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Single-molecule fluorescence quenching near small nanoparticles V. N. PUSTOVIT, T. V. SHAHBAZYAN, Jackson State University — We study theoretically radiative and nonradiative decay of a single molecule near small gold nanoparticle. The local field enhancement leads to an increased radiative decay rate while the energy transfer from molecule to optically-inactive electronic states in nanoparticle results in a decrease in fluorescence quantum efficiency for small molecule-nanoparticle distances. We performed a DFT-TDLDA calculation of both the enhancement and the quenching for small nanometer-sized gold nanoparticles. We found that in a close proximity to the surface, the non-radiative decay rate is dominated by generation of electron-hole pairs out of the Fermi sea resulting in a significantly lower quantum efficiency as compared to that obtained from electromagnetic calculations. For large distances, the efficiency is maximal for molecule polarized normal to the surface, whereas for small distances it is maximal for parallel orientation.

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