Pulsed quantum optomechanics

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Studying mechanical resonators via radiation pressure offers a rich avenue for the exploration of quantum mechanical behavior in a macroscopic regime. However, quantum state preparation and especially quantum state reconstruction of mechanical oscillators remains a significant challenge. Here we propose a scheme to realize quantum state tomography, squeezing, and state purification of a mechanical resonator using short optical pulses. The scheme presented allows observation of mechanical quantum features despite preparation from a thermal state and is shown to be experimentally feasible using optical microcavities. Our framework thus provides a promising means to explore the quantum nature of massive mechanical oscillators and can be applied to other systems such as trapped ions.

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