel system architectures that are inherently more robust and/or cost effective, and the development of simulation methods to better understand programmatic approaches integrating design, manufacture, assembly, alignment, and testing with large scale project management issues like procurement and logistical challenges.

This Conference offers designers, researchers, engineers, and scientists an opportunity to be rewarded for their professional accomplishments with the recognition of their peers in the community who can best understand and appreciate their art. All are encouraged to participate and benefit from the presentations and discussions that ensue.

Submit an abstract: spie.org/op21call
This conference is dedicated to the modeling of imaging and non-imaging optical systems and associated test-equipment and related predictions of performance over a broad range of active and passive optical systems and engineering disciplines. Unclassified papers are solicited from nano-scale systems through to components such as special fiber-optics, gratings, holographic systems, light sources and detectors, and on to large deployable telescopes. Environmental factors can range from HEL through cryogenic, configurations can span use in the laboratory to underwater and outer-space, and wavelengths can range from x-rays to THz, and on through micro and mm waves.

Papers and/or suggested panel discussions are specifically requested on current and evolving analytical techniques that address:

OPTICAL MODELS, METHODS, AND PERFORMANCE ESTIMATES
- geometrical and physical optics
- diffractive optics and holographic systems
- beam propagation
- metamaterials (including negative index, photonic crystals, cloaking)
- plasmonics and evanescent waves, thermal phonons, and topolaritons
- polarization
- adaptive optics
- radiometry
- fiber-optics and photonics
- interferometers and nullers
- image doubling
- illumination (including lasers, LEDs, Micro-LEDs, OLEDs, EL tape/paint, solar)
- MTF, PSF, and EE
- stray light/ghosts and narcissus; contamination consequences and control
- quantum dots
- optimization
- phase/prescription retrieval
- tolerancing and probabilistic design.

ELECTRO-OPTICAL MODELS INCLUDING RELATING FACTORS
- detector quantum efficiency and rapid read-outs
- charge diffusion
- EMI/EMC influences on E-O performance.

OPTICAL COATING PERFORMANCE
- filters
- laser damage resistance.

MEMS AND MOEMS
- electrostatics; Casimir forces
- structures.

STRUCTURAL AND OPTOMECHANICAL MODELING
- ultra-lightweight optics, nano-laminates, membrane mirrors
- mounting stresses, G-Release, and/or launch and deployment
- high impact/shock and pressure loadings
- influence functions
- vibration and damping
- closely-coupled dynamic structure-controls-optics simulations
- micro-dynamics and influences of piece-part inertia; friction/stiction; pinning
- mechanical influences such as scanning deformations and special zoom/servo effects
- thermo-elastic effects
- stress birefringence
- fracture mechanics, micro-yield, and lifetime estimates
- proof testing models
- material anisotropy/inhomogeneity; plating, heat-treats
- bonding and bolting
- nodal accuracy; meshing.

THERMAL AND THERMO-OPTICAL MODELING
- effects of energy absorption with depth in transmissive elements; heat flow within mirrors
- thermal run-away in IR elements
- aircraft/UAV/instrument windows, missiles, and domes; inspection tie-ins
- solar loading
- cryogenics, cooling electronics
- thermo-optical material characterizations over new wavelengths and/or temperatures
- system sterilization
- hole drilling, welding, and laser heat treating
- HEL effects including survivability and hardening
- recursive models where thermo-elastic changes in-turn impact heating
- effects of joint resistance on conduction changes; mounting to a S/C-deck
- effects on LEDs
- effects at MEMS and nano-scale sizes
- meshing.

INTEGRATED MODELS
- closely-coupled thermal-structural-optical models
- optical control systems
- global optimizers
- acquisition, pointing, and tracking
- end-to-end simulations.

SPACE-BORNE (AND/OR MICROLITHOGRAPHIC/MEDICAL) CONTAMINATION, AND RADIATIVE FACTORS
- contamination control (esp. for UV systems and large optics)
- particulate/NVR models
- photopolymerization
- radiative damage, atomic O_{2+}<sub>2</sub>
- spacecraft charging
- micro-meteoroid modeling, including spalling.

Continued
OPTICAL OPTICS

AERO-OPTICS
• boundary layer and shock wave effects
• convective effects and air-path conditioning/self-induced turbulence.

MODELING OF VISION SYSTEMS
• HUDs
• HMDs.

APPLICATION-SPECIFIC UNIQUE OPTICAL MODELS AND PERFORMANCE PREDICTIONS
• adaptive optics
• bio and medical optics/sensing, vision
• hyperspectral imaging; spectroscopy
• image processing
• lasers/laser communication systems/LIDARs
• LEDs/solid state lighting
• machine vision

• MEMs/nano technology
• existing/evolving photonic devices and systems
• solar technology.

OTHER
• phenomenology
• reliability
• reticles: design and fabrication; performance
• rules of thumb and scale factors of use to individual disciplines
• shutters: design and fabrication; performance
• 3D printing of glass and multi-colored components
• specialized metrology
• weight, power, cost, and schedule models for electro-optical systems.

Of special interest are new methods of analysis, and contributions to a body of work that will help provide various model “anchors” and parametric relationships that correlate results with predictions.

Present and publish with SPIE.

When you share your research at an SPIE conference and publish in the SPIE Digital Library, you are opening up opportunities for networking, collaborating, and promoting your work. Proceedings of SPIE are covered by major scientific indexes and search services, including Web of Science, Scopus, Inspec, EI Compendex, Astrophysical Data Service (ADS), CrossRef, and Google Scholar.

SPIE supports Green Open Access

SPIE Proceedings
spie.org/proceedings

Your paper becomes globally available to the research community.
NOVEL OPTICAL SYSTEMS, METHODS, AND APPLICATIONS
XXIV (OP305)

Conference Chairs: Cornelius F. Hahlweg, bbw Hochschule (Germany); Joseph R. Mulley, IDEX Health & Science LLC (USA)

Program Committee: Joseph S. Choi, Raytheon Space and Airborne Systems (USA); Arthur J. Davis, ORAFOL Americas, Inc. (USA); Stephan Fahr, JENOPTIK Optical Systems GmbH (Germany); Peter I. Goldstein, Philips Color Kinetics (USA); G. Groot Gregory, Synopsys, Inc. (USA); Eric Herman, Zygo Corporation (USA); R. John Koshel, Wyant College of Optical Sciences (USA); Sara Madaan, The Univ. of Southern California (USA); Bharathwaj Appan Narasimhan, Limbak 4PI S.L. (Spain); Craig Olson, L-3 Sonoma EO (USA); José Sasián, Wyant College of Optical Sciences (USA); Hamilton Shepard III, Waymo, LLC (USA); Haiyin Sun, ChemImage Corp. (USA); Udo Zölzer, Helmut-Schmidt Univ. (Germany), Univ. of the Federal Armed Forces Hamburg (Germany)

Novel Optical Systems, Methods, and Applications includes topics on new and unique optical systems as well as original and innovative design methods and applications. Papers submitted should appeal to a reasonably wide audience. Recent topic areas that have been popular include: novel instrumentation, camera systems, novel optimization and simulation methods, displays, freeform optics, novel photonics and cross-disciplinary concepts applied to optical systems. We are continuing to solicit submissions in these areas.

Also, we are continuing to solicit submissions in the fields of 3D printing/additive optics, human factors, and computational optics. Optical technologies that don’t otherwise have a well-defined category are also welcome in this conference.

Novel Optical Systems, Methods, and Applications XXIII is calling for paper submissions in the following topic areas:

OPTICAL ELEMENTS, SYSTEMS AND APPLICATIONS
• freeform optics
• light field optics
• micro- and nano-optics
• liquid optics
• gradient index optics
• optics and entertainment
• optics and sound
• systems measuring or employing special effects of human perception
• optical technology inspired by biological systems
• biomedical applications
• pandemic-related applications
• miniature systems
• wearable optics
• volumetric displays and 3D imaging
• exotic and unconventional optics and systems
• multi- and hyperspectral applications
• advanced metrology methods
• photogrammetric applications
• systems employing 3D printed elements or supporting 3D printing technology
• novel photonics.

OPTICAL ANALYSIS AND DESIGN
• using phase space in design and analysis
• energy efficiency
• special optical effects
• light propagation
• extending depth of field
• history
• tricks of the trade.

COMPUTATIONAL TOOLS AND OPTIMIZATION
• open-source computing
• high-performance computing and cloud computing
• photorealistic rendering
• design and analysis software
• novel optimization and tolerancing methods
• software post-processing
• computational imaging.

CROSS-DISCIPLINARY CONCEPTS AND METHODS
• optical methods in other disciplines
• thermal analysis, modeling and design
• optoacoustic/ photoacoustic methods
• THz optics
• effects on biological systems
• human factors.

CALL FOR PAPERS

Save the date

ABSTRACTS DUE:
3 February 2021

AUTHOR NOTIFICATION:
5 April 2021

The contact author will be notified of acceptance by email.

MANUSCRIPT DUE DATE:
7 July 2021

PLEASE NOTE: Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.
Current Developments in Lens Design and Optical Engineering XXII (OP306)

Conference Chairs: R. Barry Johnson, Alabama A&M Univ. (USA); Virendra N. Mahajan, Wyant College of Optical Sciences (USA); Simon Thibault, Univ. Laval (Canada).

Conference Co-Chairs: Robert M. Bunch, Rose-Hulman Institute of Technology (USA); Ching-Cheng Sun, National Central Univ. (Taiwan).

Program Committee: Julie L. Bentley, The Institute of Optics, Univ. of Rochester (USA); Florian Bociort, Technische Univ. Delft (Netherlands); Pierre H. Chavel, Institut d’Optique (France); Apostolos Deslis, JENOPTIK Light & Optics (USA); José Antonio Díaz Navas, Univ. de Granada (Spain); James E. Harvey, Photon Engineering LLC (USA); Lakshminarayan Hazra, Univ. of Calcutta (India); Irina L. Livshits, ITMO Univ. (Russian Federation); Steven A. Macenka, Jet Propulsion Lab. (USA); Michael P. Mandina, Optimax Systems, Inc. (USA); Pantazis Mournoulis, Jet Propulsion Lab. (USA); Alfonso Padilla-Vivanco, Univ. Politécnica de Tulancingo (Mexico); Jocelyn Parent, ImmerVision (Canada); Yuzuru Takashima, Wyant College of Optical Sciences (USA); Yongtian Wang, Beijing Institute of Technology (China); Cornelius J. Willers, Consultant (South Africa); Andrew P. Wood, Qioptiq Ltd. (United Kingdom); Maria Josefa Yzuel Giménez, Univ. Autònoma de Barcelona (Spain).

Optical design is a fascinating activity, ranging as it does from lens design and modeling with the help of the immensely powerful design software currently available, to the semi-intuitive art of creating the conceptual design, which underlies any successful optical system. The ‘art’ depends on a wide-ranging knowledge of many of the sub-disciplines that make up optical engineering, which in turn encompasses the interaction between optics and all the activities that turn an optical design into an operational instrument. Beyond ray tracing, the optical designer may employ the tools of radiative transfer, electromagnetic theory for detailed diffraction or polarization modeling, principles of scattering for stray light analysis and control, and other appropriate modeling tools and techniques for deriving suitable performance metrics arising from such fields as spectroscopy, astronomy, vision, or microscopy. Beyond optical design, the optical engineer is concerned with the fabrication of components, assembly and alignment techniques, metrology and calibration, as well as the interaction with other engineering disciplines such as mechanical, thermal, electronic, and software.

The Current Developments conference serves the multi-faceted discipline that is lens design and optical engineering, and the multi-talented individuals that dedicate themselves to this field. This perennial conference, held since 1984 under a number of slightly varied titles, will continue to spotlight the hot topics in lens design and optical engineering while still covering the breadth of this field. The lens designer and the optical engineer, often the same person, will find this conference a home to stay abreast of the frontiers of this constantly evolving field. Contributions dealing with recent developments in lens design techniques, instruments, components, processes, materials, thin film, systems, design, or topics in an optical engineering subject area at any wavelength belong here, including demonstration of how optical engineering can help move photonic devices, IoT, and solid-state lighting (SSL) technologies forward. The following is a listing of topics of interest to be considered this year:

**THEORY AND APPLICATIONS**
- lens design methodology and innovative lens designs
- aberration theory and image analysis
- advances in techniques for system design, modeling, and global optimization
- optics in consumer, medical, industrial, or space applications
- optics in art, artwork conservation, forensics, archaeology
- advances in microscopy, lithographic optics, cameras, visual systems, telescopes
- freeform surfaces
- metasurfaces
- bio-inspired design
- optics in harsh and hostile environments
- lensless and computational imaging
- modeling of optical fibers and couplers
- AI, deep learning in lens design

**INTEGRATION OF OPTICAL DESIGNS INTO COMPLETE INSTRUMENTS**
- interaction of optics with mechanics and electronics
- integrated modeling
- fabrication, tolerancing, alignment, stray light considerations
- incorporation of system metrics into optical design
- vision and physiological optics considerations
- optics for visual and infrared searchlights.

**DEVELOPMENTS IN OPTICAL COMPONENTS, TECHNIQUES, AND MATERIALS**
- diffractive optics, micro-optics, gradient index, metasurfaces, special optical surfaces
- optical fabrication techniques, novel materials, and processes
- optical designs enabled by new techniques and materials
- innovative testing methodologies and instrumentation.

**THIN-FILM OPTICAL COATINGS**
- design of multilayer films and coatings and performance prediction
- novel optical coating and thin-film materials
- substrate preparation, deposition and pre- and post-processing manufacturing methods
- characterization, monitoring, and measurement
- innovative applications of optical coatings and thin-films from x-ray to the far IR.

**APPLICATIONS FOR SOLID-STATE LIGHTING**
- lighting for smart cities
- energy-efficient lighting systems
- LEDs for optical communication
- outdoor lighting
- residential lighting
- quality of light
- smart lighting systems
- architectural lighting
- marine lighting
- stadium lighting
- automotive and street lighting
- integrated solar lighting
- agricultural lighting.

**SYSTEM-LEVEL ILLUMINATION DESIGN AND OPTIMIZATION**
- micro-LEDs and display technologies
- fixture designs
- LED lamp, engine, and luminaire designs
- optical design, simulations, and evaluations
- LED light-source modeling
- vision, human factors, and lighting user interfaces.

**DEVICE-LEVEL PACKAGING FOR SOLID-STATE LIGHTING**
- lasers in lighting applications
- light extraction from LEDs
- lighting phosphor technology (YAG, tricolor, etc.)
- nanostructured LEDs.

**TESTING, RELIABILITY, AND STANDARDS FOR LEDS AND SOLID-STATE LIGHTING**
- CIE and chromaticity measurements
- LED and SSL luminous flux and color maintenance
- LED and SSL testing, modeling, and evaluation
- optical materials.
LASER BEAM SHAPING XXI (OP307)

Conference Chairs: Angela Dudley, Univ. of the Witwatersrand, Johannesburg (South Africa); Alexander V. Laskin, AdiOptica Optical Systems GmbH (Germany)

Program Committee: Fred M. Dickey, FMD Consulting LLC (USA); Andrew Forbes, Univ. of the Witwatersrand, Johannesburg (South Africa); Patrick Gretzki, Fraunhofer-Institut für Lasertechnik ILT (Germany); Raul I. Hernandez-Aranda, Tecnológico de Monterrey (Mexico); Alexis V. Kudryashov, Active Optics Night N Ltd. (Russian Federation); Todd E. Lizotte, BOLD Laser Automation (USA); Daryl Preece, Beckman Laser Institute and Medical Clinic (USA); Gediminas Račiukaitis, Ctr. for Physical Sciences and Technology (Lithuania); Mateusz Michal Szatkowski, Wroclaw Univ. of Science and Technology (Poland)

Many scientific experiments and industrial and medical applications require the shaping of the spatial and temporal profiles of laser beams. The previous Laser Beam Shaping conferences have been excellent venues to integrate the various facets of beam shaping theory, design, and application. Interest in laser beam shaping techniques and applications continues to grow.

The purpose of this conference is to continue to provide a forum for the interaction of engineers and scientists interested in the various aspects of laser beam shaping. Papers on all forms of laser beam shaping theory, design, and application are solicited. Papers presenting data on proven systems and real application examples are especially encouraged. In addition, the conference will consider papers involving the shaping of the radiation patterns of non-laser sources.

General laser beam shaping topics include, but are not limited to:

THEORY AND DESIGN
Geometric and physical optics, geometrical beam shapes, vector diffraction theory, vortex and vector beams, optical angular momentum, non-diffracting fields, structured light, mathematical & computational techniques, optimization-based design, intra-cavity beam shaping, diffractive and refractive beam shaping, multi-spot beam shaping, broadband beam shaping, pulse compression and pulse chirping, spatial and temporal beam profile shaping of short pulses, acousto-optics, spatial and temporal beam shaping, stokes polarimetry, beam shaping methods of image enhancement, interference lithography and high power beam shaping.

FABRICATION AND TESTING
Refractive, diffractive, reflective and hybrid elements, digital holography, spatial light modulators (SLMs), digital micro-mirror devices (DMDs), micro-electro-mechanical systems (MEMS), and micro-opto-electro-mechanical systems (MOEMS), grayscale lithography, thin film optics, and chemical etching technologies.

Application topics for laser beam shaping include but are not limited to:

INDUSTRIAL AND COMMERCIAL APPLICATIONS
Material processing, high-power beam shaping involving fiber coupled multimode lasers, laser displays, illumination applications, surface modification, microscopy, interferometry, holography, optical data storage, fiber injection systems, single and multimode fibers, photonic crystal fibers, and lidar.

MICRO-OPTICS AND MICRO MANIPULATION APPLICATIONS
Beam shaping achieved via MOEMS/MEMS, and beam-shaping applications in optical tweezeing and trapping.

MILITARY APPLICATIONS
Laser ranging, laser targeting, laser weapons and laser counter-measures (dazzling).

MEDICAL AND BIOMEDICAL APPLICATIONS
Dermatology, surgery, ophthalmology, fiber optic delivery methods, photodynamic therapy, dentistry, UV sterilization, and industrial and biomedical sterilization.

QUANTUM OPTICS APPLICATIONS
Beam shaping applied in quantum optics such as quantum key distribution (QKD), quantum walks, ghost imaging, hyper-entanglement and higher-dimensional entanglement systems.

OPTICAL COMMUNICATION APPLICATIONS
Beam shaping applied in laser communications and sensors/ detection techniques and applications, spatial division multiplexing and de-multiplexing, high-bandwidth communication, free-space and fiber based communication systems.

ADAPTIVE OPTICS APPLICATIONS
Adaptive optics, spatial light modulators (SLM), digital micro-mirror devices (DMD), acousto-optical modulators, computer generated holograms, liquid lens technology, and propagation through turbulence.
Development of space based, airborne, and ground based optical systems relies critically on selection and application of optical and structural materials which are best suited to address challenging requirements of the application. The Materials Technologies and Applications Conference is complementary to the other conferences within the Optomechanics and Optical Manufacturing Track, providing a forum where fabrication techniques, test results and end-application of advanced materials technologies can be discussed.

A foundation to the conference are papers which introduce or update state-of-the-art material fabrication processes, with emphasis on providing an up-to-date materials properties database for optical substrates and precision support structures, including a discussion of joining and bonding techniques for optical assemblies and instruments. Papers relating to test results can cover in-process inspection techniques of interest to manufacturers, or relate material properties to optical performance against a range of operational requirements (e.g., mechanical properties to address launch dynamics, thermal properties for cryogenic or high heat load applications, radiation tolerance for space use, etc).

Of particular interest are papers which describe the end-use of these precision materials and/or processes. The advantages of any material are best demonstrated by component and/or sub-system testing. The conference provides a forum to present end-use/application of these materials in order to advance their adoption by the community and to get feedback from end-users to researchers and technologists working these advanced material development/characterization fields.

Papers are solicited on materials for reflective and transmissive optics and for reaction and support structures in the following areas:

- ceramic materials including silicon carbide, silicon nitride, and SiOC for optics and structures
- metals including beryllium, aluminum, and Be/Al and alloys, for optics and structures
- low-expansion glass ceramics and glasses for reflective and/or refractive optics
- carbon fiber materials for mirror substrates or structural applications
- composite materials (metal matrix, aluminum/SiC, nanolaminates, syntactic, etc.)
- hierarchical nanocomposites
- silicon and other infrared optics (reflective and transmissive)
- advanced optical materials for windows and domes
- properties of thin film materials.

New developments for forming optical substrates and joining optics and reaction or support structures are also solicited. Test results updating material properties for use in fabricating and/or designing optical components, subassemblies, and assemblies are also solicited. In particular material properties which effect operation in space environments (e.g., UV, atomic oxygen), solar environments (e.g., high proton, electron and neutron flux), cryogenic environments (e.g., deep space), and launch environments are a strong area of interest for the community.

Performance related material properties include:
- mechanical and thermal properties
- optical properties
- long-term dimensional stability
- radiation testing.
- reliability of test data statistics & Weibull testing.

Finally, lessons-learned case studies of recent projects are of particular interest. The goal here is to generate a dialogue between the people developing and the people applying these advanced materials. These may include:
- design and fabrication of complex a-thermal optical systems
- characterization of OGSE for optics
- characterization of components to mechanical or thermal environmental stresses (gravity sag, launch dynamics, solar loading).

Submit an abstract: spie.org/op21call
OPTICAL SYSTEM ALIGNMENT, TOLERANCING, AND VERIFICATION XIV (OP309)

Conference Chairs: José Sasián, Wyant College of Optical Sciences (USA); Richard N. Youngworth, Riyo LLC (USA)

Program Committee: Laura E. Coyle, Ball Aerospace (USA); Matthew B. Dubin, Wyant College of Optical Sciences (USA); Jonathan D. Ellis, Wyant College of Optical Sciences (USA); Ulrike Fuchs, asphericon GmbH (Germany); Sen Han, Univ. of Shanghai for Science and Technology (China); William P. Kuhn, Opt-E (USA); Chao-Wen Liang, National Central Univ. (Taiwan); Robert M. Malone, National Security Technologies, LLC (USA); Raymond G. Ohl IV, NASA Goddard Space Flight Ctr. (USA); Craig W. Pansing, Synopsys, Inc. (USA); Robert E. Parks, Optical Perspectives Group, LLC (USA); Brian C. Primeau, Ball Aerospace (USA); Dmitry Reshidko, Microsoft Corp. (USA); Martha Rosete-Aguilar, Univ. Nacional Autónoma de México (Mexico); Peng Su, ASML US, Inc. (USA)

The topics of tolerancing, alignment, and verification are crucial in the development of successful optical systems. The effective assembly of optical systems requires alignment of different system components. The precision and accuracy level of the alignment depends on the assigned tolerance error budget, and so alignment and tolerances are interrelated. Verification involves validating optical system performance, including assurance of performance under a variety of operating conditions.

This conference seeks to further the state-of-the-art in alignment and tolerancing, including verification of subsystems and at the system level, by providing a forum where these important topics can be discussed. The conference also seeks to provide the audience with past and current useful insights in these topics. We expect the 2021 conference, whether done virtually or in-person, to continue offering substantial valuable technical information and networking to both authors and audience. Prospective authors and attendees are invited to gauge the breadth and depth of the conference by perusing the thirteen previous volumes of the conference proceedings available through SPIE.

Papers are solicited in the following areas:
- theories of alignment and tolerancing
- novel tolerancing methods
- approaches to tolerancing and error budgets
- tolerance desensitization and nominal design
- integrated optical design with tolerancing and design for manufacturability
- pupil alignment in concatenated systems
- modeling and simulation for alignment, tolerancing, and verification
- alignment techniques, equipment, and tools
- instruments for alignment
- development of metrology instruments for alignment
- development of algorithms for alignment and system verification
- optical alignment examples
- alignment in traditional lens systems and telescopes
- alignment of micro optics
- alignment of coherent and high-power optical systems
- optical alignment of nanostructures
- case studies and alignment pitfalls
- alignment and tolerancing of aspheres
- alignment and tolerancing of freeform optics and systems
- loosening tolerances using active elements
- alignment in electro-optical systems
- alignment in metrology applications
- alignment of fiber optic systems
- active optical system alignment and tolerancing
- system verification approaches
- examples and applications of system verification
- tools and techniques for verification
- tutorials on alignment, tolerancing, and/or verification
- optomechanical alignment
- applications of metamaterials to alignment
- novel alignment instrumentation
- pupil alignment techniques.

CALL FOR PAPERS

ABSTRACTS DUE: 3 February 2021
AUTHOR NOTIFICATION: 5 April 2021
MANUSCRIPT DUE DATE: 7 July 2021

PLEASE NOTE: Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.

Save the date

3 February 2021
5 April 2021
7 July 2021
Optical metrology techniques continue to improve and enter new applications that push the state of the art of optical metrology. These visionary high-payoff systems often require several innovative low (1 to 3) TRL technologies or the innovative, high risk combination of higher TRL technologies. This conference covers those technologies. The detailed level of this material is what one would expect in a proposal to develop an instrument or to begin an architecture study of a telescope system. The mission areas cover ground-based telescopes and space-based candidates for explorers, probes and great observatories with the TRL<4 technology.

To enable and support developments in these areas, papers are sought addressing topics that include, but are not limited to, the following point designs, low TRL technology, and mission concepts:

- point designs that require innovative technology to make cost-effective astrophysical measurements from space
- high value, low cost missions and their technologies as applied to astrophysics investigations
- approaches to mission development and implementation that exhibit some of the following characteristics:
  - technology demonstrations
  - instruments to supplement other missions to provide cost effective science
  - enabling system concepts for space telescopes, instruments, and infrastructure support elements, such as:
    - assembly and servicing of large systems in space to enable fabrication of telescopes and instruments larger than can be launched with any foreseeable launch vehicles, and the servicing and upgrading that can enable multi-decade operational lifetimes for these systems
    - a complete infrastructure to enable these large, long lived systems
    - innovative real time in-space metrology and wavefront sensing and control
    - formation flying concepts for assembly and technologies for modular telescopes
    - system concepts and technologies utilizing servicing for extended and upgraded mission lifetimes
    - Explorer-class and Probe-class mission concepts and technologies
    - concepts for future large aperture space telescopes, particularly at the shorter wavelengths (i.e., into the ultraviolet)
    - concepts for innovative, low cost missions enabled by cubesats or constellations of cube- or small-sats
    - wide field of view (WFOV) >10-degrees telescope concepts and technologies
    - approaches to increasing insight into dark matter and dark energy using space telescopes.
- design progress for innovative observatories currently under development or production. Specifically details regarding mission-level, telescope-level, or instrument-level architecture, performance, and verification
CALL FOR PAPERS

ASTRONOMICAL OPTICS: DESIGN, MANUFACTURE, AND TEST OF SPACE AND GROUND SYSTEMS III (OP312)

Conference Chairs: Tony B. Hull, The Univ. of New Mexico (USA); Dae Wook Kim, Wyant College of Optical Sciences (USA); Pascal Hallibert, European Space Research and Technology Ctr. (Netherlands)

Program Committee: Jonathan W. Arenberg, Northrop Grumman Aerospace Systems (USA); Stephanie Behar-Lafenetre, Thales Alenia Space (France); Seunghyuk Chang, Ctr. for Integrated Smart Sensors (Korea, Republic of); Alain J. Corso, CNR-INFN Padova (Italy); Laura E. Coyle, Ball Aerospace (USA); Bill A. Goodwin, Goodman Technologies, LLC (USA); James P. Hamilton, Univ. of Wisconsin-Platteville (USA); John M. Hill, Large Binocular Telescope Observatory (USA); Frank Stefan Höller, Carl Zeiss AG (Germany); Pengda Hong, Lehigh Univ. (USA); Joseph M. Howard, NASA Goddard Space Flight Ctr. (USA); Janina Krieg, SCHOTT AG (Germany); Steven A. Macenka, Jet Propulsion Lab. (USA); Luca Maresi, European Space Research and Technology Ctr. (Netherlands); Maria Guglielmina Pelizzo, CNR-INFN Padova (Italy); Narasinha S. Prasad, NASA Langley Research Ctr. (USA); Stuart B. Shaklan, Jet Propulsion Lab. (USA); David Walker, Univ. of Huddersfield (United Kingdom); Thomas Westerhoff, SCHOTT AG (Germany); Grant Williams, MMT Observatory (USA)

The Astronomical Optics: Design, Manufacture and Test (DMT) of Space and Ground Systems conference is dedicated to the engineering and implementation of astronomical optical systems, telescopes, instruments, assemblies and components for both spaceborne missions and ground observatories. Airborne and balloon-borne astronomical instrumentation are also included. Current or anticipated future concepts and technologies for DTT are appropriate, including those for NASA’s LUVOIR, HabEx, and OST as well as NASA’s Probe mission concepts, and ESA’s LISA, ARIEL and SPICA and international initiatives. The scope of papers may include system architecture, methods, materials, special enabling technologies, optical mechanical fabrication as appropriate to topic, and test methods relevant to these missions. Papers may discuss developments in processes, technologies, facilities or equipment used to enable new architectures, including Design-to-Cost (DTC) processes. Supporting technologies like wavefront sensing and control, payload dynamic disturbance management, active systems, advanced modelling and test beds are appropriate. Papers defining special optical requirements of anticipated new infrared, visible, ultraviolet, missions are encouraged. New developments and lessons learned from recent space/ground astronomy related projects are particularly desired. Papers are specifically requested on:

TECHNOLOGIES AND CONCEPTS FOR LARGE ULTRA-STABLE TELESCOPES AND INSTRUMENTS

- systems level error budgets, gravity release and mitigation of unknowns
- space/ground astronomical telescopes with large monolithic mirrors or deployed segmented mirrors
- strategies for optimal thermal control of optics and metering
- deformable and active mirrors
- active control of mirror segment optical forms in space/ground
- dimensional stability of materials and structure in space environments
- passive and active athermalization
- vibration isolation, stiffness and control of jitter
- effects of jitter in large spaceborne OTAs including OTA surface errors and pupil shear, and its cause and control
- material trades at assembly level for spaceborne thermal dimensional stability: implications of high-CTE/high-diffusivity vs low-CTE/low-diffusivity (Note: Submissions covering more fundamental level material (e.g., substrate before it is manufactured in to a lens or mirror) topics and technologies are recommend to be submitted to The Mirror Material and Design Conference.)

NOVEL OPTOMECHANICAL TELESCOPE ARCHITECTURES AND CONCEPTS

- methods for mounting of mirrors resulting in minimal surface error
- reconfigurable spaceborne optical telescopes and instruments in space
- optical systems concepts minimizing the number of reflections
- segmented aperture deployable optical telescope assemblies
- wide field-of-view optical telescope assemblies
- integration and testing large optical telescope assemblies
- special approaches for balloon-borne astronomical optical telescope assemblies
- Design to Cost for Spaceborne Architectures

OPTICAL MATERIALS AND COATINGS

- optimized CFRP for metering low-expansion optics
- hybrid glass metal optical benches and metering structures
- architecture of all SiC systems
- architecture of all glass and all-glass-ceramic systems
- role of beryllium in present and future spaceborne missions
- visible quality spaceborne mirrors made of aluminum
- the effect of different spatial frequency thermal expansion inhomogeneities in lightweight mirrors
- ultraviolet reflective coatings in space
- far-UV coatings for space and control of molecular contamination
- ultraviolet filters
- solar-blind filters.

INSTRUMENTS CONCEPTS, MANUFACTURING, AND TESTING

- wide field-of-view concepts
- fast f/4 systems
- innovative end-to-end systems tests
- interferometric systems
- IR systems and cryogenic optics

MULTI-OBJECT SPECTROGRAPHS (MOS) AND INTEGRAL FIELD UNITS (IFU) FOR SPACEBORNE OBSERVATIONS

- Earth and planetary spaceborne imaging systems
- ultraviolet polarimeter systems
- management of polarization induced error in optical systems
- contamination management of ultraviolet instruments both pre-launch and in-operation.

PROGRAMMATIC CHALLENGES AND SOLUTIONS

- snap-together assembly of optical systems
- parametric cost modeling
- design-to-cost methods for ground and space missions
- schedule optimization for optical development, manufacturing, integration, and testing.

ADVANCES IN MANUFACTURING MATERIALS, ABRASIVES, TOOLS, MACHINES, AND PROCESSES

- addressing technology readiness level (TRL) for new methods for optics
- large optics substrates, grinding, polishing and figuring
- mechanical mounting for 4-10 meter-class optics
- spectrometer gratings
- contemporary materials for affordable high-performance space telescopes
- computer-aided processes
- rapid/efficient manufacturing of large telescope mirror segments
- effects of mid-spatial frequency surface errors on optical system performance, and its control via deterministic optical surfacing methods
- diamond turning and precision machining
- ion/plasma/water-jet removal: foot print, speed of removal and remaining artifacts
- optical contacting/advanced bond methods
- evolving ways to fabricate substrates and optical surfaces of lightweight mirrors for space/ground
- manufacture of lightweight mirror substrates

Continued
This conference will examine recent progress in UV, x-ray, and gamma-ray instrumentation for astrophysics and solar system missions. We seek to highlight recent missions, new concepts, and techniques for detection in spectroscopy and imaging, and their application to specific experiments both current and future. Examples of space science missions exploring the UV, x-ray, and gamma-ray bands include AGILE, ASTRO-E2, ASTROSAT, CHANDRA, EUVST, FERMI/GLAST, GLIDE, GOLD, EMM, ESCAPE, HINODE, HST, ICON, INTEGRAL, IRIS, JUICE, KEPLER, LBTI, LRO/LAMP, MAXI, NUSTAR, ROSETTA, SWIFT, TIMED-SEE, VeSpR, XEUS, and XMM-Newton. We request contributions detailing the operation of the instrumentation on these (and other planned) missions, with presentation of early experimental results. The development of advanced instrumentation through sounding rocket experiments and basic laboratory research are also fundamental for progress in space astrophysics, and therefore of specific interest. Moreover, the radiation environment in space presents unique instrumentation problems for each new mission. Hence, we encourage submissions on all types of space hardware program development, and especially results for missions related to instrument technology and the space environment. Work on novel experimental techniques, detector, spectroscopy, and imaging systems for these wavelength regions is of particular interest.

Topics that will be covered include, but are not restricted to:

**UV AND SOFT X-RAY DETECTION - PHOTOMISSIVE, PHOTOCONDUCTIVE, SUPERCONDUCTIVE**
- microchannel plates, photocathodes, photodiodes, gaseous counters
- calibration reference devices, windows and filters
- Si, CZT, Ge, and other detectors, CCDs, CMOS, APS, and CID
- mixed signal ASIC design for position sensitive detectors
- superconducting detection techniques, STJ, TES, calorimeters.

**HARD X-RAY AND GAMMA-RAY SPECTROSCOPIC AND IMAGING TECHNIQUES**
- scintillator crystal spectrometers
- gas and liquid proportional counters
- gas scintillation and solid state drift chambers
- coded apertures, modulation collimators, grid collimators
- imaging via crystal diffraction.

**SPACEBORNE EXPERIMENTS AND MISSIONS**
- flight instruments, calibration, and results
- hard x-ray and gamma-ray spectrometers and imagers
- x-ray and gamma-ray polarimeters
- monitoring and timing instruments
- FUV, EUV, and soft x-ray spectroscopy and imaging
- space radiation background and its instrumental suppression
- radiation damage effects in instruments and detectors
- integrated circuits and ASIC'S for-flight applications.

Submit an abstract: spie.org/op21call
OPTICS FOR EUV, X-RAY, AND GAMMA-RAY ASTRONOMY X (OP314)

Conference Chairs: Stephen L. O’Dell, NASA Marshall Space Flight Ctr. (USA); Jessica A. Gaskin, NASA Marshall Space Flight Ctr. (USA); Giovanni Pareschi, INAF - Osservatorio Astronomico di Brera (Italy)

Program Committee: Hisamitsu Awaki, Ehime Univ. (Japan); Nicolas M. Barrièrre, cosine B.V. (Netherlands); Marcos Baudaz, European Space Research and Technology Ctr. (Netherlands); Vadim Burwitz, Max-Planck-Institut für extraterrestrische Physik (Germany); Finn E. Christensen, DTU Space (Denmark); Marta M. Civitani, INAF - Osservatorio Astronomico di Brera (Italy); Desiree Della Monica Ferreira, DTU Space (Denmark); Peter Friedrich, Max-Planck-Institut für extraterrestrische Physik (Germany); René Hudec, Astronomical Institute of the ASCR, v.v.i. (Czech Republic); Kiranmayee Kilaru, Universities Space Research Association (USA); Alexander A. Lutovinov, Space Research Institute of the RAS (Russian Federation); Kristin Madsen, Caltech (USA); Hironori Matsumoto, Osaka Univ. (Japan); Randall L. McEntaffer, The Pennsylvania State Univ. (USA); Noriyuki Narukage, National Astronomical Observatory of Japan (Japan); Robert Petre, NASA Goddard Space Flight Ctr. (USA); Brian D. Ramsey, NASA Marshall Space Flight Ctr. (USA); Paul Reid, Harvard-Smithsonian Ctr for Astrophysics (USA); Suzanne E. Romaine, Harvard-Smithsonian Ctr. for Astrophysics (USA); Mark L. Schattenburg, MIT Kavli Institute for Astrophysics and Space Research (USA); Daniele Spiga, INAF - Osservatorio Astronomico di Brera (Italy); Vladimir V. Vassiliev, Univ. of California, Los Angeles (USA); Zhanshan Wang, Tongji Univ. (China); Richard Willingale, Univ. of Leicester (United Kingdom); David L. Windt, Reflective X-Ray Optics LLC (USA); William W. Zhang, NASA Goddard Space Flight Ctr. (USA)

Currently operating x-ray observatories, Chandra, XMM-Newton, Swift, NuSTAR, and Hinode, demonstrate the importance of imaging optics to x-ray astronomy. Other missions using focusing x-ray optics have recently launched (e.g., ASTROSAT, Spectrum-Röntgen-Gamma). Other missions (e.g., IXPE, XRISM, Einstein-Probe, and eXTP) are being implemented, while other agencies continue research toward developing technologies for future x-ray mission concepts are being studied.

Facility-class x-ray observatories will rely upon large-area precision optics to achieve the sensitivity and angular resolution required to build upon the successes of Chandra and of XMM-Newton. NASA, ESA, JAXA, and other agencies continue research toward developing technologies for lightweight, large-area, precision, x-ray mirror and grating systems. Indeed, ESA has selected ATHENA (1.4 m² effective area and 5 arcsecond angular resolution), an x-ray mission enabled by development of innovative x-ray optics, as the second large-class mission in its Science Program. Meanwhile, NASA is studying the Lynx X-Ray Surveyor, based upon a telescope with an angular resolution comparable to that of Chandra (= 0.5 arcsecond) and collecting area 20 times greater. Such missions will revolutionize our understanding of the physics of astronomical systems and enable frontier science from first accretion light in the Universe to solar-system objects.

Together with research into more futuristic topics, including diffractive or interferometric imaging optics and active optics, significant progress continues to be made worldwide toward meeting the future needs of EUV, x-ray, and gamma-ray astronomy.

This conference provides a forum for discussion of recent progress in imaging and spectroscopic optics for EUV, x-ray, and gamma-ray astronomy. Conference sessions will cover all relevant areas of optical science and technology, including the following:

- performance of EUV, x-ray, and gamma-ray optical systems
- development of lightweight, precision and high-throughput grazing-incidence mirrors
- development of lightweight, precision grating systems for dispersive spectroscopy
- material selection, formulation, deposition, and characterization of multilayers
- uses of multilayers for normal- and grazing-incidence mirrors, filters, polarimetry, and synthetic crystals
- applications of Lobster-Eye, Kirkpatrick-Baez, microchannel-plate, pore, and capillary optics
- theoretical and experimental analysis of surface properties and contamination of mirrors
- approaches and analyses for addressing system-level optical performance—pre-collimators, baffles, filters, contamination, etc.
- concepts, designs, and experiments in wide-field imaging
- concepts, designs, and experiments in high-resolution refractive/diffractive imaging
- concepts, designs, and experiments in diffractive (Bragg or Laue) concentration and imaging

CALL FOR PAPERS

ABSTRACTS DUE: 3 February 2021
AUTHOR NOTIFICATION: 5 April 2021
MANUSCRIPT DUE DATE: 7 July 2021

PLEASE NOTE: Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.

Save the date
TECHNIQUES AND INSTRUMENTATION FOR DETECTION OF EXOPLANETS X (OP315)

Conference Chairs: Stuart B. Shaklan, Jet Propulsion Lab. (USA); Garreth J. Ruane, Jet Propulsion Lab. (USA)

Program Committee: Olivier Guyon, Subaru Telescope, National Astronomical Observatory of Japan (USA); Research Corp. of Univ. of Hawaii (USA), The Univ. of Arizona (USA); Bruce A. Macintosh, Stanford Univ. (USA); Dimitri P. Mawet, Caltech (USA); M. Charley Noecker, Jet Propulsion Lab. (USA); Rémi Soummer, Space Telescope Science Institute (USA); Rhonda M. Morgan, Jet Propulsion Lab. (USA)

Exoplanet discoveries and advances in exoplanet detection and characterization technologies have fueled great interest in the scientific community and the general public. Precision radial velocity and microlensing programs from ground-based telescopes have discovered hundreds of exoplanets in systems similar to and vastly different from our own solar system, including a potentially habitable planet orbiting Proxima Centauri. The Kepler, CoRoT, and TESS missions have added thousands of new planets, including terrestrial planets in the habitable zone, using precise transit measurements. New missions, such as CHEOPS, and the future extremely large telescopes (ELTs) and James Webb Space Telescope (JWST) will characterize the bulk compositions and atmospheres of many of these known planets. GAIA’s catalogs of high-precision stellar positions promise orbital solutions identifying many new planets. Significant investments in ground and space-based exoplanet imaging and characterization technologies have resulted in great progress toward the ultimate goal of characterizing exoplanet systems containing terrestrial planets. The first dedicated ExAO coronagraph systems (GPI, SPHERE, SCExAO) have become operational on large telescopes paving the way for similar instruments on the ELTs, which are expected to measure significant numbers of spectra of giant planets. These results will inform the required scale, duration, and agility of future planet imaging and characterization missions.

In the past decade we have seen amazing progress in direct detection technologies for both imaging and high-resolution spectroscopy techniques. The first direct spectra of giant planets with the GRAVITY interferometer has demonstrated tremendous promise for multi-aperture interferometric techniques. Laboratory demonstrations of coronagraphs have achieved ~5e-10 contrast, in broad-band visible light, at small working angles. These technologies are within striking distance of the required 1e-10 visible light contrast required to observe exo-earths. The Roman Space Telescope coronagraph is under development and has demonstrated the ability to control dynamic aberrations using on-board wavefront sensors. Major advances have been made in the design of coronagraphs for large, segmented aperture telescopes. Starshade petals, trusses, and optical shields have been built and deployed to tolerances consistent with exo-earth detection. A starshade for the Roman Space Telescope that would join the telescope on orbit late in the next decade is under study.

Significant progress has been made in models of exoplanet instruments to predict science performance and aid in the design of future space missions and ground observatories. Full end-to-end models like AYO and EXO-SIMS simulate direct imaging space-based missions while ground based end-to-end models simulate extreme precision radial velocity cadences and observing scenarios. Instrument models, ranging from radiometric performance to observation sequencing, are necessary to find the most efficient observational approaches and instrument designs.

This session seeks papers that describe progress in planet detection technologies and methodologies. While direct imaging has been emphasized in this summary, papers are encouraged in indirect techniques that will lead to a better understanding of planetary systems.
NONIMAGING OPTICS: EFFICIENT DESIGN FOR ILLUMINATION AND SOLAR CONCENTRATION XVIII (OP400)

Conference Chairs: Roland Winston, Univ. of California, Merced (USA); Eli Yablonovitch, Univ. of California, Berkeley (USA)

Program Committee: Pablo Benitez, CeDInt-UPM (Spain); Light Prescriptions Innovators LLC (USA); William J. Cassarly, Synopsys, Inc. (USA); Àngel García-Botella, Univ. Politécnica de Madrid (Spain); Michael W. Haney, ARPA-E (USA); Lun Jiang, Univ. of California, Merced (USA); Sarah R. Kurtz, Univ. of California, Merced (USA); Juan Carlos Miñano, CeDInt-UPM (Spain); Light Prescriptions Innovators LLC (USA); Narkis E. Shatz, SureFire, LLC (USA)

Many important optical subsystems are concerned with power transfer and brightness rather than with image fidelity. Nonimaging optics is a design approach that departs from the methods of traditional optical design to develop techniques for maximizing the collecting power of concentrator and illuminator systems.

Nonimaging devices substantially outperform conventional imaging lenses and mirrors in these applications, approaching the theoretical (thermodynamic) limit. Nonimaging design methods usually involve solving ordinary or partial differential equations, calculating the flow lines of the ray bundles, coupling the edge rays of extended sources and targets or optimizing a multi-parameter merit function computed by ray-tracing techniques. While geometrically based, the design fundamentals have been extended to the diffraction limited and even sub-wavelength domain. Therefore applicability exists in near-field optical microscopy and nanometer scale optics.

This conference will address the theory of nonimaging optics and its application to the design and experimental realization of illumination and concentration systems, tailored freeform optics, display backlighting, condenser optics, high-flux solar and infrared concentration, daylighting, LED optical systems, laser pumping, and luminaires.

The revival of considerable work in solar energy concentration for both photovoltaic and thermal applications, much of which includes nonimaging optics, prompts reincorporating these fields into this conference.

The use of nonimaging optics promises higher efficiency, relaxed physical tolerances, improved optical uniformity, and reduced manufacturing costs. We encourage submissions ranging from fundamentals to critical design issues and practical applications.

Paper submissions are also solicited in the following and related areas:
- radiative transfer near the étendue limit
- concentrator optics
- illumination and irradiation optics
- solar photovoltaic and solar thermal concentration
- the optical science of light trapping
- the science of extracting the luminescence
- electro-luminescent refrigeration
- thermo-photovoltaic electricity generation
- fiber-optic and light-pipe optical systems
- radiometry
- daylighting
- characterization of light-transfer devices
- freeform optics
- optical furnaces and radiative heating
- infrared detection
- LED applications
- laser pumping
- condenser optics
- ultra-compact concentrator systems
- luminaires
- Cerenkov detectors for astronomy.

NEW CONCEPTS IN SOLAR AND THERMAL RADIATION CONVERSION IV (OP401)

Conference Chairs: Peter Bermel, Purdue Univ. (USA); Jeremy N. Munday, Univ. of California, Davis (USA)

Program Committee: Fiona Beck, The Australian National Univ. (Australia); Neelkanth G. Dhere, Univ. of Central Florida (USA); Partha Dutta, Rensselaer Polytechnic Institute (USA); Nicholas J. Ekins-Daukes, The Univ. of New South Wales (Australia); Roberto Russo, Consiglio Nazionale delle Ricerche (Italy); Sheng Shen, Carnegie Mellon Univ. (USA); Wilfried G. J. H. M. van Sark, Utrecht Univ. (Netherlands); Xiaobo Yin, Univ. of Colorado Boulder (USA); Zongfu Yu, Univ. of Wisconsin-Madison (USA); Jia Zhu, Nanjing Univ. (China)

This conference centers on discovering and exploring novel concepts in optics, photonics, and plasmonics with significant potential to improve the performance of solar and thermal energy conversion devices, as well as larger systems with significant sustainable energy components. Recent developments in material science, nanophotonics, plasmonics, and metasurfaces make this a uniquely promising time to develop corresponding new capabilities. These can then have direct applications in a range of fields, including but not limited to solar photovoltaics, sustainable food-energy-water systems, energy-efficient lighting, infrared sources, and the thermophotovoltaic generation of electricity from heat. Topics of relevance in thermophotovoltaics include design of advanced photonic crystals effective in high-temperature environments, management of excess heat in the photovoltaic cell, enhancement of the low-bandgap photovoltaic cells, and integrating various components into high-performance systems. Another key area requiring careful control of thermal radiation is radiative cooling, whether for terrestrial or space-based applications. Radiative cooling allows both for daytime passive cooling above and beyond standard convective processes, as well as below-ambient cooling for low-temperature systems and efficient power generation. Optics-related research significantly impacting other parts of energy systems is also of interest.

This conference will primarily cover the following areas:
- nanophotonic and nanoplasmonic materials and structures for solar cells
- optical characterization of aging in solar cells
- advanced solar conversion mechanisms, such as tandem or multijunction structures, intermediate bands, hot carrier effects, and multi-exciton generation
- novel photonic concepts to reduce photon entropy (e.g. angular restriction mechanisms) or cool PV devices (e.g. radiative cooling)
- spectral conversion mechanisms such as up- and down conversion
- selective solar absorbers for generating hot water and higher-grade heat for solar thermal energy generation and storage
- selective thermal emitters for tailoring the wavelengths, angles, and polarizations of thermal radiation, particularly at elevated temperatures
- thermophotovoltaics for efficiently converting medium- to high-temperature heat into electricity
- radiative cooling to increase the ability of systems near room temperature to reach ambient or below ambient temperatures via long-wavelength infrared thermal emission
- incorporation into larger system applications with significant photonic components, such as building-integrated photovoltaics, unmanned aerial vehicles, and sustainable food-energy-water systems.

Highlight:
- A joint session with Organic, Hybrid, and Perovskite Photovoltaics.
The main theme of this conference is focused on exploiting ultrafast and nonlinear optical techniques for imaging and spectroscopy applications. The merging of ultrafast nonlinear optics and imaging has created exciting opportunities to explore nonlinear susceptibility as contrast mechanisms for label-free imaging. For instance, second harmonic generation (SHG) imaging relies on the difference in second order nonlinear susceptibility to form an image and can be used to probe molecules or structures without inversion symmetry. The introduction of the multi-photon nonlinear excitation technique using femtosecond pulses to fluorescence microscopy has allowed for the use of longer excitation wavelengths hence deeper penetration depth in scattering media, reduced photo-toxicity, and natural optical sectioning capability. By combining nonlinear molecular vibrational spectroscopy (such as coherent anti-Stokes Raman spectroscopy – CARS, and stimulated Raman scattering – SRS) with imaging, coherent Raman microscopy possesses the unique chemical selective imaging capability. Last but not the least, various novel sources generated by ultrafast nonlinear processes (e.g., supercontinuum) also have significant impact on the field of imaging and spectroscopy.

This conference provides an excellent opportunity for researchers working on the field of ultrafast nonlinear imaging and spectroscopy to present their most recent progress. Papers on all related areas are solicited, including novel ultrafast nonlinear optical imaging and spectroscopy techniques, nonlinear imaging contrast mechanisms, applications of ultrafast nonlinear imaging and spectroscopy, nonlinear optical sources, and computational techniques related to ultrafast nonlinear imaging and spectroscopy. The following are a list of exemplary topical areas:

- sum frequency generation (SFG) spectroscopy, SFG and SHG (second harmonic generation) microscopy
- multi-photon excitation fluorescence microscopy
- third harmonic generation (THG) microscopy
- four wave mixing spectroscopy and imaging, coherent Raman spectroscopy and microscopy (e.g., CARS, SRS)
- ultrafast nanoscale nonlinear imaging and spectroscopy
- ultrafast electron diffraction and imaging
- multispectral imaging
- multidimensional spectroscopy
- Brillouin imaging
- holographic nonlinear imaging
- stimulated emission depletion microscopy (STED)
- structured illumination imaging
- nonlinear sources (e.g., supercontinuum, THz) for imaging and spectroscopy
- novel ultrafast and nonlinear imaging and spectroscopy techniques
- computational nonlinear imaging and spectroscopy
- application of machine learning to ultrafast/nonlinear imaging/spectroscopy and photonic systems
- biological and chemical imaging and sensing applications.
PHOTONIC FIBER AND CRYSTAL DEVICES: ADVANCES IN MATERIALS AND INNOVATIONS IN DEVICE APPLICATIONS XV (OP411)

Conference Chairs: Shizhuo Yin, The Pennsylvania State Univ. (USA); Ruyan Guo, The Univ. of Texas at San Antonio (USA)

Program Committee: Manmohan D. Aggarwal, Alabama A&M Univ. (USA); Partha P. Banerjee, Univ. of Dayton (USA); Liliana Braescu, Matelligence Inc. (Canada); Liangcai Gao, Tainghua Univ. (China); Amol Choudhary, Indian Institute of Technology Delhi (India); Ken-Yuh Hsu, National Chiao Tung Univ. (Taiwan); Rongqin Hui, The Univ. of Kansas (USA); Suganda Jutamulia, Univ. of Northern California (USA); Byoungho Lee, Seoul National Univ. (Korea, Republic of); Carl M. Liebig, Air Force Research Lab. (USA); Sergei F. Lyuksyutov, The Univ. of Akron (USA); Paul B. Ruffin, Alabama A&M Univ. (USA); Narasingh B. Singh, Univ. of Maryland, Baltimore County (USA); Wei-Hung Su, National Sun Yat-sen Univ. (Taiwan); Ching-Cherng Sun, National Central Univ. (Taiwan); Jun Zhang, U.S. Army Research Lab. (USA); Xiang Zhang, Univ. of California, Berkeley (USA)

The Photonic Fibers and Crystal Devices Conference aims to establish a well-defined forum with focus on innovations of photonic, optoelectronic, and optical devices that depend essentially on advancement in materials processing, optical and photonic property, wave mixing, and photorefractive phenomena. This conference is a continuation of the successful SPIE conferences on Photorefractive Fiber and Crystal Devices with strengthened topics on crystal growth of nonlinear optic materials. The scope of applications this conference encompasses covers a broad range from components to systems architectures in optical signal processing, optical storage, optical networks and communications, and photorefractive material-based novel photonic devices. The objective of this conference is to promote scientific interaction that bridges advancement in photonic fibers and bulk crystal materials with innovations in photonic technology and device development.

Sessions will focus on the latest achievements on both photonic materials and device technologies that can lead to further advances in the communication, sensing, data storage, display, biomedical, and defense applications. The status and future challenges in these areas also will be reviewed by invited speakers.

Authors are encouraged to submit papers addressing the following session topics:

PHOTONIC FIBERS AND CRYSTAL MATERIALS
- novel photorefractive, electro-optic, and nonlinear optical fibers and crystals including glasses, semiconductors, ferroelectrics, polymeric, and magneto-optic materials
- crystal growth, defect and doping control, quasi phase matching and domain manipulation
- photonic fibers, 2- and 3-dimensionally engineered photonic crystal, and photonic bandgap materials
- photosensitivity and spectral responses, physical and optical characterizations
- experiments and theory that elucidate correlations between materials doping and defect-structure with photonic properties
- chalcogenide photonics
- hollow-core photonic crystal fiber design and applications
- polarization maintaining photonic crystal fiber designs and applications
- progress in high peak power capable photonic fibers
- work on understanding the fundamental mechanisms on photodarkening in fibers along with process and design improvements to reduce photodarkening effects
- advances in software for the design and simulation of photonic fibers and photonic fiber based systems.

PHOTONIC DEVICES AND APPLICATIONS
- components for optical communication, sensing, and data storage, including transmission, amplification, modulation, detection, dispersion management, switching, data handling, and packaging
- integrated optical components, nonlinear frequency converters, diffractive devices, three-dimensional optical memory, and dynamic memories
- dynamic sensing for chemical, harsh environment, biophotonic, and defense applications
- adaptive optical devices utilizing coupled effects such as electro-optic, elasto-optics, photostriction, magneto-optics, and pyro-optics
- novel free-space and waveguiding optical components, devices and subsystems including supercontinuum lasers for photonic computing, optomechanics, interconnects, switching, and packaging of photonic processors
- analog and digital holographic data storage, holographic miniaturization of functional mapping, holographic image amplification, volume holographic imaging, 3D imaging and display
- phonic bandgap switches and modulation-based switching devices
- photonic devices for energy conversion and harvesting
- electromagnetic (nonlinear phenomena and propagation of light in nonlinear crystals/optical media)
- crystalline fiber lasers.

Submit an abstract: spie.org/op21call
The THz domain extending approximately from 100 GHz to 10 THz can be considered as a link between electronics and photonics. Since the beginning of the 1990s this field was growing first with the development of time-domain spectroscopy and now is becoming more and more attractive with the emergence of new technologies: quantum cascade lasers, nano-transistors, photomixing, mixers, frequency multipliers and material systems like novel semiconductor heterostructures exploiting nitride, zinc oxide based heterostructures, 2D nanostructures and van der Walls layered heterostructures. These materials and devices have already found many applications in different systems exploiting unique properties of the THz region of the electromagnetic spectrum. The optical excitation and control of spins in magnetic materials and structures opens new prospects for merging of spin-based devices and ultrafast photonic processing whereas terahertz spectroscopy presents an ideal tool for the study of spin dynamics in magnetic materials. Furthermore, novel optical and photonic systems recently emerged to further extend the THz research field to the investigations of phenomena at the nanoscale. Among the new trends in the THz technology there also are tunable, compact THz gas lasers, THz optical components manufactured with 3d printing, chip-level THz signal generation, THz imaging with a single pixel camera etc.

The conference is intended to provide a forum for scientists, engineers, and researchers from a diverse set of disciplines who are interested in presenting their last achievements in this field. The scope of the conference includes sources and detectors of THz radiation, optical components, and photonics systems, near field microscopy as well as different applications exploiting this technology.

Papers are solicited in the following areas:

FUNDAMENTALS OF GENERATION, DETECTION, AND PROPAGATION OF THZ WAVES
- modeling of THz sources and detectors
- performance limitations
- photonic crystal devices and applications
- single element antennas
- phased array antennas
- photonically driven antennas
- photonic phase locked loops
- MMICs.

SOURCES OF THZ AND FAR-INFRARED RADIATION
- quantum cascade lasers
- difference frequency THz generation
- frequency comb generators
- frequency mixers
- frequency multipliers
- FET and HEMT sources
- resonant tunneling diodes
- parametric oscillators
- solid-state sources
- electron beam sources
- vacuum electronics sources
- p-germanium sources
- photoconductive sources
- single frequency and broad band sources,
- tunable sources
- high power sources.

THZ DETECTORS
- quantum detectors
- Schottky and other mixers
- bolometers and other thermal detectors
- THz focal plane arrays
- antenna integrated detectors
- heterodyne detection techniques.

THZ COMMUNICATIONS
- THz and microwave communications
- THz and microwave links
- sensors and detectors for THz communications
- interfaces and protocols for wireless communications.

IMAGING
- active and passive THz imaging systems
- image treatment
- substance identification.

SPECTROSCOPY
- spectral measurement techniques
- spectroscopic approaches and techniques
- identification of organic and inorganic materials using THz spectroscopy.

ULTRAFAST SPINTRONICS
- ultrafast spin dynamics
- spintronic THz emitters
- THz spectroscopy of magnetic materials and structures
- spin-based THz applications.

THZ OPTICS
- optical components and systems
- waveguides, couplers, gratings.

THZ MICROSCOPY
- scattering near field optical microscopy
- aperture near field optical microscopy
- ultrafast THz nanoscopy
- STM microscopy.

BIOMEDICAL APPLICATIONS
- DNA identification, cell abnormalities, medical imaging
- identification of biological and chemical species
- burn and water content analysis, tissue abnormality identification, cancer identification and screening
- pharmaceutics, dentistry, other medical and clinical applications.

NEW TRENDS IN THZ DEVICES
- new concepts, experimental procedures, and implementations
- new fabrication processes
- novel applications
- integrated THz optic devices
- tunable, compact THz gas lasers
- THz optical components manufactured with 3d printing
- chip-level THz signal generation
- THz imaging with a single pixel camera.

MATERIALS FOR THZ DEVICES
- photonic crystal structures and metamaterials
- nonlinear optical materials and devices
- THz plasmonics
- organic materials for THz components and devices
- nanostructures
- graphene
- non-conventional materials for THz QCLs and other sources.
ODS 2021: INDUSTRIAL OPTICAL DEVICES AND SYSTEMS (OP413)

Conference Chairs: Ryuichi Katayama, Fukuoka Institute of Technology (Japan); Yuzuru Takashima, Wyant College of Optical Sciences (USA)

Program Committee: Pierre-Alexandre J. Blanche, Wyant College of Optical Sciences (USA); Min Gu, Univ. of Shanghai for Science and Technology (China); Thomas D. Milster, Wyant College of Optical Sciences (USA); Kimihiro Saito, Kindai Univ. Technical College (Japan); Luping Shi, Tsinghua Univ. (China); Xiaodi Tan, Fujian Normal Univ. (China); Din Ping Tsai, The Hong Kong Polytechnic Univ. (Hong Kong, China); Kazuyoshi Yamazaki, Hitachi, Ltd. (Japan)

The ODS special conference offers an excellent forum for exchanging information on the status, advances, and future directions in the field of industrial optical devices and systems. Formerly, the main topic of this conference was optical data storage. However, competition with hard disk drives and solid state drives, as well as the growth of storage in the cloud, made it unclear what the future optical data storage system might look like. Therefore, the scope of the conference was extended to “Industrial Optical Devices and Systems” in 2018, and the new scope was brought to the forefront in 2019. To further activate the ODS conference, the new scope will be continuously highlighted in 2021.

Currently, optics research and development community in industry is seeking for new applications of the technologies developed for optical data storage in the past. The possibility of applications of optical technologies to emerging industrial domains such as automotive, IoT, big data, healthcare, security, etc. will be the main focus at this conference. A variety of optical technologies such as LiDARs, VR/AR, intelligent lighting, advanced cameras, etc. are involved in the above applications. Of course, new developments in technologies for future optical data storage systems such as holographic data storage, nano-photonics, etc. will also be discussed. Contributions in a variety of areas within the new scope of ODS are strongly encouraged.

Papers are solicited in the following and related areas:
- LiDARs
- VR/AR
- Intelligent lighting
- Advanced cameras
- Optical technologies for automotive
- Optical technologies for IoT
- Optical technologies for big data
- Optical technologies for healthcare
- Optical technologies for security
- Other industrial optical devices
- Other industrial optical systems
- Holographic data storage
- Nano-photonics for optical data storage
- Other optical data storage technologies.

CALL FOR PAPERS

ABSTRACTS DUE:
3 February 2021

AUTHOR NOTIFICATION:
5 April 2021

The contact author will be notified of acceptance by email.

MANUSCRIPT DUE DATE:
7 July 2021

PLEASE NOTE: Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.
Over the past 18 months and despite the challenges of a global pandemic, the Earth Observing Systems XXV conference was successfully held in August 2020; and Earth observing missions continued to be launched and/or developed. For example, missions recently launched and commissioned include the Indian Space Research Organization (ISRO) RISAT 2BR-1 mission launched on December 11, 2019 and Cartosat-3 launched on November 27, 2019, the Canadian Space Agency (CSA) RADARSAT mission on June 12, 2019, and the Korean Aerospace Research Institute (KARI) Geostationary Environmental Monitoring Spectrometer (GEMS) on February 18, 2020. An impressive number of missions are under development and being readied for launch in the next 2 to 3 years. These include the National Oceanic and Atmospheric Administration/National Aeronautics and Space Administration (NOAA/NASA) Joint Polar Satellite System-2 (JPSS-2) in 2022, the NOAA/NASA Geostationary Operational Environmental Satellite-T (GOES-T) in 2021, NASA’s Tropospheric Emissions: Monitoring of Pollution (TEMPO) in 2022, the Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission in 2023, the Geocarb mission in 2022, and Landsat-9 in 2021. The European Space Agency (ESA) is also preparing an impressive number of missions for launch, including the two Earth Explorer missions, the Biomass and the Fluorescence Explorer (FLEX), slated for launch in 2022, and the Sentinel 5 mission which will launch on the Meteosat Second Generation A satellite and Sentinel 4A mission which will launch on the Meteosat Third Generation Satellite-S slated for launch in 2021. The China Meteorological Administration (CMA) continues to develop and launch its Feng Yun-3 (FY-3) and Feng Yun-4 (FY-4) missions.

A number of joint, international missions are also under development. These include the joint ESA, European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), NASA, NOAA and Centre National d’études Spatiales (CNES) Copernicus Sentinel-6 Michael Freilich mission to be launched in November 2020, the joint, ESA/Japan Aerospace Exploration Agency (JAXA) Earth, Cloud, Aerosol, and Radiation Explorer to be launched in 2022, and the joint NASA, CNES, CSA, and UK Space Agency Surface Water Ocean Topography (SWOT) mission to be launched in 2021. On an international scale, these missions have or will join the already impressive number of Earth observing satellite systems currently operating on-orbit with active and passive instruments producing remote sensing data—from the ultraviolet through the radar/microwave wavelength region. This proliferation of satellite instruments requires calibration and validation of the quality of the data they produce through a combination of careful pre-launch testing, on-orbit monitoring, and on-orbit inter-instrument comparisons of measurements made by other on-orbit assets and by airborne, balloon-borne, and ground-based remote sensing instrumentation. Advances in electro-optic technologies and data acquisition and analysis techniques by commercial, academic, and governmental research institutions have promoted the successful on-orbit operation of hyperspectral Earth remote sensing instruments and enabled the development of lower-cost, miniature satellite sensors with specific areas of performance equal to or better than those of traditional systems.

Lastly, space agencies continue to formulate and/or refine their long-term mission plans. For example, the 2017-2027 U.S. National Research Council’s Decadal Survey on Earth Science and Applications from Space continues to serve as the guide for the science and application objectives of future US space-based observations of Earth in terms of instruments and missions. NASA continues its development of its Earth Venture missions. ESA and EUMETSAT continue instrument formulation and launch planning for their future Earth Explorers, follow-on Copernicus Sentinel Missions, Meteosat Third Generation (MTG), and EUMETSAT Polar System-Second Generation (EPS-SG) programs.

In summary, the Earth Observing Systems XXV conference welcomes the submission of papers over a wide range of remote sensing topics. Papers are solicited in the following general areas:

- Earth-observing mission studies including new system requirements and plans
- Commercial system designs
- Electro-optical sensor designs and sensitivity studies
- Ultraviolet through thermal infrared, microwave, radar, and lidar remote sensing systems
- Hyperspectral remote sensing instruments and methodologies
- Instrument sub-system and system level pre-launch and on-orbit calibration and characterization
- Vicarious calibration techniques and results
- Satellite instrument airborne simulators
- Techniques for enhancing data processing, reprocessing, archival, dissemination, and utilization
- Conversion from research to operational systems
- On-orbit instrument inter-comparison techniques and results
- Enabling technologies (optics, antennas, electronics, calibration techniques, detectors, and models)
- Sensor calibration traceability, uncertainty, and pre-launch to on-orbit performance assessments
- Lunar radiometry and photometry
- Remote sensing data acquisition and analysis

Conference Chairs: James J. Butler, NASA Goddard Space Flight Ctr. (USA); Xiaoxiong (Jack) Xiong, NASA Goddard Space Flight Ctr. (USA); Xingfa Gu, Institute of Remote Sensing and Digital Earth, CAS (China)

Program Committee: Amit Angal, Science Systems and Applications, Inc. (USA); Philip E. Ardanuy, Innovim, LLC (USA); Jeffrey S. Czapla-Myers, Wyant College of Optical Sciences (USA); Armin Doerry, Sandia National Labs. (USA); Christopher N. Durell, Labsphere, Inc. (USA); Bertrand Fougnie, EUMETSAT (Germany); Joel McCorkel, NASA Goddard Space Flight Ctr. (USA); Vijay Murgai, Raytheon Space and Airborne Systems (USA); Thomas S. Pagano, Jet Propulsion Lab. (USA); Jeffery J. Puschell, Raytheon Space and Airborne Systems (USA); Mark A. Schwarz, SAIC (USA)
INFRARED REMOTE SENSING AND INSTRUMENTATION XXIX (OP421)

Conference Chair: Marija Strojnik, Centro de Investigaciones en Óptica, A.C. (Mexico)
Program Committee: Gabriele E. Arnold, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Gerald T. Fraser, National Institute of Standards and Technology (USA); Jorge Luis Flores Nuñez, Univ. de Guadalajara (Mexico); Sarath D. Gunapala, Jet Propulsion Lab. (USA); Sven Höfling, Julius-Maximilians-Univ. Würzburg (Germany)

A great deal of knowledge about the Earth’s environment and about space (including outer space) has recently been acquired using infrared remote sensing and astronomical techniques. In this conference we plan to bring together scientists and engineers involved with the design, engineering, and data analysis of existing and future infrared remote sensing instruments, including scientific returns obtained from remotely collected data.

Areas of interest include:
- scientific objectives for future missions
- scientific results for those missions that have flown
- instrument design requirements to meet mission objectives and the resultant design and implementation experiences
- sensor technology challenges in meeting instrument requirements
- instrument and sensor integration challenges and experiences
- planned and required enabling technologies.

Papers are solicited on the following and related topics:

REMOTE SENSING FUNDAMENTALS
- radiometry and energy throughput
- imaging
- fundamental limits to IR imaging, including detector quantum noise and background limit
- stray light considerations, including analysis, signal-to-noise, and instrument performance limitations
- instrument calibration, comparison of predicted and measured results
- space environment and radiation effects
- calibration and testing
- data analysis
- standards and characterization of components and materials
- IR/electro-optical system modeling and simulations
- non-contact and non-invasive technique.

INSTRUMENT OBSERVATIONAL FACILITIES
- Planck Observatory
- James Webb Space Telescope
- SPICA Far-IR Facility
- SAFIR Telescope
- Darwin
- IRTF
- SOFIA
- HERSCHEL.

INSTRUMENTS AND THEIR SCIENTIFIC RETURNS
- bolometers
- spectrometers
- imaging cameras
- photometers (multiband)
- radiometers
- imaging and nonimaging interferometers
- microcameras
- interferometers.

REMOTE SENSING
- Earth resource mapping
- atmosphere and weather prediction
- space exploration
- exploration of planets and comets within our solar system
- generation of light noise and ground temperature increase in urban and populated environments
- remote diagnostics and monitoring in human-unfriendly and disaster environments (nuclear power plants, earthquake, tsunami and mines)
- contamination of natural sources of sweet water and their reclamation
- monitoring of forests, their diseases, fuel accumulation and fire occurrences
- monitoring of volcanic activities
- natural and human-made fires and their propagation
- remote monitoring of humans and animals in quarantine and controlled access environment
- remote calibration
- Moon reconnaissance
- compact satellites
- satellite security and monitoring.

ENABLING TECHNOLOGIES
- sensor design
- cold read-out electronics
- data processing
- infrared materials.

INFRARED TELESCOPES FOR EARTH REMOTE SENSING, FOCAL PLANE TECHNOLOGY, AND DETECTION SCHEMES
- near-IR detectors
- IR detectors
- mid-IR detectors and sources
- far-IR detectors
- sub-mm detectors
- focal plane detectors
- focal plane layout and architecture.

Submit an abstract: spie.org/op21call
The detection of infrared radiation has proven to be a viable tool in environmental studies, homeland security, astronomy, meteorological satellites and in medical, automotive, and military applications. This conference will provide a venue for papers ranging from basic device physics to novel applications. Improvements in infrared sensing & imaging relating to reduced feature size for the read-out integrated circuit (ROIC) fabrication, and compositional and doping control for the detector layer, have led to new opportunities for meeting the needs of the terrestrial, air, and space user communities. Unique IR device structures have been shown to evolve from new capabilities in the nanotechnology realm. Recent developments in novel detector materials, including those for strained superlattice and barrier architectures, promise significant technological advances. Room temperature infrared detectors for terrestrial use also benefit from these advancements. Various read-out circuit architectures allow functionality for higher-sensitivity cooled IR focal plane arrays, and also permit increased capabilities. We are also seeking papers that expand the state-of-the-art and affordability of sensors, with novel pixel readout approaches and improved signal processing, including the digital flow of data off the FPA in the form of LVDS, for example.

The conference is a high-level forum bringing together scientists and engineers involved in the research, design, and development of infrared sensors and focal plane arrays. A special session titled “Infrared Technology to address Global Climate Change” is in the planning stage for this conference. Papers are solicited for infrared technology, including the following topics:

**NOVEL DETECTOR MATERIALS AND ARCHITECTURES**
- SWIR, MWIR, LWIR, and VLWIR detectors
- materials (e.g., InSb, HgCdTe, InAsSb)
- nanotechnology-based EO/IR detectors/Arrays
- nano-/microbolometers
- HgCdTe (MCT) technology
- HgCdTe detector growth on alternative substrates
- III-V strained-layer superlattice detector technology
- higher-operating temperature infrared detectors
- high sensitivity at low photon flux detectors / applications
- UV, visible and IR avalanche photodiodes
- quantum dot detector technology.

**MODELING OF IR OPTOELECTRONIC DEVICES AND MATERIALS**
- carrier transport models for novel IR materials
- carrier transport models for super lattices and quantum devices
- transport properties in non-crystalline materials
- simulation techniques for detector arrays
- optical and electrical simulation models for crosstalk, modulation transfer functions and photon recycling
- models for point and extended defects and their impact on device performance
- novel numerical approaches for large scale IR detector and array simulation.

**FOCAL PLANE ARRAYS, READ-OUT INTEGRATED CIRCUITS, AND COMPONENTS**
- FPA signal and data processing, both on- and off-Chip
- electronic readout image intensifier devices
- smart focal planes
- diffractive optics on the FPA
- advanced microchannel plates
- photon-counting technology
- image intensification
- improved photocathodes
- plasmonics.

**APPLICATIONS OF IR TECHNOLOGY**
- terrestrial, air, and space sensors
- multispectral sensors
- imaging spectrometer applications
- imaging polarimeter applications
- infrared imaging for next generation smart phones
- space-based sensing applications
- astronomical applications
- climate monitoring and change sensing technologies
- industrial and structural applications
- automotive applications
- Bio-medical applications
- cameras for low light levels
- unmanned autonomous vehicle cameras.

**ADVANCED CHARACTERIZATION TECHNIQUES**
- energetic particle radiation effects
- anomalous noise sources
- responsivity and frequency response
- cryogenic and ultra-low noise.

Submit an abstract: spie.org/op21call
CUBESATS AND SMALLSATS FOR REMOTE SENSING V (OP424)

Conference Chairs: Thomas S. Pagano, Jet Propulsion Lab. (USA); Charles D. Norton, NASA Headquarters (USA); Sachidananda R. Babu, NASA Earth Science Technology Office (USA)

Program Committee: William J. Blackwell, MIT Lincoln Lab. (USA); Pamela E. Clark, Jet Propulsion Lab. (USA); Marco Esposito, cosine B.V. (Netherlands); Martin Kaufmann, Forschungszentrum Jülich (Germany); Massimiliano Pastena, European Space Research and Technology Ctr. (Netherlands); Jeffery J. Puschell, Raytheon Space and Airborne Systems (USA); Steven C. Reising, Colorado State Univ. (USA); Roger Walker, European Space Research and Technology Ctr. (Netherlands)

Advances in electro-optic remote sensing technologies now enable measurements to be made in a fraction of the size once required in earlier systems. Miniaturization of critical instrument technologies including optical systems, electronics, mechanisms, cryocoolers and sensors as well as increases in the density of semiconductor electronics and detector arrays now enable instruments to be made significantly smaller while achieving the same or better performance. Additionally, spacecraft technologies including navigation, C&DH, communications, power systems, and structures can be made in a fraction of the size enabling the entire satellite and instrument to be housed in “CubeSats” (where a single “U” is 10x10x10cm), and “SmallSats” where satellites are significantly smaller than traditional but not necessarily in the “U” form factor. These technologies lead to a significant reduction in instrument, spacecraft and launch costs, building robustness into current remote sensing programs and enabling new measurements to be made through more opportunity and through constellations of satellites to improve revisit time. Numerous challenges remain, including achieving legacy performance in a small package, power and data rate limitations, and mission reliability.

This conference is intended to explore all aspects of remote sensing with CubeSats and SmallSats including:

**PAYLOAD TECHNOLOGIES**
- Instrument systems to support remote sensing of Earth, moon, planets, comets, asteroids
- Optics: including telescopes, spectrometers, imagers, freeform optics, etc.
- Sensors: UV, visible, infrared, microwave, radar, lidar, fields and particles
- Calibration and validation: methods, innovative techniques and results of calibration and validation of payloads
- Telecom: satellite-to-satellite, satellite-to-ground communications, high data rate solutions
- Electronics: in-flight demonstrations of novel electronic designs, on-board processing, and payload electronic architectures
- Mechanical systems: packaging approaches enabling smaller instruments.

**SPACECRAFT TECHNOLOGIES**
- Power management: batteries, solar panels
- Communications: transmitters, receivers
- Navigation and pointing control: star trackers, GPS, propulsion
- De-orbit strategies and technologies
- Flight computers and on-board signal processing
- Mechanical aspects: bus structure, materials, packaging, vibration and thermal control.

---

**Save the date**

**ABSTRACTS DUE:**
3 February 2021

**AUTHOR NOTIFICATION:**
5 April 2021
The contact author will be notified of acceptance by email.

**MANUSCRIPT DUE DATE:**
7 July 2021

**PLEASE NOTE:** Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.
Optical polarization is a powerful tool used in many aspects of remote sensing. Active and passive polarimetric sensors have been developed for use in all optical regions from UV–LWIR and into the THz region. Polarization has been demonstrated to enhance target contrast, aid in target identification, assist in the penetration of scattering media, probe material surfaces, and characterize particles suspended in the air and water. Applications of polarimetry have included passive and active air- and ground-based sensing, underwater imaging, medical imaging, industrial imaging, and non-imaging sensing for environmental and industrial monitoring. Polarization in remote sensing has been demonstrated to enhance target contrast, aid in target identification, and to characterize them in an unambiguous way. In addition, polarization vision is known to be used by many species of vertebrates and invertebrates for the identification of prey and intra-species communications.

This conference will focus on the science, phenomenology, measurement methods, applications, and mathematics of polarization and polarimetric remote sensing. Papers are encouraged that discuss instruments, calibrations, novel theoretical treatment, or practical applications of polarimetric measurements or polarimetric imagery.

Papers are solicited on the following and related topics:

**POLARIZATION IN VISION AND COMPUTER VISION**
- Polarimetric image quality metrics
- Polarization analysis of optical systems
  - Polarization in optical design and polarization ray tracing
  - Polarization aberrations
  - Instrumental polarization
  - Polarimeter calibration.
- End-to-end systems analysis.

**POLARIZATION-BASED OPTICAL SYSTEMS AND COMPONENTS**
- Passive polarimeters
- Laser radar (lidar or ladar) and other active polarimeters
- Polarization imagers
- Optical signal processors and computers
- Optical data storage
- Fiber optic sensors
- Optical modulators.

**POLARIZATION PROPERTIES OF MATERIALS**
- Liquid crystals and crystalline materials
- Ceramics and plastics
- Organic and biological materials
- Optical fiber.

**MATHEMATICS OF COHERENCE, POLARIZATION, AND SCATTERING POLARIZATION**
- Methods of displaying polarization data

**POLARIZATION IN REMOTE SENSING**
- Atmospheric or oceanic polarization measurements and modeling
- Polarization for characterizing clouds, haze, and aerosols
- Atmospheric and biological aerosol measurements
- Terrestrial and planetary surface sensing
- Agricultural crop and soil polarization and modeling
- Polarization remote sensing programs
  - Spectropolarimetry
  - Polarization imaging
  - Polarization lidar/ladar and other active polarimetry.

**POLARIZATION PHENOMENOLOGY OF NATURAL AND ARTIFICIAL SCENES**
- Polarization phenomenology measurements
- Polarization phenomenology simulations.

**ASTRONOMICAL POLARIMETRY**
- Polarization properties of sources and detectors
- Polarization metrology and instrumentation
  - Passive and active polarimetry
  - Ellipsometry
  - Polarization scattered light measurements
  - Spectropolarimetry
  - Imaging polarimetry
  - Polarization-based biological microscopy, imaging, and instrumentation.
This conference provides a forum for researchers, engineers, and systems developers to present and discuss the latest advances in communication and imaging systems operating in the Earth’s atmosphere, near-water, and underwater environments. We aim to stimulate interdisciplinary discussions of atmospheric turbulence, light wave propagation phenomena, and their effects on these systems. Submissions are encouraged from those interested in both defense and commercial applications.

The effects of the atmosphere and oceans on optical communication can often be the limiting performance factor in many optical systems. The primary factors in beam degradation are absorption and scattering, large-scale refractive effects, and optical turbulence. For many applications, it is necessary to understand how these factors can be predicted and modeled. Specific environments remain difficult for beam propagation models: long horizontal propagation paths near or through the ocean surface or near the land surface can encounter large vertical gradients in turbulence intensity and in extinction. Inhomogeneous regions such as coastal areas, mountains, or urban islands are difficult to model.

High data rate free-space optical (FSO) communication remains an emerging technology with several technical challenges preventing widespread acceptance and implementation. The focusing and transmission of directed laser energy through the atmosphere, space, and air-water interface involves problems related to signal detection, pointing, acquisition, tracking, steering, laser-beam propagation, laser speckle, rain effects, system design, and information processing. Similarly, single-photon free-space communication systems used for establishing secure quantum-key-distribution (QKD)-based links over long distances are subject to the same atmospheric and system challenges described above.

For imaging systems, atmospheric effects may lead to serious degradation of image quality, e.g., through contrast reduction, blurring and scintillation. There is a need for a description of turbulence in terms of environmental parameters, in terms of its impact on image quality, and in terms of image processing techniques to improve image quality by removing turbulence effects.

We encourage submissions that address:

- modeling or experiments of the atmospheric interaction and propagation of spectrally broadband light sources that are spatially coherent, but temporally incoherent, such as supercontinuum lasers
- modeling and detection of beams featuring Orbital Angular Momentum (OAM) over long horizontal paths for FSO applications
- experimental demonstrations or system modeling of Quantum FSO communications in the atmosphere or over underwater links
- imaging formation and mitigation in scenarios featuring extreme anisoplanatism (where the isoplanatic angle is on the order of or smaller than the diffraction limit of the imaging system)
- light-field approaches applied to understanding the effects of atmospheric and oceanic turbulence on light propagation
- application of machine learning (ML) algorithms to atmospheric propagation data, such as scintillation and imaging.

Papers are solicited in the following and related areas:

- LIDAR and application of remote sensing tools to describe the atmospheric propagation environment
- measurement and modeling of the effects of turbulence, aerosols, rain and particulates on laser beam propagation and imaging systems
- single-photon FSO communication systems over turbulent paths
- underwater FSO communications and propagation in oceans
- mitigation techniques for FSO and imaging systems
- light-field approaches to imaging through turbulence
- optical components for use in FSO systems especially those related to detection of OAM and QKD
- Use of broadband laser sources to simultaneously characterize absorption, scattering, and turbulence over a range of wavelengths
- experimental demonstrations, tests, and performance characterizations in laboratory and field.

**Save the date**

**ABSTRACTS DUE:**
3 February 2021

**AUTHOR NOTIFICATION:**
5 April 2021

The contact author will be notified of acceptance by email.

**MANUSCRIPT DUE DATE:**
7 July 2021

**PLEASE NOTE:** Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.
Quantum communications and quantum imaging are emerging technologies that promise great benefits beyond classical communications and classical imaging - as well as great challenges. The objective of this conference is to provide a forum for scientists, researchers, and system developers in both fields and encourage technology exchange between the quantum communication and quantum imaging research communities. Papers are solicited on the following and related topics:

**QUANTUM COMMUNICATIONS, QUANTUM INTERNET, AND QUANTUM INFORMATION**
- quantum free-space and fiber optics communications and cryptography
- quantum communications experimental demonstrations
- quantum key distribution (QKD), entangled QKD, stochastic QKD, heralded QKD
- quantum cryptography protocols
- quantum probes
- quantum communication security
- quantum communications with orbital angular momentum (OAM) states
- quantum communication using entanglement
- teleportation; continuous variable teleportation counter-factual quantum communications
- Bell-state analyzer development
- nonlinear crystal and nonlinear fiber use in generating and engineering entanglement
- multiphoton and multiple-particle entangled states and entangled beams
- continuous and pulsed laser sources of entangled photons
- fundamental properties of the photon
  - qubit physics
  - single and multi-photon physics
  - squeezed states
  - slow/trapped light and photons
  - amplification and transmission of photon holes
  - quantum wavefunctions & measurements
  - quantum probability
  - quantum bi-photon physics
- frequency and polarization entanglement
- atmospheric quantum communication, satellite, and technology applications
- quantum satellites, quantum cube satellites
- quantum UAV, drone, robot and aircraft research and applications
- atmospheric effects on quantum communications systems

**QUANTUM COMMUNICATIONS AND QUANTUM IMAGING XIX (OP431)**

Conference Chairs: Keith S. Deacon, CCDC Army Research Lab. (USA); Ronald E. Meyers, CCDC Army Research Lab. (USA)

Program Committee: Stefania A. Castelletto, RMIT Univ. (Australia); Milena D’Angelo, Univ. degli Studi di Bari Aldo Moro (Italy); Warren P. Grice, Qubitekk (USA); Mark T. Gruneisen, Air Force Research Lab. (USA); Richard J. Hughes, Los Alamos National Lab. (Retired) (USA); Yoon-Ho Kim, Pohang Univ. of Science and Technology (Korea, Republic of); William J. Munro, NTT Basic Research Labs. (Japan); Kae Nemoto, National Institute of Informatics (Japan); Todd B. Pittman, Univ. of Maryland, Baltimore County (USA); Barry C. Sanders, Univ. of Calgary (Canada); Alexander V. Sergienko, Boston Univ. (USA); Oliver Slattery, National Institute of Standards and Technology (USA); Dmitry V. Strekalov, Jet Propulsion Lab. (USA); Shigeki Takeuchi, Kyoto Univ. (Japan)

- quantum data compression
- compressive sensing and compressive imaging with quantum information
- nonclassical information from entangled states and non-entangled states
- non-local measurements
- quantum secret sharing

**QUANTUM IMAGING AND QUANTUM SENSING**
- quantum ghost imaging, ghost imaging
- quantum imaging with entangled photons
- quantum imaging with thermal light
- incoherent light and solar light quantum imaging
- quantum imaging in turbulence and obscurants
- quantum imaging and satellites
- color and multispectral quantum imaging
- quantum imaging at diverse wavelengths
- quantum imaging and quantum lithography: bi-photon photo resist
- bi-photon and n-photon quantum imaging
- quantum holography and quantum identification
- quantum imaging resolution and superresolution
- quantum imaging with sparsity constraints
- quantum imaging noise reduction
- quantum imaging for medical applications
- quantum imaging using fluorescence
- temporal and spatial quantum / ghost imaging
- plenoptic quantum imaging

- nonlocal quantum imaging physics
- quantum versus classical imaging physics
- quantum imaging versus speckle imaging
- uncertainty principle in quantum imaging
- quantum interference; multiphoton interference
- squeezed states

- quantum remote sensing; quantum sensors; quantum sources
- quantum two-photon sensing and detection
- single-photon and multiphoton detectors
- quantum measurements using cameras
- fast, sensitive cameras for quantum technology
- quantum lidar and quantum ladder
- new ways to make entangled photon and pseudo thermal sources for quantum imaging
- quantum illumination

- quantum relativity, GPS, and metrology
- quantum clock synchronization
- quantum clocks in quantum coincidence measurements.
UNCONVENTIONAL IMAGING AND ADAPTIVE OPTICS 2021 (OP432)

Conference Chairs: Jean J. Dolne, The Boeing Co. (USA); Mark F. Spencer, Air Force Research Lab. (USA)

Program Committee: Santasi R. Bose-Pillai, Air Force Institute of Technology (USA); James R. Fienup, The Institute of Optics, Univ. of Rochester (USA); Victor L. Gamiz, Tau Technologies LLC (USA); Kenneth J. Jerkatis, Ball Aerospace (USA); Matthew Kemnetz, Air Force Research Lab. (USA); Denis W. Oesch, Liedos, Inc. (USA); Casey J. Pellizzari, U.S. Air Force Academy (USA); Markus E. Testorf, Dartmouth College (USA); David G. Voelz, New Mexico State Univ. (USA)

The objective of this conference is to bring together researchers interested in the development of unconventional imaging and adaptive-optics systems. Therefore, we seek papers that:

1. describe novel imaging and adaptive-optics techniques using unconventional means of sensing, data collection, data processing, and interpretation;
2. address laboratory-, space-, airborne-, sea-, and ground-based systems, including those requiring compensation for distributed-volume aberrations (e.g., deep turbulence), high-speed aberrations (e.g., aero effects), scattering media (e.g., fog and tissue), and speckle phenomena (e.g., rough-surface scattering); and
3. seek to design effective and efficient algorithms for processing different kinds of available data and constraints to obtain solutions to many kinds of imaging and adaptive-optics applications.

Papers from industry, government, academia, and other research organizations are welcome on the following and related areas:

**IMAGING**
- computational imaging
- system modeling and regularization
- imaging from active or passive illumination
- imaging from image-plane measurements, pupil-plane measurements, or both
- imaging from synthetic aperture ladar and inverse synthetic aperture ladar systems
- inverse problems using probabilistic and Bayesian methods
- imaging from diversity measurements, including phase diversity, polarization diversity, aperture diversity, wavelength diversity, and wavefront sensing
- imaging using ultrafast pulses
- radar, lidar, and sonar imaging
- biological and molecular imaging
- imaging of, or through turbulent, refracting, or highly scattering media
- profile inversion
- wavefield propagation
- synthetic aperture imaging
- nanoimaging
- mm wave imaging
- phase retrieval, superresolution, and deconvolution
- multispectral and hyperspectral imaging
- coded aperture imaging
- compressive sensing and 3D and surface reconstruction and computer vision
- information-theoretic limits for image recovery and synthesis
- experimental results or hardware related to the implementation of unconventional imaging systems
- low-light imaging
- computationally efficient algorithms
- applications in remote sensing, medicine, biology, geophysics, etc.
- reconfigurable diffractive optical systems
- approaches using artificial intelligence, such as machine learning and deep learning.

**ADAPTIVE OPTICS**
- computational sensing
- wavefront sensing and reconstruction
- active and passive tracking
- woofer-tweeter approaches
- multi-conjugate approaches
- extended-beacon approaches
- compensation of jitter
- compensation of aero effects
- compensation of deep turbulence
- advances in deformable mirrors, fast-steering mirrors, phase modulators, spatial-light modulators, etc.
- advances in non-mechanical beam steering
- advances in gradient, curvature, and interferometric wavefront sensors
- advances in phased arrays and tiled arrays
- advances in digital holography
- applications such as long-range imaging, retinal imaging, confocal microscopy, ultrashort pulse shaping, fiber coupling, laser communications, laser designation, astronomy, power beaming, beacon cleanup, and laser cavities
- ophthalmological applications of adaptive optics and wavefront sensing
- scaled-laboratory disturbance generation
- active and passive flow control
- aero-optics and deep-turbulence characterization
- developments in scaling-law and wave-optics theory and simulations
- developments in adaptive/predictive control theory and simulations
- approaches using artificial intelligence, such as machine learning and deep learning.
ADVANCES IN X-RAY/EUV OPTICS AND COMPONENTS XVI (OP500)

Conference Chairs: Christian Morawe, European Synchrotron Radiation Facility (France); Ali M. Khounsary, Illinois Institute of Technology (USA); Shunji Goto, RIKEN SPring-8 Ctr. (Japan)
Conference Co-Chairs: Hidekazu Mimura, The Univ. of Tokyo (Japan); Daniele Spiga, INAF - Osservatorio Astronomico di Brera (Italy)
Program Committee: Lucia Alianeli, Diamond Light Source Ltd. (United Kingdom); Lahsen Assoufid, Argonne National Lab. (USA); Stefan Braun, Westsächsische Hochschule Zwickau (Germany); Daniele Cocco, Lawrence Berkeley National Lab. (USA); Raymond P. Conley Jr., Argonne National Lab. (USA); Christian David, Paul Scherrer Institut (Switzerland); Hans M. Hertz, KTH Royal Institute of Technology (Sweden); Yoshio Ichii, JTEC Corp. (Japan); Werner H. Jark, Elettra-Sincrotrone Trieste S.r.p.A. (Italy); George A. Kyrala, Los Alamos National Lab. (USA); Eric Louis, Univ. of Twente (Netherlands); Patrick P. Naulleau, The Ctr. for X-Ray Optics (USA); Haruhiko Ohashi, RIKEN SPring-8 Ctr. (Japan); Ladislav Pina, Czech Technical Univ. in Prague (Czech Republic); Michael J. Pivovaroff, SLAC National Accelerator Lab. (USA); Yuriy Y. Platonov, Rigaku Innovative Technologies, Inc. (USA); Regina Soufli, Lawrence Livermore National Lab. (USA); Stanislav Stoupin, Cornell Univ. (USA); Mau-Tsu Tang, National Synchrotron Radiation Research Ctr. (Taiwan); Zhanshan Wang, Tongji Univ. (China); Makina Yabashi, RIKEN SPring-8 Ctr. (Japan); Kazuto Yamauchi, Osaka Univ. (Japan); Brian W. Yates, Canadian Light Source Inc. (Canada)

Expanding use of x-ray and EUV radiation in many scientific and technical applications requires the continued development of new and improved sources and optics to deliver brighter, better-conditioned beams to the end-user. This conference focuses on the advances, as well as the emerging needs, in x-ray and EUV sources, optics, including adaptive technologies, and applications including next-generation synchrotron sources, EUV photolithography, and x-ray astronomy.

In relation to sources and source/optics integration, the topics covered include design, development, fabrication, installation, evaluation, and applications of optical elements such as mirrors, monochromators, multilayers, zone-plates, and lenses. It is also an aim of this conference to provide an opportunity for the developers and users to share both the progress and challenges in each of these and related areas.

Presentations on emerging needs, progress reports, and topical reviews covering the following and related topics are solicited:
- synchrotron and XFEL sources
- novel optics for x-ray, XFEL, and EUV beams
- metrology techniques for x-ray optics
- crystal optics design, fabrication, and applications
- mirror fabrication: surface figuring and finishing techniques, capabilities, and limitations
- coating- and multilayer-based optics and performance
- focusing optics including refractive, reflective, and diffractive optics
- filters, windows, x-ray beam position monitors
- x-ray optics for extreme spatial and/or energy resolution
- novel optical substrates, materials, processes, and applications
- management of optical components under high heat/radiation load and in hostile environments
- thermal and mechanical stability of optical systems
- active/passive/adaptive shape control of optical elements and technologies
- x-ray optics alignment techniques
- coherence preservation and wave front quality
- optimization and automatization algorithms
- x-ray optics software.

ADVANCES IN LABORATORY-BASED X-RAY SOURCES, OPTICS, AND APPLICATIONS VIII (OP502)

Conference Chair: Daniele Spiga, INAF - Osservatorio Astronomico di Brera (Italy)
Program Committee: Nikolay A. Artemiev, KLA-Tencor Corp. (USA); Sandra G. Biedron, Colorado State Univ. (USA); Björn Hansson, Excillum AB (Sweden); Ali M. Khounsary, Illinois Institute of Technology (USA); George A. Kyrala, Los Alamos National Lab. (USA); Jom Luiten, Technische Univ. Eindhoven (Netherlands); Ladislav Pina, Czech Technical Univ. in Prague (Czech Republic); J. Scott Price, GE Global Research (USA); Bianca Salmaso, INAF - Osservatorio Astronomico di Brera (Italy); Donald P. Umstadter, Univ. of Nebraska-Lincoln (USA); Gert van Dorssen, PANalytical B.V. (Netherlands)

There is a continued demand for brighter laboratory-based x-ray beams for a variety of industrial, medical, and scientific applications. Development of brighter (novel or conventional) sources and the optics to collect and deliver the beams would broaden the range of applications.

Large-scale x-ray sources such as synchrotrons do provide extremely bright beams but the need for portability, access, cost, control, and system integration makes the laboratory-based sources indispensable for many applications. The focus of this conference is on the progress in both source and optics developments for laboratory-based x-ray systems and on the challenging applications that benefit from and derive these advancements.

Contributed papers are solicited on the following and related topics:

LABORATORY-BASED SOURCE DEVELOPMENT
- rotating anode and fixed tube x-ray sources
- laser plasma sources
- non-conventional x-ray sources
- advanced materials and metallurgical issues in source design
- cooling techniques.

LABORATORY-BASED OPTICS DEVELOPMENT
- multilayer and graded index multilayer optics
- shaped mirrors
- nested cones
- bent crystals
- refractive optics
- capillary and polycapillary optics
- novel optical elements.

LABORATORY-BASED APPLICATIONS REQUIRING BRIGHT SOURCES
- imaging (including phase contrast imaging)
- metrology
- crystallography
- microfluorescence
- microdiffraction
- nondestructive testing
- calibration, alignment, and integration facilities and beamlines.
HARD X-RAY, GAMMA-RAY, AND NEUTRON DETECTOR PHYSICS XXIII (OP503)

Conference Chairs: Nerine J. Cherepy, Lawrence Livermore National Lab. (USA); Michael Fiederle, Freiburger Materialforschungszentrum (Germany); Ralph B. James, Savannah River National Lab. (USA)

Program Committee: Toru Aoki, Shizuoka Univ. (Japan); Gerard Arioño-Estrada, Univ. of California, Davis (USA); Tim Aucott, Savannah River National Lab. (USA); Jim E. Bacik Jr., Univ. of Florida (USA); Aleksey E. Bolotnikov, Brookhaven National Lab. (USA); Arnold Burger, Fisk Univ. (USA); Raymond Cao, The Ohio State Univ. (USA); Henry Chen, Consulting LLC (USA); Jeffrey J. Derby, Univ. of Minnesota, Twin Cities (USA); Mao-Hua Du, Oak Ridge National Lab. (USA); Anna Erickson, Georgia Institute of Technology (USA); Petro Fochuk, Chernivtsi National Univ. Y. Fedkovich (Ukraine); Jan Franc, Charles Univ. (Czech Republic); Larry Franks, Consultant (USA); Volodymyr A. Gnatyuk, V. E. Zashchigrov Institute of Semiconductor Physics NASU (Ukraine); Amber L. Guckes, Univ. of Nevada, Las Vegas (USA); Zhong He, Univ. of Michigan (USA); Keitaro Hitomi, Tohoku Univ. (Japan); Kris Iniewski, Redlen Technologies (Canada); Alan Janos, U.S. Dept. of Homeland Security (USA); Mercouri Kanatzidis, Northwestern Univ. (USA); Kihyun Kim, Korea Univ. (Korea, Republic of); Krishna C. Mandal, Univ. of South Carolina (USA); Sharriar Motakef, CapeSym, Inc. (USA); Sanjoy Mukhopadhyay, International Atomic Energy Agency (USA); Madan Niraula, Nagoya Institute of Technology (Japan); Stephen A. Payne, Lawrence Livermore National Lab. (USA); Utpal N. Roy, Brookhaven National Lab. (USA); Arie Ruzin, Tel Aviv Univ. (Israel); Michael R. Squillante, Radiation Monitoring Devices, Inc. (USA); Ashley C. Stowe, Y-12 National Security Complex (USA); Sergey E. Ulin, National Research Nuclear Univ. MEPhI (Russian Federation); Edgar V. van Loef, Radiation Monitoring Devices, Inc. (USA); Richard S. Woolf, U.S. Naval Research Lab. (USA); Ge Yang, North Carolina State Univ. (USA); Ren-Yuan Zhu, Caltech (USA); Mariya Zhuravleva, The Univ. of Tennessee Knoxville (USA)

Advances continue to be made in hard x-ray, gamma-ray, neutron detectors and associated technologies for spectroscopy and imaging of these energetic photons and particles. Many types of position and energy sensitive detectors are actively being developed, including semiconductor detectors and arrays, high-density noble gas detectors, phosphors, scintillators, thin film transistor arrays, charge-coupled devices, microchannel plates, and calorimetric detectors. These detectors are being employed singly, or in conjunction with optical components and x-ray/gamma-ray sources to produce systems having important applications ranging from medical diagnostics and treatment to astronomical research. Important examples include nuclear medicine, dental imaging, dosimetry, industrial radiography, nondestructive testing, heavy metals analysis, cargo inspection, nuclear safeguards and surveillance, treaty verification, explosives detection, and environmental monitoring. This conference will provide rapid dissemination of the latest results from the forefront of research on hard x-ray, gamma-ray and neutron detector physics through seminal invited papers and qualified contributed papers from academic, government, and industry researchers. Important new results are solicited concerning, but not limited to, the following general areas:

- theory of hard x-ray and gamma-ray detector operation
- design, fabrication, and testing of new devices for photon and particle detection
- advanced room-temperature semiconductor and scintillator materials
- semiconductor and scintillator crystal growth and characterization
- electrical contacts and their effects on device response including waveform analysis
- scintillator physics, scintillator/PM tube devices, scintillating fiber optics, phosphors
- scintillator/semmiconductor array devices (such as Si-APD and Si-PM)
- microchannel plate detectors
- gaseous and liquid medium detectors
- calorimeters
- advanced readout electronics including charge amplifier arrays, CCDs, CIDs, TFTs
- radiation damage, aging, and environmental effects
- spatial, energy, and timing sensitivity and resolution
- advanced or engineered devices for spectroscopy and/or imaging
- fabrication and tests of strip and pixel arrays and discrete detectors
- detectors for space, cargo inspection, nondestructive testing, dosimetry, x-ray fluorescence, environmental, industrial, security, safeguards, and surveillance applications.

Submit an abstract: spie.org/op21call
In recent years, both synchrotron and laboratory-based facilities have witnessed astounding progress in x-ray nanoimaging instruments and methods. Nanoprobes with sub-50-nm resolution have proliferated, while imaging with 1-nm spatial resolution may soon become possible. Combination and correlation of complementary analytical techniques such as x-ray spectroscopy, diffraction, tomography, ptychography, in-situ environment, and other methods are solving more important questions than ever.

This conference will focus on the latest developments in optics, instrumentation and systems, data science, and integration with other techniques, for both scanning and full-field x-ray imaging, including:

- laboratory and synchrotron based scanning and full field microscopes and dedicated beamlines
- high-resolution nanofocusing optics
- instruments for nanoimaging and nanopositioning
- advanced control and detection schemes
- image analysis, data science, and data management
- novel nanoimaging methods and correlative techniques
- in-situ and operando sample environments.
The conference is a platform for researchers and teams active in the field of x-ray tomography to exchange on the latest progress in instrumentation, algorithms, and non-destructive three-dimensional characterization. Several thousand x-ray tomography systems are currently operated in industry and academia and thousands more in clinics. While conventional attenuation contrast imaging is dominant, other forms of tomographic x-ray imaging are emerging. The huge amount of generated data requires state-of-the-art software for image reconstruction and analysis. Several technical advancements are enabling or pushing applications of tomography in pathology, tissue engineering, anthropology, etc. It is increasingly common to produce impressive imagery of unique objects and derive relevant features of the underlying structures and dynamics. Furthermore, multi-modal imaging, which recently incorporates the reciprocal space information, has started to play an increasingly important role. The Developments in X-ray Tomography conference series warmly welcomes PhD students and postdoctoral fellows in the field. In order to support their career advancement, we will again recognize and award the best poster presented by a PhD student as the first author, the best oral presentation and proceedings paper. This conference encourages interdisciplinary discussions and collaborations. Scientists and experts are openly invited from medicine/dentistry, biology, earth and materials science, crystallography, solid-state and soft-matter physics, chemistry, computer sciences, engineering and applied mathematics to present results on system instrumentation, algorithm design and evaluation, and current applications. Papers are solicited on the following and related topics:

**ALTERNATIVES TO CONVENTIONAL ATTENUATION-BASED TOMOGRAPHY**
- phase tomography using single- and multiple gratings, edges, crystals and in-line approaches
- three-dimensional reciprocal-space techniques including scattering
- x-ray optics in tomographic imaging, spectral imaging.

**RECENT ADVANCES IN X-RAY SOURCES AND DETECTOR TECHNOLOGY**
- liquid metal sources in tomography, compact light sources, photon-counting spectral detectors, virtual mono-energy imaging.

**CHARACTERIZATION AND OPTIMIZATION OF CT-SYSTEMS**
- quantitative characterization of x-ray sources, sample manipulators, x-ray detectors
- modeling of photon energy and photon statistics in phase and absorption modes
- image quality assessment.

**CLASSIC/DEEP LEARNING ALGORITHMS FOR RECONSTRUCTION AND IMAGE ANALYSIS**
- image reconstruction from noisy, incomplete and inconsistent data
- artifact correction
- image segmentation and registration
- detection, classification, and quantification of various objects such as mineral samples and porous media
- phase-retrieval
- management and mining of big data.

**MICRO- AND NANO-TOMOGRAPHY OF HUMAN TISSUES**
- brain imaging
- imaging of scaffolds and cells in tissue engineering/regenerative medicine
- characterization of human tissues in normal and diseased conditions.

**NON-DESTRUCTIVE CHARACTERIZATION OF UNIQUE OBJECTS**
- paleontology
- museum science, anthropology, insects and plants, and niche applications
- implementation of temperature control and mechanical loading to samples.

**ADDED VALUE OF COMBINING X-RAY TOMOGRAPHY WITH OTHER METHODS**
- multi-modal imaging
- joint histogram analysis/data fusion
- registration-based segmentation
- hierarchical imaging and interior tomography, workflow integration, and optimization.

**TRENDING APPLICATIONS OF X-RAY TOMOGRAPHY**
- quantum technology
- batteries and fuel cells, reverse engineering of semiconductor chips
- detecting plant growth below ground.

### Save the date

<table>
<thead>
<tr>
<th>ABSTRACTS DUE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 February 2021</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AUTHOR NOTIFICATION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 April 2021</td>
</tr>
</tbody>
</table>

The contact author will be notified of acceptance by email.

<table>
<thead>
<tr>
<th>MANUSCRIPT DUE DATE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 July 2021</td>
</tr>
</tbody>
</table>

**PLEASE NOTE:** Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.
This conference is intended to provide a forum for interchange on various algorithms, systems, sensors, and architectures for novel applications in optics and photonics in information processing. Original unpublished contributions reporting recent advances in analog and hybrid optical information systems and techniques are solicited. In addition, papers related to teaching of conference topics to the students or tutorials reviewing a particular field from the following list are welcome. All abstracts will be reviewed by the program committee for originality and merit. Topics of interest include, but are not limited to, the following:

ALGORITHMS
• optical encryption, information security, security of digitally stored medium
• optical pattern recognition, devices, optical correlation hardware, nonlinear techniques for pattern recognition
• neural networks including deep learning networks
• novel transforms for optical imaging systems, including wavelets transforms
• optical image processing algorithms
• task-specific information for pattern recognition
• algorithms for large scale data (Big Data) processing and deep learning
• algorithms for data processing on wearable devices and IoTs
• algorithms for robot vision and autonomous vehicle navigation
• adaptive algorithms for optical image restoration and enhancement
• algorithms for optical metrology, camera calibration, and 3D object digitization.

NEW ARCHITECTURE AND SYSTEMS
• quantum computing, cyber-physical systems and IoTs for optical information processing
• spatial light modulators (SLMs), photorefractive materials for optical information systems
• holographic techniques in information processing, and information display systems
• optical storage/memory systems for information processing
• optical systems for 3D pattern recognition, 3D imaging, and Big Data image processing
• applications of novel optical materials for information processing
• novel diffractive optics structures and devices
• nano photonics for optical computing
• metasurfaces
• calibration of optical systems.

OPTICAL SWITCHING AND INTERCONNECTS
• optical interconnects and supercomputing
• optics in server architecture
• waveguide, optical-fiber-based, polarization, and intensity switching, optical limit switches, optical multiplexing
• interconnection networks: fiber optic, free-space, massively parallel optical interconnections, quantum, static and reconfigurable interconnects, optical backplanes and VCSEL and VLSI
• implementation of interconnects
• optical back bones for conventional computers, optical/hybrid interconnects for electronic computers.

DIGITAL OPTICAL PROCESSING
• multi-valued logic, linear algebra processor, system demonstrations, fault-tolerant computing, optical logic and memory
• holographic memory-based computing, integrated optics, and soliton-based and semiconductor devices for optical computing
• modeling of holographic elements, joint optimization
• computational sensing, computational imaging for Big Data processing
• digital holography applications.

APPLICATIONS IN BIOPHOTONICS
• optical processing for biophotonics
• applications of optical systems to information security
• optical systems for biometrics sensing and recognition.

IMAGE FORMING AND PROCESSING APPLICATIONS
• imaging: 2D, 3D, integral, holographic, optical, digital, polarimetric
• novel x-ray-based image processing, algorithms and systems, noise processing, applications in medical, EUV, modeling, etc.
• image processing of optical images for large scale systems such as laser fusion facilities, applications in optical alignment, optics inspection, off-normal detection
• optical systems and algorithms for Big Data SAR/IR/visible/medical image processing and recognition
• VR/AR (virtual and augmented reality) systems and algorithms
• 3D printing for optics.

PARALLEL DIGITAL COMPUTING ARCHITECTURE
• high-speed digital computation circuitry for Big Data
• application of FPGAs and GPUs in opto-digital data processing
• signed-digit based computing
• memristor-based computing.

OPTICAL INFORMATION PROCESSING AROUND THE GLOBE
• review of optical information processing research over decades in different countries around the globe.
CALL FOR PAPERS

APPLICATIONS OF DIGITAL IMAGE PROCESSING XLIV (OP507)

Conference Chairs: Andrew G. Tescher, AGT Associates (USA); Touradj Ebrahimi, Ecole Polytechnique Fédérale de Lausanne (Switzerland)

Program Committee: Anne Margot Aaron, Netflix, Inc. (USA); Vasudev Bhaskaran, Qualcomm Inc. (USA); Antonin Descampe, intoPIX s.a. (Belgium); Frederic Dufaux, CNRS (France); Dan Grois, Comcast Corp. (USA); Ofer Hadar, Ben-Gurion Univ. of the Negev (Israel); Ioannis Katsavounidis, Facebook Inc. (USA); C.-C. Jay Kuo, The Univ. of Southern California (USA); Ajay Luthra, Piscel Labs (USA); Andre J. Oosterlinck, Kuleuven R & D (Belgium); Sathuraman Panchanathan, Arizona State Univ. (USA); Fernando Pereira, Instituto de Telecomunicações (Portugal); Yuriy A. Reznik, Brightcove, Inc. (USA); Thomas Richter, Fraunhofer-Institut für Integrierte Schaltungen IIS (Germany); John A. Saghri, California Polytechnic State Univ., San Luis Obispo (USA); Peter Schelkens, Vrije Univ. Brussels (Belgium); Gary J. Sullivan, Microsoft Corp. (USA); David S. Taubman, The Univ. of New South Wales (Australia); Pankaj Topiwala, FastVDO Inc. (USA)

Submissions to the conference should have abstract text lengths 1,000 words or less.

The field of digital image processing has experienced continuous and significant expansion in recent years. The usefulness of this technology is apparent in many different disciplines covering entertainment through remote sensing. The advances and wide availability of image processing hardware along with advanced algorithms have further enhanced the usefulness of image processing. The Application of Digital Image Processing conference welcomes contributions of new results and novel techniques from this important technology.

Papers are solicited in the broad areas of digital image processing applications, including:

APPLICATION AREAS
- image processing in medical applications
- image processing in remote sensing
- image processing in space
- image processing in automotive applications
- image processing in entertainment
- image processing in digital cinema
- image processing in gaming
- image processing in video surveillance
- image processing in drones
- image processing in multimedia applications
- image processing in telesence
- image processing in visual search
- image processing in real time applications
- blockchain and distributed ledger technologies in imaging.

NEW IMAGING MODALITIES AND THEIR PROCESSING
- high dynamic range
- wide color gamut
- high frame rate
- ultra-high definition (4K, 8K, and beyond)
- holographic content
- light field content
- point cloud content
- plenoptic content
- multidimensional content
- multimodal content.

IMMERSIVE IMAGING
- imaging in virtual reality
- imaging in augmented reality
- imaging in mixed reality
- omnidirectional imaging
- 360-degree imaging.

IMAGE AND VIDEO PROCESSING AND ANALYSIS
- image and video enhancement
- image and video restoration
- image registration techniques
- robot and machine vision
- pattern recognition
- feature extraction and tracking
- computational imaging
- image and video annotation
- image and video indexing
- image and video management
- search and retrieval.

NEW STANDARDS IN IMAGE AND VIDEO APPLICATIONS
- JPEG
- MPEG
- VCEG
- SMPT
- AOM
- other standards.

SECURITY IN IMAGING
- ownership protection
- integrity verification
- conditional access
- privacy protection
- biometrics
- forensics
- deepfakes.

IMAGING REQUIREMENTS AND FEATURES
- low latency
- low power
- low complexity
- real-time
- scalability
- error resiliency
- random access
- new requirements and features.

IMAGING SYSTEMS
- new image processing architectures
- implementation considerations
- complexity considerations
- power consumption considerations
- optimization considerations
- performance metrics.

COMPRESSION
- image compression
- video compression
- perceptual compression
- lossless compression
- transcoding
- new methods for image compression
- new methods for video compression.

HUMAN VISUAL SYSTEM AND PERCEPTUAL IMAGING
- image quality assessment and metrics
- video quality assessment and metrics
- perceptually motivated image processing
- Quality of Service (QoS) issues in imaging
- Quality of Experience (QoE) issues in imaging.

ARTIFICIAL INTELLIGENCE IN IMAGING
- machine learning applied to imaging
- deep learning applied to imaging
- assessment of Quality of Data (QoD) in imaging
- imaging using Generative Adversarial Network (GAN)
- reinforcement learning applied to imaging
- image compression based on artificial intelligence
- video compression based on artificial intelligence
- new machine learning approaches in imaging.

NOVEL AND EMERGING METHODS IN IMAGING
- new and emerging applications in imaging
- new and emerging approaches in imaging.
APPLICATIONS OF MACHINE LEARNING 2021 (OP509)

Conference Chairs: Michael E. Zelinski, Lawrence Livermore National Lab. (USA); Tarek M. Taha, Univ. of Dayton (USA); Jonathan Howe, NVIDIA Corp. (USA)

Conference Co-Chairs: Abdul A. S. Aw Battalion, Lawrence Livermore National Lab. (USA); Khan M. Iftikharuddin, Old Dominion Univ. (USA)

Program Committee: Md. Zahangir Alom, St. Jude Children's Research Hospital (USA); Brent D. Bartlett, BeamIO (USA); May V. Casterline, NVIDIA Corp. (USA); Emily A. Donahue, Sandia National Labs. (USA); Sindhu Ghanta, Pyxeda, Inc. (USA); James Henrikson, Lawrence Livermore National Lab. (USA); Dhireesha Kudithipudi, Univ. of Texas San Antonio Chapter (USA); Nathan Mundhenk, Lawrence Livermore National Lab. (USA); Barath Narayanan Narayanan, Univ. of Dayton (USA); Karl Song-Jeng Ni, Google (USA); Manar D. Samad, Tennessee State Univ. (USA); Shaohui Sun, ArchiFiction, Inc. (USA); Amanda K. Zieman, Los Alamos National Lab. (USA)

This conference provides a technical forum for members of both industry and academia to present their latest applications of machine learning. Machine learning has been applied to a broad domain of image/vision systems from medical imaging to consumer cameras. Learned tasks such as image recognition, noise reduction, or natural language processing, are currently being applied in many common devices such as mobile phones. Training datasets and training methods for machine learning are critical for the success of a system. Studies demonstrating the deployment and benchmarking of machine learning algorithms on specialized computer hardware is highly valuable to many groups in this field. Sensor hardware design or selection as it pertains to machine learning tasks; for example, an analysis of different camera designs and how each pertains to the performance of an image recognition task such as object detection, is of interest. Analysis of full systems that include the sensor technology, data processing hardware, and results are welcome as each area is critical for the successful application of machine learning.

Papers or tutorials reviewing the topics covered by this section are welcome. All abstracts will be reviewed by the program committee for originality and merit. Topics of interest include, but are not limited to, the following:

**ALGORITHMS**
- application or adaptation of known neural network and deep learning architectures
- neural networks, deep learning, reinforcement learning, evolutionary, and spiking algorithms
- computational intelligence, graphical models
- optimization methods which better enable application of machine learning algorithms (mixed or lower precision, pruning, grouped convolutions, node fusion, etc.)
- analysis and comparison of computational complexity, utility, speed, green AI
- full system analysis of image sensor data, computer hardware, machine learning task, and results
- training methods, such as transfer learning, meta learning, few-shot learning, low shot learning, unsupervised, recurrent and self-supervised learning
- data augmentation techniques
- application of AR, VR, or MR to ML tasks
- explainable AI, uncertainty quantification, salient image studies.

**CONSUMER APPLICATION**
- application of ML algorithms to specific datasets, tasks, or hardware
- image classification, detection, localization, segmentation
- interpolation, denoising, clustering, super-resolution, image quality
- hyperspectral target detection
- biometrics
- voice recognition, natural language processing
- human/machine smart interface
- tracking (global and local), generative models, and RF applications (classification, detection, spoofing, etc.)

**INDUSTRIAL APPLICATION**
- remote sensing
- predictive and preventative maintenance
- automotive safety
- self-driving cars
- machine inspection of industrial parts
- agricultural, food safety
- surveillance
- optical manufacturing
- 3D manufacturing
- cognitive agents and decision making
- robotics.

**SECURITY**
- biometrics
- face recognition
- bias in security application.

**MEDICINE**
- medical diagnostic and evaluation
- drug/viral antibody design

**BIG DATA**
- real-time processing of data using machine learning algorithms
- Big Data applications of machine learning
- medical data (tumor, cancer, longitudinal studies)
- training datasets for machine learning
- multi-sensor data and data fusion (radio frequency, EO, hyperspectral, IR)
- meteorological
- remote sensing data.

**HARDWARE**
- application of machine learning algorithms on low SWaP computer hardware
- sensor modalities (mobile phone, consumer camera, machine vision systems, automotive imaging systems, micro-pulse radar, x-ray, OCT, CAT, MRI, hyperspectral, image satellites, airborne imaging systems, astronomical observing telescopes)
- image system or general sensor design and its relationship to machine learning tasks, methodologies for system characterization using machine learning tasks
- selection of image system parameters and their relationship to machine learning tasks
- real-time applications of machine learning.

**BIG EXPERIMENTAL FACILITIES**
- controlling multiparameter physics experiments
- optical damage evaluation
- big physics data
- optical component manufacturing
- 3D manufacturing
- high energy physics facilities such as NIF and others
- multiparameter optimization in large physics-based simulations.
Present your research at SPIE Optics + Photonics

Follow these instructions to develop a successful abstract and accompanying manuscript for the conference and for publication in the Proceedings of SPIE in the SPIE Digital Library.

How to submit an abstract

• Browse the conference topics online or view the Call PDF.
• Choose one conference that most closely matches the topics of your abstract.
  Important: each abstract may be submitted to one conference only.
• Click “Submit an Abstract” from within that online conference. You’ll be prompted to sign in to your spie.org account to complete the submission wizard.

What you will need to submit

• Title
• Author information
• 250-word abstract for technical review
• 100-word summary for the program
• Keywords used in search for your paper (optional)
• Some conferences may indicate additional requirements in the Call for Papers

Note: Only original material should be submitted. Commercial papers, papers with no new research/development content, and papers with proprietary restrictions will not be accepted for presentation.

Review and program placement

• To ensure a high-quality conference, all submissions will be assessed by the Conference Chair/Editor for technical merit and suitability of content.
• Conference Chairs/Editors reserve the right to reject for presentation any paper that does not meet content or presentation expectations.
• Final placement in an oral or poster session is subject to Chair discretion.

Contact information

For questions about submitting an abstract, or the meeting, contact the Contact the Program Coordinator. For questions about your manuscript, contact AuthorHelp@spie.org.

Save the date

ABSTRACTS DUE:
3 February 2021

AUTHOR NOTIFICATION:
5 April 2021
The contact author will be notified of acceptance by email.

MANUSCRIPT DUE DATE:
7 July 2021

PLEASE NOTE: Submissions imply the intent of at least one author to register, attend the symposium, present the paper as scheduled, and submit a full manuscript by the deadline.

Submit an abstract: spie.org/op21call
CALL FOR PAPERS

GENERAL INFORMATION

Venue
SPIE Optics+Photonics 2021 will be held at the San Diego Convention Center, 111 West Harbor Dr., San Diego, CA 92101 and at the San Diego Marriott Hotel & Marina located adjacent to the Convention Center at 333 West Harbor Dr., San Diego.

Registration
SPIE Optics + Photonics registration will be available April 2021. All participants, including invited speakers, contributed speakers, session chairs, co-chairs, and committee members, must pay a registration fee. Authors, coauthors, program committee members, and session chairs are accorded a reduced symposium registration fee. Fee information for conferences, courses, a registration form, and technical and general information will be available on the SPIE website in April 2021.

Hotel Information
Opening of the hotel reservation process for SPIE Optics + Photonics is scheduled for April 2021. SPIE will arrange special discounted hotel rates for SPIE conference attendees. The website will be kept current with any updates.

Student Author Travel Grants
A limited amount of contingency student author travel grants will be awarded based on need. See https://spie.org/membership/student-services/student-author-travel-grants for more information.

Clearance Information
If government and/or company clearance is required to present and publish your presentation, start the process now to ensure that you receive clearance if your paper is accepted.

Important News for All Visitors from Outside the United States
Find important requirements for visiting the United States on the SPIE Optics + Photonics website. There are steps that ALL visitors to the United States need to follow.
Online at: www.spie.org/visa

About San Diego
San Diego is California’s second largest city and the United States’ seventh largest. Bordered by Mexico, the Pacific Ocean, the Anza-Borrego Desert and the Laguna Mountains, and Los Angeles 2 hours north, San Diego offers immense options for business and pleasure. For more information about San Diego, sightseeing, shopping and restaurants, visit their website at: www.sandiego.org

Stay up to date via Email
Sign up to receive email about SPIE Optics + Photonics.
spie.org/signup
Submit an abstract: spie.org/op21call
CALL FOR PAPERS

Be part of SPIE Optics + Photonics — the largest international, multidisciplinary optical sciences and technology event in North America.

A home for your research.

Although much in the world remains uncertain, the one constant is that your work is important, and SPIE is here to assist in getting your research seen. Continue to do the good work, submit your abstract and by doing so you will guarantee that your research is ready to be shared with the world.

ABSTRACTS DUE: 3 February 2021

3,200 ATTENDEES

2,500 PAPERS

25 COURSES

55 CONFERENCES

150+ EXHIBITING COMPANIES

spie.org/op21call
#SPIEOpticsPhotonics
Call for Papers

Participate in the premier event for optical engineering and applications, nanotechnology, quantum science, organic photonics, and astronomical instrumentation.

1-5 August 2021
San Diego Convention Center
San Diego, California, USA

spie.org/op21call
#SPIEOpticsPhotonics