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Long-Range Order in Nonequilibrium Interacting Quantum Spin Chains

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Abstract:

We conjecture that nonequilibrium boundary conditions generically trigger long-range order in nonequilibrium steady states of locally interacting quantum chains. Our result is based on large scale density matrix renormalization group simulations of several models of quantum spin-1/2 chains which are driven far from equilibrium by coupling to a pair of unequal Lindblad reservoirs attached locally to the ends of the chain. In particular, we find a phase transition from exponentially decaying to long-range spin-spin correlations in an integrable Heisenberg XXZ chain by changing the anisotropy parameter. Long-range order also typically emerges after breaking the integrability of the model.