Special MMU seminar

Domain wall dynamics under non-local spin-transfer torque

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Place: 8F Medium Seminar Room, Sengen

Abstract

We study the effects of spin diffusion on the spin transfer torque (STT) within a continuously variable magnetization distribution, integrating with micromagnetics the diffusive model of Zhang and Li (Phys. Rev. Lett. **93**, 127204 (2004)). This study is performed in the steady-state regime, where comparison to analytical predictions in the case of the local torques is possible.

Current-driven wall motion is, in that regime, shown to be adequately described by an effective non-local nonadiabatic parameter. In the case of NiFe, using the parameters of literature, this parameter is found to be 20% larger than its local counterpart for a vortex wall, and hardly modified for a transverse wall. On the local level, this corresponds to a enhancement by a factor as large as 3 in the vicinity of the vortex core. This may explain why vortex walls are more mobile than transverse walls under STT, a feature observed experimentally but not predicted by the local STT in a perfect structure. It is also shown that, at least for small current densities, this effective parameter can be derived from the calculation of the non-equilibrium spin accumulation performed domain wall structure at rest.

These results open another possibility to control STT by modifying the diffusion of the carriers. In addition, they offer a starting point to study multilayer structures like spin-valve nanostrips where the understanding of the observed increased efficiency of STT to drive domain walls still remains elusive.

D. Claudio Gonzalez, A. Thiaville, and J. Miltat, Phys. Rev. Lett. **108**, 227208 (2012)

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