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Surface states of the Topological Insulator $\mathbf{Bi_{1-x}\ Sb_x}$[1] JEFFREY TEO, LIANG FU, CHARLES KANE, University of Pennsylvania — The alloy $Bi_{1-x}Sb_x$ is a narrow gap semiconductor for $.07 < x < .22$. Based on the bulk bandstructures of Bi and Sb this material was recently predicted to be a three dimensional strong topological insulator (STI). The STI is distinguished from ordinary insulators by a Z_2 topological invariant characterizing the bulk and by the presence of topological protected surface states, whose Fermi arc encloses an odd number of Dirac point. Here we study the surface states of the 111 face of $Bi_{1-x}Sb_x$ using a semi infinite tight binding model. This calculation demonstrates explicitly the topological character of the surface states. In addition, we examine other robust, model independent features of the surface states which arise due to (1) charge neutrality at the surface, (2) the presence in the bulk bandstructure of a 3 dimensional Dirac point with a small mass and (3) the presence of mirror symmetry, which leads to an additional topological characterization of the band structure in terms of a mirror Chern integer. Implications for photoemission experiments will be discussed.

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Jeffrey Teo
University of Pennsylvania

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