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Calculation of energy barriers for magnetic vortices in sub-100 nm dots[1] PAVEL LAPA, ANDREW KING, IGOR V. ROSHCHIN, Texas A&M University — In a magnetic vortex, the magnetization is curling in plane everywhere except the "core," where it is out of plane. Interest in switching of magnetic vortices in nanodots is stimulated by their potential application for magnetic memories and nano-oscillators. By combining analytical and micromagnetic techniques, we calculated energy barriers for vortex switching in 20 nm-thick iron dots as a function of applied in-plane field and dot diameter. Using analytical formula for magnetization distribution in the vortex,[2] we performed micromagnetic calculations of the dot energy for different vortex core positions. In contrast to the "rigid body approximation," the core size and core shape in our calculations were varied to achieve the energy minimum for every core displacement. The energy barriers required for vortex nucleation and annihilation were calculated as a function of magnetic field. By comparing these barriers to the thermal energy k_BT we obtained the temperature dependences of the vortex nucleation and annihilation fields in good agreement with the experiment.[3]

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[2]N. A. Usov and S. E. Peschany, J. Magn. Magn. Mater. **118**, 290 (1992).
[3]R. K. Dumas *et al.*, Appl. Phys. Lett. **91**, 202501 (2007).

Pavel Lapa
Texas A&M University

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