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Some aspects of light-matter interactions in chiral Fabry-Pérot cavities

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In this presentation, I will review some recent experimental [1,2] and theoretical attempts [3,4] to design innovative electromagnetic cavities for chiral-sensing purposes or polaritonic chemistry. In particular, I will focus on the interplay between the degree of polarization of the optical cavitymode and the intra-cavity light-matter interactions, exhibiting some difficulties to enhance circular-dichroism in standard optical Fabry-Pérot cavities. I will then provide some general theoretical framework [4,5,6] to describe the rich physical mechanisms that are responsible for the polarization-dependent transmission and absorption signals, developing in linear and reciprocal Fabry-Pérot optical cavities. An example will be shown of helicity-preserving cavity [3,4] made of two photonic dielectric mirrors. A Pasteur medium hosted inside such a cavity is shown to couple efficiently, in a narrow frequency range, to both the output electromagnetic field and to the helicity-preserving cavity mode, thus inheriting an enhanced chiral character. For such cavities, I will show some interesting theoretical predictions, reporting clear signatures of the formation of chiral cavitypolaritons. Some open perspectives in the theoretical modeling [7,8], experimental design and use of such chiral Fabry-Perot cavities in the strong-coupling regime for ultrasensitive chiral sensing in optics or stereochemistry will be given.

References:

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