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Control of plasmonic nanostructures for high performance applications

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Interaction of light with plasmonic nanoparticles whose wavelength is of the order of interacting light wavelength, have new physics and applications in electronics, optics and optoelectronics. When the light of wavelength corresponding to the surface plasmon resonance absorption propagates through a nonlinear medium metal nanoparticles strongly absorb visible light due to their surface plasmon resonance in which the conducting electrons undergo a collective excitation induced by electric field of visible light. This enhances the local electric field near and on the surface of metal nanoparticles. The enhancement of local electric field within the metal nanoparticles, leads to the formation of an electromagnetic wave. This wave induces a huge field on the particle surface strongly polarizing the atoms of the molecules adsorbed. As the electrons of the atoms vibrate around their center of mass, the induced dipole moment oscillates at the wave frequency. This will affect the density, velocity and plasmonic oscillations of the electronic clouds of each nanoparticle which will improve self-focusing property of the light propagating through a nonlinear media. Self-focusing can be tuned by controlling size and shape of nanostructures that can play a significant role in medical purposes, LEDs, lasers, sensor, solar cell, photovoltaic and other optical applications. The Ag@Au nanoparticles are used so that the plasmon resonance corresponding to excitation wavelength can be systematically tuned by varying the thickness of the Au-shell. This can help in increased stability and trapping capability of plasmonic nanoparticles that will boost the development of numerous applications in science and technology.

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