北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Weekly Seminar

Realization of Massive Relativistic Spin-3/2 Rarita-Schwinger Quasiparticle in Condensed Matter Systems

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Time: 4:00pm, Nov. 15, 2017 (Wednesday)

时间：2017年11月15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会议室

Abstract

The same as Weyl and Majorana fermions, the relativistic spin-3/2 elementary particle, known as Rarita-Schwinger (RS) fermion, has also been proposed but not observed in the laboratory or nature. Sharply in contrast with any wave equation describing spin-1/2 fermions, the RS equations contain nontrivial constraints to eliminate the redundant DOF. Consequently the standard procedure adopted in realizing relativistic spin-1/2 quasi-particle is not capable of creating the RS fermion in condensed matter systems (CMS). We propose a generic method to construct a Hamiltonian which implicitly contains the RS constraints, thus includes the eigenstates and energy dispersions being exactly the same as those of RS equations. By implementing our 16×16 or 6×6 Hamiltonian, one can realize the 3 dimensional or 2 dimensional (2D) massive RS quasiparticles in CMS, respectively. Due to the nontrivial constraints, the simplified 2D massive RS quasiparticle has an exotic property: it has vanishing orbital magnetic moment while its orbital magnetization is finite. Finally, we discuss the material realization of RS quasiparticle.

About the speaker

万贤纲，南京大学物理学院教授，2000年在南京大学获得理论物理博士学位，2001起在南京大学历任讲师，副教授，教授。主要学术成绩为：提出了新型拓扑量子态—Weyl 半金属，引发了国际上Weyl 半金属的研究热潮；发展了一套计算磁性相互作用的方法并确定多个复杂体系的基态磁构型。获得2014年度香港大学Daniel Tsui Fellowship。2015年获得国家杰出青年科学基金；2016年被评为教育部长江学者特聘教授。