ELECTRONIC TRANSPORT AND SIGNATURE OF MAJORANA FERMIONS IN ZIGZAG CHAIN.

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The scientific advance in condensed matter physics using superconductors and topological insulators are promoting great development in the creation of new nanodevices, especially in the characterization of their surface properties [1]. Given such importance, we present theoretically a class of device formed by electrodes coupled to a quantum point and connected to a chain of zigzag atoms deposited on a superconducting wire [2]. This, finally, generates a growing interest in the production of Majorana fermions (MBS) [1] in the solid state laboratory environment and this makes the theoretical and experimental studies on Majorana states are related to the guiding question of being in the parameter and the right regime or not for the detection of MBS in condensed matter systems. We will use the theoretical properties of electronic transport to study the zigzag chain of atoms that will be investigated through Green's analytical method of functions. From this method, we find the respective Green functions of the system studied for five sites or atoms that form a network or grid [3]. With this, we obtained the formulas pertinent to transmittance, state density and current in the system. The transmittance, state density, and current graphs signal the electronic signature of the system with the detection of Majorana fermions (MBS) due to the pairing of Majorana modes at the ends of the chain and signatures of common fermions caused by the pairing of Majorana modes in same site. Furthermore, for the four- and five-site models, we observe that there are adjacent peaks of common fermions as the chain of atoms increases, this gives rise to noises in the system and may make it difficult to obtain the Majorana signal. Our results show a relationship between the nature of the couplings that make up the nanodevices that efficiently reduce the noise of the system, obtaining the signal of the Majorana fermions.

References

[1] DONG, E. L.; BARANGER, H. U., Detecting a Majorana-Fermion Zero Mode Using a Quantum Dot. Phys. Rev. B **84**, (2011).

[2] KRAUS, C. V.; DIEHL, S.; BARANOV, M. A., *Preparing and Probing Atomic Majorana Fermions and Topological Order in Optical Lattices*. N. J. of Phys., **14**, (2012).

[3] KRAUS, Y. E.; STERN A., Majorana fermions on a disordered triangular lattice. N. J. of Phys., **13**, (2011).