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Screening and transport of bilayer graphene[1]

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We present the screening function of bilayer graphene (BLG) which is calculated within the random phase approximation, and compare our results with the corresponding single layer graphene. We use the screening function to calculate transport properties of bilayer graphene. Even though the charged Coulomb impurity invariably present in the graphene environment is the most dominant scattering source in single layer graphene, the scattering strength of charged Coulomb impurity in BLG is significantly reduced due to the enhancement of screening. Due to the reduction of Coulomb scattering other scattering sources (for example, neutral short-range impurity), which are negligible in single layer graphene, play more significant role in BLG transport. We find that the calculated density dependent conductivity with proper BLG screening agrees well with current experimental results. We also present the temperature dependent conductivity and thermopower of bilayer grapheme. The purely electronic temperature dependence of our theory arises from two independent mechanisms: the explicit temperature dependence of the finite temperature screening and the finite temperature energy averaging of the transport scattering time. We also present the transport of bilayer graphene in the presence of in-plane magnetic field. We take into account the magnetic field induced spin polarization and the change of the screening behaviour due to the polarization.

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