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Theory of 2D Transport in Graphene for Correlated Disorder[1] QIUZI LI, EUYHEON HWANG, Condensed Matter Theory Center, Department of Physics, University of Maryland, College Park, Maryland 20742, USA, ENRICO ROSSI, Department of Physics, College of William and Mary, Williamsburg, Virginia 23187, USA, SANKAR DAS SARMA, Condensed Matter Theory Center, Department of Physics, University of Maryland, College Park, Maryland 20742, USA — We theoretically revisit graphene transport properties as a function of carrier density, taking into account possible correlations in the spatial distribution of the Coulomb impurity disorder in the environment. We find that the charged impurity correlations give rise to a density-dependent graphene conductivity, which agrees well qualitatively with the existing experimental data. We also find, quite unexpectedly, that the conductivity could increase with increasing impurity density if there is sufficient interimpurity correlation present in the system. In particular, the linearity (sublinearity) of graphene conductivity at lower (higher) gate voltage is naturally explained as arising solely from impurity correlation effects in the Coulomb disorder.

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