Electron-electron interactions in non-equilibrium bilayer graphene

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Conducting steady-states of doped bilayer graphene have a non-zero sublattice pseudospin polarization. In this talk, I will demonstrate that electron-electron interactions renormalize this polarization even at zero temperature, when the phase space for electron-electron scattering vanishes. We have shown that, because of the strength of interlayer tunneling, electron-electron interactions nevertheless have a negligible influence on the conductivity which vanishes as the carrier number density goes to zero [1]. The influence of interactions is qualitatively weaker than in the comparable cases of single-layer graphene or topological insulators, because the momentum-space layer pseudo spin vorticity is 2 rather than 1. Our study has reliesd on the quantum Liouville equation in the first Born approximation with respect to the scattering potential, with electron-electron interactions taken into account self-consistently in the Hartree-Fock approximation and screening in the random phase approximation. Within this framework the result we have obtained is exact.

[1] Weizhe Edward Liu, A. H. MacDonald, and Dimitrie Culcer, Physical Review B 87, 085408 (2013).