Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Microfluidic device for the electrokinetic manipulation of single molecules JASON KING, LLOYD DAVIS, BRIAN CANFIELD, WILLIAM HOFMEISTER, University of Tennessee Space Institute, PHILIP SAMPSON, Vanderbilt University — We are developing a microfluidic device for three-dimensional electrokinetic manipulation of single fluorescent molecules in solution. The device consists of electrode pairs deposited onto glass cover slips via UV microlithography and ionic sputtering. By positioning two such electrode pairs in a tetrahedral configuration separated by 100 microns and applying appropriate digitally-controlled voltages to each, the apparatus generates an electric field of selected directionality in the central bounded region. Proof of concept is demonstrated by controlling the motion of micron-size latex beads, visualized with an EM-CCD camera. By use of a double Mach-Zehnder interferometer configuration, 40 fs Ti:Sapphire laser pulses (repetition rate 76 MHz) are split into four temporally interleaved pulses (effective rate 304 MHz), which are then focused to the vertices of a tetrahedron (approximately one micron per side) within the central electrode region to generate two-photon-excited fluorescence from single molecules. The time stamp data from this four-focus probe, collected with a custom fast-timing single-photon avalanche diode, enables characterization of particle motion through fluorescence cross-correlation spectroscopy.

Jason King
University of Tennessee Space Institute

Date submitted: 21 Nov 2008 Electronic form version 1.4