Calculation of electrical transport properties and electron entanglement in inhomogeneous quantum wires

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Abstract
In this paper, we have investigated the spin-dependent transport properties and electron entanglement in a mesoscopic system, which consists of two semi-infinite leads (as source and drain) separated by a typical quantum wire with a given potential. The properties studied include current-voltage characteristic, electrical conductivity, Fano factor and shot noise, and concurrence. The calculations are based on the transfer matrix method within the effective mass approximation. Using the Landauer formalism and transmission coefficient, the dependence of the considered quantities on type of potential well, length and width of potential well, energy of transmitted electron, temperature and the voltage have been theoretically studied. Also, the effect of the above-mentioned factors has been investigated in the nanostructure. The application of the present results may be useful in designing spintronic devices.

Keywords: electrical transport, entanglement, concurrence, Coulomb repulsion, Bulge quantum wires

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