ARPES studies of some Topological Insulators

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Abstract

Studies of surface state (SS) bands in many Bi and Sb based binary Topological Insulators (TI) are marred by significant contributions from their bulk states. Tuning of the Dirac point (DP) by chemical doping is important in this context. In the quaternary alloy $Bi_{2-x}Sb_xTe_{3-y}Se_y$ (BSTS) this is achieved by changing the ratio of the pnictogen (Bi and Sb) and chalcogen (Se and Te) atoms without disturbing its crystallinity. In this system, topological nature with different bulk resistivity have been experimentally observed in a wide range of x and y combinations. BSTS thus provides an ideal platform to study the nature of topological surface states by tuning the Dirac node within the bulk energy gap. In this talk I will discuss the results of our angle resolved photoelectron spectroscopy (ARPES) studies on some of the Tis focussing mainly on $BiSbTeSe_2$. I will also discuss our density functional theory (DFT) results on similar systems. Signals of non-trivial topology of the surface state bands (SSB) and a strong warping of the Fermi surface (FS) are clearly observed in the ARPES data. We also found pronounced effects of ageing due to band bending (BB) and it is relatively stronger in this compound compared to the TI Bi_2Se_3 .