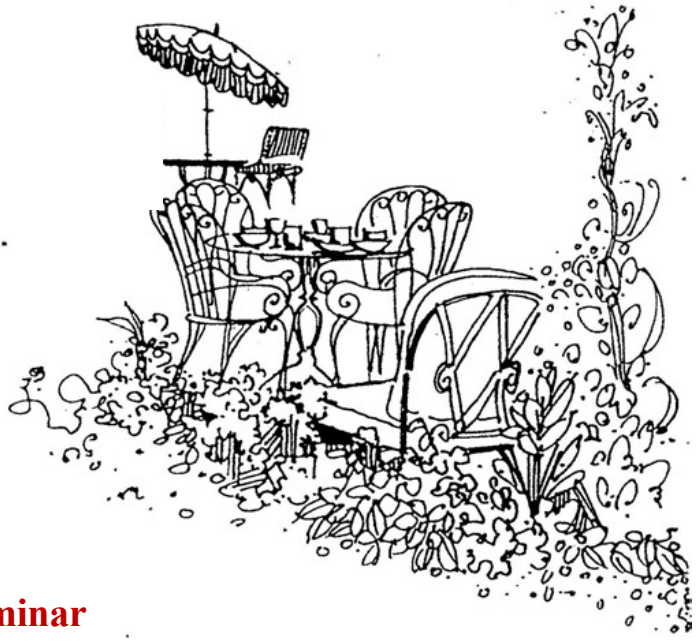
Chez Pierre

Presents ...

Monday, October 24, 2022
12:00 pm
Duboc Room - 4-331



Chez Pierre Seminar

Kevin Slagle, Rice University

"A New Picture of Quantum Dynamics and A New Kind of Tensor Network"

Although quantum dynamics are local for local Hamiltonians, the locality is not explicit in the Schrodinger picture since the wavefunction amplitudes do not obey a local equation of motion. In the first part of this talk, I will introduce a new picture of quantum dynamics, which is similar to the Schrodinger picture, but with the feature that spatial locality is explicit in the equations of motion. To do this, we replace the wavefunction with a local wavefunction for each patch of space. The Hilbert spaces for a pair of spatial patches are related to each other by dynamical unitary connections. In the second part of this talk, I discuss a new kind of tensor network ansatz that is inspired from this picture of quantum dynamics. The ansatz has a similar structure of local wavefunctions and connections, but in a truncated Hilbert space. This structure is also similar to a classical lattice gauge theory coupled to a Higgs field, but with non-unitary connections. Thus, by simply relaxing the unitary constraint of the gauge connections, we find that classical gauge theory can locally encode approximate quantum wavefunctions. A major advantage of the new tensor network ansatz is that the computational cost for numerical simulations with fixed bond dimension does not increase with the spatial dimension. Encoding fermionic wavefunctions is also straightforward. We provide a simple algorithm for approximately simulating quantum dynamics of bosonic or fermionic Hamiltonians in any spatial dimension. We compare the new quantum dynamics algorithm to exact methods for fermion systems in up to three spatial dimensions.