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Time dynamics in XXZ spin chains far from equilibrium

Matthew Hastings
Center for Nonlinear Studies and Theoretical Division
Los Alamos National Laboratory
Los Alamaos, NM 87545
USA

hastings@lanl.gov

Abstract

We consider time dynamics in a model quantum system far from equilibrium, an XXZ spin chain started in a Neel state and evolved for a period of time. This system relaxes to a local equilibrium state consistent with the various conserved quantities. This system is integrable, but we don't know how to use the integrability to analyze the dynamics in this situation. Further, the entanglement entropy in this system increases rapidly with time, making it very difficult to simulate using existing methods. We discuss numerical results for short time dynamics, and we then develop a mean-field for the time dynamics; this mean-field dynamics is also integrable, but in this case we are able to make more effective progress using the integrability. New effects such as beating modes are observed for the order parameter via the mean field.

Some of this is joint work with L. Levitov.