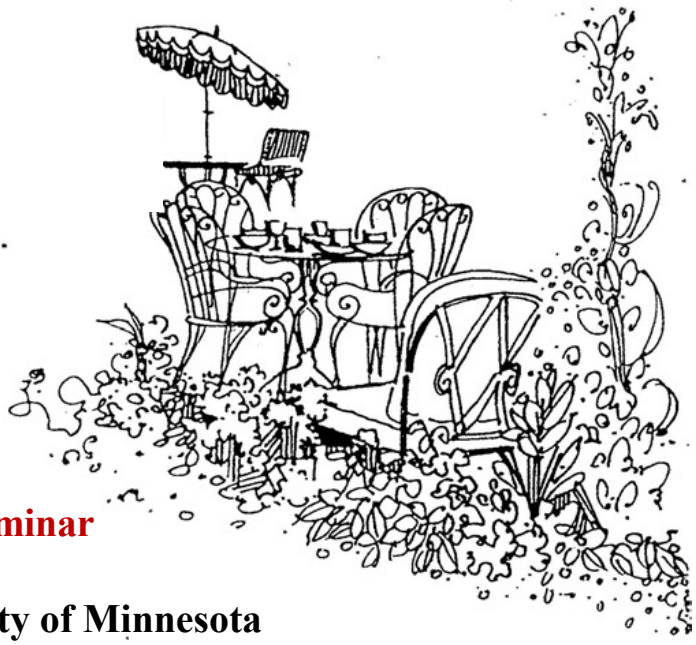
# Chez Pierre

Presents ...

**Monday, November 4, 2024**
**12:00 – 1:00 pm**
**Duboc Room – 4-331**



## Chez Pierre Seminar

**Martin Greven, University of Minnesota**

## "New developments in oxide superconductors – the role of inherent inhomogeneity".

Superconductivity has been a major scientific topic for more than a century, yet in many important materials the emergence of this macroscopic quantum phenomenon remains poorly understood. From measurements such as the nonlinear magnetic response, we have uncovered that superconductivity emerges in an unusual manner upon cooling in three well-known families of complex oxides – strontium titanate, strontium ruthenate, and the cuprates – for which the origin of superconductivity is thought to differ [1]. Our complementary structural diffuse neutron and x-ray scattering measurements reveal evidence for rare-region effects and indicate that the universal electronic behavior is rooted in intrinsic correlated inhomogeneity inherent to the oxides' perovskite-based crystal structures [2]. The prevalence of such inhomogeneity has far-reaching implications for the interpretation of electronic properties of perovskites in general, including thin films and heterostructures. In the case of the cuprates, this constitutes a pivotal part of a robust phenomenological model that comprehensively captures hitherto elusive properties of the normal and superconducting states [3]. In the case of strontium titanate, these insights motivated a systematic study of plastically deformed crystals and led to the discovery of remarkable superconductivity and ferroelectricity enhancements, along with the emergence of magnetism, associated with the self-organization of dislocations into periodic structures [4].

[1] D. Pelc *et al.*, Nat. Commun. **10**, 2729 (2019)
[2] D. Pelc *et al.*, Sci. Rep. **12**, 20483 (2022)
[3] D. Pelc *et al.*, Sci. Adv. **5**, eaau4538 (2019); Phys. Rev. B **102**, 075114 (2020)
[4] S. Hameed *et al.*, Nat. Mater. **21**, 54 (2022); X. Wang *et al.*, Nat. Commun. **15**, 7442 (2024)