MA 12: Invited Talk Fähnle

Time: Tuesday 9:30–10:00 Location: HSZ 04

Invited Talk MA 12.1 Tue 9:30 HSZ 04

Electron theory of fast and ultrafast dissipative magnetization dynamics — •Manfred Fähnle, Daniel Steiauf, and Jonas Seib — Max-Planck-Institut für Metallforschung, Heisenbergstr. 3, 70569 Stuttgart

In recent years the fast (ns-ps) and ultrafast (several hundred fs) dissipative magnetization dynamics in magnetically ordered materials has been studied very extensively, among others because of its great importance for the switching of magnetic devices. Thereby, a comprehensive understanding of the physical mechanisms leading to the transfer of energy and angular momentum from the spin system to the lattice is one of the most challenging and interesting issues in today's condensed matter physics. In the present talk two models are presented to describe damping on the fast near-adiabatic time scale (relevant for the switching of the magnetization by magnetic fields or spin-polarized currents) and on the ultrafast time scale relevant for the demagnetization after excitation with strong laser pulses. For the near-adiabatic time scale the breathing Fermi surface model of Kamberský is combined with the ab-initio electron theory to derive an equation of motion for the magnetization dynamics on the atomic level which exhibits an anisotropic and nonlocal damping term. For the ultrafast time scale the Elliott-Yafet model of spin- flip scattering is discussed. The spin-mixing parameter which is essential for the spin relaxation in this model is calculated by the ab-initio electron theory for several materials. It is shown that this model is in principle able to describe the demagnetization rates after excitation with a strong laser pulse in Ni, for instance.