O 70: Invited talk (Loth, Sebastian)

Time: Thursday 14:00–14:45 Location: H36

Invited Talk O 70.1 Thu 14:00 H36

Sensing and controlling the spin of an atom by electric current — •Sebastian Loth — IBM Research Almaden, San Jose CA, USA

Electrons interact with the magnetic moment of the material they flow through [1]. This effect is harnessed in the spin transfer torque (STT) to manipulate the relative alignment of the magnetization directions of ferromagnetic thin films in magnetic multilayer devices. We show that similar electrical control is possible for quantum magnetic systems where magnetic excitations are energetically discrete. Individual transition metal atoms adsorbed to a copper nitride layer on a copper substrate serve as model system. We use a low temperature scanning tunneling microscope (STM) to address individual adatoms and probe their energetically discrete excitations by inelastic tunneling [2]. By attaching one magnetic atom to the probe tip and positioning it above another magnetic atom on the surface electric current flows between them and efficiently transfers spin-angular momentum. Similar to the macroscopic STT, the direction of current flow determines whether the magnetic moments of the atoms are driven towards alignment or anti-alignment and a magnetoresistive elastic tunnel current enables sensing it. This technique gives access to the dynamic behavior of the surface-bound spin. We study the mechanism for spin relaxation out of the highly excited spin states and quantify the spin lifetimes in these quantum magnetic systems.

[1] Chappert, et al., Nature Materials 6, 813 (2007). [2] Hirjibehedin, et al., Science 317, 1199 (2007).