Heavy quasiparticles and cascades without symmetry breaking in twisted bilayer graphene

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Twisted bilayer graphene (TBG) exhibits a plethora of electronic phases. Among the variety of correlated states, the cascades in the spectroscopic properties and in the compressibility happen in a much larger energy [1,2,3], twist angle and temperature range than other effects, pointing to a hierarchy of phenomena. Using Dynamical Mean Field Calculations (DMFT), in this work [4], we show that the spectral weight reorganization associated to the formation of local moments and heavy quasiparticles, and not a symmetry breaking process, is responsible for the cascade phenomena. Due to the fragile topology of TBG, a strong momentum differentiation is found in the incoherent spectral weight. The phenomena reproduced here include the cascade flow of spectral weight, the oscillations of the remote band energies and the asymmetric jumps of the inverse compressibility. We also address other posible measurements which may help distinguishing the phenomenology of the cascades discussed here from proposals involving symmetry breaking.

References

[1] Wong et al, Nature 582, (2020), 198

[2] Zondiner et al, Nature 582, (2020) 203.

[3] Polski et al, arXiv:2205.05225.

[4] A. Datta, M.J. Calderón, A. Camjayi, E. Bascones, arXiv:2301.13024

Figures

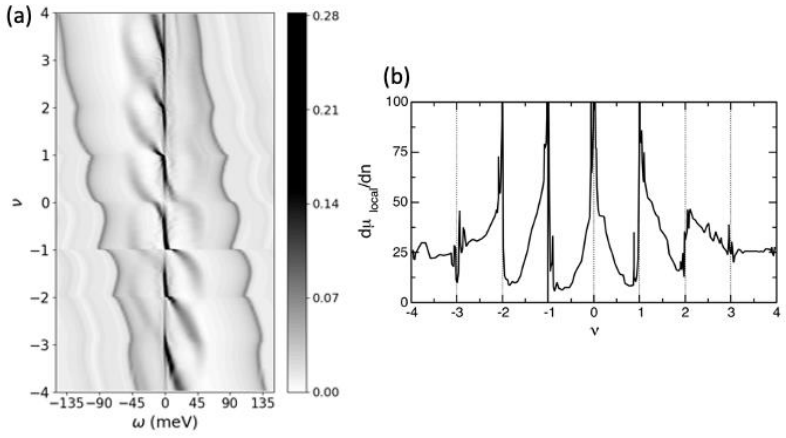

Figure 1: (a) Density of states and (b) inverse compressibility as a function of doping ν obtained in our DMFT calculations for a 1.08° twisted bilayer graphene [4].