

Topologically protected surface states, hexagonal warping effects and bound states on the surface of the topological insulator Bi_2Te_3

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Scanning tunneling spectroscopy studies on high-quality Bi_2Te_3 crystals exhibit perfect correspondence to ARPES data, hence enabling identification of different regimes measured in the local density of states (LDOS). Oscillations of LDOS near a step-edge are analyzed. Within the main part of the surface band oscillations are strongly damped, supporting the hypothesis of topological protection. At higher energies, as the surface band becomes concave, oscillations appear which disperse with a particular wave-vector that result from an unconventional hexagonal warping term. Furthermore, the data reveal a one-dimensional bound state that runs parallel to the step-edge and is bound to it at some characteristic distance. This bound state is clearly observed in the bulk gap region, while it becomes entangled with the oscillations of the warped surface band at high energy and with the valence band states near the Dirac point.