MAR06-2005-040007

Abstract for an Invited Paper
for the MAR06 Meeting of
the American Physical Society

Ultrafast coherent control of Spin- and magnetization dynamics

THEO RASING[1], Insitute for Molecules and Materials

The manipulating of the electron spin is not only relevant for magnetic storage but may also lead to the development of novel electronic devices with new characteristics (so-called spintronics). Therefore, the investigations of the physical mechanisms underlying the manipulation of electron spin in ferromagnets, semiconductors and hybrid ferromagnet/semiconductor structures constitute at present an exciting area of research. Due to the fact that in antiferromagnets no angular momentum is associated with the order parameter, spin dynamics in these materials is intrinsically much faster than in ferromagnets, expanding the area of spin-dynamics even more [1]. Femto-second laser excitation opens the way to excite magnetic systems on a time scale much shorter than fundamental time scales such as spin-lattice relaxation or precession times. This has already lead to surprising and exciting results like changes in magnetization on a sub-picoscond time scale [2]. Fs laser pulses can also be used to generate short magnetic field pulses, that allow coherent control of the magnetization dynamics [3] . Recent progress in this area will be discussed, demonstrating in particular the use of time resolved magneto-optical methods to investigate the static and dynamic properties of magnetically ordered structures and the possibility of direct spin manipulation with optical fields[4,5]. [1] A. V. Kimel, A. Kirilyuk, A. Tsvetkov, R. V. Pisarev, and Th. Rasing, Nature 429 850 (2004). [2] *Spin Dynamics in Confined Magnetic Structures I-II*, edited by B. Hillebrands and K. Ounadjela (Springer-Verlag, Berlin, 2002-2003). [3] Th. Gerrits, H. A. M. van den Berg, J. Hohlfeld, L. Bär, and Th. Rasing, Nature 418, 509 (2002). [4] A. Kimel, A. Kirilyuk, P.A. Usachev, R.V. Pisarev, A.M. Balbashov and Th. Rasing, Nature 435, 655 (2005) [5] F. Hansteen, A.V. Kimel, A. Kirilyuk and Th. Rasing, PRL 95, 047402-1 (2005). **Acknowledgements** This work was partially supported by the European IST network SPINOSA, the RTN network DYNAMICS, the Russian Foundation for Basic Research (RFBR), Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO) as well as Stichting voor Fundamenteel Onderzoek der Materie (FOM).

[1]Radboud University Nijmegen