A 1D phoXonic crystal.

J. Gomis-Bresco[1], **D. Navarro-Urrios**[1], M. Oudich[2], S. El-Jallal[2,3], A. Griol[4], D. Puerto[4], E. Chavez[1], Y. Pennec[2], B. Djafari-Rouhani[2], F. Alzina[1], A. Martínez[4] and C. M. Sotomayor Torres[1, 5, 6].

[1] *ICN2 - Institut Catala de Nanociencia i Nanotecnologia, Campus UAB, 08193 Bellaterra (Barcelona), Spain*

[2]*IEMN, Universite de Lille 1, Villeneuve d'Ascq, France*

[4] *PRILM, Université Moulay Ismail, Faculté des sciences, Meknès, Maroc*

[3]*Nanophotonics Technology Center, Universitat Politècnica de València, Valencia, Spain*

[5] *Dept. of Physics, Universitat Autònoma de Barcelona, 08193 Bellaterra (Barcelona), Spain.*

[6] *ICREA - Institucio Catalana de Recerca i Estudis Avançats, 08010 Barcelona, Spain*

Simultaneous confinement of light and sound in the same cavity generates a strong phonon-photon interaction, named optomechanical (OM) effect. Several implementations provided already proof of concept demonstrations for enhanced telecommunication devices and sensors. And using OM cavities, the basis for quantum phonon computation have already been set and/or propose. A particular case of OM cavities, OM crystals[1] (cavities built using the concepts of photonic and phononic crystals) target high frequency phonons. High frequency phonons have a competitive advantage in terms of isolation to thermal population. Using OM crystals, a recent work[2] achieved occupations of the confined phonon mode below one at moderate cryogenic temperatures.

If the OM cavity is built using a complete phonon bandgap we expect a better limitation of phonon losses, even if reasonable phonon confinement has been achieved without. Cavities with simultaneous bandgap for light and sound are known as phoXonic crystals.

We study the OM interaction in a 1D phoXonic crystal cavity. The cavity consists of a suspended silicon nanobeam made with the repetition of a cell with a centered hole and a centered stub[3]. A defect made by changing appropriately the cell dimensions towards the nanobeam center confines simultaneously light and sound. We present the experimental characterization of such structure, where we have detected by OM transduction modes inside the complete bandgap[4].

1. Eichenfield, M., Chan, J., Camacho, R. M., Vahala, K. J. & Painter, O. Optomechanical crystals. *Nature* **462,** 78–82 (2009).

2. Chan, J. *et al.* Laser cooling of a nanomechanical oscillator into its quantum ground state. *Nature* **478,** 89–92 (2011).

3. Pennec, Y. *et al.* Band gaps and cavity modes in dual phononic and photonic strip waveguides. *AIP Advances* **1,** 041901 (2011).

4. Gomis-Bresco, J. *et al.* A 1D Optomechanical crystal with a complete phononic band gap. 9 (2014). at <http://arxiv.org/abs/1401.1691>