FLUORESCENCE LIFETIME NEAR RESONANT NANOPARTICLES

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The **spontaneous emission rate of a single emitter** (e.g., atom, molecule, quantum dot) depends on the environment. The control of the decay rate through the Photon Local Density of States (PLDOS) was first pointed out (at radio frequencies) by Purcell [1]. Modifications of the spontaneous decay rate of molecules close to metallic surfaces [2,3] or atoms in simple cavities [4] are well known examples nowadays. Nanometer scale objects behave as **nanoantennas for single-emitter fluorescence** modifying the radiative emission rate as well as the far-field angular radiation pattern [5].

Theoretical discussions are usually based on electric dipolar interactions. Analytical formulas based on a dipole–dipole model have been derived [6] for radiative, Γ^R, and non-radiative, Γ^{NR}, decay rate versus the distance between a single emitter close to a **metallic nanoparticle**. Γ^R is dominated by a z_0^{-3} dependence, a z_0^{-6} dependence being visible at plasmon resonance.

A drawback when using metallic objects is the presence of absorption, which creates additional non-radiative channels. **Resonant dielectric structures** provide an alternative way to control both field enhancements and emission rates [7]. Very recently it has been shown [8,9] that submicron silicon spheres present non-absorbing dipolar magnetic and electric resonances in the near infrared.

As it is known, small dielectric particles present an electric dipolar response. However, as the size increases (or the wavelength deacreases) the first Mie-resonance always corresponds to a magnetic dipolar resonance. In absence of absorption, at resonant conditions, the extinction cross section does not depend on the particle size or material properties.

In this work we study the spontaneous decay rate of a single (electric) dipole emitter close to a dielectric resonant subwavelength particle using an analytical approach. As we will show, both lifetime and angular emission near a dielectric particle at the magnetic resonance present unexpected properties that differ from those predicted for metallic nanoparticles. Lifetime near magneto-optical particles will also be discussed [11].

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