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Complex squeezing for force measurement beyond the standard quantum limit SYDNEY SCHREPPLER, University of California, Berkeley, LUKAS BUCHMANN, Aarhus Universitet, JONATHAN KOHLER, University of California, Berkeley, NICOLAS SPETHMANN, University of California, Berkeley, Technische Universitt Kaiserslautern, DAN STAMPER-KURN, University of California, Berkeley, Lawrence Berkeley National Laboratory — Squeezed quantum states are popular theoretical and experimental means of overcoming precision limits set by quantum mechanics. We identify "complex squeezing" as time delayed correlations that can in general not be measured using homodyne or heterodyne detection schemes, but nonetheless arise naturally in measurement devices such as optomechanical systems. In this case, the dispersive coupling between a mechanical element and an electromagnetic resonator causes real ponderomotive squeezing at frequencies away from mechanical resonance, but that squeezing becomes complex closer to resonance, where the system can be operated more sensitively for force detection. We describe a measurement protocol sensitive to complex squeezing and show how it can lead to enhanced sensitivity of force measurements using optomechanical oscillators.

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