

Guest Editorial

Orbital Angular Momentum Photonics

AS GUEST Editors, we are pleased to introduce this Special Issue of the Journal of Lightwave Technology on Orbital Angular Momentum Photonics!

It is well known that angular momentum carried by elementary particles can be categorized as spin angular momentum (SAM) and orbital angular momentum (OAM). Since the early 1900 s, Poynting recognized that a particle, such as a photon, can carry SAM, which has only two possible states, i.e., clockwise and counterclockwise circular polarization states. However, only recently, in 1992, Allen et al. discovered that photons with helical phase fronts can carry OAM, which has infinite orthogonal states. Since its discovery, the OAM-carrying beam has gained increasing interest from many different research communities, including physics, chemistry, and engineering, enabling tremendous advances in fundamental theories, devices, and applications.

Due to its unique characteristics, OAM Photonics has opened new possibilities in various applications, including micromanipulation, laser beam machining, nonlinear matter interactions, imaging, sensing, quantum cryptography and, classical communications. During the past decade OAM Photonics has grown tremendously, and the field has turned out to be an extremely prosperous research area. This Special Issue provides a snapshot on the latest state of the art for the OAM Photonics field.

This Special Issue hosts 36 papers, including 2 tutorial papers and 15 invited papers. These papers provide comprehensive reviews and report recent advances on OAM technologies and their applications. The papers cover all the current hot topics in OAM Photonics, among which the following are particularly worth to mention: advances in OAM lasers, generation of OAM beams by Durnin ring/spirally tiled mirror/angular modulated cascading LPFG, optical fiber supporting OAM mode with tailorable chromatic dispersion, and the applications of OAM Photonics to communications, imaging, sensing.

It has just been 30 years since the discovery of OAM by Les Allen and his co-workers. Within this fairly short period of time, an extensive research community has been established globally, and OAM theories have been further improved. Especially during the past decade, OAM related devices and applications have experienced significant growth. From this trend, we are

expecting the OAM field to continue grow with novel and unique applications to debut one after another. Hopefully, more OAM related technologies can be commercialized in the near future to enable new industry and serve our society.

The guest editors would like to thank all the authors for submitting their excellent work to this Special Issue. Furthermore, we would like to thank all the reviewers for their outstanding job in evaluating the manuscripts and providing helpful comments. The guest editors also would like to thank Doug Hargis and Sonal Parikh for their preparation, editing, and managing of this Special Issue. Finally, we would like to express our sincere gratitude to the JLT Editor-in-Chief Gabriella Bosco, for her kind guidance and support through the whole process. We would not be able to reach the collection of high-quality papers without this joint effort.

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Antonella Bogoni is currently a Full Professor with Sant'Anna School-Italy, which is one of the pioneers of the Integrated Research Center for Photonic Networks and Technologies created in Pisa in 2001 by the School and CNIT (National Inter-University Consortium for Telecommunications). She is currently the Director of the CNIT National Laboratory on Photonic Networks and Technologies-PNTLab. From 2020 to 2021, she was technical responsible of the Integrated Photonic Technologies Center-INPHOTEC, a technology center for the fabrication and packaging of integrated photonic circuits and leader of the digital & microwave photonics area. She is author or co-author of 55 patents, two books, nine chapters and more than 200 papers on the main scientific international journals. She dedicated her research activity to photonics technologies for optical communication and sensing, with special focus on Security, Space, Automotive and precise agriculture applications. From 2015 to 2018, she was coordinator of the H2020 Project ROAM: Revolutionizing optical fiber transmission and networking using the Orbital Angular Momentum of light. She collaborated with the University of Southern California (USC) in Los

Angeles, where she worked in 2008 and from 2009 to 2010 as winner of a Fulbright Scholarship. In 2009, she received three ERC Grants (one starting and two proof of concept) for developing a photonic-based fully digital radar system, presented on NATURE in 2014.

She got more than 50 national and international project grants with funding exceeding 13M€ and nine Best Paper awards. She is the Deputy Editor of *Optics Letters* and has been the General Chairman of the main international conferences of the sector.



Ivan B. Djordjevic (Fellow, IEEE) received the Ph.D. degree from the University of Nis, Niš, Serbia, in 1999. He is currently a Professor of electrical and computer engineering and optical sciences with The University of Arizona, Tucson, AZ, USA, the Director of the Optical Communications Systems Laboratory and Quantum Communications Lab, and co-director of the Signal Processing and Coding Laboratory. He has authored or coauthored 11 books, more than 570 journal and conference publications, and he holds 55 US patents. He is a Fellow of the OSA (Optica). Dr. Djordjevic is the Area Editor/Associate Editor/Member of Editorial Board for the following journals, including IEEE TRANSACTIONS ON COMMUNICATIONS, *Optical and Quantum Electronics*, and *Frequenz*. He was an Associate Editor of OSA (OPTICA)/IEEE JOURNAL OF OPTICAL COMMUNICATIONS AND NETWORKING from 2019 to 2023. From 2012 to 2021, he was the Editor/Senior Editor/Area Editor of IEEE COMMUNICATIONS LETTERS. Finally, he was an Editorial Board Member/Associate Editor for the *IOP Journal of Optics* and *Elsevier Physical Communication Journal* from 2016 to 2021. Prior to joining the University of Arizona, he

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