北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Defects and Boundaries in 2D Materials: Correlating Electronic Properties to Atomic Structures

Time: 4:00pm, November 23, 2015 (Monday)

2015 11 23 4:00

Venue: Room w563, Physics building, Peking University

563

The quest for novel two-dimensional (2D) materials has led to the formation of hybrid heterostructures of graphene and other 2D atomic films with a variety of defects and boundaries. These defects and boundaries can break the lattice symmetry and are believed to have a major impact on the electronic properties, especially the transport behaviors in 2D materials. In this talk I will introduce our recent results on the study of two types of defect to illustrate how electronic and transport properties must be understood with a correlation to the atomic structures. The first type of defect is 1D boundary in hexagonal boron nitride (hBN) and graphene planar heterostructures, where a polar-on-nonpolar 1D interface is expected to possess peculiar electronic states associated with edge states of graphene and the polarity of hBN [1]. STM/STS measurements reveal a zigzag oriented boundary, showing boundary states about 0.6 eV below or above the Fermi level depending on the terminations of the hBN at the boundary [2]. Another type of defect is the monolayer-bilayer (ML-BL) boundaries in epitaxial graphene on SiC. By measuring the transport spectroscopy across individual ML-BL graphene boundaries with multi-probe scanning tunneling potentiometry, a greater voltage drop is observed when the current flows from bilayer to monolayer graphene than in the reverse direction, displaying an asymmetric electron transport upon bias polarity

1. L. Liu, et al., *Science* **343**, 163 (2014).
2. J. Park et al., *Nature Commun*. **5**, 5403 (2014).

4. K. W. Clark, et al., *Phys. Rev. X* **4**, 011021 (2014).

Dr. An-Ping Li is a Senior Research Staff Member and a Theme Leader at the Center for Nanophase Materials (CNMS) of Oak Rdige National Laboratory (ORNL), with an Adjunct Professor appointment in the Department of Physics Astronomy of The University of Tennessee. He obtained his PhD degree in Consended Matter Physics from Peking University in 1997. His research experience includes a Max-Planck-Society Fellowship in Max Planck Institute of Microstructure Physics, a visiting scientist appointment in Michigan State University, and a Senior R&D Scientist in Galian Photonics. He joined ORNL in 2002, first working on the Magnetic Semiconductor, and since 2005 he has been leading the Nanotransport research program in CNMS and 2015 he has been appointed as the Theme Leader for Electron Scattering and Excitation in Low-Dimensional Materials. He has published more than 70 scientific papers that have been cited more than 4,000 times. His current research interest is electronic transport and excitations in nanostructured materials.