Electron-plasmon Scattering in Doped Graphene

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Decay mechanisms and plasmon satellites formed in the spectrum of a photo-excited hole in doped graphene is a phenomenon that has been investigated for a long time using Angle Resolved Photo-Emission Spectroscopy (ARPES) measurements [1–3]. The results I will present are produced by the ab-initio simulation of photo-emission spectra in electrostatically and chemically (KC_8) doped graphene, in the framework of our recently developed many-body RPA- G_0W_0 approximation. The decay width along the graphene π^+/π^- bands at the Fermi level features the exponential law $\Gamma \quad |E_{\sigma,\pi K} - E_{Fermi}|^{\alpha}$ (**Fig. 1a**), which perfectly fits the previous experimental results [1, 4], deviating from the standard Fermi liquid behavior $\alpha = 2$. At lower energies, the width of the π^+/π^- bands exhibits a peak due to the Dirac plasmon emission decay, also experimentally measured [1]. On the other hand, the plasmonic satellites appearing in the spectrum (**Fig. 1b**) feature much lower intensities than experimentally obtained [2, 3], except in the $E_{Dirac} < \omega < E_{Fermi}$ frequency range. Also, due to the Fermi liquid theory, we obtained a kink at the Fermi level in highly doped graphene (**Fig. 1b**).

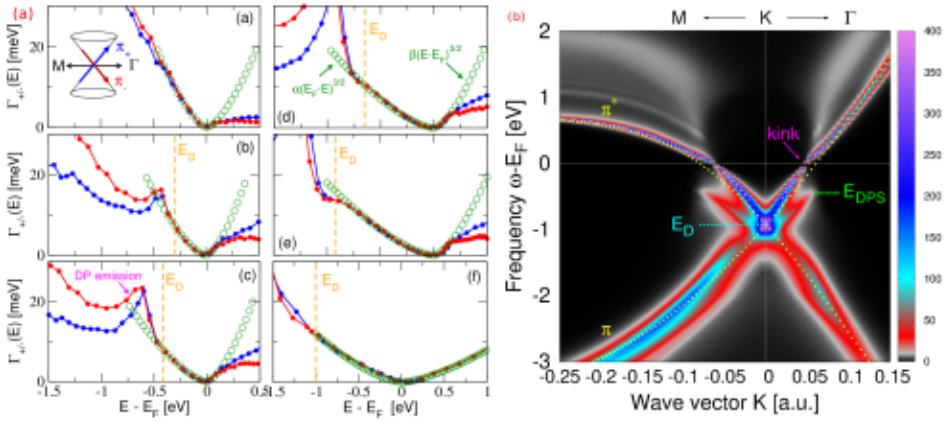

Figure 1. **a)** The imaginary part of self-energy along π^+/π^- bands in electrostatically doped [witt concentrations increasing (a)→(e)] and chemically (f) doped KC_8 graphene. **b)** The simulation of spectral intensity along the high symmetry path (M←K→ Γ) in electrostatically highly doped graphene (10^{14} cm^{-2}).

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