Robustness of TIs under Strong Surface Disorder and Anomalous Spin Diffusion in Strained Hole Doped Systems

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Abstract

In the first part of this talk, we use numerical simulations to prove that protected surface conduction in 2-D topological insulators is independent of non-magnetic surface disorder, regardless of the disorder strength. In particular, the surface band remains conducting even when surface state inhomogeneities destroy the characteristic linear Dirac relation between energy and momentum. The main effects of disorder are to pull the surface states into the disordered layers, decrease their Fermi velocity, and increase the density of states. These effects are controlled by a resonance between the disorder potential and the bulk bands. We also show that protection and disruption of the Dirac cone is controlled by the bulk band width, not the bulk band gap.

In the second part of this talk, we obtain the spin-orbit interaction and spin diffusion equations of a two-dimensional heavy hole gas under the influence of strain. We predict an enhanced spin lifetime associated with a spin helix standing wave similar to the Persistent Spin Helix which exists in the two-dimensional electron gas with equal Rashba and Dresselhaus spin-orbit interactions.

About the speaker

Dr Vincent Sacksteder IV does both analytical and numerical research on conduction in disordered systems. He was born in Ohio, had a software career at Microsoft, and finished his Ph.D. in Rome under Giorgio Parisi. He has held professor and research positions in the USA, the Philippines, India, Korea, and China.