清华大学高等研究院

Institute for Advanced Study, Tsinghua University

学术报告

Title: **Hubbard Model, Unconventional Superconductivity and Density Waves in Twisted Bilayer Graphene**

Speaker: **Noah Fan Qi Yuan (*MIT*)**

Time: **4:00pm, Tuesday, August 28, 2018**

Venue: **Conference Hall 322, Science Building, Tsinghua University**

Abstract

We study the twisted bilayer graphene where unconventional superconducting and correlated insulating phases are recently discovered at the filling of n=2 electrons per supercell. In the strong-coupling point of view, we obtained the effective tight-binding model and hence Hubbard model for the lowest four minibands, by constructing the maximally-localized Wannier orbitals which preserve required symmetries. In the weak-coupling point of view, we study electronic ordering instabilities at n=2, motivated by the Fermi surface nesting and the proximity to Van Hove singularity. We find d/p-wave superconductivity and charge/spin density wave emerge as the two types of leading instabilities driven by Coulomb repulsion. The density wave state has a gapped energy spectrum at n=2 and yields a single doubly-degenerate pocket upon doping to n>2. The intertwinement of density wave and superconductivity, and the quasiparticle spectrum in the density wave state are consistent with experimental observations.