Acoustical engineering for integrated optomechanical oscillators

Giuseppe Modica[a], Rui Zhu[a] and R.Braive[a,b]

a. Centre de Nanosciences et de Nanotechnologies, CNRS, Univ. Paris-Sud, Université Paris-Saclay, C2N Marcoussis, 91460 Marcoussis, France

b. Université Paris Diderot, Sorbonne Paris Cité, 75207 Paris Cedex 13, France

∗ giuseppe.modica@c2n.upsaclay.fr

A new generation of oscillators based on integrated optomechanical crystals could lead to high-spectral purity and low phase noise signals directly at the frequency of interest allowing an easy on-chip integration at μm scale (useful for potential on-board applications such as navigation and telecommunication systems, metrology or sensing). In the proposed system, the resonator part is made by a 2D photonic crystal membrane suspended over a silicon waveguide, sustaining optical modes around 1.55 um and mechanical modes around a few GHz. The mechanical excitation and stabilization of such a system will be implemented thanks to Surface Acoustic Waves (SAWs) transducers allowing a full mechanical control of the oscillating structure. Moreover, implementation of phononic crystal waveguides will open a novel way to engineer the group velocity of the acoustical waves in order to achieve the desired delay for the stabilization of the oscillations. Simulation, fabrication and experimental work of resonant mechanical excitation in the GHz range will be discussed with particular emphasis on SAWs transducers and phononic crystal waveguides for acoustic delay engineering (Figure 1).

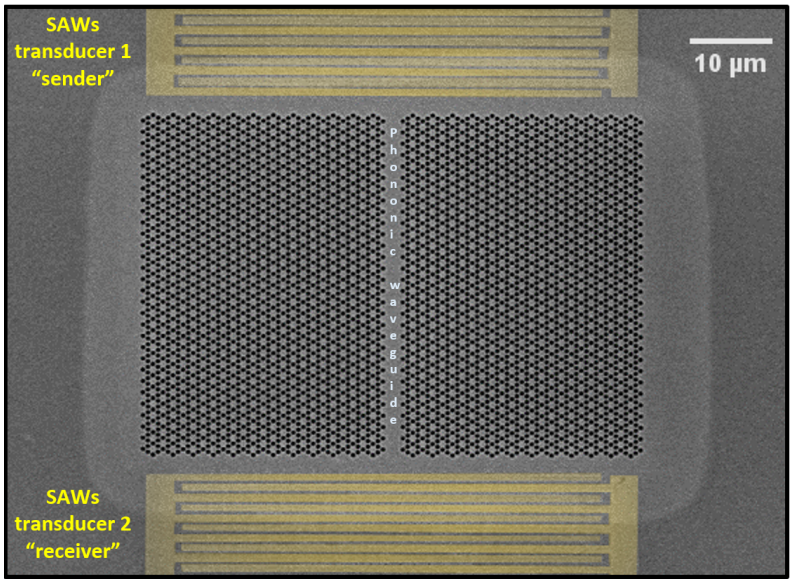

Figure 1: Suspended phononic waveguide, designed to have low group velocity, between two SAWs transducers for transmission measurements.