Squeezing-enhanced measurement sensitivity in a cavity optomechanical system

We determine the theoretical limits to squeezing-enhanced measurement sensitivity of mechanical motion in a cavity optomechanical system. The motion of a mechanical resonator is transduced onto quadrature fluctuations of a cavity optical field and a measurement is performed on the optical field exiting the cavity. We compare measurement sensitivities obtained with coherent probing and quantum-enhanced probing of the mechanical motion, i.e. the coherent probe field carries vacuum states and quadrature squeezed vacuum states at sideband frequencies, respectively. We find that quantum-enhanced probing provides little to no improvement in motion sensing for resonators in the unresolved sideband regime but may significantly increase measurement sensitivities for resonators in the resolved sideband regime.

General information
State: Published
Organisations: Department of Physics, Quantum Physics and Information Technology, University of Queensland
Number of pages: 8
Pages: 107-114
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Annalen der Physik
Volume: 527
Issue number: 1-2
ISSN (Print): 0003-3804
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.35 SJR 0.915 SNIP 0.801
Web of Science (2017): Impact factor 2.557
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.7 SJR 1.469 SNIP 1.077
Web of Science (2016): Impact factor 3.039
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.32 SJR 1.435 SNIP 1.205
Web of Science (2015): Impact factor 3.443
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.94 SJR 1.403 SNIP 1.126
Web of Science (2014): Impact factor 3.048
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.27 SJR 0.709 SNIP 0.643
Web of Science (2013): Impact factor 1.483
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.06 SJR 0.869 SNIP 0.668
Web of Science (2012): Impact factor 1.51
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.72 SJR 0.522 SNIP 0.627
Web of Science (2011): Impact factor 0.841
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.854 SNIP 0.81
Web of Science (2010): Impact factor 0.861
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.966 SNIP 0.976
BFI (2008): BFI-level 1