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25 - 30 January 2025  
The Moscone Center  
San Francisco, CA, USA

**CALL FOR PAPERS**

Submit abstracts by  
**17 July 2024**

## **Terahertz, RF, Millimeter, and Submillimeter-Wave Technology and Applications XVIII (OE106)**

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

*Program Committee:* **René Beigang**, Rheinland-Pfälzische Technische Univ. Kaiserslautern-Landau (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 (United States); **R. Jennifer Hwu**, InnoSys, Inc. (United States); **Mona Jarrahi**, UCLA Samueli School of Engineering (United States); **Karen K. Lin**, A\*STAR Institute of Materials Research and Engineering (Singapore); **Daniel Molter**, Fraunhofer-Institut für Techno- und Wirtschaftsmathematik ITWM (Germany); **Kyung Hyun Park**, Electronics and Telecommunications Research Institute (Korea, Republic of); **Marco Rahm**, Rheinland-Pfälzische Technische Univ. Kaiserslautern-Landau (Germany); **Jinghua Teng**, A\*STAR Institute of Materials Research and Engineering (Singapore); **Maddy Woodson**, Freedom Photonics, LLC (United States); **Jiangfeng Zhou**, Univ. of South Florida (United States)

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  $\mu$ m) 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 photonic-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 technologies and applications. Papers on terahertz photonics including photonic generation and detection of terahertz waves to/or infrared, THz to/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  $\text{cm}^{-1}$  to 100  $\text{cm}^{-1}$  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 reflection and absorption properties that change dramatically with tissue characteristics), medical (including cancer detection and related) 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 on linear and other types of accelerators as well as light sources and fusion energy are also encouraged.

Papers on efficiency and sustainability 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
- using THz to control quantum properties
- measuring nonlinear effects in matter due to THz radiation
- artificial intelligence/machine learning for THz sources
- cancer detection and prevention
- sustainable sources including manufacturing processes.

### **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

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- artificial intelligence/machine learning for RF, sub-millimeter-wave and millimeter-wave sources
- sustainable sources including manufacturing processes.

#### **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
- artificial intelligence/machine learning for detectors and sensors
- sustainable detectors including manufacturing processes.

#### **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
- artificial intelligence/machine learning for high-power sources, modules and systems
- sustainable sources, modules, and systems including manufacturing processes.

#### **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
- sustainable passive components including manufacturing processes.

#### **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
- sustainable materials including manufacturing, fabrication and processes
- the use of artificial intelligence/machine learning for materials for THz and GHz devices.

#### **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 photonic-driven antennas
- phased-array and single-element antennas, systems, concepts, approaches
- low-V<sub>π</sub> 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
- sustainable manufacturing, processes and deployment.

#### **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
- sustainable manufacturing, processes, and deployment.

#### **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
- artificial intelligence/machine learning for biomedical applications
- sustainable manufacturing, processes, and deployment.

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**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
- sustainable manufacturing, processes, and deployment.

**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.
- artificial intelligence/machine learning for imaging and security, including of specific topics of computer vision
- sustainable manufacturing, processes, and deployment.

**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
- artificial intelligence for astronomy, Space and other areas of photonics, light, and matter
- sustainable manufacturing, processes, and deployment.

**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, conceptual and/or experimental procedures, implementations, concepts, etc.
- wearables, implantable, etc.
- innovations using artificial intelligence
- innovations in or using sustainability.

**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
- sustainable manufacturing, processes and deployment, operation, etc.

**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
- sustainable design, manufacturing, processes, and deployment.

**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
- sustainable manufacturing processes and deployment.

**SMALL SATELLITES**

- systems
- components
- detectors
- sensors
- instrumentation
- communications
- concepts
- implementations
- sustainable manufacturing, processes, and deployment.

- **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
- artificial intelligence/machine learning in additive manufacturing/ 3D printing
- sustainable additive manufacturing and/or 3D printing including materials.

# Present your research at SPIE Photonics West

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## Important dates

Abstracts due	17 July 2024
Registration opens	October 2024
Authors notified and program posts online	7 October 2024
Submission system opens for manuscripts and poster PDFs*	25 November 2024
Poster PDFs due for spie.org preview and publication	2 January 2025
Manuscripts due	8 January 2025
Advance upload deadline for oral presentation slides**	23 January 2025

\*Contact author or speaker must register prior to uploading

\*\*After this date slides must be uploaded onsite at Speaker Check-in

## What you will need to submit

- Presentation title
- Author(s) information
- Speaker biography (1000-character max including spaces)
- Abstract for technical review (200-300 words; text only)
- Summary of abstract for display in the program (50-150 words; text only)
- Keywords used in search for your paper (optional)
- Check the individual conference call for papers for additional requirements (i.e., special abstract requirements or instructions for award competitions)

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.

## How to submit your abstract

- Visit the conference page: [www.spie.org/oe106call](http://www.spie.org/oe106call)
- Choose one conference that most closely matches the topics of your abstract. You may submit more than one abstract, but submit each abstract only once
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- Sign in to your SPIE account, or create an account if you do not already have one
- Follow the steps in the submission wizard until the submission process is completed
- If your submission is related to an application track below, indicate the appropriate track when prompted during the submission process

## Application track

Listed below are the application tracks available for this meeting. Application tracks aggregate presentations and focus on emerging technical and societal needs that require a multidisciplinary approach.

- **AI/ML:** Papers that highlight the use of artificial intelligence, machine learning, and deep learning to create and implement intelligent systems across multiple sectors, technologies, and applications
- **Sustainability:** Papers that highlight the use of optics and photonics for renewable energy, natural resource management, sustainable manufacturing, and greenhouse gas mitigation in support of the UN Sustainable Development Goals
- **Brain function:** Papers that highlight the development of innovative optics and photonics technologies that increase our understanding of brain physiology and function
- **Translational research:** Papers that highlight the transition from bench to bedside using the latest photonics technologies, tools, and techniques for healthcare
- **3D printing:** Papers that highlight the innovative use of optics and photonics in multidisciplinary applications for multidimensional manufacturing
- **Photonic chips:** Papers that highlight advances in materials, design, fabrication, integration, testing and packaging of photonic components at the chip level

## Submission agreement

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

- Register and pay the conference registration fee
- Agree to receive email messaging for the conference series
- Oral presenters: recording and publication of your onsite presentation (slides synched with voice) for publication in the Proceedings of SPIE in the SPIE Digital Library
- Poster presenters: one person may not present more than two posters in a poster session; poster presenters may submit an optional poster PDF available for preview in the online program (web and app) and for publication in the Proceedings of SPIE in the SPIE Digital Library
- Submit a manuscript by the advertised due date for publication in the Proceedings of SPIE in the SPIE Digital Library
- Obtain funding for registration fees, travel, and accommodations
- Attend the meeting
- Present at the scheduled time

## Review and program placement

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

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