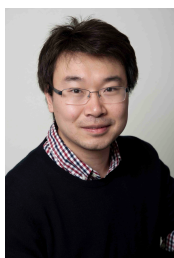

Upconversion nanoparticle-based optical sensing

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Upconversion nanoparticles (UCNPs) are a type of nanomaterial that can absorb near-infrared light and convert it into output light in the ultraviolet, visible, and near-infrared ranges. This material has many advantages, including high emission intensity, non-quenching, non-blinking, high optical nonlinearity and NIR excitation and emission wavelength; hence, it has been used for biophotonics applications such as super-resolution imaging and optical tweezers. Here, we introduce the application of UCNP for optical sensing. With the help of single-particle characterization, we have achieved real-time single-particle distinguishment and tracking and intracellular viscosity sensing. We further developed the fluorescence self-interference method for ultra-fast axial position sensing imaging, achieving resolutions below 2.8 nm at a frequency of 50 Hz. Applying a doughnut beam to convert power-dependent information onto the emission point spread function, we could directly sense the doping concentration of upconversion nanoparticles by imaging. Using the 3D super-resolved localization of UCNPs, we have achieved ultra-sensitive weak force sensing in water.



Short Bio:

Fan Wang received his PhD degree in Photonics from the University of New South Wales in 2014 in Australia. He is a professor at Beihang University, China, leading the nanophotonic research group. He has been working in the field of photonics and biophotonics technologies, including optical tweezers, super-resolution microscopy, optical sensing and computational imaging. Prof. Wang has published over 89 peer-reviewed journal articles, including 13 Nature series articles, with 6157 citations. He was awarded a Chinese overseas young talent project, the Australia Discovery Early Career Researcher Award, the David Syme research prize and the iCANX Young Scientist Awards. His expertise is recognised through more than 20 invited talks at conferences and a Light People character interview by Light: Science & Applications.