Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Spin Dynamics in Single Domain Structures J.P. PARK, R.L. COMPTON, P.A. CROWELL, University of Minnesota — Spin waves at nonzero wave vector can exist in nonellipsoidal single domain particles due to the dynamic demagnetization field. In order to investigate spin dynamics in a single domain state, we have fabricated 20 nm thick Permalloy ellipses with a minor axis b ranging from 50 nm to 500 nm and the ratio a/b of 2, 3, 4, and 5, where a is the major axis. We used ion-milling to transfer 30 nm thick Ti patterns made by e-beam lithography onto a Permalloy film grown on a 150 μm glass substrate, which allows a 430 nm probe beam to pass through for a time-resolved Kerr microscopy measurement. The ellipses relax from saturation into either a single domain state or a vortex state, depending on the magnitude of b and the ratio a/b. The spin dynamics in isolated Permalloy ellipses in a single domain state have been investigated using micromagnetic simulations with a 150 ps wide in-plane magnetic field pulse along b. We have identified two distinct modes in the single domain state corresponding to the backward volume magnetostatic spin-wave modes (BWVMS) with different wave vectors, where the dynamic demagnetization field plays a major role. As the ratio a/b for a fixed b increases, the frequency separation between these two BWVMS modes remains the same, while an overall blue shift occurs due to the increase in shape anisotropy and the decrease in wave vector. This work was supported by the University of Minnesota MRSEC (NSF DMR-02-12032) and a Doctoral Dissertation Fellowship.

Jooho Park
University of Minnesota

Date submitted: 01 Dec 2004 Electronic form version 1.4