DRUDE WEIGHT, PLASMON DISPERSION, AND A.C. CONDUCTIVITY IN DOPED GRAPHENE SHEETS

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We demonstrate [1] that the plasmon frequency and Drude weight of the electron liquid in a doped graphene sheet are strongly renormalized by electron-electron interactions even in the long-wavelength limit. This effect is not captured by the Random Phase Approximation (RPA), commonly used to describe electron fluids and is due to coupling between the center of mass motion and the pseudospin degree of freedom of the graphene's massless Dirac fermions. Making use of diagrammatic perturbation theory to first order in the electron-electron interaction, we show that this coupling *enhances* both the plasmon frequency and the Drude weight relative to the RPA value. We also show that interactions are responsible for a significant enhancement of the optical conductivity at frequencies just above the absorption threshold. Our predictions can be checked by far-infrared spectroscopy or inelastic light scattering.

References

[1] S.H. Abedinpour, G. Vignale, A. Principi, M. Polini, W.-K. Tse, and A.H. MacDonald, arXiv:1101.4291.