

CONDENSED MATTER SCIENCES SEMINAR

Professor Ilya Esterlis

University of Wisconsin - Madison

Host

Dr Hitesh Changlani

Title

Quantum dynamics in two-dimensional electron crystals

Friday, October 3rd, 2025

1st Floor – B101

15:00-16:00

Abstract

Electron crystals — states of matter in which itinerant electrons spontaneously crystallize — feature prominently in the phase diagrams of two-dimensional materials. At experimentally relevant electron densities, these crystals are highly quantum: significant overlap between electron wave functions leads to frequent tunneling between lattice sites, giving rise to rich quantum dynamics. I will present new theoretical results on the consequences of these quantum effects in both monolayer and bilayer electron crystals. In monolayers, increasing electron density can drive a transition to a metallic charge density wave state, which can be viewed as a quantum crystal with a finite density of itinerant ground-state defects. In bilayers, interlayer Coulomb interactions stabilize new lattice geometries, where ring-exchange processes give rise to a variety of magnetic ground states, and metallic density wave states emerge under a small density imbalance between layers.