

Chez Pierre

Presents ...

Monday, September 12, 2022

12:00pm Noon

Duboc Room 4-331



Chez Pierre Seminar

Yu He, Yale University

“Lattice fluctuation and electron-phonon coupling in a “failed” excitonic insulator.”

Analogous to Cooper pair condensation in superconductors, when electron-hole pairs (excitons) condense, an excitonic insulator is born. Creation of an exciton condensate has been demonstrated in bilayer junctions, but remains challenging in bulk systems due to either fast recombination or an often inseparable lattice instability. Using angle-resolved photoemission spectroscopy and hard x-ray scattering, we examine the nature of the broken symmetry in a leading excitonic insulator candidate - van der Waals chalcogenide Ta₂NiSe₅. Strong lattice fluctuations, diverging structural susceptibility, and negative electronic compressibility all point to a lattice instability that denies true exciton condensation. With this example, we demonstrate how model calculations can be paired with nonthermal tuning methods to estimate microscopic interaction parameters, help delineate multiple degrees of freedom in “intertwined” phase transitions, and guide double-blind predictive materials engineering in correlated systems.

Reference: Chen et al., arXiv:2203.06817; Chen et al., in preparation; He et al., Phys Rev X 11, 031068 (2021)