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Field Dependence of Magnetic Vortex Dynamics R.L. COMPTON, J.P. PARK, P.A. CROWELL, University of Minnesota — We have used time-resolved Kerr microscopy (TRKM) to investigate the dynamical behavior of micron diameter disks patterned from sputtered Permalloy (Py) films. Different growth conditions yielded grain diameters of ∼35 nm and ∼80 nm while average roughness (Ra) remained less than 1 nm for 50 nm thick films. The magnetization of the disks relaxes into a vortex ground state, in which broadband spin dynamics include a low frequency vortex translational mode (vortex mode) that is expected to be nearly independent of field, based on simulations and analytical theory. We measured the field dependence of the vortex dynamics of individual disks using 5 Oe field steps from 0 Oe through the vortex annihilation field (H_a). For a 1 μm diameter disk the vortex mode has a mean frequency of ∼300 MHz, but the frequency fluctuates throughout the entire field range ($H_a \sim 350$ Oe) with a magnitude Δf ∼200 MHz and a characteristic period ∼30 Oe. The fluctuations are not symmetric about zero field and look different in detail for different disks, but are highly repeatable for the same disk. We have also observed non-linear effects including the presence of up to 3 higher harmonics of the vortex mode, with a higher harmonic occasionally dominating the spectrum. A consistent interpretation is that the vortex core samples a distribution of pinning potentials, some of which are anharmonic, as it traverses the disk under the influence of the static applied field. Supported by NSF DMR 04-06029.

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