Memory-function conductivity formula in doped graphene

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Abstract

The generalized self-consistent field method is used to describe intraband relaxation processes in a general multiband electronic system with presumably weak residual electron-electron interactions. [1] The resulting memory-function conductivity formula is shown to have the same structure as the result of a more accurate approach based on the quantum kinetic equation. [2] The results are applied to heavily doped and lightly doped graphene. It is shown that the scattering of conduction electron by phonons leads to the redistribution of the intraband conductivity spectral weight over a wide frequency range, in a way consistent with the partial transverse conductivity sum rule. The present form of the intraband memory function is found to describe correctly the scattering by quantum fluctuations of the lattice, at variance with the semiclassical Boltzmann transport equations, [3,4,5] where this scattering channel is absent. This is shown to be of fundamental importance in quantitative understanding of the reflectivity data measured in lightly doped graphene. [6]

References

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