

Strong Electron-Phonon coupling in Graphene

Experimental evidence for exceptionally strong electron-phonon coupling is found in recent ARPES measurements (F.~Mazzola et al. Phys. Rev. Lett. 111, 216806 (2013)). The interpretation from the data indicates a strength of the electron phonon coupling nearly an order of magnitude greater than what is found in the π -bands near the Dirac point. The challenge is to understand why and to find a way to utilize this to make graphene superconducting.

An international team, *experiment* and *theory*, is presently working on understanding the electron-phonon coupling (EPC) in the σ -band of graphene. To complement the advanced Density function density (DFT) based calculations I have developed a flexible tight-binding model (TBM) based code. So far no analysis of inter-band π - σ scattering has been reported in the literature. Our DFT and TBM calculations indicate that the π - σ scattering is crucial.

Project

You should continue last year successful bachelor thesis project that was based on a simple model study of the electron-phonon matrix elements (*Chem. Phys. Lett.* 660, 233 (2016), H. Toren, L. Samuelsson and B. Hellsing).

With the TBM code you will calculate and analyze the spectral function which is measured in the ARPES experiment. The aim is to resolve the spectral function in terms of contributions from interband and intraband scattering and to make clear which phonon modes are in operation in the two cases.

Background

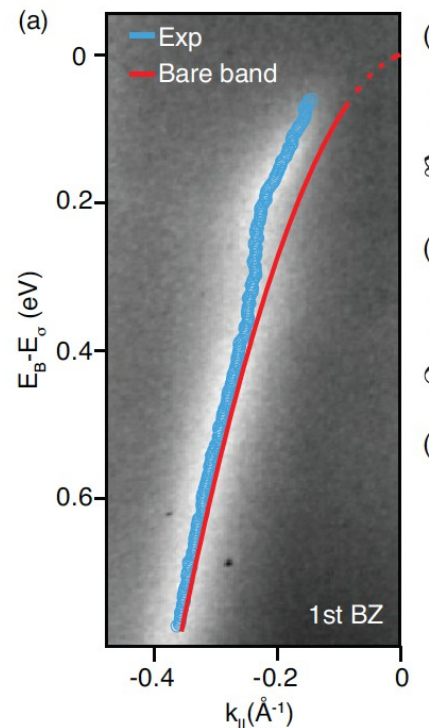
Quantum mechanics and some elementary Solid State course.

Group size

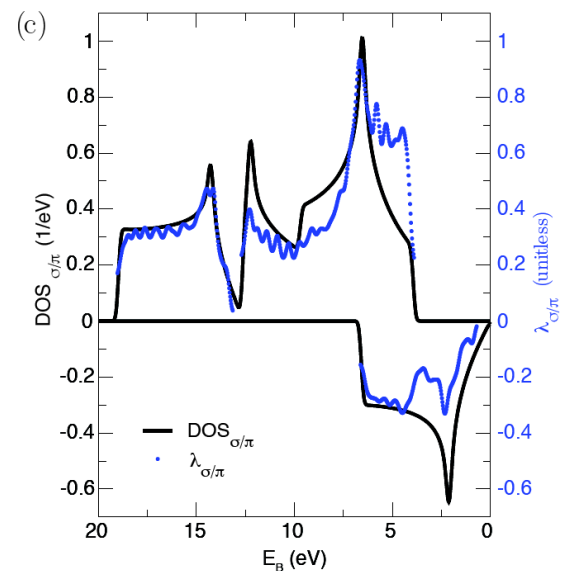
3 or more students

Supervisor

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ARPES electron-phonon "kink"



DFT calculations of e-ph coupling constant