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Dirac-Like Plasmons in Honeycomb Lattice of Metallic Nanoparticles CLAIRE WOOLLACOTT, Centre for Graphene Science, Department of Physics, University of Exeter, UK, GUILLAUME WEICK, Institut de Physique et Chimie des Materiaux de Strasbourg, Universite de Strasbourg, France, WILLIAM L. BARNES, Department of Physics, University of Exeter, UK, ORTWIN HESS, The Blackett Laboratory, Department of Physics, Imperial College London, UK, EROS MARIANI, Centre for Graphene Science, Department of Physics, University of Exeter, UK — We consider a two-dimensional (2D) honeycomb array of metallic nanoparticles, each supporting a localized surface plasmon, and study the quantum properties of the collective plasmonic modes resulting from the near-field dipole interaction between nanoparticles. We analytically investigate the dispersion, effective Hamiltonian and eigenstates of the collective plasmons for an arbitrary orientation of the individual dipole moments. For polarization pointing normal to the plane, the spectrum presents Dirac cones similar to those present in the electronic band structure of graphene. The effective Dirac Hamiltonian and corresponding spinor eigenstates represent Dirac-like massless bosonic excitation, presenting similar effects to electrons in graphene, for example, non-trivial Berry phase and the absence of backscattering off smooth inhomogeneities. However, by tilting the polarisation, the Dirac points can be manipulated and a gap can be controllably opened in the spectrum. Therefore the properties of this metamaterial can be manipulated by the incident light polarization, paving the way for a fully tunable plasmonic analogue of graphene. - G. Weick, C. Woollacott, W. Barnes, O. Hess and E. Mariani, Phys. Rev. Lett. 110, 106801 (2013)

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