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Dispersion relation and density of states of coupled plasmon modes in periodic chains of metallic nanoparticles C.W. LING, M.J. ZHENG, K.W. YU, The Chinese University of Hong Kong — Energy transmission through one-dimensional chains of equally spaced metallic nanoparticles has been studied via the propagation of coupled surface-plasmon modes. These modes are characterized by well-defined dispersion relation $\omega(k)$ and group velocity $v_g = d\omega/dk$ in a band. The nanoparticles are routinely modelled by Drude metallic spheres and the coupled plasmon modes are calculated in the point-dipole approximation. When the particles approach and finally touch, these bands can differ significantly from those obtained by the point-dipole approximation due to strong multipolar interaction among the particles. In this regard, we have calculated the coupled plasmon modes by a tight-binding approach, taking fully multipolar interactions into account. For approaching particles, the dipolar bands move from the visible down to the infrared region and $\omega(k)$ becomes almost independent of k. Concomitantly, the group velocity v_g showed an intriguing non-monotonic behavior versus the particle spacing. When the spacing decreases, v_g increases initially but decreases when the particles approach and touch. For moderate spacing, v_g can be reduced drastically to $0.01c$, except at $kd = 0$ and $kd = \pi$, resulting in a slow propagation. Thus one can tune the propagation of plasmon modes by simply varying the spacing between the particles.

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