Phase and amplitude gradient engineering for metasurface vortex beam emission

FANG Xu
School of Electronics and Computer Science
University of Southampton, UK

Biography: Dr FANG Xu is a lecturer at the School of Electronics and Computer Science, University of Southampton, UK. He obtained his bachelor's degree in Materials Science and Engineering from Tsinghua University, and his Ph.D. in Condensed Matter Physics from the Institute of Physics, Chinese Academy of Sciences. Before joining the University of Southampton, he held a 3-year fellowship in the national research institute of RIKEN, Japan. His recent works focus on metasurfaces, which include their uses for thin-film logic gates, spectroscopy, microfluidic sensing, beam-steering, light focusing, THz detection, and vortex beam generation.

Abstract:
For many applications such as remote sensing and free-space communications, the use of integrated photonic chips for the generation of optical vortex beam is highly desired, as this device format could leverage the mass production capability of semiconductor fabrication foundries. At the University of Southampton, my team has explored a few methods in this research direction. We started with using microring resonators, where nonlinear optical effects [1] and coherent tuning [2] are utilized to control the vortex emission. More recently, we have explored the use of metasurfaces for this purpose, which inherently brings a high level of control over the propagation of light (e.g., [3]). We demonstrate that, by engineering the phase and amplitude gradients of waveguide-integrated metasurfaces, conjugate symmetry in light emission can be broken, bringing more freedom in topological light creation [4]. Controlling the gradients also allows for the creation of a large topological charge [5], which is usually a challenging task for planar vortex beam emission.

References

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[3] Over 240 resonances on a metasurface-pixelated silicon wafer in an octave-spanning terahertz range. Advanced Optical Materials, 11, 2301979 (2023).
[4] Asymmetric vortex beam emission in a metasurface-integrated microring with broken conjugate symmetry. Optics Express, 31, 42549 (2023).
[5] Amplitude gradient-based metasurfaces for off-chip THz wavefront shaping. Photonics Research, 11, 1542-1552 (2023).

Notes

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中文作者姓名：方煦

中文单位名称：南安普顿大学