Field Effect transistor presenting anomalous correlations

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Abstract

Consistent theoretical models [1] that explore the characteristics of electronic transport in metal-molecule-type metal devices are widely used in architecture formed by trans-polyacetylene coupled to two metal electrodes, the device was able to capture all the physical characteristics that appear on the transmittance curves [2]. We present an analytical study of the electronic transport characteristics of junctions composed by dimerized trans-polyacetylene molecules containing an odd number of sites coupled to metal leads in T-shaped geometry using the extended Su-Schrieffer-Heeger model based on tight-binding Hamiltonian with the Green´s Function in and out of equilibrium, in which we use the Heisenberg´s equation of motion and the Keldysh formalism, respectively. Thus, we calculate the current and differential conductance curves versus bias of the systems that describe the electronic transport properties as an application in molecular electronic devices. We specifically consider odd atom chains weakly coupled to the metal contacts ($\square_L$ and $\square_R$), where we find that increasing the number of sites, are accessed the energy bands that can be available to obtain tunneling with greater ease (1 + $\square$) due to the double bonds in the molecule, improving the conductance. The systems presented were satisfactory for detecting common fermions (electrons) via Heisenberg's equation of motion and anomalous correlations in field effect transistors (FET) via Keldysh formalism, provided that the coupling parameters are properly tuned, i. e., Γ and δ. Therefore, for this system we used Γ= 0.5eV because if $\Gamma \neq$ 0.5eV then the system with fermions ceases to be FET and we used $\delta <$ 1 because if $\delta \geq$ 1 the system loses the dimerization and there is an imbalance in tunneling.

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[2] M. Büttiker. Phys.Rev. Lett. 57, 1761 (1986).