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Gravitational sensing with weak value based optical sensors. (English) Zbl 1423.81025
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Summary: Using weak value amplification angular resolution limits, we theoretically investigate the gravitational sensing of objects. By inserting a force-sensing pendulum into a weak value interferometer, the optical response can sense accelerations to a few 10 's of zepto-g $\text{Hz}^{-1/2}$, with optical powers of 1 mW. We convert this precision into range and mass sensitivity, focusing in detail on simple and torsion pendula. Various noise sources present are discussed, as well as the necessary cooling that should be applied to reach the desired levels of precision.

MSC:

- 81P15 Quantum measurement theory, state operations, state preparations
- 46G10 Vector-valued measures and integration
- 81V80 Quantum optics
- 83B05 Observational and experimental questions in relativity and gravitational theory
- 85A99 Astronomy and astrophysics

Keywords:

weak value amplification; optical sensing; gravimetry; gravity gradiometer

Full Text: [DOI](#)

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