Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition : 16 Nov. 2015

Responsable du stage / *internship supervisor*:

Nom / *name*:	DUBREUIL	Prénom/ *first name* :	Nicolas
Tél :	01 64 53 34 61	Fax :	
Courriel / *mail*:	Nicolas.dubreuil@institutoptique.fr		

Nom du Laboratoire / *laboratory name*: Laboratoire Charles Fabry

Code d'identification : UMR8501 Organisme : CNRS-Institut d'Optique

Site Internet / *web site*: https://www.lcf.institutoptique.fr

Adresse / *address:* 2 Avenue Augustin Fresnel – 91127 Palaiseau Cedex

Lieu du stage / *internship place*: Palaiseau (France)

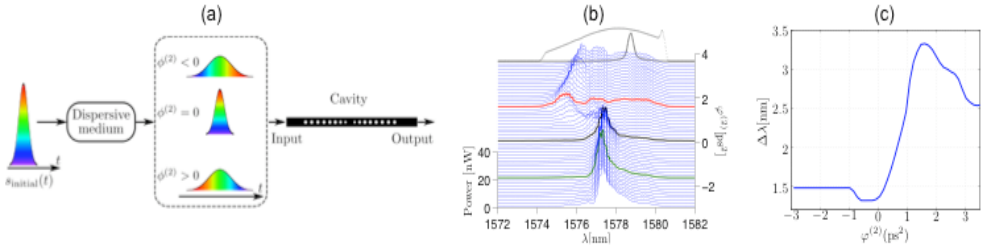
Titre du stage / *internship title*: **Coherent control of nonlinear micro-resonators**

Résumé / *summary*

The strong light confinement achieved in photonic crystal microcavities allows the enhancement of light-matter interactions, including nonlinear interactions. However, the frequency shift dynamics of the cavity resonance, which is driven by nonlinear refractive index change, tends to limit the coupling efficiency under a pulsed excitation. As a result, the cavity enhancement effect is not maintained for the entire pulse duration, even if the latter is longer than the cavity photon lifetime.

In order to preserve the benefit of light localization throughout the pulsed excitation, we have recently reported the first experimental demonstration of coherent excitation of a nonlinear microcavity, leading to an enhanced intra-cavity nonlinear interaction. Although this technique is commonly used to improve light matter interactions, its extension to cavity resonances had only been theoretically investigated.

We have investigated the nonlinear behavior of a Silicon-based microcavity subject to tailored positively chirped pulses (a), enabling to increase the free carrier density generated by two-photon absorption by up to a factor of 2.5 compared with a Fourier-transform limited pulse excitation of equal energy. It is accompanied by an extended frequency blue-shift of the cavity resonance reaching 19 times the linear cavity bandwidth (b-c).



This experimental result highlights the interest in using coherent excitation to control intracavity light-matter interactions and nonlinear dynamics of microcavity-based optical devices. **Following this preliminary experimental result, our objective is to completely study the behavior of the nonlinear behavior of a cavity subject to coherent control. It will be necessary to compare the experiment results with a coupled mode theory. A pump-probe experiment will be set in order to measure the dynamics of intracavity fields.**

- J. Oden, S. Trebaol, P. Delaye and N. Dubreuil, "Coherent excitation of a nonlinear microcavity," J. Europ. Opt. Soc. Rap. Public. **8**, 13046 (2013).
- S. Serna, J. Oden, M. Hanna, C. Caer, X. Le Roux, C. Sauvan, P. Delaye, E. Cassan, N. Dubreuil, "Enhanced nonlinear interaction in a microcavity under coherent excitation", Opt. Express **23**, 29964-29977 (2015)

Toutes les rubriques ci-dessous doivent obligatoirement être remplies

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : YES**

Si oui, financement de thèse envisagé/ *financial support for the PhD*: **Doctoral School EDOM**

Lumière, Matière, Interactions	**X**	Lasers, Optique, Matière	**X**

*Fiche à transmettre (fichier pdf **obligatoirement**) sur le site http://stages.master-omp.fr*