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Resonance near-field optical response of metal nanoparticle structures in a layer environment

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Abstract

The near-field response of optically excited nanoparticle structure buried within thin dielectric layer is theoretically and numerically studied. Nanostructure is modeled as a finite-size periodic array of dipole-like gold nanoparticles, the size of the structure is assumed to be much smaller than the wavelength of the external electromagnetic wave. The layer with the particles is located on a dielectric substrate which is irradiated by an external monochromatic optical wave under condition of total internal reflection. For the determination of the field in the system we make use of the Green's function formalism and the dipole approximation. The dyadic Green's function of a three layer system is used in the unretarded approximation. In order to investigate plasmon resonance response of the nanoparticle structure we calculated the average dipole moment magnitude of the particles as a function of light wavelength for different parameters characterizing the layer environment and the structure. It has been found that the dielectric constant of layer containing the particle structure can strongly effect the resonance shifts in the system. This influence is depended on the external field polarization and inter-particle distances in the structure.

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Keywords

Nanoscopic particles, One single layer structure, Self-consistent integral equation