Einladung zum Theoretisch-Physikalischen Kolloquium
gemeinsam mit SFB/TRR 173 Spin+X

Am Donnerstag, 31.01.2019, um 15:30 Uhr

TU Kaiserslautern, Raum 46 – 576

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Laser-induced ultrafast magnetism in nickel and gold nano-objects

Ultrafast magnetism has become a topical research area since the pioneering work of Beaurepaire et al. [PRL 76, 4250 (1996)], who first observed the demagnetization of thin nickel films irradiated with femtosecond laser pulses. In spite of intense investigations, the nature of such ultrafast demagnetization has not been totally elucidated.

In this talk, we consider two aspects of ultrafast magnetism.

First, we introduce a novel phase-space model to study the interaction between a laser pulse and the electron charges and spins in a ferromagnetic nickel film. The model combines both itinerant and localized magnetism and their interplay through various magnetic exchange mechanisms. Our principal result is that oscillating spin currents can be generated in the film via the application of a femtosecond laser pulse of modest amplitude. Such currents may possibly be observed through their emitted magnetic dipole radiation.

In the second part of the talk, we study the creation of a magnetic moment in gold nanoparticles by circularly polarized laser light. The collective electron dynamics is described semiclassically using a quantum hydrodynamic model that incorporates the principal quantum many-body and nonlocal effects, such as the electron spill-out, the Hartree mean field, as well as exchange and correlation effects. We show that gold nanoparticles can build up a static magnetic moment through the interaction with circularly polarized laser light at the surface plasmon resonance. The underlying physical mechanism is a plasmonic inverse Faraday effect, resulting from electric currents on the nanoparticle's surface. The computed laser-induced magnetic moments are sizable, of about 0.35 μB/atom for a laser intensity of 450 GW/cm2 at resonance.

[1] J. Hurst, P.-A. Hervieux, G. Manfredi, Phys. Rev. B 97, 014424 (2018).
[2] J. Hurst, P. M. Oppeneer, G. Manfredi, P.-A. Hervieux, Phys. Rev. B 98, 134439 (2018).

Der Gast wird betreut von Prof. Dr. H.-C. Schneider
GÄSTE SIND HERZLICH WILLKOMMEN!