TOPOLOGICAL SURFACE STATES IN SAMARIUM HEXABORIDE VIA PLANAR TUNNELING SPECTROSCOPY.

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Samarium hexaboride (SmB_6), a well-known Kondo insulator, has recently drawn a great deal of attention owing to its possibly topological nature harboring protected surface states.[1] Although numerous investigations have provided growing evidence for the existence of such states, corroborative spectroscopic evidences are still lacking unlike in the weakly correlated counterparts. We adopt planar tunneling spectroscopy to unveil their detailed nature and behavior by utilizing its inherently high energy resolution and high momentum selectivity.[2] Measurements of tunneling conductance on two different crystals oriented along [001] and [011] directions exhibits clear linearity within the bulk hybridization gap, as expected for the topological surface states, arising from two and one Dirac cone(s), respectively. Quite remarkably, the linear conductance ends at small bias voltages, implying that the topological states in SmB_6 cease to be protected well before they merge into the bulk states. A phenomenological modeling of the tunneling process involving the interaction with spin excitons originating from the bulk SmB_6, as predicted by a recent theory,[3] provide consistent explanations for all the observed features. These findings corroborate the theoretical proposal that the topological surface states in SmB_6 are not protected completely due to their strong interaction with bulk excitations, in contrast to the case of weakly correlated topological insulators.

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