Modeling the excitation of graphene plasmons in periodic grids of graphene ribbons: An analytical approach - DTU Orbit (27/07/2019)

Modeling the excitation of graphene plasmons in periodic grids of graphene ribbons: An analytical approach

We study electromagnetic scattering and subsequent plasmonic excitations in periodic grids of graphene ribbons. To address this problem, we develop an analytical method to describe the plasmon-assisted absorption of electromagnetic radiation by a periodic structure of graphene ribbons forming a diffraction grating for THz and mid-IR light. The major advantage of this method lies in its ability to accurately describe the excitation of graphene surface plasmons (GSPs) in one-dimensional (1D) graphene gratings without the use of both time-consuming, and computationally demanding full-wave numerical simulations. We thus provide analytical expressions for the reflectance, transmittance, and plasmon-enhanced absorbance spectra, which can be readily evaluated using any personal computer with little to no programming. We also introduce a semianalytical method to benchmark our previous results and further compare the theoretical data with spectra taken from experiments, for which we observe a very good agreement. These theoretical tools may therefore be applied to design new experiments and cutting-edge nanophotonic devices based on graphene plasmonics.

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