Electron-Phonon Coupling in Magic-Angle Twisted-Bilayer Graphene

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Twisted graphene systems are outstanding platforms to explore correlated electron physics and superconductivity with exceptional tunability [1]. The importance of phonons in these strong correlation phenomena in twisted bilayer graphene (TBLG) at the so-called magic-angle is therefore very necessary to be clarified [2-4]. In this talk, we will present our recent study [5] using gate-dependent Raman spectroscopy and atomistic modeling to investigate the electron-phonon coupling through the C-C stretching mode (G band) linewidth in magic-angle TBLG. Our study has been performed particularly for three TBLGs at twist angles θ = 0° (Bernal stacking), ~1.1° (magic-angle) and ~7° (large angle). Overall, the value of the G band linewidth in magic-angle TBLG is shown to be much larger when compared to that of the other samples, in qualitative agreement with our calculations. In addition, the obtained results also show that a broad and p/n-asymmetric doping behavior is observed at the magic-angle, in clear contrast to the behavior observed at other angles. Simulations reproduce these experimental observations, revealing how the unique electronic structure of magic-angle TBLGs impacts the electron-phonon coupling, reflected by its effects on the G band linewidth. Our study thus points to a relationship between electron-phonon coupling and the strongly correlated phenomena in the magic-angle TBLG.

References

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Figures

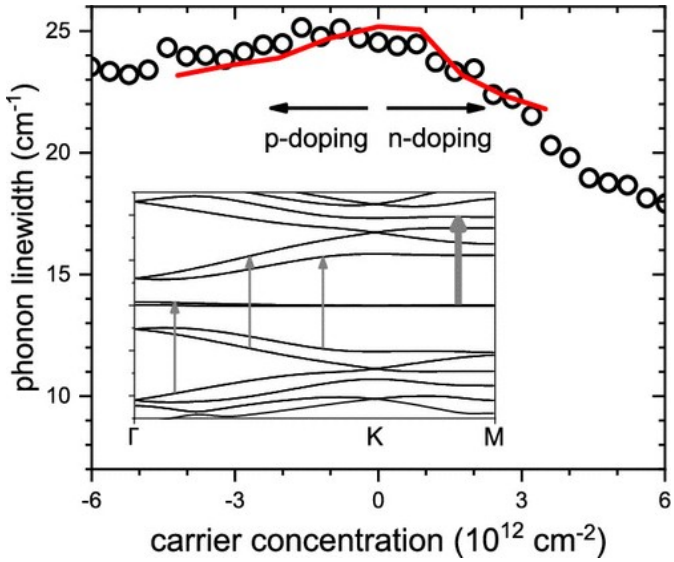

Figure 1: Gate-dependent G-band Full-Width-Half-Maximum in the magic-angle TBLG