Subject: MSD Colloquium, Majetich, Thurs, 3/22, 11am, 212, A-157
From: Suzanne Kokosz <kokosz@anl.gov>
Date: Thu, 08 Feb 2007 15:17:19 -0600
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SPEAKER: Dr. Sara A. Majetich
Carnegie Mellon University
Pittsburgh, PA

****IEEE Magnetics Society Distinguished Lecture****

TITLE: Magnetic Nanoparticles: Self-Assembly

and Nanoscale Behavior

DATE: Thursday, March 22, 2007

TIME: 11:00 a.m.

PLACE: Building 212, Room A157

HOST: Axel Hoffmann

Refreshments will be available at 10:45 a.m.

Abstract: The magnetic behavior of a monodomain nanoparticle was first described by Stoner and Wohlfarth nearly sixty years ago, yet this simple system is frequently invoked in discussions of high-density magnetic recording media, magnetic refrigeration materials, and a host of biomagnetic applications. Here we will examine two cross-cutting themes of current research on magnetic nanoparticles: self-assembly and nanoscale magnetic behavior.

Different types of superstructure can be self-assembled from the same type of particles. In organic solvents, two-dimensional arrays with long-range order can be formed using Langmuir layer techniques. These monolayers are also used as nanomasks for crystallographically oriented thin films, which provide an alternative approach to preparing nanoparticle arrays for data storage media. Faceted three-dimensional single ^{3}grain^2 nanoparticle crystals are formed by colloidal crystallization methods. Magnetic field gradients can also be used to guide self-assembly. For example, gold-coated iron oxide particles can be used to image self assembly dynamics in aqueous media, in response to patterned magnetic elements, using plasmon scattering and dark field optical microscopy to track single particles.

The ability to make magnetic nanostructures creates a need for new tools that enable us to visualize their magnetization patterns. Small angle neutron scattering provides average magnetic correlation lengths within three-dimensional assemblies, where correlations of hundreds on nanometers may be present at low temperature. Electron holography shows real-space magnetization patterns of magnetic monolayers, where vortices and transverse domain walls are present as low energy excitations. Scanning probe techniques have the potential for single-particle-per-bit magnetic

information storage.