EuCd2As2: a magnetic semiconductor

David Santos-Cottin,[1] J.H Dil,[2] Mario Novak,[3] Alexey Kuzmenko,[4] Milan Orlita,[5] and Ana Akrap[1]

[1] *Department of Physics, University of Fribourg, Fribourg, Switzerland*
[2] *Institut de Physique, EPFL, Lausanne, Switzerland*
[3] *Department of Physics, Faculty of Science, University of Zagreb, Zagreb, Croatia*
[4] *Department of Physics, University of Geneva, Geneva, Switzerland*
[5] *LNCMI, CNRS-UGA-UPS-INSA, 25, avenue des Martyrs, Grenoble, France*

EuCd2As2 exhibits antiferromagnetic order along the c direction with a Neel temperature TN 9.5 K [1]. Recent ab-initio calculations suggest that EuCd2As2 hosts a single pair of Dirac points at the Fermi level in its AFM configuration [2]. Interestingly, these calculations also predict that a single pair of Weyl points may be generated in a ferromagnetic state by applying an external magnetic field [3,4]. Moreover, the Fermi surface of EuCd2As2 appears to be strongly sensitive to the sample growth procedure [5], with a delicate interplay between magnetism and the Fermi surface. In this context, we investigate the electronic, optical, and magneto-optical properties of EuCd2As2, expecting to observe characteristic Landau-level transitions of Weyl fermions. This poster will present a comparative study of samples grown under different conditions. On high-quality crystals, we were able to reduce the number of carriers, leading to a strong increase in resistivity, which is in agreement with optical conductivity measurements. We will present magneto-reflection and transmission measurements on high-purity EuCd2As2. Interestingly, we found that this system is actually a semiconductor with a large gap of 0.77 eV, rather than a Dirac or Weyl semimetal. We will also show that an externally applied magnetic field has a profound impact on the band structure of the system, resulting in a significant decrease in the band gap, as large as 125 meV at 2 T.

[1] Schellenberg, et al., allgemeine Chemie 637, 1863 (2011).
[2] L. L. Wang et al., Phys. Rev. B 99, 245147 (2019).
[3] Na Hyun Jo et al., Phys. Rev. B 101, 140402(R) (2020).
[4] M. C. Rahn et al., Phys. Rev. B 97, 214422 (2018).
[5] J.-Z. Ma et al, Science Advances 5 4718 (2019).