**Frequency and damping of plasma waves in intrinsic graphene**

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In contrast to conventional semiconductor materials the two-dimensional (2D) electrons and holes in graphene have not a parabolic but the linear energy dispersion near the Fermi level. This leads to many unusual electrical, mechanical, thermal and optical properties. In this work we theoretically study the electromagnetic response and plasma oscillations in *intrinsic* graphene, under the condition, when the chemical potential $\mu$ coincides with the Dirac points and the density of electrons and holes in the conduction and valence bands is determined by the finite temperature $T$ ($\mu=0$, $T>0$). In doped graphene ($|\mu|\neq 0$, $T=0$) the plasma waves have been studied both within the Dirac model [1,2], when the electronic spectrum is described by two cones touching each other at the Dirac points, and within the full-band tight-binding approximation [3,4]. In intrinsic graphene the frequency of plasmons has been investigated only within the Dirac model in [5]. We calculate the electromagnetic properties of intrinsic graphene (the dielectric function and the polarization operator) within the self-consistent-field approach (equivalent to the random phase approximation) describing the spectrum of electrons and holes in full-band tight-binding approximation. We have found that the 2D plasmon frequency substantially differs from the result known in the literature [5]. We have also calculated the damping of the 2D plasmons and studied the influence of the wave-vector, temperature and the scattering rate of electrons on the plasmons damping. Nonlinear effects in the electromagnetic response of graphene have been also studied.

## References

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