

A reconfigurable arbitrary retarder array as complex structured matter

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Tuneable retarder arrays, such as spatially patterned liquid crystal devices, have given rise to impressive photonic functionality, fuelling diverse applications ranging from microscopy and holography, to encryption and communications. Presently these solutions are limited by the controllable degrees of freedom of structured matter, hindering applications that demand photonic systems with high flexibility and reconfigurable topologies. Here we demonstrate a compound modulator that implements a synthetic tuneable arbitrary elliptical retarder array as virtual pixels derived by cascading low functionality tuneable devices, realising full dynamic control of its arbitrary elliptical axis geometry, retardance value, and phase. Our approach opens unprecedented functionality that is user-defined and possesses high flexibility, allowing our modulator to act as a new information carrier, beam generator, analyser, and corrector, opening an exciting path to tuneable topologies of light and matter.



Short Bio:

Dr. Chao He is a Lecturer, Principal Investigator, and doctoral supervisor at the University of Oxford. He runs the Vectorial Optics and Photonics Group, which focuses on optical techniques for vectorial beam manipulation, including structured light, structured matter, adaptive optics, and polarisation sensing. He completed his DPhil degree in the Department of Engineering Science at the University of Oxford from 2018-2020 and was later elected as a Stipendiary Junior Research Fellow in Engineering at St John's College. He has published over 80 scientific papers, including first- and corresponding-authored papers in journals such as Nature Communications, Light: Science & Applications, eLight, Optica, Advanced Photonics. He also serves as a reviewer of Nature Photonics, Light: Science & Applications, Nature Communications, etc., and is an Editorial Board member of Journal of Optics, Light: Advanced

Manufacturing, and Guest Editor-in-Chief of Light: Science & Applications. He acts as General Chair/co-Chair multiple times at international optics and photonics conferences. He independently leads several research grants, whose overall value exceeds J1 million, followed by substantial commercial investment.