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Proximity-induced global time-reversal symmetry (TRS) breaking and enhanced surface ferromagnetism mediated by Dirac fermions in bilayers of magnetic topological insulators (TIs) C.-C. CHEN, M. L. TEAGUE, W. FAN, N.-C. YEH, Dept. of Physics, Caltech, Pasadena, CA 91125, L. HE, X. KOU, M. LANG, K.-L. WANG, Dept. of Elec. Eng., UCLA, Los Angeles, CA 90095 — Proximity-induced magnetic effects on the surface Dirac spectra of TIs are investigated by scanning tunneling spectroscopic (STS) studies of bilayer structures consisting of an undoped TI layer Bi_2Se_3 and $(Bi_{1-x}Sb_x)_2Te_3$ on top of a Cr-doped, magnetic TI of 6 quintuple-layer (QL) thickness.[1] For all samples with the top layer thinner than 4-QL, a surface gap Δ opens up below T_c^{2D}, much higher than the bulk Curie temperature T_c^{3D} derived from the anomalous Hall resistance. The temperature (T) evolution of Δ shows an initial increase below T_c^{2D}, followed by a 'dip' near T_X, and then rises again, reaching maximum at $T \ll T_c^{3D}$. The gap is spatially inhomogeneous, and its average value and spatial homogeneity at low T increases with applied magnetic field H and Cr-doping level x. The appearance of massive Dirac spectra below $T_c^{2D}$is the result of global TRS breaking in the surface state of TIs. The non-monotonic T-dependence of Δ and the finding of $T_c^{2D} \gg T_c^{3D}$ may be attributed to proximity magnetism induced by a 3D contribution from the bulk magnetism that dominates at low T, and a 2D contribution from the RKKY interaction mediated by surface Dirac fermions, which dominates at $T_c^{3D} \ll T_X < T < T_c^{2D}$ and can significantly enhance the surface magnetism due to the long wavelengths of Dirac fermions. [1]C.-C. Chen et al., New J. Phys. (2015); arXiv:1506.06841

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