Master in Photonics – "PHOTONICS BCN"
ERASMUS+ "EUROPHOTONICS"

MASTER THESIS PROPOSAL

Dates: April - September 2020

Laboratory : Quantum Nano-optoelectronics (Koppens group)
Institution: ICFO
City, Country : Castelldefels

Title of the master thesis: Cavity quantum electrodynamics with nano-cavities.

Name of the master thesis supervisor: Frank Koppens
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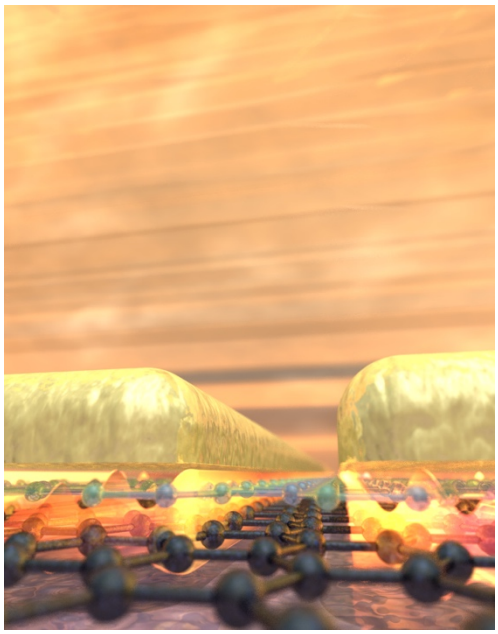
Keywords : cavity quantum electrodynamics

Summary of the subject (maximum 1 page) :

Coupled cavity phonon polaritons - the ability to confine light to subwavelength cavities generally comes at expense of the quality of confinement - the smaller the cavity, the less time we can force light to spend in it. But in a recent (and still ongoing) research work, we have managed to restrict light to extremely subwavelength volumes on the order of just a nanometer. This unprecedented degree of confinement gives rise to very high fields and dramatically enhanced coupling between the cavity modes and nearby quantum entities. The goal of this research project will be to investigate the resultant quantum behaviors enabled by these cavities with spectrally resolved optical measurements. The objective is to touch upon the unexplored physics of the ultra-strong coupling between light and matter. The master's student will acquire optical measurement and nanofabrication skills, working on cutting edge experimental research.



References:

- Probing the ultimate plasmon confinement limits with a van der Waals heterostructure, Science (2018)
- Polaritons in layered two-dimensional materials, Nature Materials (2017).
- Ultrastrong coupling between light and matter, Nature Reviews Physics (2019)

Additional information :

* Required skills : Physics studies

* Miscellaneous : The project will be carried out in the group of Prof. Frank Koppens at ICFO. This group has all the state-of-the-art facilities on 2D material research and technology development, including photoluminescence setups at low temperature and near-field scanning optical microscopes. The work led to more than 80 articles on this topic that have received over 20.000 citations. See:
koppensgroup.icfo.eu
and
graphene.icfo.eu