Emergent scale invariance of nonclassical plasmons in graphene nanoribbons

Using a nearest-neighbor tight-binding model we investigate quantum effects of plasmons on few-nanometer wide graphene nanoribbons, both for zigzag and armchair edge terminations. With insight from the Dirac description we find an emerging scale-invariant behavior that deviates from the classical model both for zigzag and armchair structures. The onset of the deviation can be related to the position of the lowest parabolic band in the band structure. Dirac theory is only valid in the parameter subspace where the scale invariance holds that relates narrow ribbons with high doping to wide ribbons with low doping. We also find that the edge states present in zigzag ribbons give rise to a blue shift of the plasmon, in contrast to earlier findings for graphene nanodisks and nanotriangles.

General information
State: Published
Organisations: Theoretical Atomic-scale Physics, Center for Nanostructured Graphene, Structured Electromagnetic Materials, Department of Photonics Engineering, Department of Physics
Contributors: Wedel, K. O., Mortensen, N. A., Thygesen, K. S., Wubs, M.
Number of pages: 10
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Physical Review B
Volume: 98
Issue number: 15
Article number: 155412
ISSN (Print): 1098-0121
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.34 SJR 1.604 SNIP 1.04
Web of Science (2017): Impact factor 3.813
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 3.16 SJR 2.339 SNIP 1.151
Web of Science (2016): Impact factor 3.836
Web of Science (2016): Indexed yes
Scopus rating (2015): CiteScore 2.8 SJR 2.377 SNIP 1.13
Web of Science (2015): Impact factor 3.718
Web of Science (2015): Indexed yes
Scopus rating (2014): CiteScore 3.3 SJR 2.762 SNIP 1.316
Web of Science (2014): Impact factor 3.736
Web of Science (2014): Indexed yes
Scopus rating (2013): CiteScore 3.55 SJR 2.813 SNIP 1.326
Web of Science (2013): Impact factor 3.664
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Scopus rating (2012): CiteScore 3.57 SJR 3.173 SNIP 1.378
Web of Science (2012): Impact factor 3.767
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Scopus rating (2011): CiteScore 3.61 SJR 3.326 SNIP 1.423
Web of Science (2011): Impact factor 3.691
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Scopus rating (2010): SJR 3.318 SNIP 1.447
Web of Science (2010): Impact factor 3.774
Web of Science (2010): Indexed yes