Currents correlations in the system of coupled quantum dots

G. Michałek, B. R. Bułka
Institute of Molecular Physics, Polish Academy of Sciences
ul. Mariana Smoluchowskiego 17, 60-179 Poznań, Poland

9.7 cm

Extensive research of the shot noise in mesoscopic systems have shown, that a negative correlation between the conducting electrons is responsible for the reduction of the shot noise below Poissonian value. However, in some cases positive correlations can arise and shot noise is enhanced much above Poissonian value. The recent theory and experiment have been focused on the sign reversal of noise cross correlations [1]. In the paper we study current noise correlations in a device composed of two large quantum dots capacitively coupled in parallel. Stationary currents, charge accumulations and polarization are calculated in the limit of sequential tunnelling. Fluctuations in the system are analyzed by means of an extended generation-recombination approach for multi-electron channels. We show that the Coulomb interactions of charges accumulated on the both quantum dots can lead to the dynamical Coulomb blockade effect. The effect can be controlled by the applied bias and the gate voltages. In the regions of the dynamical Coulomb blockade the positive noise cross correlations can induce super–Poissonian noise, while besides these regions the noise cross correlations are negative. Our theoretical results show, that the dynamical Coulomb blockade is responsible for bunching of electrons and enhancement of the current noise seen in recent experiment [1].

[1] D. T. McClure, L. DiCarlo, Y. Zhang, H.-A. Engel, C. M. Marcus, M. P. Hanson, A. C. Gossard, PRL **98**, 056801 (2007)

13.4 cm

Subject category :

1. Strongly Correlated Electrons and High Temperature Superconductivity

Presentation mode :
poster

Corresponding author :
G. Michałek

Address for correspondence :
Institute of Molecular Physics, Polish Academy of Sciences
ul. Mariana Smoluchowskiego 17, 60-179 Poznań, Poland

Email address :
grzechal@ifmpan.poznan.pl