

Editorial for special issue on advances in metasurface

Metasurface refers to a type of artificial thin film materials with sub-wavelength features that can generate the desired and/or new optical phenomena. The past decade has witnessed significant advances in the metasurface, ranging from fundamental physics to nanomanufacturing methods and practical applications. Typical research efforts include wavefront engineering and detection [e.g., Yu, *Science* **334**, 333 (2011); Capasso, *Nat. Commun.* **3**, 1278 (2012)], flat optics for focusing and imaging [e.g., Capasso, *Nano Lett.* **12**, 4932 (2012); Yu, *Nat. Mater.* **13**, 139 (2014)], polarization manipulation [e.g., Zhan, *Opt. Lett.* **40**, 4711 (2015); *Sci. Rep.* **6**, 29626 (2016)], metahologram [e.g., Genevet, *Rep. Prog. Phys.* **78**, 24401 (2015); Tsai, *Nano Lett.* **14**, 225 (2014)], light trapping and localization [e.g., Gan, *Adv. Mater.* **26**, 2737 (2014); *Adv. Opt. Mater.* **5**, 1700223 (2017)], absorption engineering [Gan, *Adv. Opt. Mater.* **5**, 1700166 (2017); *Sci. Adv.* **3**, e1602783 (2017)], and colorimetric display. Being able to manipulate the optical properties of metasurfaces will create new regimes of optical physics and impact a broad range of photonic, energy, and biomedical technologies, including new commercial product research and development. Research and development efforts of these artificial thin film materials in promising areas continue to emerge. To capture the latest developments in this important emerging field of optics, it is our pleasure to introduce the *Chinese Optics Letters* Special Issue on Advances in Metasurface with contributions from scientists around the world who are active in this field.

Interest in the development of a structured light beam remains strong. As summarized in a review article by Wang, recent progress was overviewed from being paradigms to forming functional devices and tailoring special light beams for wide emerging applications. By coding different wavelengths into orthogonal polarizations of patterned metasurface structures, Luo *et al.* proposed an approach to construct high-efficiency multi-wavelength metasurfaces with independent phase control for powerful vortex beam manipulation. In addition, Lee *et al.* proposed a strategy to introduce phase-change materials in the design of active metasurface devices for polarization manipulation. By controlling the coupling and phase using controlled resonators, Ouyang *et al.* showed the freedom to manipulation of the interference pattern of terahertz surface waves.

Researchers continue to invent new types of metasurfaces for optical absorption and transmission engineering. As introduced in a Letter by Zheng *et al.*, quasi-periodic Moire metasurfaces were developed by superimposing different periodic patterns, realizing a controlled broadband or narrow band absorption controlled surface. By introducing magnetized plasma in the design of indefinite media, magnetic field manipulation will be enabled in the optical transmission property of metasurface films. Zhang *et al.* demonstrated this remarkable active tunability using theoretical modeling.

The unique optical properties and powerful controllability of metasurfaces enable a wide range of applications. By carefully engineering the metal/semiconductor interfaces, Berini *et al.* reported a highly compact photodetector component for high-density Si photonics. Building upon the additional degree of magnetic freedom, Xiao *et al.* developed a significantly enhanced magnetic dipole emission device. The findings from these studies may enable the development of new optical components with functionalities that were not possible in conventional optics.

There has indeed been extraordinary growth in the research on metasurfaces with the collection of Letters in this special issue providing a useful snapshot of the field that is representative of the international and interdisciplinary scope of interest. With exciting new developments ever on the horizon, we strongly encourage our colleagues who have an ongoing interest in this subject to submit their future work in this very promising area of optics to *Chinese Optics Letters*.

Sincerely,

Prof. Qiwen Zhan, Guest Editor
Department of Electro-Optics and Photonics
University of Dayton, USA
Email: qzhan1@udayton.edu

Prof. Qiaoqiang Gan, Guest Editor
Electrical Engineering Department
University at Buffalo, SUNY, USA
Email: qqgan@buffalo

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