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Quantum control of an ultracoherent mechanical resonator with a fluxonium qubit

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Nowadays, the state-of-the-art chip-scale phononic-crystal membranes can achieve lifetimes over 100 s and coherence times in the order of seconds in a thermal environment at 10 mK. [1]. It can be achieved using softly-clamped silicon-nitride membranes (typically in MHz frequency range). The strong coupling between these outstanding mechanical resonators and the superconducting qubits (typically in GHz frequency range), the most promising platform for scalable quantum computers, has been a long-pursued goal since it could open the door to novel quantum technology applications, like record-beating quantum memories, microwave-optical quantum transducers [2] or even fundamental quantum gravity tests [3] by creating superposition of non-gaussian states of the membrane. The main challenge to overcome is reducing the wide frequency difference between both quantum devices, typically 10ˆ3. Inspired by recent works [4], our group had proposed a novel coupling scheme to finally turn the dream into a reality. We developed a 2MHz qubit with state-of-the-art coherence times for such qubit architecture and we are able to produce the membranes with the defect large enough to be coupled with this qubit.
I'd like to present the results on the phononic-crystal membrane that we use and how we can create non-classical states of this membrane using the superconducting qubit as well as result on qubit itself and why it is almost state-of-art qubit in MHz range of frequencies.

References

[1] Y. Tsaturyan, et al. Nat. Nanotech. 12, 776 (2017)
[2] R. W. Andrews, et al. Nat. Phys. 10, 321 (2014)
[3] M. Gely and G. Steele, arXiv:2004.09153 (2021)
[4] J. J. Viennot, X. Ma, and K. W. Lehnert, Phys. Rev. Lett. 121 (2018) 183601

Affiliation de l'auteur principal

Laboratoire Kastler Brossel, CNRS, Laboratoire de Physique de l'ENS, Collège de France, Sorbonne University

Auteurs principaux: GERASHCHENKO, Kyrylo (Laboratoire Kastler Brossel, CNRS, Laboratoire de Physique de l'ENS, Collège de France, Sorbonne University); M. NAJERA, Luis (Laboratoire Kastler Brossel); M. PATANGE, Himanshu (Laboratoire Kastler Brossel); M. JACQMIN, Thibaut (Laboratoire Kastler Brossel); DELEGLISE, Samuel (Laboratoire Kastler Brossel)

Co-auteurs: LEGHTAS, Zaki (LPENS); FLURIN, Emmanuel (CEA); SMITH, Clarke (LPENS); SARLETTE, Alain (INRIA); RIVA, Angela (INRIA)

Orateur: GERASHCHENKO, Kyrylo (Laboratoire Kastler Brossel, CNRS, Laboratoire de Physique de l'ENS, Collège de France, Sorbonne University)

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