# From optimal microwave-acoustic transduction to ultra-strong coupling in quantum acoustics


**J. J. Viennot**
A. Hugot, M. Tomasian, Q. A. Greffe, F. Balestro

*Univ. Grenoble Alpes, CNRS, Grenoble INP, Institut Neel, Grenoble, France*

Jeremie.viennot@neel.cnrs.fr


We recently acheived optimal piezoelectric transduction between microwave networks and acoustic networks in lithium niobate, pushing the efficiency-bandwidth product of the transducer to the fundamental limits imposed by the piezoelectric effect [1]. Our approach uses SQUID arrays to transform the large complex impedance of wide-band interdigital transducers to 50 ohms, enabling an efficiency-bandwidth product of 440 MHz, with a maximum efficiency of 62% at 5.7 GHz.

We now extend these principles to the piezoelectric coupling of transmon circuits to acoustic resonators. For appropriate circuit designs (Fig. 1), the transmon-resonator coupling strength is governed solely by the effective piezoelectric constant of the resonator. I will present preliminary experimental results showing transmon circuits coupled to lithium niobate Lamb wave resonators, achieving coupling rates on the order of 700 MHz with resonator linewidths on the order of 1 MHz. These findings highlight the potential of acoustic systems to explore the multi-mode ultra-strong coupling regime, with perspectives for the study of many-body phenomena.

## References


[1] A. Hugot et al., Nature Electronics (2026)


## Figures

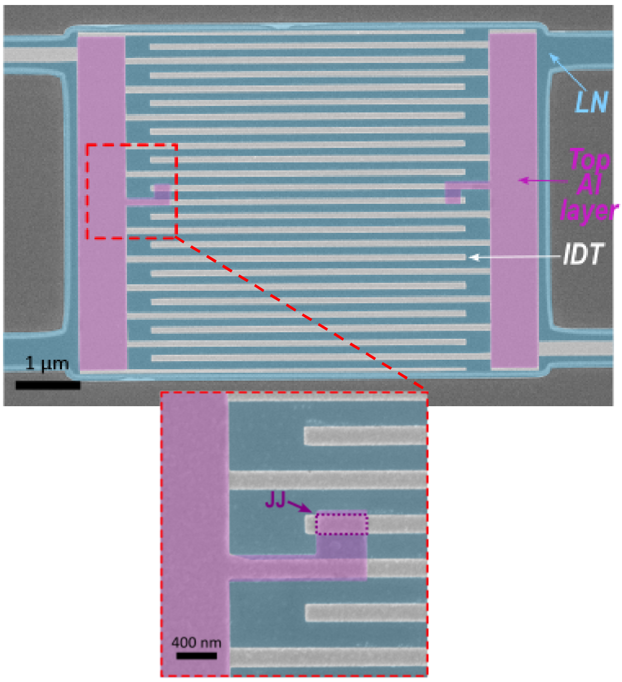


**Figure 1:** Lamb wave resonator made out of lithium niobate (LN) and coupled to a transmon (Josephson junction shown as JJ) via an interdigital transducer (IDT).