LSU LOUISIANA STATE UNIVERSITY

PHYSICS & ASTRONOMY WEEKLY CALENDAR

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WEEKLY CALENDAR

May 4, 2009

DEPARTMENTAL COLLOQUIUM

"Vortices in Nanomagnets"

3:40 PM, May 7, 2009
109 Nicholson Hall

Kristen Buchanan
Colorado State University

Host: Michael Cherry

• Refreshments served at 3:15 PM in 201 Nicholson Hall •

Nanomagnets have great potential for technologies such as magnetic storage media, magnetic sensors, biomedicine and spintronics. Confinement in nanomagnets alters their energetics and leads to new magnetic states, for example, magnetic vortices, which have interesting properties and provide a convenient model system for studying fundamental dynamical phenomena. Magnetic vortices in restricted geometries exhibit a rich excitation spectrum, of which the fundamental mode is a non-degenerate translational excitation that corresponds to spiral-like motion of its core at a characteristic frequency in the sub-GHz frequency range. Recently there has been considerable interest in the unique dynamics of these vortices, motivated in part by the potential applications of field- and current-driven core polarization reversals. I will discuss our investigations of the dynamics of magnetic vortices confined in lithographically defined, micron-sized Permalloy disks with circular and elliptical symmetry. The resonance frequencies are detected experimentally using a microwave reflection technique where an r.f. current in a coplanar waveguide generates an oscillating magnetic field that is absorbed preferentially at the eigenfrequencies of the magnetic disks patterned on its central strip. We have used this technique, combined with micromagnetic simulations and time-resolved X-ray photoemission electron microscopy imaging at the Advanced Photon Source, to explore how the frequency the vortex translational mode can be tuned through choice of geometry and static magnetic field, to understand the dynamic interactions of a vortex pair, and, more recently, to investigate the effects of increasing the amplitude of the driving magnetic field, where we find that the translational-mode peak in the impedance spectra splits into two well-defined peaks.

Work at Argonne National Laboratory, including use of the Center for Nanoscale Materials, was supported by the U. S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. DE-AC02-06CH11357.

Publications:

"Beyond ideal MHD: towards a more realistic modeling of relativistic astrophysical plasmas." Carlos Palenzuela, **Luis Lehner**, Oscar Reula, Luciano Rezzolla, Mon. Not. R. Astron. Soc. 394, 1727-1740 (2009).