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The Raman spectrum of graphene in the light of picosecond laser excitation

Carino Ferrante
Istituto Italiano di Tecnologia, Italy

Since its first observation in 1928, the Raman effect has evolved into one of the most popular analytical characterization tools in diverse areas, including biology, geology, semiconductor, materials and polymer science. In graphenic materials, Raman spectroscopy is routinely used to determine the number and orientation of layers, the quality and types of edge, and the effects of perturbations, such as electric and magnetic fields, strain, doping, disorder and functional groups. Still, there are several unexplored dimensions related to Raman effect of graphene. In this talk I will present an out-of-equilibrium characterisation of phonons in Single Layer Graphene using picosecond Raman excitation, an optimal trade-off to generate electronic subsystem temperatures largely exceeding that of the phonon bath, still maintaining an adequate spectral resolution [1]. We find a peculiar behaviour of the frequency and lifetime of both G and 2D (cold) phonons as function of the (hot) carriers temperature, which we rationalize by revisiting the traditional theoretical modelling of the electron-phonon coupling to account for this transient, highly excited scenario. Specifically, we identify additional intra-band coupling channels allowed by a light induced blurring of the Dirac cone, which are potentially relevant for the emerging field of graphene-based nanophotonics and optoelectronic devices operating at THz rates. "This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 785219 – GrapheneCore2"

Biography

Carino Ferrante has completed his PhD about ultra-fast phenomena in heme proteins in 2014. He has continued the postdoctoral studies in the Istituto Italiano di Tecnologia and University of Rome "Sapienza". The main research topics are the study of ultrafast structural dynamics in photosensitive materials and Raman imaging in 2D materials. He has published 20 papers in reputed journals, including Nature Chemistry, Nature Photonics, PNAS and J. Phys. Chem. Lett. He has been serving as a reviewer of 5 reputed scientific journals.

Carino.Ferrante@roma1.infn.it

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