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Mitigating back-scattered light with dual-homodyne readout

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Back-scattered light results in parasitic modulations of the output light of gravitational-wave observatories. It constitutes a major noise source at low audio-band frequencies. Modulations due to the back-scattered light appear both in phase and amplitude quadratures of the output light. It is proposed to use dual-homodyne detection to measure both quadratures and to discriminate between GW signal and scattered light for consequent subtraction of the parasitic signal from the h(t) strain data. The use of two-mode squeezed light allows to take advantage of quantum enhancement in the detector without suffering the penalty for dual-homodyne readout. The proof of principle was researched in the recent years [1-2]. We discuss its extension to the case of the frequency-dependent squeezing and application in future detectors.

[1] M. Meinders, R. Schnabel, Sensitivity improvement of a laser interferometer limited by inelastic back-scattering, employing dual readout, Class. Quantum Grav. 32, 195004 (2015).
[2] M. Ast, S. Steinlechner, R. Schnabel, Reduction of Classical Measurement Noise via Quantum-Dense Metrology, Phys. Rev. Lett. 117, 180801 (2016).

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