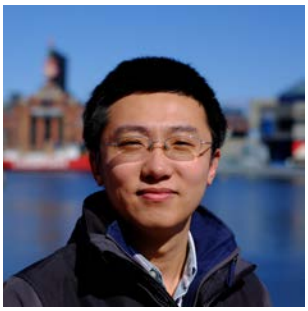
THE CHINESE UNIVERSITY OF HONG KONG

Department of Physics

COLLOQUIUM

Half-Quantum Flux in Topological Superconductors

by



Dr. Yufan LI (李禹帆博士)
Department of Physics and Astronomy
Johns Hopkins University, USA

Date: January 6, 2021 (Wednesday)
Time: 10:00 - 11:00 a.m.
Join ZOOM Meeting: https://qrgo.page.link/Trgxx

ALL INTERESTED ARE WELCOME

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Abstract

Spin-triplet superconductors (SCs) are highly desirable but rarely realized. On the other hand, there are surging interest in the spin-triplet p-wave pairing due to its close relevance to topological superconductivity and noise-resilient quantum computing. The superconducting gaps of triplet and singlet SCs with odd and even parity respectively can be exploited for unequivocal identification. We show that the magnetic flux quantization, one of the defining characteristics of a superconductor (SC), is a decisive phase-sensitive method to distinguish triplet-pairing SCs from the more common spin-singlet SCs. A superconducting ring with triplet pairing may demonstrate half-integer flux quantization $(n + ½)\Phi_o$, where n is an integer, i.e., half flux quanta with half-integer quantum numbers of 1/2, 3/2, 5/2, *etc*. instead of the exclusive integer quantization $n\Phi_o$ observed in singlet SCs. We have observed half-quantum flux in mesoscopic rings of superconducting β-Bi_2Pd thin films [1]. The result provides conclusive evidence for spin-triplet *p*-wave pairing in β-Bi_2Pd as a leading candidate of intrinsic topological SCs. We have also observed half-quantum flux in noncentrosymmetric α-BiPd, where an admixture of singlet and triplet pairing is expected from the absence of parity symmetry [2]. I shall discuss how the half-quantum flux may lead to a new design of flux qubit, which can operate without a bias magnetic field. Our findings establish a new paradigm for identifying spin-triplet pairing, and usher in new venues for studying topological superconductivity.

[1] Y. Li, X. Xu, M.-H. Lee, M.-W. Chu, C. L. Chien, Science 366, 238-241 (2019).
[2] X. Xu, Y. Li, C. L. Chien, Physical Review Letters 124, 167001 (2020).

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