MA 45: Spin Structures and Magnetic Phase Transitions II

Time: Thursday 15:00–16:00 Location: EB 407

MA 45.1 Thu 15:00 EB 407

Modelling thermal transport in spiral magnets — •Margherita Parodi[1,2] and Sergey Artyukhin[1] — [1]Italian Institute of Technology, Genova, Italy — [2]University of Genova, Italy

Magnetic memory and logic devices, including prospective ones based on skyrmions, inevitably produce heat. Thus, controlling heat flow is essential for their performance. Here we study magnon contribution to thermal conductivity in the most basic non-collinear magnet with a spin spiral ground state. Non-collinearity leads to anharmonic terms, resulting in magnon fusion and decay processes. These processes determine the magnon lifetime which can be used to estimate thermal conductivity in single mode approximation. However, by solving the full Boltzmann equation numerically, we find much higher thermal conductivity. This signifies that heat is carried not by individual magnons but by their linear combinations, called relaxons. The thermal conductivity is found to be increasing with the diminishing twist angle, consistent with recent experiments. The results pave the path to understanding magnetic thermal transport in other non-collinear magnets.

MA 45.2 Thu 15:15 EB 407

Optical conductivity in the kagome-based skyrmion-host material $Gd_3Ru_4Al_{12}$ — •Luca Malucelli[1], Felix Schilberth[1], Max Hirschberger[2], and István Kézsmárki[1] — [1]Experimentalphysik V, Center for Electronic Correlations and Magnetism, Institute for Physics, Augsburg University, D-86135 Augsburg, Germany — [2]RIKEN Center for Emergent Matter Science (CEMS), Wako 351-0198, Japan

Materials hosting topological magnetic textures, such as the atomic-scale skyrmion lattice in $Gd_3Ru_4Al_{12}$, attract great attention. In this itinerant magnet, the magnetic texture influences the electronic structure, leading to giant topological Hall Effect (THE) in the skyrmion lattice state of this compound. Motivated by this, we investigated the electronic structure of $Gd_3Ru_4Al_{12}$, with a breathing kagome lattice of Gd sites, by optical spectroscopy. In the talk, we discuss the main features of the optical conductivity spectrum arising from bands near the Fermi energy, with a special focus on changes of the optical properties upon the magnetic ordering taking place below 18 K.

MA 45.3 Thu 15:30 EB 407

Tuning Magnetism in Epitaxial $(Cr_{1-x}Mn_x)_2GaC$ MAX Phase Films: Insights into Stoichiometry and Chemical Disorder — •Ivan Tarasov, Hanna Pazniak, Olga Miroshkina, Michael Farle, and Ulf Wiedwald — University of Duisburg-Essen

MAX phases promise quasi-2D highly anisotropic magnetic properties due to their nanolaminated structure, tunable chemistry, and high oxidation resistance. Here, we study the $(Cr_{1-x}Mn_x)_2GaC$ MAX phase system with $0 \leq x \leq 1$ aiming to fine-tune magnetic responses through stoichiometric adjustments. High-quality epitaxial thin films (thickness 25 to 75 nm) are grown on rigid MgO(111), Al_2O_3(0001), and flexible muscovite $KAl_3Si_3O_{10}(OH)_2$(001) substrates by pulsed laser deposition. The structural characterization reveals a competition between $(Cr_{1-x}Mn_x)_2GaC$ MAX phase and competing phases, which is mitigated by optimizing the growth conditions. Vibrating sample magnetometry indicates an overall trend of increasing magnetization and ordering temperature with higher Mn content. The broad transition towards the paramagnetic phase within up to 150 K, however, for different $(Cr_{1-x}Mn_x)_2GaC$ MAX phase films are explained by local chemical order on M sites, as supported by first-principles calculations and Monte Carlo simulations within the Heisenberg model.

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MA 45.4 Thu 15:45 EB 407

Proton disorder in the double hydroxide perovskite $CuSn(OH)_6$ under hydrostatic pressure. — •Nikolai Pavlovskii[1], Anton Kulbakov[1], Kaushick Krishnakanta Parui[1], Darren C. Peets[1], Thomas Doert[2], Thomas Hansen[3], Ellen Häusler[2], Ines Puente-Orench[3], Vladimir Pomjakushin[4], and Dmytro S. Inosov[1] — [1]IFMP, TU Dresden, Germany — [2]Anorg. Chemie II, TU Dresden, Germany — [3]ILL, France — [4]PSI, Switzerland

The understanding of proton disorder in materials beyond water ice is useful for the discovery of unique quantum phenomena. We present a comprehensive study of $CuSn(OH)_6$ (mineral name: mushistonite), a double hydroxide perovskite. Based on both X-ray and neutron diffraction studies, we have solved crystal structure of the synthetic deuterated compound $CuSn(OD)_6$ - *Pnnn*. At the same time, we have identified a strong disorder at all the deuterium sites. Furthermore, no magnetic Bragg peaks were found down to 50 mK, indicating that proton disorder may play a significant role in suppressing long-range magnetic ordering in this system, suggesting a ground state similar to that of a quantum spin liquid. It also motivates a pressure dependent investigation. Our experimental results reveal the structural nuances of $CuSn(OD)_6$ under varying pressures within a Paris-Edinburgh cell and shed light on potential structural phase transitions associated with proton ordering.