Contribution ID: **189** Type: **invited talk**

Separating the bulk and surface n- to p-type transition in the topological insulator GeBi_(4-x)Sb_xTe_7

Thursday, 19 September 2013 10:45 (15 minutes)

We identify the multi-layered compound GeBi_(4-x)Sb_xTe_7 to be a topological insulator with a freestanding Dirac point, slightly above the valence band maximum, using angle-resolved photoemission spectroscopy (ARPES) measurements. The spin polarization satisfies the time reversal symmetry of the surface states, visible in spin-resolved ARPES. For increasing Sb content in GeBi_(4-x)Sb_xTe_7 we observe a transition from n- to p-type in bulk sensitive Seebeck coefficient measurements at a doping of x=0.6. In surface sensitive ARPES measurements a rigid band shift is observed with Sb doping, accompanied by a movement of the Dirac point towards the Fermi level. Between x=0.8 and x=1 the Fermi level crosses the band gap, changing the surface transport regime. This difference of the n- to p-type transition between the surface region and the bulk is caused by band bending effects which are also responsible for a non-coexistence of insulating phases in the bulk and in the near surface region.

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Session Classification: Strongly Correlated Electron Systems: Novel Interaction Phenomena