



PHYSICS COLLOQUIUM: Charge Coherent Order from Measuring the Wrong Thing

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Date:

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Time:

10:30 AM – 11:50 AM

Location:

GRAN 135

About The Speaker:

Olumakinde Ogunnaike is a Presidential Postdoctoral Fellow working on in condensed matter theory at the University of California, Berkeley. He received his B.A. in Physics and Math from Harvard University in 2013, an MSt. in Philosophy of Physics at Oxford in 2018, and his Ph.D. from MIT in 2024, where he worked on the characterization of magnetic phases of bilayer graphene. His current interests lie at the intersection of many-body dynamics, open quantum systems, and quantum information theory, particularly the description of the dynamics of quantum systems subject to decoherence and measurement.

Abstract:

Quantum systems are never perfectly isolated: coupling to the environment and the act of measurement can qualitatively reshape their dynamics. In recent years, this has led to the discovery of measurement-induced transitions, in which monitoring can change how quantum information spreads, how entanglement scales, and how quickly an initially mixed state becomes pure. In systems with a conserved continuous charge, local charge measurements can also drive a distinct charge-sharpening transition, separating a regime with broad late-time charge fluctuations from one in which charge becomes rapidly well defined. In this talk, I will describe a more surprising possibility. If one measures local observables that do not directly probe the conserved charge—measuring the “wrong” thing—these measurements can instead stabilize a new charge-coherent phase. In this phase, the system retains not only charge fluctuations but also quantum coherence between different charge sectors at late times. This behavior is striking because monitoring and environmental coupling are usually expected to destroy coherence, not protect it. I will show how these dynamical phases can be understood through mappings to equilibrium statistical mechanics, where their universal long-time behavior is described by spontaneous breaking of an emergent ensemble symmetry.

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