



清华大学高等研究院

Institute for Advanced Study, Tsinghua University

物理学学术报告

Physics Seminars (biweekly)

- Title:** Detecting Majorana fermions in fully gapped and nodal topological superconductors
- Speaker:** Prof. Kam Tuen Law
(*The Hong Kong University of Science & Technology*)
- Time:** 3:15pm, Wednesday, June 5, 2013
(2:45~3:15pm, Tea, Coffee, and Cookie)
- Venue:** Conference Hall 322, Science Building, Tsinghua University

Abstract

An important progress has been made recently that zero bias conductance peaks (ZBCPs) in Andreev reflection type experiments, which are possibly due to Majorana fermions, have been observed in superconductor/semiconductor heterostructures. However, recent experiments cannot rule out other possible origins of the enhancement local Andreev reflections.

In this talk, we show that two spatially separated but strongly coupled Majorana fermions can strongly enhance crossed Andreev reflection amplitudes between two spatially separated leads, which are connected to the two Majorana fermions separately. The resulting strong current-current correlations and shot noise can be used to detect the non-local properties of Majorana fermions.

The creation and detection of Majorana fermions in the so-called DIII class topological superconductors which preserve time-reversal symmetry will also be discussed.

In this talk, we also discuss the possibility of detecting Majorana fermions in nodal superconductors. We predict that Majorana fermion flat bands appear in $d_{x^2-y^2}$ -wave superconductors with Rashba spin-orbit coupling. Unlike the zero energy fermionic Andreev bound states which appear on the [110] edges of usual d-wave superconductors, the Majorana fermions on the same edge cannot be lifted to finite energy by an in-plane magnetic field. Therefore, tunnelling spectroscopy for a $d_{x^2-y^2}$ -wave superconductor under an in-plane magnetic field gives rise to a triple peak feature with the central ZBCP caused by Majorana fermions.