Electronic excitations in alkali-intercalated graphene

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Pristine graphene supports only interband plasmons, and the dominant modes are π and π + σ plasmons [1]. Doping causes the appearance of "tunable" Dirac plasmon in the graphene, but for the experimentally feasible doping it is weak and broad. Therefore, nowadays graphene is being intercalated with various alkali and alkali earth metals. The intercalated metal donates electrons to the graphene causing the electronic doping of the graphene π band, in a way that the metallic σ band remains partially filled. This results in the formation of two quasi two-dimensional plasmas and also adds new bands to the band structure, opening possibilities for the intraband and interband electronic transitions not possible in the pristine or doped graphene. For example, most of these systems support not one, but two intraband plasmons, acoustic and Dirac [2], with frequencies up to 4eV, as well as various interband modes which occur at higher frequencies, and can be intra-layer and inter-layer, as can be seen in Fig.1 [3]. Because of the heavy doping, the Dirac plasmon is very strong, while the interband and especially the inter-layer modes can be optically active in the visible and UV frequency region and therefore interesting for optical applications. In addition to that, some of these modes can be manipulated by doping. We present how the choice of the intercalated metal and the coverage, i.e. the intensity of the electronic doping influences the spectra and tunes the intensities of the plasmon modes.

References

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Figures

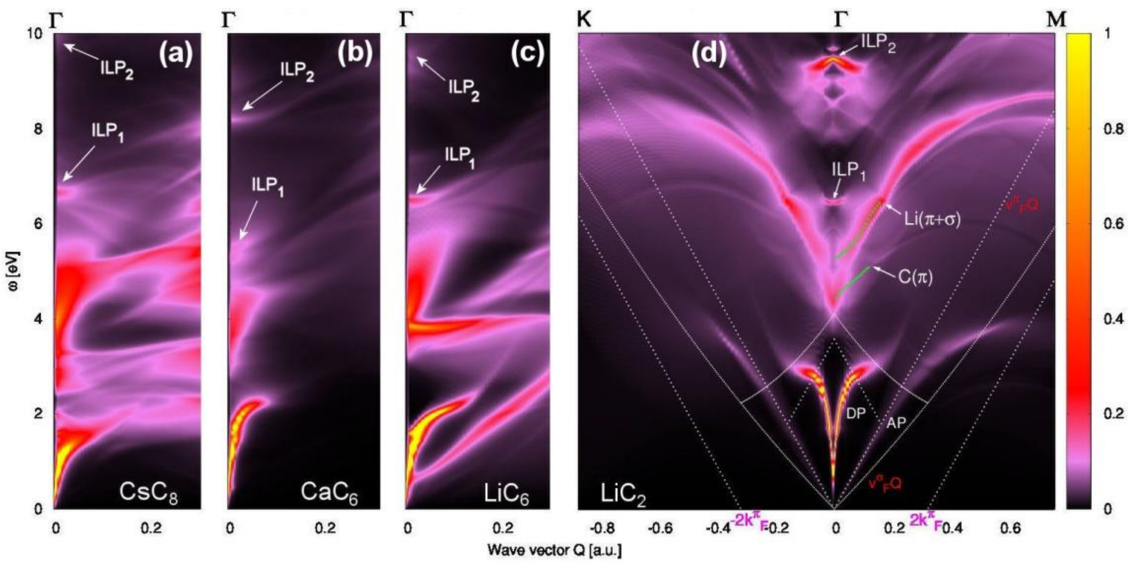

Figure 1 The intensities of the electronic excitations in CsC_8, CaC_6, LiC_6 and LiC_2 monolayer