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Out of equilibrium energy dynamics in low dimensional quantum magnets STEPHAN LANGER, MARKUS HEYL, LMU Munich, IAN MCCULLOCH, U Queensland, Brisbane, Australia, FABIAN HEIDRICH-MEISNER, LMU Munich — We investigate the real-time dynamics of the energy density in spin-1/2 XXZ chains using two types of quenches resulting in initial states which feature an inhomogeneous distribution of local energies [1]. The first involves quenching bonds in the center of the chain from antiferromagnetic to ferromagnetic exchange interactions. The second quench involves an inhomogeneous magnetic field, inducing both, an inhomogeneous magnetization profile [2] and local energy density. The simulations are carried out using the adaptive time-dependent density matrix renormalization group algorithm. We analyze the time-dependence of the spatial variance of the bond energies and the local energy currents which both yield necessary criteria for ballistic or diffusive energy dynamics. For both setups, our results are consistent with ballistic behavior, both in the massless and the massive phase. For the massless regime, we compare our numerical results to bosonization and the non-interacting limit finding very good agreement. The velocity of the energy wave-packets can be understood as the average velocity of excitations induced by the quench.

[1] Langer et al. Phys. Rev. B in press; arXiv:1107.4136
[2] Langer et al. Phys. Rev. B 79, 214409 (2009)

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