Nonlinear optics of twisted bilayer graphene

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Abstract

In this talk after briefly reviewing the physics of twisted materials, in particular the discovery of correlated phases, I will present a study of the nonlinear optical response of twisted bilayer graphene (fig1). I will discuss the contribution of the Berry phase to the nonlinearity when inversion symmetry is broken, thus underlining the interplay between band and real-space geometry, and nonlinear response. The last part of the talk will focus on an effect that is characteristic of extreme nonlinear optics, namely the generation of harmonics in disguise. This effect emerges in twisted bilayer graphene at relatively moderate field strengths because of the reduced bandwidth (fig 2).

References

[1] L. Di Mauro Villari, A. Principi, Phys, Rev. B 106, 035401 (2022)
[2] T. N. Ikeda, Phys. Rev. Res. 2, 032015(R) (2020).

Figures

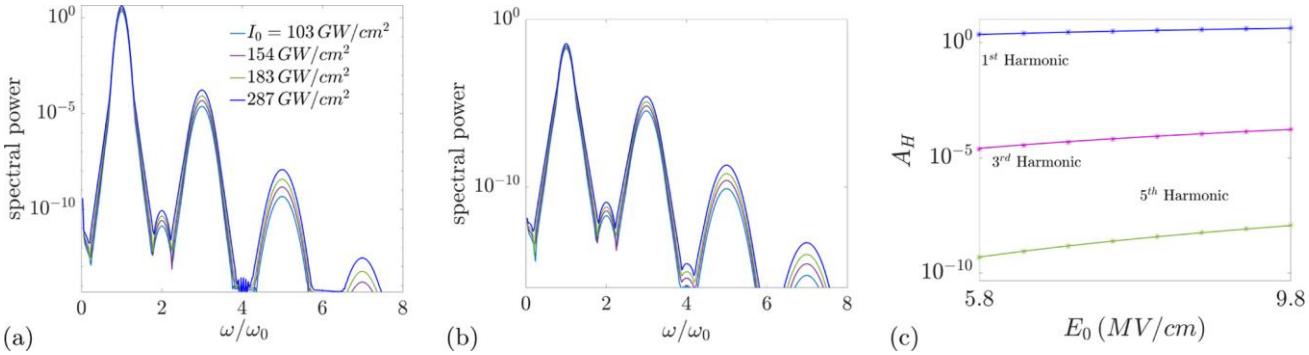

Figure 1(a), (b) Currents along the x- and y-directions for different values of the impinging field in logarithmic scale. (c) Variation of harmonic amplitude for the x-polarization with the electric field strength. The solid lines show the theoretical polynomial curves AH ≈ E0 in log scale.

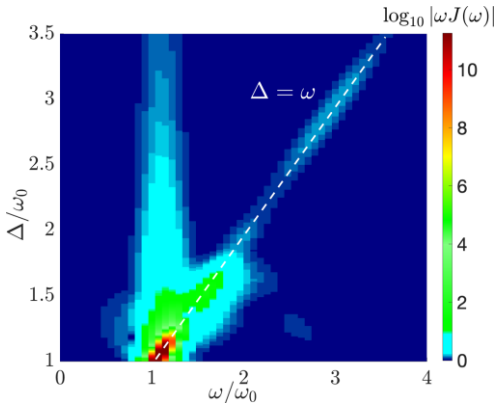

Figure 2 Current spectra for a two-flat-band system with varying transition frequency.