Stuttgarter Physikalisches Kolloquium

Max-Planck-Institut für Intelligente Systeme*
Max-Planck-Institut für Festkörperforschung
Fachbereich Physik, Universität Stuttgart

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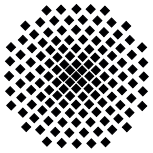

Dienstag, 29. November 2011 | **17.15 Uhr** | **Hörsaal 2 D5**

Stuttgarter Max-Planck-Institute, Heisenbergstraße 1, 70569 Stuttgart-Büsnau

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Magnetization dynamics in the femtosecond flash light of pulsed x-ray sources

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Abstract

In this talk I will discuss how novel insight into magnetization dynamics occurring on the femtosecond time scale can be obtained with femtosecond pulsed x-ray sources, which have become available over the past years. These are the circularly polarized femto-slicing source at BESSY, X-ray Free Electron Lasers like FLASH in Hamburg, LCLS in Stanford and FERMI in Trieste. And IR laser based High Harmonic Generation sources covering the lower part of the soft x-ray photon energy range. The scientific context of this talk is given by our study of ultrafast demagnetization dynamics occurring upon non-thermal excitation of a magnetic thin film by an intense, femtosecond short IR laser pulse. This phenomenon has been at the focus of intense research activity ever since its discovery by E. Beaurepaire and coworkers in 1996 [1]. Since then, it has been investigated in a variety of ferro- and ferrimagnetic transition metal and rare earth compounds and the initially proposed three temperature model [1] has been developed to a convincing phenomenological model, see, .e.g., Ref. [2]. An ab-initio explanation of the ultrafast demagnetization phenomenon is however still missing, implying that there is still a lack of crucial experimental data. In particular, one notes that all data available so far have been recorded by averaging spatially over areas large with respect to the fundamental length scales of magnetism, no information is available detailing the evolution of the local magnetization on the nanometer length scale. In addition, only homogeneously saturated thin films have been studied so far and the importance of domains and their boundaries for the ultrafast demagnetization process is unclear. Our first experiments performed at fs pulsed XFEL and HHG sources demonstrate how these points can be addressed by combining femtosecond temporal with nanometer spatial resolution.

[1] E. Beaurepaire et al., Phys. Rev. Lett. 76, 4250 (1996).
[2] B. Koopmans et al., Nature Mater., 9, 259 (2010)

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