Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Photoemission spectroscopy and X-ray diffraction analysis of 3D topological and Kondo insulators PAVEL SHIBAYEV, Princeton University, HASAN GROUP TEAM[1] — The advantage of studying 3D topological insulators (TIs), compounds that have attracted the attention of many in the condensed matter field, is the ability for their existence at room temperature and no magnetic fields, allowing both for resolving their band structure via angle-resolved photoemission spectroscopy (ARPES) and understanding electrical transport and other properties via X-ray diffraction (XRD) and point-contact spectroscopy (PCS). A comprehensive quantitative analysis of Bi_2Se_3, a 3D TI, was carried out using these methods. The Bi_2Se_3 crystals were synthesized in-house at Princeton University. A first-principles calculation based on density functional theory, DFT, was performed using the Abinit software. The band structure of the crystal was then resolved via ARPES at the Advanced Light Source in LBNL, resulting in a surprisingly stark and clear single Dirac cone. A large band gap was confirmed, suggesting an increased potential for applications. In contrast, Kondo insulators are found in rare-earth based materials with f-electron degrees of freedom. Photon energy dependent dispersion relationships and temperature dependence studies were performed on a Kondo candidate CeB_6 via ARPES, showing an even number of Dirac cones and a non-TI behavior. Analysis of I-V characteristics through PCS will follow, in addition to characterization via Bruker XRD for both compounds.

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Date submitted: 14 Nov 2014 Electronic form version 1.4