Abstract Submitted
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Magnetism-induced massive Dirac fermions and topological defects in the surface state (SS) of binary and ternary topological insulators (TIs)[1] CHIEN-CHANG CHEN, M. L. TEAGUE, N. WOODWARD, W. FAN, N.-C. YEH, Dept. of Physics, Caltech, Pasadena, CA 91125, L. HE, X. KOU, M. LANG, K. L. WANG, Dept. of Electrical Engineering, UCLA, Los Angeles, CA 90095 — Magnetic doping effects on the SS of Bi_2Se_3 and $(Bi_{1-y}Sb_y)_2Te_3$ are studied by scanning tunneling spectroscopy (STS) on MBE-grown bilayers of $Bi_2Se_3/(Bi_{1-x}Cr_x)_2Se_3$ and $(Bi_{0.5}Sb_{0.5})_2Te_3/((Bi_{0.5}Sb_{0.5})_{1-x}Cr_x)_2Te_3$ on InP (111) as a function of the undoped layer thickness (d) and the Cr-doping level (x). For x = 5% and 10%, magnetic proximity effect is induced in the SS of Bi_2Se_3 for d <4-QL, leading to gapped Dirac spectra for temperatures (T) below a 2D Curie temperature T_c = (210±10) K and (240±10) K for x =5% and 10%, respectively, which are much higher than the bulk T_c ∼25 K where anomalous Hall effect occurs. The gap (Δ) is spatially inhomogeneous in zero magnetic field ($H = 0$), and reaching a maximum Δ = (0.4±0.1) eV at $T << T_c$. The gap inhomogeneity decreases with increasing x, H and decreasing T. Moreover, localized sharp impurity resonances are found occasionally near the boundaries of gapped and gapless regions, which are attributed to isolated Cr impurities that couple with the spins of Dirac fermions and form long-lived topological defects. With increasing interlayer H, the resonance peaks diminish as the spatial gap homogenizes. These findings in the bilayer binary TIs are compared with those in the bilayer ternary TIs of more uniform bulk ferromagnetism.

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