Non-stationary and noise properties of molecular junctions in the polaronic regime

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Localized vibrations (phonons) may have an important impact in the transport properties of nanoscale conductors [1]. Such effects have been observed in many different systems such as atomic chains, semiconducting quantum dots, carbon nanotubes and other molecular junctions. In spite of this variety, from a theoretical point of view all these situations can be qualitatively described by the rather simple Anderson-Holstein model. This model considers a single resonant level coupled to fermionic reservoirs and to a localized phonon mode. While the stationary properties of this model have been extensively analyzed, by many approximations, the way the system reaches the steady-state is not yet well understood.

In this work we focus in the so called polaronic regime, where the coupling between electrons and phonons is strong, compared with the coupling of the level to the electrodes. In order to study the transient regime properties of the system we use an approximation studied in a previous work, based on on a resummation of the dominant Feynman diagrams from the perturbation expansion in the coupling to the leads [2].

Using this approximation we are able to analyze the evolution of the current and the average population of the level, observing long transient behavior when increasing the electron-phonon coupling and no bistability at long time. These results are compared with numerical exact results obtained from path-integral Monte Carlo [3], showing a good agreement for different range of parameters and initials preparations of the system. Using the expressions developed by Mukamel *et al.* [4], we are able to evaluate the single electron probabilities transfer through the junction and the evolution of the current cumulants, showing an universal oscillatory behavior for higher order cumulants.

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