Electron-electron interaction effects on the optical conductivity of doped graphene sheets

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The Drude weight and the dispersion of the collective (plasmon) modes at long wavelengths in parabolic-band electron liquids are, as a consequence of Galileian invariance, unrenormalized by many-body effects. In this talk I will show how the Drude weight and the plasmon frequency of the electron liquid in a doped graphene sheet, which is described by a massless Dirac Hamiltonian and not invariant under ordinary Galileian boosts, are strongly renormalized even in the long-wavelength limit. This effect is *not* captured by the Random Phase Approximation (RPA), commonly used to describe electron fluids. It is due primarily to non-local inter-band exchange interactions, which, as we show, *reduce* both the plasmon frequency and the Drude weight relative to the RPA value. If time allows, I will also present some recent results on the electron-electron interaction effects due to multipair excitations on the real part of the optical conductivity. Our predictions can be checked using infrared spectroscopy and inelastic light scattering.

Reference: M. Polini, A.H. MacDonald, and G. Vignale, arXiv:0901.4528v1.