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Samarium Hexaboride - First True 3D Topological Insulator[1]
STEVEN WOLGAST, ÇAĞLIYAN KURDAK, KAI SUN, JAMES ALLEN, Dept. of Physics, University of Michigan, ZACHARY FISK, Dept. of Physics and Astronomy, University of California, Irvine — Although many important breakthroughs in the study of topological states of matter have been achieved within the last few years, a very important link still remains missing–the experimental discovery of a true 3D topological insulator. Materials currently known to have topological surface states (e.g. $Bi_{1-x}Sb_x$, Bi_2Se_3 and Bi_2Te_3) are also bulk conductors, and thus do not have a well-defined topological index. Recent calculations of the heavy-fermion Kondo insulator Samarium Hexaboride (SmB_6) have predicted the possibility of in-gap topological surface states in this material. Meanwhile, the conjectured existence of a topologically-protected surface state in SmB_6 could resolve many of the long-standing puzzles surrounding its low-temperature transport properties. Here we study the transport properties of SmB_6 with a novel configuration designed to distinguish bulk-dominated conduction from surface-dominated conduction. We find that SmB_6 is a true topological insulator with an insulating bulk and a metallic surface. This discovery resolves the standing puzzles about the strange transport behavior of this material, and it provides the first material in which transport properties of a 3D topological state can be studied.

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