Light Manipulation and Applications

Science Exploration

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Inaugural Editorial to *Light Manipulation and Applications*

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Although ancient Greeks already understood the rainbow to be a natural optical phenomenon, the scientific story of structured light arguably began nearly 225 years ago with Thomas Young's seminal interference experiment. By illuminating two pinholes with a beam of light, Young observed the celebrated interference fringes, the first recorded one-dimensional structured light patterns[1]. Undoubtedly, an entirely new chapter opened with the invention of the laser. In principle, a typical laser can simultaneously excite millions of transverse modes per square millimeter of a light beam. It is then somewhat surprising that for many years, only the lowest order structured laser modes, the ubiquitous Gaussian beams, were in demand. The situation changed dramatically with the momentous discovery by Allen and Woerdman's group that complex Laguerre-Gaussian laser modes can carry orbital angular momentum[2]. This groundbreaking work triggered a flurry of activity in the field of structured light, resulting in an impressive zoology of structured light fields of increasing complexity[3]. This, in turn, prompted a colleague of ours to ask perhaps a rhetorical question: "What is non-structured light?"

This spectacular progress toward structuring light fields has become possible thanks to the unprecedented capabilities to control and manipulate light that the optics and photonics community has acquired over the last couple of decades or so. Nowadays, at least one degree of freedom of virtually any optical field, generated by a table-top source of light, can be structured employing an array of tools from spatial light modulators and digital micromirror devices to geometric phase elements (q-plates) and metasurfaces.

The unique mission of *Light Manipulation and Applications* (*LMA*) is to connect fundamental advances in light manipulation with application-driven and engineering research on the subject. At *LMA*, we seek high-quality submissions that advance fundamental understanding and practical implementation of light manipulation across diverse scientific, technological, and engineering domains. On the fundamental side, submissions on all aspects of optical physics of structured light fields, including vector beams, optical vortices, orbital angular momentum carrying fields, skyrmions, hopfions, merons, and other topologically and spatiotemporally structured fields, are encouraged. Exploring structured space-time wave packets and topologically nontrivial states of light establishes a gateway into the fundamental behavior of analogous fields in far more complex and less experimentally accessible settings in condensed matter physics, general relativity, and quantum field theory. In the case of partially coherent (speckled) light fields, space-time (space-frequency) field correlations can be structured. *LMA* then encourages submissions on optical coherence theory and partially coherent light, including speckle phenomena and light scattering. In addition, submissions on structured light in quantum, ultrafast, and nonlinear optics are welcome. At the same time, *LMA* seeks to report on advances in structured light generation, manipulation, transformation, and characterization across multiple platforms from advanced metasurfaces to nanophotonic platforms for light field structuring, as well as on applications of structured light in light-matter interactions, imaging, holography, sensing and metrology, optical computing, communications, information processing, and beyond.

At *LMA*, we are proud to have a diverse expertise and truly international editorial team, encompassing editorial board members from 11 regions of the world, including Asia, Europe, the Middle East, and North America. Another unique feature of *LMA* is its almost peerless diversity of available submission formats, ranging from research articles, comprehensive and mini reviews, and perspectives to short communications and methods articles. The inaugural issue fully embraces this diversity by containing three reviews, a research article, and a perspective.

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Light-field and external-field modulation in surface-enhanced Raman scattering: Strategies and perspectives—Zhang and colleagues pen a comprehensive review of recent advances in multi-physical field modulation in surface-enhanced Raman scattering[4].

Non-Hermitian twisted photonic lattices—Wang and coworkers propose theoretically and demonstrate experimentally a non-Hermitian photonic lattice architecture with dynamically tunable gain-loss modulation[5].

Fractional vortex beam: Fundamentals and beyond—Cai and colleagues review the theory of fractional vortex beams and latest developments in this rapidly evolving field[6].

Topological light waves manipulating particles: A perspective—Xie and Shen offer a perspective on how light waves of intricate spatiotemporal topology can couple degrees of freedom to manipulate previously inaccessible complex motion regimes of microparticles[7].

Advances in nonlinear manipulation of structured light fields: From fundamentals to applications—Wang and coworkers review recent advances in structuring and manipulation of high-intensity light fields and engineering nonlinear structured light-matter interactions[8].

We are excited that we are finally ready to launch this venue. Let the journey begin; we welcome your submissions!

Declarations

Authors contribution

Ponomarenko S: Conceptualization, writing-original draft.
Cai Y, Zhan Q: Writing-review & editing

Conflicts of interest

Sergey Ponomarenko is the Co-Editor-in-Chief, Yangjian Cai is the Editor-in-Chief, and Qiwen Zhan is the Advisory Editor-in-Chief of the journal *Light Manipulation and Applications*. The authors declare that they have no other conflicts of interest.

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Consent for publication

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