Condensed Matter Physics Seminar Series

Transfer learning large-scale simulation and kinetic magnetism in moiré semiconductor

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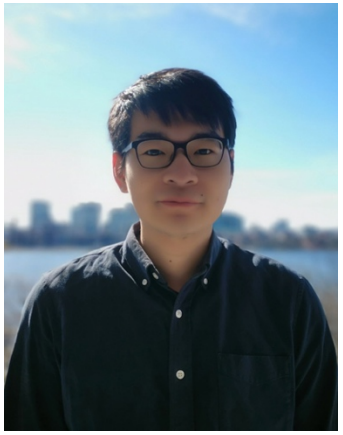

Transition metal dichalcogenide (TMD) based moiré materials have been shown to host various correlated electronic phenomena including Mott insulating states and fractional filling charge orders, quantum spin Hall effects, and (fractional) quantum anomalous Hall effects. To describe the low-energy states of long-wavelength moiré superlattice, we introduced the concept of moiré quantum chemistry, and developed transfer learning based large-scale first principle methods. In twisted bilayer TMD, we proposed the Mott ferroelectricity, kinetic magnetism and pseudogap metal from spin polarons. The pseudogap metal phase emerges at small doping below half filling and an intermediate range of fields, which exhibits a single-particle gap and a doping-dependent magnetization plateau.

I will also discuss the fractional quantum anomalous Hall effect in twisted homobilayer and its competing states. This series of works reveal the rich physics of semiconductor moiré superlattices as manifested in a variety of correlated and topological states.

Yang Zhang is an Assistant Professor of Physics at the University of Tennessee, Knoxville. He earned his Bachelor's degree in Physics and Mathematics from Tsinghua University in 2015, followed by a Ph.D. in Physics from the Max Planck Institute Dresden in 2019, then he worked as a postdoc at MIT until 2022. Dr. Zhang has received several awards, including two overall Winner Awards in the World Supercomputing Contest, SFB Best Doctoral Thesis Award, the Tschirnhaus Medal from the Leibniz Association, the Otto-Hahn Medal of the Max Planck Society, and the IUPAP Early Career Scientist Prize in Computational Physics.

Friday, September 27th at 3:00 PM
4-330 PAB