MA 25: Invited Talks Woltersdorf / Meier / Rasing

Time: Thursday 12:00–13:30 Location: EB 301

Invited Talk MA 25.1 Thu 12:00 EB 301

Magnetization dynamics due to pure spin currents — •Georg Woltersdorf[1], Olexandr Mosendz[2], Christian H. Back[1], and Bret Heinrich[2] — [1]Physik, Universität Regesburg, Universitätsstraße 31, 93040 Regensbug, Germany — [2]Physics Department, Simon Fraser University, 8888 University Drive, V5A 1S6 Burnaby, B.C., Canada

The magnetization dynamics in magnetic double layers is affected by spin-pump and spin-sink effects. So far, only the spin-pumping and its effect on the magnetic damping was studied. However, due to conservation of angular momentum this spin current also leads to magnetic excitation of the layer dissipating this angular momentum (spin-sink). We use the time resolved magneto-optic Kerr effect to directly show the excitation due to the pure spin current. In particular, we observe magnetization dynamics due to the transfer of spin angular momentum in magnetic double layers. In contrast to other experiments where a spin polarized charge current is passed through a nanomagnet this effect is based on pure spin currents without net transfer of electric charge.

In addition it is shown that this effect can be used to estimate the spin diffusion length of the non-magnetic spacer material.

Invited Talk MA 25.2 Thu 12:30 EB 301

Time-Resolved Imaging of Domain-Wall and Vortex Motion Driven by Spin-Polarized Currents — •Guido Meier — Institut für Angewandte Physik und Zentrum für Mikrostrukturforschung, Universität Hamburg, Germany

Transmission x-ray microscopy can directly visualize the influence of a spin-polarized current on the magnetization of micro- and nanostructures. We investigate the stochastic motion of domain walls in curved wires and the motion of vortices in squares. To observe domain-wall motion pulses of nanosecond duration and high current density are send through permalloy wires and either move or deform the domain wall. Repetitive pulse measurements reveal the stochastic nature of current induced domain-wall motion. Via a micromagnetic code based on OOMMF including the spin-torque transfer model of Zhang and Li experiments are compared to theory. The simulations support the interpretation of the experimental results.

Sinusoidal high-density currents are applied to micrometer-sized permalloy squares containing ferromagnetic vortices. Spin-torque induced vortex gyration on the nanosecond timescale is observed. The phase of the gyration in structures with different chirality are compared to an analytical model and micromagnetic simulations, considering both alternating spin-polarized currents and the current's Oersted fields. This analysis reveals that spin-torque is the main source of motion.

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Invited Talk MA 25.3 Thu 13:00 EB 301

Controlling Magnetism by light — •Theo Rasing — Institute for Molecules and Materials, Radboud University Nijmegen, The Netherlands

The interaction of light with magnetic matter is well known: magneto optical Faraday or Kerr effects are frequently used to probe the magnetic state of materials. or manipulate the polarisation of light.

The inverse effects are less known but certainly as fascinating: with light one can manipulate matter, for example orient their spins. Using femtosecond laser pulses we have recently demonstrated that one can thus generate ultrashort and very strong (˜Teslas) magnetic field pulses that provide unprecedented means for the generation, manipulation and coherent control of magnetic order on very short time scales.

In this talk the basic ideas will be discussed and illustrated with recent results.

References

A.V.Kimel, A.Kirilyuk, P.A.Usachev, R.V.Pisarev, A.M.Balbashov and Th.Rasing,Ultrafast nonthermal control of magnetization by instantaneous photomagnetic pulses, Nature 435 (2005), 655-657

C.D.Stanciu, F.Hansteen, A.V.Kimel, A.Kirilyuk, A.Tsukamoto, A.Itoh and Th.Rasing, All-optical Magnetic Recording with Circularly polarized Light, Phys.Rev.Lett.99, 047601 (2007)