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Casimir-Polder effect for a stack of conductive planes

Khusnutdinov N., Kashapov R., Woods L.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The Casimir-Polder interaction between an atom and a multilayered system composed of infinitely thin planes is considered using the ζ-function regularization approach with zero-point energies summation. As a prototype material, each plane is represented by a graphene sheet, an atomically thin layer of carbon atoms organized in a hexagonal lattice, whose optical response is described by a constant conductivity or Drude-Lorentz model conductivity. Asymptotic expressions for various separations are derived and compared to numerical calculations. We distinguish between large atom-plane distance limit, where retardation effects are prominent, and small atom-plane distance limit, where the typical van der Waals coefficient is found to be dependent on the number of graphenes and characteristic separations. The calculated energies for different atoms and graphene conductivity models brings forward the basic science of the Casimir-Polder effect and suggests ways to manipulate this interaction experimentally.

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