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Atom-assisted quadrature squeezing of a mechanical oscillator inside a dispersive cavity ASOKA BISWAS, ANIL KUMAR CHAUHAN, Indian Institute of Technology Ropar — Measurement of position of a mesoscopic harmonic oscillator below standard quantum limit in cavity optomechanics has seen a growing interest in recent times. If the oscillator is suspended inside the cavity (with both the mirrors fixed) at a position where the cavity frequency becomes extremum (a membrane-in-the-middle setup), large squeezing can be achieved by conditional measurement of thermal photons; however the cavity decay degrades such squeezing. Here we propose an atom-cavity-oscillator hybrid scheme, in which the effect of cavity decay is eliminated via dispersive coupling of the cavity mode. The atom in Λ configuration is considered to be trapped on either side of the membrane inside the cavity. We show that a considerable amount of squeezing (far beyond the 3 dB limit) can be achieved that is not affected by spontaneous emission of the atom. The squeezing depends upon the initial preparation of the atomic states. Further, the external classical fields, that drive the atomic transition and the cavity mode, control the degree of squeezing and can also lead to a strong effective atom-oscillator coupling. Effect of thermal phonon bath on squeezing is studied in terms of the squeezing spectrum. The results are supported by the detailed analytical calculations.

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