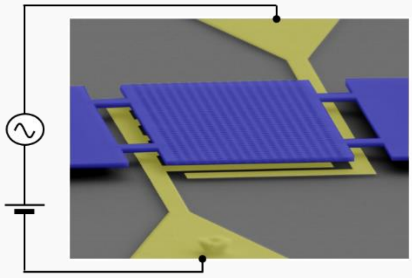
Centre de Nanosciences & de Nanotechnologies

PhD proposal:
Chaos sensing with electro-opto-mechanical photonic crystal

In ordinary consciousness, noise and chaos are associated with the term "hindrance"; it is considered as a nuisance that can lead to communication or signal transmission failure or prevent the detection of a weak signal to be measured. However, intensive investigations, performed in the last decades, have shown that under certain conditions the impact of noise can be counter-intuitively a resource [1]. In nonlinear systems, noise can induce novel regimes leading to the formation of synchronized structures, coherence between the output and the input of resonators or even to the amplification of weak signals. In other words, noise and chaos can play a constructive role, with potential benefits for signal processing or sensing for instance. Chaos in optomechanical system could be relevant for ultra-precision measurement or fundamental tests on the physical conditions for classical dynamics. Because the mixed regular-chaotic dynamics is sensitive to small variations of the system parameters (mass of the system, external induced noise…), such variations can be detected through drastic change in the membrane dynamics. For instance, these could find use in applications such as random number generation and secure communication as well as chaotic optical sensing.



In this frame, we optically study nonlinear and chaotic dynamics assisted by noise in optomechanics with a versatile system whose elementary element is suspended photonic crystal membrane embedding an optical cavity (see figure above). These single or coupled Nano-Opto-ElectroMechanical (NOEMs) resonators could be used as a toy-system to pursue these barely studied effects such as noise-enhanced synchronisation between coupled resonators and chaos. Thus, it could lead to highly sensitive optomechanical sensors triggered by chaotic dynamics.

PhD student will be involved in numerical simulations of the nonlinear and chaotic dynamics. The fabrication in clean-room of C2N will also be part of the project. She/he will also be involved in experimental developments required to address several resonators at the same time enabling the study of synchronised behaviour. The PhD student will be funded by the ANR project "ADOR".

Please send the following application documents to: Rémy BRAIVE (remy.braive@c2n.upsaclay.fr)
- Cover letter expressing your motivation in the position
- CV

[1] Chowdhury et al, Phys. Rev. Lett. 119, 234101 (2017)