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The effect of the Fermi velocity on the conductance of the graphene - insulator - d-wave superconductive graphene junction

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The conductance of the normal graphene - insulator – d-wave superconductive graphene junction is calculated within the framework of the Blonder-Tinkham-Klapwijk formalism [1]. The eigenfunctions, the Andreev and the normal reflection rates are evaluated by solving the Dirac-Bogoliubov-de Gennes equations. The Fermi velocity is believed to be different in the normal and in the superconductive regions [2]. Two options are considered: cases of the gapped and the gapless graphene.

It is demonstrated that the characteristics of the junction under consideration are sensitive to the value of $z = \upsilon_n / \upsilon_s$, where υ_n, υ_s are the Fermi velocities in the normal and the superconductive graphene respectively. This conclusion refers to the Andreev reflection as well as to the normal one. The first of them is shown to be the dominant process for the formation of the conductance. These results are actual for an arbitrary value of the orientational angle of the d-waves. For sufficiently thick insulator layer, the conductance reveals an oscillating character, both the period and the amplitude of oscillations being dependent on the value of *z*. If the parameters take on the values for which the conductance is presented by the mono tonic (nonoscillating) curves the calculations show that the steepness of these curves depends on *z* significantly. The dependence of the conductance on the external electrostatic potential as well as on the Fermi energy is also analyzed.

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

1. *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.**-P. 1315.
2. *Concha A., Tesanovic Z.* Effect of the velocity barrier on the ballistic transport of Dirac fermions// Phys. Rev.B,-2010.-**82.**-P. 033413.