Position-momentum correlations induced by the quantum interference phenomena in the resonant-tunneling nanosystems. The phase-space approach.

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ABSTRACT

Dynamics of the conduction electrons in semiconductor nanostructures is determined by the quantum phenomena, so the wave properties of the carriers cannot be neglected. On the other hand, the quantum size effect leads to the discretization of the energy spectrum and the transport channels through the nanosystem are well defined. In these cases the description of the electronic transport cannot be based on the Boltzmann equation because the position-momentum correlations due to interference phenomena are neglected [1]. On the other hand they are very sensitive to perturbations, and moreover the standard configuration of the nanodevice operation suggests that the considered nanosystem should be regarded as an open system [2].

In this contribution we present the results of our studies on the influence of the dephasing mechanisms on the position-momentum correlations in the typical resonant tunnelling nanostructure using the phase-space formulation of the electron transport theory based on the quantum kinetic equation for the Wigner distribution function [3, 4].

References

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