Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Elastic Torque on a Ferromagnetic Disk within a Nematic Liquid Crystal JOEL B. ROVNER, DAN S. BORGNIA, CLAYTON P. LAPOINTE, DANIEL H. REICH, ROBERT L. LEHENY, Department of Physics and Astronomy, Johns Hopkins University — An aspherical particle suspended in a nematic liquid crystal will impose an orientationally dependent energy due to coupling to the nematic elasticity. This energy depends strongly on the anchoring conditions on the surface of the inclusion, its shape, as well as the proximity of other boundary conditions on the fluid such as those set by the container. To study these properties, ferromagnetic nickel disks with homeotropic surface anchoring were suspended in the liquid crystal 4-cyano-4'-pentylbiphenyl (5CB) in a planar cell. The disks, 300 nm in thickness and 10 μm in diameter, possess a permanent magnetic moment confined to the disk's plane. In the absence of any external torque the disks align with the normal to their faces parallel to the director. Rotating of the disks from this preferred orientation creates an elastic deformation that is manifested by an opposing torque. Balancing this torque with the torque from an external magnetic field for various angles of rotation, we have mapped out the orientationally dependent energy. Over a large range of angles the torque shows a linear dependence as predicted by an electrostatic analogy.

Joel B. Rovner
Department of Physics and Astronomy, Johns Hopkins University

Date submitted: 10 Nov 2011 Electronic form version 1.4