

# Introduction to Issue on Terahertz Photonics

**W**ELCOME to the IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS (JSTQE) Issue on Terahertz Photonics. Terahertz radiation, as generally defined in the frequency range of 0.3–10 THz, has attracted tremendous interest owing to potential applications in imaging and spectroscopy for medical diagnostics and biology, broadband communications, security, defense, and non-destructive testing. Terahertz radiation falls between microwaves and infrared and shares some characteristics of both regimes. This intermediate nature of terahertz radiation that bridges electronics and photonics has made it an important area of research with a broad range of applications giving it an advantage over electromagnetic radiation in other frequency regimes. Terahertz radiation is sensitive to charged quasiparticles and has distinct spectral signatures that have enabled an accurate study of phonon resonances and intraband transitions in two-dimensional materials such as graphene. Recent developments have also demonstrated terahertz radiation-based spin manipulation and superconductivity in materials. Better performing terahertz sources have enabled either higher output powers, narrower pulses, or broader frequency ranges. Several measurement techniques based on terahertz spectroscopy are now employed for fundamental materials research giving rise to many interesting findings.

The purpose of this issue of JSTQE is to highlight the recent progress and trends in the research of terahertz photonics. The papers published in this issue cover a broad range of photonics areas summarized in the following sections:

- Advances in terahertz sources and detectors
- Unique spectroscopic techniques and systems
- Progress in terahertz imaging
- New phenomena in terahertz metamaterials, plasmonics, waveguides, and nonlinearities
- Novel terahertz materials, such as nanostructures and topological insulators
- Terahertz interactions with matter
- Development of terahertz devices, components, and systems

These key research topics are highlighted as comprehensive overviews of the current status and future trends as well as original results and recent developments in the field of terahertz photonics.

This issue contains 55 papers, including 12 invited and 43 contributed papers authored by well-established research groups and promising scientists from all over the world. The invited papers include extended overviews on recent advances on terahertz quantum cascade lasers, detectors, metamaterials, and terahertz

technology. The contributed papers cover a broad variety of key research areas including terahertz sources, detectors, plasmonics and metamaterials, nonlinear optics, fundamental terahertz science, and terahertz technology.

We hope you will find this JSTQE Issue on Terahertz Photonics to be an interesting and useful reference that will impact, stimulate and promote further advances in terahertz research.

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W. Z HANG, *Primary Guest Editor*  
School of Electrical and Computer Engineering,  
Oklahoma State University  
Stillwater, OK 74078 USA  
(e-mail: weili.zhang@okstate.edu)

S. M. KIM, *Guest Editor*  
Department of Electrical and Computer Engineering,  
University of Alabama  
Tuscaloosa, AL 35487 USA  
(e-mail: seongsin@eng.ua.edu)

R. SINGH, *Guest Editor*  
School of Physical and Mathematical Sciences,  
Nanyang Technological University  
Singapore 637371  
(e-mail: ranjans@ntu.edu.sg)

M. TONOUCHI, *Guest Editor*  
Institute of Laser Engineering, Osaka University  
Suita, Osaka 565-0871, Japan  
(e-mail: tonouchi@ile.osaka-u.ac.jp)

C. ZHANG, *Guest Editor*  
School of Physics, University of Wollongong  
Wollongong, NSW 2522, Australia  
(e-mail: czhang@uow.edu.au)



**Weili Zhang** received the B.S. degree in laser science, and the M.S. and Ph.D. degrees in optical engineering from Tianjin University (TJU), Tianjin, China, in 1987, 1990, and 1993, respectively. In 1993, he joined the Department of Physics, Hong Kong University of Science and Technology as a Postdoctoral Research Associate.

Since 1995, he has been as the faculty of TJU and Oklahoma State University (OSU), Stillwater, OK, USA. He is currently a Professor of electrical engineering at OSU and an adjunct Changjiang distinguished Professor of optoelectronics and the Director of the Center for Optics and the Center for Terahertz Waves at TJU. His research interests include terahertz optoelectronics, nano- and microstructured materials optics, and ultrafast phenomena. He has published more than 280 invited or contributed articles in peer-reviewed journals and presented more than 130 plenary, keynote, invited, and contributed talks at international conferences and institutional colloquia. He is currently an Editorial Board member of *Scientific Reports* and an Associate Editor or Topical Editor for a number of other journals. He is a Fellow of the Optical Society.



**Seongsin Margaret Kim** (M'04–SM'14) received the Ph.D. degree in electrical and computer engineering from Northwestern University, Evanston, IL, USA, in 1999. Since 2007, she has first been an Assistant Professor and then Associate Professor in the Department of Electrical and Computer Engineering, University of Alabama, Tuscaloosa, AL, USA. Prior to joining the University of Alabama, she was a Research Associate at Stanford University (2003–2007) after having worked at both Samsung (South Korea) and Agilent Technologies (San Jose, CA, USA). Her current research interest include the area of terahertz photonics and light matter interaction in metamaterials and their application to sensing and imaging, including biomedical imaging, near field THz microscopy and biosensing, novel metamaterials devices, THz sources and detectors, and optical and terahertz spectroscopy, two-dimensional materials for photonics and electronics. She has authored more than 140 publications, 6 book chapters, and holds 3 U.S. patents. She currently serves as a member of the editorial board of *Scientific Reports*, a panel member of *Journal of Physics D*.



**Ranjan Singh** received the B. E. degree in telecommunications engineering from Bangalore University, Bangalore, India, in 2001, the M. Tech. degree in optoelectronics and laser technology from Cochin University of Science and Technology, Kochi, India, in 2004, and the Ph. D. degree in photonics from Oklahoma State University, Stillwater, OK, USA, in 2009. He is an Assistant Professor in the School of Physical and Mathematical Sciences, Division of Physics and Applied Physics, Nanyang Technological University (NTU) Singapore. Before joining NTU, he was a Postdoctoral Research Associate at the Los Alamos National Laboratory from 2009. His current research interest includes superconductors, ultrafast optics, terahertz time resolved spectroscopy, micronanophotonics, metamaterials, plasmonics, and high-Q RF cavities for accelerator applications. He has published more than 100 peer-reviewed journal papers including *Nature Communications*, *Advanced Materials*, *Applied Physics Letters*, *Physical Review B*, and *Physical Review Letters*. His metamaterial works has been highlighted by several scientific magazines and general public media such as optics and photonics news, MRS news, materials 360

online news, science news, nanotechnology now, photonics online, physics.org, and R&D magazine.



**Masayoshi Tonouchi** received the B.S. and M.S. and Dr. Eng. degrees from Osaka University, Suita, Japan, in 1983, 1985, and 1988, respectively. From 1988 to 1989, he worked as the Faculty of Engineering Science of the same university. From 1989 to 1994, he joined the Faculty of Computer Science and System Engineering, Kyushu Institute of Technology, Kitakyushu, Japan. In 1994, he moved to Kansai Advanced Research Center, Communications Research Laboratory, Japan. From 1996 to 2000, he was an Associate Professor in the Research Center for Superconducting Materials and Electronics, Osaka University. He is currently a Professor in the Institute of Laser Engineering, Osaka University and a Concurrent Professor of Nanjing University, Nanjing, China. His current research interests include ultrafast optical and terahertz science of advanced quantum materials and devices, and development-and-applications of terahertz systems such as the laser terahertz emission microscope. He is also an Associate Editor for *Journal of Applied Physics*, *American Institute of Physics* since 2015. He is a member of the Optical Society of America, the Japan Society of Applied Physics, the Physical Society of Japan, and the Institute of Electronics, Information and Communication Engineers.



**Chao Zhang** received the Ph.D. degree in physics in 1987 from the City University of New York, New York, NY, USA. From 1987 to 1989, he was a Postdoctoral fellow at Max-Planck-Institute for solid research in Stuttgart, Germany, working on quantum magneto-transport in semiconductor nanostructures. From 1989 to 1992, He was a Research Associate at Canada's Meson Research Facility in Vancouver, working on quantum coherence and dissipation in solids. From 1993, he has been a tenured faculty member in the School of Physics, University of Wollongong, Australia. He is currently a Senior Professor of physics. From 2004 to 2014, he served as the Associate Director of the Institute of Superconducting and Electronic Materials. He is a Fellow of Australian Institute of Physics. He is an advisory member of the International Organising Committee for Infrared, Millimeter and Terahertz Waves. His research interests include the areas of quantum transport of nanostructures, terahertz photonics, nonlinear dynamics of semiconductors, grapheme, and topological insulators.

He is the Associate Editor of *Frontier of Optoelectronics* and a member of the editorial board of *Scientific Reports*.