Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Vortices and Antivortices as Harmonic Oscillators B. KRUEGER, M. BOLTE, A. DREWS, U. MERKT, G. MEIER, D. PFANNKUCHE, University of Hamburg, Germany — In experiments the distinction between current-induced dynamics and the dynamics induced by the Oersted field of the current is still an open problem. Here we investigate the gyroscopic motion of current- and field-driven magnetic vortices/antivortices in micro- or nanostructured thin-film elements by analytical calculations and by numerical simulations. Starting from the micromagnetic equation of motion extended by the spin torque introduced by Zhang and Li, we derive an analytical expression for the current- and field-driven trajectory of the vortex/antivortex. The gyroscopic motion is well described by modeling the stray-field energy as a harmonic-oscillator potential. For small harmonic excitations the vortex/antivortex cores perform an elliptical rotation around their equilibrium positions. Our analytical model allows to calculate the amplitude and phase of the gyration. The phase of the rotation and the ratio between semi-axes are determined by the frequency and amplitudes of Oersted field and spin torque. The analytical result is compared to micromagnetic simulations with good accordance.[1] Even though the influence of weak magnetic fields on the vortex/antivortex trajectories is small, the phase of the rotation is significantly changed. Thus, the model can estimate the Oersted field's contribution in spin-torque experiments.[1] B. Krueger et al., Phys. Rev. B 76, December (2007).

Markus Bolte
University of Hamburg, Germany

Date submitted: 27 Nov 2007 Electronic form version 1.4