北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

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

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Time: 10:30am, Aug. 30, 2018 (Thursday)

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Venue: Room W563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

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.

About the speaker

I got my Ph. D. in The Hong Kong University of Science and Technology in 2017, and now am a postdoc in Liang Fu's group at MIT.

I'm mainly interested in superconductivity and topological phases. During my Ph. D. research, I studied topological superconductors, Majorana zero modes, spin-orbit coupling effect in superconductivity (so-called Ising superconductivity) and chiral versus nematic superconductivity. My research has been deeply related to experiments, which includes both to explain experimental data and to propose experimental realization of exotic superconducting phases in specific materials such as transition metal dichalcogenides and bismuth selenides.

Currently I'm interested in the unconventional superconducting and correlated insulating phases in twisted bilayer graphene, which are discovered recently.