Out-of-equilibrium dynamics in strongly correlated one-dimensional quantum many-body systems

PhD Thesis Abstract

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I concentrate on strongly interacting one-dimensional quantum many-body systems, focusing on the out-of-equilibrium dynamics, integrability, and its breakdown in spin chains and quantum field theories. To describe the dynamics in a non-equilibrium setting, I simulate quantum quenches using several versions of the truncated Hamiltonian approach. I also study the real-time decay of the false vacuum in the (1+1)d φ^4 theory, obtain precise numerical results for the decay rate, and determine the range of validity of different semi-classical methods in interacting field theories. By developing and applying a mini-superspace-based truncated Hamiltonian approach, I investigate the non-equilibrium time evolution of two coupled one-dimensional bosonic quasi-condensates in experimentally available settings, partially described by the sine-Gordon model. Moreover, I study the so-called weak integrability breaking of the XXZ spin chain using random matrix theory to compare weakly and strongly integrability breaking perturbations.