universität innsbruck

Department of Theoretical Physics

Theory Colloquium

Thomas C. Lang, Institute for Theoretical Physics, University of Innsbruck

"Close encounters of the quadratic, linear and flat kind"

Abstract

Semiconductor moiré materials made from graphene and transition metal dichalcogenide layers have emerged as platforms, which allow for a high degree of control, such as continuous tuning of band structures and the influence of interactions. In this talk I will break down the fundamental scenarios which underly these complex two dimensional systems: In the weak coupling regime the fate of bands touching at the Fermi level is determined by lattice symmetry, spin degree of freedom and interaction range. Despite this seemingly simple setup even weak interactions can induce topological changes, many body interactions and quantum phase transitions which render these systems strongly correlated. Only recently we were able to extract accurate descriptions of many of these scenarios by means of large-scale numerical simulations augmented by renormalization group arguments.

I will focus on the effects of local interactions in quadratic band touching and Dirac-like models using quantum Monte Carlo simulations and spectroscopy from exact diagonalization. In the end I will draw the connection between these fundamental scenario and the interplay of Berry curvature, nontrivial single-particle dispersions and the competition between fractional Chern insulator and charge-density-wave states in a realistic model for twisted bilayer graphene aligned with its hexagonal boron nitride substrate.

Wednesday | 14.04.2021 | 16:15

Zoom link:

https://us02web.zoom.us/j/87814167848?pwd=NFMwWll4czNWLy9ONDYzV09Md2x0QT09

Meeting ID: 878 1416 7848

Passcode: 218727