

# *Chez Pierre*

Presents ...

**Thursday, February 23, 2023**

**11:00 am -12 noon**

**Duboc Room – 4-331**



## **Special Chez Pierre Seminar**

**Timothy Hsieh, Perimeter Institute for Theoretical Physics**

### **“Opening up quantum criticality”.**

Quantum simulators have advanced significantly in controlling interactions between system and environment, and many platforms can now perform mid-circuit measurements. I will demonstrate how such controllably open quantum systems can give rise to novel forms of quantum criticality in mixed states. In the first half of the talk, I will show how measurements and unitary evolution conditioned on the measurement outcomes (“adaptive quantum circuits”) can produce mixed state long-range order and criticality, despite coexisting with extensive entropy. As an illustration, I will show how symmetry-protected topological order can be universally converted into mixed state long-range order, which can undergo a mixed state phase transition with logarithmic scaling of entanglement negativity, a measure of quantum correlations in mixed states. Further applications include fermion occupation measurements and feedback, which are possible in optical lattices, and I will show how these can efficiently transform a gapped pure ground state into a quantum critical mixed state. In the second half, I will discuss how decoherence can remarkably enrich quantum critical pure states, giving rise to renormalization group flows between quantum channels with important implications on the entanglement structure of the resulting critical mixed states.