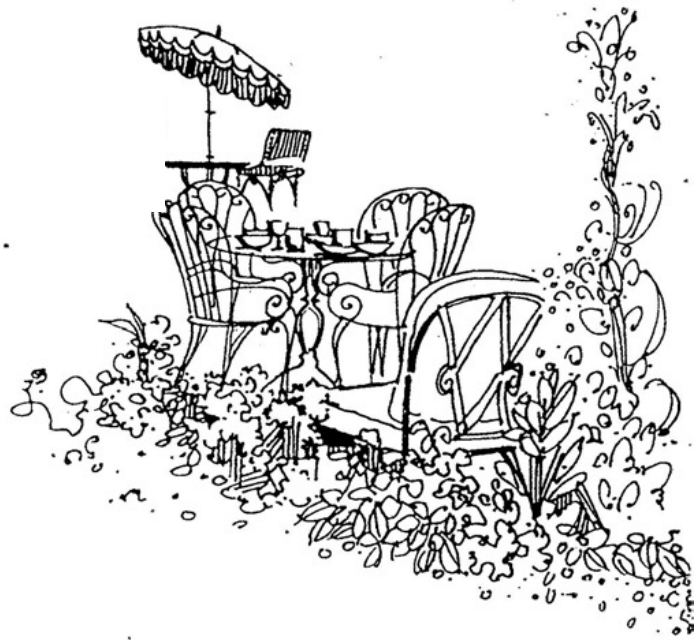
Chez Pierre

Presents ...

Monday, November 9th 2026
12:00 pm - 1: 00 pm
Duboc room - 4-331



Chez Pierre Seminar

Yang Zhang, University of Tennessee

"A Fractional Quantum Hall Factory on Quantum Processors: Constant-Depth Preparation of Non-Abelian States"

Abstract: Non-Abelian fractional quantum Hall states are among the most elusive phases of quantum matter, becoming increasingly difficult to realize as their topological order grows more intricate. Remarkably, this hierarchy is reversed on quantum processors. I will show that clustered non-Abelian states can be prepared using constant-depth quantum circuits, while the simpler Laughlin states require circuits whose depth grows with system size within the same construction. This counterintuitive advantage originates from their root patterns, where correlated electron hopping processes in clustered states can be executed in parallel.

Using parent hamiltonian determined rotation angles and simple CNOT-based circuits, we prepared eighteen fractional quantum Hall states on IBM's 156-qubit processors, reaching up to 104 electrons. We further probed fractional charges e/3, e/4, and e/5, Moore–Read quasi-hole braiding, and Fibonacci anyon fusion in Read–Rezayi states, extracting the golden ratio directly from measurement data. I will conclude by discussing the challenges of moving from experimentally demonstrated anyon fusion to genuinely topologically protected quantum gates.