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Influence of excitation fields on vortex core dynamics in micron-sized magnetic disks[1] XUEMEI CHENG, DAVID KEAVNEY, KRISTEN BUCHANAN, RALU DIVAN, Argonne National Laboratory — Magnetization vortices in micron-sized magnetic disks have been of great interest because of potential applications in memory devices. Theory predicts a rich spectrum of excitations including the fundamental or gyrotropic mode. Experimentally the gyrotropic mode is observed in some experiments while in others a linear or elliptical trajectory is seen. We have imaged free vortex core motion in permalloy disks of 6 μm diameter using time-resolved x-ray photoemission electron microscopy at beamline 4-ID-C of the Advanced Photon Source with 90 ps temporal resolution. We demonstrate that the vortex core motion trajectory depends on the magnitude of the excitation field. The vortex core exhibits a gyrotropic trajectory under low excitation fields, while under high excitation fields the core shows a more linear trajectory. We find that if the initial displacement of the core is greater than 20% of the disk radius, transient magnetic domains appear in the first 1 ns after removal of field. These domain states then profoundly influence the subsequent motion. The core oscillation frequencies are consistent with theoretical predictions, regardless of the excitation amplitude.

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Xuemei Cheng
Argonne National Laboratory

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