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Direct Observation of Magnetic Vortex Cores using Scanning Electron Microscopy with Polarization Analysis (SEMPA) SEOK-HWAN CHUNG, CNST, NIST, Gaithersburg, MD 20899 / Maryland NanoCenter, University of Maryland, College Park, MD 20742, DANIEL PIERCE, JOHN UNGURIS, CNST, NIST, Gaithersburg, MD 20899 — Magnetic singularities associated with magnetic vortex cores are a common feature in patterned magnetic nanostructures. Their small size, on the order of 10 nm, makes them technologically interesting, but also difficult to measure or image directly. We used Scanning Electron Microscopy with Polarization Analysis (SEMPA) to image magnetic vortices in a wide variety of patterned nanostructures. Since SEMPA can measure both the in-plane and the out-of-plane component of the surface magnetization, SEMPA can potentially determine both the chirality and the polarity of the vortex core, simultaneously. Samples consisted of NiFe (25nm) / Ta (3nm), and other soft magnetic films, patterned by electron beam lithography and lift-off into disks with various diameters. The films were grown on 85nm thick SiN membranes to reduce image degradation from backscattered electrons. The experimental results were compared to micromagnetic simulations and the vortex core profile showed a good correspondence with theoretical predictions, which considers only the exchange and magnetostatic energy. This work has been supported in part by the NIST-CNST/UMD-NanoCenter Cooperative Agreement.

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