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Microfluidic device for three-dimensional electrokinetic manipulation of single fluorescent molecules JASON K. KING, BRIAN K. CANFIELD, LLOYD M. DAVIS, WILLIAM H. HOFMEISTER, Center of Laser Applications, The University of Tennessee Space Institute — The ability to manipulate and trap single molecules in solution through the application of actively controlled electric fields is a valuable tool for a number of bio-molecular studies of proteins and nucleic acids. Here we report the development of a microfluidic device consisting of four electrodes sputtered onto two glass coverslips and fixed in a tetrahedral arrangement. This geometrical configuration allows for a uniform electric field of any orientation through the application of appropriate voltages. Three-axis control has been demonstrated for micron-sized polystyrene beads and 40 nm fluorescent spheres in phosphate buffered solution. Previous work has characterized planar motion. Recent changes to the experimental setup include the addition of a cylindrical lens in the detection arm to quantify axial position and a National Instruments PCI-7833R to provide precise voltage control. Finally, a real-time tracking algorithm and its use for trapping will be discussed.

Jason K. King
Center of Laser Applications, The University of Tennessee Space Institute

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