Signal processing for electron quantum optics

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Abstract

Electron quantum optics is an emerging branch of electronic transport aiming at generating, manipulating and characterizing elementary excitations of the electronic fluid, similarily to what is done in photon quantum optics [Annalen der Physik **526**, 1 (2014)].

The key question in electron quantum optics is to determine what single-electron and more generally many-electron wavefunctions are propagating within the conductor. This is encoded within the electronic coherences defined similarily to the Glauber correlation function of order n giving access to the result of every n-particle interferometry experiments. This raises the question of the best elementary signals describing the electronic coherences of a periodically driven electronic source [Physical Status Solidi (b), 1600621 (2017)].

In this work, we introduce the spectral decomposition of the electron and hole parts of the first-order coherence. From this we compute the best elementary signals describing a periodic source. Whenever interactions can be neglected, we can reconstruct the whole many-body state. We then define a many-body notion of entanglement spectrum giving a many-body criterion for pure electron or hole emission. This is in particular relevant when considering a driven Ohmic contact or the mesoscopic capacitor.

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