Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Majorana Superconducting Qubits"

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Abstract: Topological superconductors hosting spatially well-separated Majorana bound states offer the possibility for realizing robust qubits protected from local environmental perturbations. Revealing new properties of Majorana bound states as well as establishing an experimentally feasible platform for Majorana-based quantum computing constitute two of the most urgent challenges in the field. In this talk, I will address these issues by discussing two setups of topological superconductors coupled to conventional superconductors:

(1) The first setup comprises a Coulomb-blockaded time-reversal invariant topological superconductor island with Majorana Kramers pairs placed in an s-wave superconductor Josephson junction. I will discuss a 2Pi Josephson effect which is mediated by the Majorana Kramers pairs and whose direction is controlled by the joint parity of all four Majorana bound states on the island, a "Parity-controlled 2Pi Josephson effect".

(2) The second setup constitutes a Majorana-based qubit in an all-superconducting circuit, a "Majorana Superconducting Qubit". I will demonstrate how universal quantum computation can be achieved in such a device and discuss advantages over conventional superconducting qubits.

[1] C. Schrade and L. Fu, Parity-controlled 2Pi Josephson effect mediated by Majorana Kramers pairs, arXiv:1801.03511
[2] C. Schrade and L. Fu, Majorana Superconducting Qubit, arXiv:1803.01002

12:00pm noon
Tuesday, March 20, 2018
Duboc Room (4-331)

Host: Liang Fu