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Quantum back action cancellation in the audio band JONATHAN CRIPE, TORREY CULLEN, Louisiana State University, YANBEI CHEN, California Institute of Technology, PAULA HEU, DAVID FOLLMAN, GARRETT COLE, Crystalline Mirror Solutions LLC and GmbH, THOMAS CORBITT, Louisiana State University — We report on the cancellation of quantum back action noise in an optomechanical cavity. We perform two measurements of the displacement of the microresonator, one in reflection of the cavity, and one in transmission of the cavity. We show that measuring the amplitude quadrature of the light in transmission of the optomechanical cavity allows us to cancel the back action noise between 1 kHz and 50 kHz, and obtain a more sensitive measurement of the microresonator's position. To confirm that the back action is eliminated, we measure the noise in the transmission signal as a function of circulating power. By splitting the transmitted light onto two photodetectors and cross correlating the two signals, we remove the contribution from shot noise and measure a quantum noise free thermal noise spectrum. Eliminating the effects of back action in this frequency regime is an important demonstration of a technique that could be used to mitigate the effects of back action in interferometric gravitational wave detectors such as Advanced LIGO.

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