Contribution ID : **60** Type : **not specified**

M. Minutillo - Anomalous Josephson effect in S/SO/F/S heterostructures

mercoledì 18 settembre 2019 18:20 (20)

Hybrid mesoscopic systems in which conventional superconductivity, spin-orbit interactions, and magnetism come into play at the same time, have attracted a lot of interest in recent studies, allowing for the possibility to carry, manipulate and transform quantum information, which is a great advantage to develop components for applications in quantum technology. In particular, superconducting circuits with Josephson junctions are among the leading candidates for the realization of the fundamental building blocks of a quantum computer. In this context, we present a study concerning the anomalous Josephson effect [1], predicting a finite pair current in the absence of phase difference between the superconductors. We focus to S/SO/F/S system in which spin-orbit coupled and ferromagnetic layers alternate. We calculate the Josephson current carried by the subgap Andreev levels calculated as a function of the phase difference φ between the two superconductors, using a scattering matrix formalism, based of phenomenological scattering matrices. We show that the coexistence of spin-orbit interaction and Zeeman effect is sufficient to break spin rotation and time-reversal symmetry in spatially separated regions of the junction, allowing to observe an anomalous Josephson effect. We also show that in the presence of an anomalous phase shift, a direction dependent critical current can show up. Finally, future perspectives of our work will be discussed, such as a semi-empirical microscopic description of the superconducting proximity effect, where the transport properties of the system are studied using the recursive Green's functions method on a two- dimensional Bogoliubov De Gennes tight-binding Hamiltonian.

References: [1] M. Minutillo, D. Giuliano, P. Lucignano, A. Tagliacozzo, and G. Campagnano, Phys. Rev. B 98, 144510 (2018).