Abstract Submitted
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Nonlinear screening and ballistic transport in a graphene p-n junction[1] L. MATTHEW ZHANG, M. M. FOGLER, UCSD — Our theoretical work is devoted to a new class of graphene devices: lateral p-n junctions. Such structures have been recently realized experimentally by modulating the electron density in graphene samples with external gates. We study the charge density distribution, the electric field profile, and the resistance of such p-n junctions. We show that the proper treatment of the electrostatic screening, including nonlinear effects, is crucial for obtaining the correct results for all these quantities. In particular, we show that the total electric field at the interface of the electron and hole regions is strongly enhanced due to limited screening capacity of Dirac quasiparticles. Accordingly, the junction resistance is significantly lower than estimated in previous theoretical literature. At the same time, our new theory enables us to achieve a closer agreement with the recent experiments.

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