



Weekly Seminar

Majorana physics in spin space: from detecting to braiding

Xin Liu (刘鑫)

Department of Physics, Huazhong University of Science and Technology

Time: 4:00pm, June. 6, 2018 (Wednesday)

时间: 2018年6月6日 (周三) 下午 4:00

Venue: Room W563, Physics Building, Peking University

地点: 北京大学物理楼 西563

Abstract

Quantum states of electronic systems inevitably have the internal degree of freedom, the spin, so do the Majorana zero modes (MZMs). In this talk, I will discuss how to utilize the spin degree of freedom to manipulate, braid, and detect Majorana modes. After a brief introduction to the conventional schemes of detecting and braiding MZMs, we show that such schemes have counterparts based on spin manipulation. For detecting MZMs utilizing their spin-triplet nature, we find an electric field driven DC supercurrent which is dual to the celebrated flux driven Josephson effect. This phenomenon can be combined with zero bias peak in the same device and give strong evidence of the existence of MZMs. For braiding MZMs utilizing their fully spin polarized character, we propose to braid MZMs by locally winding the Majorana spins, which topologically corresponds to twisting two associated worldribbons, equivalent to worldlines that track the braiding history of MZMs. The braiding operation by winding Majorana spins is robust against local imperfections such as irregular winding paths, the static and dynamical disorder effects, which is a natural consequence of the intrinsic connection of our scheme to topological charge pumping.

About the Speaker

Prof. Xin Liu got his B.S. degree in Nankai University and M.S. degree in Chern Institute of Mathematics, Tianjin. He received his Ph. D. from Texas A&M University in 2012. After graduation, he had worked as a postdoctoral researcher in the Pennsylvania State University from 2012 to 2014 and Condensed Matter Theory Center, University of Maryland from 2014-2015. He joined Huazhong University of Science and Technology in 2015.