TECHNISCHE UNIVERSITÄT CHEMNITZ

Institut für Physik
Physikalisches Kolloquium

Mittwoch, 13.07.2016, um **16:00 Uhr**

Ort: Reichenhainer Str. 90;
Zentrales Hörsaal- und Seminargebäude,
Raum 2/N013

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Topology – from the materials perspective

Topological insulators (TIs), Weyl and Dirac semimetals are a new quantum state of matter, which attracted interest of condensed matter science. Heusler compounds are a remarkable class of materials with more than 1,000 members and a wide range of extraordinary multifunctionalities [1] including TIs [2]. Many of these ternary zero-gap semiconductors (LnAuPb, LnPdBi, LnPtSb and LnPtBi) contain the rare-earth element Ln, which can realize additional properties ranging from superconductivity (e.g. LaPtBi) to magnetism (e.g. GdPtBi) and heavy fermion behavior (e.g. YbPtBi). These properties open new research directions in realizing the quantized anomalous Hall effect and topological superconductors. C1b Heusler compounds have been grown as single crystals and as thin films. The control of the defects, the charge carriers and mobilities can be optimized [3]. Dirac cones and Weyl points can occur at the critical points in the phase diagrams of TI.

Weyl points, a new class of topological phases were also predicted in NbP, NbAs and TaP. The magneto-transport properties of NbP show a large magnetoresistance of 850,000% at 1.85 K (250% at room temperature) in a magnetic field of up to 9 T, without any signs of saturation, and an ultrahigh carrier mobility of $5*10^6$ $cm^2V^{-1}s^{-1}$ accompanied by strong Shubnikov–de Haas oscillations. We found also ultrahigh magnetoresistance, mobilities and Fermi arcs in NbP, TaAs and TaP [4,5]. Depending on the structure $MoTe_2$ is a Weyl semimetal which becomes superconducting under pressure [6]. More emerging quantum properties and potential applications will be discussed.

1. Tanja Graf, Stuart S. P. Parkin, and Claudia Felser, Progress in Solid State Chemistry 39 (2011) 1-50
2. S. Chadov, X. Qi, J. Kübler, G. H. Fecher, C. Felser, S.-C. Zhang, Nature Materials 9 (2010) 541
3. C. Shekhar, S. Ouardi, A.K. Nayak, G.d H. Fecher, W. Schnelle, and C. Felser, Phys. Rev. B 86 (2012) 155314
4. C. Shekhar et al., Nature Physics 11 (2015) 645 & C. Shekhar et al., Nature Communication 7 (2016) 11615
5. L. Yang, Nature Physics (2016), preprint arXiv: 1507.00521 & Z. K. Liu et al., Nature Materials 15 (2016) 27
6. Yanpeng Qi et al., Nature Communication 7 (2016) 11038

Alle Zuhörer sind ab 15:45 zu Kaffee und Tee vor dem Hörsaal eingeladen.

Informationen zum Vortrag erteilt:
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