# Phononic Circuits: an Optomechanics-Mediated Demonstration

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In the quest to find low power information processes, phonons offers an attractive possibility. The key mechanism explored here is an strong interaction of coupled photons and phonons: optomechanics. We designed, simulated, realised and characterised a phononic circuit built in a nc-silicon-AlN platform consisting of a phonon source [1], an interaction region of phonons and photons in the form of a waveguide which exhibits switching behaviour [2] and a detector. The circuit operates at room temperature and at low power (< 1 mW) [3] and is based on 1-dimensional nanobeams which exhibit simultaneously a band gap for photons in the THZ regime and for phonons in the GHz range. State-of-the-art optical and mechanical Q-factors are reached at 300 K.

The experimental realization has been described [4] and we demonstrated that optomechanical crystal cavities of Si and nc-Si have optical and mechanical properties that enable non-linear dynamical behaviour based on effects such as thermo-optic/free-carrier-dispersion self-pulsing, phonon lasing 0.3 GHz in self-pulsing mode and at 5.5 GHz in back-action mode. Recently synchronization between two nanobeams has been obtained [5]. Our results open the door to advanced NOEMS as well as quantum applications.

This work was funded by the EU H2020 FET Open project PHENOMEN (All-Phononic Circuits Enabled by Opto-mechanics), GA Nr. 713450.

## References

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## Figures

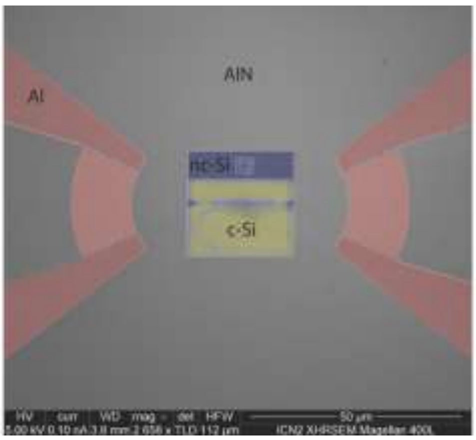


**Figure 1:** The core of the PHENOMEN platform. Left and right in orange depict the interdigitated electrodes for launching and detecting surface acoustic waves. The central square is the heart of the circuit. It includes a nanobeam actuated by a waveguide running in parallel and with a photonic crystal mirror termination This platform was demonstrated at 1 GHz [6] and 2 GHz (To be published).