

Topological photonic quasiparticles of free space-time

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Abstract

Abstract: Topological complex electromagnetic waves give access to nontrivial light-matter interactions and provide additional degrees of freedom for information transfer. For instance, topologically stable quasiparticles or skyrmions have been demonstrated in quantum fields, solid-state physics, and magnetic materials, but only recently observed in photonic fields, triggering fast expanding research across different spectral ranges and applications. Here I introduce an extended family of photonic skyrmions within a unified framework, starting from fundamental theories to experimental generation and topological control in spatiotemporally structured light. I will further highlight generalized classes of optical topological quasiparticles beyond skyrmions and outline their exotic topological robust properties, emerging applications, future trends, and open challenges. A complex vectorial field structure of optical quasiparticles with versatile topological characteristics controlled in ultrasmall and ultrafast space-time domain emerges as an important feature in modern spin-orbital optics, imaging and metrology, optical informatics, and topological and quantum technologies.

Biography

Dr. Yijie Shen is currently a Marie Curie Senior Research Fellow in Nanophotonics & Metamaterials Group in Optoelectronics Research Centre (ORC), University of Southampton, UK. He is going to be an Nanyang Assistant Professor in Division of Physics and Applied Physics, School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore. He received the Ph.D. degree in optical engineering at the Department of Precision Instrument, Tsinghua University, China, in 2019. He received the B.S. degree in mechanical engineering and automation from South China University of Technology, China, in 2018. During Mar.-Jun. 2019, he was invited as a visiting researcher in School of Physics: Structured Light Laboratory (Andrew Forbes group), University of the Witwatersrand, Johannesburg, South Africa. He is a member of the Chinese Optical Society (COS) and Chinese Society of Theoretical and Applied Mechanics, was previously an invited member of the Optical Society of America (OSA). He won the Wang Da-Heng Optics Award (COS, China) in 2019. He won the IOP and OSA Outstanding Reviewer Awards in 2020. He was recognized as an honorary Rosalind Member of London Journals Press in 2021. He has published more than 70 papers in high-impact journals with about two-thousand citations.

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