Seminar talk, January 29th, 10:30 in seminar room B, 2.6.

Many-body theory of ultrafast demagnetization and angular-momentum transfer in transition metals

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Exact time evolutions in the framework of a many-electron model of itinerant magnetism provide insights into the laser-induced ultrafast demagnetization observed in ferromagnetic transition metals. The model Hamiltonian takes into account hybridizations, Coulomb interactions, spin-orbit interactions and the coupling to the laser field on the same electronic level. Time propagations for Ni cluster models demonstrate that the demagnetization effect can be understood as the result of an interplay between local spin-orbit interactions and interatomic hopping. The underlying mechanism behind the angular-momentum transfer from the electronic spins to the lattice is revealed from a microscopic perspective by rigorously complying with all fundamental conservation laws. Moreover, recent studies of the dependence of the ultrafast demagnetization dynamics on the characteristics of the initial laser excitation are presented. Systematic variations of the most relevant laser parameters, namely, the fluence, wave length, polarization and pulse duration, show how they allow one to control the spectral distribution of the initial excitation and the subsequent magnetization dynamics.