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Developing a toolset for adjustable picometer- stable interferometers for future gravitational wave detectors

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Optical benches for low-frequency, picometer-stable laser interferometry, as used in the space-based gravitational wave detector LISA, are usually made by bonding silicate glass components to an ultra-low-expansion glass ceramic. To provide ground-support equipment for the mission and for testing parts of the instruments we are studying a toolset to realize picometer-stable interferometers which, in contrast, are adjustable. For this we use an ULE-ceramic baseplate with thermally compensated optical mounts which are mounted in the bench using invar insets, screws and clamps. Our toolset will be placed inside a vacuum chamber to suppress temperature noise and reach a stability of 1 pm/√Hz down to 3 mHz. A testbed for adjustable ultra-stable interferometers might have further applications in other, future gravitational wave detectors on the ground and in space. We present the current status of our set-up and the concept of a heterodyne laser locking experiment to verify the stability of our approach before implementing a larger-scale optical bench.
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Primary authors: Dr DARSOW-FROMM, Christian (Universität Hamburg); BECK, Marcel (Universität Hamburg); GERBERDING, Oliver (Universität Hamburg)

Presenter: BECK, Marcel (Universität Hamburg)

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