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Mitigating back-scatter light with quantum-enhanced dual homodyne readout

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Back-scatter light is one of the main technical limitations on the sensitivity of the detectors. Minimizing it requires significant effort in optimizing surfaces, implementing baffles and other advanced instrumentation techniques. As the last line of defense, the dual homodyne readout was proposed to sense and subtract the noise introduced by back-scattered light. However, till now this approach was not compatible with frequency-dependent squeezing. In our work we extend the dual homodyne approach to take full advantage of frequency-dependent squeezing. We theoretically study the concept and discuss its advantages, possible configurations and potential limitations. Crucially, we show that quantum-enhanced dual homodyne readout can be implemented without modification of the core optical design. We further discuss its applications in GW detection beyond mitigation of back-scatter light.

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