MAR09-2008-002143

Abstract for an Invited Paper
for the MAR09 Meeting of
the American Physical Society

Statistics of the Work done in a Quantum Quench

ALESSANDRO SILVA, Abdus Salam ICTP

The quantum quench, i.e. a rapid change in time of a control parameter of a quantum system, is the simplest paradigm of non-equilibrium process, completely analogous to a standard thermodynamic transformation. The dynamics following a quantum quench is particularly interesting in strongly correlated quantum systems, most prominently when the quench in performed across a quantum critical point. In this talk I will present a way to characterize the physics of quantum quenches by looking at the statistics of a basic thermodynamic variable: the work done on the system by changing its parameters [1]. I will first elucidate the relation between the probability distribution of the work, quantum Jarzynski equalities, and the Loschmidt echo, a quantity that emerges usually in the context of dephasing. Using this connection, I will then characterize the statistics of the work done on a Quantum Ising chain by quenching locally or globally the transverse field. I will then show that for global quenches the presence of a quantum critical point results in singularities of the moments of the distribution, while, for local quenches starting at criticality, the probability distribution itself displays an interesting edge singularity. The results of a similar analysis for other systems will be discussed.

[1] A. Silva, Phys. Rev. Lett. 101, 120603 (2008).