



Iranian Journal of Physics Research, Vol. 17, No. 3, 2017

## The effect of the presence of a single and double quantum dots on transport of non-interacting fermions in resonant tunneling diodes

M T Asefpour and P Sahebsara

Department of Physics, Isfahan University of Technology, Isfahan, Iran

E-mail: sahebsara@cc.iut.ac.ir

(Received 11 August 2016 ; in final form 1 January 2016)

### Abstract

We show that including quantum dots could affect the microscopic transport properties of fermions in resonant tunneling diodes (RTD). Detailed Hamiltonian is introduced for different parts of the photovoltaic p-i-n system. By calculating the green's function in the tight-binding approximation, we obtained the local density of states and the current-voltage characteristic of the p-i-n structure. Our results show a non-Ohmic behavior and negative differential resistance in RTDs. As a result of presence of a longitudinal electric field, we concluded that the local density of states changes by variation of the applied potential. We also figured out that the insertion of a few quantum dots in the system, not only causes a negative differential resistance according to the resonant tunneling phenomenon, but also enables the system to have several discontinuous quantum states. We studied the structure including one and two quantum dots.

**Keywords:** resonant tunnelling diode, Green function, quantum dots, transport, local density of states

For full article, refer to the Persian section