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Tunneling spectroscopy of topological superconducting states – toward detection of Majorana fermions[1] WAN KYU PARK, K. COUGHLIN, C. WAN, M. LIU, L.H. GREENE, University of Illinois at Urbana-Champaign, J. SCHNEELOCH, R.D. ZHONG, Z.J. XU, G. GU, Brookhaven National Laboratory
— Topological insulators and superconductors have attracted much research interest recently. These materials are known to possess exotic electronic structures that cannot be adiabatically transformed to topologically trivial ones. The spin-momentum locked (helical) Dirac fermions form surface conduction bands while the bulk is insulating. When they become superconducting, charge-neutral zero-energy modes, the so-called Majorana fermion modes, are predicted to emerge due to the unique quasiparticle properties in such a superconducting state. Aiming at detect them, we investigate two novel superconducting systems using tunneling spectroscopy: i) thin film Nb which is proximity-coupled to the helical Dirac fermions in $(Bi,Sb)_2Se_3$; ii) (Sn,In)Te, a potential topological superconductor. Our measurements reveal unusual conductance features in the background and near zero bias. We will report results on their temperature and magnetic field dependences and discuss their implications.

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