Classification of topological insulators/superconductors via their transport properties

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Fri Nov 11 14:00 2011
(Seminar Room)

Abstract

The topological invariant of a topological insulator (or superconductor) is given by the number of symmetry-protected edge states present at the Fermi level. Despite this fact, established expressions for the topological invariant require knowledge of all states below the Fermi energy. Here, we propose a way to calculate the topological invariant employing solely its scattering matrix at the Fermi level without knowledge of the full spectrum. Since the approach based on scattering matrices requires much less information than the Hamiltonian-based approaches (surface versus bulk), it is numerically more efficient. In particular, is better-suited for studying disordered systems. Moreover, it directly connects the topological invariant to transport properties potentially providing a new way to probe topological phases.