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Hybridization-induced interface states in a topological insulator - ferromagnetic metal bilayer[1] YI-TING HSU, PRIYAMVADA JADAUN , CRAIG FENNIE, EUN-AH KIM, Cornell University — Recent experiments demonstrating large spin-torque in topological insulator(TI)/ferromagnetic metal(FM) bilayer, revealing their potential for spintroics applications raised much excitement. However, there is little understanding on the impact of the bilayer formation on the TI surface state and whether it is possible to represent such bilayer using a simple model. Moreover, due to the large charge-transfer from the FM layer, these Dirac surface states are unlikely to be anywhere near the fermi level to contribute to the observed spin-torque. In order to establish a theoretical starting point, we calculated the band structure of a TI-FM bilayer using density functional theory (DFT) and built a simple effective model that captures the essence of the DFT results. Through this double-pronged approach, we find new surface states we dubbed reflection states to form close to chemical potential due to level-repulsion between the original Dirac surface states and the energetically close-by FM states with the same momentum. Depending on the coupling strength, the reflection states can carry a large weight of the original surface states and thus inherit not only the spatial localization but also the spin-winding of the original Dirac surface state.

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