Chez Pierre

Presents ...

Monday, December 7, 2015
12:00pm
MIT Room 4-331

Chez Pierre Seminar

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”Discovery of Weyl Fermion and Topological Fermi Arc Quasiparticles in Condensed Matter Systems“

Topological matter can host Dirac, Majorana and Weyl fermions as quasiparticle modes on their boundaries. First, I briefly review the basic concepts defining insulators and superconductors where topological surface state (Dirac and Majorana) modes are robust only in the presence of a gap (Hasan and Kane; Rev. of Mod. Phys. 82, 3045 (2010)). In these systems topological protection is lost once the gap is closed turning the system into a trivial metal. A Weyl semimetal is the rare exception in this classification scheme which is a topologically robust metal (semimetal) whose low energy excitations are Weyl fermion quasiparticles. In a Weyl semimetal, the chiralities associated with the Weyl fermion nodes can be understood as topological charges, leading to split monopoles and anti-monopoles of Berry curvature in momentum space. This gives a measure of the topological strength of the system. Due to this topology a Weyl semimetal is expected to exhibit 2D Fermi arc quasiparticles on its surface. These arcs (“fractional” Fermi surfaces) are discontinuous or disjoint segments of a two dimensional Fermi contour, which are terminated onto the projections of the Weyl fermion nodes on the surface (Xu, Belopolski et.al., Science 349, 613 (2015). I show that Fermi arc quasiparticles can only live on the boundary of a 3D crystal which collectively represents the realization of a new state of quantum matter.