Theoretical Physics Seminars

Impurity textures in a Chern insulator

Speaker: Mr. Vibhuti Bhushan Jha

From: SAC , ISRO Ahmedabad

When: August 10 , 2017 Thursday 4:00 pm

Place: Room No. 469

Chern insulators arguably provide the simplest examples of topological phases. They are characterized by a topological invariant and can be identified by the presence of protected edge states. A local impurity in a Chern insulator induces a twofold response: bound states that carry a chiral current and a net current circulating around the impurity. This is a manifestation of broken time reversal symmetry and persists even for an infinitesimal impurity potential. To illustrate this, we consider a Coulomb impurity in the Haldane model. We show that an infinitesimal impurity strength suffices to create bound states. We find analytic wave functions for the bound states and show that they carry a circulating current. Both the cases of trivial and non trivial topology has been considered. In the many-body problem of the Haldane model at half-filling, we use a linear response approach to demonstrate a circulating current around the impurity. Impurity textures in insulators are generally expected to decay exponentially; in contrast, this current decays polynomially with distance from the impurity. Going beyond the Haldane model, we consider the case of coexisting trivial and nontrivial masses. We find that the impurity induces a local chiral current as long as time-reversal symmetry is broken. However, the decay of this local current bears a signature of the overall topology—the current decays polynomially in a nontrivial system and exponentially in a trivial system.

All are welcome