LIGHT EMISSION FROM ULTRANARROW GRAPHENE NANORIBBONS: EDGE AND TERMINI EFFECTS

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Owing to their width-dependent sizable band gaps, graphene nanoribbons (GNRs) have attracted increasing attention in the last decade as a viable route for graphene-based nano- and opto-electronic applications. More recently, the successful production of ultranarrow and structurally well-defined GNRs by means of bottom-up techniques has further boosted this research line.

Here, I will present our recent work on the optical properties of GNRs, as resulting from state-of-the-art ab initio calculations beyond mean field, and compare them with experimental data from different optical spectroscopies. We show that the extreme quantum confinement leads to linear and non-linear optical spectra dominated by strong multi-particle excitations (i.e. excitons and biexcitons) [1,2], whose energy position is significantly influenced by both edge morphology and functionalization. Finite size effects and below-bandgap light emission are rationalized and compared with STS measurements on suspended GNRs [3].

[1] Exciton-dominated optical response of ultra-narrow graphene nanoribbons, R. Denk et al., Nat. Commun. 5, 4253 (2014)
[2] Exciton-exciton annihilation and biexciton stimulated emission in graphene nanoribbons, G. Soavi et al., Nat. Commun. 7, 11010 (2016)
[3] Bright electroluminescence from single graphene nanoribbon junctions, M. Chong et al., Nano Lett. 18, 175 (2018).