Title: “Strong Correlations Meet Topology in Exotic Insulators”

Abstract*:* Topological states of quantum matter represent a rapidly developing area of research, where a fascinating variety of exotic phenomena occur, ranging from unusual transport properties to fractionalized excitations that may emerge at system’s defects. Of particular recent interest has been the topic of strongly-interacting topological phases, where electronic correlations and topology both play an important role. In this talk, I will review recent theoretical and experimental work on a relatively new class of such interacting topological material system – topological Kondo insulators, which appear as a result of interplay between strong correlations and spin-orbit interactions. I will start by explaining in simple terms the basics of topological quantum matter, including the by now standard theory of topological band insulators. Then, I will use these concepts to show that the conduction electrons and localized magnetic moments in certain heavy fermion compounds hybridize to give rise to a topological insulating behavior. I will explain key experimental results, which have confirmed our predictions in the Samarium hexaboride heavy fermion compound, where the long-standing puzzle of the residual low-temperature conductivity has been shown to originate from topological surface states. I will also mention several recent theory-experiment collaborative projects that led to the development of a “topological device” and new methods to extend topological behavior in Kondo insulators from a few Kelvin to room temperature. In conclusion, I will discuss a series of recent puzzling experiments, which unexpectedly observed quantum oscillations, typical to a metal, coming from an inert, insulating bulk of Kondo insulators, which may represent a smoking gun of a new fractionalized state of matter.

Galitski's bio:
Victor Galitski is a Chesapeake Chair Professor of theoretical physics at the University of Maryland and Fellow of the Joint Quantum Institute there. He also holds an honorary Professorship at Monash University in Melbourne, Australia, serves as an Editor in the Annals of Physics and as a Board Member at the Aspen Center for Physics. Galitski holds a MS degree (Cum Laude) in Engineering (1998), and two PhD degrees: in applied mathematics (1999) and theoretical condensed matter physics (Univ. of Minnesota, 2002). Galitski's group at the University of Maryland, where he has been on faculty since 2005, works on a broad spectrum of problems in quantum physics including superfluidity and superconductivity, non-equilibrium many-body physics, quantum chaos, solitons, and topological phases of matter. Galitski is a co-author of more than 100 research papers in leading physics journals and of a 1000-page textbook, "Exploring quantum mechanics," published by Oxford University Press in 2013, which is arguably the world’s largest collection of solved problems in quantum mechanics. His most well-known research results include explanation of the minimal conductivity in graphene, prediction of topological Kondo insulators and spin-orbit-coupled Bose-Einstein condensates, both subsequently discovered experimentally in solid state systems and cold atoms, respectively. He is also known for introducing the concept of a Floquet topological insulator that has developed into an active research field. Galitski’s research in quantum physics has been funded by the US Army Research Office, the US Department of Energy, DARPA, and National Science

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