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Surface plasmons imaging on metallic spherical nanoparticles

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Metallic nanoparticles of different shapes can be used as sources of enhanced scattered light by excitation of the localized surface plasmons. The localized surface plasmon properties and the associated phenomena are strongly dependent on the particle size and shape. Resonant interaction of light with plasmonic nanoparticles is essential for many applications. Excitations of surface plasmons in nanoparticles at plasmon resonance frequency give rise to a variety of effects, such as frequency dependent absorption and scattering or concentration and near-field enhancement which can be exploited in various applications such as surface-enhanced Raman scattering, high-resolution microscopy, nano-optical antennas, solar cells, non-diffraction limited nanoscopic waveguides and high-sensitivity biosensors. Surface plasmons are widely used for the realization of thin films, arrays of nanoholes or more complex nanostructures or metamaterials. In many of those applications metallic nanoparticles of spherical shapes are used. Plasmon surface waves cannot be visualized experimentally, we can't see how surface plasmon waves look like on the surface of spherical metallic nanoparticles, we can observe only manifestation of plasmon resonances in the scattered or absorbed intensity of light by a nanoparticle. This work demonstrates modeled standing surface free-electron waves and their associated electromagnetic fields. Particles are illuminated by a homogeneous light field at plasmonic resonant frequencies, or close to those frequencies.
This study of surface charge density waves is aimed to demonstrate the diversity and complexity of optical properties of a plasmonic spherical metallic nanoparticle, which is illuminated by light at plasmon resonance frequency. This result is computer simulated model and can be useful to see what a surface plasmon on the spherical metal–dielectric interface is. Aside from the near field demonstration of these surface charge waves also the far field view on such excited surface plasmon is shown. These results are presented in form of 3D images and animated video, showing the dynamics of the system.