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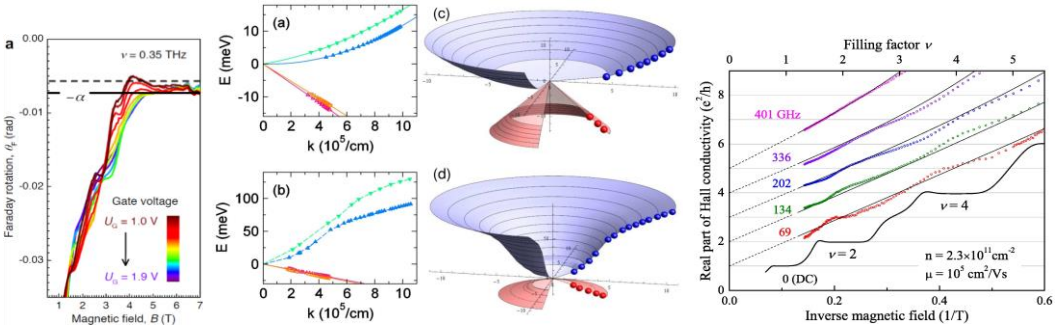
Physical Sciences Seminar

Coherent terahertz magnetooptics of topological insulators and semiconductors

Alexey Shuvaev
(Institute of Solid State Physics, Vienna University of Technology)

Host: Zhanybek Alpichshev

Magnetooptics is a powerful technique to determine important dynamic parameters of semiconductors and metals. The maximal sensitivity to the electronic response is achieved at frequencies comparable to the inverse transport scattering time of the charge carriers. This range corresponds to microwave or terahertz frequencies for many systems at low temperatures. The present talk gives an overview of the most important results obtained on topological insulators and normal semiconductors using the quasioptical Mach-Zehnder interferometer operating in CW mode in the frequency range between 50 and 1000 GHz.
Strained epitaxial mercury telluride (HgTe) films belong to the class of 3D topological insulators. They have directly demonstrated the quantized Faraday angle equal to the fine structure constant $\alpha \approx 1/137$ [1]. The observation of other quantum features in the Faraday angle with the special sequence in the reciprocal magnetic field evidences that the effect stems from the surface states.
The quantitative analysis of the cyclotron resonance peak as a function of the Fermi level in the samples with the semitransparent gate has allowed to reconstruct the band structure of HgTe quantum wells [2].
The observation of Shubnikov-de Haas oscillations in small fields and quantum steps in the Faraday rotation angle in high magnetic fields in the GaAs/AlGaAs heterojunctions has provided the unique frequency dependence of quantum Hall effect [3].



[1] V. Dziom, A. Shuvaev et. al., Nat. Commun. 8, 15197 (2017).
[2] A. M. Shuvaev, V. Dziom et. al., Phys. Rev. B 96, 155434 (2017). [3] V. Dziom, A. Shuvaev, et. al., Phys. Rev. B 99, 045305 (2019).

Tuesday, April 30, 2019 at 11:00 am

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