Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Proximity induced ferromagnetism at the interface between a topological insulator (TI) Bi_2Se_3 and a ferromagnetic insulator (FI)[1] PENG WEI, FERHAT KATMIS, Francis Bitter Magnet Lab, MIT, Cambridge, MA, BADIH ASSAF, DON HEIMAN, Physics Department, Northeastern University, Boston, MA, PABLO JARILLO-HERRERO, Physics Department, MIT, Cambridge, MA, JAGADEESH MOODERA, Francis Bitter Magnet Lab and Physics Department, MIT, Cambridge, MA — The ferromagnetic phase of the surface states of a TI is predicted to carry many exotic properties, for example quantum anomalous Hall effect, magnetic monopole, and magneto-electric effects etc. In our study, we explore this novel phase utilizing the proximity induced exchange splitting to introduce ferromagnetism close to the surface of the Bi_2Se_3 film. High quality Bi_2Se_3 thin films were grown using molecular-beam-epitaxy, and in-situ deposited the ferromagnetic insulator (FI) EuS over this film. Magnetization measurements demonstrated a magnetic moment of more than $7\mu_B$ per Eu^{2+} ion (bulk value), and reaching up to $11\mu_B$ per Eu^{2+} ion for 1nm thick EuS film, showing the unambiguous existence of excess ferromagnetism. The transport studies of these TI/FI bilayers unveiled a clear switching behavior of the magnetoresistance in the Bi_2Se_3 film. There was significant temperature dependence seen in both MR and the coercivity. Due to the near range nature of the exchange interactions, these extra magnetic moments and the MR results are attributed to come from the induced ferromagnetism at the Bi_2Se_3 surface.

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[1]Work supported by ONR grant N00014-09-1-0177, NSF grant DMR 0504158 and NSF DMR 08-19762 (CMSE - Initiative 2)

Date submitted: 06 Dec 2011 Electronic form version 1.4