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Quasiparticle dynamics of topological insulator Bi2Se3 studied by time and angle-resolved photoemission spectroscopy

YIHUA WANG, DAVID HSIEH, EDBERT SIE, DILLON GARDNER, HADAR STEINBERG, YOUNG LEE, PABLO JARILLO-HERRERO, NUH GEDIK, MIT — Topological insulator is a new state of matter that hosts spin helical surface states that may be important for future spintronic applications. Even though the conical bandstructure of the helical Dirac fermions is well established, elastic and inelastic scattering rates of their excitations are less well known because conventional transport or optical techniques can not easily separate surface contribution from bulk effects. Here we use time and angle-resolved photoemission spectroscopy to study the surface electron time-domain dynamics of a prototypical topological insulator Bi_2Se_3. We observe non-Fermi liquid behavior of quasiparticles both above and below the Fermi level. Our result suggests that surface-bulk scattering can play an important role in the transport properties of topological insulator.

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