CFEL SCIENCE

SEMINAR

30th January 2013 - 11:00 a.m.

CFEL-bldg. 99, seminar room IV

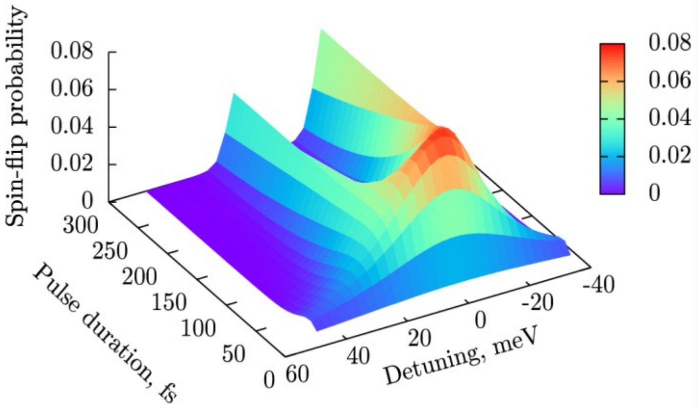
Daria Popova

Peter Grünberg Institute and Institute of Advanced Simulation,
Forschungszentrum Jülich and JARA, Germany

Microscopic description of the inverse Faraday effect at subpicosecond time scales

The inverse Faraday effect (IFE) is a magneto-optical process, which leads to the generation of magnetization by circular polarized light. Since it was experimentally demonstrated that the IFE can serve for non-thermal and coherent excitation and control of magnetization dynamics at femtosecond time scales [1], the effect gained much significance. However, despite its relevance for technological applications, the origin of this effect is poorly understood.

The classical theory of the IFE induced by stationary excitation was developed fifty years ago considering the experimental conditions available at that time. However, we showed that the mechanisms of magnetization changes induced by ultrashort laser pulses is quite different from that excited by stationary excitation [2]. Thus, we develop a new theoretical approach for the IFE based on the solution of the time-dependent Schrödinger equation. It allows to describe magnetization time evolution triggered by circularly-polarized laser pulses at subpicosecond time scales [3].



We investigate the dependence of the effect on ultrafast laser pulse parameters and electron interactions in a system, namely on spin-orbit, Zeeman, crystal field and exchange interactions. The approach is applied to describe laser-induced spin precessions in an external magnetic field and dynamics of an easy plane antiferromagnet.

[1] A. Kimel et al., Nature **435**, 655 (2005).
[2] D. Popova, A. Bringer, S. Blügel, Phys. Rev. B **84**, 214421 (2011).
[3] D. Popova, A. Bringer, S. Blügel, Phys. Rev. B **85**, 094419 (2012).

Host: Robin Santra - CFEL Theory Division