ARPES theory of graphene-based moiré superlattices and broken flavor-symmetry states in magic-angle twisted bilayer graphene (MATBG)

Dr. Jihang Zhu

August 16, 2021

Abstract

Graphene-based moiré superlattices are now established as an interesting platform for strongly-correlated many-electron physics.

The talk will have two parts. The first part is about the ARPES theory of graphene-based moiré superlattices. Motivated by recent experimental progress, we present a theoretical model study whose aim is to assess the potential of ARPES to resolve some of the many open issues in these systems. The theory is developed specifically for graphene on hexagonal boron nitride (G/hBN) and twisted bilayer graphene (TBG) moiré superlattices, but is readily generalized to any system with active degrees of freedom in graphene sheets.

The second part of the talk will be focused on the broken flavor-symmetry states in MATBG with a focus on the special magnetic properties of the spin- and valley-polarized ground state, based on a mean-field level study. A variety of spontaneously broken symmetry states have been observed in multilayer graphene moiré superlattices, including superconductors, correlated insulators and Chern insulators. Strong interactions as a result of flat bands formation at low energies are responsible for these spontaneous symmetry breaking states. In addition to flat bands, valley and spin degeneracies and the topological feature of graphene make graphene moiré systems rich in phenomena but complex as well.