MA 12: Spincaloric transport

Time: Monday 17:15–18:30 Location: H53

MA 12.1 Mon 17:15 H53

Magneto-thermoelectronic properties of Weyl semimetal Co2MnGa thin films — •H. Reichlova[1], R. Schlitz[1], S. Beckert[1], P. Swekis[1,2], A. Markou[2], Y. C. Cheng[2], D. Kriegner[2], S. Fabretti[1], G. H. Park[3,4], A. Niemann[3], S. Sudheendra[3], A. Thomas[3], K. Nielsch[3,4], C. Felser[2], and S. Goennenwein[1] — [1]Institut für Festkörper- und Materialphysik, Technische Universität Dresden, Germany — [2]MPI CPfS, Dresden, Germany — [3]IFW Dresden, Institute for Metallic Materials, Germany — [4]Technische Universität Dresden, Institute of Materials Science, Germany

The non-trivial topology of the band structure of Weyl semimetals leads to unexpected magneto-thermoelectronic transport phenomena. A promising Weyl semimetal is the ferromagnetic Heusler compound Co_2MnGa with the Fermi energy in the vicinity of the Weyl nodes. Here we report the observation of a record large anomalous Nernst coefficent -2μV/K in Co_2MnGa thin films [1]. We will discuss the procedure for the quantitative determination of the thermal gradient and address potential artifacts potentially impacting the anomalous Nernst coefficient. Comparing the magnitude of the anomalous Nernst coefficient in Co_2MnGa films of different thickness, we conclude that the microscopic origin of the anomalous Nernst effect in Co_2MnGa is complex and contains contributions from the intrinsic Berry phase and surface states. [1] Reichlova *et al.*, APL 113, 212405 (2018)

MA 12.2 Mon 17:30 H53

Spin Seebeck Effect in Noncollinear Antiferromagnets — •Robin R. Neumann[1], Alexander Mook[1], Jürgen Henk[1], and Ingrid Mertig[1,2] — [1]Institut für Physik, Martin-Luther-Universität, D-06120 Halle — [2]Max-Planck-Institut für Mikrostrukturphysik, D-06120 Halle

Applying a temperature gradient to a magnetic insulator results in a magnonic spin current response, a phenomenon that goes under the name “spin Seebeck effect” (SSE). To date the SSE has been measured in ferromagnets/ferrimagnets [1] or in collinear antiferromagnets in an external magnetic field [2]. However *in zero field* the SSE vanishes in collinear antiferromagnets [2] whereas *noncollinear* antiferromagnets exhibit a SSE, which we demonstrate theoretically by reference to the kagome antiferromagnet potassium iron jarosite. Our findings suggest to replace ferromagnets by antiferromagnets as the spin-active parts of next-generation spincaloritronic devices.

[1] Uchida *et al.*, Nat. Materials **9**, 894–897 (2010).
[2] Wu *et al.*, PRL **116**, 097204 (2016).

MA 12.3 Mon 17:45 H53

Anomalous Nernst effect in magnetic tunnel junctions: A concept for direction dependent temperature sensing — Ulrike Martens[1], Torsten Huebner[2], Henning Ulrichs[3], Oliver Reimer[2], Timo Kuschel[2], Ronnie Tamming[4], Chia-Lin Chang[4], Raanan Tobey[4], Andy Thomas[5], Markus Münzenberg[1], and •Jakob Walowski[1] — [1]Universität Greifswald, Greifswald, Germany — [2]Bielefeld University, Bielefeld, Germany — [3]Universität Göttingen, Göttingen, Germany — [4]University of Groningen, Groningen, The Netherlands — [5]IFW Dresden, Institute for Metallic Materials, Dresden, Germany

CoFeB/MgO based magnetic tunnel junctions (MTJs) exhibit a large tunnel magnetoresistence effect due to a high spin polarization given by the material combination. This enables information storage based on the magnetization state. Replacing the voltage as a driving force for the spin polarized currents by temperature gradients opens up new functionalities for these devices. By applying a homogeneous temperature gradient across the tunnel barrier, the tunneling magneto-Seebeck effect (TMS) can be used as a readout method, because the generated voltage is magnetization dependent. Inhomogeneous temperature gradients generate additional thermomagnetic effects, which have an impact on the TMS. Those effects, e.g. the anomalous Nernst effect (ANE), can be extracted by systematically changing the temperature gradient direction and measuring the TMS. We demonstrate, that analyzing the ANE with respect to the temperature gradient directions, allows for direction dependent temperature sensing.

MA 12.4 Mon 18:00 H53

Thermal Hall Effect in Noncollinear Coplanar Insulating Antiferromagnets — •Alexander Mook[1], Jürgen Henk[1], and Ingrid Mertig[1,2] — [1]Institut für Physik, Martin-Luther-Universität, D-06120 Halle — [2]Max-Planck-Institut für Mikrostrukturphysik, D-06120 Halle

Recently, it was predicted and demonstrated that antiferromagnets can exhibit an anomalous Hall effect [1], which was traditionally ascribed to ferromagnets. Here, we show that insulating antiferromagnets can exhibit a thermal Hall effect due to their collective magnetic excitations, magnons. The two necessary requirements for the existence of this Hall effect are: (i) the breaking of an effective time-reversal symmetry and (ii) a magnetic point group compatible with ferromagnetism. Since the latter does not imply the actual presence of ferromagnetism, antiferromagnets with sufficiently low symmetry may meet both requirements. Such antiferromagnets are realized, for example, on the kagome lattice in the inverse vector chiral magnetic phase, as it occurs approximately in cadmium kapellasite [2].

[1] Chen *et al.*, PRL **112**, 017205 (2014); Kübler, Felser, EPL, **108**, 67001 (2014); Ajaya *et al.*, Science Advances **2**, e1501870 (2016).
[2] Okuma *et al.*, PRB **95**, 094427 (2017).

MA 12.5 Mon 18:15 H53

Impact of magnetic moment and anisotropy of $Co_{1-x}Fe_x$ thin films on the magnetic proximity effect of Pt — Panagiota Bougiatioti[1], Orestis Manos[1], Olga Kuschel[2], Joachim Wollschläger[2], Martin Tolkiehn[3], Sonia Francoual[3], and •Timo Kuschel[1] — [1]Center for Spinelectronic Materials and Devices, Bielefeld University, Germany — [2]Center of Physics and Chemistry of New Materials, Osnabrück University, Germany — [3]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

We have investigated the magnetic proximity effect in Pt depending on the magnetic moment and anisotropy of adjacent metallic ferromagnetic films by x-ray resonant magnetic reflectivity at the Pt absorption edge (11565 eV) [1]. For Pt on different ferromagnetic metals such as $Ni_{1-x}Fe_x$ [2] and $Co_{1-x}Fe_x$ [3], we observe a linear dependence between the Pt magnetic moment and the moment of the adjacent ferromagnet. The largest Pt magnetic moment of (0.72±0.03) μ_B per spin polarized Pt atom has been detected in Pt/$Co_{0.33}Fe_{0.67}$ [3]. In addition, the Pt magnetic moment clearly follows the magnetic anisotropy of the ferromagnet below. This has been studied for Pt on Fe(001) and on $Co_{0.5}Fe_{0.5}$(001) with 45° rotated fourfold magnetocrystalline anisotropy as checked by magnetooptic Kerr effect [3]. In future work, the interplay of spin caloritronic and thermoelectric effects in these all-metallic bilayers will be explored.

[1] T. Kuschel et al., Phys. Rev. Lett. 115, 097401 (2015)
[2] C. Klewe et al., Phys. Rev. B 93, 214440 (2016)
[3] P. Bougiatioti et al., arXiv:1807.09032