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Nanomechanical Detection of Magnetic Hysteresis of a Single-crystal Yttrium Iron Garnet Micromagnetic Disk JOSEPH LOSBY, ZHU DIAO, JACOB BURGESS, SHAWN COMPTON, FATEMEH FANI SANI, Dept. of Physics, University of Alberta and National Institute for Nanotechnology, TAYYABA FIRDOUS, Dept. of Physics, University of Alberta, DOUGLAS VICK, MIRO BELOV, National Institute for Nanotechnology, WAYNE HIEBERT, MARK FREEMAN, Dept. of Physics, University of Alberta and National Institute for Nanotechnology — A micromagnetic disk was milled from a monocrystalline yttrium iron garnet film using a focused ion beam and micromanipulated onto a nanoscale torsional resonator. Nanomechanical torque magnetometry results show a unipolar magnetic hysteresis characteristic of a magnetic vortex state. Landau-Lifshitz-Gilbert-based micromagnetic simulations of the disk show a rich, flux-enclosed, three-dimensional domain structure. On the top and bottom faces of the disk, a skewed vortex state exists with a very small core. The core region extends through the thickness of the disk with a smooth variation in core diameter reaching a maximum along the midplane of the disk. The single crystalline nature of the disk lends to an observed absence of Barkhausen-like steps in the magnetization-versus-field curves, qualitatively different in comparison to the magnetometry results of an individual polycrystalline permalloy microdisk. Prospects for the mechanical detection of spin dynamical modes in these structures will also be discussed.

Joseph Losby
Dept. of Physics, University of Alberta and
National Institute for Nanotechnology

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