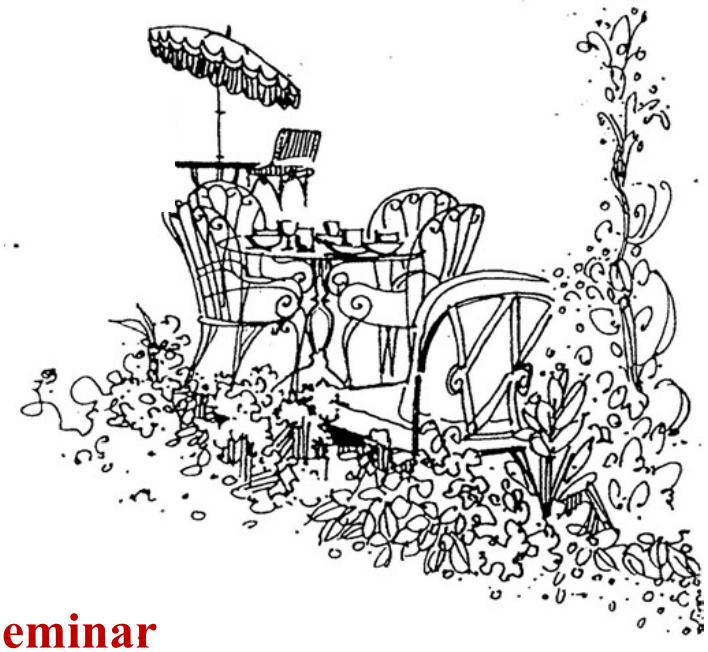
Chez Pierre

Presents ...

Monday, March 9, 2026
12:00 – 1:00 pm
Duboc Room – 4-331



Chez Pierre Seminar

Xavier Roy, Columbia University

"Quantum complexity in simple materials".

Two-dimensional (2D) materials have received widespread attention over the past 20 years due to their remarkable physical, mechanical and chemical properties, and our ability to integrate them into devices. In this seminar, I will discuss a new approach for realizing long-sought electronic structures of geometrically frustrated lattice models (*e.g.* kagome and pyrochlore), by "decorating" un-frustrated, primitive lattices with a particular set of atomic orbitals. In the process, we identify the vdW intermetallic compound Pd_5AlI_2 as the first material to realize the electronic structure of the 2D Lieb lattice – featuring Dirac-like bands intersected by a flat band – persisting in ambient conditions down to the monolayer limit. I will discuss how this unique electronic structure gives rise to compact localized states and bound states in continuum (BICs), which could provide a platform for lossless and topologically protected electronic processes. I will then detail our recent synthesis of CeSiI, the first van der Waals (vdW) metal with a heavy fermion ground state. Conceptually, our synthetic design takes a traditional 3D intermetallic structure and slices it into atomically-thin vdW sheets by incorporating iodine into the structure. The resulting material is cleavable and effectively electronically 2D.