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Tunable Mott Insulator and Superconductivity in Graphene

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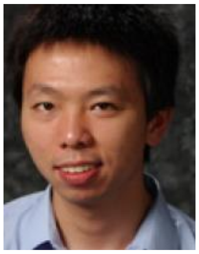
Abstract: Mott insulator plays a central role in strongly correlated physics, where the repulsive Coulomb interaction dominates over the electron kinetic energy and leads to insulating states with one electron occupying each unit cell. In this talk, I will discuss the realization of a tunable Mott insulator in the ABC trilayer graphene (TLG) and hexagonal boron nitride (hBN) heterostructure with a moiré superlattice. Unlike massless Dirac electrons in monolayer graphene, electrons in pristine ABC TLG are characterized by quartic energy dispersion and large effective mass that are conducive for strongly correlated phenomena. 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. In addition, signatures of superconductivity are observed at low temperature near the ¼ filling Mott insulator state in the TLG/hBN heterostructures.



Speaker: Professor Feng Wang received a B.A. from Fudan University, Shanghai, in 1999 and a Ph.D. from Columbia University in 2004. From 2005-2007, he has been a Miller Fellow with Miller Institute for Basic Science at Berkeley. He joined the Physics faculty in Fall, 2007. He is also affiliated with the Materials Sciences Division of Lawrence Berkeley National Laboratory, and the Kavli Energy NanoSciences Institute.

Dr. Wang's research interest is in probing and controlling light-matter interactions in condensed matter systems, with an emphasis on novel physical phenomena emerging in nanoscale structures and quantum phenomena in novel low dimensional materials. His research group is developing and employing novel optical spectroscopy that simultaneously achieves ultra-broadband energy tunability, polarization control, nanometer spatial resolution, and femto-second temporal resolution.