DEPARTMENT OF PHYSICS AND ASTRONOMY

(Special Seminar)

An Anomalous Odyssey in Two-Dimensions: Quantum Hall Effect without a Magnetic Field

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A recent series of experiments in two-dimensional moiré materials have discovered the physics of quantum Hall effect in the absence of an external magnetic field. These so-called "(Integer/Fractional) Quantum Anomalous Hall" phases have been observed in twisted transition metal dichalcogenide MoTe2 moiré heterostructure, as well as more recently in pentalayer rhombohedral graphene aligned with a hexagonal Boron-Nitride (hBN) substrate. Unlike the standard theoretical framework of the quantum Hall effect, where one has a flat band at the single-particle level, these discoveries provide a fertile ground for exploring the minimal conditions that are required to realize and stabilize such exotic phases of matter. In this talk, I will examine the microscopic origin of both the integer and fractional QAH phases in N-layer graphene aligned with hBN through a combination of Hartree-Fock methods and Exact Diagonalization. I will also discuss the delicate role of the moiré superlattice potential in determining the ultimate ground state in multilayer graphene and strongly-correlated two-dimensional moiré materials.

Monday, January 27, at 10:30 AM,
CSP Conference Room 322, Physics Building

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