

Chez Pierre

Presents ...

Monday, April 27, 2026

12:00 pm - 1:00 pm

Duboc room – 4-331

Zoom Link: <https://mit.zoom.us/j/99194133079>



Chez Pierre Seminar

Kevin P. Nuckolls – MIT

“Moiré Crystals: Simulators of Higher-Dimensional Physics”

In the past decade, moiré materials have revolutionized how we engineer and control quantum phases of matter. To date, nearly all reports of moiré materials have investigated van der Waals heterostructures assembled far from thermodynamic equilibrium. In this talk, I will introduce a conceptually new approach to synthesizing high-mobility moiré materials in thermodynamic equilibrium [1]. We report a newly discovered family of “moiré crystals”, which are foliated superlattice materials $(\text{Sr}_6\text{TaS}_8)_{1+\delta}(\text{TaS}_2)_8$ that are van-der-Waals layered, exfoliatable, atomically incommensurate crystals. Analogous to a vertical stack of 2D moiré heterobilayers, lattice mismatches between alternating layers in moiré crystals generate their moiré superlattices and are tunable through their synthesis conditions without altering their chemical composition. Using transport and thermodynamic measurement techniques, we uncover a complex spectrum of quantum oscillation frequencies that are naturally described under a higher-dimensional (4D) superspace theoretical framework. More broadly, our work demonstrates the first step towards a scalable synthesis approach for producing large-area moiré materials for electronics applications and evidences a generalizable material design concept for accessing a broad range of physical phenomena proposed in higher dimensions.

[1] K. P. Nuckolls*, N. Paul* et al., Nature 651, 333-340 (2026)