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Light-induced binding of metal nanoparticles via surface plasmons[1] K. L. CHAN, M. J. ZHENG , K. W. YU, The Chinese University of Hong Kong — Recently, nanomachines based on the interaction of nanosize objects with nanostructrued surfaces have attracted much attention. In this work, we study theoretically the light-induced binding forces between a metallic nanosphere and a planar structure, and also between nanoparticles in a diatomic plamonic chain of shelled and unshelled metallic nanoparticles placed alternatively. These forces are calculated by Bergman-Milton spectral representation and multiple image methods within the long wavelength limit. When we tune the incident frequency to the surface plasmon resonant frequency, a stable local minimum in the potential energy is found. It signifies a binding between nanoparticles (nanostructures), which indicates a possible stable structure of the metallic clusters. Such binding is caused by the excitation of collective plasmon modes, which depends on the interparticle distances. This study has potential applications in plasmonic waveguides and colloidal metallic clusters on the nanoscales.

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