

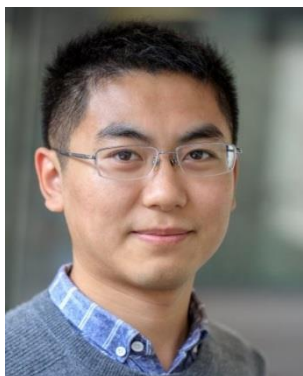


## Weekly Seminar

### Correlation Physics in Twisted Bilayer Graphene and a Mapping to a Heavy Fermion Problem

宋志达

北京大学量子材料科学中心



**Time: 3:00pm, Mar. 9, 2022 (Wednesday)**

**时间: 2022年3月9日 (周三) 下午3:00**

**Venue: Room W563, Physics building, Peking University**

**地点: 北京大学物理楼, 西563会议室**

#### Abstract

In this talk, I will summarize a series of our recent works on the many-body physics in twisted bilayer graphene (TBG) and present an outlook for future theoretical studies. First, I will review the projected Coulomb Hamiltonian of TBG and derive its  $U(4) \times U(4)$  and  $U(4)$  symmetries in different limits. Then, with the help of symmetries, we can write down exact eigenstates of the projected Coulomb Hamiltonian at integer fillings. These results are confirmed by numerical exact diagonalization. Given the many-body symmetries and exact ground states, we can also derive the exact charge 1, 2, 0 excitations, with Goldstone modes included. Remarkably, through charge 2 excitations, we prove the absence of Cooper pairs in the project Coulomb Hamiltonian around integer fillings. Finally, we map the TBG system to a heavy-fermion problem in a first-principles spirit. This mapping explains many previous analytical and numerical results both qualitatively and quantitatively in a simple and intuitive picture. In the end, I will discuss potential applications of the heavy-fermion model in explaining relevant experiments.

#### About the speaker

Zhida Song is an assistant professor at International Center for Quantum Materials, School of Physics, Peking University. He earned his Ph.D. at Institute of Physics, Chinese Academy of Sciences in 2018 and his B.S. at University of Electronic Sciences and Technologies in 2013. He is a theorist in condensed matter physics, with current primary interests in topological states and two-dimensional twisted materials.