O 1: Overview Talk (Harald Brune)

Time: Monday 9:30–10:15 Location: HE 101

Invited Talk O 1.1 Mon 9:30 HE 101

The Smallest Surface Adsorbed Magnets — •Harald Brune — Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland

Making magnets smaller increases thermal fluctuations of the magnetization direction, magnetization reversal by tunneling and by electron scattering. For magnetic storage, the spin relaxation time has to be high, and for quantum computing the spin coherence time. We review the state-of-the art in small surface adsorbed magnets. The ultimate question is, can a single atom be a magnet in the sense that it exhibits remanence or a significant spin coherence time ?

The currently smallest anti-ferromagnets are composed of 12 Fe atoms adsorbed on Cu_2N/Cu(100) [1], and the smallest ferromagnets consist of only 5 Fe atoms on Cu(111) [2]. We find exceptionally large magnetic anisotropy energies for single surface adsorbed atoms of $3d$ elements, with Co on MgO(100) being the record [3]. Nevertheless, these atoms are paramagnetic. $4f$ elements have higher spin-orbit coupling and the potential of magnetic stability. Using X-ray magnetic circular dichroism, we find for Ho and Er on close-packed Pt and Cu surfaces magnetic ground states that are not compatible with long spin coherence times [4]. We show other systems that are more promising for the realization of single atom magnets.

[1] S. Loth *et al.*, Science **335**, 196 (2012); [2] A. A. Khajetoorians *et al.*, Science **339**, 55 (2013); I. G. Rau *et al.*, Science **344**, 988 (2014); F. Donati *et al.*, PRL **113**, 237201 (2014).