



清华大学高等研究院

Institute for Advanced Study, Tsinghua University

学术报告

- Title:** Designing quantum geometry and nonlinear responses in van der Waals homostackings
- Speaker:** Huitao Shen 沈汇涛 (MIT)
- Time:** 3:00pm, Thursday, July 4, 2019
- Venue:** Conference Hall 322, Science Building, Tsinghua University

Abstract

The recent discovery of magic-angle twisted bilayer graphene has attracted tremendous interest. The moire superlattice potential due to the translational symmetry breaking strongly modifies graphene's electronic structure, leading to striking emergent quantum phenomena such as correlated insulating and superconducting states. Despite the excitement, an important open question is that whether layer stacking can enable other new dimensionalities that can be utilized to discover fundamentally new physics and functionalities. In this talk, I will show that van der Waals (vdW) homostackings can be used to very effectively design the quantum geometry and nonlinear or nonreciprocal responses of many vdW materials. Specifically, carefully designed homostackings can generate strong Berry curvature in the electronic structures of 2D materials. As a result, exotic nonlinear responses such as nonlinear Hall and circular photogalvanic effects are enabled in materials. Moreover, homostackings can turn many vdW materials, even graphene and transition metal dichalcogenides, into being ferroelectric, paving the way for realizing nonvolatile memory devices. The results are applicable to a wide range of vdW materials and therefore provide a new means to discover, control and harness emergent quantum phenomena in 2D devices.

References:

HS, Yang Zhang, Su-Yang Xu, Liang Fu, to appear; Nature 565, 337–342 (2019);
Nature Physics 14, 900–906 (2018); Phys. Rev. Applied 11, 024048 (2019)