

Guest Editorial

Introduction to JSTQE Special Issue on Photonic Antennas

WELCOME to the IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS (JSTQE) Special Issue on **Photonic Antennas**! Early attempts in developing Photonic Antennas can be traced back to the 1990's with the design and fabrication of micrometer-scale infrared and visible light antennas. From that time on, interest in this emerging research field has expanded rapidly, with growing sophistication of designs enabled by advancements in the micro and nanofabrication technology. In the last ten years or so, Photonic Antennas have become a very dynamic field of research in the broad area of photonics, both theoretically and experimentally. This has led to remarkable progress in the understanding of resonant optical micro and nanostructures with potential for formidable impact on a wide range of applications, from high-rate wireless communications and optical signal processing to molecular sensing and nonlinear effects enhancement. This JSTQE Special Issue focuses on the recent progress of Photonic Antennas and trends in leading-edge fundamental concepts and novel applications.

This Issue contains 33 papers, including 10 invited and 23 contributed papers authored by well-regarded research groups and scientists, both established and emerging, from all over the world. These papers cover a broad range of advanced topics related to Photonic Antennas such as phased arrays, metasurfaces, tunability, reconfigurability, all-dielectric structures, plasmonic design, nonlinear effects, quantum emitters, and novel materials; applied to areas of great research and industrial interest including high-rate communications, light detection and ranging, THz technology, sensing and biotechnology.

We hope you will find this JSTQE Special Issue on Photonic Antennas to be an interesting and useful reference that will impact, stimulate and promote further advances in this exciting field.

ACKNOWLEDGMENT

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around the world who, despite the restrictions of this pandemic time and their many other commitments, provided high-quality reviews of the manuscripts. We would like to thank the IEEE publications staff for their general support, and Ms. Chin Tan Lutz, in particular, for her prompt help, boundless energy, and excellent organization skills in helping us meet the deadlines. We would like to thank Dr. José Capmany, Editor-in-Chief of the JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS, for his stimulating encouragements for this Special Issue.

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Hugo E. Hernandez-Figueroa received the B.Sc. degree in electrical engineering from the Federal University of Rio Grande do Sul, Porto Alegre, Brazil, in 1983, the M.Sc. degree in electrical engineering and the M.Sc. degree in informatics from the Pontifical Catholic University of Rio de Janeiro, Rio de Janeiro, Brazil, in 1988 and 1989, respectively, and the Ph.D. degree in physics from the Imperial College of Science, Technology and Medicine, London, U.K., in 1994. After spending two years as a Postdoctoral Fellow with the Department of Electronic and Electrical Engineering, University College London (UCL), London, U.K., he joined the University of Campinas (UNICAMP), School of Electrical and Computer Engineering (FEEC), as an Assistant Professor in 1995. He became Full Professor (maximum level) in 2005. He has authored or coauthored more than 134 papers in renowned journals, more than 230 international conference papers and 15 patents. He is a Co-Editor of the books *Localized Waves: Theory and Applications* (Wiley and Sons, 2008) and *Non-Diffracting Waves* (Wiley-VCH, 2013). His research interests concentrate on a wide variety of wave electromagnetic phenomena and applications mainly in

integrated photonics, photonics biosensors, nanophotonics, optical fibers, metamaterials, plasmonics, and the design of antennas for a wide range of applications including RFID, IoT, radar and advanced wireless technologies. He is also involved on research projects dealing with information technology applied to technology-based education. Prof. Hernandez-Figueroa has delivered more than 90 invited talks worldwide, has supervised to completion 17 Postoc projects, 33 Ph.D. Thesis and 58 M.Sc. Thesis. Since 1994, Prof. Hernandez-Figueroa has been very active with IEEE (Photonics Society, Microwave Theory and Techniques Society, Antennas and Propagation Society, and Education Society), and also, with the Optical Society of America (OSA), acting as an Organizer of several international conferences, Guest Editor of several Special Issues, and AdCom Member. He founded in 2010 and Chairs the first IEEE Photonics Society Brazilian Chapter. He was an Associate Editor (Nanophotonics) for the IEEE PHOTONICS JOURNAL (March 2011 to February 2018), and was an Associate Editor (Opto-Electronics/Integrated Optics) of the *IEEE / OSA Journal of Lightwave Technology* (January 2004 to December 2009). He was the General Co-Chair of the OSA Integrated Photonics and Nanophotonics Research and Applications (IPNRA) 2008 topical meeting held in Boston, MA, USA, and was the General Chair of the OSA Latin American Optics and Photonics Conference (LAOP 2018) held in Lima, November 12–15, 2018. He is a Fellow of the OSA class 2011, was the recipient of the IEEE Third Millennium Medal in 2000, and the recipient of the Attilio Giarola's Medal in 2013, for outstanding research achievements from the Brazilian Microwaves and Optoelectronics Society (SBMO). He has acted as an Area Coordinator of engineering at the prestigious Sao Paulo Research Foundation (FAPESP) since 2014. Presently, he is the Director of the National Institute of Science and Technology Photonics for Communications (FOTONICOM) and the Head of LEMAC (Laboratory of Applied and Computational Electromagnetism).



Mona Jarrahi received the B.S. degree in electrical engineering from the Sharif University of Technology in 2000 and the M.S. and Ph.D. degrees in electrical engineering from Stanford University in 2003 and 2007. She was a Postdoctoral Scholar with the University of California Berkeley from 2007 to 2008. After serving as an Assistant Professor with the University of Michigan Ann Arbor, she joined the University of California Los Angeles in 2013 where she is currently a Professor of electrical engineering and the Director of the Terahertz Electronics Laboratory. Prof. Jarrahi has made significant contributions to the development of ultrafast electronic and optoelectronic devices and integrated systems for terahertz, infrared, and millimeter-wave sensing, imaging, computing, and communication systems by utilizing novel materials, nanostructures, and quantum well structures as well as innovative plasmonic and optical concepts. The outcomes of her research have appeared in 200 publications and 160 keynote/plenary/invited talks and have received a significant amount of attention from scientific news outlets including *Huffington Post*, *Popular Mechanics*, *EE Times*, *IEEE Spectrum*, *Optics & Photonics News Magazine*, *Laser Focus*

World, and *Photonics Spectra Magazine*. Prof. Jarrahi is a Fellow of, OSA, SPIE, and IOP societies and was a Distinguished Lecturer of IEEE, Traveling Lecturer of OSA, and Visiting Lecturer of SPIE societies. Her scientific achievements have been recognized by several international and national prestigious awards including the Presidential Early Career Award for Scientists and Engineers (PECASE), Friedrich Wilhelm Bessel Research Award from Alexander von Humboldt Foundation, Moore Inventor Fellowship from the Gordon and Betty Moore Foundation Kavli Fellowship by the USA National Academy of Sciences (NAS), Grainger Foundation Frontiers of Engineering Award from the USA National Academy of Engineering (NAE) Breakthrough Award from Popular Mechanics Magazine, Research Award from Okawa Foundation; Early Career Award in Nanotechnology from the IEEE Nanotechnology Council, Outstanding Young Engineer Award from the IEEE Microwave Theory and Techniques Society, Booker Fellowship from the USA National Committee of the International Union of Radio Science, Lot Shafai Mid-Career Distinguished Achievement Award from the IEEE Antennas and Propagation Society, Early Career Award from the USA National Science Foundation (NSF), Young Investigator Awards from the USA Office of Naval Research (ONR), the Army Research Office (ARO), and the Defense Advanced Research Projects Agency (DARPA), the Elizabeth C. Crosby Research Award from the University of Michigan, and Distinguished Alumni Award from the Sharif University of Technology.



Yungui Ma received the B.S. and Ph.D. degrees from the Lanzhou University of China. He was a Research Fellow and a Research Scientist with the National University of Singapore from 2005 to 2010. Afterwards, he joined the College of Optical Science and Engineering, Zhejiang University of China as a Full Professor. His current research interests include metamaterials, metasurface, near-field heat transfer and nanophotonics.



Paolo Biagioni is an Associate Professor with the Physics Department of Politecnico di Milano, Italy. His research interests include nano-optics and plasmonics. At present his main activities are focused on linear and nonlinear properties of nanoantennas, polarization control and optical chirality at the nanoscale, and mid-infrared plasmonics and sensing with heavily-doped semiconductors. He was the Coordinator of the FET-Open project GEMINI (“Germanium mid-infrared plasmonics for sensing”) financed by the European Commission and of the PRIN project “Plasmon enhanced vibrational circular dichroism” financed by the Italian Ministry of Education, University and Research. He is also the Coordinator of the CD LAB, an interdepartmental facility for chiroptical spectroscopies with Politecnico di Milano, and the President for the years 2021–2022 of the Italian Society for Optics and Photonics (SIOF), the Italian branch of the European Optical Society (EOS). He is the coauthor of more than 85 publications on international scientific journals and more than 200 contributions at international conferences and workshops.



Andrey E. Miroshnichenko received the Ph.D. degree from the Max-Planck Institute for Physics of Complex Systems in Dresden, Germany, in 2003. In 2004, he moved to Australia to join the Nonlinear Physics Centre at the Australian National University. During that time, he made fundamentally important contributions to the field of photonic crystals and bringing the concept of the Fano resonances to nanophotonics. In 2017, he moved to the University of New South Wales Canberra and became UNSW Scientia Fellow. In 2019, Professor Miroshnichenko was recognized as one of the Highly Cited Researchers by the Web of Science Group. The topics of his research include nonlinear nanophotonics, nonlinear optics, resonant interaction of light with nanoclusters, including optical nanoantennas, and metamaterials.