RESOLUTION ENHANCEMENT ON SUBWAVELENGTH SILICON NANOSTRUCTURES BY UNEXPECTEDLY OPTICAL NONLINEARITY

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ABSTRACT

Nonlinear silicon photonics is emerging as a major research field in the recent decade. It provides many applications, such as light amplification, lasing and optical sensing, and has potential to be integrated into the next generation optical circuit. On the other hand, nonlinearity is a common approach to enhance spatial resolution in the field of optical microscopy [1,2]. However, the intrinsic nonlinearity of silicon is weak. Our group recently discovered that silicon nanostructures show unexpectedly large nonlinearity of scattering due to photothermal effect [3]. The photothermal nonlinearity of nano-silicon is 5 orders larger than that of bulk. In this study, we enhance spatial resolution of silicon nanostructure observation down to λ/6 through applying saturated excitation approach with the unusually large nonlinearity [4]. This paves the way for label-free optical nanoscopy of silicon.

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