Title: Thermo-elastic and thermo-optical effects on-board LISA Pathfinder

Thermal gradients on board the LISA Pathfinder mission can induce effects with a potential impact to perturb the main differential acceleration measurement between both free-falling test masses.

Temperature gradients across the housing induce forces through three different effects, namely asymmetric outgassing, radiation pressure and radiometer effect. The latter is related to the residual gas pressure around the test mass and, therefore, allows the estimation of the Brownian noise contribution, one of the limiting noise contributions for a future observatory like LISA.

Apart from thermal forces arising due to gradients around the test mass, thermo-optical and thermo-elastic effects can also contribute to the instrument noise. There are two locations where such a distortion can be critical. First, the optical window, i.e. the interface between the optical bench and the test mass. This optical element ---the only not bonded on the Zerodur optical bench--- is clamped in a Titanium ring and therefore is susceptible to mechanical stress or changes in the refractive index due to thermal gradients across the glass. The second location are the struts holding the optical bench inside the thermal shield acting as the main thermal link to the outside (thermally noisier) environment. Temperature changes in these structures can induce net displacements or tilts of the bench with direct impact on the interferometer read-out.

During the LISA Pathfinder mission we have carried out several experiments by which we characterized and quantified the previous effects. The aim of this talk is to show the impact of thermo-elastic and thermo-optical effects, that we have obtained by analyzing the experiments, on the main differential acceleration measurement. In the same way we want to give an estimate of the impact of these thermal effects for the LISA mission.