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TOULOUSE

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CV/ biography

Gérard COLAS des FRANCS is full professor at the Université de Bourgogne. Alumni of ENS Cachan (1994). He holds a doctorate in Physics (2002) from the University of Toulouse, where he worked on fluorescence in a surface-tip junction. He then moved to University of Münster (Germany) as a Marie Curie fellow where he investigated highly resolved optical near-field microscopy. He has joined the Laboratoire Interdisciplinaire Carnot de Bourgogne (ICB) in 2004. His current interests are focused on the fundamental aspect of nanophotonics, surface enhanced spectroscopies, and quantum plasmonics. He is currently the head of the submicron optics group at ICB.

Plasmonics Purcell factor:

reconciling classical and cQED approach and downscaling quantum optics to the nanoscale

Optical microcavities can store light for a long time allowing efficient light-matter interaction with important applications such as low threshold laser, or single photon generation. Light-matter interaction is generally quantified thanks to the Purcell factor Q/V where Q and V refer to the quality factor and mode volume of the cavity, respectively. Cavity quantum electrodynamics (cQED) relies on the extremely high quality factor but at the price of diffraction limited sizes. That is why strong efforts have been done since a decade to transpose cQED concepts to nanophotonics and plasmonics, taking benefit from the deeply subwavelength confinement of localized surface plasmon polaritons (LSP).

Therefore, an exact definition of the plasmonic Purcell factor is of strong interest to engineer quantum plasmonics devices but also for a better understanding of the light matter interaction at the nanoscale. I will introduce this concept with particular attention devoted to the role the radiation leakages that prevents to extrapolate standard cQED definition for the mode volume. The Purcell factor also constitutes a simple parameter and permits a scale law approach profiting from the strong maturity of cQED concepts and adapt them to nanophotonics. I will discuss cooperative emission by quantum plasmonic superradiance, paving the way towards ultrafast and extremely bright optical nanosources.

Keywords: quantum plasmonics, Purcell factor, superradiance