

Abstract Submitted
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Plasmonic Dicke Effect in Molecular Fluorescence near a Metal Nanoparticle¹ T.V. SHAHBAZYAN, V.N. PUSTOVIT, Jackson State University

— We study theoretically the role of dipole-dipole interactions in surface-plasmon-mediated cooperative emission of light by an ensemble of molecules near a metal nanoparticle (plasmonic Dicke effect). In a typical experimental situation, fluorescing molecules are attached to nanoparticle surface via DNA linkers with controllable lengths, and the inter-molecule interactions lead to the ordering of molecules into a periodic structure. We calculated radiative and non-radiative decay rates as well as quantum efficiency of such systems by taking into account both dipole-dipole interactions and energy shifts due to plasmon exchange between molecules in the ensemble. We found that, in contrast to the usual (photonic) Dicke effect, the interactions merely shift the energy of sub-radiant mode without significantly affecting super-radiant modes, thus preserving the cooperative nature of the emission. Deviations from periodicity also do not significantly alter the structure of collective states.

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