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Effect of thick barrier in a gapped graphene Josephson junction

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We study the Josephson effect in a gapped graphene-based superconductor/barrier/superconductor junction as using the Dirac-Bogoliubov de Gennes (DBdG) equation for theoretical prediction. A massive gap of this regime is induced by fabricating a monolayer graphene on substrate-induced bandgap and superconductivity is acquired by the proximity effect of conventional superconductor (s-wave superconductor) through top gate electrodes. This Josephson junction is investigated in case of thick barrier limit that is pointed out the effect of applying a gate voltage V_G in the barrier. We find that the switching supercurrent can be controlled by the gate voltage V_G and the effect of thick barrier can influence the switching linear curve. When the barrier is adjusted to manner of a potential well which is inside the range of $-mv_F^2 \leq V_G \leq 0$, the supercurrent in thick barrier case is examined to the same behavior as the thin barrier case. The controlling supercurrent through the electrostatic gate is suitable for alternative mechanism into experimental test.

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