Chez Pierre

Presents ...

Virtual Chez Pierre Seminar

Mark Rudner – University of Washington

"The Lindblad equation: not just for quantum optics anymore."

With the exception of the universe as a whole, the evolution of a quantum system is generically non-unitary due to the coupling between the system and its environment. In quantum optics, the powerful framework of Lindblad master equations has been developed and employed for many years to describe the effective evolution of atomic-like systems in the presence of electromagnetic and other environmental degrees of freedom. Importantly, explicit derivations of Lindblad master equations have traditionally relied on highly restrictive assumptions on energy level spacings that limit its applicability to few-level/few-body systems. In this talk I will review the basic features of evolution of open quantum systems, and describe a new route to obtaining the Lindblad equation which circumvents all unnecessary assumptions on the nature of the system at hand. This "universal Lindblad equation" can therefore be applied to a wide range of many-body systems, including emerging quantum hardware with several to many coupled qubits. The explicit expressions for the "jump operators" that describe incoherent processes induced by the bath have a natural interpretation in terms of an operator spreading picture, akin to that which has recently provided much insight into thermalization of closed quantum systems. I will conclude with a discussion of future prospects and applications of this new framework.