北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Topological Insulator with Spin-Resolved Edge Current

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Time: 4:00pm,Nov.15, 2013 (Friday)

时间：2013年11月15日 （周五）下午4:00

Venue: Room 607, Conference Room A , Science Building 5

地点：理科五号楼607会议室

Abstract

First I will review the topological insulating states known so far using the honeycomb lattice structure and the notion of Berry phase. I then reveal that one can realize a novel topological insulator with simultaneous finite charge and spin Chern numbers. The idea is to use staggered electric potential, antiferromagnetic exchange field and spin-orbit coupling (SOC) together in order to control the spin, valley and sublattice degrees of freedom of electrons on honeycomb lattice, and thus to achieve a full band engineering. In a finite system in this state, there appears a quantized edge current with full spin polarization, and the spin polarization of the dissipationless edge current can be inverted by gate voltage, a property important for spintronics. I will discuss on the robustness of the state against Rashba SOC and on how to generate this state without honeycomb structure.

This work is based on collaboration with Q.-F. Liang and L.-H. Wu.

About the Speaker

Xiao HU had studied in Peking University. He got his Bachelor's Degree, Master's Degree and Doctor's Degree in University of Tokyo. From June 2006 to 2010, he was a member of “International Team on Superconductivity and Novel Electronic system”, Chinese Academy of Science. Since April 2007, he has been a professor in Graduate School of Pure and Applied Science, University of Tsukuba. In Jan. 2011, he joined in 1000 Plan(Nanjing University). He has published over 180 papers and given 80 invited talks.

学术成就

胡晓和合作者在世界上首次提出反铁磁拓扑绝缘体概念及材料设计方案。利用反铁磁交换场，自旋轨道耦合以及交替电势，可以对蜂窝格点上的电子所具有的3个自由度（自旋，副格子，谷）进行完整的调制，实现一种新的拓扑态。其显著特征是，样本边缘上的量子化非耗散电流具有自旋极化，而且自旋极化可以通过电场反转。这样为拓扑绝缘体在自旋电子学技术的应用提供了开阔前景。受邀为著名杂志Advances in Physics拟写综述论文。

胡晓和合作者提出了拓扑超导Majorana准粒子操作的崭新方法。巧妙地设计纳米拓扑超导结构，充分利用拓扑特性，通过局域门电压的控制实现电中性Majorana准粒子的制备，移动，位置交换以及辫子群操作。为实现拓扑量子比特的大规模集成以及稳定的量子计算提供了可行的方案。论文在Europhysics Letters(Editor Choice)发表，并受邀为Nanotechnology拟写综述论文。