

3D Target Locking: Spectroscopy, Manipulation, and Imaging

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We discuss a new experimental method that allows locking a nanoscale target at the focus of a microscope objective and tracing the target's 3D motion in real time with 10- μ s time resolution and 10-nm localization precision in all three dimensions. We show how spectroscopy can be performed on a freely moving gold nanoparticle, to reveal the shape anisotropy of the nanoparticle. Beyond passive tracking and spectroscopy, we discuss how one can utilize thermal fluctuations for purposeful work — photon nudging — driving a Janus particle like a submarine. Finally, if time permits, we will discuss how the technology enables new imaging modalities, making it possible to uncover the life stages of a virus-like particle entering a live cell.