Abstract Submitted
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Real-time decay of a highly excited charge carrier in the one-dimensional Holstein model[1] LEV VIDMAR, FLORIAN DORFNER, FABIAN HEIDRICH-MEISNER, University of Munich, CHRISTOPH BROCKT, ERIC JECKELMANN, University of Hannover — We study the real-time dynamics of a highly excited charge carrier coupled to quantum phonons via a Holstein-type electron-phonon coupling [1]. This is a prototypical example for the non-equilibrium dynamics in an interacting many-body system where excess energy is transferred from electronic to phononic degrees of freedom. We use an efficient numerical method [2,3], i.e., diagonalization in a limited functional space, to study the non-equilibrium dynamics on a finite one-dimensional chain. We perform a comprehensive analysis of the time evolution in different parameter regimes by calculating the electron, phonon and electron-phonon coupling energies, and the electronic momentum distribution function. For example, we demonstrate that in the weak coupling regime, the relaxation dynamics obtained from the Boltzmann equation agrees very well with the numerical data. We also study the time dependence of the eigenstates of the single-site reduced density matrix, the so-called optimal phonon modes, unveiling that their structure in non-equilibrium contains very useful information for the interpretation of the numerical data. [1] Dorfner et al, submitted (2014) [2] Vidmar et al, PRB 83, 134301 (2011) [3] Golez et al, PRL 109, 236402 (2012)

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