

Elena Bascones (Instituto de Ciencia de Materiales de Madrid, Spain)

Cascades: The unconventional normal state of twisted bilayer graphene

Twisted bilayer graphene exhibits an abundance of correlation phenomena, many of them still not understood. Among these effects, the cascades in the spectroscopic properties and in the compressibility [1], happen in a much larger energy, twist angle and temperature range than other effects, pointing to a hierarchy of phenomena. These cascades have been primarily described in terms of symmetry breaking states.

On the basis of DMFT calculations [2], in the talk, I will 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. The framework presented reproduces the cascade flow of spectral weight, the oscillations of the remote band energies, the asymmetric jumps of the inverse compressibility and the presence of resistive states. Due to the fragile topology of TBG, we also predict a strong momentum differentiation in the incoherent spectral weight. In the talk, I will also address other possible measurements which may help distinguishing the phenomenology of the cascades discussed here from proposals involving symmetry breaking.

[1] Wong et al, Nature 582, 198 (2020), Zondiner et al, Nature 582, 203 (2020), Polski et al, arXiv:2205.05225

[2] A. Datta, M.J. Calderón, A. Camjayi, E. Bascones, Nature Comms. 14, 5036 (2023)