

# Passive microscopy with quantum advantage

A I LVOVSKY<sup>1</sup>, A WARKE<sup>1</sup>, L GONG<sup>1</sup>, M MISHRA<sup>1</sup>, AND A ZHANG<sup>1</sup>

<sup>1</sup>*Department of Physics, University of Oxford, Oxford, UK*  
Contact Email: alex.lvovsky@physics.ox.ac.uk

Far-field optical imaging inevitably involves low-pass spatial filtering, limiting the resolution. Moreover, conventional imaging suppresses high spatial frequency components close to the cutoff, making them invisible under noise — particularly the shot noise arising from discrete and random nature of quantum light. We propose and implement a method for reducing the effect of this noise by optically pre-processing the incoming light prior to detection, thereby optimizing the quantum measurement performed on it. In this way, we can approach the quantum precision limit defined by the quantum Fisher information.