Topologically protected surface conduction in SmB_6 – new solution to a thirty year old mystery*

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The paradigm mixed valence insulator SmB_6, exhibits a mysterious residual metallic conductivity at low temperatures ($T < 4$ K) [1], with a value too small to explain within the framework of three-dimensional extrinsic [1] or intrinsic [2] bulk conduction. All efforts to eliminate this residual conductivity have failed. It has recently been shown that the symmetry requirements for a bulk single particle gap in SmB_6 [3] also satisfy the requirements for the protected surface states of a topological insulator (TI) [4]. I will describe recent transport [5] and de Haas van Alphen [6] experiments at the University of Michigan, angle resolved photoemission spectroscopy at the Advanced Light Source [7], and, as time permits, other work, showing that SmB_6 is indeed a TI material. These new findings resolve in an elegant way the 30 year old transport mystery of SmB_6, provide a material in which the dc transport properties of a 3D topological state can be directly studied, and generally point the way to the exploration of topological symmetries in strongly correlated electron materials.

* Collaboration with co-authors of references [5,6,7]

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