CRC/TRR 270

HoMMage

TECHNISCHE UNIVERSITÄT DARMSTADT

UNIVERSITÄT DUISBURG ESSEN

Offen im Denken

Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

Tuesday, 11 October 2022, 9:00 s.t., TU Darmstadt, in person and via Zoom

Prof. Dr. Claudia Felser

Max Planck Institute Chemical Physics of Solids, Dresden, Germany

Topology for energy efficient spintronics and energy conversion

Abstract:

Topology, a mathematical concept, recently became a hot and truly transdisciplinary topic in condensed matter physics, solid state chemistry and materials science. All 200 000 inorganic materials were recently classified into trivial and topological materials, such as topological insulators, Dirac, Weyl and nodal-line semimetals, and topological metals [1]. More than 25% of all materials host topological bands around the Fermi energy. Beyond the single particle picture, we have identified first antiferromagnetic topological materials [2]. Experimentally, we have realized ferromagnetic materials, examples are Co2MnGa and Co3Sn2S2. Surprisingly all crossings in the band structure of ferromagnets are Weyl nodes or nodal lines [3]. Mn3Sn and YbMnBi2 are examples of non collinear antiferromagnetic Weyl semimetals, which show giant values for the anomalous Hall and Nernst effect [4]. In the context of real space topology, skyrmions and antiskyrmions are a possible new direction for new data storage [5]. Our goal is to identify new quantum-materials for highly efficient spintronics, quantum computing and energy conversion.

1. Bradlyn et al., Nature 547 298, (2017), Vergniory, et al., Nature 566 480 (2019), Vergniory, et al., Science accepted arXiv:2105.09954.
2. Xu et al. Nature 586, 702 (2020).
3. Liu, et al. Nature Physics 14, 1125 (2018), Belopolski, et al., Science 365, 1278 (2019), Guin, et al. Advanced Materials 31 (2019) 1806622, Liu, et al., Science 365, 1282 (2019), Morali, et al., Science 365, 1286 (2019)
4. Pan, et al., Nature Materials 21 (2022) 203, Kübler and Felser, EPL 120 (2017) 47002 and EPL108 (2014) 67001, Nayak, et al. Science Advances 2 (2016) e1501870
5. Nayak et al., Nature 548 (2017) 561

About the speaker:

Claudia Felser studied chemistry and physics at the University of Cologne, completing there her doctorate in physical chemistry (1994). She joined the University of Mainz in 1996 as an assistant professor (C1) becoming a full professor there in 2003 (C4). She is currently Director at the Max Planck Institute for Chemical Physics of Solids in Dresden. She is fellow of the IEEE Magnetic Society, American Physical Society and Institute of Physics, London. In 2018, she became a member of the Leopoldina, the German National Academy of Sciences, and acatech, the German National Academy of Science. In 2019, Claudia Felser was awarded the APS James C. McGroddy Prize for New Materials. In 2020, she was elected to the United States National Academy of Engineering (NAE) and in 2021 to the United States National Academy of Sciences (NAS). In 2022 she was awarded the Max Born Prize and Medal, of German Physical Society and the Institute of Physics, and. the Liebig Medal of the Gesellschaft Deutscher Chemiker (GDCh) and the Wilhelm-Ostwald-Medal of the Saxon Academy of Science. Her research foci are the design, synthesis, and physical characterization of new quantum materials, in particular, Heusler compounds and topological materials for energy conversion and spintronics.