Title: The non-equilibirum statistical mechanics of self-correcting memories

Abstract: A self-correcting memory is a physical system with spatially local dynamics which is capable of retaining information of its initial conditions for an arbitrarily long time, even in the presence of generic perturbations. A longstanding goal in mathematics and computer science---which is becoming increasingly important with the advent of small-scale noisy quantum computers---is to construct simple examples of self-correcting memories in low spatial dimensions. In this talk, I will present a new construction of a 2D classical self-correcting memory which is particularly interesting from the perspective of non-equilibirum statistical mechanics. This model has an ordered phase that is robust against all perturbations, and is "fluctuation-stabilized": the order is made possible only by fluctuation corrections to mean field theory, and the model becomes disordered in dimensions D > 2, where fluctuations become too weak to sustain order. I will also briefly comment on a new 1D classical self-correcting memory, and its applications to 2D self-correcting quantum memories.