Probing nonlocal effects in metals with graphene plasmons

In this paper, we analyze the effects of nonlocality on the optical properties of a system consisting of a thin metallic film separated from a graphene sheet by a hexagonal boron nitride (hBN) layer. We show that nonlocal effects in the metal have a strong impact on the spectrum of the surface plasmon-polaritons on graphene. If the graphene sheet is nanostructured into a periodic grating, we show that the resulting extinction curves can be used to shed light on the importance of nonlocal effects in metals. Therefore graphene surface plasmons emerge as a tool for probing nonlocal effects in metallic nanostructures, including thin metallic films. As a byproduct of our study, we show that nonlocal effects may lead to smaller losses for the graphene plasmons than what is predicted by a local calculation. Finally, we demonstrate that such nonlocal effects can be very well mimicked using a local theory with an effective spacer thickness larger than its actual value.

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