Physics > Optics

Negative Backaction Noise in Interferometric Detection of a Microlever

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Interferometric detection of mirror displacements is intrinsically limited by laser shot noise. In practice, however, it is often limited by thermal noise. Here we report on an experiment performed at the liquid helium temperature to overcome the thermal noise limitation and investigate the effect of classical laser noise on a microlever that forms a Fabry-Perot cavity with an optical fiber. The spectral noise densities show a region of negative contribution of the backaction noise close to the resonance frequency. We interpret this noise reduction as a coherent coupling of the microlever to the laser intensity noise. This optomechanical effect could be used to improve the detection sensitivity as discussed in proposals going beyond the Standard Quantum Limit.

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