**Metasurfaces rewrite the rule of optical design**

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Metamaterials are artificial subwavelength metal/dielectric structures that are used to control and manipulate light, sound, and many other physical phenomena. However, their practical applications have been hindered by the high losses and strong dispersion associated with the resonant responses and the use of metallic structures, as well as the fabrication difficulty for the micro- and nanoscale 3D structures. Metasurfaces, the two-dimensional analogue of conventional metamaterials, have attracted great interest during the past several years due to their exotic electromagnetic properties. The unprecedented capabilities of metasurfaces in the nanoscale manipulation of nanoscale manipulation of the light’s amplitude, phase, and polarization have rewritten the rule of optical design. The ultrathin nature of metasurface and the ease of fabrication make the metasurface platform very attractive for device miniaturization and system integration. In this talk, I am going to review the recent progress in the physics of metasurfaces operating in the visible range and talk our recent work on metasurface research, including dual-polarity lens, image-switchable hologram, polarization-controllable superposition of orbital angular momentum states, vector vortex beam generation, multifunctional optical devices and so on. Finally, I will conclude by providing my opinion of opportunities and challenges in this rapidly developing research field.

Dr Xianzhong Chen (陈献忠) is an Assistant Professor in Nanophotonics and leads the Experimental Nanophotonics Group at the Heriot-Watt University (HWU). His research interests include nanophotonics, metamaterials, metasurfaces, plasmonics, ultrathin nanodevices, and low-cost nanofabrication. Supported by his EPSRC grants, his research mainly focuses on light-matter interactions at the nanoscale and their applications in photonics, energy and biomedicine. He received his MSc (2001) and PhD (2004) from the Institute of Optics & Electronics (IOE), Chinese Academy of Sciences and subsequently worked there for two years first as a research assistant professor and then a research associate professor. Prior to joining HWU, he was a research fellow (2007-2013) at the University of Birmingham. He has published over 50 research papers in journals including Nature Communications, Light: Science & Applications, Nano Letters and Advanced Materials. He was the winner of the Contribution Point Award at HWU in 2016 and Innovation Award for Young Researchers at IOE in 2005. His work on macroscopic invisibility cloaking of visible light was selected as one of the "Top 10 Breakthroughs for 2010" by Physics World, "Top 100 Stories in 2011" by Discover Magazine, and received wide media coverage including BBC News and USA Today. He is a reviewer for Royal Academy of Engineering program, EPSRC program and Chang Jiang Scholars program. He was the organizer and co-chair of the special session "Metasurface and its application in optical devices" at META'16 in Spain (2016). He also serves as a reviewer for high-profile journals such as Nature Nanotechnology and Nature Communications. Recently, he was invited as one of the guest editors for the special session of Metasurface for Journal of Physics D. Details about his research can be found on his group website (http://nanophotonicslab.eps.hw.ac.uk/).

