O 13 Magnetismus

Zeit: Freitag 15:45–17:00 Raum: TU EB107

O 13.1 Fr 15:45 TU EB107

Nanomagnet arrays fabricated on self-organized semiconductor templates — •C. Teichert[1], A.M. Mulders[2], M.A. Niño[3], S. Heun[4], A. Locatelli[4], C. Hofer[1], N. Mikuszeit[3], J. Camarero[3], A. Fraile Rodriguez[2], J.J. de Miguel[3], and R. Miranda[3] — [1]Inst. of Physics, University of Leoben, A-8700 Leoben, Austria — [2]Dept. of Physics, Uppsala University, S-75121 Uppsala Sweden — [3]Dept. of Condensed Matter Physics and Institute of Materials Science N. Cabrera Univ. Autónoma de Madrid, Cantoblanco, 28049-Madrid, Spain — [4]Sincrotrone Trieste, in AREA Science Park, 34012 Basovizza, Trieste, Italy

Self-organized nanofaceted semiconductor surfaces are attractive candidates to be used as large-area templates for the growth of magnetic nanostructures. By shadow deposition onto selected facet types, arrays of isolated nanomagnets can be fabricated. Using this technique we prepared Co nanomagnets on SiGe templates at the Nanospectroscopy Beamline of the synchrotron ELETTRA. X-ray magnetic circular dichroism (XMCD) measurements using a photoemission electron microscope reveal the in plane magnetization of the 7 monolayer thick Co nanomagnets. Their base size of about 200 nm x 25 nm corresponds to the facet size of the templates as determined by atomic-force microscopy. Although the nanomagnets are isolated, XMCD reveals several micrometer large areas within which the nanomagnets have correlated magnetization. The magnetic coupling is preferentially along the easy axis of the nanomagnets in agreement with micromagnetic simulations.

O 13.2 Fr 16:00 TU EB107

Quantum-Well States and Spin Polarization in Ni/Cu Thin-Film Structures — •Volker Renken, Dehong Yu, Georgi Rangelov, and Markus Donath — Physics Institute, University of Münster, Wilhelm-Klemm-Str. 10, 48149 Münster, Germany

Spin- and angle-resolved inverse photoemission was used to study the unoccupied quantum-well states in ultrathin Ni films on Cu(001). Three quantum-well features are clearly resolved that disperse to higher energies with increasing Ni overlayer thickness. The transition from two- to three-dimensional behaviour is followed by observing the bulk sp-band being formed from discrete quantum-well states. The dispersion of the quantum-well states as a function of the wave vector parallel to the surface agrees well with the corresponding sp-band dispersion. Our results are discussed in comparison with results for Co on Cu(001) [1] with respect to energy dependence and magnetic exchange splitting.

[1] Yu et al., Phys. Rev. B 68 (2003) 155415.

O 13.3 Fr 16:15 TU EB107

Spin polarization and electron confinement in nanoscale Co islands on Cu(111) — •Oswald Pietzsch, André Kubetzka, Stefan Heinze, Matthias Bode, and Roland Wiesendanger — Institute of Applied Physics,University of Hamburg,Jungiusstrasse 11, 20355 Hamburg, Germany

Spin-polarized scanning tunneling spectra (SP-STS) of nanoscale ferromagnetic Co islands on Cu(111) show that the spin polarization (SP) is strongly dependent on the energy in the vicinity of the Fermi level [1]. In particular, the sign of SP is reversed several times within the observed energy window. We discuss possible explanations based on first principles spin-resolved band structure calculations.

Similar to the Cu surface, the Co islands exhibit a standing wave pattern in the local density of states (LDOS) which can be observed by STM [2]. A comparison of the Co and Cu patterns as a function of energy reveals the essential difference: while the latter shows two-dimensional (2D) free electron gas behavior, the former is determined by lateral electron confinement. We compare our results with models based on an exact solution of the particle-in-a-triangular-box problem and a multiple scattering approach. signature of the island rim which is yet different from that of both Co and Cu.

[1] O. Pietzsch *et al.*, Phys. Rev. Lett., **92**, 057202 (2004).
[2] L. Diekhöner *et al.*, Phys. Rev. Lett. **90**, 236801 (2003).

O 13.4 Fr 16:30 TU EB107

Complex magnetism of small 3d transition metal clusters on Ni and Cu surfaces — •Phivos Mavropoulos, Samir Lounis, Rudolf Zeller, Stefan Blügel, and Peter H. Dederichs — IFF, Forschungszentrum Jülich, D-52425 Jülich, Germany

We present ab-initio calculations of magnetic clusters on non-magnetic or magnetic substrates. Firstly, we study small clusters (1-9 atoms) of Fe, Cu, and Ni on Ni and Cu surfaces. Emphasis is given on the dependence of the spin moments on cluster shape and size. For Fe we derive a quantitative rule connecting the moment of each Fe atom linearly to its coordination number. Thus the moment of an arbitrary cluster can be readily found if the positions of the atoms are known. For Co clusters the rule holds to a lesser extent, and much less so for Ni clusters.

Secondly, we focus on small magnetic Mn and Cr clusters, where a competition between ferro– and antiferromagnetic interactions can lead to noncollinear spin structures. The size and orientation of the local moments and the stabilization of noncollinear magnetic state are investigated.

Work supported by the DFG Schwerpunktsprogramm “Clusters in contact with Surfaces” (SPP 1153).

O 13.5 Fr 16:45 TU EB107

Evidence for canted spin structures for small mass selected deposited chromium clusters? — •Matthias Reif, Leif Glaser, Michael Martins, and Wilfried Wurth — Institut für Experimentalphysik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg

The magnetic properties of small (N=1..13) Cr_N clusters deposited on ultrathin Fe films on a Cu(100) substrate magnetized normal to the surface plane have been investigated. To determine the element specific magnetic spin and orbital moments, we have measured X-ray Magnetic Circular Dichroism (XMCD) spectra at the BESSY II storage ring. Soft landing conditions have been used for cluster deposition.

A strong decrease of the spin magnetic moments with increasing cluster size is observed. The spin moments per d-hole decrease from a value of $0.4\mu_B$ for the monomer down to values of $0.1\mu_B$ for the Cr_{13} clusters. The orbital magnetic moments are close to zero for the various cluster sizes except for the Cr_4 cluster. Here, an orbital moment coupled antiparallel to the spin moment is observed and the spin moment is strongly enhanced compared to Cr_3 or Cr_5.

The strong decrease of the spin magnetic moments with increasing cluster size suggests a non collinear alignment of the individual spin moments of the atoms in the larger clusters.

This work was supported by the German ministry for education and research (BMBF) under grant KS1 GUB/5.