Infrasound gravitational wave detection with atom interferometers

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Atom interferometry offers a perspective for the detection of gravitational waves in a frequency band between eLISA [1] and Advanced LIGO [2]. Several proposals exist, and many aspects relevant for the atom optics were discussed for a future implementation. Ground based setups with vertical [3] or horizontal baselines were considered [4], satellite missions investigated [5], and interferometer topologies developed [5,6]. The research is still ongoing to identify the most suitable concept, and to mitigate demanding requirements. We investigate a novel geometry for a ground based device combining several advantages as (i) a horizontal baseline, enabling long baselines, (ii) a single axis laser link between the atom interferometers acting as phasemeters, and (iii) suppressing errors sources otherwise implying very strict requirements onto the atomic source. It is based on recent developments in symmetric large momentum beam splitters [6], relaunching techniques for suspending the atoms against gravity [7], and delta-kick collimation techniques to generate atomic ensembles with very low expansion rates [8]. We will present the geometry, discuss the requirements, and make a comparison with previous proposals and the state of the art in atom optics.

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