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 :

Responsable du stage / *internship supervisor*:

Nom / *name*: BRAIVE — Prénom/ *first name* : Rémy

Tél : 01 70 27 04 33 — Fax :

Courriel / *mail*: remy.braive@c2n.upsaclay.fr

Nom du Laboratoire / *laboratory name*: Centre de Nanosciences et de Nanotechnologies

Code d'identification : UMR 9001 — Organisme : CNRS

Site Internet / *web site*: c2n.universite-paris-saclay.fr/fr/activites/optomecanique/

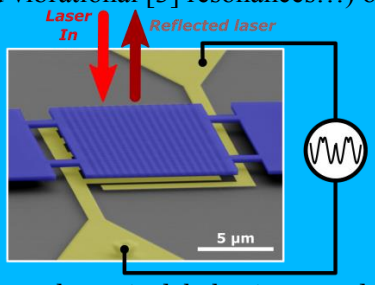
Adresse / *address:* Avenue de la Vauve 91120 Palaiseau - France

Lieu du stage / *internship place*: Palaiseau

Titre du stage / *internship title*: Nonlinear dynamics and chaos with integrated nano-optomechanical resonators

Résumé / *summary*

Optomechanical interactions allow now for reading but also tailoring, via optical forces, the motion of mechanical oscillators such as suspended photonic crystal membranes embedding a high quality factor optical cavity. Integrating mechanical resonant excitation for such structures opens up the scope of possibilities by reaching nonlinear behaviour. Thus we were already able to investigate much nonlinear dynamical behaviour (sub- and super-harmonics resonances [1], stochastic [2] and vibrational [3] resonances…) on such device (figure below).



Suspended photonic crystal membrane (purple) and interdigitated electrode (yellow) placed 400 nm below

Beyond these nonlinear dynamical behaviours, a large variety of noise-assisted phenomena occurring in coupled nonlinear systems is the focus of vivid on-going endeavours, including noise-aided synchronization, chaos and emergence of bifurcation structures.

Nonlinear dynamics in optomechanical resonator can cause both the optical and the mechanical modes to evolve from periodic to chaotic oscillations. Despite recent progress and growing interest on nonlinear dynamical effects occurring in photonic crystal Nano-OptoElectroMechanical systems (NOEMs), optomechanical chaos and stochastic resonance remain largely unexplored experimentally. Further experimental and theoretical studies on such phenomenon in optomechanical systems of higher dimensionality will not only substantially deepen our understanding of noise-induced processes in non-linear NOEMs but also cast the bases for their use in noise-aided high-precision measurements and noise-assisted detection of weak signals. Such platforms also hold great potential for applications due to their integration and possible scaling up to network size.

This work is a multifaceted project which involved nanofabrication in the laboratory clean rooms, laser physics, nanophotonics, high precision optical experiments as well as numerical simulations of the resonators, thus allowing acquiring a broad knowledge in several fields and of many experimental techniques.

The intern will be mainly involved in the investigation of nonlinear optomechanical effects and their simulations. The training may lead to a PhD work, extending the investigation of nonlinear optomechanical effects in network size for metrology.

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***: Yes**

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

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