Seminar

Topological crystalline insulators and superconductors

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Time: 10:30 am, July.11, 2014 (Friday)
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地点: 理科五号楼607会议室

Abstract

The study of symmetry protected topological states has become a heated field in condensed matter physics. At the center of the emergent field is the concept of topological insulators (TI). Ideally, a TI has an insulating gap in the bulk and at the same time gapless electronic excitations on the edge, protected from being gapped by time-reversal symmetry (TRS). The idea of TI can be naturally extended to systems with symmetries other than TRS, e.g., crystalline symmetries: a topological crystalline insulator (TCI) is an insulator that has gapless edge modes protected by space group symmetries. Tin telluride (SnTe) is the first experimentally confirmed TCI, having on the (001)-surface four non-degenerate Dirac cones protected by mirror reflection symmetry. I will show that the new topological surface states can be used to realize quantum anomalous Hall states with Chern numbers tunable between ±4. I will then introduce a new class of 3D TCIs in spinless systems (or where SOC is negligible) that is protected by crystalline symmetries only. These systems have new topological invariants in the bulk and exotic surface states such as quadratically touching topological surface bands. Finally, I will discuss topological crystalline superconductors, which have Majorana edge states protected by crystalline symmetry. I will theoretically show that the surface states of SnTe with proximity induced s-wave superconductivity belongs to this class, where a superconducting vortex binds exactly two Majorana states at each end.

About the Speaker

Fang Chen graduated from Peking University in 2004 and obtained his Ph.D. degree at Purdue University in 2011, with Dr. Jiangping Hu as his advisor. He then became a postdoc at Princeton University working with Dr. Andrei Bernevig.