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Theoretical study on the optical response of silver nanoparticles and array[1] ZHIYU JIANG, Department of Physics, Lehigh University, SONGYOU WANG, Department of Optical science and Engineering, Fudan University — The optical properties of nanoparticles and their arrays are closely related to their surface plasmon resonance. This paper reports a study of optical response of single Ag nanosphere and periodical two-dimensional structure arrays by computer simulation based on the Mie and the multipole resonance theory. For Ag spheres with a radius of less than 40 nm, one observed extinction peak is attributed to electric dipole resonance. For spheres more than 40 nm in radius, apart from the peak contributed by the electric dipole, there is a peak at shorter wavelength, caused by resonance of the electric quadrupole. The electric fields in the particle are weaker than that in the two poles, suggesting the toroidal current in the particle is small and the magnetic dipole and quadrupole resonance contribute little to the extinction efficiency. The simulated results are in accord with the experimental data. For an infinite two-dimensional Ag-nanosphere arrays, two resonance peaks attributed to the dipole resonance of single particle and the Wood-Rayleigh anomalous diffraction were observed. The frequency of multipole resonance can be controlled by tuning the size and the periodicity distribution of the arrays.

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