Ultrafast spin-orbit dynamics probed with femtosecond x-ray pulses

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The rapidly increasing information density of modern magnetic data storage devices requires new way of magnetic switching. Magnetic field induced magnetization reversal seems to reach a fundamental limit for magnetic field pulse with durations below several picoseconds [1]. Optical control of magnetization [2] could overcome this limitation. However, it challenges our understanding of ultrafast energy and angular momentum transfer between electronic and lattice degrees of freedom. The use of fs laser excitation leads to the fascinating prospect of observing energy and angular momentum transfer between different degrees of freedom with the ultimate goal of their coherent control. This also serves to disentangle the influence of many particle interactions in materials, a remaining formidable challenge in modern physics. We recently succeeded in demonstrating that tunable polarized fs x-ray pulses are capable of probing the angular momentum dissipation in a ferromagnetic model system directly [3]. On the one hand such studies are of relevance for establishing the ultimate time scale for magnetic switching in future nanoscale data storage devices. They also indicate how the availability of VUV- and X-FEL sources will revolutionize the field.

References

[1] I. Tudosa, *et al.,* The ultimate speed of magnetic switichng in granular recording media, *Nature* **428**, 831 (2004).
[2] A.V. Kimel, et al., Nature **435**, 655-657 (2005).
[3] C. Stamm, et al. Nature Materials **6**, 740 (2007).