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Quantifying spin torque effects using a current-driven magnetic vortex[1]

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Spin transfer torques offer great potential for the development of spin-based devices for processing and storing information but there is still debate surrounding the relative contributions of the adiabatic and non-adiabatic spin torque effects. Magnetic vortices in patterned magnetic films provide a model system that can be used to quantify these effects. Micromagnetic calculations of the current-driven motion of a magnetic vortex in a patterned Permalloy element show that the two spin torque effects have distinguishable influences on the trajectories of the vortex core and, furthermore, that the effect of the current-generated magnetic fields (Oersted) that are often non-negligible when current flows through magnetic nanostructures can also be separated out. An analysis of a series of experimental images of vortex trajectories obtained using a recently developed dynamic Lorentz transmission electron microscopy technique provides a measure of the non-adiabatic spin torque parameter with greatly improved precision [1]. The work described here was carried out in collaboration with Shawn Pollard, L. Huang, Dario Arena, and Yimei Zhu (Brookhaven).

[1] S. Pollard, L. Huang, K. S. Buchanan, D. Arena, and Y. Zhu, *Nature Communications* **3**, 1028, 2012.

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