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Quantum plasmonics through retarded Coulomb coupling to graphene electrons ANDRII IUROV, Center for High Technology Materials, UNM, DANHONG HUANG, Air Force Research Laboratory, Kirtland Air Force Base, GODFREY GUMBS, Hunter college, CUNY, WEI PAN, Sandia National Laboratories, ALEXEI MARADUDIN, Department of Physics and Astronomy, University of California, Irvine — The retarded Coulomb couping of the surface plasmon mode to the collective excitation of Dirac electrons in a neighboring graphene monolayer is investigated and the characteristics of the resulting hybrid quantum- plasmon modes are discussed. The unique dispersion relations of these quantum-plasmon modes are expected to be experimentally observable. For double-layer graphene, the interplay between the interlayer Coulomb interaction and the retarded coupling of a surface plasmon mode to each sheet is obtained. As a significant correction to the static dielectric function of the host cladding layer on top of the conductor surface, the effective scattering matrix for coupled double-layer graphene and a thick conductor is obtained for constructing an effective-medium theory, which includes the role of both the Coulomb interaction between electrons in different graphene sheets and the retarded Coulomb coupling of these layers to the conductor. A scattering matrix can be employed for an effective-medium theory to calculate the optical properties of inserted conducting nanodots and nanorods between graphene and a conductor which can be applied to a super-resolution near-field imaging beyond the diffraction limit for functionalized biomolecules attached to these nanodots and nanorods.

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