北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Graphene: Plays More Than One Tune

Guorui Chen 陈国瑞

Department of Physics, UC Berkeley

Time: 4: 00 Pm, Jan. 15, 2020 (Wednesday)

时间：2020年1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

2D material is a highly tunable system that provides the opportunity to design, create and study different physics for purpose. In this talk, I will take graphene as an example to show how we tune the electronic properties of graphene and study different physics varying from single-particle physics, to strongly correlated physics and topological physics. In particular, I will start from the band engineering of graphene on hBN moire superlattice[1]. Then I will discuss a general route to engineer strongly correlated physics in two-dimensional moiré superlattices, and show the experimental realization of a tunable Mott insulator in the ABC stacked trilayer graphene (TLG)/hBN moiré superlattice[2]. The moiré superlattice in TLG/hBN heterostructures leads to narrow electronic minibands and allows for the observation of gate-tunable Mott insulator states at 1/4 and 1/2 fillings. Based on the trilayer graphene system, interesting signatures of superconductivity are observed at low temperatures near the 1/4 filling Mott insulating state[3]. By simply tuning the gate voltages, a topological Chern insulator with Chern number C = 2 and ferromagnetism are experimentally observed in the non-trivial band in trilayer graphene system, which makes it possible to study Mott, superconductivity and topological physics in one system[4].

[1] Guorui Chen *et al*, Emergence of tertiary Dirac points in graphene moiré superlattices, Nano Letters, 17 (6), 3576–3581. (2017)

[2] Guorui Chen *et al*, Evidence of a gate-tunable Mott insulator in a trilayer graphene moiré superlattice, Nature Physics, 15, 237-241. (2019)

[3] Guorui Chen, Aaron L. Sharpe *et al*, Signatures of tunable superconductivity in a trilayer graphene moiré superlattice, Nature 572, 215-219. (2019)

[4] Guorui Chen *et al*, Tunable correlated Chern insulator and ferromagnetism in trilayer graphene/boron nitride moiré superlattice, Nature *accepted*. arXiv:1905.06535 (2019).

About the speaker

陈国瑞，加州大学伯克利分校博士后。2010年本科毕业于山东大学物理与微电子学院，2016年博士毕业于复旦大学物理系并留校任博士后（导师张远波教授），2017年至今为美国加州大学伯克利分校物理系博士后（Prof. Feng Wang课题组）。研究兴趣主要在高质量二维材料及其范德瓦尔异质结，尤其是石墨烯的强关联和拓扑效应的量子输运。近年来在Nature, Nature Physics, Nature Materials, Nature Nanotechnology, PRL和Nano Letters等杂志期刊发表十多篇文章，被引用1500多次。同时担任Nature, Science, NanoLetters等杂志的审稿人。