PHYSICAL MATH SEMINAR

A Simple Correspondence Between Stochastic Processes and Quantum Systems

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ABSTRACT:

Among stochastic or probabilistic processes, a Markov chain has the distinctive property that the physical system's present-moment configuration alone determines its future configurations. What happens if one allows a stochastic process to be sufficiently non-Markovian, or ‘indivisible’ in time? Remarkably, one ends up with a quantum system. In this talk, I will provide a detailed description of this new and highly general connection between quantum theory and the class of indivisible stochastic processes unfolding in old-fashioned configuration spaces.

This ‘stochastic-quantum correspondence’ has implications in both directions. The stochastic-to-quantum direction suggests that some stochastic processes that are currently difficult to model might be particularly well-suited to being simulated on quantum hardware, opening up potential new applications for quantum computers. The quantum-to-stochastic direction demotes the wave function from having a primary or physical role in quantum theory, and deflates many of the theory's exotic features, like superposition and entanglement. In the last part of the talk, I will explain why the stochastic-quantum correspondence suggests a microphysical definition of causal influences, which I will use to revisit the significance and meaning of Bell's theorem.

TUESDAY, OCTOBER 8, 2024

2:30 PM – 3:30 PM

Building 2, Room 449

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