Inelastic effects on the electronic current noise through nanojunctions

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We study [1] the effects of vibrational degrees of freedom in nanojunctions on the electronic current (shot) noise presently being addressed in ongoing experiments on atomic wires and molecules [2]. Working in the experimentally relevant limit of weak electron-vibronic coupling and using the extended non-equilibrium Green's function formalism with counting field [3, 4] we evaluate the inelastic contribution to the current noise for generic junctions [1], thus extending previous studies addressing only the mean current [5, 6, 7]. The result consists of combinations of terms specific for a given junction and expressed via its structural properties, which can be calculated with, e.g., state-of-the-art ab-initio techniques, and universal, i.e., junction-independent, analytical functions of vibration frequency, voltage, and temperature. We also discuss effects of non-equilibrium phonon occupation (heating), their proper theoretical description within the presented formalism, and their physical relevance and interpretation [8]. Finally, we briefly comment on the connection of our theoretical predictions with the preliminary (unpublished) experimental findings.

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