OPTICAL CONDUCTIVITY OF GRAPHENE BEYOND THE DIRAC CONE APPROXIMATION

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We calculate the conductivity of a clean graphene sheet at finite temperatures starting from the tight-binding model. We obtain a finite value for the dc-conductivity at zero temperature. For finite temperature, the spontaneous electron-hole creation, responsible for the finite conductivity at zero temperature, is washed out and the dc-conductivity yields zero. Our results are in agreement with calculations based on the field-theoretical model for graphene.

We then compute the optical conductivity of graphene beyond the usual Dirac cone approximation, i.e., we include non-linear corrections to the density of states. The effect of next nearest neighbour hopping is also discussed. We find that the additional terms to the current operator do not contribute to the conductivity and that modifications only enter through the modified energy dispersion.

Using the full conductivity of clean graphene, we determine the transmissivity and reflectivity of light that is scattered from two media with different permittivity and graphene at the interface. Our results are relevant for optical experiments in the visible frequency range.