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Program Track Chairs: **James G. Grote**, Photonics Engineering Consultant (USA); **Shibin Jiang**, AdValue Photonics, Inc. (USA)

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### Photonics West 2021

SPIE remains committed to advancing light-based research and meeting the needs of our constituents by providing you with an opportunity for sharing your work and connecting you with the global science and engineering community. SPIE Photonics West 2021 is scheduled to take place as planned, and we look forward to your participation.

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This conference targets existing, and new physical and mathematical methods as applied to optoelectronics, as well as recent advances in new materials and devices. Its objective is to bring together experimentalists, theorists, computational specialists, and development engineers to provide an interdisciplinary forum to discuss physical understanding and state-of-the-art computational analysis of active and passive optoelectronic materials and devices. Theoretical and experimental papers are solicited on the following and related topics:

- **optoelectronic device modeling**: lasers, light-emitting diodes, photodetectors, modulators, solar cells
- **materials for optoelectronic devices**: wide bandgap materials; band structure, band offsets, gain and recombination in II-VI and III-nitride structures, materials for mid-infrared optoelectronic devices, photonics synthetic matter
- **plasmonic materials and structures**: theory and application in optoelectronic devices
- **2D materials and their application in photonics**: electronic band structure, luminescent properties, device strategies
- **physics of nanostructures**: quantum well, quantum wire, and quantum dot lasers and surface plasmon devices; hybrid nanostructures, lattice mismatch and strain effects; Coulomb effects and macroscopic theories; carrier and quantum transport, capture, and dynamics; hole burning, gain suppression and non-equilibrium effects; coherent effects; polarization phenomena
- **micro- or nano-cavity effects and photonic crystals**: applications for LEDs and lasers; thresholdless laser; novel VCSEL structures; polariton lasers
- **quantum communications**: semiconductor quantum bits; single-photon devices; entangled states; quantum cryptography; optically-probed spin dynamics; cavity quantum electrodynamics, superconducting optoelectronics
- **neuromorphic computing**: modeling and concepts for photonic neural networks

- **dynamics and noise in diode lasers and systems**: gain switching; passive and actively mode-locked diode lasers; self-pulsations; chaos and instabilities in diode lasers and laser arrays; effects of injected light and optical feedback; coherence of lasers and laser arrays
- **numerical simulation methods**: heterolayer transport simulation; ab-initio and multi-scale simulation of materials for optoelectronics; computational electromagnetics; multi-scale and multi-physics methods
- **modeling techniques for fiber and integrated optical devices**: eigenvalue techniques, finite difference, finite element and Fourier transform methods, high-order propagation methods, wide-angle and vector wave equations, models of guided-wave reflection
- **advances in waveguides and waveguide devices**: pulse propagation in active waveguides, waveguide structures for routing, switching and high brightness devices; tapered waveguides; waveguide-fiber coupling; nonlinear and high-power effects in waveguides and fibers; gratings; soliton propagation.
Physics, Simulation, and Photonic Engineering of Photovoltaic Devices X (OE102)

Conference Chairs: Alexandre Freundlich, Univ. of Houston (USA); Stéphane Collin, Ctr. de Nanosciences et de Nanotechnologies (France); Karin Hinzer, Univ. of Ottawa (Canada)

Program Committee: Urs Aeberhard, ETH Zürich (Switzerland); Abderraouf Boucherif, Univ. de Sherbrooke (Canada); Gavin C. Conibeer, The Univ. of New South Wales (Australia); Olivier Durand, Fonctions Optiques pour les Technologies de l’Information (France); Jean-François Guillemoles, Institut Photovoltaïque d’Île-de-France (France); NextPV LIA (Japan); Oliver Höhn, Fraunhofer-Institut für Solare Energiesysteme ISE (Germany); Seth M. Hubbard, Rochester Institute of Technology (USA); Laurent Lombez, Institut Photovoltaïque d’Île-de-France (France), NextPV LIA (Japan); Ian R. Sellers, The Univ. of Oklahoma (USA); Samuel D. Stranks, Univ. of Cambridge (United Kingdom); Masakazu Sugiyama, The Univ. of Tokyo (Japan); Robert J. Walters, Packet Digital (USA); Peichen Yu, National Chiao Tung Univ. (Taiwan)

This conference attempts to capture basic research and breakthroughs in the application of photonic/ novel device architectures and the development of advanced modeling and simulation techniques to feed the innovation pipeline leading to revolutionary and practically viable high-efficiency photovoltaic (PV) technologies. The conference also aims at providing an interdisciplinary forum to enhance interactions between physicists, photonic engineers, and photovoltaic device specialists at both the experimental and theoretical levels.

Theoretical or experimental papers are sought to address recent advances in basic material/device physics, simulation, demonstration, and optimization of:

• advanced light management concepts and architectures, including new approaches to spectral engineering (i.e. luminescent concentrators, up-down converters), light concentration, surface texturing and light trapping (i.e. ordered and disordered patterning, micro/nano- engineered ARs), as well as synergistic hybrid/multifunctional designs
• non-conventional PV converters, in particular application of advanced photonics to enable unique conversion mechanisms. Examples include application of photonics to enable the demonstration of advanced quantum confined or nanostructured concepts, intermediate band concepts, multiple exciton generation, thermophotonics or hot-carrier effects
• advanced single and multi-junction devices leveraging on innovative materials or/and photonic architectures. In particular the simulation or/and demonstration of cross-cutting photonic engineering approaches for enhancing the performance, reliability and functionality of these devices
• advanced optical characterization techniques, including photoluminescence, electroluminescence and cathodoluminescence, ellipsometry, reflectometry, and time-resolved measurements. Correlative and multi-scale characterization techniques are also welcome
• quantum- and nano-structured devices with a particular focus on deciphering the science at play in photogeneration, recombination, and carrier transport in quantum well/quantum dot and wire devices
• novel materials for PV absorbers (perovskites, and related materials), polycrystalline semiconductor (CdTe, CIGS, CZTS), hybrid organic/inorganic heterostructure devices, and advances in transparent conducting oxides
• defect-tolerant PV designs and application of photonics to enhance defect tolerance (dislocations, radiation defects, grain-boundaries, points defects) of solar cells
• contributions dealing with advanced, scalable micro/nano-fabrication technique, the development of low-cost fabrication of material and devices, are also of relevance.

Finally, the conference also welcomes new and emerging methods in simulation of PV and hybrid photonic/PV devices, including but not limited to 3D-drift diffusion and RCWA models, integrated ab-initio and multi-scale simulation techniques.
Active and passive optical components are playing key roles in current optical communication networks, optical sensors, and medical optical devices. Extensive research continues to be carried out to improve their performance and functionality, and to reduce their size and cost. Areas of research that are particularly active include high-power fiber lasers, switches, filters, ultra-short-pulse fiber lasers, as well as material research in rare-earth-doped glasses, semiconductors, and nano-particles for enabling innovative photonic devices. There is also significant activity in developing components in lightwave circuits, which will ultimately reduce manufacturing cost while integrating multiple active and passive functions on a single chip.

The purpose of this conference is to bring together researchers and engineers from academia and industry to discuss recent developments in these rapidly advancing fields. Suggested topics include:

- rare-earth-doped devices and materials
- rare-earth-doped or metal-doped glasses, crystals, polymers, semiconductors, hybrid materials, and fibers
- spectroscopy of rare-earth ions and other laser species
- graphene and carbon nanotubes
- new materials for mode-locking
- nanoparticles
- quantum dots
- fiber amplifiers design and fabrication
- waveguide lasers and amplifiers
- UV to far-infrared fiber lasers
- cladding-pumped lasers and amplifiers
- Raman laser and amplifiers
- Brillouin lasers
- broadband fiber sources
- semiconductor-based lasers and amplifiers
- optical switches, modulators, and other devices
- optical nonlinearities in fibers and waveguides
- lithium niobate bulk-optic and waveguide devices
- thermal and UV poling of silica and other glasses
- electro-optic poled sol-gels
- progress in lithium niobate electro-optic modulators
- nonlinear frequency converters
- photonic-bandgap fibers and devices
- plasmonic devices and technologies
- sub-wavelength optical elements
- photosensitivity in fibers and planar waveguides
- photosensitivity in glasses and polymers
- filters, reflectors, and other grating-based devices
- fiber and waveguide Bragg gratings
- long-period fiber gratings
- modeling glass structure and defects arising from UV irradiation
- novel passive and active components for dense WDM
- tunable filters and add-drop filters
- device packaging, testing, and reliability
- devices for optical interconnect
- detectors
- SWIR photodetectors
- single-photon detectors
- silicon-based photodetectors
- low-noise detection architectures
- unique detector materials and special spectral regions
- progress in MEMS-based detectors
- detectors with gain.

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Organic Photonic Materials and Devices XXIII (OE104)

Conference Chairs: William M. Shensky III, CCDC-Army Research Lab. (USA); Ileana Rau, Univ. Politehnica din Bucuresti (Romania); Okihiro Sugihara, Utsunomiya Univ. (Japan)

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For energy-saving and economic reasons, there is a growing interest in organic/polymeric photonic and electronic materials and devices that is generating a revolution in optical communication, data transmission, storage, displays, and many other photonic applications. Recent advances in optical interconnection and electro-optic devices as well as planar light-wave circuits, light-emitting and photovoltaic devices suggest that organic and polymeric materials will play a significant role in these areas. Organic-inorganic hybrid materials and biophotonic materials are of special concern for novel photonic device development. The ability to solution process various organic and organic-inorganic hybrid materials opens them up to next-generation advanced processing techniques, such as additive manufacturing and roll-to-roll printing, which are usually not feasible with all inorganic photonic materials. Applications that require flexible and stretchable photonic devices are also more viable with organic materials compared to most inorganic alternatives. Organic Photonic Materials and Devices XXIII will serve as a forum for the dissemination and discussion of state-of-the-art results pertaining to organic/polymeric opto-electronic, nanophotonic, and biophotonic materials and devices, their manufacturability, and their applications.

The objective of this conference is to bring together researchers and engineers from academia, industry, and government laboratories who share a common interest in organic/polymeric photonic materials and devices. This conference will provide a forum for an update on progress in the highly-connected and multidisciplinary subject of photonic technologies based on organic/polymeric materials. Papers are solicited in the following areas:

- organic light-emitting materials and devices (OLEDs)
- polymer solar cells and photodetectors
- nonlinear optical materials and devices
- multiphoton processes
- saturable-absorption and reverse-saturable absorption
- charge transport in organic materials
- photochromic materials
- plasmonic NLO effects
- theoretical description of NLO processes
- nanophotonics and organic metamaterials
- photorefractive materials and processes
- polymer optical waveguides and fibers
- organic field effect transistors
- polymer lasers and amplifiers
- biophotonics
- biopolymers
- hybrid organic-inorganic materials
- single-molecule spectroscopy
- electro-optic materials for silicon photonics
- organic-inorganic hybrid materials and devices
- flexible semiconductors
- polymeric photonic crystals
- printed optical materials and processes
- RF organic materials properties.
Ultrafast Phenomena and Nanophotonics XXV
(OE105)

Conference Chairs: Markus Betz, Technische Univ. Dortmund (Germany); Abdulhakem Y. Elezzabi, Univ. of Alberta (Canada)

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Conference Cosponsor:

This conference covers ultrafast phenomena in bulk semiconductors, semiconducting and metallic nanostructures and devices with emphasis on ultrafast optical and/or coherent phenomena. Manuscripts are solicited in the following topics but not restricted to:

ULTRAFAST DYNAMICS IN SEMICONDUCTORS AND HETEROSTRUCTURES
- carrier-carrier, carrier-phonon interactions
- polariton dynamics in microcavities
- ultrafast acoustic phenomena.

COHERENT DYNAMICS OF OPTICAL EXCITATIONS
- excitonic coherences and exciton dynamics
- quantum interference effects
- four-wave mixing, two-dimensional spectroscopy.

NON-LINEAR OPTICAL EFFECTS
- optical frequency conversion
- multi-photon processes, high-field physics
- high harmonic generation, attosecond physics
- nonlinear and ultrafast processes at surfaces and interfaces.

NON-EQUILIBRIUM CARRIER TRANSPORT
- ballistic carrier transport
- tunneling phenomena
- Bloch oscillations.

ULTRAFAST PHENOMENA CARBON NANOMATERIALS
- dynamics in graphene and carbon nanotubes
- graphene plasmonics
- carbon-based quantum dots.

ULTRAFAST PHENOMENA IN MONOLAYER SEMICONDUCTORS
- nonlinear and dynamical processes in transition metal dichalcogenides (TMDs)
- optics in silicene, germanene and black phosphorus
- novel emerging 2D materials.

SPIN DYNAMICS AND SPIN MANIPULATION
- ultrafast optical spin manipulation
- spin coherence and relaxation
- ultrafast magnetism
- spin injection and transport.

ULTRAFAST PLASMONICS
- active plasmonics
- THz plasmonics
- ultrafast dynamics in metallic nanostructures.

THZ SPECTROSCOPY
- THz wave generation
- field-resolved techniques
- THz time-domain spectroscopy
- strong-field THz physics.

ULTRAFAST PROCESSES IN DEVICES AND LASERS
- ultrafast optical switching
- wavelength conversions
- gain dynamics in lasers and amplifiers.

ULTRAFAST NANO-OPTICS
- nanoemitters, nanoantennae
- nanolocalization of optical fields
- coherent control in nanostructures
- semiconductor quantum dots and wires
- single-photon sources
- applications for quantum information processing.

ULTRAFAST OPTICAL PROPERTIES OF METAMATERIALS
- photonic and phononic crystals
- metal-semiconductor hybrid structures
- negative-index materials
- epsilon-near-zero materials
- metatronics.

ULTRAFAST QUANTUM ELECTRONICS
- quantum dots in resonators
- quantum entanglement
- color centers in wide bandgap materials
- single photon sources.

ULTRAFAST PHOTOCURRENTS
- bulk material ultrafast phenomena
- ultrafast microscopy.

continued next page
BEST STUDENT PAPER AWARDS

All contributed papers of conference OE105 given by a young scientist (PhD student or postdoc within the first two years after graduation) are eligible for the award. Note that this award is for contributed papers only. Invited papers and contributions to other symposia do not qualify. To facilitate handing out the award during the meeting, applications will be collected prior to the meeting. To qualify for the award, applicants must:

• be a young scientist (PhD student or postdoc within the first two years after graduation)
• be listed as a contributing author (not invited) on an accepted paper within conference OE105
• have conducted the majority of the work to be presented
• submit your manuscript online by 5 January 2021
• present your paper as scheduled
• be present at the Awards Ceremony.

To Apply, qualified applicants must submit:

• slides of presentation (Powerpoint or PDF document)
• additional information about the scientific content of the presentation
• date of graduation if you have already completed your PhD.

The presentation and the supplementary material should be sent via email to Prof. Markus Betz (please include your SPIE paper number) by 8 January 2021.

Save the date

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Submit your abstract today: spie.org/opto21call
**Terahertz, RF, Millimeter, and Submillimeter-Wave Technology and Applications XIV** (OE106)

**Conference Chairs:** Laurence P. Sadwick, InnoSys, Inc. (USA); Tianxin Yang, Tianjin Univ. (China)

**Program Committee:** René Beigang, Technische Univ. Kaiserslautern (Germany); Jianji Dong, Huazhong Univ. of Science and Technology (China); Frank Ellrich, Technische Hochschule Bingen (Germany); Fabian Friederich, Fraunhofer-Institut für Techno- und Wirtschaftsmathematik ITWM (Germany); Robert H. Giles, Univ. of Massachusetts Lowell (USA); R. Jennifer Hwu, InnoSys, Inc. (USA); Mona Jarrahi, Univ. of California, Los Angeles (USA); Daniel Molter, Fraunhofer-Institut für Techno- und Wirtschaftsmathematik ITWM (Germany); J. Anthony Murphy, National Univ. of Ireland, Maynooth (Ireland); Créidhe O’Sullivan, National Univ. of Ireland, Maynooth (Ireland); Kyung Hyun Park, Electronics and Telecommunications Research Institute (Korea, Republic of); Alessia Portieri, TeraView Ltd. (United Kingdom); Marco Rahm, Technische Univ. Kaiserslautern (Germany); Jinghua Teng, Institute of Materials Research and Engineering (Singapore); Michael Weibel, Joint Research and Development, Inc. (USA); Maddy Woodson, Freedom Photonics, LLC (USA); Jiangfeng Zhou, Univ. of South Florida (USA)

This conference brings together researchers and engineers from academia, industry, and government laboratories to explore and present work in the frequency range covering approximately less than 1 GHz (300 mm) to greater than 3 THz (100 μm) as well as infrared including near, mid and far infrared. Papers on RF and millimeter and infrared technology including advances in wireless communications, radar, lidar, microwave and mm-wave photonics, metamaterials, antennas, phased array radar, modulation, security, monitoring, detection, imaging are encouraged. Papers in photon-related fields including, but not limited to, radio over fiber (RoF) RF photonics including photonic generation of microwave signals, photonic processing of microwave signals, and photonic distribution of microwave signals and semiconductor (including Si, SiC, SOI, GaAs, GaN, InP, SiGe, diamond, graphene and other materials) RF, mm-wave and terahertz devices and related applications are also encouraged, as well as the hybrid photonic systems and applications. Terahertz (THz) technology deals with the generation and utilization of electromagnetic energy covering what is also known as the sub-millimeter wave region of the spectrum. In this region, which lies between the millimeter wave and far infrared spectral regions, materials exhibit properties that can be exploited to advantage for use over a broad range of important applications and technologies. Papers on terahertz photonics including photonic generation and detection of terahertz waves to/or infrared, THz to/or infrared lasers are also encouraged.

This conference includes low- to high-power sources, detectors, amplifiers, systems, including both photonic and electronic modulated sources, detectors, and systems as well as nanodevices, nanomaterials, nanotechnology, nanostructures, etc. At THz frequencies, the primary difficulty encountered by scientists and engineers working in this field is the lack of convenient and affordable sources and detectors of terahertz radiation, but this difficulty is gradually changing as new sources and improved detectors are being developed as the technology continues to mature and broaden. At RF and millimeter frequencies, more and more hybrid systems are being integrated with photonic devices that enhance the functions, specifications and stabilities tremendously compared to their traditional counterpart systems. The purpose of this conference is to gather scientists and engineers from a diverse set of disciplines, who are interested in either learning more about terahertz and sub-millimeter and millimeter wave and RF technology and related and coupled technologies, or who are contributing to the field through their own research, development, or manufacturing activities.

This conference also includes hybrid technologies including, for example, microwave to THz wearable devices of any type and form as well as microwave to THz communications and data links, artificial intelligence, machine learning virtual reality and augmented reality in microwave to THz, GHz, mm-wave, sub-mm-wave, microwave and IR imaging, etc.

Disciplines utilizing terahertz technology include physical chemistry (certain molecules or molecular segments exhibit strong resonances in the 10 cm⁻¹ to 100 cm⁻¹ spectral region), military, and homeland security (terahertz radiation can penetrate clothing and packing materials but is reflected by metals and other materials), biomedical technology (tissue exhibits strong reflection and absorption properties that change dramatically with tissue characteristics), medical and dental, secure short-distance wireless communications (atmospheric water content prevents terahertz radiation from traveling very far), astronomy (the cold background of the universe exhibits a peak in this spectral region), space communications (where the terahertz region is wide open for use) and other disciplines where new, yet-to-be-discovered applications will undoubtedly come forth. Since the low energy associated with terahertz radiation is expected to be no more harmful than infrared or microwave radiation, safety issues are not expected to limit the use of terahertz radiation at low-power levels. Papers on power supplies and electronic power conditioners and associated power protection systems including energy-efficient power supplies are also encouraged. Papers are solicited in the following and related areas:

**TERAHERTZ SOURCES**

- solid-state sources, electron-beam sources, vacuum electronics sources, frequency mixers, frequency multipliers, parametric oscillators, hybrids, graphene, FET and HEMT sources, gas lasers, quantum cascade lasers and related sources, p-germanium sources, photoconductive switches, resonant tunneling diodes, backward wave oscillators
- novel stabilized photonic THz sources
- fabrication processes
- high bandwidth devices, structures, sources, detectors, sensors, etc.
- wearables
- systems and systems integration
- THz pulse-induced ferroelectric behavior in materials

continued next page
Terahertz, RF, Millimeter, and Submillimeter-Wave Technology and Applications XIV (OE106 continued)

• using THz to control quantum properties
• measuring nonlinear effects in matter due to THz radiation.

RF, SUB-MILLIMETER-WAVE, AND MILLIMETER-WAVE SOURCES
• power sources of all types in the range of 1 GHz to 300 GHz and 300 GHz and higher (i.e. from S-band to the higher end of the millimeter-wave frequencies and all of the sub-millimeter-wave frequency region)
• novel stabilized photonic RF, millimeter-wave, sub-millimeter-wave sources.

DETECTORS AND SENSORS
• bolometers and other thermal detectors, Schottky and other mixers, thermopiles, quantum devices, antenna integrated detectors, heterodyne detection techniques, hybrid detection, direct detection techniques
• transistor-based detectors including graphene, silicon, III-V, II-VI, nitride-based, etc.
• theoretical modeling
• novel detectors and sensors
• detector arrays.

HIGH-POWER SOURCES, MODULES, AND SYSTEMS
• THz, RF, millimeter-wave and sub-millimeter-wave high-power sources
• THz, RF, millimeter-wave and sub-millimeter-wave modules
• THz, RF, millimeter-wave and sub-millimeter-wave systems
• power supplies and support circuits, electronics, optoelectronics, systems.

TERAHERTZ, IR, RF, MILLIMETER-WAVE, AND SUB-MILLIMETER-WAVE PASSIVE COMPONENTS
• metamaterials, plasmonics, and artificial materials
• optics, lenses, gratings, waveguides, photonic crystal structures and metamaterials, couplers, wire guides, other components
• using graphene to control polarization of IR and THz waves.

MATERIALS FOR THZ AND GHZ DEVICES
• metamaterials, plasmonics, and artificial materials
• linear and nonlinear optical materials and devices
• organic and inorganic source and modulator materials and devices
• RF, millimeter-wave and sub-millimeter-wave materials, devices and fabrication processes
• THz and/or GHz material systems including devices, detectors and sensors
• silicon (Si)-based
• silicon carbide (SiC)-based
• silicon-on-insulator (SOI)-based
• gallium arsenide (GaAs)-based
• gallium nitride (GaN)-based
• indium phosphide (InP)-based
• silicon germanium (SiGe)-based
• quantum dot (QD) based including for QDs for sensors, detectors and sources
• diamond-based
• graphene-based
• other-based.

ENHANCEMENTS, IMPROVEMENTS AND ADVANCES IN RF, MILLIMETER-WAVE AND SUB-MILLIMETER WAVE GENERATION, MODULATION AND DETECTION
• RF, millimeter-wave and sub-millimeter-wave integrated photonic devices
• RF, millimeter-wave and sub-millimeter-wave and photonic integration process development
• RF, millimeter-wave and sub-millimeter-wave performance characterization
• phased-array and single-element photonically-driven antennas
• phased-array and single-element antennas, systems, concepts, approaches
• low-Vπ and wide-bandwidth modulators
• direct-driven millimeter-wave lasers and amplifiers
• millimeter-wave, sub-millimeter and THz photonic crystal devices and applications
• RF, millimeter-wave, sub-millimeter-wave and THz photonic up- and down-converters
• photonic phase locked loops
• RF, millimeter-wave, sub-millimeter-wave, and THz MMICs
• wearables
• RF, millimeter-wave, sub-millimeter-wave, high power solid-state and electronic vacuum devices.

SIMULATIONS AND MODELING
• simulations and/or modeling of RF devices, components, and/or systems
• simulations and/or modeling of millimeter-wave devices, components, and/or systems
• simulations and/or modeling of sub-millimeter-wave devices, components, and/or systems
• simulations and/or modeling of THz devices, components, and/or systems
• modeling of optical components, optical systems, imaging systems, wave propagation, modes, Gaussian beam characteristics, couplers, antennas, performance limitations, software designs
• artificial intelligence, machine learning, augmented reality, virtual reality.

SPECTROSCOPY AND FREQUENCY METROLOGY
• terahertz and/or sub-millimeter spectroscopy, DNA segment identification, cell abnormalities, cancer identification and screening, imaging, medical and dental detection
• infrared spectroscopy
• identification of biological and chemical detection and fingerprinting
• identification of hazardous, explosive, and/or dangerous materials
• identification of chemical or biological threats
• scalar and vector network analysis at sub-millimeter and terahertz frequencies
• measurement techniques at sub-millimeter, millimeter, and terahertz frequencies
• identification of organic and inorganic compounds using terahertz and/or sub-millimeter wave spectroscopy
• high-speed and/or high-resolution spectroscopic techniques, methods, approaches
• artificial intelligence, machine learning, augmented reality, virtual reality, etc.
• novel approaches, systems, designs, techniques, reflection, sensitivity, applications.

BIOMEDICAL APPLICATIONS
• DNA identification, burn analysis, tissue abnormality identification, pharmaceutical, dentistry, medical, clinical, commercial applications
• cancer, burn, and/or water content detection; high sensitivity, high contrast, etc.
• biological and/or physiological aspects and/or related effects of RF, millimeter-wave, sub-millimeter-wave and/or THz
• artificial intelligence, machine learning, augmented reality, virtual reality, etc.
• imaging techniques, methods, hardware design, strategies, technologies and techniques.

COMMUNICATION AND SENSING SYSTEMS
• terahertz, RF, millimeter-wave and sub-millimeter-wave communications, media characteristics, wireless communications, inspection systems, detection systems, screening systems
• RF, millimeter, sub-millimeter-wave and microwave links
• RF, millimeter-wave, sub-millimeter-wave photonic communication and sensing systems
• Internet of things (IOT) sensors, detectors and communication interfaces, protocols and implementations including but not limited to wireless sensors and wireless communications.

IMAGING AND SECURITY
• RF imaging devices, components, and/or systems
• millimeter-wave imaging devices, components, and/or systems
• sub-millimeter-wave imaging devices, components, and/or systems
• THz imaging devices, components, and/or systems
• RF, millimeter-wave and sub-millimeter-wave active and passive imaging systems
• artificial intelligence, machine learning, augmented reality, virtual reality, etc.
• x-ray imaging including components, systems, power supplies, applications, techniques, etc.

ASTRONOMY, SPACE AND OTHER AREAS OF PHOTONICS, LIGHT, AND MATTER
• imaging techniques, ultra-sensitive detection, applications, programs
• artificial intelligence, machine learning, augmented reality, virtual reality, etc.
• satellite communications
• space based electronics and devices
• satellite components and systems
• space and satellite qualifications and testing
• radiation hard electronics
• high-energy physics and related topics
• fusion and related topics
• fission and related topics.

INNOVATIONS
• new or novel terahertz, RF, millimeter-wave and sub-millimeter, microwave concepts, systems, applications
• new or novel developments in THz or sub-millimeter waves including teaching, instruction, course offerings, simulations, conceptional and/or experimental procedures, implementations, concepts, etc.
• wearables, implantable, etc.

POWER SUPPLIES AND ELECTRONIC POWER CONDITIONERS
• high-power power supplies
• low- and ultra-low-power power supplies
• low-noise power supplies
• high- and ultra-efficient power supplies
• associated power protection systems
• energy-efficient power supplies
• novel designs and architectures
• specialized power electronics
• portable power supplies
• power supplies tailored for photonics and/or RF, mm-wave and/or THz applications
• power supplies for lighting applications including solid state lighting such as LEDs, OLEDs and quantum dots.

ORGANIC ELECTRONICS
• DC and low frequency
• high frequency
• novel designs and architectures
• passive and active addressable arrays
• low power
• modulated configurations
• sensing, detection, and/or emitting
• organic light-emitting diodes and associated electronics
• lighting therapy using solid state lighting including microLEDs, LEDs, OLEDs and quantum dots
• solid state lighting including microLEDs, OLEDs and quantum dots.

continued next page
INFRARED DEVICES, COMMUNICATIONS, SOURCES, SENSORS, AND DETECTORS
- infrared amplifiers
- infrared imaging devices, components, and/or systems
- infrared sources devices, components, and/or systems
- infrared sensors, detectors and/or associated devices, components, and/or systems
- infrared communications devices, components, and/or systems
- infrared active and passive components and/or systems
- infrared advances including components, systems, power supplies, applications, techniques, etc.
- infrared applications
- wearables
- artificial intelligence, machine learning, augmented reality, and virtual reality.

SMALL SATELLITES
- systems
- components
- detectors
- sensors
- instrumentation
- communications
- concepts
- implementations.

ADDITIVE MANUFACTURING AND 3D PRINTING
- additive manufacturing and/or 3D printing of/for RF, microwaves, millimeter-waves, THz and/or infrared devices, systems, communications, etc.
- additive manufacturing and/or 3D printing of/for electronics and materials
- 2D for electronics and/or materials for RF, microwaves, millimeter-waves, THz, and/or infrared
- chip-level waveguides
- chip-level frequency comb generator
- nanotubes including graphene films for RF, microwaves, millimeter-waves, THz, and/or infrared
- other quantum technologies, devices, and applications
- comb generators for use in electronics, RF, microwaves, millimeter-waves, THz, and/or infrared.

Save the date

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(All Confs Except OE506, OE801, OE802, and OE803)

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: spie.org/opto21call
This conference will focus on recent advances and challenges in GaN and related materials and electronic, switching, and optical devices based on them, including potential applications. An important objective of this conference is to provide a forum for dissemination of the latest results on current and emerging topics in GaN and related materials and devices, as well as paving the way for in-depth discussions among participants. The topics of discussion will include, but not be limited to, scientific and technological advances in all aspects of materials, including bulk GaN, ternaries and quaternaries, heterostructures, micro- and nanostructures, new substrates and new methodologies employed for alternative substrates, materials physics, devices (electronic and optical), device physics, novel devices such as microcavity based ones, processing, and particularly devices with emphasis on light-emitters in the visible and UV regions of the optical spectrum, novel growth techniques, and device reliability.

Topics for presentation and discussion will include but not be limited to:

**EPITAXIAL GROWTH, BULK GROWTH, AND GROWTH OF NANOSTRUCTURES**

MOVPE, MBE, HVPE, substrates (patterned and planar, alternative orientations), solution growth methods, very high pressure and not so high pressure, or by any other method, precursors for dopants and constituents, epitaxial lateral overgrowth, alloys, low-dimensional systems, growth, and exploitation of non-polar and semi-polar surfaces, high-resistivity bulk GaN.

**DEFECTS AND DOPING**

Defect structures at the structural and electronic energy levels, electronic states associated with group dopants (mainly involuntary kinds), techniques applied to illuminate the local nature of impurities, surface states; surface passivation; interface states; DLTS and its variants, low-frequency noise techniques, microscopy (TEM, electron holography, STM, AFM and its variants), x-ray analysis, novel dopants. Impact of defects and doping on electronic and optical devices.

**OPTICAL, ELECTRICAL, AND MATERIAL CHARACTERIZATION**

Structural, electrical, and optical characterization of nanostructures, bulk material, optical and electrical devices, both on macroscopic and microscopic scales. For optical characterization, this includes photoluminescence, electroluminescence, cathodoluminescence, optical-emission imaging, non-linear optics, microscopic spectroscopy, experimental measurement of energy band parameters and band structure, etc. For electrical characterization it includes Hall effect, carrier transport, magneto-transport, photoconductivity, thermally stimulated currents, etc., and for structural characterization, x-ray, TEM and its variants, local charge mapping, AFM detection of dislocations, stacking faults, etc.

**III-NITRIDE MICRO- AND NANOSTRUCTURES, PHOTONIC INTEGRATED DEVICES (PIC), AND MOEMS**

Model nanostructures such as self-assembled and ordered quantum dots, quantum wires and related low-dimensional structures, for microstructures micro-rods, and micro-fins structures, and optoelectronic and electronic devices based on these structures are among the topics envisioned for discussion. Naturally these structures include waveguides, photonic crystals, and micro-cavities for linear and non-linear optics, both as stand alone and as components for photonic integrated devices. Micro-opto-electronic-mechanical systems employing the particular properties of III-nitrides will also be among the topics of discussion.

**FUNDAMENTAL PHYSICS OF III-NITRIDE SEMICONDUCTORS**

Band structure (including quantum well heterostructures), quantum size effects, strain effects, excitons (free and bound), polaritons, nanocavities, plasmon-ic effects, surface phenomena, polarization effects, piezoelectric effects, theoretical models.
Gallium Nitride Materials and Devices XVI (OE107 continued)

IN-PLANE LASER DIODES, SLEDs, AND VCSEL FOR THE SHORT VISIBLE TO UV SPECTRAL REGION

Topics to be covered include development, characterization, and modelling of laser diodes, superluminescent diodes (SLEDs) and vertical cavity surface emitting lasers (VCSEL) for high optical power with applications to even material processing, high speed modulation for applications such as virtual/augmented reality, VR/AR/MR and big data communication, efficient illumination, low power consumption, and single longitudinal mode operation. Extending the wavelengths toward longer and shorter wavelengths, in particular into UV will be considered.

ELECTRONIC DEVICES

Vertical GaN devices, and HFETs, and dielectric-gated FETs for high-power switching and RF as well as high-frequency applications inclusive of topics such as hold-voltage and on-current, hot-phonon and hot-electron effects, power dissipation, degradation/reliability, pathways for degradation and ways to improve reliability along with application are solicited. Moreover, biological sensors, field-emitters, integrated GaN electronics, and integration with other technologies are among the topics to be discussed.

VISIBLE AND UV LEDS, MICRO-LEDS, AND DETECTORS

Topics include single photon-sources to high-power and high-efficiency LEDs, with a special emphasis on micro-LEDs for display and other applications, and on photo diodes including avalanche varieties, inclusive of devices physics (theory and simulations), device processing, and applications in general as well as specific ones aimed at lighting, automotive, displays, bio-medicine, spectroscopy, quantum optics, etc. Topics particularly on efficiency, reliability, and extending wavelengths toward longer and shorter wavelengths, e.g. for UV LEDs and optical detectors will be featured.

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Oxides are remarkable multifunctional materials with a huge range of emerging applications spanning domains as diverse as solid-state lighting, photovoltaics, nanotechnology, biotechnology, capacitors, transparent electronics, next-generation memories, sensors, and spintronics. A number of breakthroughs over the past few years have driven an exponential surge in research activity in the field. This interdisciplinary conference is intended to cover (but not be limited to) oxide materials for use as transparent conductors, opto-semiconductors, ferroelectrics, piezoelectrics, dielectrics, multiferroics, superconductors, magnetic oxides, metamaterials, and various electrical/optical components. We would like to encourage you to take part in this conference and submit an abstract. Presentations are solicited on the following topics:

- bulk growth and characterization
- thin films and multilayers (growth, interfaces, surfaces, and properties) of oxides, and oxides/non-oxide
- 2D materials
- nanostructured growth, properties and applications
- amorphous oxide semiconductors
- highly-correlated complex systems
- phase transitions
- modeling and theoretical studies
- structural, mechanical, electrical, chemical, thermal, magnetic, and optical properties
- degenerate conduction
- plasmonics
- doping and band gap engineering
- photon-induced phenomena in complex oxides
- optical studies
- processing, etching, annealing, and formation of ohmic and Schottky contacts
- applications including: LEDs, lasers, photovoltaics, TCOs, transparent electronics, FETs, TFTs, memories, spintronics, scintillators, sensors, actuators, SAW devices, MEMS, optical coatings plus devices for high temperature, RF, radiation hard, microwave, and radar applications
- integration with Si + beyond Si oxide electronics
- gate-controlled metal-insulator transitions in oxides
- multilayered oxide structures for optical materials
- graphene/graphene oxide/hybrids of graphene and oxides
- nanoionics
- energy management: production, harvesting, and storage
- “green” processing of materials/devices (cost-competitive biocompatible materials and processes).

Building on the last two years of excellent contributions, we are again calling for special focus sessions on Ga2O3 and perovskite solar cells.
2D Photonic Materials and Devices IV (OE109)

Conference Chairs:
Arka Majumdar, Univ. of Washington (USA); Carlos M. Torres Jr., Naval Information Warfare Ctr. Pacific (USA); Hui Deng, Univ. of Michigan (USA)

Program Committee:
Ritesh Agarwal, Univ. of Pennsylvania (USA); Igor Aharonovich, Univ. of Technology, Sydney (Australia); Joshua R. Hendrickson, Air Force Research Lab. (USA); Maiken H. Mikkelsen, Duke Univ. (USA); Nathaniel P. Stern, Northwestern Univ. (USA); A. Nick Vamivakas, The Institute of Optics, Univ. of Rochester (USA); Feng Wang, Univ. of California, Berkeley (USA); Fengnian Xia, Yale Univ. (USA); Xiaodong Xu, Univ. of Washington (USA)

Atomically thin 2D materials have recently emerged as attractive optoelectronic materials. These materials exist in metallic, dielectric, and semiconducting form, and exhibit unusual properties, such as high-mobility of carriers in graphene, strong light-matter interactions in transition metal di-chalcogenides, and anisotropic optoelectronic properties in black phosphorus. These materials can be transferred either on top of each other to form heterostructures, or on any substrate for integrated photonics, as the interaction is via Van-der Waals force and no explicit lattice matching is required. This unique property enables new device applications, especially in materials platform, where growing quantum wells will be very difficult. The field of 2D materials, and optoelectronics devices based on 2D materials, has seen rapid advances in exciting experimental demonstrations and theoretical results. This conference aims to provide an international forum for presenting the latest results and reviewing technologies relevant to new physics and devices using 2D materials. Prospective authors are invited to submit original experimental and theoretical papers dealing with enabling technology for 2D materials-based device integration in nanophotonics.

Topics of particular interests include:
- 2D material optoelectronics and integrated nanophotonics
- chalcogenides and boron nitride monolayer-based devices
- phononics with 2D heterostructure
- quantum optoelectronics with 2D materials
- graphene optoelectronics
- atomically thin classical and quantum light sources
- 2D material nonlinear optical devices and cavity-enhanced nonlinear optics
- valleytronics with 2D materials
- 2D material exciton-polariton
- scalable growth of 2D material for large-scale integration
- emerging 2D materials, including ferroelectric and ferromagnetic materials.

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PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Submit your abstract today: spie.org/opto21call
The scope of this conference is to highlight the continuous growth and advancement of the field of integrated optics, its applications, devices, materials and technologies by soliciting papers that report progress in all branches of waveguide-based integrated optics (IO). Recent advances in fabrication technologies including novel and advanced material deposition methods of optical materials and high-resolution lithographic and replication techniques have made possible unprecedented control of the properties and geometry of waveguide (WG) structures and IO elements down to the level of nanoscale. This has enabled a broad range of new functionalities in light generation and amplification, frequency conversion, spectral filtering and analysis, routing, splitting, multiplexing, optical interconnects, laser locking as well as advanced integration techniques for diverse applications. Continuing innovations in waveguide optics provide supporting platforms for integrated sensors, bio-applications, signal processing, optical communications, microwave photonics, deep learning, artificial intelligence and optofluidics, to name a few.

This conference aims to provide an interdisciplinary update in this fast evolving field and encourage exchange of ideas in diverse topics ranging from waveguide materials down to the nanoscale structures, to active and passive devices and applications, manufacturing technologies and theoretical and experimental supporting tools. The topics include, but are not limited to:

- **WG optics of conventional and novel materials** (polymers, hybrid sol-gel materials, semiconductors, dielectrics, ceramics, glasses, ferroelectrics, hybrid and photorefractive materials, chalcogenides, and subwavelength-engineered metamaterials)
- **nonlinear (NL) WG optics** (parametric conversion in WG devices, periodically-poled materials and poling techniques, NL materials for waveguide optics, applications of three- and four-wave mixing, stimulated scattering, self- and cross-phase modulation in WG devices, supercontinuum generation and applications involving propagation instabilities, filamentation and optical solitons in WG devices)
- **integrated planar waveguide circuits for fiber optics, signal processing, microwave photonics, optical interconnects, datacom and telecom applications**
- **complex photonics in WG, photonic crystals, waveguide arrays, integrated resonators, PT and other synthetic structures or devices**

- **integrated optical circuits based on hybrid/heterogeneous integration approaches, including III-V silicon, wafer and chip bonding, and co-packaging**
- **light-sound integrated circuits** (forward and backward Brillouin scattering, waveguide structures for light and sound, applications of acousto-optic integrated devices, acoustic bandgap devices, coupling of light and sound in silicon, chalcogenides and other material platforms, surface acoustic wave devices, analysis and simulations of acousto-optic integrated devices)
- **integrated devices for quantum information processing and communications, for entanglement, squeezed states and other non-classical states of light, quantum metrology, integrated devices for quantum sources and single photons emitters and detectors**
- **integrated magneto-optics and integration of magneto-optical materials on platforms** (non-reciprocal devices, modulators, sensors)
- **integrated devices for deep learning and artificial intelligence**
- **biophotonics and waveguide sensors** (evanescent-field based devices, grating and microring resonators, WG spectrometers, bio-applications, lab-on-a-chip)
- **rare-earth-doped integrated devices** (optical amplifiers, CW and pulsed lasers, use of nano crystals as rare-earth sensitizers) for telecom, sensing and other applications
- **on-chip amplifiers and lasers** (high gain, high efficiency, low threshold, narrow-linewidth, tunable, different wavelength ranges, short pulses, novel laser performance)
- **optofluidics** (co-integration of microfluidic and IO), light guiding into fluids, integrated optical tweezers and other applications
- **integrated subwavelength grating metamaterial and diffractive photonics** (advances in submicron and nanoscale fabrication technologies and WG.IO-applications based thereupon: active, passive, reconfigurable diffractive and holographic processing devices, arrayed-waveguide gratings, WG echelle gratings, resonant guided-mode gratings, grating couplers, Bragg gratings, integrated holographs)

**continued next page**
Integrated Optics: Devices, Materials, and Technologies XXV
(OE201 continued)

• enabling photonics integration technologies (dense and large scale component integration; hybrid and monolithic integration of light sources, SOAs, modulators, (de)multiplexers, optical isolators, mode converters, feedback resistant lasers, etc.)
• IO circuits based on the physics and technologies of guided-wave nano-optics (gap and index guidance in photonic crystal structures, new guidance concepts, metamaterials, slowlight waveguides, photonic wires, nanopatterning and nanoreplication, nanostructural integration)
• low-power-consumption integrated photonics for data-center applications
• surface plasmon waveguides and devices (plasmonic transmission lines, nanoparticle waveguides, hybrid dielectric-plasmonic structures, plasmonic WG sensors)
• testing and metrology of IO devices: surface analysis and structural characterization, spectroscopic and optical testing methods, reliability and life-testing
• theory and modeling supporting the above-mentioned areas (numerical modeling methods and design tools, propagation phenomena in special WG structures, optical guided-wave circuit design, thermal and mechanical modeling of IO systems).

The authors are kindly requested to select one of the following categories at the time they submit their abstracts:
• integrated sensors
• nonlinear photonics
• subwavelength metamaterial photonics
• novel waveguides
• photonics integration
• novel materials
• plasmonics
• planar waveguide circuits
• integrated quantum optics
• integrated microwave photonics
• sources, modulators, and detectors
• deep-learning and artificial intelligence.

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Smart Photonic and Optoelectronic Integrated Circuits XXIII (OE202)

Conference Chairs: Sailing He, KTH Royal Institute of Technology (Sweden), Zhejiang Univ. (China); Laurent Vivien, Ctr. for Nanoscience and Nanotechnology, CNRS, Univ. Paris-Sud, Univ. Paris-Saclay (France)

Program Committee: Pavel Cheben, National Research Council Canada (Canada); Ray T. Chen, The Univ. of Texas at Austin (USA); Jaime Gomez Rivas, Technische Univ. Eindhoven (Netherlands); Chennupati Jagadish, The Australian National Univ. (Australia); Stefan A. Maier, Imperial College London (United Kingdom); Lorenzo Pavesi, Univ. degli Studi di Trento (Italy); Joachim Piprek, NUSOD Institute LLC (USA); David V. Plant, McGill Univ. (Canada); Andrew W. Poon, Hong Kong Univ. of Science and Technology (Hong Kong, China); Ali Serpengüzel, Koç Univ. (Turkey); Bertrand Szelag, CEA-LETI (France); Augustine M. Urbas, Air Force Research Lab. (USA); Dries Van Thourhout, Univ. Gent (Belgium); Alan X. Wang, Oregon State Univ. (USA); Jian Wang, Huazhong Univ. of Science and Technology (China); Qian Wang, Huawei Technologies Co., Ltd. (China); Michael R. Watts, Massachusetts Institute of Technology (USA); Lin Yang, Institute of Semiconductors, Chinese Academy of Sciences (China); Rui Q. Yang, The Univ. of Oklahoma (USA)

Papers are solicited in the area of optical or photonics integrated circuits (PICs) and optoelectronic integrated circuits (OEICs) for smart or intelligent systems. Optical, photonic, optoelectronic, electronic, and/or biological devices are addressed to address the issues of functionality, performance, reliability, scalability and cost in an increasingly complex and connected world with dynamic environments that can benefit from smart solutions comprising integrated micro- or nanoscale circuits with possible artificial intelligence.

Demands for greater bandwidths have driven the telecom and datacom research and development communities to realize complex optoelectronic integrated circuits such as transceivers, switching systems, low chirp optical sources, and multichannel optical distribution systems. The integration of multi-wavelength laser arrays, monitoring photodiodes, and drivers is becoming a reality in the communications arena. Other emerging fields include 3D time of flight (TOF) sensing/scanning, real-time 3D imaging/mapping, 3D printing, holographic displays, smart pixel arrays, neural networks, optical computing, optical data storage, medical diagnostics, chemical/biological sensing, and object detection, tracking, identification, and classification.

The increased level of integration in recent years has resulted in an increased level of miniaturization. The scientific and technological issues and challenges concerning the micro/nano/quantum-scale integration of optoelectronic devices, circuits, and systems include the size effect, proximity effect, energy confinement effect, microcavity effect, single photon effect, optical interference effect, high field effect, noise effect, quantum optical effect, nonlinear effects, and chaotic noise effects. Optical alignment effects, and chaotic noise effects. Optical alignment, between miniature devices, minimizing interconnection lossses, and maintaining optical modes between devices, are important issues and require careful consideration. Scientists and engineers from academic institutions, research laboratories, and the industry are strongly encouraged to submit papers in the following areas:

- physics, theory, design, modeling, simulation, and scaling of photonic integrated circuits (PICs) and optoelectronic integrated circuits (OEICs)
- PIC/OEIC materials (semiconductors, graphene, glasses, polymers, ferroelectrics, magnets, metals, biomaterials, DNA, molecules, etc.)
- integration, interconnection, fabrication, assembly, packaging, characterization, and roadmap of micro/nano silicon and compound semiconductor photonic and optoelectronic devices
- electronics and photonics convergence on a silicon CMOS platform
- integration of different photonic and optoelectronic structure types (dols, wires, wells, planar, free space, 1D/2D/3D photonic bandgap devices, plasmonic devices, etc.)
- integration of miniature (micro/nano/quantum-scale) photonic and optoelectronic devices, circuits, and systems; photonic/optoelectronic system on a chip; VLSI/ULSI photonics and optoelectronics
- integration of novel devices using micro-rings, micro-disks, micro-spheres, micro-cavities, nano-optic/nano-photonic devices, nano-lasers, nano-detectors, nano-wires, plasmonics, and metamaterials
- integration and assembly of micro- and nanoscale imaging systems
- integration and assembly of micro- and nanoscale smart sensor and detector systems
- miniaturization and integration of THz and microwave photonic devices, components, and systems
- integration and interconnection of different functions (lasers, amplifiers, detectors, sensors, modulators, isolators, circulators, switches, attenuators, couplers, phased arrays, multi/demultiplexers, filters, wavelength converters, polarization controllers, PMD/CD compensators, control electronics, etc.)
- integration of dynamic devices actuated through thermo-optic, electro-optic, acousto-optic, magneto-optic, and all-optical mechanisms
- monolithic and hybrid integration of optical, photonic, optoelectronic, electronic, and biological devices
- parallel and serial integration of optical, photonic, and optoelectronic devices
- fabrication and processing techniques (UV/ deep UV/X-ray/e-beam lithography, casting, molding, embossing, etching, passivation, etc.)
Smart Photonic and Optoelectronic Integrated Circuits XXIII (OE202 continued)

- alignment, tolerance, coupling, and interconnections; designs for alignment tolerance relaxation
- optical interconnection and integration on photonic PCBs
- integration on novel flexible and rigid substrates
- assembly and packaging approaches and processes
- characterization (optical, electrical, optoelectronic, thermal, structural, etc.)
- standards, quality, reliability, qualification, and certification
- components, modules, subsystems, and systems
- smart PIC- and OEIC-based systems with artificial intelligence
- smart systems of special interest include nodes in self-healing optical communication networks, light detection and ranging (LiDAR) sensing systems with object detection, tracking, identification, and classification capability
- applications: communications, quantum information services, computing, data storage, sensing, scanning, imaging, mapping, displays, printing, industrial automation, robotization, autonomous vehicles, etc.
- subsystem-on-chip for bio-detection, sensing and communications.

Refinement of existing schemes as well as novel concepts are within the scope of this solicitation. Authors are also encouraged to emphasize design-for-manufacturing criteria and manufacturing methods that enable the commercial deployment of PIC- and OEIC-based smart systems.

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The field of silicon photonics continues to develop for an increasing number of application areas. Technology allowing the combination and miniaturization of optoelectronic and electronic devices in an integrated silicon platform is the key to providing affordable smart components for many different markets. Integration offers reduced component costs and size reduction in photonic networks, particularly for the emerging markets. Examples continue to appear of integrated systems and sub-systems, with the Data Center application leading the technology pull. Similarly, smart measurement and sensing systems using integrated optoelectronics could be miniaturized and made available at low cost, allowing wide deployment for medical, biological, and environmental screening applications. The need for optical interconnects on ULSI circuits is now an essential part of the roadmap for Si microelectronics.

As systems emerge, there is an increased focus on implementation, interfacing, and test. Consequently work is increasing on automated wafer scale testing systems, packaging, and passive alignment, all realized at low cost. Silicon is the ideal platform for integration of smart components. Large diameter, high quality silicon, and silicon-on-insulator (SOI) wafers are available at a relatively low cost and provide many chips per wafer, even for large area opto-electronic circuits. Furthermore, the move to 300mm wafers only exacerbates the need for high quality test and packaging in order to reach mass market applications. The maturity of Si process technology provides leverage for manufacture of optoelectronic components and provides many ways to integrate optoelectronic and electronic components on the same substrate. For optical interconnects, other important topics are the overall circuit architectures, the total power consumption, and the technology for optical wiring, couplers, modulators, emitters, and detectors, I/O, multiplexing and increasing levels of integration.

The emergence of the field of mid infra-red Silicon Photonics also opens many opportunities for this maturing technology to be applied into another buoyant application area, perhaps more naturally aligned with silicon based technology to be applied into another buoyant application area, perhaps more naturally aligned with technology, CElastic and photonic integrated circuits)

Topics of particular interest are silicon photonics devices and systems based on:
- monolithic integration in Si and group-IV alloys (electronic and photonic integrated circuits)
- hybrid integration (heterostructures, flip-chip bonding, and multi-chip modules on silicon)
- optical interconnect technology for ULSI
- wafer scale testing
- packaging
- optical I/O
- towards high-volume manufacturing
- systems and energy
- cost models for Si Photonics
- 300nm-technology implementation
- low-power devices
- LEDs
- lasers
- detectors
- amplifiers
- wavelength converters
- mux/demux (rings, arrayed waveguide gratings, etc.)
- modulators
- interposers
- passive alignment
- switches
- waveguides (SOI, SI02/Si, SU-8, or sol-gel materials, including design innovation for high-index contrast Si-nanophotonic waveguide systems)
- coupling
- Si photonics crystals and micro-cavities
- lab-on-a-chip
- optoelectronic sensors on Si for measurement and screening in biological, clinical, genomics, proteomics, and environmental applications
- micro-opto-electro-mechanical systems (MOEMS)
- mid-infrared applications
- quantum photonics
- long-wavelength communications.
PHOTONIC INTEGRATION

Optical Interconnects XXI (OE204)

Conference Chairs: Henning Schröder, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration IZM (Germany); Ray T. Chen, The Univ. of Texas at Austin (USA)

Program Committee: Maggie Yihong Chen, Texas State Univ. (USA); Darrell Childers, US Conic Ltd. (USA); Hamed Dali, Omega Optics, Inc. (USA); Alan F. Evans, Corning Incorporated (USA); Douwe H. Geuzbroek, LionIX International BV (Netherlands); Kobi Hasharomi, Dust Photonics (Israel); Ruth Houbertz, Muiltrophoton Optics GmbH (Germany); Marika P. Immonen, TTM Technologies, Inc. (Finland); Takaaki Ishigure, Keio Univ. (Japan); Mikko Karpinnen, VTT Technical Research Ctr. of Finland Ltd. (Finland); Tobias Lamprecht, vario-optics ag (Switzerland); Matthias Lorenz, AEMtec GmbH (Germany); Christopher T. Middlebrook, Michigan Technological Univ. (USA); Peter O’Brien, Tyndall National Institute (Ireland); Bert Jan Offrein, IBM Research – Zürich (Switzerland); Hyo-Hoon Park, KAIST (Korea, Republic of); Ignazio E. M. Piacentini, ficonTEC Service GmbH (Germany); Nikos Pleros, Aristotle Univ. of Thessaloniki (Greece); Richard C. A. Pitwon, Univ. of St. Andrews (United Kingdom); Jie Qiao, Rochester Institute of Technology (USA); Brandon W. Swatowski, Cornell Univ. (USA); Peter O’Brien, Michigan Technological Univ. (USA); Ian H. White, Univ. of Cambridge (United Kingdom); Chris G. Wu, Corning Incorporated (USA); Xiaochuan Xu, Harbin Institute of Technology Shenzhen Graduate School (China)

Papers are solicited in the following areas:

SUBSTRATE-BASED OPTICAL INTERCONNECT TECHNOLOGIES
- photonic substrate packaging and embedding for optoelectronic and micro-optical components
- optical interconnect design and system architectures, end-to-end link modelling and simulation
- electronic/photonics printed circuit boards and optical backplanes, panel level integration of photonics
- optical waveguide, substrate guided, flexible, lay-in fiber and free space optical interconnects
- machine-to-machine, board-to-board, chip-to-chip, intra-chip optical interconnects
- silicon/glass/silicon nitride/polymer made photonic interposers
- heterogeneous integration on chip/chipled-level using photonic short reach interconnects (polymer/glass/SiN)
- trends in ultra-short reach optical links
- additive manufacturing and 3D-writing of optical interconnects
- laser structuring of optical waveguides and interfaces in glass and polymer.

PIC INTEGRATION AND OPTICAL COUPLING
- silicon photonics, SiN, Ge, SiGe, III-V device integration
- high-speed and near-IR vertical-cavity surface-emitting lasers
- small size and low loss waveguide-based active and passive devices
- heterogeneous and monolithic device integration including silicon photonics
- advances in chip-to-waveguide or chip-to-fiber coupling schemes including: grating coupler, adiabatic taper and butt-coupling approaches
- subwavelength gratings for on-chip interconnect applications
- 2D membrane-based devices
- photonic crystals and surface plasmonic waveguides for interconnect applications
- new regimes involving surface plasmons or optical polaritons
- implementation of optical interconnects in Si CMOS process compatible environment
- measurement and testing methods for hybrid electronic/photonics assemblies
- reliability assessment of optical interconnects, sub-systems and electronic/photonics assemblies.

PARALLEL OPTICAL LINK MODULE TECHNOLOGIES
- single-mode conversion in data centers
- data communication systems with parallel optical links and active optical cables
- integration and packaging technologies for parallel on-board transceivers
- parallel optical engines for on-board data communication
- optical bus architectures for on-board interconnects
- ultra-low cost and ultra-low power optical links using novel laser and photodiode array components for interconnect applications
- fiber optical connectors and coupling approaches
- assembly and alignment of arrayed components
- free-space parallel optical interconnect
- mid-IR optical interconnects for free space communications and sensing
- massively distributed optical interconnects suitable for neuromorphic optical computing.

OPTICAL COMMUNICATION AND COMPUTING IN NEXT-GENERATION SYSTEMS
- optical interconnect solutions for quantum communication and quantum computing
- advanced photonic integration technologies for computercom applications
- rack- and enclosure scale disaggregation
- optically enabled hyperconverged infrastructures
- multi-tier optical connectivity
- optical packet and circuit switch technologies and architectures for data centers
- WDM and SDM switching technologies and architectures for intra-data-center interconnections
- power-efficient optical computing for data centers
- future demands for parallel optics in data center: inter-rack, inter-board and inter-chip
- implementation timeline for integrated photonics roadmaping.

continued next page
MATERIALS FOR PHOTONIC PACKAGING AND INTERCONNECTS
• advanced photonics packaging materials
• thin glass for board, modules and panel-level packaging
• polymers and organic/inorganic hybrid materials for optical interconnects
• novel nanostructures and nanotechnologies for optical interconnects
• AuSn bonding for flip-chip with highest precision
• structured fibers, multicore fibers and other novel optical fibers
• integrated meta-material applications
• nanomaterials and applications
• novel bonding materials and processes.

MICRO-OPTIC ASSEMBLY AND HYBRID PHOTONIC MICROSYSTEM MANUFACTURING
• micro-optic component assemblies and integrated micro-optics
• 3D optical routing and assembly of coupling elements
• new connectors and novel light coupling approaches
• quantum sensor integration, NV cells and atom trap devices
• prototyping for advanced interconnect fabrication
• new fiber optical integration/coupling/connectorization techniques
• fiber handling –optic components, holograms, gratings and aspherical lenses
• advanced micro
• reflective, refractive and diffractive micro-optic elements and micro-optical systems
• active optical alignment and assembly automation
• passive micro-optic alignment techniques
• solder reflow compatible connectivity
• interconnect reliability, qualification and test
• multimode fiber for single mode optical biosensing systems including coronavirus detection.

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Save the date
Photonic Instrumentation Engineering VIII (OE205)

Conference Chairs: Yakov Soskind, Apple Inc. (USA); Lynda E. Busse, U.S. Naval Research Lab. (USA)

Program Committee: Ishwar D. Aggarwal, The Univ. of North Carolina at Charlotte (USA); James B. Breckinridge, Caltech (USA); James T. A. Carriere, Coherent, Inc. (USA); Catalin Florea, Honeywell International Inc. (USA); Sanjay Gangadhara, Zemax, LLC (USA); G. Groot Gregory, Synopsys, Inc. (USA); Daniel C. Herrmann, Synopsys Inc. (USA); Gary B. Hughes, California Polytechnic State Univ., San Luis Obispo (USA); Jacob B. Khurgin, Johns Hopkins Univ. (USA); Patrick C. Mock, RAM Photonics, LLC (USA); Kristen Norton, Synrad, a Novanta Co. (USA); Nada A. O’Brien, Facebook Inc. (USA); S. Craig Olson, L-3 Sonoma EO (USA); Lucas Redlarski, Mitutoyo Research Ctr. Europe B.V. (Netherlands)

This conference provides an interdisciplinary forum for engineers and scientists to present their ideas, designs, case studies, and success stories in photonic instrumentation development. It also offers attendees an invaluable insight into the latest developments and trends in the continuously-evolving field of photonic instrumentation engineering.

The significant expansion and proliferation of photonic instrumentation has been driven by continuing advancement in several key areas: the discovery of new physical phenomena, the commercial availability of a wide variety of sophisticated optoelectronic devices, and the development of powerful simulation and analysis techniques. These improvements have led to technology that can exploit photons or optical fields and their interactions with matter across a wide expanse of scientific and industrial application areas. Today’s instrumentation developers are able to take advantage of a broad range of commercially available components for the generation, propagation, control, and detection of photons and optical fields for achieving system level design and development goals.

Contributions at both the component, sub-system, and system levels in the multi-disciplinary area of photonic instrumentation engineering are desired. Consideration will be given to submissions showing system-level interactions between various components and subsystems of photonic instruments, rather than the development of individual photonic components. Paper submissions related to the integration of optical radiation sources with various types of electro-optical components with adjustable properties, photo-detectors, as well as with active and passive photonic modules for the conditioning, delivery, and control of the propagating radiation, are considered for this conference. Emerging photonics technologies and instrumentation schemes are certainly welcome.

Theoretical and experimental papers are solicited in the following and related areas:

APPLICATIONS OF PHOTONIC INSTRUMENTS
• photonic instrumentation for astronomy and imaging
• consumer applications: optical data storage, augmented and virtual reality devices, information and head-up displays, optical sensors
• metamaterials, plasmonic and nanostructures in photonic instruments
• hyperspectral imagery and laser spectroscopy
• laser instrumentation in material processing and manufacturing, laser-matter interactions, micro-machining and multi-photon fabrication
• instrumentation for optical lithography, alignment and proximity sensors
• medical, pharmaceutical, and bio-photonics instrumentation
• metrological instrumentation: interferometry, profilometry, polarimetry, reflectometry, scatterometry, polarimetry, super-resolved microscopy, optical tomography
• nanofabrication and self-assembly, tracking and micromanipulation
• remote sensing and probing techniques, LIDAR and time-of-flight systems, multi-aperture and computational imagery systems.

DESIGN, DEVELOPMENT, AND FABRICATION OF PHOTONIC INSTRUMENTS
• novel photonic instrumentation architectures, design approaches and concepts, design techniques for super-resolution, wavefront and polarization control
• design and integration of metamaterials, plasmonic, and nanostructures in photonic instruments
• modeling, tolerance analysis and optimization of photonic instruments
• innovative packaging and integration solutions
• agile, reconfigurable and real-time-controlled photonic instruments
• photonic instruments in extended spectral domains, including THz, EUV, and x-ray.
LIGHT SOURCES IN PHOTONIC INSTRUMENTATION
• novel coherent and incoherent sources
• photonic instrumentation employing unique properties of laser radiation
• light control in spatial, spectral and temporal domains
• laser beam shaping and structured light; ToF sources
• interaction between emitters and other system’s components.

METROLOGY, CHARACTERIZATION, AND FABRICATION OF PHOTONIC INSTRUMENTS
• photonic metrology instrumentation on the nano, micro, and macro levels
• metrology systems based on super-resolution, wavefront control and polarization techniques
• system-level evaluation and performance verification
• calibration schemes and reference measurement techniques
• alignment and compensation techniques in photonic instrumentation.

SENSORS AND RUGGEDIZED SYSTEMS
• innovative sensor architectures and their applications
• multi-spectral and broadband sources, supercontinuum sources and SLEDs, sources based on optical excitation, rapidly tunable and spectrally adjustable sources
• high sensitivity, high dynamic range and broadband detectors and detection techniques
• fiber sensors and sensor networks
• sensor miniaturization and functional integration
• photonics sensors for harsh and industrial environments
• sensors for display, virtual and augmented reality, and interactive gaming and learning.

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Save the date
Engineered nanostructures (e.g., photonic crystals, metamaterials) offer the possibility of controlling and manipulating the propagation of electromagnetic (or acoustic) waves within a given frequency range. The existence of photonic (and phononic) bandgaps in such nanostructures makes it possible to fabricate ultrasmall optical (and acoustic) devices like lasers and cavities. These cavities find applications in several novel fields, including cavity quantum electrodynamics (QED) and quantum communications.

Optical and acoustic metamaterials other unique material platform in which the geometrical engineering of the nanostructure allows for novel properties (e.g., negative refraction) that cannot be found in conventional bulk materials.

Plasmonic structures are another set of structures that have recently demonstrated unique capabilities to control the propagation of light. Such structures are formed by engineering the metallic structures either separately or when combined with dielectric materials. Plasmonic structures provide unique capabilities that cannot be matched by conventional bulk materials.

The ability to control the propagation of electromagnetic (or acoustic) waves using engineered nanostructures (e.g., metamaterial and metasurfaces) makes them very attractive for the development of new set of devices that take advantage of the novel optical (or acoustic) properties of these structures. The ability for custom designing the electromagnetic mode patterns, frequencies and numbers opens up the possibility of novel devices (imaging systems, miniature lasers and detectors at different frequencies, switches, filters, interconnects, etc.) and interesting physics. The outstanding potentials of such meta-devices to revolutionize communications, sensing, information, and energy technologies along with the existence of several challenges in design, optimization, fabrication, and characterization of such structures have inspired extensive research activities in the field of engineered nanostructure materials and devices.

The number of design parameters in engineered nanostructures like metasurfaces have necessitated new inverse design techniques to take maximum advantage of their unique capabilities. While mathematically rigorous approaches have been developed in the last two decades, new approaches based on machine learning and deep learning algorithms for both knowledge discovery and design of engineered nanostructures have emerged in the last few years. These techniques can potentially result in new classes of structures for practical application.

It is the aim of this conference to bring together scientists and engineers worldwide to review and discuss state-of-the-art developments and future trends of engineered nanostructure materials and devices. Among such structures, photonic and phononic crystals, metamaterials, and plasmonic structures will be extensively covered.

We encourage authors to submit abstracts and manuscripts demonstrating their research achievements concerning, but not limited to, the following topical areas:

- fabrication of 2D and 3D structures (photonic and phononic crystals, plasmonic structures, metasurfaces, and metamaterials)
- numerical methods for the analysis of engineered nanostructure materials and devices
- deep-learning and machine-learning techniques for inverse design and knowledge discovery in engineered nanostructures
- photonic and phononic crystal waveguides, cavities, and active devices
- novel plasmonic devices and their characterization
- new metasurface-based structures for imaging and computing applications
- novel photonic and optoelectronics materials (e.g., 2D materials, phase-change materials, graphene, diamond)
- hybrid CMOS-compatible material platforms through integration/bonding of active, nonlinear, or other materials with CMOS-compatible substrates
- active and reconfigurable nanostructures and metamaterials
- nonlinear effects in plasmonic structures, photonic crystals, and metamaterials
- novel phenomena in engineered nanostructures
- acoustic metamaterials
- negative index properties
- super-dispersive nanostructures for wavelength demultiplexing and spectroscopy
- dispersion engineering in photonic and phononic nanostructures
- novel applications of plasmonic and dielectric metamaterial/metasurface devices (e.g., sensing, communications)
- applications of resonance effects in engineered nanostructures for lasing, cavity QED, and quantum computation
- photonic crystal fibers; supercontinuum generation
- integration of photonic, phononic, plasmonic, fluidic, and/or electronic functionalities on a single substrate.
High Contrast Metastructures X (OE302)

Conference Chairs: Connie J. Chang-Hasnain, Univ. of California, Berkeley (USA); Jonathan A. Fan, Stanford Univ. (USA); Weimin Zhou, U.S. Army Combat Capabilities Development Command (USA)

Program Committee: Andrea Alù, The City Univ. of New York Advanced Science Research Ctr. (USA); Markus-Christian Amann, Walter Schottky Institut (Germany); Amir Arbabi, Univ. of Massachusetts Amherst (USA); Il-Sug Chung, Ulsan National Institute of Science and Technology (Korea, Republic of); Andrei Faraon, Caltech (USA); Mikhail A. Kats, Univ. of Wisconsin-Madison (USA); Fumio Koyama, Tokyo Institute of Technology (Japan); Arseniy I. Kuznetsov, A*STAR Institute of Materials Research and Engineering (Singapore); Philippe Lalanne, Lab. Photonique, Numérique et Nanosciences (France); John R. Lawall, National Institute of Standards and Technology (USA); Tien-Chang Lu, National Chiao Tung Univ. (Taiwan); Rainer F. Mahrt, IBM Research – Zürich (Switzerland); Arka Majumdar, Univ. of Washington (USA); Bala Pesala, Council of Scientific & Industrial Research (India); Pengfei Qiao, Pinnacle Photonics (USA); Jon A. Schuller, Univ. of California, Santa Barbara (USA); Pierre Viktorovitch, Ecole Centrale de Lyon (France); Alan E. Willner, The Univ. of Southern California (USA); Ming C. Wu, Univ. of California, Berkeley (USA)

A completely new class of planar optics has emerged using subwavelength metastructures and metasurfaces with a large contrast in dielectric constants. “High-contrast metastructure” refers to this type of optical material which is formed by a planar array of coupled-resonance structures, which are defined by high refractive index contrast boundaries that have dimensions comparable to the wavelength of interest. This metastructure allows very strong light-matter interaction within the thin planar material which provides a new platform to efficiently manipulate photons. Both 1D and 2D, uniform and chirped high-contrast gratings (HCGs), metastructures and metasurfaces are demonstrated to create mirrors, lenses, filters, polarizations, birefringent elements, 3D display and many traditional bulk optical components. This has enabled simple fabrication of long-wavelength vertical-cavity surface-emitting lasers (VCSELs), dynamically tunable all-pass filters (APF) for fast optical beam steering, high-Q resonators with surface-normal and arbitrary angle output, enabling massive wafer-scale semiconductor lasers and optical filters. They are used to form hollow core waveguide for chip-scale ultra-low loss photonic devices. Vertical to in-plane waveguide coupler can be made with high efficiency for easy integration with Si-photonics circuits. Chirped HCGs are shown as excellent focusing reflectors and lenses with very high numerical apertures. Finally, simple but rigorous theoretical studies lead to intuitive device designs. The field has seen rapid advances in exciting experimental demonstrations and theoretical results. This conference aims to provide an international forum for presenting the latest results and reviewing technologies relevant to new physics and devices using high contrast subwavelength metastructures. Prospective authors are invited to submit original experimental and theoretical papers dealing with enabling technology for optoelectronic device integration either on Si, or III-V-based platforms. Topics of particular interests include incorporation of high-contrast metastructures in the following:

- metasurface optical phase masks for phase and polarization control: new concepts and applications
- 3D display and hologram: design, fabrication and applications
- optomechanics: physics and devices
- sensors and high-Q resonators
- VCSELs, tunable VCSELs and membrane lasers
- broadband mirrors, lenses, and focusing mirrors
- filters, tunable filters, WDM multiplexer and demultiplexers
- all-dielectric dissipation-less metamaterials
- zero-index metamaterials and anisotropic metamaterials
- bound states in the continuum
- photonic topological insulator
- response to both the electric and magnetic fields of light
- support of large optical chirality and anisotropy
- dispersion engineering
- spectral tailoring and management for solar photovoltaic and solar thermal applications
- slow light, fast light, and stop light devices
- optical switches and modulators
- metastructure waveguides
- nonlinear optics; coherent optical mixers
- optical amplifiers
- omni mirrors and spatial-mode filtering
- subwavelength plasmonics
- manipulation of polarization
- beam-steering devices
- novel fabrication techniques and materials
- photonic crystal devices, guided mode and leaky mode resonances.
Realization of nanostructure as active elements in functional devices requires novel synthesis methods along with unique characterization techniques and simulation methods. Of interest is the nanoscale control of geometry, location, composition, and surface interaction along with the resulting electronic and optoelectronic properties. This conference seeks to highlight the most compelling work in nanostructures. We host a unique forum where materials scientists, theorists, and device experts can exchange recent results on this focused topic. Invited papers will represent international expertise in materials synthesis, fabrication and characterization of nanostructured and quantum materials. The conference will include invited papers on nanomaterials (quantum dots, nanowires), applications in optoelectronics through new device and integration possibilities.

Contributed papers are solicited concerning growth, characterization, and modeling of the following areas:
• nanowires, quantum dots, and quantum materials
• nanoparticles and colloidal quantum dots
• 2D materials
• epitaxial growth, characterization, and modeling
• nanofabrication and nanolithography
• unique nanoscale characterization techniques
• modeling for extracting opto-/electronic properties based on material parameters
• optics of single quantum dots, ensembles, and exploratory devices
• nanoscale properties such as energy transport, nonlinear processes, and decoherence
• single-photon emitters and detectors based on quantum dots
• nanopatterning and hybrid 2D/QD integration.

Submit your abstract today: spie.org/opto21call

Save the date

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AUTHOR NOTIFICATION: 21 SEPTEMBER 2020
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MANUSCRIPTS DUE: 9 DECEMBER 2020
(Confs OE506, OE801, OE802, and OE803 Only)

MANUSCRIPTS DUE: 5 JANUARY 2021
(All Confs Except OE506, OE801, OE802, and OE803)

PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.
Advanced Fabrication Technologies for Micro/Nano Optics and Photonics XIV (OE401)

Conference Chairs: Georg von Freymann, Technische Univ. Kaiserslautern (Germany); Eva Blasco, Karlsruher Institut für Technologie (Germany); Debashis Chanda, Univ. of Central Florida (USA)

Program Committee: Cornelia Denz, Westfälische Wilhelms-Univ. Münster (Germany); Ruth Houbertz, Multiphoton Optics GmbH (Germany); Saulius Juodkazis, Swinburne Univ. of Technology (Australia); Stephen M. Kuebler, Univ. of Central Florida (USA); Mangirdas Malinauskas, Vilnius Univ. (Lithuania); Robert R. McLeod, Univ. of Colorado at Boulder (USA); Hernán R. Míguez Garcia, Institute of Materials Science of Seville (Spain); Aaron J. Pung, Sandia National Labs. (USA); John A. Rogers, Northwestern Univ. (USA); Raymond C. Rumpf, The Univ. of Texas at El Paso (USA); Winston V. Schoenfeld, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Thomas J. Suleski, The Univ. of North Carolina at Charlotte (USA); Michael Thiel, Nanoscribe GmbH (Germany); Sandra Wolff, Technische Univ. Kaiserslautern (Germany)

Conference Co-Sponsor: nanoScribe

Technologies for fabrication of optics and photonics at the micro- and nanoscale continue to advance and diversify due to rising demands for miniaturization, cost reduction, functional integration, and increased performance in optical and photonic systems. Examples include three-dimensional microoptics, topological photonics, photonic crystals, photonic metamaterials, plasmonic devices, sub-wavelength optics, microrefractive optics, diffractive optics, optical waveguides, and heterogeneously integrated active and passive micro- and nano-optical devices. These devices are playing increasing roles in a wide range of applications, including sensors, communications, imaging, biomedical, data storage, photovoltaics and other areas.

Both conventional and unconventional micro- and nanofabrication techniques serve as fundamental enablers for wide ranges of passive and active optical components and devices. To this end, this conference provides a forum for exchange of viewpoints and reports on new techniques and advances in fabrication methods for optics and photonics at the micro- and nanoscale. Applications enabled through these novel fabrication processes are also appropriate.

Topics of interest include, but are not limited to:

NON-CONVENTIONAL LITHOGRAPHY AND NOVEL APPROACHES
- two-photon processes for two-dimensional and three-dimensional micro- and nanostructures
- STED inspired lithography
- plasmonic lithography
- lithography with structured light
- nanoimprint lithography
- dip-pen lithography
- soft lithography.

LITHOGRAPHIC FABRICATION APPROACHES
- three-dimensional laser lithography, three-dimensional microprinting
- fabrication methodologies based on binary, grayscale, and interferometric techniques
- additional techniques, such as additive lithography, and lift-off processes for sub-micron patterning.

ULTRAFAST LASER MICROMACHINING
- surface and bulk micromachining for micro- and nano-optics
- fabrication of 2D and 3D waveguides
- fabrication of novel optical elements.

ELECTRON AND ION BEAM FABRICATION OF MICRO- AND NANO-OPTICS
- three-dimensional structuring
- analog and multi-exposure methods
- unique patterning and beam controls.

MATERIALS ISSUES AND TECHNOLOGIES FOR MICRO- AND NANO-OPTICS
- light-matter interaction under ultra-short laser pulses
- two- and multiphoton-absorption processes
- photochemistry under ultra-short laser exposure
- three-dimensional micro- and nano-optics and freeform surfaces
- replication in polymer, metals and other materials, novel photoresists.

PROCESSING OF NANOPHOTONIC DEVICES
- holographic lithography and multi-beam exposure methods
- nanopatterning for site selective growth
- texturing and patterning for enhanced light extraction
- fabrication of plasmonic devices
- quantum device fabrication for micro and nano-optics.

MICRO- AND NANO-OPTICAL INTEGRATION AND MANUFACTURING
- passive and/or active integration
- quality and metrology issues
- volume fabrication techniques for micro- and nano-optics and photonics.

JOINT SESSION WITH OE401 AND OE403

Advanced Fabrication using a Digital Micromirror Device or MEMS Array

Active research in the fields of advanced fabrication and MEMS Arrays, such as the digital micromirror device, have shown application and promise for implementing lithography and other forms of high precision printing. The purpose of this joint session is to explore the relationships between MEMS technology and fabrication as they relate to:

- 3D printing
- additive manufacturing
- lithography
- structured light.

continued next page
JOINT SESSION WITH OE401 AND LASE LA401

3D Printing

The purpose of this joint session is to emphasize the growing field of laser printing/fabrication of micro/nano-sized structures for optics and photonics.

BEST PAPER AWARDS

We are pleased to announce that a cash prize, sponsored by Nanoscribe GmbH, will be awarded to the best paper and best student paper in this conference. Qualifying papers will be evaluated by the awards committee. Manuscripts will be judged based on scientific merit, impact, and clarity. The winners will be announced during the conference and the presenting authors will be awarded a cash prize.

To be eligible for the Best Paper Award, you must:
• be listed as an author on an accepted paper within this conference
• have conducted the majority of the work to be presented
• submit your manuscript online by 5 January 2021
• present your paper as scheduled.

To be eligible for the Best Student Paper Award, you must:
• be a student without a doctoral degree (undergraduate, graduate, or PhD student)
• submit your abstract online, and select “Yes” when asked if you are a full-time student, and select yourself as the speaker
• when submitting your abstract, under TOPIC selection, choose “Consider for Best Student Paper Award”
• be the presenting author on an accepted paper within this conference
• have conducted the majority of the work to be presented
• submit your manuscript online by 5 January 2021
• present your paper as scheduled.

Nominations

All submitted papers will be eligible for the awards if they meet the above criteria.

Save the date

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Submit your abstract today: spie.org/opto21call
CALL FOR PAPERS

MOEMS and Miniaturized Systems XX (OE402)

Conference Chairs: Hans Zappe, Univ. of Freiburg (Germany); Wibool Piyawattanametha, King Mongkut’s Institute of Technology Ladkrabang (Thailand), Michigan State Univ. (USA); Yong-Hwa Park, KAIST (Korea, Republic of)

Program Committee: Caglar Ataman, Univ. of Freiburg (Germany); Robert Brunner, Ernst-Abbe-Hochschule Jena (Germany); Pei-Yu Eric Chiou, Univ. of California, Los Angeles (USA); David L. Dickensheets, Montana State Univ. (USA); Jan Grahmann, Fraunhofer-Institut für Photonische Mikrosysteme IPMS (Germany); Ulrich Hofmann, OQmented GmbH (Germany); Ki-Hun Jeong, KAIST (Korea, Republic of); Diaa A. M. Khalil, Si-Ware Systems (Egypt); David G. Lishan, Plasma-Therm LLC (USA); Veljko Milanović, Mirrorcle Technologies, Inc. (USA); Yves-Alain Peter, Polytechnique Montréal (Canada); Zhen Qiu, Michigan State Univ. (USA); Niels Quack, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Stefan Richter, Carl Zeiss AG (Germany); Anna Rissanen, Aalto Univ. (Finland); Hamdi Torun, Northumbria Univ. (United Kingdom); Frédéric Zamkotsian, Lab. d’Astrophysique de Marseille (France); Guangya Zhou, National Univ. of Singapore (Singapore)

Conference Co-Sponsor:

Highly miniaturized optical and photonic systems are at the heart of an increasingly wide spectrum of applications and coalesce a rich expanse of diverse technologies into components and assemblies with exceptionally high functionality yet very compact dimensions.

In fields as diverse as medicine, telecommunications, transportation or consumer electronics, optical and photonic microsystems play an essential enabling role and are poised to become a key technology for areas ranging from LiDAR to medical imaging and diagnostics to advanced displays.

This conference addresses all aspects of optical and photonic microsystems, from materials and fabrication of micro-optical and photonic components, through assembly and packaging, to systems and applications. We invite papers on novel materials as well as new and unconventional fabrication processes for optical and photonic devices; innovative and original passive optical and active photonic components; and wide-ranging cutting-edge applications for hybrid and integrated optical microsystems.

Typical areas of interest include, but are not limited to:

**MATERIALS AND FABRICATION FOR MICRO-OPTICAL COMPONENTS**
- semiconductors, polymers, liquids and glass
- micromachining and MEMS processes
- additive and subtractive manufacturing
- hybrid assembly and integration
- micro- and nano-contact and roll-to-roll printing.

**OPTICAL AND PHOTONIC COMPONENTS AND SUBSYSTEMS**
- refractive and diffractive micro-optics
- tunable lenses, filters, mirrors, and light emitters
- optofluidic devices and systems
- devices for beam shaping, steering and switching
- spectroscopic components
- wavefront modulators.

**SYSTEMS AND APPLICATIONS**
- biomedical, endoscopic and multi-modal imaging and diagnostics
- LiDAR and remote sensing
- miniaturized confocal, OCT, Raman, photoacoustic and other microscopy systems
- portable and wearable medical diagnostics and health monitoring
- 2D, 3D and holographic displays and imaging
- distributed sensing, environmental monitoring and quality control.

**JOINT SESSION WITH OE402 AND OE403**

**TOPIC: Spatial Light Modulators**
Various technologies including MEMS, LCD, lasers, LED, and OLED are under development to build high-performance projection and flat panel display systems. They are needed to provide large display sizes or high light efficiency in comparison to integrated displays for mobile phones, digital cameras, biomedical instruments, and personal digital assistants with ever decreasing size. This special session will give a comprehensive overview about recent development activities and results of the various light modulating technologies from modulating devices to module/system integration for novel applications.

**JOINT SESSION WITH OE402 AND BIOS BO103**

**TOPIC: Endoscopic Microscopy**
This special joint session is in conjunction with BiOS conference BO103: Endoscopic Microscopy. Papers are solicited that address the unique challenges to deliver high-fidelity microscopic imaging of tissue with a miniaturized instrument platform. Example topics include mechanisms for distal beam scanning, focus control and aberration correction using MOEMS devices, MEMS actuators or electrowetting optics; proximal scanning based on DMD or other SLM technologies; novel optical assembly and alignment techniques; highly corrected miniature optical systems.

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continued next page
**BEST PAPER AWARDS**

We are pleased to announce that a cash prize, sponsored by Mirrorcle Technologies, Inc., will be awarded to the best paper and best student paper in MOEMS and Miniaturized Systems. Qualifying papers will be evaluated by the awards committee. Manuscripts will be judged based on scientific merit, impact, and clarity. The winners will be announced during the conference and the presenting authors will be awarded a cash prize.

**To be eligible for the Best Paper Award, you must:**
- be listed as an author on an accepted paper within this conference
- have conducted the majority of the work to be presented
- submit your manuscript online by 5 January 2021
- present your paper as scheduled.

**To be eligible for the Best Student Paper Award, you must:**
- be a student without a doctoral degree (undergraduate, graduate, or PhD student)
- submit your abstract online, and select “Yes” when asked if you are a full-time student, and select yourself as the speaker
- when submitting your abstract, under TOPIC selection, choose “Consider for Best Student Paper Award”
- be the presenting author on an accepted paper within this conference
- have conducted the majority of the work to be presented
- submit your manuscript online by 5 January 2021
- present your paper as scheduled.

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**Save the date**

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Submit your abstract today: [spie.org/opto21call](http://spie.org/opto21call)
Emerging Digital Micromirror Device Based Systems and Applications XIII (OE403)

Conference Chairs: John Ehmke, Texas Instruments Inc. (USA); Benjamin L. Lee, Texas Instruments Inc. (USA)

Program Committee: Karine Blandel, IN-VISION Digital Imaging Optics GmbH (Austria); Michael R. Douglass, Texas Instruments Inc. (USA); Jeremy Gribben, Ajile Light Industries Inc. (Canada); Roland Höfling, VIALUX GmbH (Germany); Alfred Jacobsen, Visitech Engineering GmbH (Germany); Yuval Kapellner Rabinovitz, EKB Technologies Ltd. (Israel); Badia Koudsi, Optecks, LLC (USA); Daniel L. Lau, Univ. of Kentucky (USA); Beiwen Li, Iowa State Univ. of Science and Technology (USA); Jinyang Liang, Institut National de la Recherche Scientifique (Canada); Alex Lyubarsky, Texas Instruments Inc. (USA); Jorge Moguel, Digital Light Innovations (USA); Eric Pruett, Texas Instruments Inc.; Hakki H. Refai, Optecks, LLC (USA); Brandon A. Sosa, Greenlight Optics, LLC (USA); Bin Yang, Duquesne Univ. (USA); Song Zhang, Purdue Univ. (USA); Renjie Zhou, The Chinese Univ. of Hong Kong (Hong Kong, China); Karel J. Zuzak, Univ. of Texas Southwestern Med. Ctr. (USA), The Lab. of Biomedical Imaging and Engineering, LBI-51, LLC (USA)

Conference Co-Sponsor:

The Digital Micromirror Device (DMD) was conceived at Texas Instruments in 1987, following a decade of work on analog deformable-mirror and cantilever-mirror devices. This particular optical MEMS or MOEMS device has been applied most famously to digital cinema projection systems, enterprise projectors and highly portable personal displays, all of which were enabled by DLP® technology. The DMD has been commercially available since 1996 leading to hundreds of products and innovative research projects spanning consumer, industrial, medical and automotive markets.

As was evident by this well-attended conference at Photonics West 2020, the DMD and associated evaluation modules are enabling many exciting new applications and equipment beyond traditional display systems. By bringing together scientists, technologists, and developers, the goal of this conference is to highlight new and interesting means of applying DLP technology to solve problems across various markets.

Technical areas of particular interest include, but are not limited to:

**PROGRAMMABLE PATTERNING AND ADVANCED IMAGING SOLUTIONS**
- 3D metrology, machine vision, and factory automation
- compressive sensing
- computational imaging
- hyperspectral imaging
- security and surveillance
- spectroscopy (including mobile spectroscopy)
- volumetric scanning.

**DISPLAY SOLUTIONS**
- 3D displays (light-field, autostereoscopic, volumetric, multi-views, and holographic)
- augmented reality, virtual reality, and mixed reality
- automotive interior (head-up displays, interior displays, interior lighting)
- automotive exterior (headlight illumination, exterior lighting)
- intelligent lighting or displays.

**MANUFACTURING SOLUTIONS**
- additive manufacturing / 3D printing
- coding and marking
- direct imaging lithography
- industrial printers and exposure systems.

**MEDICAL DEVICES**
- biochemical visualization
- microscopy
- ophthalmology.

**LIGHT MANIPULATION**
- beam steering / wave-front shaping
- optical micromanipulation
- spectrally tunable light sources.

**OTHER**
- NIR applications
- optical telecommunications
- UV applications.

**JOINT SESSION WITH BIOS BO500 AND OE403**
Biomedical Imaging and Cell Manipulation using a Digital Micromirror Device or MEMS Array

This special joint session is in conjunction with BiOS conference BO500: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues. The utilization of the DMD and other Optical MEMS arrays to manipulate light has numerous medical applications ranging from cancer detection to operating room aids to the manipulation of individual cells. Papers are solicited that address the uses of a DMD and other Optical MEMS arrays with:
- 3D medical visualization
- confocal microscopes
- cytomters
- hyperspectral imaging
- image-guided intervention
- microscopy
- optoelectronic tweezers
- ophthalmology
- organs on a chip
- oxygenation measurements
- phototherapy
- selectable wavelength light sources
- spectroscopy (including mobile spectroscopy)
- structured light or 3D imaging
- tissue illumination.

continued next page
MOEMS-MEMS IN PHOTONICS

Emerging Digital Micromirror Device Based Systems and Applications XIII (OE403 continued)

JOINT SESSION WITH OE401 AND OE403
Advanced Fabrication using a Digital Micromirror Device or MEMS Array
Active research in the fields of advanced fabrication and MEMS Arrays, such as the digital micromirror device, have shown application and promise for implementing lithography and other forms of high precision printing. The purpose of this joint session is to explore the relationships between MEMS technology and fabrication as they relate to:
• 3D printing
• additive manufacturing
• lithography.

JOINT SESSION WITH OE702 AND OE403
AR/VR Displays using DMDs or other SLM Devices
AR/VR is an exciting area of development. Much progress hinges on the capabilities of light modulators. The purpose of this joint session is to explore and demonstrate the capabilities of different light modulators.

BEST PAPER AWARDS
We are pleased to announce that a cash prize, sponsored by Texas Instruments DLP Products, will be awarded to the best paper and best student paper in Emerging DMD-Based Systems and Applications. Qualifying papers will be evaluated by the awards committee. Manuscripts will be judged based on scientific merit, impact, and clarity. The winners will be announced during the conference and the presenting authors will be awarded a cash prize.

To be eligible for the Best Paper Award, you must:
• be listed as an author on an accepted paper within this conference
• have conducted the majority of the work to be presented
• submit your manuscript online by 5 January 2021
• present your paper as scheduled.

To be eligible for the Best Student Paper Award, you must:
• be a student without a doctoral degree (undergraduate, graduate, or PhD student)
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Microfluidics, BioMEMS, and Medical Microsystems XIX (B0307)

Conference Chairs: Bonnie L. Gray, Simon Fraser Univ. (Canada); Holger Becker, microfluidic ChipShop GmbH (Germany)

Conference Co-Chair: Bastian E. Rapp, Univ. of Freiburg (Germany)

Program Committee: Hatrice Altug, Ecole Polytechnique Fédérale de Lausanne (Switzerland); Brian W. Anthony, Massachusetts Institute of Technology (USA); Jalone Tirapan Azpíroz, IBM Research - Brazil (Brazil); Colin Dalton, Univ. of Calgary (Canada); Yolanda Fintschenko, FounderTraction (USA); Albert K. Henning, Aquarian Microsystems (Canada); Yu-Cheng Lin, National Cheng Kung Univ. (Taiwan); Yuehe Lin, Pacific Northwest National Lab. (USA); Ian Papautsky, Univ. of Illinois at Chicago (USA); Thomas Stieglitz, Albert-Ludwigs-Univ. Freiburg (Germany); Sindy Kam-Yan Tang, Stanford Univ. (USA); Hayden K. Taylor, Univ. of California, Berkeley (USA); Julian Thiele, Leibniz-Institut für Polymerforschung Dresden e.V. (Germany); Bernhard H. Weigl, Intellectual Ventures Management, LLC (USA)

SPECIAL ABSTRACT REQUIREMENTS

Submissions to this conference must include:

- 100-word text abstract (for online program)
- 250-word text abstract (for abstract digest)
- 2-page extended abstract (for committee review only). The extended abstract must be submitted as a separate PDF document limited to two pages, including tables and figures. Include author names and affiliations; text; any figures, tables, or images; and sufficient data to permit committee review.

The purpose of this conference is to provide an international technical forum to showcase recent advances in microfluidics, BioMEMS, and medical Microsystems. Microfluidic devices and systems have created a tremendous interest in many application fields, including life sciences, point of care (POC) diagnostics, and environmental applications. They offer many advantages over the existing macroscale systems, including compact size, disposability, higher speed and parallelism of analyses, increased functionality and decreased sample/reactant volumes. In the life sciences, recent research efforts have focused on bio/chemical analyses, pharmaceutical high-throughput systems, and biomaterial surface modification. The interaction of Microsystems with living cells and tissues opens a pathway to novel methods of medical diagnostics and therapeutics. Thus, the range of interests has expanded from the molecular scale over single cells to more complex biological systems, and finally, living organisms. Further, several conventional methods in medical engineering for diagnosis and therapy have also been shifting towards miniaturization and MEMS technologies, including minimally invasive surgery, in vivo and ex vivo monitoring, and smart implants. Last but not least, environmental applications have focused on developing inexpensive sensors for in situ monitoring of contaminants in the environment for public safety or measuring a person’s exposure to environmental contamination.

For many of these applications, microfluidics and other MEMS technologies are essential, as they provide the functional basis of many research tools as well as commercial devices and applications. Thus, over the past several years, there has been a significant increase in the activities associated with understanding, development, and application of micromechanical and microfluidic devices and systems for BioMEMS and medical Microsystems.

Papers are solicited on the following major topics and other related subjects:

MICRO/NANO FLUIDIC COMPONENTS
- fluid delivery, transport, and control
- micro -valves, -pumps, -mixers, and -reactors
- nanofluidic devices and systems
- microdroplet generation and manipulations
- micro-heating/cooling devices
- emerging microfluidic approaches (inertial microfluidics, electrofluidics, paper/textile microfluidics)
- optofluidics
- CAD, modeling, and analysis.

MICROFABRICATION TECHNOLOGIES FOR MICROFLUIDICS AND BIOMEMS
- polymer microfabrication methods
- emerging fabrication technologies (e.g., 3D printing/additive manufacturing)
- fluidic modules and interconnects
- fluidic packaging and assembly
- microstructuring of organic materials
- functional materials for microfluidics and BioMEMS
- surface texturing and modification.

APPLICATIONS OF MICROFLUIDICS, BIOMEMS, AND MEDICAL Microsystems
- point-of-care (POC) medical monitoring and diagnostics
- nano bio/medical sensors
- optofluidics, on-chip waveguides and optical detection
- cell-based sensing devices and systems, flow cytometry
- implantable medical Microsystems
- sensors and systems for environmental monitoring
- sensors and systems for in vitro/in vivo monitoring and diagnosis
- cells, tissues, and organisms on-a-chip
- microfluidic-based drug development and analysis.

BEST STUDENT PAPER AWARD

A cash prize sponsored by microfluidic ChipShop GmbH will be awarded to the best student paper.

Judging and Requirements

Presentations and manuscripts will be judged based on scientific merit, impact, and clarity. Candidates for the award need to be the presenting author, a full-time student, must have conducted the majority of the research presented in the paper, and must submit their manuscript by the deadline in January 2021.

Nominations

To be considered, submit your abstract online, select “Yes” when asked if you are a full-time student, and select yourself as the speaker.
Adaptive Optics and Wavefront Control for Biological Systems VII (BO505)

Conference Chairs: Thomas G. Bifano, Boston Univ. (USA); Sylvain Gigan, Lab. Kastler Brossel (France); Na Ji, Univ. of California, Berkeley (USA)

Program Committee: Jacopo Bertolotti, Univ. of Exeter (United Kingdom); Martin J. Booth, Univ. of Oxford (United Kingdom); Wonshik Choi, Korea Univ. (Korea, Republic of); Tomáš Čižmár, Univ. of Jena (Germany); Meng Cui, Purdue Univ. (USA); John M. Girkin, Durham Univ. (United Kingdom); Benjamin Judkewitz, Charité Universitätsmedizin Berlin (Germany); Ori Katz, The Hebrew Univ. of Jerusalem (Israel); Peter A. Kner, The Univ. of Georgia (USA); Pablo Loza-Alvarez, ICFO - Institut de Ciencies Fotòniques (Spain); Allard P. Mosk, Utrecht Univ. (Netherlands); Rafael Piéton, Univ. of Colorado Boulder (USA); Laura Waller, Univ. of California, Berkeley (USA); Monika Ritsch-Marte, Medizinische Univ. Innsbruck (Austria); Lei Tian, Boston Univ. (USA)

SPECIAL ABSTRACT REQUIREMENTS

Submissions to this conference must include:
• 100-word text abstract (for online program)
• 250-word text abstract (for abstract digest)
• 2-page extended abstract (for committee review only). The extended abstract must be submitted as a separate PDF document limited to two pages, including tables and figures. Include author names and affiliations; text; any figures, tables, or images; and sufficient data to permit committee review.

All submissions will be reviewed by the Program Committee to determine acceptance. Extended abstracts will be used only for the purpose of review, and will not be published.

Wavefront engineering has greatly expanded the capability of optical microscopy and measurements in biological systems. Recent breakthroughs in measuring and controlling optical wavefront have led to many important applications, including deep tissue microscopy with improved imaging quality and depth, optical tweezers with sophisticated shape and momentum distribution, and three-dimensionally patterned optogenetic excitation. This conference will bring together leading experts in a variety of research fields that employ innovative wavefront control technologies for biomedical applications.

Technical papers concerning the following aspects of adaptive optics are appropriate for submission and consideration:
• adaptive optics for microscopy, optical coherence tomography and ophthalmology
• guide-star probes for wavefront measurement and light guiding in biological tissues
• imaging neural connectivity and function deep in brain tissue
• focusing light through scattering tissues (optimization, transmission matrix)
• imaging with multimode fibers
• wavefront shaping for photoacoustic and acousto-optical imaging
• applications of time-reversal and optical phase conjugation in biological imaging
• mesoscopic effects and their applications to imaging and light delivery (open channels, memory effect)
• shaped beams for light sheet and structured illumination microscopy
• computational optical imaging techniques
• wavefront shaping devices (deformable mirrors, spatial light modulators, MEMS, active lenses).

Save the date

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Submit your abstract today: spie.org/opto21call
Many of the promises of the quantum information revolution are expected to be enabled by photonics. Whether it is quantum computing, quantum communication, or even quantum simulation applications, photonics will be a key player.

In quantum computing, photonics will likely be needed for applications ranging from short distance links within a quantum processor to long distance links to enable distributed quantum processing. This is in addition to frequency translation or transduction needed to convert from frequencies optimized for one component’s operation to frequencies optimized for another. Such photonic utility applies equally to quantum communication and quantum-enabled communication. Of much interest is the development of the many components necessary to make quantum computation and quantum communication a practical reality. These include basic hardware such as nonclassical sources (single-photon sources) and single-photon detectors, along more complex hardware like optical memories, components to mediate photon-photon interactions, and quantum repeaters.

Also, of interest for computation and communications is the advance of software, algorithms, and simulations that improve efficiency, fidelity, enable error correction, and reduce the current stringent requirement placed on hardware components. In other words, needed is the development of quantum methods that are compatible with the non-ideal state of existing hardware.

Papers are solicited on the following and related topics:

• quantum computation
• quantum communication and quantum internet
• quantum simulation
• quantum algorithms
• quantum memory
• quantum teleportation
• quantum repeaters and quantum cryptography
• optically controlled neutral-atom-based quantum information processing
• optically controlled NV diamond-based quantum information processing
• radio-frequency components for superconducting quantum computers
• optical aspects of trapped ion quantum information processing
• quantum error correction
• quantum-enhanced or quantum-enabled communication
• space-based, free-space, and fiber-based quantum communication
• quantum optical entanglement and hyperentanglement for computational and communication links
• quantum interfaces and frequency conversion or transduction between optical frequencies and between optical and microwave, acoustic, and material systems
• hybrid structures combining source, processing, and detection components
• optomechanics for quantum information processing
• single-photon source components based on nonlinear materials such as parametric down-conversion, 4-wave mixing, as well as isolated quantum systems such as color centers, quantum dots, rare-earth atoms, single atoms or ion, optical cavities, etc.
• single-photon detection components based on semiconductor and superconductor systems and detection processing techniques that provide new nonclassical capabilities
• single-photon processing components, such as waveguides, nanofiber, nanotube, nanoparticles plasmonics, etc. with particular attention to scalability
• optical aspects of quantum computing, materials, methods, and algorithms.
The objective of this conference is to bring together researchers whose expertise covers the entire spectrum of technological advances and applications in the field of optical, opto-atomic, opto-molecular, opto-ionic and entanglement enhanced precision metrology.

Precision metrology (PM) deals with the ability to detect and quantify miniscule changes in the ambient environment. It encompasses various forms such as temperature and magnetic field, as well as stress, strain, position, time, rotation, force, acceleration, gravitation, and so on. In addition to practical applications, precision metrology is an important tool for exploring the frontiers of fundamental physics and seeking evidence of phenomena beyond the Standard Model. Examples include the search for permanent electric dipole moment of elementary particles, variations in fundamental constants, search for dark matter and dark energy, possible role of gravitation in the decoherence of macroscopic quantum superpositions with spatial separations, violation of the Newtonian law of gravitational attraction at very short distances, precision tests of General Relativity, and so on.

Interferometers (optical and atomic) are among the most suitable devices for PM as they provide the ability to detect extremely small changes in the optical/quantum phase, which can be associated with the variation of the desired parameter/quantity. Among the means for enhancing the sensitivity of interferometers is dispersion control and engineering, where particularly steep dispersion profiles are desired for this purpose.

Many different systems are currently being investigated in order to achieve optimal performances for these applications. Numerous techniques and physical systems have been studied for controlling and engineering the dispersion properties of an effective medium. Steep positive dispersion has been demonstrated by conventional electromagnetically induced transparency (EIT) in a lambda system, population pulsations in a two-level system, Raman and Brillouin gains, wave mixing in photorefractive media, photonic bandgap structures, coupled micro-resonators, and so on. Realizing steep negative dispersion, on the other hand, requires systems such as dual peaked Raman gain, dual pumped Brillouin gain in a fiber, coupled whispering gallery resonators, and photorefractive media, among others. Some important technological developments for advancing these systems include rubidium loaded hollow core fiber and Arrow waveguide, tapered fiber and SiN waveguides embedded in hot and cold rubidium vapor, dynamically adjustable photonic crystal structures, etc.

A specific example for enhanced PM using steep dispersion engineering is utilizing it for obtaining very slow and very fast group velocities. Slow light process can be employed to enhance the precision of relative rotation sensing and spectrally resolved interferometry. The fast light process, on the other hand, can be used to realize an absolute rotation sensor with a sensitivity that is orders of magnitude better than that of a conventional gyroscope. A fast light enhanced gyroscope may be sensitive enough to detect the gravitational frame-dragging effect territorially, via measuring the Lense-Thirring rotation. Furthermore, a white light cavity (WLC) realized via making use of negative dispersion can be employed to enhance the sensitivity/bandwidth product of the next-generation interferometer being developed for detecting gravitational waves. Beyond the relatively simple case of group velocity control, more complex dispersion profiles enable controlling the shapes of optical pulses and facilitates various applications.

Traditionally, interferometry (including dispersion effect) has been investigated in passive systems. However, it is also important to investigate such effects in active media, particularly in a laser. One example is the superluminal laser, which can be realized by using a gain medium with a dip in the gain profile. In particular, it has been shown that such a laser may be the ideal system for fast-light enhanced sensitivity in measuring a broad range of effects, including rotation, acceleration/vibration, magnetic fields, temperature, and so on. It may also be possible to realize a gravitational wave detector using such a laser as well. It is also possible to realize a subluminal laser, with a steep peak in the gain spectrum. Such a laser is also likely to have important properties, such as extreme robustness to perturbations, and ultra-narrow quantum noise limited linewidth. As such, it can be used in some recently proposed experiments for detecting dark matter. In order to optimize the utilization of the superluminal and subluminal laser, it is also important to study, theoretically and experimentally, the quantum effect limited noise properties thereof.
As evident from the discussions above, PM can benefit dramatically by dispersion engineering which allow for tailored phase control. However, similar effects based on multilevel atomic, molecular or ionic (both atomic and molecular) resonances can also be used in general for PM, without necessarily making use of dispersion effects explicitly. Thus, the scope of this conference includes a sub-set of PM that makes use of optically induced transitions in atomic, molecular or ionic media. This sub-area of opto-atomic precision metrology includes, but is not limited to, coherent population trapping based clocks and magnetometers in vapors or cold atoms, optical clocks using frequency combs, optically pumped microwave atomic clocks, optical ion clocks, ring laser gyroscopes using atomic gases, including those employing fast-light effects, laser induced atomic interferometry for rotation sensing, gravimetry, gravity gradiometry and magnetometry. Broadly speaking, any PM technology that employs atomic, molecular or ionic resonances excited by electromagnetic waves would be under the purview of this call, irrespective of the part of the spectrum occupied by the waves. As such, devices such as nuclear magnetic resonance (NMR) based gyroscopes would also be of interest. Also, of interest are new ideas of gravitational wave detection using atomic interferometry, fast-light enhanced gravitational wave detection, and superluminal ring-laser based vibrometers and accelerometers.

Use of quantum entanglement, in various forms, can enable enhancement of sensitivity far beyond the standard quantum limit, for many devices, including optical interferometers, atomic interferometers, atomic clocks, ionic clock, and atomic magnetometers. Well-known examples of entanglement-enhanced PM technology includes optical squeezing for optical interferometers, including gravitational wave detectors, and imaging, and spin squeezing for atomic interferometers, atomic clocks, atomic magnetometers, and optical clocks. Non-linear effects are needed for generating both optical squeezing and spin squeezing. Any effort in this regard, requiring the use of electromagnetic waves in any part of the spectrum, would fall under the purview of this program.

List of topics:
- atomic clocks and atomic magnetometers using coherent population trapping in vapors or cold atoms or other optical techniques
- optical clocks, atomic and ionic, using frequency combs
- optically-pumped microwave atomic clocks
- laser-induced atomic interferometry for rotation sensing, gravimetry, gravity gradiometry, and magnetometry
- ring laser gyroscope using atomic gases
- NMR gyroscopes
- spin squeezing for atomic clocks, atomic interferometers, and magnetometers any other precision metrology application
- optical squeezing for interferometry, gravitational wave detection, imaging and any other precision metrology application
- qubits bases quantum logic employing optical techniques for precision metrology
- gravitational wave detection using dispersive or atomic interferometry
- search of permanent electric dipole moment of elementary particles
- search for variations in fundamental constants
- search for dark matter and dark energy
- search for violation of Newtonian law of gravitational attraction at short distances
- gravitationally induced decoherence of macroscopic quantum superpositions with spatial separations
- precisions tests of General Relativity
- materials and systems for dispersion control and engineering for precision sensing
- application of dispersion for interferometry, spectrum analysis and sensing
- use of dispersive media for rotation and acceleration sensing
- development and characterization of superluminal and subluminal cavities and lasers
- quantum noise and linewidth of superluminal and subluminal lasers
- quantum optics for precision sensing
- nonlinear optics for precision sensing
- metamaterials, plasmonics and nano-antennas for precision sensing
- periodic and semi-periodic optical structure such as coupled cavities and resonators and photonic crystals, PT symmetric systems and symmetry breaking for precision sensing
- integrated optics and nanophotonics for precision sensing
- atomic metrology
- entanglement enhanced metrology
- optomechanics and force detection
- quantum metrology.
Complex light – light with structured wavefronts, amplitudes, phase and polarization – is the common theme in a rapidly expanding number of areas in optics. Fundamental topics in this field include: classical and quantum aspects of the spin and orbital angular momentum of light; spin-orbit effects; optical beams with a structured wavefront; high-order modes and their generation methods; optical waves that have singularities of phase and non-uniform polarization; monochromatic and multichromatic optical vortices; chiral interactions; vortex loops and knots; novel propagation dynamics; the interaction between singularities; new topological effects of multidimensional space modes; the interactions of complex light with rotating optical elements and within laser cavities; the encoding of spatial modes onto light for communication, and the extent of that capacity. These studies also link significantly into other fields including optical trapping, lab-on-a-chip fluidics, microfluidics, and cold atoms. Increasing interest in quantum information has also led to developments in the multimode encoding of quantum information, quantum communication, quantum imaging, the use of orbital angular momentum quantum eigenstates for quantum computing, and new fundamental tests of quantum mechanics.

The complex light fields that can now be routinely produced also offer an unprecedented level of control for probing and exerting forces on matter at the microscale and nanoscale level. The applied topics of this conference include novel ways to manipulate matter with optical fields, and to organize, rotate, bind, channel or sort microscale or nanoscale objects. The applications of optical forces on matter generally engage light fields with boundaries and gradients: through the exchange of linear or angular momentum between light and matter, optical force fields and torques can be produced with no conventional counterpart. Optical tweezers offer exquisite control over microscale objects based on intensity and phase discontinuities, exploiting beams with vortices, singularities and other kinds of phase structure: hollow beams; tailor-made three-dimensional optical traps; sheets of light; curved focus beams and evanescent waves. The optical elements associated with the production and detection of such beam structures themselves have significant imaging applications. These methods offer new opportunities for implementation in ultrahigh resolution imaging, nanoscale probes, optical tools for biotechnology, nanofabrication and photonics, laser cooling, atom trapping, atom chips, and particle sorting. Together, these topics represent a highly active interdisciplinary field with a rich scope for new developments, notably spanning and linking fundamental and applied aspects. This conference provides a well-established annual forum for advancing the development and application of new forms and methods of generating complex optical structures. The world-wide interest in these topics brings together an international community to discuss new fundamentals, methods, techniques, and devices. Papers are solicited, focusing on any of the following or related topics:

- singular optics with phase or polarization discontinuities
- optical vortices, propagation, loops, knots and interactions
- optical angular momentum
- geometric phases
- spiral phase contrast and vortex filters
- structured Gaussian and non-diffracting optical modes
- Laguerre-Gauss, Hermite-Gauss, Bessel, Mathieu, Airy, helico-conical beams
- vector, Poincaré and space-variant polarized beams
- 3D structured light, caustics and spatial wavepackets
- pulsed- and time-structured beams, Bessel-X pulses
- optical tweezers and fiber tweezers
- holographic optical trapping and manipulation
- nanoscale and deep imaging and trapping
- optical binding
- cooling of nanoparticles
- optical manipulation using generalized phase contrast (GPC)
- imaging with structured light
- light robotics
- laser cooling, atom trapping and atom chips
- single-molecule and liquid-crystal-molecule interactions with light
- communication, encoding and cryptography with spatial modes
- quantum multimode and vector spaces
- quantum information processing and imaging with complex light
- entanglement and hyper-entanglement with spatial modes
- micro- and nano fabrication with structured light
CALL FOR PAPERS

• nano-optics and nanostructure devices
• optofluidics, optical sorting, optical fractionation
• chirality in optical fields
• chirality in particles and film nanophotonics
• near-field and evanescent wave interactions
• ultrahigh-resolution imaging
• electron vortices
• multimode propagation in fibers
• spin-orbit effects.

Building on the success of last year’s session, we are again organizing a Workshop on Experimental Methods of Complex Light. In this special session we will cover the experimental techniques of controlling optical light fields that are central to a wide variety of novel scientific advances. In small workgroups, attendees will get hands on training in several fundamental procedures and will be introduced to equipment that could be integrated into their future research. The session will be designed to accommodate both students and experienced researchers with a passion to learn new skills.

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PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.
Photonic Heat Engines: Science and Applications III (OE504)

Conference Chairs: Denis V. Seletskiy, Polytechnique Montréal (Canada); Richard J. Epstein, ThermoDynamic Films LLC (USA); Mansoor Sheik-Bahae, The Univ. of New Mexico (USA)

Program Committee: Michel J. F. Digonnet, Stanford Univ. (USA); Peter D. Dragic, Univ. of Illinois (USA); James G. Eden, Univ. of Illinois (USA); Raman Kashyap, Polytechnique Montréal (Canada); Masaru K. Kuno, Univ. of Notre Dame (USA); Peter J. Pauzauskie, Univ. of Washington (USA); Ali Sayir, Air Force Office of Scientific Research (USA); Mauro Tonelli, Univ. di Pisa (Italy); Eli Yablonovitch, Univ. of California, Berkeley (USA)

The emerging field of photonic heat engines generally encompasses the science of manipulation of thermal state of matter using or involving electromagnetic and optical radiation. In particular, the field of laser cooling of solids (optical refrigeration) and the related areas of electroluminescence refrigeration and radiation-balanced lasers have been advancing at a rapid pace. Most recently, optical refrigeration in rare-earth-doped crystals has achieved sub-100K temperatures which has subsequently led to the demonstration of the world’s first all-solid-state cryocooler. On the more fundamental side, optical refrigeration has been used to manipulate and investigate micro-mechanical systems and nano structures approaching their quantum-mechanical ground state. Mitigating and/or balancing the heat generated from quantum defects in solid-state lasers by anti-Stokes fluorescence cooling has led to novel “athermal” or radiation-balanced lasers, which promises to eliminate thermal instabilities in high power solid-state lasers. In parallel, fundamental research on optical refrigeration and electroluminescence cooling in semiconductor structures has advanced immensely in recent years. In addition to direct applications of laser cooling, the related fields of thermophotonics and thermophotovoltaics exploit efficient harvesting of electro-and photo-luminescence in semiconductors for conversion of waste or solar heat into electricity.

We encourage the submission of papers dealing with experimental and theoretical studies as well as the applications of photonic heat engines including but not limited to the fields of optical and electroluminescence refrigeration, radiation balanced lasers, thermophotonics, thermophotovoltaics and optomechanical cooling.

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PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.
The exponential increase in the amount of data created every day has led to a new era in data exploration and utilization. Optical sensors and fibers have enabled capture and transfer of massive data across both short and long distances and have formed the backbone of the internet. The field of biological research and healthcare have been transformed by photonics sensing technologies ranging from imaging, tomography to spectroscopy and vibrometry. Optical sensors are able to collect a massive amount of data at high frame rates in a non-contact fashion. These trends are fueling the need and the opportunity for artificial intelligence (AI) techniques that take advantage of the massive amount of data generated by optical sensing and metrology instruments. For instance time stretch microscopy and spectroscopy systems generate nearly 1Tb/s of continuous data. Early examples of the augmentation of optical instruments with AI include integration of artificial intelligence with various types of microscopy for classification of biological cells and tissue, AI enhancement of image resolution, improvement of optical sensors and receivers using machine learning. Augmented Reality (AR) and Virtual Reality (VR) represent the convergence of the advanced microoptics with AI and communication technology. Other promising areas are inverse design problems using AI, optical implementations of the computational primitives and neural networks including reservoir computing. In the field of cybersecurity, optics can offer means to generate and distribute keys for encrypted communication. Going forward, the convergence of AI with cutting-edge optics will have a transformative impact on communication, imaging, sensing and AR/VR systems.

The goal of this conference is to serve as a unique platform for bringing together artificial intelligence and photonics researchers from around the world to showcase the newest trends and best practices in the field. Researchers from leading companies and universities present their high-impact research and products and exchange new ideas.

Topics of interest include but are not limited to:

- metamaterials for computational sensing
- augmented reality and virtual reality
- inverse design
- optical encryption and security
- optical classification and real-time inference
- edge computing
- analog optical computing
- photonic hardware accelerators
- hardware acceleration
- time stretch instruments
- optical coding and encryption
- augmented reality
- structured illumination
- neural imaging and neural lens
- target recognition
- digital pathology
- smart microscopy
- digital holography
- super-resolution imaging
- optical data compression
- optical phase recovery
- physics-inspired algorithms
- computational sensors
- optical information theory
- nonlinear Fourier transform
- machine learning for optical sensing and metrology
- machine learning in optical receivers and networks
- computational imaging
- reservoir computing.
Quantum Sensing and Nano Electronics and Photonics XVIII

(OE506)

Conference Chair: Manijeh Razeghi, Northwestern Univ. (USA)

Conference Co-Chairs: Giti A. Khodaparast, Virginia Polytechnic Institute and State Univ. (USA); Miriam S. Vitelli, Istituto Nanoscienze (Italy)

Program Committee: Amir H. Atabaki, Massachusetts Institute of Technology (USA); Jason M. Auxier, U.S. Naval Research Lab. (USA); Henri-Jean M. Drouhin, Lab. des Solides Irradiés (France); Jérôme Faist, ETH Zurich (Switzerland); Rodrigo Ferrão de Paiva Martins, UNINOV (Portugal); Riad Haidar, ONERA (France); Amr S. Helmy, Univ. of Toronto (Canada); Sven Höfling, Julius-Maximilians-Universität Würzburg (Germany); John E. Hubbs, Ball Aerospace (USA); Jean-Pierre Huignard, Jňphoto (France); M. Salf Islam, U. of California, Davis (USA); Chennupati Jagadish, The Australian National Univ. (Australia); Woo-Gwang Jung, Kookmin Univ. (Korea, Republic of); Tsukuru Katsuyama, Sumitomo Electric Industries, Ltd. (Japan); Pedram Karahili, Northwestern Univ. (USA); Kwok Keung Law, Naval Air Warfare Ctr. Weapons Div. (USA); Giuseppe Leo, Lab. Matériaux et Phénomènes Quantiques (France); Jay S. Lewis, Defense Advanced Research Projects Agency (USA); Amy W. K. Liu, IQE Inc. (USA); Ryan McClintock, Northwestern Univ. (USA); Paul-Louis Meunier, ESTP-Paris (France); Jerry R. Meyer, U.S. Naval Research Lab. (USA); Maya P. Mikhailova, Ioffe Institute (Russian Federation); Carolyn A. Moore, U.S. Army Combat Capabilities Development Command CSISR (USA); Minh Nguyen, HRL Labs., LLC (USA); Jill A. Nolte, U.S. Naval Research Lab. (USA); Shannee Pacley, Air Force Research Lab. - Wright Patterson AFB (USA); Jean-Luc Pelourdo, Ctr. de Nanosciences et de Nanotechnologies (France); Hákan Pettersson, Halmstad Univ. (Sweden); Narasimha S. Prasad, NASA Langley Research Ctr. (USA); Edik U. Rafailov, Aston Univ. (United Kingdom); Fengbo Ren, Arizona State Univ. (USA); Isabelle Ribet-Mohamed, ONERA (France); Edward H. Sargent, Univ. of Toronto (Canada); James P. Shaffer, Transformative Quantum Technologies, RA2 (Canada); Meimei Z. Tidrow, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Joseph G. Tischler, U.S. Naval Research Lab. (USA); Cunzhu Tong, Changchun Institute of Optics, Fine Mechanics and Physics (China); Eric Tournié, Univ. de Montpellier (France)

This conference aims to provide a broad overview of the current state-of-the-art and future prospects in quantum sensing, nano-electronics, and photonics. This exciting program will cover different areas to address the challenges and progress in advanced topics such as, photonic materials and devices, artificial intelligence, neuromorphic devices, optoelectronics, quantum information, spintronics, medical science and technology, space and satellite programs, and related areas. Future advances in these areas are inspired by the use of quantum-sized effects to achieve higher efficiency and multi-functionality. By bringing together experts in physics, chemistry, materials science, engineering, national labs, and industry we will have a well-rounded view of how science has progressed towards developing integrated and versatile detection systems at the nanoscale.

Addressing many of the challenges in the fast-paced technological world, require continued scientific and technological advances in materials, optics, and photonics; therefore, the diversity of topics listed here has been chosen to encourage the exchange of ideas between the different relevant disciplines.

Contributions for this conference are solicited in the following areas:

- quantum devices, including solar cells, LED lasers, detectors, pin, avalanche photodiodes, QWIP, BIB, UV, visible, IR, FIR, etc.
- applications (quantum spectroscopy, imaging, communications, cryptography)
- new quantum structures (quantum wells, wires, dots)
- nonlinear and ultrafast optical phenomena
- hyperbolic metamaterials
- characterization (optical, electrical, structural, etc.)
- micro- and nano-fabrication technologies (e-beam lithography, deep-UV, etching, passivation, contacts, etc.)
- semiconductor quantum detectors, FPAs and ROICs for UV, visible, Type-II, MWIR, LWIR, VLWIR, THz, and applications
- nano-photonics, metamaterials, graphene, active plasmonics
- THz emitters and receivers (quantum-cascade lasers, narrow band-gap, III-nitride, etc.)
- single-photon counting detectors, FPAs and their applications
- biosensing
- terahertz nano-photonics and nanoelectronics
- graphene and other 2D materials
- near-field optics and scanning probe microscopy, and flat optics
- bio-electronics and biophotonics
- light-matter interaction at the nano-scale
- nano-structured and functionalized surfaces
- photonic bandgap structures and their applications
- neuromorphic devices, circuits, and systems
- unconventional computing, including stochastic and probabilistic methods
- high-speed and low-power memory and data storage technologies
- spin waves, magnonics, magnonic bandgap structures and their applications
- spintronic GHz to THz sources and detectors, including spin-transfer and spin-orbit torque oscillators, spin torque diodes and magnetic tunnel junctions
- topological devices and materials, including skyrmion-based devices, topological insulators and Weyl semimetals
- magneto-optical devices.
INNOVATION AWARD IN QUANTUM SENSING AND NANO ELECTRONICS AND PHOTONICS

SPIE announces the Innovation Award in Quantum Sensing and Nano Electronics and Photonics at SPIE Photonics West OPTO 2021 initiated by Prof Manijeh Razeghi. These awards will recognize the outstanding scientific contribution of students and outstanding scientists who present the most notable recent discoveries with broad impact in the areas of quantum sensing and nano electronics and photonics. These discoveries should be innovative in that they represent a new paradigm or way of thinking which will have a broad impact in their respective field. Participants will be required to give a 15-minute presentation at the evening technical event on 26 January 2021, 7:30 to 9:00 PM. The winners will be announced at the end of the Tuesday evening event. Winners will be awarded a commemorative plaque as well as a cash prize. To submit your work for consideration in this awards session, contact Prof. Manijeh Razeghi with a two-page abstract (containing working title, author(s)/affiliation(s), description, and references) by Friday 18 December 2020.

IMPORTANT: The Proceedings for this conference will be published on the SPIE Digital Library on the first day of the meeting. Manuscript submission (6-page minimum) is obligatory for participation in the conference. Note the earlier manuscript due date of 9 December 2020.

Save the date

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Submit your abstract today: spie.org/opto21call
Sustained research and development of vertical-cavity surface-emitting lasers (VCSELs) over the past thirty years has transformed VCSELs to viable components in the photonic marketplace for optical interconnects, sensors, 3D sensing, and many other applications. This conference seeks to provide a forum for interaction between VCSEL researchers, product developers, and system engineers, to disseminate information about new advances and applications. We also aim to cover the synergy with the recent developments in the area of vertical-external-cavity surface-emitting lasers (VECSEL), an emerging class of vertical-cavity lasers that shares many of the material engineering aspects with the VCSELs while offering complementary features.

General topics of interest for the conference include the design, novel fabrication, novel heterostructures, characterization, and application aspects of VCSELs and VECSELs. Papers concerning commercial activity and new applications are particularly solicited.

More specific topics of interest include:

- high-performance VCSELs (low-threshold, high-output power, high-speed modulation, frequency doubling, ultrafast operation, etc.)
- high-performance VECSELs (high-output power, frequency doubling, ultrafast operation, etc.)
- applications (position sensing, smart pixels, optical data links, print heads, display, scanning, sensors, medical, quantum technology etc.)
- hybrid VCSEL/VECSEL integration with optics and/or microelectronics
- advances in fabrication technologies and packaging including processing techniques and monitoring of growth
- new materials and wavelength extension
- 2D VCSEL arrays
- characterization and control of transverse optical modes and polarization
- commercialization aspects including production techniques and reliability aspects.

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High-quality, in-plane semiconductor lasers exhibit improved performance over a wide range of emission wavelengths from ultraviolet into the THz range. Devices are finding an ever-increasing number of applications in, for example, telecommunications, printing, spectroscopy, displays, and medical diagnostics and therapy.

Well-developed GaAs- and InP-based lasers operating from the 0.8 to 2-μm are achieving multi-watt output powers with beams of high spatial and spectral purity. Lasers made from new material systems, such as dilute nitride-antimonides, bismides or quantum-dot active regions, are pushing performance and spectral coverage. Mode-locked diode lasers are demonstrating improvements such as reduced pulse length and timing jitter. Applications in communication are pushing advances in laser dynamics, including the use of coupled and/or chaotic semiconductor lasers. The GaN based laser field continues to innovate and make progress in terms of e.g. power, reliability and to extend operation deeper into the green and the ultraviolet parts of the spectrum. In the infrared, Sb-based quantum well lasers display high performance at wavelengths up to ~5 μm, and quantum cascade lasers operate at wavelengths from just below 3 μm to almost 300 μm. Emerging applications in the mid/far-infrared stimulate the development of high-efficiency, high-power quantum cascade lasers operating at an ambient temperature and with new functionalities such as ultrashort pulse generation, frequency combs, injection locking, and beam control. Novel laser sources utilize recent advances in plasmonics, nanophotronics, topological photonics, and nonlinear optics for efficient generation and manipulation of light. A variety of approaches are being developed for silicon-based lasers, including hybrid structures by local area growth or wafer bonding. Laser sources based on novel two-dimensional and topological materials are being proposed.

This conference provides a forum for the most recent breakthroughs in device design and performance. We solicit papers describing novel designs that achieve higher performance levels and unique operational characteristics, as well as papers describing the technical limitations of the current in-plane laser technology and lasers tailored to particular applications such as heat-assisted magnetic recording or neuromorphic computing. We are interested in new methods of fabrication or new methods of characterization that are necessary for improved performance. Papers of experimental and/or theoretical nature are welcome.
Light-Emitting Devices, Materials, and Applications XXV (OE603)

Conference Chairs: Jong Kyu Kim, Pohang Univ. of Science and Technology (Korea, Republic of); Michael R. Krames, Arkesso, LLC (USA); Martin Strassburg, OSRAM Opto Semiconductors GmbH (Germany)

Program Committee: Jim R. Bonar, Facebook Technologies, LLC (USA); Yong-Hoon Cho, KAIST (Korea, Republic of); Aurelien David, Google (USA); Amélie Dussaigne, CEA-LETI (France); Kolja Haberland, LayTec AG (Germany); Jana Hartmann, Technische Univ. Braunschweig (Germany); Michael Heuken, AIXTRON SE (Germany); Christoph G. A. Hoelen, Signify N.V. (Netherlands); Hee Jin Kim, Lumileds, LLC (USA); Juania N. Kurtin, OSRAM Opto Semiconductors Inc. (USA); Soo Min Lee, Veeco Compound Semiconductor Inc. (USA); Yun-Li Li, PlayNitride Inc. (Taiwan); Tien-Chang Lu, National Chiao Tung Univ. (Taiwan); Koh Matsumoto, Taiyo Nippon Sanso Corp. (Japan); Matteo Meneghini, Univ. degli Studi di Padova (Italy); Klaus P. Streubel, OSRAM GmbH (USA); Tetsuya Takeuchi, Meijo Univ. (Japan); Rie Togashi, Sophia Univ. (Japan); Li-Wei Tu, National Sun Yat-Sen Univ. (Taiwan); Marie Anne van de Haar, Seaborough Research B.V. (Netherlands); Dong-Sing Wuu, National Chung Hsing Univ. (Taiwan); Erin C. Young, Apple Inc. (USA)

Light-emitting devices (LEDs) have been evolving as the dominant light source in mobile phones, displays, automobiles, and now also general lighting. The availability of devices emitting not only in the full visible color range including white, but also in ultraviolet and infrared, enables a variety of exciting applications.

Novel materials and device architectures combined with increasingly sophisticated manufacturing processes promise low-cost solid-state light sources with high efficiency and luminous flux. With the recent advances in efficiency, radiance, output power, and white quality, LEDs are now dominating conventional lighting technologies in virtually all areas of lighting including the huge general lighting market. Looking forward, LED technology is well positioned to disrupt other markets such as displays, automobiles, visible light communications, water and air purification, sanitization, projection, bio sensing, sensors for internet of things (IoT), and lighting for health, amenity, medical diagnostics, and urban farming.

The objective of this conference is to bring together scientists and engineers working on material and device aspects as well as manufacturing and application aspects of LEDs for illumination, information, and beyond, and to review the current state of the art, development trends, and outlooks in efficiency, spectral quality, reliability, brand new emerging applications and other relevant factors. Theoretical and experimental papers will include, but not be limited to the following areas:

UV AND DUV LEDS AND THEIR APPLICATIONS
- LEDs for near- and deep-UV emission, including semiconductor and packaging materials and device architectures
- applications for UV/DUV LEDs including water/air/food safety
- identification and eradication of bacterial and viral pathogens.

NIR/IR-EMITTING LEDS
- LEDs for near-IR and IR emission including arsenides and phosphides
- applications for NIR/IR LEDs
- sensors for IoT.

AUGMENTED AND VIRTUAL REALITY
- technologies and platforms for the augmented and virtual reality (AR/VR), including wearables
- microLEDs and small pixel size solutions including brightness and color purity
- light emitters for 3D sensing.

LIGHT BASED SENSORS AND COMMUNICATION
- autonomous vehicles and drones, geolocation
- light-based support of climate-neutral and smart cities
- LiFi, Optical Wireless Communication (OWC), and LIDAR.

LED APPLICATIONS AND SOLID-STATE LIGHTING
- LEDs, LED modules, and LED systems for solid state lighting (SSL), including general and special lighting applications, quality of white light, phosphors and packages for SSL, and white binning
- quality of light including spectral, spatial, and temporal aspects, human centric spectral distributions including impact on biological stimuli, etc., and metrics
- lighting for automobiles, health, emotion, medical diagnostics, horticulture, agriculture, etc.

ELECTROLUMINESCENT SEMICONDUCTOR MATERIALS AND DEVICES FOR SSL
- perovskites, graphene, boron nitride, transition metal dichalcogenides, and other novel materials
- stimulated emission devices, including super-luminescent and laser diodes
- vertical cavity surface emitting LEDs, SLEDs, and lasers.

WAVELENGTH CONVERSION MATERIALS AND COMPONENTS
- novel down-conversion materials, including narrow-band luminescent conversion materials
- high power density converters and solutions for phosphor “droop”
- fundamental physics and reliability of down conversion mechanisms and devices.
TECHNOLOGIES FOR LED DESIGN AND FABRICATION
• simulations and optimization
• novel LED fabrication methods
• “phosphor-less” white LEDs
• materials, architectures, packaging and mounting technologies for high power density operation.

MEASUREMENTS AND CHARACTERIZATIONS FOR LED MATERIALS AND DEVICES
• optical, electrical, thermal, compositional, morphological, structural, etc. properties of LEDs
• point, line, planar, and bulk defects analyses
• degradation mechanisms and reliability issues.

EFFICIENCY CHALLENGES IN III-NITRIDES LEDS
• high current performance and “droop” (fundamental physics and droop-optimized structures)
• long-wavelength progress (green, yellow and beyond)
• low-current performance for micro-LED applications.

LED MANUFACTURING
• metalorganic chemical vapor deposition (MOCVD), molecular beam epitaxy (MBE), hydride vapor phase epitaxy (HVPE) and other deposition technologies
• LED packaging and processing (etching, bonding, patterning, novel processes, etc.)
• artificial intelligence (AI) and machine learning (ML) for advanced manufacturing.

SUBSTRATES FOR LED EPITAXIAL GROWTH
• LEDs on non-sapphire crystalline substrates, including silicon, GaN, Ga2O3, etc.
• LEDs on large area substrates including metal foils, glass, plastic, etc.

SUBMOUNTS FOR LED MOUNTING
• LEDs on large area, low cost submounts including metal foils, glass, plastic, etc.
• submounts for extremely high power density emitters
• submounts for (driver/sensor-) integrated, smart, and multi-pixel or matrix devices.

QUANTUM DOT BASED LEDS
• both photo-injected and electrically injected quantum-dot based light-emitting devices for applications to displays and illumination, among others
• quantum dots for down-conversion of pixelated microLED arrays.

NANOMATERIALS AND NANOSTRUCTURES FOR LEDS
• nanowires, quantum dots, and low-dimensional structures
• photonic crystals and surface plasmons
• nano-phosphors for display and illumination applications, including microLEDs.

Submit your abstract today:
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ABSTRACTS DUE: 15 JULY 2020
AUTHOR NOTIFICATION: 21 SEPTEMBER 2020
The contact author will be notified of acceptance by email.
MANUSCRIPTS DUE: 9 DECEMBER 2020
(Conf OE506, OE801, OE802, and OE803 Only)
MANUSCRIPTS DUE: 5 JANUARY 2021
(All Confns Except OE506, OE801, OE802, and OE803)
PLEASE NOTE: Submission implies the intent of at least one author to register, attend the conference, present the paper as scheduled, and submit a full-length manuscript for publication in the conference proceedings.

Save the date
Join us at the 2021 Emerging Liquid Crystal Technologies XVI conference. This conference provides a forum for academic and industrial scientists and engineers to present frontier and high-impact scientific and technological research on recent advances in materials, devices, and applications. Numerous emerging topics on liquid crystal science and technology have taken advantage of unique anisotropic properties of liquid crystal materials to significantly improve the performance of existing devices or create new device applications. The conference will feature keynote, invited, topical oral and poster sessions and an industrial exhibition. Attend for enlightened discussions and exchange ideas on frontier science and technologies on liquid crystal materials, devices, and applications.

Papers are solicited but not limited to the following areas:

- AR/VR/MR displays
- head-mounted and near-eye displays
- projection, light-field, and holographic displays
- 3D displays
- high-resolution displays (both transmissive and reflective)
- e-paper and wearable displays
- liquid-crystal lenses and microlens arrays
- foveated imaging
- holographically-formed optical elements
- switchable diffractive waveplates
- LCoS and spatial light modulators
- photo-patterning and photoalignment
- lasing, waveguides, nonlinear optics, and flat optics
- LC antenna array
- LC applications in the infrared, microwave, and terahertz
- polarizers, optical retarders, and other display components
- new materials and effects
- chiral phases and device applications
- nano-dispersions and nanostructured materials
- polymers and liquid crystal composites
- lyotropic and biological self-assemblies
- nanostructured systems and metamaterials
- optical tweezing, imaging, and manipulation of nanoparticles
- organic semiconductor and photovoltaic devices
- energy saving and storage systems
- smart windows
- soft robotics
- sensors and actuators.

Save the date

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Submit your abstract today: spie.org/opto21call
Advances in Display Technologies XI (OE702)

Conference Chairs: Jiun-Haw Lee, National Taiwan Univ. (Taiwan); Qiong-Hua Wang, Beihang Univ. (China); Tae-Hoon Yoon, Pusan National Univ. (Korea, Republic of)

Program Committee: Karlheinz Blankenbach, Hochschule Pforzheim (Germany); Pierre M. Boher, ELDIM (France); Liangcai Cao, Tsinghua Univ. (China); Liang-Chy Chien, Kent State Univ. (USA); Tien-Lung Chiu, Yuan Ze Univ. (Taiwan); Nobuyuki Hashimoto, Citizen Watch Co., Ltd. (Japan); Yi-Pai Huang, Apple Inc. (USA); Byoung-Ho Lee, Seoul National Univ. (Korea, Republic of); Sin-Doo Lee, Seoul National Univ. (Korea, Republic of); Akihiro Mochizuki, i-CORE Technology, LLC (USA); Michael Wittek, Merck KGaA (Germany)

In all market segments and applications, expectations for display performance have grown at a rapid pace, driving not only the accelerated development of diverse display technologies but also supporting control algorithms and image-processing methodology. Display technologies have evolved to support a wide range of applications. The diversity in display technologies with enormous difference in operating principles, imaging qualities and functions presents both opportunities and challenges for application-specific displays development. Although some advancements in display performance focus on the applications, there are general trends toward improved spatial and temporal resolution, higher dynamic range, wide color gamut, and augmented and virtual reality.

Join us for the upcoming Advances in Display Technologies conference. This conference will provide a forum for presentations on advances in display technologies, featuring Keynote and Plenary sessions, parallel topical sessions, poster sessions, and an industrial exhibition. Papers are solicited but not limited to the following areas:

• VR/AR/MR (virtual, augmented and mixed reality) displays
• HUD (head-up display), NTE (near-to-eye) and wearable displays
• laser displays, speckle issues, and screen technology
• 3D, 2D/3D convertible displays
• holographic and light-field displays
• OLED and OLET displays
• mini- and micro-LED materials and displays
• quantum-dot displays (QDDs)
• SLM, LCOS, and MEMS for displays
• projection displays
• electrophoretic (EPD) and photophoretic (PPD) displays
• electrowetting displays
• oxide TFTs
• touch and interactive displays
• flexible displays
• transparent displays
• high-resolution (8K and above) displays
• graphene, CNT, and nanotechnologies in displays
• electronics and optics for displays and display systems
• energy-efficient technologies for displays
• display metrology, human factors, and image quality
• display manufacturing and equipment
• other novel and emerging display technologies.

JOINT SESSION:
AR/VR Displays using DMDs or other SLM Devices with conferences:
OE702: Advances in Display Technologies XI
OE403: Emerging Digital Micromirror Device Based Systems and Applications XIII

AR/VR is an exciting area of development. Much progress hinges on the capabilities of light modulators. The purpose of this joint session is to explore and demonstrate the capabilities of different light modulators.
Ultra-High-Definition Imaging Systems IV (OE703)

Conference Chairs: Seizo Miyata, Tokyo Univ. of Agriculture and Technology (Japan); Toyohiko Yatagai, Utsunomiya Univ. Ctr. for Optical Research & Education (Japan); Yasuhiro Kolke, Keio Univ. (Japan)

Program Committee: Partha P. Banerjee, Univ. of Dayton (USA); Liangcai Cao, Tsinghua Univ. (China); Janglin Chen, Industrial Technology Research Institute (Taiwan); Ray T. Chen, The Univ. of Texas at Austin (USA); Toshiro Chiba, Kairos Co., Ltd. (Japan); Namho Hur, Electronics and Telecommunications Research Institute (Korea, Republic of); Azusa Inoue, Keio Univ. (Japan); Norihiko Ishii, NHK Japan Broadcasting Corp. (Japan); Toru Iwane, Nikon Corp. (Japan); Bahram Javidi, Univ. of Connecticut (USA); Kyuheon Kim, Kyung Hee Univ. (Korea, Republic of); Gauthier Lafruit, Univ. Libre de Bruxelles (Belgium); Byoungho Lee, Seoul National Univ. (Korea, Republic of); Shihuan-Huei Lin, National Chiao Tung Univ. (Taiwan); Wolfgang Osten, Institut für Technische Optik (Germany); No-Cheol Park, Yonsei Univ. (Korea, Republic of); Ifor D. W. Samuel, Univ. of St. Andrews (United Kingdom); Mark Schubin, Hollywood Post Alliance (USA); Okihoro Sugihara, Utsunomiya Univ. (Japan); Xiaohao Tan, Fujian Normal Univ. (China); Kenkichi Tanioka, Medical Imaging Consortium (Japan); Din Ping Tsai, The Hong Kong Polytechnic Univ. (Hong Kong, China); Kenji Yamamoto, National Institute of Information and Communications Technology (Japan); Hiromasa Yamashita, Kairos Co., Ltd. (Japan); Whitney R. White, Chromis Fiberoptics Inc. (USA)

In recent years, Ultra-High-Definition (UHD) displays such as 4K and 8K resolutions have been rapidly developed for the increasing demands for overwhelmingly realistic imaging quality for many applications such as entertainment, education, especially medical imaging and diagnosis that require highly precise display performance, security, defense and so on. Ultra-high definition images and video data give observers the feeling of being at a real scene. It can contribute to wide-ranging applications. In medical applications, UHD microscopy and endoscopy give wide viewing area as well as high-resolution images. This means an enormous improvement in medical research and diagnosis. This has accelerated research and development of 4K/8K distribution technologies for consumers to watch full-scale broadcasts. This emerging technology of UHD imaging systems needs the high-performance optical design, high-quality imaging systems, data storage, and advanced communication systems with high-speed and high-bandwidth. In this conference we focus on the state-of-the-art technologies to support the UHD Imaging System with an interdisciplinary approach in various areas, for example, high-speed optical fibers, holographic storage for large volume data, photonics polymer materials for display parts to realize real colors on displays just as actual objects, and more.

The conference Ultra-High-Definition Imaging Systems II welcomes participants who are active in various fields exchanging the latest information in each area of materials, components, and technologies that are aiming to develop the highest quality UHD Imaging Systems. Papers are solicited in the following topics and related areas:

• ultra-high-definition TV systems
• ultra-high-definition display systems
• ultra-high-definition data storage
• high-speed and wide-band communication systems
• processing of UHD images
• medical high-definition images and their applications
• art and entertainment with UHD images
• advanced photonics polymers for display
• inorganic and organic materials for displays.

Save the date

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CALL FOR PAPERS

Practical Holography XXXV: Displays, Materials, and Applications (OE704)

Conference Chairs: Hans I. Bjelkhagen, Glyndwr Univ. (United Kingdom), Hansholo Consulting Ltd. (United Kingdom); Seung-Hyun Lee, Kwangwoon Univ. (Korea, Republic of)

Program Committee: Maria Isabel Azevedo, Univ. de Aveiro (Portugal); David Brotherton-Ratcliffe, Geola Technologies Ltd. (United Kingdom); Philippe Gentet, Ultimate Holography (France); Nam Kim, Chungbuk National Univ. (Korea, Republic of); Aikivadiis Lembessis, The Hellenic Institute of Holography (Greece); Juan Liu, Beijing Jiaotong Univ. (China); Deanna McMillen, EOTech, Inc. (USA); Hiroshi Yoshikawa, Nihon Univ. (Japan)

DISPLAYS
Widely regarded as the ultimate 3D display technology, holography has largely become digital in recent years, yet the most visually stunning holograms continue to be made through analog methods. This conference offers the opportunity for sharing the latest advances in both domains.

- techniques and concepts in display holography
- “electro-holography,” meaning the electronic generation, transmission, or display of holographic image information, and the creation of dynamic or interactive holographic images
- spatial light modulators, computational methods, and related technologies relevant to advances in digital holographic imaging
- perceptual issues related to viewing of holographic images

MATERIALS
The widespread application of holography to commercial electronics and communication applications requires recording holograms and diffractive elements in real materials. Successful engineering solutions require understanding of handling and process issues, as well as familiarity with the performance properties of existing and designed materials. This conference will focus on holographic recording materials and processes used in display, engineering, medical, energy, and data storage applications, and on holographic optical elements (HOEs), which take advantage of material properties. New materials will be discussed, as well as advances in existing materials.

- materials for holography and diffractive optics
- holographic performance and optical properties
- mechanism of image formation
- modeling and analysis of holographic performance
- durability and environmental testing of materials and devices, and materials issues affecting device construction
- HOEs and DOEs utilizing materials properties for enhanced performance
- improved processing of materials, including techniques and processes for production of holograms, HOEs, and DOEs
- real-time and active holographic materials and processes for information storage and dynamically switchable holograms
- WDM applications of holographic materials
- applications and demonstrations of new or improved materials in display holography, security holograms, HOEs, DOEs, holographic information storage, and real-time holography.

APPLICATIONS
Holography has emerged from the research laboratory to find applications to communication and engineering problems, capture of historical artifacts, and artistic expression. This conference will highlight advances of holographic and technology, especially those that impact the practice and applications of holography to imaging and display engineering.

- 3D imaging for application in industry, medicine, education, advertising, and other visual communication areas, with an emphasis on the visualization of 3D digital data by holographic means; holographic stereograms and computer-generated image holograms are areas of strong current interest including HOEs in autostereoscopic 3D systems
- processes, hardware, and techniques: new systems and applications for the recording, producing, manufacturing, or optimizing of holograms and diffractive elements
- digital reconstructions of holograms for image analysis
- metrology, microscopy, nondestructive testing, and holographic optical elements, emphasizing the application and engineering issues rather than the underlying scientific principles or component fabrication issues
- artistic applications of holography and the use of holography in recording and display of historical items.
OPTICAL COMMUNICATIONS: DEVICES TO SYSTEMS

Broadband Access Communication Technologies XV (OE801)

Conference Chairs: Benjamin B. Dingel, Nasfine Photonics, Inc. (USA); Katsutoshi Tsukamoto, Osaka Institute of Technology (Japan); Spiros Mikroulis, Huawei Technologies Co., Ltd. (Germany)

Program Committee: Shlomi Arnon, Ben-Gurion Univ. of the Negev (Israel); Neil Caranto, Intel Corp. (USA); Harald Haas, The Univ. of Edinburgh (United Kingdom); Atsushi Kanno, National Institute of Information and Communications Technology (Japan); Mohsen Kavehrad, CRKC LLC (USA); Nathaniel Libatique, Ateneo de Manila Univ. (Philippines); Nicholas Madamopoulos, The City College of New York (USA); Ken-ichi Sato, Nagoya Univ. (Japan); Atul K. Srivastava, NTT Electronics America, Inc. (USA); Manoj Thakur, Univ. of Essex (United Kingdom); Junwen Zhang, CableLabs (USA)

Conference Co-Sponsors: CORNING

To satisfy the growing demand of end-customers for fast Internet access, new multimedia services, and rapid interactive applications, all telecommunication networks operators are under intense pressure to solve the “last-mile connectivity” problem. This problem is not only the need for huge broadband in one direction but also for high-speed two-way connectivity, and mobile access as opposed to fixed access. Moreover, 5G is now becoming a reality, with first products ready and to be widely deployed in 2020. WDM technology will be the enabler and photonic components will be the driving force to lower the cost resulting from the resource sharing.

New emerging access technologies such as Optical Coherent Access, NG-PON2 or 25G/50GPON, optical fiber to the home (FTTH), Cloud RAN (C-RAN) or partially centralized RAN, Radio-over-Fiber (RoF), and eCPR, are increasingly being researched, developed and deployed since they offer huge broadband potential and mobility. We will have special sessions on:

- millimeter-wave and sub-THz technologies for fiber-wireless (Fi-Wi) integrated access networks
- millimeter-wave photonic devices
- millimeter-wave beamforming techniques
- millimeter-wave radio-over-fiber systems and techniques
- sub-THz devices and technologies.

- the role of silicon photonics at the 5G era and beyond
- photonics in 5G access networks and 5G edge cloud
- photonics for optical to the antenna at millimeter-wave for 5G and beyond
- silicon-on-insulator vs. silicon nitride
- graphene silicon photonics for optical front-hauling
- silicon photonics transceivers for 5G ethernet-based front-haul
- silicon photonics switches
- multiple-carrier comb sources for 5G parallel photonics
- silicon photonics for low energy consumption
- beam-formed photonic antennas based on silicon photonics
- true optical delay lines
- hybrid photonic platform for 5G; integration of passive SiON/Si$_3$N$_4$ and active SOI/III-V/ LiNbO$_3$ in 5G
- transmission and networking
- silicon devices for microwave photonic signal processing sub-THz devices and technologies.

- optical wireless communication for data centers
- OWC or FSO (free-space optics) system and subsystem for data centers
- VLC (visible light communication ) for data-center applications
- advanced devices for high-speed data-center links
- pointing, acquisition, and tracking for data centers
- transmitters, receivers, subsystems, optical and optoelectronic components for OWC data centers
- optics for electronic module interconnects
- advanced optical components and modules
- nanophotonics and micro/nano optics
- microwave photonics
- quantum and nonlinear optics.

This conference will also address (but not limited to) the following topics:

NEXT-GENERATION OPTICAL BROADBAND ACCESS TECHNOLOGIES
- coherent access network design and optimization
- next-gen PON (WDM-, CWDM-PON, OFMD PON, CDMA-PON technologies)
- 100G/400G/800G ethernet-based networks, ethernet over first mile
- fiber-in-the-loop (FITL), FTTP, FTTH, FTTC, HFC
- advanced components, optical fiber and equipment
- passive optical network (PON)-based access and deployments (EPON, GPON, SuperPON)
- advanced devices, optical fiber, equipment for PON
- advanced modulation formats and digital signal processing for PON
- security for future broadband access.

LI-FI BROADBAND ACCESS, VISIBLE LIGHT COMMUNICATION (VLC), AND DATA CENTERS
- advanced components and novel architecture
- green technologies for accessing data centers
- demo and novel VLC implementation.

TECHNO-ECONOMIC ANALYSIS OF BROADBAND ACCESS
- economics of broadband access
- pricing strategies for access
- advanced and cost-effective power management.
RADIO-OVER-FIBER (ROF) AND DIGITAL ROF (CPRI/ECPRI) BROADBAND ACCESS TECHNOLOGIES
• RoF and millimeter-wave RoF-based distributed antenna systems, wireless access, and wireless networks
• advanced opto-electronic devices, optical fiber and equipment for RoF and mm-wave RoF-based access
• digital RoF networks, CPRI/eCPRI
• fiber wireless, hybrid systems, and network (indoor/outdoor wireless architectures).

WIRELESS BROADBAND ACCESS TECHNOLOGIES
• wireless access, components, and protocols
• emerging and advanced components to support Wi-Fi, UWB, Bluetooth
• long-term evolution (LTE) and LTE Advanced
• 5G and mm-wave technologies
• M-MIMO technologies for high-speed mobile users
• mobile front-haul/backhaul network technologies
• resilient wired and wireless access networks
• non-orthogonal waveforms.

OPTICAL COMMUNICATIONS BEST PAPER AWARDS
We are pleased to announce Best Paper Awards in Optical Communications, sponsored by Corning and NTT Electronics. These awards will recognize the outstanding work of students and professionals who present the most notable recent results with broad impact in the area of optical communications. Qualifying papers will be evaluated by the awards committee. Manuscripts will be judged based on technical merit, impact, and clarity. The winners will be announced immediately following the Optical Communications Joint Keynote Session, and the presenting authors will be awarded a certificate and cash prize.

To be eligible for the Best Student Paper Award, you must:
• be a student without a doctoral degree (undergraduate, graduate, or PhD student)
• be listed as an author on an accepted paper within conferences OE801, OE802, or OE803
• have conducted the majority of the work to be presented
• submit your manuscript online by 9 December 2020
• present your paper as scheduled
• be present at the Awards Ceremony.

To be eligible for the Best Technical Paper Award, you must:
• be a post-doc or early career professional
• be listed as an author on an accepted paper within conferences OE801, OE802, or OE803
• have conducted the majority of the work to be presented
• submit your manuscript online by 9 December 2020
• present your paper as scheduled
• be present at the Awards Ceremony.

How to Apply
After your Manuscript is submitted online (by 9 December 2020), send an email to nasfine@stny.rr.com by Friday 18 December 2020, stating your desire to be considered, and for which award you qualify.

IMPORTANT: The Proceedings for this conference will be published on the SPIE Digital Library on the first day of the meeting. Manuscript submission (6-page minimum) is obligatory for participation in the conference. Note the earlier manuscript due date of 9 December 2020.
This conference will focus on the optical network architecture and components for metro networks, data centers and short reach data links including high-performance computing. It promotes discussion on optical network strategies regarding high-data-rate and cost-optimized architectures for these networks. It provides a forum for discussion on the recent technological advances in metro, datacenter and optical short-reach transmission systems, network equipment, modules, and related components.

DIGITAL TRANSMISSION SYSTEMS
- metro and short-haul transmission: system solutions, experiments, and field demonstrators
- 400Gbit/s, 1Tbit/s and higher networks
  - advanced modulation formats, super channels, client interfaces
  - coherent systems and digital signal processing
  - probabilistic constellation shaping
- sliceable bandwidth transceivers (flexible rate, flexible modulation format)
- next generation FTTH/PON solutions, black link approach and compatibility of link and line interfaces
- disaggregated photonic networks
- RF overlay networks for video distribution
- fixed-wireless access (FWA) and WiFi solutions for home gateway interconnection.

NETWORK ARCHITECTURES AND APPLICATIONS
- access, aggregation, and transport networks and enablers
- IP integration into optical layer
- control plane protocols/interfaces
- architectures for inter- intra-datacenter interconnects and networks
- hard and soft type network slicing strategies for 5G reconfigurable WDM technology for elastic and flexible networking
- very low latency high-performance server-to-server connectivity
- 5G fixed-mobile convergence solutions
- automotive optical networks
- communications in smart cities
- edge networks for IoT.

SUBSYSTEMS COMPONENTS AND LINK ARCHITECTURES FOR DATA CENTERS, HPC AND SHORT-REACH LINKS
- optical backplanes
- embedded optics
- DSP evolution and integration; low power, low dissipation strategies.

COMPONENTS AND ADVANCED TRANSCEIVER TECHNOLOGY FOR DATA CENTERS, HPC AND SHORT-REACH LINKS
- 100Gb/s, 400Gb/s and higher-rate transceivers
- novel modulation formats and direct detection robust schemes
- CMOS-based and integrated photonic devices and subsystems
- backplane, board-to-board, and chip-to-chip optical connectivity
- reliability of optical components under high-temperature operation
- visible light and free-space communication.

NETWORK COMPONENTS, EQUIPMENT, AND SUB-SYSTEMS
- hybrid electrical-optical network equipment
- WSS-based ROADM networks including colorless, directionless, and contentionless architectures
- flexible grid ROADM components, high port count and twin WSS architecture
- performance monitoring techniques
- fault isolation strategies in complex meshed optically transparent islands, distributed monitoring, correlation analysis tools, instruments for practical field deployment
- space-division multiplexing, advances in fiber technology, multi-core fibers, multi-mode fibers.

SERVICES AND NETWORK SECURITY
- routing, congestion control, peer-to-peer/overlay
- novel routing strategies for optimized traffic flow, e.g. segment routing and alternatives reliability and quality of service
- security issues in datacenter networks
- quantum key distribution.
CALL FOR PAPERS

OPTICAL COMMUNICATIONS BEST PAPER AWARDS

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To be eligible for the Best Technical Paper Award, you must:
• be a post-doc or early career professional
• be listed as an author on an accepted paper within conferences OE801, OE802, or OE803
• have conducted the majority of the work to be presented
• submit your manuscript online by 9 December 2020
• present your paper as scheduled
• be present at the Awards Ceremony.

How to Apply
After your Manuscript is submitted online (by 9 December 2020), send an email to nasfine@stny.rr.com by Friday 18 December 2020, stating your desire to be considered, and for which award you qualify.

IMPORTANT: The Proceedings for this conference will be published on the SPIE Digital Library on the first day of the meeting. Manuscript submission (6-page minimum) is obligatory for participation in the conference. Note the earlier manuscript due date of 9 December 2020.

Submit your abstract today: spie.org/opto21call
OPTICAL COMMUNICATIONS: DEVICES TO SYSTEMS

Next-Generation Optical Communication: Components, Sub-Systems, and Systems X (OE803)

Conference Chairs: Guifang Li, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Kazuhide Nakajima, Nippon Telegraph and Telephone Corp. (Japan)

Program Committee: Kazi S. Abedin, OFS Fitel LLC (USA); Jin-Xing Cai, TE Connectivity Ltd. (USA); Ezra Ip, NEC Labs. America, Inc. (USA); Yongmin Jung, Optoelectronics Research Ctr. (United Kingdom); Tsuoshi Konishi, Osaka Univ. (Japan); Ming-Jun Li, Corning Incorporated (USA); Chao Lu, The Hong Kong Polytechnic Univ. (Hong Kong, China); Akhiro Maruta, Osaka Univ. (Japan); Takashi Sasaki, Innovation Core SEI, Inc. (USA); Siyuan Yu, Univ. of Bristol (United Kingdom); Xiang Zhou, Google (USA); Yanjun Zhu, Hisense Broadband, Inc. (USA)

Conference Co-Sponsors: CORNING

NTTElectronics

This conference provides a forum to present the latest advances in technology and product developments in next-generation optical communication including coherent, space- and mode-division multiplexed optical transmission systems. The conference program encompasses components and subsystems related to next-generation optical communication technology as well as coherent, space- and mode-di-

vision multiplexed optical communication systems. Early-stage concepts and controversial solutions are also welcome and encouraged.

We particularly invite students to submit their thesis work to this conference. Students who are first au-

thors will be eligible for the Optical Communications Best Student Paper Awards.

Topics for the conference include but are not limited to:
• advanced components for coherent transmitters and receivers
• photonic and optoelectronic integration
• subsystems including DSP algorithms, AI/ML
• coherent transport systems
• free-space optical communication
• analog and microwave photonics
• optical switching
• coherent detection for networking including access networks
• components for space-division multiplexing
• components for mode-division multiplexing
• electrical and optical signal processing for space- and mode-division multiplexing
• space- and mode-division multiplexed optical communication systems
• SDM networks.

OPTICAL COMMUNICATIONS BEST PAPER AWARDS

We are pleased to announce Best Paper Awards in Optical Communications, sponsored by Corning and NTT Electronics. These awards will recognize the outstanding work of students and professionals who present the most notable recent results with broad impact in the area of optical communications. Qualifying papers will be evaluated by the awards committee. Manuscripts will be judged based on technical merit, impact, and clarity. The winners will be announced immediately following the Optical Communications Joint Keynote Session, and the presenting authors will be awarded a certificate and cash prize.

To be eligible for the Best Student Paper Award, you must:
• be a student without a doctoral degree (undergraduate, graduate, or PhD student)
• be listed as an author on an accepted paper within conferences OE801, OE802, or OE803
• have conducted the majority of the work to be presented
• submit your manuscript online by 9 December 2020
• present your paper as scheduled
• be present at the Awards Ceremony.

To be eligible for the Best Technical Paper Award, you must:
• be a post-doc or early career professional
• be listed as an author on an accepted paper within conferences OE801, OE802, or OE803
• have conducted the majority of the work to be presented
• submit your manuscript online by 9 December 2020
• present your paper as scheduled
• be present at the Awards Ceremony.

How to Apply
After your Manuscript is submitted online (by 9 December 2020), send an email to nasfine@stny.rr.com by Friday 18 December 2020, stating your desire to be considered, and for which award you qualify.

IMPORTANT: The Proceedings for this conference will be published on the SPIE Digital Library on the first day of the meeting. Manuscript submission (6-page minimum) is obligatory for participation in the conference. Note the earlier manuscript due date of 9 December 2020.
Free-Space Laser Communications XXXIII (LA402)

Conference Chairs: Hamid Hemmati, ViaSat, Inc. (USA); Don M. Boroson, MIT Lincoln Lab. (USA)

Program Committee: Abhijit Biswas, Jet Propulsion Lab. (USA); Donald M. Cornwell Jr., Amazon.com, Inc. (USA); Baris I. Erkmen, X Development LLC (USA); Frank F. Heine, Tesat-Spacecom GmbH & Co. KG (Germany); William S. Rabinovich, U.S. Naval Research Lab. (USA); Zoran Sodnik, European Space Research and Technology Ctr. (Netherlands); Linda M. Thomas, U.S. Naval Research Lab. (USA); Morio Toyoshima, National Institute of Information and Communications Technology (Japan)

This conference will provide a forum for all professionals involved in technologies related to free-space laser communications, and broadband optical communications. The conference will cover subjects related to the latest research and technology advances, and provide an overview useful to lasercom specialists, technology managers, and communication engineers. Papers are encouraged on ongoing laser communication programs, free-space laser communication system requirements, technology and subsystem advancements, and in-depth analysis of present status and future trends. Original papers are solicited on, but are not limited to, the following topics:

FREE-SPACE LASER COMMUNICATION TECHNOLOGIES AND ATMOSPHERIC PROPAGATION

• present and future laser communication systems; space-based systems, airborne links terrestrial/indoor/commercial links
• next-generation lasercom technologies
• modulation and error correction encoding
• pointing, acquisition, and tracking
• atmospheric propagation, transmission effects, and compensation techniques
• transmitters for space, receivers, subsystems, optical and optoelectronic components
• flight qualification, lifetime and reliability
• ground receivers, particularly low-cost large apertures (telescope, dome, gimbal)
• beyond-line-of-sight communications
• quantum communication and cryptography
• optics for electronic module interconnects
• global communications systems that make use of wireless-terrestrial, air, and space optical connections
• free-space-laser-based gravitational wave sensing systems.
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GENERAL INFORMATION

VENUE
The Moscone Center
747 Howard Street
San Francisco, CA 94103-3118 USA

San Francisco is often called “Everybody’s Favorite City,” a title earned by its scenic beauty, cultural attractions, diverse communities, and world-class cuisine. Visitors rate the atmosphere and ambiance as their top reason for visiting San Francisco. Measuring 49 square miles, this walkable city is dotted with landmarks like the Golden Gate Bridge, cable cars, and Alcatraz.

REGISTRATION
SPIE Photonics West registration will be available October 2020

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 October 2020.

STUDENT AUTHOR TRAVEL GRANTS
The Society offers a small number of supplemental travel grants to eligible and selected SPIE student members who are authors, and plan to present and publish an accepted paper at an SPIE meeting. For more information visit: spie.org/membership/student-services/student-author-travel-grants

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 Photonics West website. There are new steps that ALL visitors to the United States need to follow.
Online at: spie.org/visa

HOTEL INFORMATION
Opening of the hotel reservation process for SPIE Photonics West 2021 is scheduled for June 2020. SPIE will arrange special discounted hotel rates for SPIE conference attendees.

The website will be kept current with any updates.

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SPIE.

SPIE is the international society for optics and photonics, an educational not-for-profit organization founded in 1955 to advance light-based science, engineering, and technology. The Society serves more than 255,000 constituents from 183 countries, offering conferences and their published proceedings, continuing education, books, journals, and the SPIE Digital Library. In 2019, SPIE provided more than $5.6 million in community support including scholarships and awards, outreach and advocacy programs, travel grants, public policy, and educational resources.
SUBMISSION GUIDELINES

Present your research at SPIE Photonics West

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

1. Browse the conference program and select the conference(s) that most closely matches the topics of the research you wish to present. **Important: each abstract may be submitted to one conference only.**

2. Click “Submit an Abstract” from within the conference you’ve chosen, and you’ll be prompted to sign in to your spie.org account to complete the submission wizard.

3. If your submission is related to an application track, indicate the appropriate track when prompted during the submission process.

What you will need to submit

A completed electronic submission should include the following:

- Title
- Author(s) information
- 250-word abstract for technical review
- 100-word summary for the program
- Keywords used in search for your paper (optional)
- Your decision on publishing your presentation recording to the SPIE Digital Library (slide capture and audio)

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.

Important dates

<table>
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<th>Important dates</th>
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<tr>
<td>Abstracts Submission Deadline</td>
<td>15 July 2020</td>
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<td>Acceptance Notification Sent to Contact Author</td>
<td>21 September 2020</td>
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<td>Manuscripts Due (Conferences OE506, and OE801-OE803 Only)</td>
<td>9 December 2020</td>
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<tr>
<td>Manuscripts Due (All Conferences EXCEPT OE506, and OE801-OE803)</td>
<td>5 January 2021</td>
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Submission agreement

Presenting authors, including keynote, invited, oral, and poster presenters, agree to the following conditions by submitting an abstract:

- Register and pay the author registration fee
- Attend the meeting
- Present at the scheduled time
- Publish their manuscript in the SPIE Digital Library
- 6-page manuscript minimum for LASE and OPTO; 4-page minimum for BIOS; 20-page maximum
- Obtain funding for registration fees, travel, and accommodations, independent of SPIE, through their sponsoring organizations
- Ensure that all clearances, including government and company clearance, have been obtained to present and publish. If you are a DoD contractor in the USA, allow at least 60 days for clearance.

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 Chairs’ discretion.

Publication of Proceedings in the SPIE Digital Library

- Conference Chairs/Editors may require manuscript revision before approving publication and reserve the right to reject for publication any paper that does not meet acceptable standards for a scientific publication.
- Conference Chair/Editor decisions on whether to allow publication of a manuscript are final.
- Authors must be authorized to transfer copyright of the manuscript to SPIE, or provide a suitable publication license.
- Only papers presented at the conference and received according to publication guidelines and timelines will be published in the conference Proceedings of SPIE in the SPIE Digital Library.
- Oral presentations are recorded, and presentation slides are synced with the presenter’s audio. Only those presentations with author permission will be published in the SPIE Digital Library.
- SPIE partners with relevant scientific databases to enable researchers to find the papers in the Proceedings of SPIE easily. The databases that abstract and index these papers include Astrophysical Data System (ADS), Ei Compendex, CrossRef, Google Scholar, Inspec, Scopus, and Web of Science Conference Proceedings Citation Index.
- More publication information available on the SPIE Digital Library.

Contact information

For questions about submitting an abstract, or the meeting, contact the Conference Program Coordinator.
Add an application track to help get your presentation noticed

When submitting an abstract, add an application track during the submission process to increase the visibility of your presentation in the program. Application tracks offer a second presentation listing so participants can easily locate presentations in the program on their area of interest.

APPLICATION TRACK

Instructions

1. Select a conference online, click “Submit an Abstract,” and follow the instructions.
2. Indicate the appropriate track when prompted during the submission process.

Accepted presentations will be listed in both the conference and application track listing in the program.

TRANSLATIONAL RESEARCH
SPIE Translational Research 2021 will highlight the latest R&D with high potential to impact healthcare.
- Photonic Therapeutics and Diagnostics
- Neurophotonics, Neurosurgery, and Optogenetics
- Clinical Technologies and Systems
- Tissue Optics, Laser-Tissue Interaction, and Tissue Engineering
- Biomedical Spectroscopy, Microscopy, and Imaging
- Nano/Biophotonics

TRACK CHAIRS:
Aaron Aguirre
Massachusetts General Hospital (USA)
Gabriela Apiou
Harvard Medical School, Wellman Ctr. for Photomedicine, Massachusetts General Hospital (USA)

3D PRINTING
SPIE 3D Printing 2021 highlights technologies enabling additive manufacturing.
- Additive Manufacturing
- Selective Laser Melting, Laser Sintering, Laser Photopolymerization
- Novel Materials, Protean Materials, and Laser Interactions
- Software that Increases Efficiencies and Speed
- In-situ Sensors or Probes to Verify and Quantify Additive Manufacturing Processes in Real Time
- Conformal Photonics/Electronics

TRACK CHAIR:
Henry Helvajian
The Aerospace Corp. (USA)

BRAIN
SPIE Brain 2021 will highlight technologies that increase our understanding of the brain.
- Clinical and Translational Neurophotonics, Optogenetics, and Optical Manipulation
- Clinical Technologies, Laser Tissue Interaction, and Tissue Engineering
- Spectroscopy, Microscopy, Imaging, Nanobiophotonics, and LASE
- Neurotechnology plenary speakers and details

TRACK CHAIRS:
David A. Boas
Boston Univ. (USA)
Elizabeth Hillman
Columbia Univ. (USA)

COVID-19 RESEARCH
The COVID-19 application track highlights papers from Photonics West that illustrate the creativity and breadth of the optics and photonics community's response to the COVID-19 pandemic.
- Photonic Therapeutics and Diagnostics
- Clinical Technologies and Systems
- Tissue Optics, Laser-Tissue Interaction, and Tissue Engineering
- Biomedical Spectroscopy, Microscopy, and Imaging
- Nano/Biophotonics
- 3D Printing and Rapid Prototyping

TRACK CHAIRS:
Tianhong Dai
Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harvard Univ. (USA)
Brian J. F. Wong
Beckman Laser Institute and Medical Clinic (USA)
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San Francisco, California, USA

- 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

20,000 ATTENDEES 5,000 PAPERS
65 COURSES/WORKSHOPS 100 CONFERENCES

BIOS
BIOS is the world’s largest international biomedical optics conference, encompassing clinical, translational, and fundamental research and development in the field of biomedical optics and photonics. It provides a premier technical forum for reporting and learning about the latest research and development, as well as for launching new applications and technologies.

LASE
SPIE LASE has developed into the main forum and meeting place not only for laser science and laser scientists, but also for novel laser applications and laser process engineers. Topics include laser manufacturing, laser materials processing, micro-nano packaging, fiber, diode, solid state lasers, laser resonators, ultrafast, semiconductor lasers and LEDs, and 3D fabrication technologies.

OPTO
SPIE OPTO addresses the most current developments and research in a broad range of optoelectronic technologies and their integration into a variety of industrial and commercial applications. Topics to be covered include optoelectronic materials and devices, photonic integration, nanotechnologies, MEMS/MOEMS, advanced quantum and optoelectronic applications, semiconductor lasers, light-emitting devices, packaging, displays, holography, optical networks, and communications.

Application tracks offer more visibility
When submitting an abstract, add an application track to get your presentation listed in one of these special sections of the program. Each track lists presentations together online and in the conference program so that participants can easily locate presentations in their area of interest.
- Translational Research
- Brain
- 3D Printing
- COVID-19 Research

Explore the Call for Papers to see where your research fits
Submit your abstract by 15 July 2020
Exhibitions: see what’s new in the photonics industry
Find the latest solutions powered by photonics that are driving today’s technology markets. Featured applications include state-of-the-art medical technologies; the Internet of Things; lasers and smart manufacturing and “Industry 4.0”; AR, VR, MR; scientific research; communications; and displays.

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23–24 January 2021
The world’s largest biomedical optics and biophotonics exhibition.
200 Companies

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26–28 January 2021
The flagship event for companies in the photonics industry.
1,400 Companies

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Build on your expertise with training from leading experts.
Topics align with technical program topics. Additional course topics include basic optics, imaging, laser safety, optical systems and lens design, metrology and standards, optomechanics, and professional development.

45 INDUSTRY EVENTS
Learn about the latest industry insights and innovations.
• 30 Sessions and workshops
• 35 Product Demos
• 45 Job Fair companies
• Prism Awards
• Startup Challenge

The 2021 Call for Papers is open
Join us at the fourth annual AR, VR, MR Conference, featuring must-see presentations and demonstrations from the biggest names in consumer electronics and up-and-coming XR companies. AR, VR, MR has never been more important. It’s assisting in virtual person-to-person communication, training, sharing of information, and more.

SPIE AR VR MR 2021 includes an academic track, invited industry talks, panel discussions, a student Optical Design Challenge, courses, workshops, headset demonstrations, and the opportunity to network with leading companies and thought leaders. Your research will drive improvements of XR hardware.

Learn more: spie.org/xr21call

www.spie.org/opto21call
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16 August 2019
Frontiers of applications of petawatt laser physics
(Conference Presentation)
Ulrich Schramm

23 August 2019
Light-induced permeabilization of liposomes
Paula Enzian, et al.

22 April 2019
Chromatic line confocal technology in high-speed 3D surface-imaging applications
Karri Niemelä

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