Quantum Physics

Exact nonequilibrium steady state of a strongly driven open XXZ chain

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An exact and explicit ladder-tensor-network ansatz is presented for the non-equilibrium steady state of an anisotropic Heisenberg XXZ spin-1/2 chain which is driven far from equilibrium with a pair of Lindblad operators acting on the edges of the chain only. We show that the steady-state density operator of a finite system of size n is - apart from a normalization constant - a polynomial of degree 2n-2 in the coupling constant. Efficient computation of physical observables is faciliated in terms of a transfer operator reminiscent of a classical Markov process. In the isotropic case we find cosine spin profiles, 1/n^2 scaling of the spin current, and long-range correlations in the steady state. This is a fully nonperturbative extension of a recent result [Phys. Rev. Lett. 106, 217206 (2011)].

Comments:	5 REVTeX pages; minor corrections + fig.2 added, essentially equivalent to the published version
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