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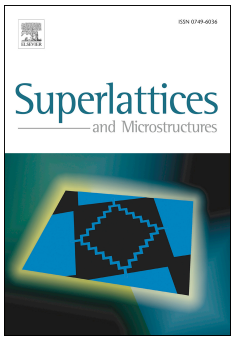

On the intra- and interband plasmon modes in doped armchair graphene nanoribbons

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On the intra- and interband plasmon modes in doped armchair graphene nanoribbons

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Abstract

With the help of the simple tight-binding Hamiltonian and Green's function technique, we study how intraband and interband plasmon modes of both semiconducting and metallic armchair graphene nanoribbons are influenced by the width, chemical doping, and incident momentum direction. In particular, we investigate the behavior of the frequency-dependent susceptibility when the system is exposed to photons or electrons. Injecting electrons by doping creates a new collective mode due to new states between the valence and conduction bands corresponding to intraband transition for which the effect of ribbon width on these transitions in the semiconducting case is much more sensitive than metallic ones. Furthermore, some critical chemical potential and momentum values for both intraband and interband modes lead to different behaviors for resonant peaks. Another remarkable point is the high sensitivity of intraband plasmons to the direction of incident momentum. In particular, the susceptibility of doped nanoribbons vanishes at perpendicular directions, i.e., the intraband plasmons disappear.

Keywords: Tight-binding approximation, Green's function, Plasmon mode,

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