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# LISA-Band Optical Pathlength Stability Measurements of the Structural Thermal Model of LISA's Telescopes

**Abstract**

The Laser Interferometer Space Antenna (LISA) will reveal portions of the gravitational wave (GW) spectrum invisible to the ground-based GW detectors and pulsar timing arrays. LISA is joint ESA-NASA mission, and one of NASA's primary contributions is providing the telescopes responsible for focusing and collecting the laser light transmitted from and received by each of the 3 spacecraft. That light is used in interferometry-based inter-spacecraft length measurements. To meet the desired strain sensitivity in the LISA band, varying optical pathlength noise introduced by the telescopes, via any mechanism, should be well below one picometer in the band of few mHz to 1 Hz at which LISA is the most sensitive. The University of Florida has been enlisted to demonstrate that this is possible by confirming that the length stability of the structural thermal model (STM) of the LISA telescope meets these stringent requirements. In our presentation we illustrate the measurement process for verifying the telescope stability requirement in a ground-based laboratory. Then, we go over significant noise sources that have made such stability testing difficult, and continue with the workarounds that we have utilized and that may be useful for similar work in the future. Finally, we discuss preliminary results, showing we are already meeting our stability goals over a large portion of the LISA band and the capability of our reference system for future LISA-related tests at UF.