Temperature-dependent dynamical conductivity of heavily doped 2D and 3D systems

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Abstract

The generalized Drude approach represents a model-independent method of analyzing measured reflectivity spectra. [1] In this approach, the dynamical conductivity formula is given in terms of a phenomenological frequency-dependent memory function. The same expression for the dynamical conductivity can be obtained theoretically by using different types of quantum transport equations. Here, we present the dependence of the memory-function dynamical conductivity on temperature in heavily doped graphene and in anisotropic 3D Dirac semimetals obtained by using a common self-consistent RPA approach. [2-4] The scattering of conduction electrons by acoustic phonons is found to lead to a two-component intraband conductivity which can be understood as a sum of an effective Drude contribution and an additional asymmetric Lorentz contribution. In heavily doped systems, in the leading approximation, the dependence on temperature can be explained in terms of an effective temperature-dependent intraband relaxation rate in the Drude contribution (Fig. 1).

References

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[2] I. Kupčić, Phys. Rev. B 90 (2014) 205426
[3] I. Kupčić, Phys. Rev. B 95 (2017) 035403
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Figures

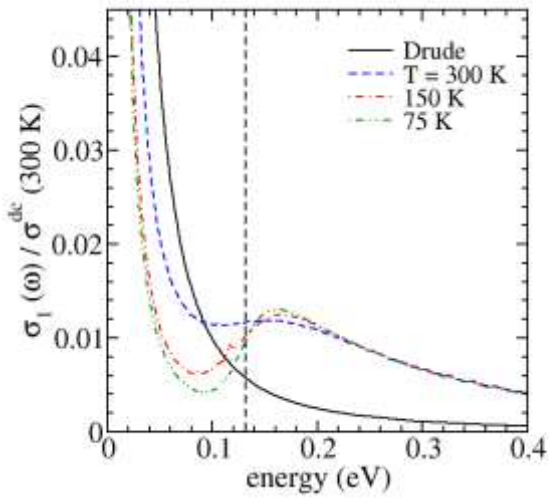

Figure 1: The temperature dependence of the infrared conductivity of heavily doped graphene for typical values of model parameters.