Anti-Brownian Electrokinetic Trapping of Fluorescence-free Nanoparticles in Water

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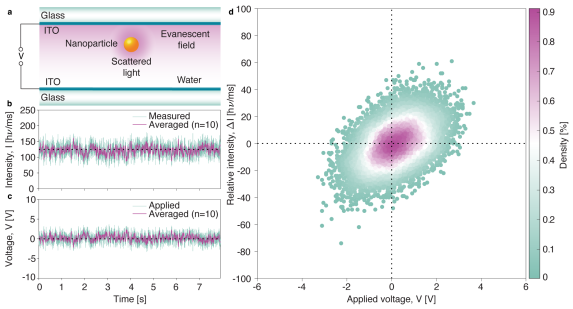
Anti-Brownian electrokinetic (ABEL) trapping enables the precise confinement of individual nanoparticles in solution by applying electric forces that counteract Brownian motion. This technique has been limited to nanoparticles and molecules that emit fluorescence, which has restricted its broader application. In this study, we present a novel approach to axial ABEL trapping that leverages the light-scattering properties of label-free nanoparticles, utilizing an evanescent field generated by total internal reflection (a). By monitoring the intensity of scattered light (b), we are able to create an external electric field (c) that maintains the nanoparticle at the desired distance from a glass surface. This method allows us to trap and observe the nanoparticle's behavior in response to applied voltages (d) at kilohertz frequencies, eliminating the need for fluorescent labeling. Our approach opens up new possibilities for studying a wide range of nanoparticles, relying solely on their light-scattering properties, and holds significant potential to advance research in cell membrane biology, surface chemistry, and single-molecule biophysics.



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