Nanoscale physics

Conductance of the graphene - superconductive graphene junction with the different Fermi velocity values

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We consider the nanoscale structure: the superconducting graphene in contact with the normal graphene and two options are considered – cases of the gapped and the gapless graphene. It is believed that the Fermi velocity value in the superconducting graphene may differ from that in the pristine graphene [1].

With the help the Blonder-Tinkham-Klapwijk formalism [2], the conductance is calculated taking into account the fact that the external potential U is applied to the superconducting part of the given structure. The coefficients of both the normal and the Andreev reflection are evaluated within the framework of the Dirac-Bogoliubov-de Gennes equations.

It is shown that the determining factor in the formation of the conductance is the process of the Andreev spectacular reflection. A characteristic feature of the *G(E)* dependence, E – the quasiparticle energy, is the presence of a peak at the point $E=\Delta_S$, Δ_S being the superconducting energy gap in graphene. The value of the maximum (peak) value of *G(E),* as well as the *G(E)* curve steepness essentially depend on the value of the Fermi velocity v_F. The dependence of the conductance on the potential U is analyzed. In particular, we show that if a normal part of the contact is represented by the gapped graphene the increase in U leads to a decrease in *G(E)* for the cases of $z=1$, $z<1$, $z=v_F/v_0$, v_0 being the Fermi velocity in the pristine graphene, and instead there is a growth of *G(E)* for the case of $z>1$.

The obtained results can be useful for applications in the graphene-based electronics.

1. *Concha A., Tesanovic Z.* Effect of the velocity barrier on the ballistic transport of Dirac fermions // Phys. Rev. B-2010.-**82.**-033413-033421.
2. *Blonder G.E., Tinkham M., Klapwijk T.M.* Transition from metallic to tunneling regimes in superconducting microconstrictions: Excess current, charge imbalance, and supercurrent conversion // Phys. Rev. B-1982.-**25.**-4515.

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The title of your work

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