TEP Seminar

UCLA

Tuesday, November 5th @ 2pm
Schwinger Lounge

"Estimating time in quantum chaotic systems and black holes"

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Abstract: A time-evolved state in a unitary chaotic quantum many-body system macroscopically resembles a thermal density matrix. However, while a thermal density matrix does not evolve with time, a pure state undergoing unitary evolution must continue to evolve with time unless it is an energy eigenstate. We sharpen this difference by considering an information-theoretic task where we attempt to estimate the time for which the state has been evolved by making measurements on the state. The effectiveness of the time estimate is captured by a quantity called the quantum Fisher information (QFI). We find that for a time-evolved pure state in a chaotic system, the QFI remains constant with time if we consider the full system. For a subsystem smaller than half of the system, the QFI decays monotonically with time to an exponentially small saturation value. For a subsystem bigger than half of the system, the late-time value of the QFI undergoes a sudden transition and becomes extensive in subsystem size. In the context of evaporating black holes, this implies that the usefulness of the radiation as a clock suddenly improves after the Page time.