

Abstract Submitted
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Charge response function and a novel plasmon mode in graphene

EUGENE MISHCHENKO, ABDEL-KHALEK FARID, SUHAS GANGADHARAIAH, University of Utah — Polarizability of non-interacting 2D Dirac electrons has a inverse square root singularity at the boundary of electron-hole excitations. The screening of this singularity by long-range electron-electron interactions is usually treated within the random phase approximation. The latter is exact only in the limit of $N \rightarrow \infty$, where N is the “color” degeneracy. We find that the ladder-type vertex corrections become crucial close to the threshold. The strong singularity in the ladder series arises due to the long range interaction between electrons which move almost collinearly to the external momentum. The series is summed up analytically yielding a non-perturbative result: the density and spin response functions acquire non-zero imaginary part in an additional frequency range $qu < \omega < qv$. The reversal of the sign of the electron polarizability in this new domain gives rise to a sharp plasmonic mode which is absent in the conventional RPA.

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