Superlensing with twisted bilayer graphene

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Abstract

The charge susceptibility of twisted bilayer graphene is investigated in the Dirac cone, respectively, random-phase approximation. For small enough twist angles $\theta \lesssim 2°$, we find genuine interband plasmons, i.e., collective excitonic modes that exist in the undoped material with an almost constant energy dispersion. In this regime, the loss function can be described as a Fano resonance, and we argue that these excitations arise from the interaction of quasi-localized states with the incident light field (see Fig 1).

Quasi-flat plasmonic bands (see Fig. 2) can be used for exponential amplification of evanescent modes of the same energy and depositing twisted bilayer graphene on both sides of a dielectric could give rise to superlensing without the need of left-handed materials [1].

References

[1] Tobias Stauber and Heinerich Kohler, Nano Lett., **16** (2016) 6844–6849

Figures

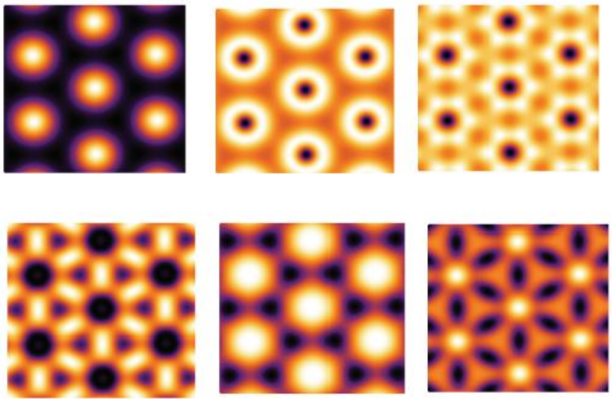

Figure 1: Local density of states of the six lowest conduction bands of twisted bilayer graphene with a twist angle θ=1.61°. Bright areas correspond to high local electronic densities that can lead to quasi-localization.

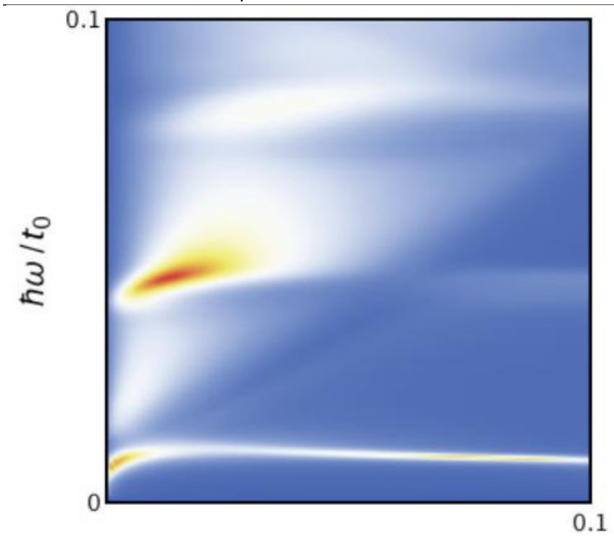

Figure 2: Loss function of twisted bilayer graphene with a twist angle θ=1.61°. Clearly seen is the quasi-flat plasmonic band for in-plane momenta up to qa=0.1.