

Bound states and non-equilibrium time evolution in integrable and nearly integrable models

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String states have been difficult to see experimentally. We discuss a non-equilibrium setup with a local quench in which these states become prominently visible in time dependent DMRG calculations. They persist even when integrability breaking perturbations are included. Following our setup, such bound states have recently been observed in a cold atom experiment. We show explicitly that Andreev-like behavior occurs when a propagating soliton-like particle encounters a change in interaction strength in the Hubbard model. When a particle is scattered off a string of bound particles (in several integrable and nearly integrable models) we show that there is a simple but intriguing pattern, very different from classical behavior. Potential applications will be discussed.

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