Abstract Submitted
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Conductivity and thermoelectric power in graphene: Interplay of disorder, Coulomb interaction, and optical phonons[1] MATTHEW FOSTER, HONG-YI XIE, Rice University — We study the electric and thermoelectric transport of Dirac fermions in graphene using the Boltzmann-equation approach. We consider the effects of quenched disorder, Coulomb interactions, and optical-phonon scattering and analyze the electric conductivity and the thermoelectric power (TEP) as functions of temperature T and chemical potential μ by unbiased numerical solutions to the Boltzmann equation. In the absence of optical phonons, for very clean graphene we observe the crossover from the interaction-limited hydrodynamic regime $\mu \ll T$ to the disorder-limited Fermi liquid regime $\mu \gg T$. In the hydrodynamic regime, the TEP significantly deviates from Mott's law and follows the result anticipated by the relativistic hydrodynamic theory. Moreover, we analyze the doping and screening effects upon the quantum minimal conductance, which indicates the dissipation induced by inelastic electron-hole scattering. On the other hand, we find that optical phonons start to contribute at relatively low temperatures, about one order of magnitude less than the phonon excitation energy. Especially, the TEP shows a non-monotonic temperature dependence and a peak appears at about $T \sim$ 200-300 K for a large variety of doping.

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