Single Electron Excitation versus Plasmon: Different Sights to the Optical Resonance of Triangular Silver Nanoparticles

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Optical spectra of triangular prismatic silver nanoparticles are composed by different resonances, among them the long-wavelength in-plane resonance with a strong bathochromic shift with increasing particle size [1]. Beside the resonance energy, a systematic variation of oscillator strength was observed in investigations on microfluidicically prepared colloidal solutions of these particles with particular high homogeneity [2].
Here, we propose to discuss the resonant inelastic interaction between the photons and the nanoparticles by an excitation process in analogy of molecular absorption involving a single electron transition between occupied and unoccupied molecular orbitals. This interpretation is based on the contrast between a collective oscillation of electrons, which is a general effect of response of matter in case of elastic interactions and the resonant non-elastic interaction, which is assumed to be always a single-photon-single-electron process. In result, we found that both the resonance energy and the oscillator strength of colloidal solutions of silver nano triangles can be well approximated by a simple semi-empirical model.

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[2] A. Knauer et al.: J. Phys. Chem. C 116 (2012), 9251-9258