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Testing athermal glass as laser frequency reference for interferometric sensors

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Improving the sensitivity of existing and future ground-based gravitational-wave detectors will enable us to detect more astronomical sources with higher precision. As the gravitational-wave signals are strong and present for a longer time in the low-frequency regime, it would be beneficial to extend the current sensitivities to lower frequencies (< 10Hz). However, seismic noise coupling into the test masses (TMs) of the detectors is acting as a major limitation and this could be tackled with active isolation with improved inertial sensors. Opto-mechanical inertial sensors with laser interferometric displacement readout are one of the major technologies studied for this. Such interferometers often require a highly stable laser frequency reference to suppress laser frequency noise coupling in due to unequal arm-length. We propose a high-finesse etalon made-up of 'athermal glass'as a potential candidate for this purpose. The athermal material can compensate for the effects of various noises on the frequency stability by maintaining a constant optical length of the cavity. In this poster, we discuss results from the primary simulations of athermal cavities and initial experimental results on our laser stabilization experiment that we plan to use to characterize such etalons.

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