Electric Transport Theory of Dirac Fermions

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The self-consistent Born approximation is employed to calculate transport properties in graphene with finite-range impurity potentials. The current-current correlation function is determined by a system of four coupled integral equations, unlike the case of short-range impurity scattering, and yet the results for the latter can exactly be reproduced in our formalism. As a test, we numerically calculate the dc electric conductivity of graphene for charged impurities with screened Coulomb potential, the linear dependence of the dc conductivity on the carrier concentration and the extrapolated value for zero-doping is shown to be finite, in a qualitative agreement with the experimental observations.

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