TECHNISCHE UNIVERSITÄT WIEN

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EINLADUNG zum IFP-SEMINAR

Exploring the magnetic and optical phenomena in the $EuCd_2X_2$ semiconductor family

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Host: Neven Barisic
Termin: Donnerstag, 21.11.2024, 11:15 Uhr
Ort: TU Wien, Freihausgebäude
Wiedner Hauptstraße 8-10, 1040 Wien
Seminarraum DC rot 07 (roter Bereich, 7. OG)

Abstract:

Recent studies in infrared optics and magneto-optics have revealed that $EuCd_2As_2$ is a magnetic semiconductor with a band gap of 770 meV, challenging the previously assumed topological semimetal nature of this material [1,2,3]. While the fundamental nature of $EuCd_2As_2$ has now been clarified, several intriguing electronic and magnetic properties remain to be explored. This work aims to further investigate these properties through infrared optics and magneto-optical experiments.
First, we identify the $EuCd_2X_2$ family (for X = P, As, Sb) as a series of magnetic semiconductors that exhibit similar behavior to the sibling compound $EuCd_2As_2$. Notably, we observe a pronounced decrease in the band gap as a function of the magnetic field, which is related to the magnetization, and a band gap value that strongly depends on the substitution content [4].
In the second phase of our study, we used both linearly and circularly polarized light to probe the remarkable magnetic properties of this family, particularly below the band gap. We observe a strong Faraday effect at very low magnetic fields that remains significant even at room temperature, exhibiting one of the highest Verdet constants observed in bulk materials. Additionally, this system exhibits unique circular dichroism across a broad energy range and at low magnetic fields, caused by band splitting under a magnetic field.
These effects are highly tunable with doping, suggesting that these materials hold considerable potential for applications in optoelectronics.

[1] D. Santos-Cottin *et al. Phys. Rev. Lett.*, **131**, 186704 (2023)
[2] Na Hyun Jo *et al., Phys. Rev. B* **101**, 140402(R) (2020)
[3] M. C. Rahn *et al., Phys. Rev. B* **97**, 214422 (2018)
[4] S. Nasrallah *et al. Phys. Rev. B*(L), accepted (2024)

FWF Österreichischer Wissenschaftsfonds

Q-M&S. Correlated Quantum Materials & Solid State Quantum Systems