Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Air-Stable Electron Depletion of Bi_2Se_3 into the Topological Regime using Molybdenum Trioxide[1] JACK HELLERSTEDT, Monash University and University of Maryland, MARK T. EDMONDS, Monash University, ANTON TADICH, Australian Synchrotron, ALEX SCHENK, La Trobe University, KANE M. O'DONNELL, Australian Synchrotron, JACOB TOSADO, Monash University and University of Maryland, NICHOLAS P. BUTCH, National Institute of Standards and Technology, PAUL SYERS, JOHNPIERRE PAGLIONE, University of Maryland, MICHAEL S. FUHRER, Monash University and University of Maryland — Bismuth selenide (Bi_2Se_3) is a three-dimensional strong topological insulator of particular interest due to its relatively large bulk band gap (300 meV) and single set of topologically non-trivial surface states. However, persistent doping makes routine electronic access to the topological regime difficult. Here we explore surface transfer doping via molecular deposition as a route to bring the Fermi level into the topological regime and protect against ambient degradation. Bi_2Se_3 single crystals are cleaved in ultra-high vacuum and X-ray photoemission spectroscopy is used to measure the shifts in work function, Bi core levels, and charge state of Mo during deposition of MoO_3 molecules; the data indicate that MoO_3 can lower the Fermi level to within $\sim$ 100 meV of the Dirac point. Thin film transport demonstrates that $\sim 10^{13}$ electrons can be depleted from the Bi_2Se_3 and that an MoO_3 capping layer is stable for days after exposure to ambient.

[1]Supported by the NSF grants DMR-11-05224 and DMR-05-20471 (Maryland MRSEC); MSF is supported by an ARC Laureate Fellowship

Jack Hellerstedt
Monash University and University of Maryland

Date submitted: 10 Nov 2014 Electronic form version 1.4