Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Topological phase transitions in multicomponent superconductors"

Yuxuan Wang, University of Illinois at Urbana–Champaign

Abstract: We study the phase transition between a trivial and a time-reversal-invariant topological superconductor in a single-band system. By analyzing the interplay of symmetry, topology, and energetics, we show that for a generic normal state band structure, the phase transition occurs via extended intermediate phases in which even- and odd-parity pairing components coexist. For inversion-symmetric systems, the coexistence phase spontaneously breaks time-reversal symmetry. For noncentrosymmetric superconductors, the low-temperature intermediate phase is time-reversal breaking, while the high-temperature phase preserves time-reversal symmetry and has topologically protected line nodes.
Furthermore, with approximate rotational invariance, the system has an emergent U(1)×U(1) symmetry, and novel topological defects, such as half vortex lines binding Majorana fermions, can exist. We analytically solve for the dispersion of the Majorana fermion and show that it exhibits small and large velocities at low and high energies. Relevance of our theory to superconducting pyrochlore oxide $Cd_2Re_2O_7$ and half-Heusler materials is discussed.

12:00pm noon
Wednesday, November 29, 2017
Duboc Room (4-331)

Host: Liang Fu