Séminaire AXE 1 - Sciences et Matériaux Quantiques

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Light-Matter Interactions and Chirality in Optical Fabry-Pérot Cavities: a Mic // Mac Point of View

In this presentation, we will explore from a theoretical point of view, the physical mechanisms at the origin of light-matter strong-coupling developing inside optical Fabry-Pérot cavities, when the cavity-embedded molecules are chosen to be optically active.

We will focus on how to describe interactions between a mesoscopic ensemble of such molecules and several quantized electromagnetic cavity-fields in Coulomb gauge, beyond electric dipole approximation, retaining the effects of magnetic dipole and quadrupole interactions that are necessary to describe optical activity. We will then develop a minimal microscopic model, in which the issue of 2D chirality vs 3D chirality is investigated, and understood in terms of simple analogs borrowed from classical Newtonian mechanics.

We illustrate on simple examples some predictions of this model on the polariton excitation spectrum, induced by molecular gyromagnetic coupling. Consequences on optical observables will be outlined, that could be achievable with state-of-the-art polarimetric technics.

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