Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Magnetophoresis of Fe_3O_4 Nanorods DAVID TAN, JITKANG LIM, CAITLIN LANNI, FREDERICK LANNI, ROBERT TILTON, SARA MAJETICH, Carnegie Mellon University — The magnetophoretic motion of a nanorod is quite different from that of a nanosphere. In large particles, motion is predicted from the balance of magnetic and viscous drag forces, but for nanoparticles random thermal forces lead to Brownian motion as well. Due to magnetic and diffusive anisotropy, a nanorod has advantages over a nanosphere for the single particle guidance and tracking, which would be important for studies within living cells. We have investigated the magnetophoretic behavior of nanorods and nanospheres both theoretically and experimentally. Peclet number analysis shows that 300 nm x 20 nm nanorods are more likely to be in the convective than diffusive regime than nanospheres of equal volume, for the same field and field gradient. Experimental studies of nanorod motion were made using Fe_3O_4 nanorods coated with poly (diallyldimethylammonium chloride) and fluorescein-5-isothiocyanate (FITC) tagged bovine serum albumin (BSA) and dispersed in saline solution. The motion of the nanorods was observed with and without magnetic field gradients using fluorescence microscopy. Fluorescence micrograph showed the nanorods undergo magnetophoretic motion toward the higher field gradient region with a velocity of about 28μm/sec. The controlled motion of magnetic nanorods within HeLa cancer cells has been demonstrated.

David Tan
Carnegie Mellon University

Date submitted: 21 Nov 2008 Electronic form version 1.4