Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Mass acquisition of Dirac fermions in the presence of magnetic doping in the topological insulator Sb_2Te_3 YEPING JIANG, CNAM, University of Maryland, ZHI LI, CANLI SONG, KE HE, LILI WANG, Institute of Physics, CAS, XI CHEN, Department of Physics, Tsinghua University, XUCUN MA, Institute of Physics, CAS, QIKUN XUE, Department of Physics, Tsinghua University — The nontrivial bulk band topology and time reversal symmetry yield gapless surface states in three dimensional topological insulators. The gapless nature of surface states in strong topological insulator is predicted to be violated by time-reversal-symmetry breaking perturbations, which opens back-scattering channels between Kramers pairs and induces a massive gap near the Dirac point of surface states. Such a massive Dirac fermion system gives rise to an unconventional magnetoelectric response relating to many exotic phenomena such as half-quantized anomalous Hall effect, topological quantized magnetoelectric effect and even the magnetic monopole. Here we introduce time-reversal-symmetry breaking by doping Cr atoms into the topmost quintuple layer or into the bulk of Sb_2Te_3 thin films. We demonstrate for the first time by Landau level spectroscopy the deviation of zero modes, which indicates the acquirement of a mass term in the presence of surface or bulk magnetic doping. We also show that the magnitude of the mass term in the surface states depends on both the Cr doping level and the magnetic field, offering a new way of measuring the doping- and field-dependence of local magnetization of dopants. Our observation suggests Cr-doped Sb_2Te_3 is a promising candidate for realization of proposed novel magnetoelectric effects.

Yeping Jiang
CNAM, University of Maryland

Date submitted: 21 Nov 2012 Electronic form version 1.4