Optical properties of two new Dirac semimetals: 8-Pmmn borophene and Kekulé-Y modulated graphene

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We present results obtained from theoretical studies on the electronic and optical properties of two Dirac semimetals of recent interest: 8-Pmmn borophene [1] and Kekulé-Y modulated graphene [2,3]. The former exhibits an anisotropic Fermi velocity and a strong electron-hole asymmetry [4,5], while the latter presents a valley-momentum coupling and two species of Dirac fermions [6,7]. We show that the electron-hole asymmetry in borophene and the valley coupling in Kekulé modulated graphene introduce a similar split in the interband conductivity of both materials (see Fig. 1). Furthermore, in Kekulé modulated graphene the valley coupling introduces a second plasmonic branch (see Fig. 2) and a tunable absorption peak originating from low energy intervalley transitions.

References

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Figures

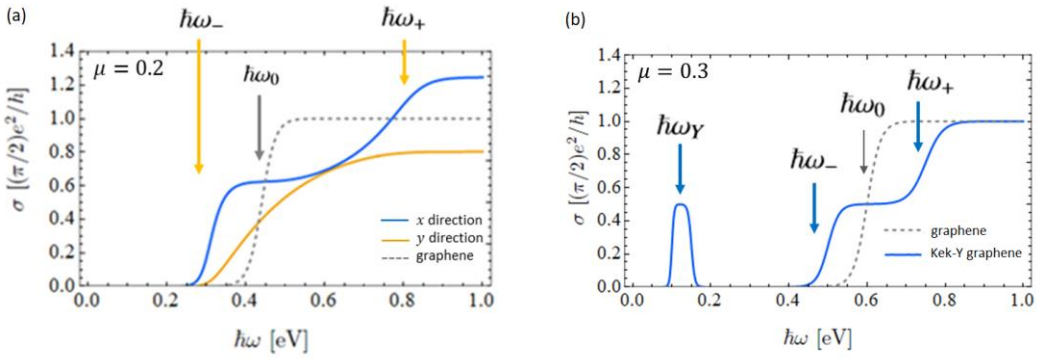

Figure 1: (a) Optical conductivity of 8-Pmmn borophene compared to that of graphene. (b) Optical conductivity of graphene with and without Kekulé-Y (Kek-Y) modulation.

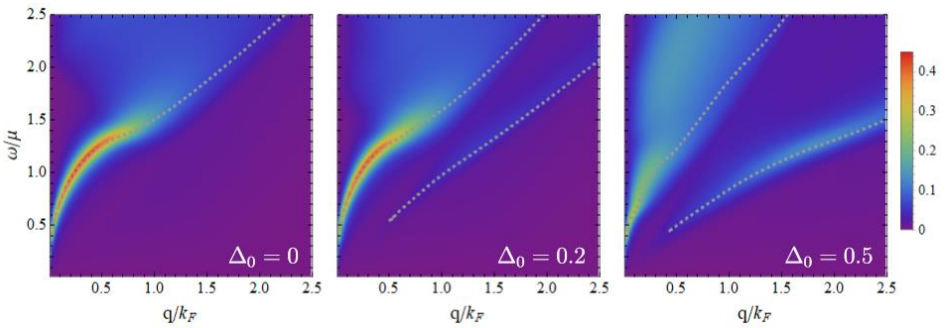

Figure 2: The plasmonic dispersion of graphene (dashed curves) and its loss function (colour plot) for different values of the valley coupling amplitude introduced by the Kekulé modulation.