THIRD-ORDER OPTICAL NONLINEARITY OF NOBLE METAL NANOSTRUCTURES

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S u m m a r y

Mechanisms of dissipative and nondissipative nonlinearities in metal nanoparticles (NP) incorporated in a dielectric matrix are theoretically considered. Influence of the shape and the size of NP on optical nonlinearities is studied. Since the dissipative nonlinearity is determined by hot electrons, the detailed analysis of factors defining the heating of electrons in such systems (in particular, light absorption by small particles, electron-lattice energy exchange in the particles, heat sink from the particles into the matrix, etc.) is carried out. A concise survey of experimental papers studying the cubic optical nonlinearity of the noble metal nanostructures (Au, Ag) is carried out. The survey is especially directed to show the influence of the geometrical parameters of NP, their environment, and the spectral position of the light wavelength against the plasmon resonance on the third-order susceptibility $\chi^{(3)}$ value. In particular, it is shown that the nonlinearity can be sufficiently enhanced not only in resonance with the surface plasmon, but also aside of it. The optical nonlinearity nature is discussed as well.