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MODELLING THE THERMAL DIAGNOSTICS EXPERIMENTS FOR LISA PATHFINDER'S FREE-FALLING TEST MASSES

Abstract

The LISA Technology Package (LTP) onboard the LISA Pathfinder spacecraft is intended to measure relative motion between two test masses in drag free conditions, with a precision of picometers in the bandwidth of mHz by means of interferometry, so as to demonstrate the technology required for a future space-borne gravitational wave observatory.

At such low frequencies, different physical effects appear in the system perturbing the cleanliness of the interferometer signal, amongst them the thermal fuctuations on different thermal-sensitive parts of the LTP. To deal with them, series of thermal diagnostic experiments are being designed to characterise the different thermal induced noise consequences in the LTP. Such experiments consists of injecting heat loads at specifc spots while the variations on the interferometer signal and on different temperature sensors are carefully measured (temperature measurements precision of $\sim 10^{-5}$ K/sqrt(Hz) at 1mHz), with the final aim of removing the thermal noise components from the interferometer readouts.

In this paper I will report on how these experiments are being designed, modelled and simulated at IEEC, including the expected signals associated to the temperature sensors and to the interferometer.