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Dirac-like plasmons in Ag nanopillar honeycomb lattices SIYING PENG, Thomas J. Watson Laboratory of Applied Physics, California Institute of Technology, Pasadena, California 91125, United States, BENJAMIN BRENNY, AMOLF, SONDRA HELLSTROM, Thomas J. Watson Laboratory of Applied Physics, California Institute of Technology, Pasadena, California 91125, United States, TOON COENEN, ALBERT POLMAN, AMOLF, HARRY ATWATER, Thomas J. Watson Laboratory of Applied Physics, California Institute of Technology, Pasadena, California 91125, United States — Surface plasmons in honeycomb lattices of Ag nanoparticles exhibit Dirac-like band structures, similar to the electronic band structure of graphene. Full wave simulations for an infinite honeycomb lattice of silver nano-pillars reveal hybridization of localized plasmonic modes between two neighboring pillars and the consequent formation of bonding and antibonding modes that are energetically degenerate at Dirac points. Electromagnetic simulations reveal the existence of plasmonic edge states in finite width nanoribbons of the honeycomb nanoparticle lattice. Nanoscale architecture of the honeycomb lattice may provide a new way to control plasmon propagation by selective excitation of directional surface plasmon edge states without backscattering. Experimentally, we have utilized cathodoluminescence (CL) spectroscopy to study angular emission patterns and construct band structures of the silver pillars in honeycomb lattices. In our initial CL measurement, silver pillars in honeycomb lattices, we have observed strong radiation patterns near the Brillouin zone edge, integrated over an interval of wavelength centered on the wavelength of the Dirac points.

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