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Electrokinetic device for three-dimensional trapping of single fluorescent emitters JASON K. KING, BRIAN K. CANFIELD, LLOYD M. DAVIS, University of Tennessee Space Institute — Trapping by use of actively controlled electric fields is a valuable tool for studies of single biological molecules and nanoparticles. Devices have been developed to trap in one and two dimensions, but these rely on physically constraining the molecule along one or more directions. However, behavior of trapped molecules may be perturbed due to high collision rates with walls. Here we report on the development of a three-dimensional (3D) electrokinetic trap to counteract Brownian motion. Two pairs of electrodes arranged in a crossed configuration on separate planes allow generation of an electric field of variable orientation and magnitude. A custom forward-illuminated microscope with astigmatism introduced to the tube lens is used to determine the nanoparticle's 3D position in real time. This device has demonstrated the capability to manipulate and confine single 40 nm fluorescent latex beads in glycerol-water solution. The use of an electron-multiplying CCD camera allows for faster detection rates ($>$100 Hz) and single-photon sensitivity. Characterization of particle motion and performance analysis of trapping methods is investigated. The use of alternative 3D detection methods is discussed, as well as applications to studies of single biomolecules and nanoparticles.

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