Condensed Matter / Biophysics Seminar

Thursday

April 23

4:00 P.M.

Rm 184 NSH

Graduate Student Presentations

Alison Deatsch -- Optical and Nanoparticle Analysis of Normal and Cancer Cells by Light Transmission Spectroscopy

We have investigated the optical properties of human oral cancer and normal cells. Specifically, we have measured the absolute optical extinction for intra-cellular material (lysates) and whole cells in aqueous suspension. Measurements were conducted over a wavelength range of 250 to 1000 nm with 1 nm resolution using Light Transmission Spectroscopy (LTS). This provides both the absolute extinction of materials under study and, with Mie inversion, the absolute number of particles of a given diameter as a function of diameter in the range of 1 to 3000 nm. Our studies show significant differences in both the optical extinction and particle-size distributions associated with cancer versus normal cells. Specifically, there appears to be a relative deficiency of particles 20 to 100 nm in diameter for cancer versus normal cells, and a relative excess of particles in the ~100 to 1000 nm diameter range for cancer versus normal cells. We have also observed a power-law dependence for the overall number density of particles versus diameter over many orders of magnitude.

Anthony Ruth -- Molecular Model of Florescence Intermittency in Graphene Oxide

It has been observed that many low-dimensional systems undergo the phenomena of Florescence Intermittency. Observations of photoluminescence (PL) of Colloidal Quantum Dots (CQDs) show sudden and drastic dips in PL intensity to near darkness which can last from milliseconds to minutes before they resume normal emission. In contrast, during the photo-induced reduction of Graphene Oxide (GO), strong time variations are seen. The Power Spectral Density (PSD) of these time variations reveal millisecond to minute time scales. In this presentation, we show that the time variations of the PL of GO can be understood as a statistical effect of many areas which vary between emitting and dark states. Furthermore, following the treatment applied to CQDs, we show that transitions from light to dark states are caused by translocation of adatoms. These results indicate that graphene oxide can be forced into light or dark states by blocking certain adatom locations through passivation.

Elizabeth DeWaard -- Structural Studies of Metastable and Ground State Vortex Lattice Domains in MgB2

Small-angle neutron scattering (SANS) studies of the vortex lattice (VL) in the type-II superconductor MgB2 have revealed an unprecedented degree of metastability that is demonstrably not due to vortex pinning, [C. Rastovski et. al Phys. Rev. Lett. **111** 107002 (2013)]. Application of an AC magnetic field to drive the VL to the ground state revealed a two-step power law behavior, indicating a slow nucleation of ground state domains followed by a faster growth. The dependence on the number of applied AC cycles is reminiscent of jamming of soft, frictionless spheres. Here, we report on detailed structural studies of both metastable and ground state VL domains. These include measurements of VL correlation lengths as well as spatially resolved SANS measurements showing the VL domain distribution within the MgB2 single crystal. We discuss these results and how they may help to resolve the mechanism responsible for stabilizing the metastable VL phases.