北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Visualizing Low Dimensional Electronic States in Complex Quantum Materials

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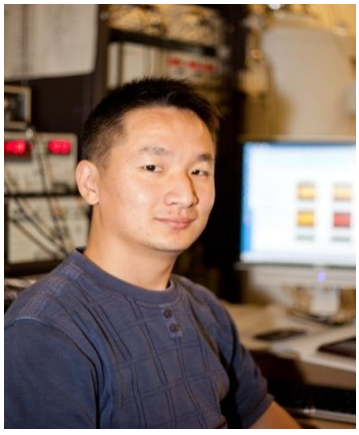

Time: 10:00am, Dec. 24, 2015 (Thursday)

时间：2015年12月24日 （周四）上午10:00

Venue: Room w563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

Low dimensional systems, such as atomically thin materials and material interfaces, offer a rich ground to discover new types of electronic states. Spatially resolved electrical probes provide direct access to these electronic states on the mesoscopic scale, complementing conventional transport techniques. In this talk, I will present two comprehensive studies on low dimensional electronic states employing Microwave Impedance Microscopy (MIM), a scanning probe technique that senses materials' capacitance and conductivity on the nanoscale.

The first study examines the canonical "edge state" picture of the quantum Hall (QH) effect in graphene, by combining MIM measurement which probes the filling of Landau levels (LL) in graphene bulk with edge-sensitive quantum transport. To our surprise, we find an unconventional edge-bulk correlation in graphene devices: the QH transport plateaus occur before the bulk Landau levels are completely filled. We explain this by analyzing complex edge-state configuration induced by electrostatic gating near the sharp graphene edges.

In the second study, we investigate metallic domain walls in a unique all-in-all-out magnetic insulator, Nd2Ir2O7. Through a combined study of MIM, transport, and X-ray micro-diffraction, we conclusively show that metallic states emerge at the magnetic domain walls when the all-in-all-out magnetic order forms with a concomitant metal-insulator transition occurring in the bulk. This represent a new type of interface conduction in a both chemically and structurally homogeneous material.

About the speaker

I received BS in Physics from Peking University in 2005. Then I went to graduate school at Cornell, worked in Prof. Dan Ralph's group on study of spin torque in nanomagnetic devices, and received PhD in Applied Physics in 2011. After that, I joined Prof. Zhi-Xun Shen's group at Stanford as a postdoc, working on mesoscopic study of electrical properties in complex quantum materials with scanning microwave impedance microscopy.