



Contribution ID: 28

Type: **not specified**

Updates on silica fibers production and characterization for future gravitational waves detectors

Friday, 25 October 2019 15:35 (25 minutes)

The observation of gravitational waves is highly influenced by the detectors sensitivity, that is limited for the low frequencies (10 -100 Hz) by the thermal noise. For this reason, the monolithic suspensions are one of the most important upgrades of the interferometric detectors including Advanced Ligo (aLigo) and Advanced Virgo (AdV). Currently the silica fibers are built to minimize the thermal noise in the band of interest and to fit the load constraints. Nevertheless, the need to have larger reference masses for the future updates of Virgo and also for the future 3G detectors, requires redesigning the fibers, and all the facilities for their production, testing and characterization. The new fibers for Advanced Virgo Plus (AdV+) will be 50% thicker to deal with a working load four times higher, thus the fabrication system requires a more accurate power stabilization of the CO₂ laser in order to control the melting process of the silica more precisely and all the testing facilities have to be updated and, in some cases, completely redesigned for the new high requirements. Furthermore, we aim to study the behavior of the pristine fibers under static and dynamic fatigue in order to achieve a consistent model of lifetime prediction for maintenance and security reasons.

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Session Classification: Advanced cryogenics