

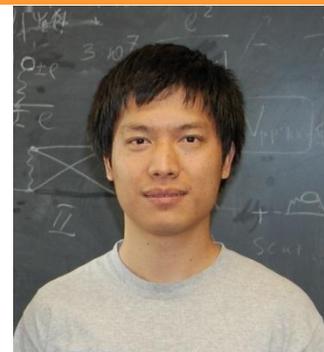


### Seminar

## Exploring topological quantum physics: from the realm of ultracold atoms to condensed matter systems

**Xiong-Jun Liu**

*ICQM, School of Physics, Peking University, China*



**Time: 16:00pm, December 28, 2017 (Thursday)**

**时间: 2017年12月28日 (周四) 下午 16:00**

**Venue: Room W563, Physics Building, Peking University**

**地点: 北京大学物理楼 西563**

#### Abstract

The concept of topological quantum matter was introduced to condensed matter physics over thirty years ago, while its study has been greatly revived since the discovery of time-reversal invariant topological insulators in the recent decade. The search for novel topological quantum states has been actively involved in the research of both condensed matter and ultracold atom systems. In this talk, I will present the main research activity of our group in predicting, realizing, and engineering topological quantum physics based on ultracold atoms (first part) and solid state materials (second part). For ultracold atoms, I will focus on our progresses of exploring topological quantum physics by realizing spin-orbit (SO) couplings in optical lattices, with the 2D SO interactions being reported last year. In particular, I will introduce why the realization of high-dimensional SO couplings for ultracold atoms is interesting, and show how it was proposed and achieved in the experiments. The novel equilibrium and non-equilibrium quantum physics with novel topology will be discussed for the SO coupled quantum gases. For the solid state systems, I will present our recent prediction of realizing non-Abelian Majorana modes in topologically nontrivial and also trivial superconductors. Several fundamental theorems will be shown, and may provide useful guidance in search for non-Abelian Majorana modes in broader range of superconducting systems. The future interesting issues will also be discussed.

#### About the Speaker

Xiong-Jun Liu graduated with Ph.D in Texas A&M University in 2011. After working as a postdoctoral fellow in Joint Quantum Institute and Condensed Matter Theory Center at University of Maryland, Hong Kong University of Sci & Tech and MIT from 2011 to 2014, he joined as a tenure-track faculty member the International Center for Quantum Materials at Peking University in Sep of 2014. His current research interests include both condensed matter theory and ultracold atoms, focused on topological quantum matter, in particular the topological superconductivity/superfluidity and interacting topological physics.