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Controlling Mechanical Dissipation through Phononic Bandgap Substrates[1] LAURA CHANG, SRIVATSAN CHAKRAM, YOGESH SHARAD PATIL, MUKUND VENGALATTORE, Cornell University — One of the fundamental challenges for the quantum control of mechanical systems is the realization of resonators with exceptionally low dissipation, through appropriate material choice and resonator and substrate design. Stoichiometric silicon nitride membrane resonators have in recent years emerged as an ultralow loss mechanical platform. In such resonators, we have demonstrated mechanical quality factors as high as 50×10^6 and $f \times Q$ products of 1×10^{14} Hz, with radiation loss to the the supporting substrate being the dominant loss process [1]. We demonstrate the suppression of radiation loss by creating resonators on substrates with a phononic bandgap. We characterize the mechanical properties of these resonators for various substrate parameters and discuss prospects for the observation of quantum optomechanical effects at room temperature.

[1] S. Chakram *et al.* PRL 112, 127201 (2014)

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