Squeezing in a strongly coupled opto-electromechanical resonator

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Opto-electromechanical devices combine the very high position sensitivity of optical readout with strong electrostatic forces. Our on-chip device consists of a high-stress SiN resonator and integrated optical circuits. By placing two electrodes, one fixed and one movable, in close vicinity we obtain very strong electromechanical interactions: the resonance frequency can be tuned over an extremely large range using the electrostatic spring effect, and the nonlinearity of the resonator varied all the way from a stiffening spring to a softening one by changing the applied voltage. When an a.c. voltage at twice the resonance frequency is applied, the thermal motion of the resonator is squeezed. However it is well known that this squeezing cannot exceed 3dB. By measuring the phase-space trajectory of the resonator and adjusting the phase of the parametric drive in real-time we achieve a stationary reduction in both quadratures that is far beyond this limit.