Centre DE Nanosciences & DE Nanotechnologies

C2N General Seminar

Friday October 18th 2019 - 10h 00

Amphitheater of C2N

"Light interaction with nanoresonators"

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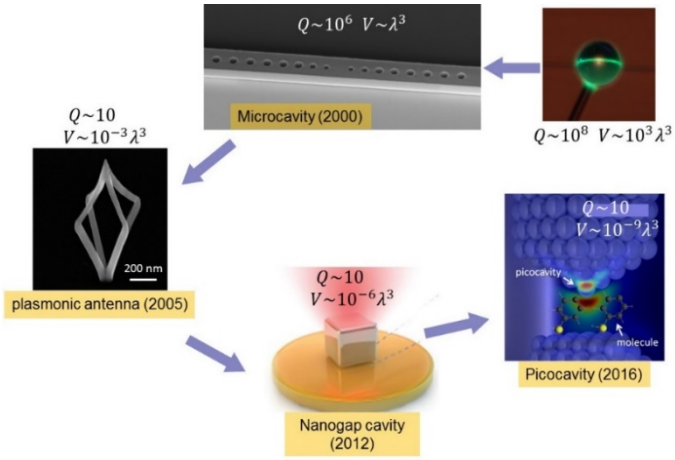
Resonators, be it plasmonic, photonic, micro or pico, are triggering the development of various applications in nanooptics, from quantum information processing, plasmon-assisted lasing, to nanosensing of biomolecules.

The properties of cavities, of any kind, are due to their intrinsic natural resonance modes. Because of dissipation, either by absorption or leakage in the open space, the modes have a finite lifetime. They are eigenstates of a non-Hermitian operator, here the Maxwell's equations.



Two characteristic parameters, which figure prominently in the physics and device applications of cavities, quantify the capability of cavity modes to boost light-matter interactions, the quality factor Q and the mode volume V.

It is therefore important to be familiar with the modes, their Qs, their Vs, their excitation rate by plane waves or near-field sources, their perturbation by tiny objects ... Usually, all these concepts are well comprehended in the limit of Hermitian physics. We will revisit them substantially in the framework of non-Hermitian physics, trying to answer questions such as: how we partition the LDOS between Q and V? Is the definition of Q so evident? Why V should be complex valued? What is the signification of Im(V)?

Philippe Lalanne (CNRS) is an international expert in computational & nanoscale electrodynamics. With his colleagues, he has elaborated powerful modal theories for gratings, photonic-crystal waveguides and nanoresonators. This helped him providing deep insight into key nanoscale optical phenomena and devices, e.g. confinement in photonic-crystal cavities and extraordinary optical transmission, and demonstrating novel nanostructures with record performance in their time, e.g. broadband photon sources, slow-light injectors. Noteworthy, he has pioneered the development of metalenses by arraying nanopillars that impart a local phase shift as a function of their dimension. This allowed the demonstration of the first flat optical elements with high efficiency and large-NA.

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