Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Electrostatic Coupling between Two Surfaces of a Topological Insulator Nanodevice VALLA FATEMI, MIT, BENJAMIN HUNT, MIT and Carnegie Mellon, HADAR STEINBERG, MIT and The Hebrew University, STEPHEN L. ELTINGE, FAHAD MAHMOOD, MIT, NICHOLAS P. BUTCH, NIST CNR and LLNL, KENJI WATANABE, TAKASHI TANIGUCHI, Advanced Materials Laboratory, National Institute for Materials Science, Tsukuba, Japan, NUH GEDIK, RAYMOND C. ASHOORI, PABLO JARILLO-HERRERO, MIT — We report on electronic transport measurements of dual-gated nanodevices of the low-carrier density topological insulator (TI) $Bi_{1.5}Sb_{0.5}Te_{1.7}Se_{1.3}$. In all devices, the upper and lower surface states are independently tunable to the Dirac point by the top and bottom gate electrodes. In thin devices, electric fields are found to penetrate through the bulk, indicating finite capacitive coupling between the surface states. A charging model allows us to use the penetrating electric field as a measurement of the intersurface capacitance C_{TI} and the surface state energy-density relationship μ(n), which is found to be consistent with independent angle-resolved photoemission spectroscopy measurements. At high magnetic fields, increased field penetration through the surface states is observed, strongly suggestive of the opening of a surface state band gap due to broken time-reversal symmetry.

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Date submitted: 14 Nov 2014

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