

MA 21: Bio- and Molecular Magnetism II

Time: Tuesday 11:00–12:45

Location: HSZ 401

MA 21.1 Tue 11:00 HSZ 401

Self assembled Kondo chains: acetylacetonate on Cu(111) — ●STEFAN SCHMAUS^{1,2}, TOSHIO MIYAMACHI^{1,2}, TOYO KAZU YAMADA^{1,3}, and WULF WULFHEKEL^{1,2} — ¹Physikalisches Institut, Karlsruhe Institut für Technologie, Germany — ²CFN-DFG Centrum für Funktionelle Nanostrukturen, Karlsruher Institut für Technologie, Germany — ³Graduate School of Advanced Integration Science, Chiba University, Japan

Single molecular magnets (SMM) are discussed as an approach for future magnetic storage. While SMM in the bulk phases possess long term spin stability, for applications they have to be placed on a substrate and additional effects, such as molecule-substrate hybridization, play an important role.

We performed scanning tunneling microscopy (STM) studies on Chromium acetylacetonate ($\text{Cr}(\text{acac})_3$), which possesses a spin of 1/2 on the Cr ion. The molecules were sublimed in ultra high vacuum onto a clean Cu(111) surface. The individual molecules as well as ordered molecular chains could be identified in the topographic STM scans. Tunneling spectroscopy, however, showed besides the distinct molecular orbitals a strong zero bias peak, which was identified as a Kondo resonance. Spatially resolved dI/dV maps on the chains showed that the Fano resonance is not only present at the magnetic impurity but is also mediated by the surface state of Cu(111) forming quantum mirages of the Kondo state similar to previous results on single Co atoms on Cu(111) [1].

[1] H. C. Manoharan *et al.*, Nature **403**, 512 (2000)

MA 21.2 Tue 11:15 HSZ 401

Spin coherence and relaxation in Mn-dimer magnetic clusters — ●Y. KRUPSKAYA¹, R. ZARIPOV², E. VAVILOVA^{1,2}, V. MILUYKOV³, I. BEZKISHKO³, D. KRIVOLAPOV³, O. KATAEVA³, O. SINYASHIN³, E. HEY-HAWKINS⁴, V. VORONKOVA², K. SALIKHOV², V. KATAEV¹, and B. BÜCHNER¹ — ¹IFW Dresden, Dresden, Germany — ²Zavoisky Physical-Technical Institute of the RAS, Kazan, Russia — ³A.E. Arbutov Institute of Organic and Physical Chemistry of the RAS, Kazan, Russia — ⁴Institute of Inorganic Chemistry, Leipzig University, Leipzig, Germany

We present a pulsed ESR study of Mn-dimer molecular complexes which show strong dependence of magnetic properties on the ligand surrounding. The complexes were studied as microcrystalline powders and, in addition, as frozen solutions (dissolved in tetrahydrofuran). An electron spin echo in these complexes was detected and the relaxation times T_1 (spin-lattice relaxation) and T_2 (phase-coherence) were determined. We observe a simple exponential T_2 relaxation in the case of dissolved samples and two-component relaxation process in powders. Interestingly, we also observe an electron spin echo envelope modulation (ESEEM) associated with the coupling of the Mn electron spins to nearby proton moments. We discuss the nature of the observed relaxation processes and in particular the role of the intermolecular Mn-Mn relaxation.

MA 21.3 Tue 11:30 HSZ 401

Is the magnetic anisotropy barrier U fixed for a given system? — ●CLAUDIA LOOSE and JENS KORTUS — TU-BA Freiberg, Institut für Theoretische Physik, Leipziger Str. 23, 09599 Freiberg

We studied several octahedral coordinated, $\mu_{1,1}$ -bridged transition metal dimers by first-principles DFT as implemented in the all-electron NRLMOL code. We have been particularly interested in the magnetic groundstate S and the magnetic anisotropy D of the respective dimers. Our results indicate that the barrier of magnetisation U does not show the expected $U = S^2|D|$ behaviour. Instead we observe a steady state behaviour. An increase of the magnetic groundstates is coupled to a decrease of the magnetic anisotropy and hence in a resulting nearly constant barrier U .

MA 21.4 Tue 11:45 HSZ 401

Properties of highly frustrated magnetic molecules studied by the finite-temperature Lanczos method — ●JÜRGEN SCHNACK and OLIVER WENDLAND — Universität Bielefeld, Universitätsstr. 25, D-33615 Bielefeld

The very interesting magnetic properties of frustrated magnetic molecules are often hardly accessible due to the prohibitive size of

the related Hilbert spaces. The finite-temperature Lanczos method is able to treat spin systems for Hilbert space sizes up to about 1 Mrd.. Here we first demonstrate for exactly solvable systems that the method is indeed accurate. Then we discuss the thermal properties of one of the biggest magnetic molecules synthesized to date, the icosidodecahedron with antiferromagnetically coupled spins of $s=1/2$. We show how genuine quantum features such as the magnetization plateau behave as a function of temperature.

MA 21.5 Tue 12:00 HSZ 401

Magnetization measurements of a $\{\text{MnMn}_6\}(\text{CH}_3\text{H}_5\text{O}_3)_3$ single-molecule magnet — ●KLAUS GIEB¹, WOLFGANG KROENER¹, CARL-GEORG FREIHERR VON RICHTHOFEN², THORSTEN GLASER², and PAUL MÜLLER¹ — ¹Department of Physics and Interdisciplinary Center for Molecular Materials (ICMM), Universität Erlangen-Nürnberg, Germany — ²Fakultät für Chemie - Lehrstuhl Anorganische Chemie I, Universität Bielefeld, Germany

We present low-temperature magnetization measurements of a novel $\{\text{MnMn}_6\}(\text{CH}_3\text{H}_5\text{O}_3)_3$ complex. The measurements at mK temperatures were carried out with a home-made micro-Hall-probe magnetometer. A commercial SQUID magnetometer was used to collect the susceptibility data. Most of the 3d-ion based single-molecule magnets, known up to now, have a low-lying spin ground state, well separated from the first excited state. In contrast to this property, the first excited state of the present complex can already be reached with moderate magnetic fields. Amazingly, loop magnetization measurements show hysteresis for both the ground state and the first excited state. This leads to a double hysteresis in the low temperature magnetization measurements. The blocking temperature was found to be $T_B \approx 1.3\text{ K}$.

MA 21.6 Tue 12:15 HSZ 401

Optical switching of single chain magnets — ●ERIC HEINTZE¹, FADI EL HALLAK², ANGELO RETTORI³, FEDERICO TOTTI⁴, MARTIN DRESSEL¹, and LAPO BOGANI¹ — ¹Physikalisches Institut, Universität Stuttgart, Stuttgart, Germany — ²London centre for Nanotechnology, University College London, United Kingdom, London — ³Dipartimento di Fisica, Università di Firenze, Firenze, Italy — ⁴Dipartimento di Chimica, Università di Firenze, Firenze, Italy

The control of the magnetic state of materials using light is seen as an appealing ingredient for the next generation of photonic or spintronic devices for information-storage, opto-electronic systems and energy conversion. Molecular magnets show a hysteresis cycle and magnetic bistability as their relaxation time becomes exponentially long at low temperatures. Here we show, for the first time, that it is possible to switch the magnetization dynamics of molecular magnetic chains using light irradiation at low powers. We investigate the switching of the magnetization dynamics on the single chain magnet $\text{Co}(\text{hfac})_2\text{NITPhOMe}$. To this aim we developed photon excited torque magnetometry. Measurements of the magnetization dynamics indicate that the energy barrier can be altered by light, consistently with the creation of preferential sites of magnetic soliton nucleation. Ab-initio calculations show very good agreement between the expected energy barrier after irradiation and the experimentally extracted one. This result will allow controlling the magnetization of molecular nanowires in spintronic and photo-switchable magnetic systems.

MA 21.7 Tue 12:30 HSZ 401

Electronic structure of magnetic organic molecules on ferromagnetic surfaces — ●DAVID KLAR¹, CLAUDIA WEIS¹, BARBARA BRENA², BERNHARD KRUMME¹, CAROLIN ANTONIAK¹, ANNE WARLAND¹, BIPLAB SANYAL², OLLE ERIKSSON², and HEIKO WENDE¹ — ¹Faculty of Physics and CeNIDE, University of Duisburg-Essen — ²Department of Physics and Astronomy, Uppsala University, Sweden

Magnetic organic molecules on metal surfaces are of interest as a prototype system for molecular spintronic devices. After identifying the magnetic coupling between Fe phthalocyanine (FePc) and ferromagnetic substrates, we focus here on the electronic structure of the FePc molecule on the surface in more detail. We investigate submonolayer coverages of magnetic FePc molecules on ultrathin ferromagnetic films of Ni and Co on Cu(100) by X-Ray absorption spectroscopy (XAS)

and X-Ray magnetic circular dichroism (XMCD). Angular-dependent XAS measurements at the nitrogen K-edge are compared to theoretical calculations both with the FEFF code and the StoBe code. With the help of the calculations we are able to identify the individual orbitals

responsible for the fine structures in the XAS. Furthermore, we will discuss the influence of radiation damage to the molecules detected by the XA-spectra. – Supported by DFG (Sfb491) and Helmholtz-Zentrum Berlin.