

"Excitonic effects in phonons: reshaping the graphene Kohn anomalies and lifetimes"

Alberto Guandalini

*Dipartimento di Fisica, Università di Roma, La Sapienza
Piazzale Aldo Moro 5, I-00185 Roma, Italy*

The electron-phonon interaction rules electrical transport, relaxation dynamics after photoexcitation and determines the presence of Kohn anomalies in the phonon dispersion.

Recent results from Raman spectroscopy indicate that the magnitude of electron-phonon interaction of graphene could have a strong momentum dependence, that has always been neglected.

Here, I will present a novel theoretical first-principles framework capable of accounting for the effects of the electron-hole excitonic attraction on the phonon properties.

This allows us to reevaluate the graphene electron-phonon interaction and its impact on the phonon dispersion and lifetimes (Kohn-anomalies) near the Gamma (zone-center) and K points (zone-border). We found a huge, momentum-dependent, enhancement of the electron-phonon coupling with respect to the previous estimations based on DFT or GW theories, when the phonon approaches the zone-border.