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Heavy Fermions, Rise of the Topologies

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The electrons in Heavy fermion materials are subject to spin-orbit coupling interactions that greatly exceed their Kinetic energy. It has long been known that the spin orbit coupling stabilizes new kinds of heavy fermion metals, superconductors and “Kondo insulators” against the competing state of magnetism. In this talk I will discuss the new realization that spin orbit coupling can influence the ground state, changing its topology and giving rise to Topological Kondo insulators. We’ll look at samarium hexaboride, SmB₆, “the worlds oldest topological insulator,” a Kondo insulator discovered 45 years ago, predicted to be topological in 2011, and tentatively confirmed to be so in a series of hot new experimental studies of the past few months. I’ll discuss a simple model for a topological Kondo insulator and introduce the most recent measurements, including ARPES, de Haas van Alphen and weak antilocalization that appear to support the idea that this is a strongly interacting topological insulator in which the surface conductance is carried by electrons on spin-orbit coupled Dirac cones. We’ll also discuss the open unanswered questions surrounding this topic.