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Time-Resolved X-ray Microscopy for Direct Observation of Spin-Torque and Oersted-Field Driven Vortex Gyration M. BOLTE, G. MEIER, L. BOCKLAGE, A. DREWS, B. KRUEGER, University of Hamburg, Germany, T. TYLISZCZAK, ALS, LBL, Berkeley, CA, A. VANSTEENKISTE, B. VAN WAEYENBERGE, Ghent University, Belgium, K.-W. CHOU, H. STOLL, Max-Planck-Institute for Metal Research, Stuttgart, Germany — Due to their symmetry, magnetic vortices are ideal candidates for studying the influence of the spin-transfer torque on the local magnetization. The out-of-plane magnetization of the vortex, the vortex core, can be excited to gyrate around its equilibrium position by in-plane magnetic fields or spin-polarized currents. Here we present results from time-resolved X-ray microscopy on permalloy squares with a vortex in the center. Spin-polarized currents with densities of $4.7 - 12 \cdot 10^{10}$ A/m^2 are laterally driven through the permalloy sample, and the gyration is imaged for different phases of the ac-excitation. The results are compared to micromagnetic simulations, to good agreement. For vortices having opposite chirality a chirality-dependent phase shift of 40° is observed that is attributed to Oersted fields from the spin-polarized current. An analytical model estimates corresponding field strengths of 40 μT. This study confirms our assumption that Oersted fields from spin-polarized currents cannot be neglected in spin-torque experiments and shows the sensitivity of the measurement technique.

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