Quantum Transport in twisted bilayer graphene

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It has been shown theoretically and experimentally that twisted bilayer graphene (TBG), forming Moiré patterns, confine electrons in a tunable way as a function of the rotation angle [1-3]. The discovery of correlated insulators and superconductivity in 2018 [3] at so-called "magic angles" has stimulated an avalanche of experimental and theoretical activities. In the framework of the Kubo-Greenwood formula for the conductivity, we present tight-binding calculations of quantum diffusion properties in TBG at various angles including the first magic angle. We analyze in particular the effect of static defects, the effect of an electric bias and electron-electron interactions. One of the main results is fact that flat bands induce a breakdown of the standard Boltzmann theory of transport. Finally, we comment on the effects of electronic correlations and magnetism on quantum transport.

References

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