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Research on topological insulators at the ARPES beamlines of BESSY II

Topological matter is of high current interest as the bestowal of the Nobel prizes 2016 shows. Generally, a topological insulator features a metallic surface protected by time-reversal symmetry and an isulating bulk. In this talk we introduce the properties of three-dimensional topological insulators through their signatures in spin- and angle-resolved photoelectron spectroscopy obtained at the BESSY II endstations ARPES1^2, ARPES1^3, and PHOENEXS. We discuss the magnetic functionalization of topological insulators and the conditions for the creation of magnetic band gaps by impurities as they are a necessary condition for the quantum anomalous Hall effect. Topological insulators are a pure band structure effect, however, electron correlation would add interesting aspects. SmB6 has meanwhile been established as the first correlated topological insulator and the first topological Kondo insulator. We show, however, with the help of data taken at ultrahigh resolution at T=1 K with the ARPES 1^3 instrument that the existing ARPES evidence does not support topological surface states and that the surface metallicity of SmB_6 has a simple, topologically trivial origin. So-called topological crystalline insulators are more vulnerable systems where surface states are protected by mirror symmetries only instead of time-reversal symmetry. We show that the system $Pb_{1-x}Sn_xSe$ can be driven by doping into a topological quantum phase transition from mirror- to time-reversal symmetry protection.