Upconversion nanoparticle-based super-resolution imaging and sensing

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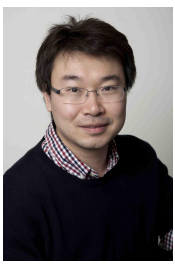
Upconversion nanoparticles (UCNPs) are a type of nanomaterial that can absorb near-infrared light and convert it into output light in the ultraviolet, visible, and near-infrared ranges. This material has high emission intensity, non-quenching, non-blinking, high optical nonlinearity and NIR excitation and emission wavelength; hence, it has been used for biophotonics applications. Here, we introduce the application of UCNP for super resolution imaging and 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. Combining imaging scanning microscopy with the high nonlinearity of UCNP, we have delivered 1/8th of the excitation wavelength resolution, which suggests a new perspective for wide field deep-tissue imaging.



Short Bio:

Fan Wang, a professor at Beihang University, China, earned his PhD in Photonics from the University of New South Wales in 2014. Leading a nanophotonic research group, his work spans optical tweezers, super-resolution microscopy, optical sensing, and computational imaging. Prof. Wang has authored over 96 peer-reviewed papers, leading author papers includes *Nature Photonics, Nature Nanotechnology, Light: Science & Applications, Nature Communications*, with an h-index of 43 and 7261 citations. He has received prestigious awards, including the Australia Discovery Early Career Researcher Award and the David Syme Research Prize. He was also recognized as Light People by *Light: Science & Applications*.