Nondegenerate internal squeezing: An all-optical, loss-resistant quantum technique for gravitational-wave detection

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The detection of kilohertz-band gravitational waves promises discoveries in astrophysics, exotic matter, and cosmology \cite{1}. At kilohertz frequencies, e.g. 1–4 kHz, interferometric gravitational-wave detectors are limited by the quantum nature of light \cite{2}.

In this theoretical study using an analytic Hamiltonian method, we show that our proposed technique \cite{3} of using quantum squeezed light generated directly inside the detector with distinct frequencies is tolerant to detection losses unlike previously proposed schemes for quantum enhancement \cite{4}. We also show that this all-optical technique is feasible for sensitivity improvements of gravitational-wave detectors in a broadband fashion when combined with an optimal readout scheme. This broadband sensitivity could increase the astrophysical range of future detectors to the observable universe.

\begin{thebibliography}{9}
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