Chez Pierre

Presents ...

**Monday, November 1, 2021**

**12:00pm Noon**

# Chez Pierre Seminar

## Ziqiang Wang– Boston College

"Correlated topological states in a new family of kagome superconductors”

Transition metal vanadium-based kagome lattice compounds $AV_3Sb_5$ ($A$=K, Cs, Rb) were discovered in 2019 [1]. These materials are non-magnetic, charge transfer metals with a $Z_2$ nontrivial band structure. They undergo charge density wave (CDW) transitions below $T_{\mathrm{CDW}} \sim 78 – 103$K and superconducting transitions below $T_c \sim 0.9 – 3.5$K [2]. The CDW state exhibits a large intrinsic anomalous Hall conductivity [3]. STM reveals an unconventional $2a_0$x$2a_0$ CDW state with the magnetic field response hinting at circulating bond current and plaquette flux [4], which is supported by evidence of time-reversal symmetry breaking in muon spin rotation experiments. Between $T_{\mathrm{CDW}}$ and $T_c$, a rotational symmetry breaking order develops with an onset temperature coinciding with that of a $4a_0$ unidirectional charge order [5]. At low temperatures, a $4a_0/3$ x $4a_0/3$ pair density wave (PDW) was detected and found to be responsible for the pseudogap behavior above $T_c$ and the spatial modulations of the superconducting gap and coherence peaks in the ground state [6], in striking analogy to the high-$T_c$ cuprates. We first provide an overview of these and other remarkable findings in this family of materials. We then argue that the essential part of the phenomenology can be captured by doped orbital Chern insulators with circulating currents on the kagome lattice, and the Chern Fermi surface pockets give rise to the “mother” PDW state at the observed wave vector [7]. We further argue that the unique hexagonal symmetry allows an orbital-driven mechanism for intrinsic chiral topological PDW superconductors.