MA 13: Magnetic Materials II

Time: Tuesday 9:30–11:15 Location: H31

MA 13.1 Tue 9:30 H31

Phonons and the metamagnetic transition in FeRh — •Michael Wolloch[1], Florian Hofer[2], Dieter Süss[2], and Peter Mohn[1] — [1]Institute of Applied Physics, Vienna University of Technology, Wiedner Hauptstraße 8-10, A-1040 Vienna, Austria — [2]Institute of Solid State Physics, Vienna University of Technology, Wiedner Hauptstraße 8-10, A-1040 Vienna, Austria

The meta-magnetic transition, from G-type antiferromagnetic (AFM) to ferromagnetic (FM) order at $\sim$ 350K, makes FeRh a very interesting material which could be used, for example, in a layered system in conjunction with FePt for heat assisted magnetic recording media [1,2,3]. Several explanations for the transition have been proposed, but there is still debate over the correct mechanism [4,5,6].

We present DFT calculations using the VASP code of several magnetic configurations of FeRh, including zero point energies and phonons. We find that FeRh is extremely sensitive to the choice of computational parameters and sensible to slight distortions in the lattice. Additionally we conclude that the vibrational zero-point energy is not negligible when considering the energetic hierarchy of different magnetic configurations.

[1] G. Shirane et al., *Phys. Rev.*, **134**, A1547 (1964)
[2] J.-U. Thiele et al., *Appl. Phys. Lett.*, **82**, 2859 (2003)
[3] D. Süss et al., *Appl. Phys. Lett.*, **89**, 113105 (2006)
[4] M. E. Gruner et al., *Phys. Rev. B*, **67**, 064415 (2003)
[5] R. Y. Gu et al., *Phys. Rev. B*, **72**, 012403 (2005)
[6] J. Kudrnovský et al., *Phys. Rev. B*, **91**, 014435 (2015)

MA 13.2 Tue 9:45 H31

Magnetic phase diagram of HoCu — •Wolfgang Simeth[1], Marein Rahn[2], Michael Wagner[1], Nives Bonacic[1], Anatoliy Senyshyn[3], Martin Meven[3], Sebastian Mühlbauer[3], Andre Heinemann[3], Tobias Weber[3], Tobias Schrader[3], Andreas Bauer[1], Robert Georgii[3] und Christian Pfleiderer[1] — [1]Technische Universität München — [2]Oxford University — [3]Heinz Maier-Leibnitz (FRM II)

The rare-earth system HoCu orders in the centrosymmetric CsCl-structure. As a consequence of several competing interactions (CEF as well as itinerant, indirect, and quadrupolar exchange interactions), the localised 4f magnetic moments of the Ho-atoms order in complex multiaxial arrangements [1]. We report the magnetic field dependence of the magnetic order up to 14 T as inferred from neutron diffraction and selected bulk properties (magnetization, ac susceptibility, and electrical transport).

[1] P. Morin and D. Schmitt, J. Magn. Magn. Mater. 21, 243 (1980)

MA 13.3 Tue 10:00 H31

Magnetic small-angle neutron scattering on bulk metallic glasses — •Denis Mettus[1], Andreas Michels[1], Dirk Honecker[2], Rainer Birringer[3], Michael Deckarm[3], and Andreas Leibner[3] — [1]University of Luxembourg, Luxembourg — [2]Institut Laue-Langevin, Grenoble, France — [3]Universität des Saarlandes, Saarbrücken, Germany

Bulk metallic glasses (BMG) are amorphous solids which are very well known for their excellent mechanical properties. In this contribution, we focus on their magnetic behavior and we discuss the influence of mechanical deformation on the magnetic microstructure as seen by magnetic-field-dependent small-angle neutron scattering (SANS). This technique allows one to investigate the spin distribution in the bulk of the material and on the nanometer length scale. We present and compare the results of unpolarized SANS on various BMG samples (as-cast, aged, deformed) and we analyze the SANS cross section in real space by computing the correlation function.

MA 13.4 Tue 10:15 H31

Strongly correlated alloys and dynamical mean field theory — •Alexander Poteryaev — M.N. Miheev Institute of Metal Physics of Ural Branch of Russian Academy of Sciences, Ekaterinburg 620137, Russia — Institute of Quantum Materials Science, Ekaterinburg 620075, Russia

For the physical description of the transition metal alloys both strong interactions and disorder have to be accounted for, and hence it is highly desirable to have a method that can treat, on equal footing, disorder and partially filled strongly interacting d states of transition metals. Combination of two techniques, the coherent potential approximation for disorder and the dynamical mean-field theory for correlated electrons which share an effective medium interpretation of the system of interest, allows one to investigate different physical properties of real alloys. The magnetic properties of Fe-Ni alloy and structural phase transition in Fe-Mn alloy are investigated as a function of temperature and concentration. Comparison of the coherent potential approximation and dynamical mean-field theory calculations agrees well with experimental data.

MA 13.5 Tue 10:30 H31

Determining the Verdet constant in antiferromagnetic materials — •Christian Tzschaschel[1], Stefan Günther[1], Takuya Satoh[2], and Manfred Fiebig[1] — [1]ETH Zürich, Switzerland — [2]Kyushu University, Japan

Recently, in the context of all-optical switching and ultrafast magnon generation, the Faraday effect and its inverse were discussed as possible mechanisms allowing to probe and stimulate magnetic excitations. The strength of both processes is related to the Verdet constant - a material parameter describing light-matter interactions in magnetic fields.

By measuring the spectral dependence of the Faraday rotation under the application of magnetic fields up to 6 T at temperatures down to 4 K, we are able to investigate fully compensated antiferromagnets like NiO and determine the Verdet constant in a broad spectral range covering the visible and near infrared. Subsequently, we compare the results to Bismuth-doped Yttrium-Iron-garnet as a well-known example of a material exhibiting a finite spontaneous magnetization.

Our results can be used to maximize the magnon generation efficiency with circularly polarized light via the inverse Faraday effect and at the same time optimize the sensitivity for the detection of magnetic excitations.

MA 13.6 Tue 10:45 H31

Flexible arrays of printed giant magnetoresistive devices — •Alexander Kutscher, Daniil Karnaushenko, Dmitriy Karnaushenko, Denys Makarov, and Oliver Schmidt — IIN, IFW Dresden, Helmholtzstraße 20, Dresden, 01069 Germany

Lightweight, flexibility and imperceptibility of magnetoelectronics is dictated by the design of modern portable and wearable devices[1]. Diverse printing and thin-film technologies were applied to satisfy the needs of this novel shape of electronics to achieve large-scale and cheap fabrication[2] capabilities. Recently, was developed printable magnetosensorics[3] relying on the giant magnetoresistive effect(GMR), which has already entered the field of flexible electronics[4]. Fast, high yield and homogenous printing of the magnetic sensors have to be achieved for industrial and commercial applications. Arrays of printed GMR sensors were fabricated on thin polymeric foils using a commercial dispenser robot. The GMR ink is applied in a form of dots on top of foil over the printed silver electrodes by the dispense printing. Hundreds of sensors could be produced. Various parameters like paste composition, binder, toxicity, viscosity and the dispensing process were optimised to obtain safe and reliable fabrication process. The printed sensor arrays possess up to 25% ratio with a high yield(>90%) across the array, broad operating temperature range and resistivity in the range of hundreds of Ohms, which is sufficient even for the most demanding applications. [1]M. Melzer, et al., Nat. Commun. 6(2015) 1 [2]H. Kang, et al., Sci. Rep. 4(2014) 5387[3]D. Karnaushenko, et al., Adv. Mater. 24(2012) 4518[4]D. Karnaushenko, et al., Adv. Mater. 27(2015) 880

MA 13.7 Tue 11:00 H31

Flux transfer across domain walls in the patterned Permalloy thin films — •Sukhvinder Singh, Haibin Gao, and Uwe Hartmann — Institute of Experimental Physics, Saarland University, P O. Box 151150, D-66041, Saarbrücken, Germany

Magnetic domain walls are subjects of intense fundamental research on controlling, manipulating and moving their internal configuration [1]. We have investigated the mechanism of magnetic flux transfer across domain walls in patterned Permalloy thin films under static magnetic field induced magnetization reversals. High-resolution images of cross-tie domain walls and asymmetric domain walls [2] were obtained by magnetic force microscopy for 40 nm and 130 nm thick Permalloy structures, respectively. The transformations between different internal structures of domain walls were studied by applying inplane magnetic fields. The motion of the vortices, antivortices and line singularities [2] was tracked along the domain walls in order to understand the magnetization reversal of domain walls. The experimental results were compared to three-dimensional micromagnetic simulations to link these internal transformations to wall energies.

[1] J.Y. Lee et al., Phys. Rev. B 76, 184408 (2007) [2] A. Hubert, and R. Schafer, Magnetic Domains (Springer Verlag, Berlin, 1998)