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Interface driven states in ferromagnetic topological insulator heterostructures.[1] VALERIA LAUTER, Oak Ridge National Lab, FERHAT KATMIS, JAGADEESH MOODERA, Department of Physics, Massachusetts Institute of Technology, Cambridge, MA-02139, USA — The broken time reversal symmetry (TRS) states can be introduced into a topological insulator (TI) material by ferromagnetic ordering at the interface. Recently [1] we demonstrated a fundamental step towards realization of high temperature magnetization in Bi_2Se_3-EuS TI-FMI heterostructures through observation of magnetic proximity-induced symmetry breaking on the Bi_2Se_3 surface via the exchange interaction by depositing EuS film on the top of the Bi_2Se_3 surface. Here we show that we can independently break the TRS on both surfaces of a TI, which brings the long-range induced magnetism on either or both surfaces of a TI in a controlled way. We provide a depth-sensitive data on details of magnetic proximity effect in hidden interfaces by Polarized Neutron Reflectometry. The proximity coupling strength and penetration depth of magnetism into TI are extracted as functions of temperature, magnetic field and magnetic history. The large neutron absorption of Eu atoms serves as the element sensitivity and enables us to identify such magnetism in TI as proximity magnetism. This provides a next step to realization of complex heterostructures of TI and FMI leading to wide applications in TI-based next generation spintronic devices. [1] F. Katmis, V. Lauter et al, submitted.

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