北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Topological superconductivity with spin-3/2 half-heusler compounds beyond spin triplet pairing

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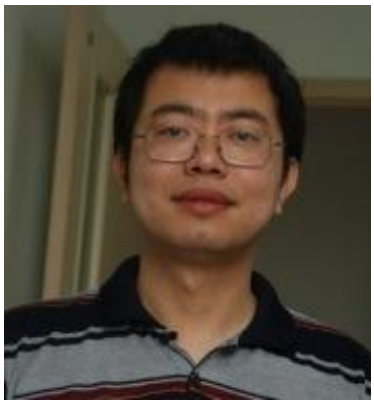

Time: 4:00pm, Dec. 21, 2017 (Thurday)

时间：2017年12月21日 （周四）下午4:00

Venue: Room W563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

Multi-component electronic systems are not rare in solid state physics due to the multi-orbital band structure and spin-orbit coupling. They exhibit richer structures of topological superconductivity beyond the conventional scenarios of spin singlet and triplet pairings. We generalize the He3-B type isotropic p-wave topological pairing to the four-component fermion systems, which are effectively described by spin-3/2 fermions. The p-wave triplet and f-wave septet pairings are identified as topologically non-trivial characterized by large topological indices and exhibiting high order Majorana-Dirac surface spectra. Recently, there has been experimental evidence of nodal spin-3/2 superconductivity in the half-Heusler compound YPtBi semi-metal with theoretically proposed p-wave septet pairing gap function. Zero energy Majorana flat bands on the (111)-surface and their signatures in the quasi-particle interference patterns are calculated. In addition, we also discuss how to realize the chiral Majorana modes by a “boundary of boundary” method starting with a degenerate Fermi surface without spin-orbit coupling. The p\pm i s superconductors develop spontaneous magnetizations on the surfaces. Along the magnetic domain walls on the surface, the chiral Majorana modes propagate uni-directionally, which can be controlled by external magnetic fields.

References:

[1] Wang Yang, Yi Li, Congjun Wu, Phys. Rev. Lett. 117, 075301 (2016).

[2] Wang Yang, Tao Xiang, and Congjun Wu, Phys. Rev. B 94, 144154 (2017).

[3] Wang Yang, Chao Xu, and Congjun Wu, arxiv:1711.05241.

About the speaker

Prof. Congjun Wu received his Ph.D. from Stanford University in 2005. Then he worked as postdoctoral research associate in KITP, University of California at Santa Barbara from 2005 to 2007. In 2007 he joined the faculty as assistant professor in Department of Physics, University of California at San Diego, and got tenured in 2011. He became a full professor at UCSD in 2017. Prof. Wu’s main research interests include theoretical condensed matter and ultracold atoms.