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Effects of quantum coherence and interference in atoms near nano-particle SUMAN DHAYAL, YURI ROSTOVTSEV, University of North Texas — Optical properties of ensembles of realistic quantum emitters coupled to plasmonic systems are studied using a self-consistent model. In particular, the coherent effects such as forming "dark states," optical pumping, coherent Raman scattering, and the stimulated Raman adiabatic passage (STIRAP) are revisited in the presence of metalic nanoparticles. It is shown that the "dark states" are still formed but have more complicated structure, the optical pumping and the STIRAP cannot be employed in the vicinity of plasmonic nanostructures. The STIRAP technique should be used carefully, because it may not work or has at least new features in the presence of nanoparticles. We have also found difference of the local atomic polarization and the atomic polarization averaged over ensemble of atoms homogeneously spread near nanoparticles. The averaged polarization is stricly related to the polarization of the external field, meanwhile the local polarization can be very different from the one induced by the external field. The obtained results are important for excitation of single molecules, e.g. new components of scattering from single molecules can be used for efficient detection of nanoparticles.

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