Reverse quenching in a one-dimensional Kitaev model

Uma Divakaran, Amit Dutta

(Submitted on 21 Jan 2009 (v1), last revised 27 Aug 2009 (this version, v2))

We present an exact result for the non-adiabatic transition probability and hence the defect density in the final state of a one-dimensional Kitaev model following a slow quench of the parameter J_-, which estimates the anisotropy between the interactions, as $J_-(t)\sim -|t/\tau|$. Here, time t goes from $-\infty$ to $+\infty$ and τ defines the rate of change of the Hamiltonian. In other words, the spin chain initially prepared in its ground state is driven by changing J_- linearly in time up to the quantum critical point, which in the model considered here occurs at at $t=0$, reversed and then gradually decreased to its initial value at the same rate. We have thoroughly compared the reverse quenching with its counterpart forward quenching $i.e.,$ $J_-\sim t/\tau$. Our exact calculation shows that the probability of excitations is zero for the wave vector at which the instantaneous energy gap is zero at the critical point $J_{-}=0$ as opposed to the maximum value of unity in the forward quenching. It is also shown that the defect density in the final state following a reverse quenching, we propose here, is nearly half of the defects generated in the forward quenching. We argue that the defects produced when the system reaches the quantum critical point gets redistributed in the wave vector space at the final time in case of reverse quenching whereas it keeps on increasing till the final time in the forward quenching. We study the entropy density and also the time evolution of the diagonal entropy density in the case of the reverse quenching and compare it with the forward case.

Comments:	10 pages, 8 figures, added references and details of calculations, Accepted in Phys. Rev.B
Subjects:	**Statistical Mechanics (cond-mat.stat-mech)**; Quantum Physics (quant-ph)
Journal reference:	Phys. Rev. B 79, 224408 (2009)
Cite as:	**arXiv:0901.3260v2 [cond-mat.stat-mech]**

Submission history

From: Uma Divakaran [view email]
[v1] Wed, 21 Jan 2009 12:45:17 GMT (29kb)
[v2] Thu, 27 Aug 2009 13:23:46 GMT (41kb)