Contribution ID: **27** Type: **Talk**

Quantum optics with atoms and molecules

Tuesday, 7 May 2024 09:00 (1 hour)

Light-matter platforms are fundamental for a variety of applications in quantum information processing, among others [1].
At the level of pure electronic systems coupled solely to light, such as in the case of structured subwavelength arrays of quantum emitters trapped in optical lattices, I will describe the emergence of cooperative behavior: the optical response can be efficiently enhanced by controlling the hopping of surface excitations via the quantum electromagnetic vacuum induced dipole-dipole interactions.
I will then move to the case of single quantum emitters embedded in solid state platforms. Such emitters, when used in quantum sensing or as qubits, strongly suffer from decay and decoherence induced by their intrinsic complexity, such as is the case for molecules, where the electron is coupled to nuclear vibrations, or by their coupling to crystal phonons, as is the case for vacancy centers, quantum dots etc. I will provide a simple theoretical introduction of electron-vibron coupling [2] and discuss the physics on non-radiative relaxation brought on by non-adiabatic effects. This is aimed at understanding the limitations for the quantum efficiency of solid state based quantum emitters.

[1] M. Reitz, C. Sommer, and C. Genes, Cooperative Quantum Phenomena in Light-Matter Platforms, PRX Quantum 3, 010201 (2022).
[2] M. Reitz, C. Sommer and C. Genes, Langevin approach to quantum optics with molecules, Phys. Rev. Lett. 122, 203602 (2019).

Abstract category

Primary author: Prof. GENES, Claudiu (Max Planck Institute for the Science of Light)

Presenter: Prof. GENES, Claudiu (Max Planck Institute for the Science of Light)

Session Classification: Invited contributions