Condensed Matter Seminar

Nanomagnets

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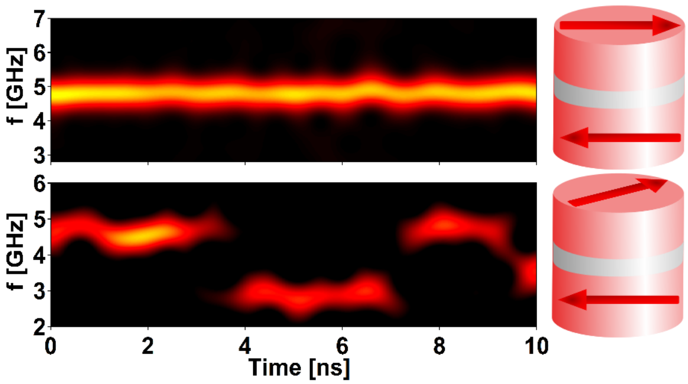
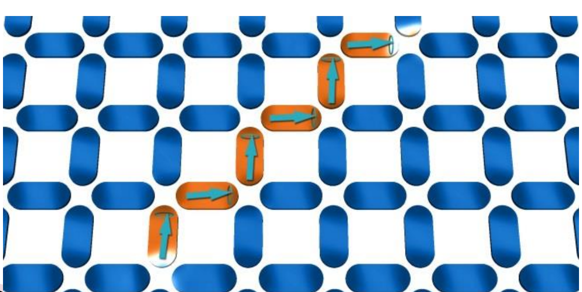
Thursday, February 13 ◆ 4:00 P.M. ◆ Room 184 NSH

Nanoscale magnetic systems have been the subject of intense research over the past decade. This has partly been driven by developments in magnetic hard disc drives, where the readback sensor is now smaller than 50 nm x 50 nm(!), but partly also driven by new emergent physics in nanoscale magnetic systems. One such example is the spin transfer torque effect, by which a dc current can induce magnetization dynamics in the GHz range. In nanoscale magnetic systems, interactions can be also be made to compete, giving rise to complex energy surfaces with interesting (and sometimes unexpected) quasi-static and dynamical behavior.

In this presentation, I will give some background on materials and interactions in these systems, and a brief overview of the spin transfer torque effect. I will then give some examples of specific systems, such as artificial spin ice lattices and spin torque oscillators, and the complex and interesting behavior they exhibit.



Frequency versus time of a spin torque oscillator: The top figure shows that frequency is stable over a long time. The bottom figure shows that the frequency is hopping with time (mode hopping). The phenomena depends on the orientation of the magnetic layers as shown in the right.



The figure shows a defect string–a Dirac string-that connects two Dirac monopoles at the string ends in an artificial spin ice lattice. The nanomagnets along the string oscillate at a specific frequency giving rise to unique oscillations that extend from one Dirac monopole to the other and can be detected experimentally.

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