MA 14: INNOMAG e.V. Dissertationspreis 2018 / Ph.D. Thesis Prize

Die Arbeitsgemeinschaft Magnetismus der DPG hat einen Dissertationspreis ausgeschrieben, welcher auf der Frühjahrstagung der DPG im März 2018 in Berlin vergeben wird. Ziel des Preises ist die Anerkennung herausragender Forschung im Rahmen einer Promotion und deren exzellente Vermittlung in Wort und Schrift. Im Rahmen dieser Sitzung tragen die vier besten der für ihre an einer deutschen Hochschule durchgeführten Dissertation Nominierten vor. Im direkten Anschluss entscheidet das Preiskommittee über den Gewinner bzw. die Gewinnerin des INNOMAG e.V. Disserationspreises 2018 in Höhe von 1000 EURO.
Talks will be given in English!

Time: Monday 15:00–16:55 Location: H 0112

Invited Talk MA 14.1 Mon 15:00 H 0112

On the magnetocaloric properties of Heusler compounds — •Tino Gottschall — TU Darmstadt, Institute of Material Science, Germany

Large magnetocaloric effects can be obtained in the Heusler alloys Ni-Mn-In and Ni-Mn-In-Co during the magnetostructural phase transformation between the low-temperature paramagnetic martensite and the high-temperature ferromagnetic austenite phase. The martensitic transition is furthermore sensitive to a magnetic field but also to hydrostatic pressure. It can therefore be induced by those external stimuli [1]. However, the existence of thermal hysteresis in those materials limits the reversible adiabatic temperature and isothermal entropy change. The magnetocaloric effect under cycling can be enhanced in so-called minor loops of hysteresis [2]. On the contrary, in very high magnetic-field rates as well as in micrometer-sized single particles, the thermal hysteresis increases significantly [3]. In order to understand the contrasting behavior of small fragments compared to bulk, a finite element model is introduced, from which the importance of mechanical stress during the transition becomes apparent [4].

[1] T. Gottschall et al., Phys. Rev. B 93, 184431 (2016).
[2] T. Gottschall et al., Appl. Phys. Lett. 106, 021901 (2015).
[3] T. Gottschall et al., Phys. Rev. Applied 5, 024013 (2016).
[4] T. Gottschall et al., Adv. Funct. Mater. 27, 1606735 (2017).

Invited Talk MA 14.2 Mon 15:25 H 0112

Topological Magnon Materials and Transverse Magnon Transport — •Alexander Mook — Institut für Physik, Martin-Luther-Universität, D-06120 Halle, Germany

Since Joule heating limits the efficiency of today's spintronics devices, electrons as carriers of information may be replaced by magnons, requiring a detailed understanding of magnon transport properties. Particularly fascinating magnon transport properties are found in topological magnon insulators that exhibit a thermal magnon Hall effect [1], calling for a general analysis of topological magnon materials like, for example, magnon Weyl semimetals [2] and magnon nodal-line semimetals [3]. I demonstrate how such topological magnon matter and its magnon Hall effects can be understood within linear spin-wave theory and Berry-phase theory. Moreover, I present a new method for the calculation of magnon transport based on atomistic spin dynamics simulations and the Green-Kubo relations. It is used to study the transverse magnon transport in the topological magnon insulator Cu(1,3-benzenedicarboxylate) [4] and in a skyrmion crystal [5].

[1] H. Katsura et al., Phys. Rev. Lett. 104, 066403 (2010); Y. Onose et al., Science 329, 297 (2010); R. Matsumoto et al., Phys. Rev. Lett. 106, 197202 (2011); A. Mook et al., Phys. Rev. B 89, 134409 (2014) [2] F.-Y. Li et al., Nature Commun. 7, 12691 (2016); A. Mook et al., Phys. Rev. Lett. 177, 157204 (2016) [3] A. Mook et al., Phys. Rev. B 95, 014418 (2017) [4] Hirschberger et al., Phys. Rev. Lett. 115, 106603 (2015); A. Mook et al., Phys. Rev. B 94, 174444 (2016) [5] A. Mook et al., Phys. Rev. B 95, 020401(R) (2017)

Invited Talk MA 14.3 Mon 15:50 H 0112

Ferromagnet-Free Magnetoelectric Thin Film Elements — •Tobias Kosub — Helmholtz-Zentrum Dresden-Rossendorf e.V., Institute of Ion Beam Physics and Materials Research, Dresden, Germany

Thin film spintronic elements could complement conventional electronic computing in the future in applications such as high efficiency data processing. Magnetoelectric antiferromagnets are attractive for two reasons: First, they allow electric field actuation of magnetic state changes. This is more energy efficient than charge current based manipulation because the latter is accompanied by conduction losses. Second, antiferromagnets offer intrinsic robustness against magnetic stray fields and potentially picosecond addressability.

This thesis encompasses the design, development, realization and testing of novel magnetoelectric thin film elements that do not rely on ferromagnets, but are based entirely on magnetoelectric antiferromagnets such as Cr_2O_3 [1]. Using a new electrical measurement scheme [2], a purely antiferromagnetic memory prototype is demonstrated, which greatly exceeds the performance of conventional counterparts based on ferromagnets.

[1] T. Kosub et al., *Nature Commun.* **8**, 13985 (2017).
[2] T. Kosub et al., *Phys. Rev. Lett.* **115**, 097201 (2015).

Invited Talk MA 14.4 Mon 16:15 H 0112

Optically induced ferro- and antiferromagnetic dynamics in the rare-earth metal dysprosium — •Nele Thielemann-Kühn — Helmholtz-Zentrum Berlin, Albert-Einstein-Str. 15, 12489 Berlin, Germany — Freie Universität Berlin, Fachbereich Physik, Arnimallee 14, 14195 Berlin, Germany

By comparing ferro- and antiferromagnetic dynamics in one and the same material -metallic dysprosium- we show both to behave fundamentally different. Antiferromagnetic order is considerably faster and much more efficiently manipulated by optical excitation than its ferromagnetic counterpart. Within a depth-resolved study of optically induced antiferromagnetic dynamics we find the magnetic order to be suppressed by a long-ranging process. We assign this fast and extremely efficient mechanism to an interatomic transfer of angular momentum within the spin-system via fast diffusion of excited valence electrons. On longer picosecond-timescales the antiferromagnetic order is further reduced only in regions where the laser directly excited the sample. In addition we observe two clearly distinguishable regions with different magnetic properties within the sample hinting to a long-living non-equilibrium state of the 4f-magnetic system. The complex depth dependent quenching behavior of the antiferromagnetic order is indicative for the interplay of different delocalized as well as local spin-scattering channels.

Selection and announcement of the winner.