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Quantum back-action evading measurement of collective mechanical modes MATT WOOLLEY, UNSW Canberra, CASPAR OCKELOEN-KORPPI, ERNO DAMSKAGG, JUHA PIRKKALAINEN, Aalto University, AASH CLERK, McGill University, MIKA SILLANPAA, Aalto University — The standard quantum limit constrains the precision of an oscillator position measurement. It arises from a balance between the imprecision and the quantum back-action of the measurement. However, a measurement of only a single quadrature of the oscillator can evade the back-action and be made with arbitrary precision. Quantum back-action evading measurements of a collective quadrature of two mechanical oscillators, both coupled to a common microwave cavity, have been demonstrated. The work allows for quantum state tomography of two mechanical oscillators, and provides a foundation for macroscopic mechanical entanglement and force sensing beyond conventional quantum limits.

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