Lea's Talk Title/ Abstract

TITLE: Thouless and Relaxation Time Scales in Many-Body Quantum Systems

ABSTRACT: A major open question in studies of nonequilibrium quantum dynamics is the identification of the time scales involved in the relaxation process of isolated quantum systems that have many interacting particles. Using experimental observables and a realistic many-body quantum model, we unveil three different time scales: a very short time that characterizes the fast initial depletion of the initial state, and two much longer times that increase exponentially with system size. These are the Thouless time and the relaxation time. The Thouless time refers to the point beyond which the dynamics acquire universal features, and relaxation happens when the evolution reaches a stationary state. We show that in chaotic systems, the Thouless time is much smaller than the relaxation time, while for systems approaching a many-body localized phase, they merge together. Our results are compared with those for random matrices, which corroborates their generality. These studies are relevant to experiments with cold atoms and ion traps, where the unitary dynamics of isolated interacting many-body quantum systems is becoming accessible for an ever longer time.