



# 清华大学高等研究院

Institute for Advanced Study, Tsinghua University

## 物理学术报告

### Physics Seminars (biweekly)

- Title:** Topologically protected quantum computation based on Majorana zero modes: A theory perspective
- Speaker:** Dong Liu  
*Department of Physics, Tsinghua University*
- Time:** 3:30pm, Wednesday, May 15, 2019  
(3:00~3:30pm, Tea and Coffee)
- Venue:** Conference Hall 322, Science Building, Tsinghua University

#### Abstract

Topological materials provide a protection from decoherence at the hardware level by using emergent non-Abelian anyons. The simplest non-Abelian anyon involves a defect that binds a Majorana zero-energy mode predicted to appear quite naturally in certain superconducting systems. I will first review recent progresses and discuss the challenges in Majorana search. Then, I will discuss a near term question: What is the simplest way to reveal the coherent signatures of Majorana devices and measure the qubit lifetime? To answer this question, we propose a simple transport measurement in a Majorana Coulomb blockade device. Finally, I will discuss a serious type of error—adiabatic error—in general topological quantum computation and Majorana qubits. Adiabatic errors only vanish as a power-law function when increasing braiding operation time. This power-law behavior can wash out the advantages of topological quantum computation. We found a scheme to overcome this serious problem.