High-Order Harmonics Generation in Graphene Quantum Dots by bichromatic laser fields of circular polarization

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Among the diverse nanostructures, graphene quantum dots (GQDs) have demonstrated relevant properties for significant enhancement of harmonic intensity compared to gaseous atomic systems, as they offer multiple excitation channels during the interaction with intense laser fields [1]. In the present work, for specific cases of triangular and hexagonal GQDs subjecting to laser fields of specific configuration matched with this symmetry of GQD, the high-harmonic generation (HHG) is considerably enhanced [2, 3]. In such situation, electrons emit coherent radiation with distinct frequencies conditioned by selection rules depending on the symmetry of a GQD. To achieve the required symmetry conditions, we consider two-colour circularly polarized laser fields with commensurate frequencies. As a representative example, Fig.1 illustrates the case of hexagonal GQD, and a schematic diagram of the driving wave field, alongside the corresponding HHG yield. The HHG spectrum is compared to that obtained with a single-color circularly polarized laser field of the same intensity. As evident from this figure, if the two symmetries are matched, the HHG intensity enhances by orders of magnitude, specifically in the higher-frequency region of the spectrum.

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References

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Figures

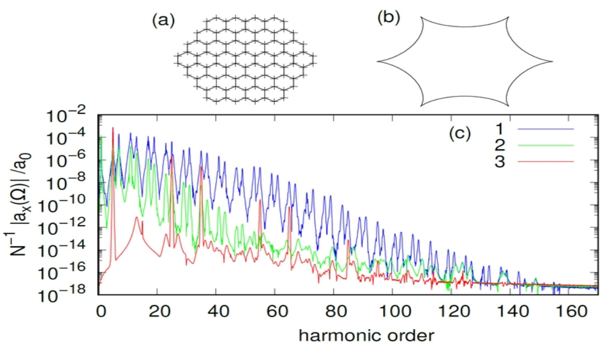

Figure 1: (a) Lattice structure of a hexagonal GQD with zigzag edges, consisting of 96 atoms. (b) Schematic diagram of the electromagnetic wave field. (c) HHG emission spectra obtained via Fourier transformation of the dipole acceleration versus harmonic order. Curve (1) represents the HHG spectrum in a two-colour circularly polarized laser field with a frequency ratio of ω_1/ω_2=1/5. Curves (2) and (3) correspond to HHG spectra for single-color circularly polarized laser fields with frequencies ω1 and 5ω1, respectively.