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Chiral edge transport induced by Dirac-electron-mediated ferromagnetic domain walls in topological Kondo insulator SmB_6

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Topological Kondo insulators provide a novel quantum state of matter with a non-trivial metallic surface robust against perturbations with time reversal symmetry in the bulk energy gap driven by strong electron correlations. One of the most promising candidates of the correlated topological insulator is Kondo compound SmB_6 [1]. Identified by extensive study including non-local transport [2] and angule-resolved photoemission spectroscopy [3], metallic surface states exist in the Kondo insulating gap formed by the hybridization between itinerant conduction electrons and localized f-electrons at low temperatures. However, the observations of polarity-driven surface states [4] and three dimensional Fermi surface in insulating states [5], together with lack of direct evidence of the chiral nature of surface conduction, have brought into question the topological nature in this material. Here, we report detailed study on very low-temperature magnetoresistance, revealing unusual ferromagnetic hysteresis with a sign reversal stemming from chiral edge conduction channels between the Dirac electron mediated ferromagnetic domains on the surfaces. Combined with suppression of the weak antilocalization and observation of anomalous Hall effect in the surface conduction, the unusual hysteresis provides strong evidence for the presence of topologically non-trivial surface states in SmB_6 [6].

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