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Prof. dr hab. Tomasz Story

Institute of Physics, Polish Academy of Sciences, Warszawa
International Research Centre MagTop, Institute of Physics PAS, Warszawa

Topological semiconductors

Important semiconductors such as silicon (Si), gallium arsenide (GaAs) or gallium nitride (GaN) - world-wide applied in contemporary electronic and optoelectronic devices - are topologically trivial materials. However, several families of semiconductors known for infrared or thermoelectric applications, such as mercury-, bismuth-, antimony- or tin-chalcogenides (HgTe, Bi_2Se_3, Bi_2Te_3, Sb_2Te_3, SnTe) constitute materials platform for experimental and theoretical development of new condensed matter systems - a “topological matter” (topological insulators, topological Weyl or Dirac semimetals, topological superconductors). These materials uniquely exhibit surface (2D) or edge (1D) conduction with unusual properties driven by strong relativistic (spin-orbital) effects. They exhibit inverted ordering of valence and conduction bands in the bulk and metallic in-gap states of linear (Dirac-like) electron energy dispersion and strong spin-momentum locking. I will show how unique possibilities of controlling electronic structure as well as electric, optical or magnetic properties of semiconductors can be used to experimentally study the surface or edge topological states by angle- and spin-resolved photoemission, scanning tunneling spectroscopy and magneto-transport or magneto-optical effects. Experimental realization of these ideas requires new topological materials in the form of high quality bulk crystals, layered heterostructures or nanowires of various semiconductors and semimetals.

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Uprzejmie zapraszam wszystkich pracowników, doktorantów i studentów Instytutu Fizyki.

Dr hab. Ryszard Zdyb, prof. UMCS
Dyrektor IF UMCS