MAR12-2011-008747

Abstract for an Invited Paper
for the MAR12 Meeting of
the American Physical Society

Magneto-Optical Properties of Electrically Gated Topological Insulators[1]

DENNIS DREW, CNAM, Physics Department, Universtity of Maryland

Topological insulators (TI) are a predicted new quantum state of matter in which spin-orbit coupling gives rise to topologically protected surface states with unpaired spin-helical Dirac cones. TIs are predicted to have exotic properties including Majorana fermions induced by the proximity effect from a superconducting film, a intrinsic magnetoelectric effect and hybridized spin-plasmon modes. The magneto-electric effect leads to Faraday and Kerr rotations quantized in units of the fine structure constant. This effect corresponds to $1/2$ integer quantum Hall step and is predicted both in field and ***in the absence of a magnetic field when magnetic order gaps the Dirac spectrum***. A key difference between this half integer QHE in TIs and the usual integer QHE is that the former cannot be measured by a dc transport experiment. I will describe experiments designed to measure the Kerr rotation in Bi2Se3, one example of a topological insulator. Gating the surface isolates the surface response from the bulk signals due to unavoidable bulk carriers from defects and impurities. Preliminary results will be presented on the surface state Kerr rotation for Bi2Se3 doped with Mg (ungapped) and Bi2Se3 doped with Sm (magnetically gapped).

[1]Work supported by DOE (Contract No.DE-SC0005436).