北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Nodal-chain metals

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Time: 2:00pm, Jan. 10, 2017 (Tuesday)

时间：2017年1月10日 （周三）下午2:00

Venue: Room w563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

The band theory of solids is arguably the most successful theory of condensed matter physics, providing the description of the electronic energy levels in a variety of materials. Electronic wave functions obtained from the band theory allow for a topological characterization of the system and the electronic spectrum may host robust, topologically protected fermionic quasiparticles. Many of these quasiparticles are analogs of the elementary particles of the Standard Model, but others do not have a counterpart in relativistic high-energy theories. A full list of possible quasiparticles in solids is still unknown, even in the non-interacting case. Here, we report on a new type of fermionic excitation that appears in metals. This excitation forms a nodal chain –a chain of connected loops in momentum space – along which conduction and valence band touch. We prove that the nodal chain is topologically distinct from any other excitation reported before. We discuss the symmetry requirements for the appearance of this novel excitation and predict that it is realized in an existing material IrF4, as well as in other compounds of this material class. Using IrF4 as an ex- ample, we provide a detailed discussion of the topological surface states associated with the nodal chain. Furthermore, we argue that the presence of the novel quasiparticles results in anomalous magnetotransport properties, distinct from those of the known materials.

Ref s:

[1] T. Bzdusek, Q S.Wu, A. Ruegg, M Sigrist, and A A. Soluyanov, Nature 538, 75–78 (06 October 2016)

[2] Q S.Wu, S N. Zhang WannierTools: An open-source software package for novel topological materials (http://www.wanniertools.com)

About the speaker

QuanSheng Wu received his BS degree from Beijing Normal University in 2008 and PhD degree from University of Chinese Academy of Science in 2013. Now, he is a postdoc in ETH Zurich. His main research interests lie in the studies of novel topological materials, including study the topological properties of existed materials, and find more candidates for novel topological excitations. Based on his work, he developed an open-source software called WannierTools, which is suitable for novel topological materials' investigations.