

Graphene Light Scattering, Absorption, and Emission

Eric J. Heller

Yuan Yang, Lucas Kocia, Wei Chen, Shiang Fang, Mario Borunda, and Efthimios Kaxiras

Harvard University, Cambridge, MA, USA

heller@physics.harvard.edu

We have applied the venerable Franck-Condon and Kramers-Heisenberg-Dirac (FC-KHD) light scattering formulations to polyacetylene and graphene for the first time. FC-KHD has been popular and successful for 90 years in molecular spectroscopy including very large, graphene-like polyaromatic hydrocarbons. The first and second order perturbation theory FC-KHD has led to consistent, direct, and revealing explanations (and predictions) of the most important and some formerly puzzling experimental findings on these systems. Graphene's dispersive and fixed Raman bands, missing bands, defect density and laser frequency dependence of band intensities, widths of overtone bands, Stokes, anti-Stokes anomalies, and other known properties emerge simply and directly. Implications of key pulsed absorption and fast emission experiments will be discussed

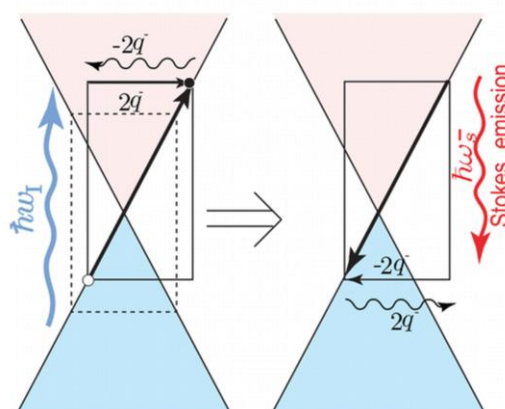


Figure 1: Indirect "transition sliding" mechanism explaining the dominance of the 2D overtone Raman band

References

- [1] Eric J. Heller, Yuan Yang, Lucas Kocia, Wei Chen, Shiang Fang, Mario Borunda, and Efthimios Kaxiras, *Theory of Graphene Raman Scattering*, ACS Nano 2016 10 (2), 2803-2818
- [2] Eric J Heller, Yuan Yang, and Lucas Kocia, *Raman scattering in carbon nanosystems: Solving polyacetylene*. ACS central science 1.1 (2015): 40-49.