Transport of wave packet on Branched nanowires under external fields effects

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Semiconductor nanostructures based on two dimensional electron gas (2DEG) have been shown as the basis of news devices for sensing, information processing and quantum computation. On the other hand, fundamental aspects of the electrons transport through these structures have so far not been clarified. As a part of these nanostructures, the nanowires (NWs) plays a great issue to investigate physical phenomena at the nanoscale range and represent a critical role in future of electronic and optoelectronic devices. In the present work, we use the propagation of a gaussian wave packet (GWP) to investigate transport properties of a 2DEG through branched NWs with four different geometry shapes. The aim is to investigate how the geometry of branched NWs affects the properties of the GWP transport. Furthermore, we applied an electric field at $x$ and $y$ directions in order to control the density of current which flows through the branched wires. The nanowires are formed by quantum channels with width of 10 nm, in which a 2DEG are scattered. The theoretical model is based on the numerical solution of the time dependent Schrödinger equation, within the effective-mass and envelope wave function formalism. The split-operator technique is applied and it allows us to calculate the transmission probability, the total probability current, the conductance, and the wave function scattering between the energy subbands.