Plasmons in graphene at terahertz frequencies

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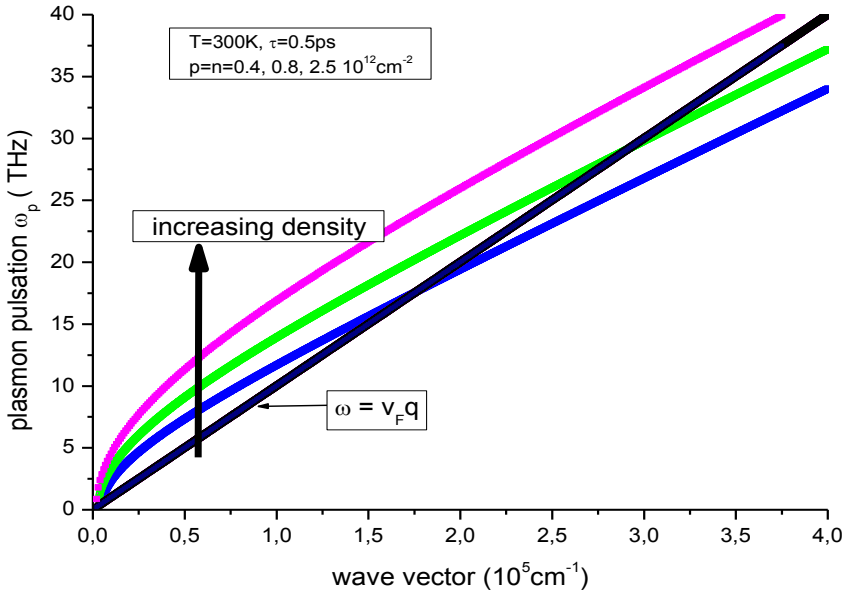
Due to the unique and excellent properties, graphene has attracted a great deal of interest. High confinement, low loss and good tunability, makes graphene a promising plasmonic material compared to the noble metals. Its two dimensional nature meets the need of surface plasmons and greatly enrich the field of plasmonics. We propose here to study the effects of temperature, doping and relaxation time in the dielectric function, on behaviors of the charge density waves (or plasmons) in graphene. In some conditions, such plasmon exists, but strongly damping, due to the interplay between the inter- and intra-band transitions. The high mobility of electrons in graphene encouraged theoretical and experimental studies in graphene based ultrahigh-speed electronic devices such as terahertz devices [1]. It has been shown that the plasmons in graphene at moderate carrier densities (10^9 –10^{11} cm^{-2}) are in the terahertz frequency range.



Plasmon dispersion relation in graphene at 300 K is plotted for different electron-hole densities

[1] E. H. Hwang and S. Das Sarma, Phys. Rev. B 75, 205418, 2007,20