O 1 Hauptvortrag Bovensiepen

Zeit: Freitag 09:45–10:30 Raum: TU EB301

Hauptvortrag O 1.1 Fr 09:45 TU EB301

Ultrafast dynamics of coherent lattice and spin excitations at the Gd(0001) surface — •Uwe Bovensiepen — Freie Universität Berlin, Fachbereich Physik, Arnimallee 14, 14195 Berlin

The dynamics of collective excitations of electrons, spins and phonons are of fundamental interest to develop a microscopic understanding of elementary interactions and relaxation mechanisms of these quasiparticles. Based on magnetoelasticity, magnon-phonon interaction is usually attributed to spin-orbit coupling which transfers a displacement of ion cores in the lattice to the spin system and vice versa. However, a microscopic picture is generally not available. Here, ferromagnetic Gd(0001) characterized by a very weak spin-orbit coupling and its exchange-split d_{z^2}-surface state serves as a model system for such coupled phonon-magnon modes, which can be excited coherently by femtosecond laser pulses. Gd(0001) is investigated by complimentary pump-probe-experiments of non-linear optical second harmonic generation (SHG) and time-resolved photoemission (TRPE). SHG separates electron/lattice and spin dynamics by their symmetry with respect to magnetization reversal. A coherent phonon-magnon mode at 2.9 THz is observed in the transient SHG response, which is driven by electronic excitation of surface and bulk states and is damped by scattering with electrons as well as thermalized phonons and spin waves. TRPE adds information on the interaction mechanism. We find that the binding energy of the surface state oscillates at 3 THz as well, which suggests a parametric phonon-magnon-coupling by modulation of the exchange splitting, contrary to the conventional type mediated by spin-orbit-interaction.