



Soutenance de thèse

Lundi 16 septembre 2019

14h00

Centre de Nanosciences et de Nanotechnologies
C2N-CNRS
10 Boulevard Thomas Gobert, 91120 Palaiseau
Amphithéâtre

Rui ZHU

“Integrated nano-optomechanics in photonic crystals”

Jury members:

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Abstract :

High purity reference oscillators are currently used in a wide variety of frequency control and timing applications including radar, GPS, space... Current trends in such fields call for miniaturized architectures with direct signal generation in the frequency range of interest, around few GHz. Recently, novel optomechanically-enhanced architectures have emerged with this purpose. Such optomechanically-driven oscillators not only generate microwave signals directly in the GHz frequency range with possibly low phase noise but also are amenable to a high degree of integration on single chip settings. This PhD work falls within this scope. The optomechanically-driven oscillator under study consists of suspended photonic crystal cavities coupled to integrated silicon-on-insulator waveguides in a three-dimensional architecture. These cavities harbor highly-confined optical modes around 1,55 μm and mechanical modes in the GHz and most importantly, feature a high phonon-photon spatial overlap, all resulting in an enhanced optomechanical coupling. This enhanced optomechanical coupling strength is here probed optically on photonic crystal structures with optimized design. These cavities are hosted in III-V semiconductor materials whose piezoelectricity enable us to integrate additional tools for probing and controlling mechanical vibrations via capacitive, piezoelectric or acoustic driving. This full control over the mechanical modes and optomechanical interaction, paves the way towards the implementation of integrated injection locking circuits of feedback loops for reducing the phase noise of the oscillator.

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