北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Weekly Seminar

Electronic Transport in Novel Nanoscale Systems: Graphene and Memristor

缪峰

南京大学物理学院

Time: 4:00pm, Sept. 18, 2013 (Wednesday)

时间：2013年9月18日 （周三）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

While traditional electronic components based on silicon technology are reaching the limit of miniaturization, researchers in both academia and industry are desperately searching for alternative materials and developing novel nanoscale devices based on new mechanisms. Understanding of the electronic transport in these novel nanoscale systems is crucial for both fundamental physics exploration and future technological applications. The first part of my talk will focus on electronic transport in graphene, a monolayer of carbon atoms which has shown tremendous potential on many applications. I will mainly discuss the electron ballistic transport phenomenon, proximity induced supercurrent and geometry-dependent minimum conductivity in substrate supported graphene, together with the controllable periodic ripples on suspended graphene membrane. In the ballistic transport regime, electrons propagate in graphene without any obstacle and scattering only happens on the interface of graphene and electrodes. This phenomenon can be realized by quantum interference of multiple reflected electronic waves between normal electrodes and multiple Andreev reflections from superconducting electrodes. Our discoveries may have important implications for graphene nanoelectronic devices, such as ballistic transistors.

The second part of my talk will focus on electronic transport in memristors, which are among the top candidates for next generation non-volatile random access memory and future nanoscale neuromorphic computation circuits. These devices work based on the modulation of nanoscale conducting channels, which determine the switching characteristics. By utilizing the pressure-modulated conductance microscopy (PCM), we study electronic transport through the conducting channels and also locate these channels, the anatomy of which reveals key information for high performance memristor devices. Our work suggests that metal oxide based memristive devices have potential of being shrunk close to atomic limit for future ultrascaled memory applications.

About the Speaker

缪峰，南京大学物理学院和南京微结构国家实验室教授。2009年美国加州大学河滨分校物理系博士，2009年至2012年任美国惠普实验室助理研究员。2012年入选中组部"青年千人计划"，同年被南京大学聘为教授。研究工作主要集中在运用电子输运、材料分析等实验手段研究石墨烯的电学性质和忆阻器(memristor)的器件物理。作为主要作者在《Science》、《Nature Nanotechnology》、《Physical Review Letters》、《Advanced Materials》等顶级学术期刊上发表论文，共发表论文29篇，总引用3400余次，其中多项工作被媒体广泛报道。并申请美国专利8项,已获授权3项。