Sessions: Nanotechnology

Preferred presentation Type: Poster

Investigation of Electronic Transport Properties in a Kitaev Chain and Signature of Majorana Modes

M. S. Costa [1], A. T. M. Beirão [2], S. S. da Silva [3], J. Del Nero [4]
[1]*Pós-graduação em Física, Universidade Federal do Pará, UFPA, Belém, PA, Brasil*
[2]*Campus de Parauapebas, Universidade Federal Rural da Amazônia, UFRA, Parauapebas, PA, Brasil*
[3] *Campus de Ananindeua, Universidade Federal do Pará, UFPA, Ananindeua , PA, Brasil*
[4]*Faculdade de Física, Universidade Federal do Pará, UFPA, Belém, PA, Brasil*

Abstract:

Experimental nanodevices having a hybrid nanowire structure of semiconductors and superconductors for the realization of a topological superconducting phase has aroused the interest of research in the area of the physics of the condensed matter that looks for the compression of the underlying basic physics as well as to detect and to control the connected states of Majorana (MBSs) of interest in quantum computing [1]. In this work we calculate transport properties such as current and differential conductance by which we will identify the signature of zero modes of Majorana (fermions of Majorana in the condensed matter) in a system formed by a single level quantum point [2] connected to a chain' Kitaev deposited on a superconducting s-wave [3]. Such a signature is characterized by a current conduction resonance, i.e. by a conductance peak, in a zero-bias region. To study the transport properties, we use a device that is composed of a quantum point coupled to two metal electrodes and connected laterally by a Kitaev chain (quantum wire) of N sites. The theoretical methodology used is based on the Green functions of non-equilibrium (Keldysh formalism). Then we derive the Meir-Wingreen electric current formula, which is similar to the Landauer-Büttiker formula [4], in the case of equilibrium situations. Given these formalisms and using an adequate matrix formalism to use the computational computation, we obtained the graphs of the currents and conductance that define the system under study.

References:

[1] **A. Y. Kitaev**, *Phys.Usp.,* **44**, 131 (2001).
[2] **M. Leijnse and K. Flensberg**, *Phys. Rev.* **B 84**, 140501 (2011).
[3**] J. Alicea**, *Rept. Prog. Phys*. **75** (2012)
[4] **Y. Meir e N. S. Wingreen,** *Phys. Rev. Lett.* **68**, 2512-2515. (1992).