Centre de Nanosciences et de Nanotechnologies

Soutenance de thèse

Lundi 22 novembre
14h00
Centre de Nanosciences et de Nanotechnologies
10 boulevard Thomas Gobert
91120 Palaiseau
Amphithéâtre

Giuseppe MODICA

"Engineering of an integrated time-delayed microwave OMO: Towards an on-chip acoustic feedback control"

Lien visio : https://u-paris.zoom.us/j/89390229526?pwd=dUxmOXlaTkZjWGp2VFI5UDU3TEY3QT09

Jury members :

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Abstract :
A new generation of oscillators based on optomechanical crystals integrated on photonic circuit could lead to the generation of high spectral purity and low phase noise signals directly at the micro-wave frequency. Such device would allow an easy on chip integration at µm scale, where the lack of good quality and miniaturized source is still a severe issue. Here, the architecture we proposed, uses three distinct elements (i) a resonator made by a 1D photonic crystal nanobeam suspended over a silicon waveguide (see fig. 1), sustaining at the same time optical modes around 1.55 µm and mechanical modes around a few GHz; (ii) interdigitated transducers (IDTs) allowing the acoustical excitation and thus a full control of the oscillating structure; (iii) a phononic crystal waveguides to engineer the group velocity of the acoustical waves in order to achieve the desired delay for the stabilization of the oscillations. These three building blocks composing such a system have been carefully investigated during this thesis. They will be singularly introduced and discussed in the main body of the manuscript. Each of them has been studied in depth with simulation, design, nanofabrication and measurements. It will allow us to show the working principles of these integrated systems as well as the specific optimization techniques implemented. Once achieved, this will allow us to demonstrate the targeted objectives for the final implementation in the envisioned complete device. Finally, a first prototype of a complete system integrating an optomechanical oscillators, an IDT and a phononic waveguide will be presented, with preliminary results showing the interactions between the different involved physical domains. The proposed system can be then exploited for potential on-board applications such as navigation and telecommunication systems, metrology or sensing.