MA 15 Spin-Dependent Transport Phenomena II

Time: Tuesday 10:15–11:45 Room: HSZ 103

MA 15.1 Tue 10:15 HSZ 103

Domain wall resistance in $(Co/Pt)_n$-multilayer-nanowires — •C. Hassel, M. Brands, and G. Dumpich — Experimentalphysik, Universität Duisburg-Essen (Campus Duisburg), Lotharstr. 1, 47048 Duisburg

Nanostructured $(Co/Pt)_n$-multilayer-wires with perpendicular magnetic anisotropy are prepared by means of high resolution electron beam lithography (HR-EBL). Structural analysis of $(Co/Pt)_n$-multilayer-films yields a polycrystalline morphology with a mean grain size of 6 ± 2 nm. The magnetic properties of single $(Co/Pt)_n$-multilayer-nanowires are investigated by magnetic force microscopy. The implantation of Ga-ions (FIB) is used to locally modify the coercive field of the wires. These areas can subsequently be used as domain nucleation centres. The pinning of single domain walls is achieved by preparing $(Co/Pt)_n$-multilayer-wires on top of thin platinum wires in a three-step EBL-process and is verified by magnetic force microscopy investigations. Magnetoresistance measurements in perpendicular magnetic fields at room temperature clearly show a positive contribution of a single domain wall with a relative resistance increase of 1.8% inside a single domain wall.

This work is supported within SFB 491.

MA 15.2 Tue 10:30 HSZ 103

Domain wall resistance of nanosize contacts — •Michael Czerner, Bogdan Yu. Yavorsky, and Ingrid Mertig — Martin Luther University, FB Physik, FG Theorie, D-06099 Halle, Germany

Recent experimental results show a large ballistic magnetoresistance in nickel single-atom conductors [1,2]. The magnetic structure of low-dimensional systems, e.g., nanowires, influences the transport properties drastically [3]. Because of the complex geometry of nanocontacts stabilization of noncollinear magnetic configurations is highly possible. In this respect first-principle calculations of the magnetic order of nanowires are of great interest.

We present calculations of the electronic and magnetic structure of suspended nanowires based on density functional theory in the frame of a screened Korringa-Kohn-Rostoker method modified to noncollinear magnetic order [4]. Furthermore, ballistic conductance was calculated within the Landauer approach by means of KKR Green's functions [5] generalized for noncollinear magnetic structures. We consider Fe,Co, and Ni chains suspended between two semi-infinite leads of the same material. We show that the realistic noncollinear magnetic order has considerable effect on the ballistic transport in the nanowires.

[1] N. Garcia et al., Phys.Rev.Lett. **82**, 2923 (1999)
[2] M.R. Sullivan et al., Phys.Rev.B **71**, 024412 (2005)
[3] V. Rodrigues et al., Phys.Rev.Lett. **91**, 096801 (2003)
[4] B.Yu. Yavorsky et al., Phys.Rev.B **70**, 014413 (2004)
[5] P. Mavropoulos et al., Phys.Rev.B **69**, 125104 (2004)

MA 15.3 Tue 10:45 HSZ 103

Point contact Andreev-reflection spectroscopy of ferromagnetic thin films — •Jan M. Scholtyssek, Lars Bocklage, Rainer Anton, Ulrich Merkt, and Guido Meier — Institut für Angewandte Physik und Zentrum für Mikrostrukturforschung, Universität Hamburg, Jungiusstr. 11, 20355 Hamburg

The spin polarisation at the Fermi energy is one of the key properties of ferromagnetic materials in the field of spintronics. We measure the spin polarisation of the conduction electrons using point contact Andreev-reflection spectroscopy (PCAR) [1]. To verify the accuracy of the method measurements on 100 nm thick Ni and Au films are performed. For the interface between the halfmetallic Heusler alloy Ni_2MnIn and InAs a spin polarisation of 100% is predicted [2]. We fabricate Ni_2MnIn films with thicknesses between 30 nm and 100 nm by coevaporation of Ni and a MnIn alloy from two independent sources [3]. Stoichiometric and morphological investigations of the Heusler films deposited on amorphous carbon films are performed in a transmission electron microscope. We present resistivity and PCAR measurements of samples grown on Si exhibiting an enhanced spin polarisation in comparison to the 3d-ferromagnets.

[1] R.J. Soulen, et. al. Science **282**, 85(1998)
[2] K.A. Kilian and R.H. Victora. J. Appl. Phys. **87**, 7064(2000)
[3] M. Kurfiß, et. al. JMMM **290**, 591(2005)

MA 15.4 Tue 11:00 HSZ 103

Current-Induced Excitations in Single Ferromagnetic Layer Nanopillars — •A. Parge and M. Münzenberg — IV. Phys. Inst., Universität Göttingen

Angular momentum transfer studies in magnetic nanostructures have mainly been performed on ferromagnet/ normal magnet/ ferromagnet bilayer junctions so far. But due to spin accumulation on either side of a ferromagnet in the cpp geometry, spin wave excitations have also been predicted theoretically and observed experimentally for junctions with only a single ferromagnetic layer.

We used e-beam lithography and evaporation in order to pattern normal metal/ ferromagnet/ normal metal pillars with a diameter of ˜100 nm on an Au bottom electrode. PMMA served as an insulating template for these structures. Thus a Cu electrode could be smoothly deposited on top of each structure.

All the experimental results presented were obtained in a four point measurement configuration, where the differential resistance dV/dI was measured by a lock-in technique in an external magnetic field. For sufficiently large DC current densities anomalies in dV/dI were observed. The correlation between these phenomena and spin transfer will be discussed in terms of field and current dependence as well as structural asymmetries.

MA 15.5 Tue 11:15 HSZ 103

Structure and dynamics of magnetic polarons in one-dimensional antiferromagnetic semiconductors — •Yaroslav Prylepskiy[1], Alexander Kovalev[1], Magnus Johansson[2], and Yuri Kivshar[3] — [1]B.I. Verkin Institute for Low Temperature Physics and Engineering, 61103, Kharkov, Ukraine — [2]Department of Physics, Chemistry and Biology (IFM), Linköping University, SE-581 83 Linköping, Sweden — [3]Nonlinear Physics Center, Research School of Physical Sciences and Engineering, Australian National University, Canberra ACT 0200, Australia

Based on the one-dimensional Anderson-Hasegawa (AH) double-exchange model we present several families of polaron-type localized solutions, which have collinear and canted arrangement of lattice spins. To study the stability and nontrivial dynamics of magnetic polarons we propose a generalization of the AH model, within which the lattice spins have a finite magnitude. By means of this generalized approach we derive the self-consistent quasiclassical dynamical equations for both the itinerant currier and (classical) lattice spin fields. Then we proceed to find the stationary localized solutions being focused, in particular, on the mobile solutions. Eventually we address the issue of dynamical stability for the several typical polarons having collinear and canted structure and find the solution recognized as a stable mobile polaron.

MA 15.6 Tue 11:30 HSZ 103

Stress vs Coulomb Interaction in La-manganite Films — •Vasily Moshnyaga[1], Kai Gehrke[1], Oleg Shapoval[2], Alexandr Belenciuc[2], Bernd Damaschke[1], and Konrad Samwer[1] — [1]I. Physikalisches Institut, Universitaet Goettingen, Friedrich-Hund-Platz 1, 37077 Goettingen, Germany — [2]Institute of Applied Physics, AS RM, str. Academiei 5, MD-2028, Chisinau, Republic of Moldova

La-deficient La(1-δ)MnO(3) (LMO) (δ=0-0.2) films were epitaxially grown on SrTiO(3) (STO) and MgO substrates by metalorganic aerosol deposition technique. The films grown on STO substrate show metal-insulator transition and ferromagnetic ordering for T<Tc=260-285 K, whereas those grown on MgO are insulating and exhibit only weak ferromagnetism for T<100 K. X-ray diffraction reveal a stress-free state of the films grown on MgO with lattice constant c=0.389 nm, which does not depend on *δ*. In contrast the LMO/STO films are biaxially strained and possess c=0.386 nm. Predominant role of Coulomb interaction in the growth of manganite films is elucidated. In the case of MgO substrate the charge compensation leads to the formation of stoichiometric LaMnO(3) phase and second phase of MnO(x). The La-deficiency can be stabilized only by an additional elastic contribution (stress) due to substrate/film lattice misfit. The obtained results open a promising possibility to control the structure and magnetotransport in manganites by the interplay between elastic and Coulomb interaction. SFB 602, TP A2 is acknowledged.