FA01

Beyond Micromagnetic Modeling of Spin Dynamics in Confined Magnetic Elements

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Magnetization dynamics in bulk and geometrically confined micrometer or nano-size magnetic elements is of considerably growing interest in the research field of time-variablemagnetic phenomena. Individual spin motions excited in magnetic nanostructures are well described by the Landau-Lifshitz-Gilbert (LLG) equation of motion. The numerical micromagnetic calculation of various model systems of restricted geometry[1-8]based on the LLG equation is likely to be a useful bridge connecting the gap between theories and experiments on ultrafast magnetization dynamics. During the past five years, our research group have conducted micromagnetic simulations on a variety of patterned thin films[1-8] and have obtained interesting results in the area of vortex dynamics, spin waves, and domain wall (DW) motions. In this talk, our recent simulation results on the vortex motions [1], interactions between vortex and antivortex[7,8], vortex-core reversals[1,2,3], and their related phenomena [2,3,4] will be presented. This talk covers the exact mechanism of vortex-core reversals[1], spin-wave radiation[2,3,4], the behaviors of those spin waves traveling in nanowire-waveguides[2,3], and a complex behavior of the periodic transformation of the internal structures of moving DWs in magnetic nanostripes[5].

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FA02

Vortex Core Dynamics Imaged by Time-Resolved Scanning Transmission X-Ray Microscopy

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Fast magnetization dynamics of ferromagnetic structures on a sub-micron length scale are currently attracting substantial scientific interest for both, technological and fundamental reasons [1]. The implementation of stroboscopic measurement techniques into a scanning transmission X-ray microscope (STXM, ALS, Beamline 11.0.2) appears to be a suitable method for such studies, as a time resolution of 50-70 ps combined with a lateral resolution of 20-40 nm can be achieved.

The vortex core plays a key role in the dynamics of micron and sub-micron sized ferromagnetic structures containing a single vortex [2]. New ways were developed to switch the out-of-plane core polarization. The reversal of the vortex core by excitation with short bursts of an in-plane alternating field was discovered recently [3]. Dynamic switching of the vortex core polarization was even possible with a single period magnetic field burst as low as 1.5 mT (Fig. 1), in contrast to (static) perpendicular fields of half a Tesla which were needed so far.

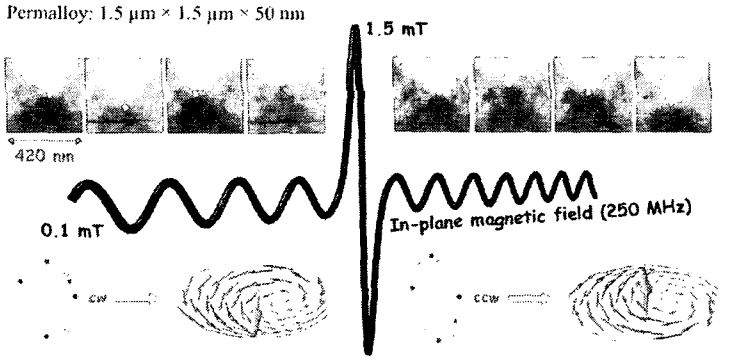

Fig. 1: Experimental results of switching the vortex core polarization [3].

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