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The use of magnetic bottles to determine the susceptibility of paramagnetic nanoparticles[1] BRANDON HARRIS, H. DANIEL OU-YANG, Department of Physics, Lehigh University — We present a new technique for determining the magnetic susceptibility of paramagnetic nanoparticles. Current methods of determining the magnetic properties of nanoparticles seem to be limited to ferromagnetic materials. Our magnetic bottles system uses microelectrodes to generate a highly localized magnetic field in a microfluidic environment. In our experiments, the fluorescently labeled paramagnetic nanoparticle concentration near the localized magnetic field can be measured using confocal fluorescence microscopy. The magnetic field distribution within the magnetic bottle, a region too small to be measured using conventional probes, can be calculated using COMSOL Multiphysics simulations. The magnetic field distribution can also be independently measured using paramagnetic nanoparticles of a known susceptibility. When a paramagnetic nanoparticle suspension is exposed to a magnetic field, the nanoparticle concentration will follow a Boltzmann distribution. The energy factor in the Boltzmann distribution is proportional to the product of the magnetic susceptibility and the square of the magnetic field. This method can be used to measure the susceptibility of any paramagnetic nanoparticle from its density distribution in a known magnetic field.

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