Interactions between Domain Walls and spin-polarized currents

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Rather than using conventional field-induced reversal, a promising approach for switching magnetic nanostructures is current-induced domain wall motion (CIDM), where due to a spin torque effect, electrons transfer angular momentum and thereby push a domain wall [1-4]. Since this interaction is strongly dependent on the wall spin structure, we have imaged domain walls in NiFe and Cobalt nanostructures and correlate the above mentioned effects with the imaged spin structure [1-4].

We find that both domain walls types can be moved due to the spin torque effect in the direction of the electron flow [2]. In addition to wall movement, changes in the wall spin structure have been observed yielding insights into the relation between the non-adiabaticity and the damping [2].

Temperature dependent measurements of field- and current-induced wall motion have shown that the critical fields for field-induced wall motion decrease with increasing temperature, which can be attributed to thermal excitations. The critical current densities for current-induced motion though have been found to increase with increasing temperature, which is opposite to the behaviour due to thermal excitations [3], and might be due to the influence of thermally activated spin waves [3]. Using constrictions, we have been able to probe the interplay between current-induced motion and the attractive potential wells that the constrictions generate [4].

[1] M. Kläui et al., PRL **94**, 106601 (2005); A. Yamaguchi et al., PRL **92**, 77205 (2004).
[2] L. Heyne, et al., PRL **100**, 66603 (2008).
[3] M. Laufenberg et al., PRL **97**, 46602 (2006).
[4] D. Bedau et al., PRL **99**, 146601 (2007).

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