Adding new dimensions to adaptive optics

University of Oxford, UK

Martin J Booth
Email: martin.booth@eng.ox.ac.uk

Adaptive optics (AO) are widely adopted to correct phase aberrations in a range of applications from telescopes to microscopes. These aberrations compromise image quality by reducing contrast and resolution. Adaptive elements, such as deformable mirrors or liquid crystal spatial light modulators, are used to modulate the optical wavefronts and remove aberrations. In microscopes, for example, AO has enabled deep-tissue imaging of neural activity in the brain and sub-wavelength super-resolution microscopy in thick specimens. However, AO can be also applied to optical properties other than phase, literally bringing new dimensions to AO capabilities. We will show how developments in spatiotemporal control of short-pulse lasers and light polarization can enhance the AO toolkit beyond solely phase correction. We will also explain how intensity and coherence control can further expand AO applications.

Short Bio:

Prof Booth is chair in Optical and Photonic Engineering at the University of Oxford. His research involves the development and application of adaptive optical methods in microscopy, laser-based materials processing and biomedical imaging. In particular, his group have developed numerous implementations of adaptive optics for aberration correction in high and super resolution microscopes. He has held Royal Academy of Engineering and EPSRC Research Fellowships and in 2016 received an Advanced Grant from the European Research Council. In 2014 he was awarded the International Commission for Optics Prize. He was appointed Professor of Engineering Science in 2014 and Chair in Optics and Photonics in 2023. He is a fellow of SPIE, Optica, and the Institute of Physics. He has over 180 publications in peer-reviewed journals, over twenty-five patents, and has co-founded two spin-off companies, Aurox Ltd and Opsydia Ltd.