Editorial

Singular Optics

Paramasivam Senthilkumaran,¹ Shunichi Sato,² and Jan Masajada³

¹ Department of Physics, Indian Institute of Technology Delhi, New Delhi 110 016, India

² Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Katahira 2-1-1, Aoba-ku, Sendai 980-8577, Japan

³ Institute of Physics, Wrocław University of Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland

Correspondence should be addressed to Paramasivam Senthilkumaran, psenthilk@yahoo.com

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Recent years have witnessed lots of research activities in the field of singular optics. This special issue is to bring out some of the important research works in this field and to provide a platform to initiate and invite the researchers to share their findings in this relatively new journal. This special issue in an open access journal provides a new dimension in disseminating the new research findings in this field. It also provides the authors and research groups more visibility in the scientific community. After conceiving this idea of bringing out a special issue, we chalked out a time line, for call for papers and the various subsequent processes involved. We have received quite a number of submissions, and after peer-review process 11 articles were selected for this special issue.

Optical vortex also known as optical phase singularity is a point phase defect at which the phase is indeterminate and amplitude is zero. This zero amplitude point draws a curve, called thread of darkness, in space as the singular beam propagates. These dark threads can be tailored to form loops, knots, and other interesting topological structures. The spiraling Poynting vector associated with the vortices in some cases points to backward flow of energy. Singular beams are known to carry orbital angular momentum, and in metrology they are used to lift the degeneracy in peak-valley detection. Special properties of singular beams further lead to many more novel applications in areas as diverse as microparticle manipulation, astrophysics, information technology and processing, beam and polarization shaping, microscopy, and optical testing. Further, singular optics also deals with the presence of singularity in any of the parameters that describe a light field.

A brief introduction given below to the articles would provide an overall idea of the areas covered in this special

issue. There are two review articles “*Interferometry with vortices*” and “*Experiments on linear and nonlinear localization of optical vortices in optically induced photonic lattices*” and nine research articles. The paper by P. Senthilkumaran et al. reviews how interference phenomena involving vortices are useful in optical testing and in polarization optics. The paper by D. Song et al. provides an overview on recent experimental work on linear and nonlinear localization of singly charged vortices (SCVs) and doubly charged vortices (DCVs) in two-dimensional optically induced photonic lattices. Continuing on photonic lattices, the paper “*Complex 3D vortex lattice formation by phase-engineered multiple beam interference*” provides computational results on the formation of diverse complex 3D vortex lattices by a designed superposition of multiple plane waves. Further on 2D vortex lattices, two new interferometric configurations for generating a variety of optical vortex lattices are presented in the paper “*Generation of optical vortex arrays using single-element reversed-wavefront folding interferometer*.” On single-vortex generation, the paper “*Generation of a purely single transverse mode vortex beam from a He-Ne laser cavity with a spot-defect mirror*” elegantly shows an intracavity generation method of Laguerre Gaussian beam with vortex. The authors describe a method in which the spot-defect mirrors replace the conventional rear mirrors of a He-Ne laser cavity with the result that the resonator yielding vortex beams. In the paper “*Generation of optical vortices by linear phase ramps*,” it is shown that vortices can evolve during propagation of a wavefront in which two regions have opposite phase gradients. Vortices of different charges are embedded in a wavefront that has quadratic phase variation, and the intensity distribution near the focal plane is studied in the paper “*Fresnel lens with embedded vortices*.” The paper “*Wavelength dependence*

of the polarization singularities in a two-mode optical fiber” shows that the coherent superposition of vector modes results in the generation of phase singular beams, and the polarization character of these beams with dislocation has strong wavelength dependence. The paper *“Tight focusing of partially coherent vortex beams”* investigates the intensity distribution, degree of polarization, and coherence of a tightly focused partially polarized vortex beam. The paper *“Detector of optical vortices as the main element of the system of data transfer: principles of operation, numerical model, and influence of noise and atmospheric turbulence”* deals with the proposal of a method of detection of topological charge of vortex in a turbulent medium in the presence of amplitude and phase noise based on intensity measurements. The paper *“Canonical and singular propagation of ultrashort pulses in a nonlinear medium”* discusses singular behaviors of ultrashort pulses in a nonlinear medium.

This issue consists of articles covering various aspects of singular optics. Many of the articles can be grouped areawise, which means that these articles are not in isolation. The groupings under possible categories are vortex generation, vortex lattice generation polarization singularity, singularity in nonlinear medium, photonic lattices, partially coherent vortex beams, and vortices in atmospheric turbulence.

We hope that the readers will enjoy the collection of articles in this special issue. This issue is realized by the efforts of authors, referees, and the Hindawi editorial team members. We acknowledge their contributions and look forward to more feature issues from this journal.

*Paramasivam Senthilkumaran
Shunichi Sato
Jan Masajada*