Chez Pierre

Presents ...



Monday, November 30th 2026
12:00 pm - 1: 00 pm
Duboc room - 4-331

Chez Pierre Seminar

Fang Liu, Stanford University

"Mapping the Moiré Landscape: From Electronic Structure to Ultrafast Lattice Dynamics?.

Twisting two atomically thin crystals creates moiré superlattices with new periodic potentials that profoundly reshape their electronic structure and lattice dynamics. These artificial quantum materials offer exciting opportunities to explore emergent physical phenomena, yet directly observing their electronic and vibrational properties remains challenging because of the small size and structural inhomogeneity of conventional moiré samples. In this talk, I will discuss how our recent advances in synthesizing macroscopic, highly uniform moiré superlattices enable us to directly visualize both their electronic structure and lattice dynamics using complementary momentum-resolved techniques. First, using high-resolution angle-resolved photoemission spectroscopy (ARPES), we directly map the electronic band structure of twisted transition metal dichalcogenides, revealing moiré-induced band folding, hybridization, and van Hove singularities. These measurements provide new insights into how interlayer interactions and atomic reconstruction reshape the electronic energy landscape. Next, I will discuss how we use ultrafast electron diffraction (UED) to watch the moiré lattice evolve in real time following photoexcitation. We observe coherent twisting and untwisting of the moiré superlattice on picosecond timescales, revealing a dynamic coupling between photoexcited carriers and atomic reconstruction. Through time- and momentum-resolved diffuse scattering, we further uncover nonequilibrium phonon dynamics in monolayers and twisted bilayers. Together, these studies provide complementary views of the moiré landscape, connecting electronic band structure with ultrafast lattice motion and opening new possibilities for understanding and controlling quantum matter.