UCLA Department of Physics & Astronomy

COLLOQUIUM

Thursday, February 19th, 2026 at 4 p.m.
PAB 1-434

"Learnable" Phases of Quantum Matter

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Noisy intermediate-scale quantum processors and quantum simulators are bringing many-body physics into a new regime, where quantum dynamics unfold in the presence of coupling to an environment and repeated measurements by an external observer. This prompts a fundamental question: which properties of an evolving many-body state can be inferred from measurement records with classical post-processing, and when is such inference fundamentally out of reach? In this colloquium I will survey recent progress on dynamical phases of “learnable” and “unlearnable” quantum matter, focusing on two themes. First, I will discuss systems with global symmetries, where the interplay of unitary evolution, dissipation, and observation produces phases of learnability that can be organized using the familiar framework of symmetry and symmetry breaking. Second, I will frame quantum error correction as a learning problem: from repeated measurements, how well can we learn and undo the errors that would otherwise destroy encoded quantum information? This perspective reveals new transitions between correctable and non-correctable regimes, whose universal properties are related to the physics of Anderson localization in disordered systems. Here, the combination of quantum interference and disorder -- due to the inherently indeterminacy of quantum measurements -- conspire to control whether quantum information is recoverable.

Refreshments at 3:30 p.m. PAB Patio. **Undergraduates Welcome!**