北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Electrons in flatland: simple and non-trivial

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Time: 4:00pm, June 5, 2017 (Monday)

时间：2017年6月5日 （周一）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

Thanks to the high performance of our custom-built, state-of-art scanning tunneling microscope, we conduct benchmarking experiments utilizing molecular vibrons as atomic cantilevers whose resonance energy is well above the measurement temperatures. The short-range interaction between the ^{12}CO-cantilever and other molecules on the sample surface induces novel collective modes that are sensitive to resolve different isotopes. Through the long-range Coulomb interaction, the ^{12}CO-cantilever can be used as a local charge probe with high charge sensitivities ($< 5\times10^{-4}$ *e*) and spatial resolution (<nm).

Atomic and molecular manipulation on surfaces has opened a new realm of possibilities where atomically precise artificial structures can be constructed with a bottom-up approach, one building block at a time. Artificial graphene, which is electron lattice created by modulating surface electrons with CO molecule array, is one of the role model on this topic. We induce axial magnetic fields via straining the lattice and study the electron wavefunctions near the Dirac-cone. Thanks to the large lattice constant (~ 2 nm) and extremely high pseudo-magnetic field (up to 300 T), we are able to observe the pseudo Landau level wavefunction at the extreme quantum limit, where the magnetic length is comparable to or even smaller than the lattice constant.

At the end of the talk, I will give a brief review to my research on interacting two-dimensional electron/hole systems in ultra-clean GaAs quantum wells. The dominating Coulomb interaction in these systems gives rise to fascinating quantum many-body states such as fractional quantum Hall effect, Wigner crystals, charge density waves, etc. I will also propose possible future experiments combining delicate material growth, fine-tuning of exotic quantum phases and scanning probe technique in order to explore the internal topological information of these novel quantum phases.

About the speaker

Dr. Yang Liu got his Bachelor degree in Electronic engineering from Tsinghua University in 2006, and his master degree there in 2008. He received his Ph.D. degree in electrical engineering from Princeton University, in 2014. After graduation, he continued to stay there to do post-doctoral research from 2014 to 2015, and then moved to Stanford University as a GLAM post-doctoral research fellow until now. Dr. Yang Liu received Finalist of Blavatnik Regional Awards in 2015, and Princeton EE Outstanding Dissertation Awards in 2014 etc. His current research focuses on scanning tunneling microscopy.