Effects of raditation on transport in graphene

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We study transport properties of graphene in a coordinate dependent step-like potential $U(x)$ irradiated by a monochromatic electromagnetic field. We show that resonant interaction of quasiparticles with the external radiation opens dynamic gaps in their spectrum, which leads to new interesting effects. In particular, the quasi-particle transmission in diverse junctions is determined by tunnelling through the gap, and can, in principle, be fully suppressed by a sufficiently large radiation power. Moreover, in the case of a p-n junction with the height of the potential $U(x)$ exceeding the radiation frequency Ω a direct current (photocurrent) flows through the junction without any voltage applied. Such a photocurrent arises as a result of an inelastic tunnelling of quasiparticles assisted by one- or two-photon absorption. We calculate current-voltage characteristics for various graphene based junctions and estimate magnitudes of the effects. Formation of the dynamic gaps is also possible in traditional $2D$ electron gases with a Rashba term. Presence of a step-like potential $U(x)$ may lead in this case to a spin polarized current and large magnetoresistance.