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Phase Sensitive Optomechanical Amplifier for Quantum Noise Evasion in Interferometric Sensors AARON MARKOWITZ, GAUTAM VENUGOPALAN, KEVIN KUNS, Caltech, YUNTAO BAI, Princeton, CHRIS WIPF, YANBEI CHEN, RANA ADHIKARI, Caltech — When making quantum-limited optomechanical measurements, one can improve sensitivity beyond the standard quantum limit by taking advantage of correlations in the observables of the squeezed sensing light field. However, optical losses mix unsqueezed vacuum field into the squeezed sensing field, thus increasing quantum noise in the observable containing the signal. We present a phase-sensitive ponderomotive pre-amplifier consisting of a pumped traveling wave cavity, balanced in a Mach-Zehnder interferometer to reduce sources of technical noise. Squeezed, signal-dominated input fields are amplified far above the vacuum level, so downstream losses do not significantly degrade the measurement signal-to-noise. We analyze the utility of this amplifier for a LIGO-type interferometer, and this class of device is applicable to many interferometric sensors.

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