TECHNISCHE UNIVERSITÄT WIEN

INSTITUT FÜR FESTKÖRPERPHYSIK
Institute of Solid State Physics

Wiedner Hauptstr. 8-10/138, 1040 Wien
www.ifp.tuwien.ac.at

EINLADUNG zum IFP-SEMINAR

Band structure of HgTe-based topological insulators

Sergey Tarasenko

Ioffe Institute, St. Petersburg, Russia

Host: Andrei Pimenov

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Seminarraum DC rot 07 (roter Bereich, 7. OG)

Abstract:

Quantum wells (QWs) and thin films based on band-inverted material HgTe have been attracting growing attention since they can realize 2D and 3D topological insulators. Here, we discuss the fine structure and optical properties of the bulk and edge states in 2D topological insulators based on HgTe QWs. A natural interface and bulk inversion asymmetry, reflecting the real atomistic structure of zinc-blende-type QWs, leads to the spitting of the Dirac states in HgTe QWs [1]. We discuss how the fingerprints of the zero-magnetic-field splitting of the Dirac states could be revealed experimentally by studying magnetotransport phenomena, Raman scattering, and THz radiation absorption. The inversion symmetry drastically modifies the dispersion, magnetic and optical properties of the helical edge states [2]. In particular, it enables the electro-dipole optical transitions between the spin branches of the edge channel and gives rise to the linear and circular dichroism associated with the edge states as well as the circular and linear edge photocurrents [3].

[1] S.A. Tarasenko, M.V. Durnev, M.O. Nestoklon, E.L. Ivchenko, J.-W. Luo, and A. Zunger, Split Dirac cones in HgTe/CdTe quantum wells due to symmetry-enforced level anticrossing at interfaces, Phys. Rev. B 91, 081302(R) (2015).

[2] M.V. Durnev and S.A. Tarasenko, Magnetic field effects on edge and bulk states in topological insulators based on HgTe/CdHgTe quantum wells with strong natural interface inversion asymmetry, Phys. Rev. B 93, 075434 (2016).

[3] M.V. Durnev and S.A. Tarasenko, Optical properties of helical edge channels in zinc-blende-type topological insulators: selection rules, circular and linear dichroism, circular and linear photocurrents, J. Phys.: Condens. Matter 31, 035301 (2019).