

Chez Pierre

Presents ...

Monday, September 26, 2022

12:00pm Noon

Duboc Room 4-331



Chez Pierre Seminar

Eun-Ah Kim, Cornell University

“Quantum Fractional Insulator with fractons In twisted bilayer graphene”

Fractionalization without time-reversal symmetry breaking is a long sought-after goal that manifests non-trivial correlation effects. While exactly solvable models offered many new theoretical insights, the physical realization of time-reversal symmetric fractionalization remained out of reach. The earlier proposal of correlated insulating states at $\nu = 1/3$ filling in twisted bilayer graphene and recent experimental observations of insulating states at those fillings provide a new platform to realize time-reversal symmetric fractionalized states. However, the nature of fractional excitations and the effect of quantum fluctuation on the fractional correlated insulating states are unknown. We show that excitations of the broken-symmetry fractional correlated insulator phases in the strong coupling limit carry fractional charges and exhibit fracton-like behavior with restricted mobility. Upon introduction of quantum fluctuations, the resonance of “lemniscate” structured operators quantum melts the broken-symmetry states into a new quantum fluid state of “quantum lemniscate liquid (QLL)”.

We propose experimental strategies to observe these fractionalized excitations and discuss the theoretical implications of the QLL phase.