Topological nature of the Fu-Kane-Mele invariants

Giuseppe De Nittis (PUC, Santiago de Chile)

Abstract: Condensed matter electronic systems endowed with an odd time-reversal symmetry (TRS) (a.k.a. class AII topological insulators) show topologically protected phases which are described by an invariant known as Fu-Kane-Mele index. The construction of this invariant, in its original form, is specific for electrons in a periodic background and is not immediately generalizable to other interesting physical models where different forms of TRS also play a role.

By exploiting the fact that system with an odd TRS (in absence of disorder) can be classified by Quaternionic vector bundles, we introduce a Quaternionic topological invariant, called FKMM-invariant, which generalizes and explains the topological nature of the Fu-Kane-Mele index.

We show that the FKMM-invariant is a universal characteristic class which can be defined for Quaternionic vector bundles in full generality, independently of the particular nature of the base space. Moreover, it suffices to discriminate among different topological phases of system with an odd TRS in low dimension.

As a particular application we describe the complete classification over a big class of low dimensional involutive spheres and tori. We also compare our classification with recent results concerning the description of topological phases for two-dimensional adiabatically perturbed systems.

This is joint work with K. Gomi.