MAR09-2008-000210

Abstract for an Invited Paper
for the MAR09 Meeting of
the American Physical Society

Ultrafast magnetization dynamics of cobalt nanoparticles and individual ferromagnetic dots

JEAN-YVES BIGOT, Institut de Physique et Chimie des Matériaux de Strasbourg, UMR7504, CNRS-ULP, Strasbourg 67034

The ultrafast magnetization dynamics of magnetic materials can be investigated using femtosecond laser pulses to perform femtosecond magneto-optical Kerr and Faraday measurements [1]. In this talk, we will focus on the magnetization dynamics of cobalt nanoparticles which are either ferromagnetic or super-paramagnetic at room temperature and on the dynamics of individual ferromagnetic dots. In the first case (Co nanoparticles), we will demonstrate that the magnetization dynamics preceding the fluctuations over the anisotropy energy barrier is coherent but exhibits a strongly damped precession [2]. These results, which have been obtained with a three dimensional analysis of the magnetization vector [3] will be discussed in the context of the Néel-Brown models involving the gyromagnetic character of the magnetization. We will also examine the dynamics of self-organized supra-crystals of cobalt nanoparticles [4]. In the second case, we will present the ultrafast magnetization dynamics of individual ferromagnetic dots ($CoPt_3$, Permalloy, Nickel) made either by e-beam lithography or induced optically on thin films deposited on sapphire and glass substrates. The technique employed is the magneto-optical pump probe imaging (MOPPI) which allows performing time resolved magneto-optical Kerr images with with spatial and temporal resolutions of 300 nm and 150 fs [5]. The study of the demagnetization of the dots for different laser intensities shows that it is possible to write and read ultrafast monodomains on thin films.

[1] E. Beaurepaire, J.-C. Merle, A. Daunois, J.-Y. Bigot Phys. Rev. Lett., **76**, 4250 (1996)

[2] L.H.F. Andrade, A. Laraoui, M. Vomir, D. Muller, J.-P. Stoquert, C. Estournès, E. Beaurepaire, J.-Y. Bigot Phys. Rev. Lett. **97**, 127401 (2006).

[3] M. Vomir, L. H.F. Andrade, L. Guidoni, E. Beaurepaire, J.-Y. Bigot Phys. Rev. Lett. **94**, 237601 (2005).

[4] I. Lisiecki, V. Halté, C. Petit, M.-P. Pileni, J.-Y. Bigot Adv. Mater., **20**, 4176 (2008).

[5] A. Laraoui, M. Albrecht, J.-Y. Bigot Optic. Letters **32**, 936 (2007).