Contribution ID: **62** Type: **not specified**

Ultra-high resolution temperature sensing using Whispering-Gallery-Mode resonators.

Wednesday 26 November 2025 16:30 (15 minutes)

As ultra-high resolution thermometry gains prominence in fields of experimental and applied physics, the demand for diverse and innovative technologies becomes imperative. This is particularly crucial as applications extend to lower frequency windows, as exemplified by space-borne gravitational wave observatorieslike LISA (Laser Interferometer Space Antenna), operating in the Hz-mHz window. To address this challenge, existing solutions based on resistive sensors can achieve micro-kelvin sensitivities (until limited by electronic or fundamental noise). Optical sensors present an opportunity to further enhance resolutioncapabilities. In this work we showcase the efforts and steps being taken into developing a thermometry subsystem using optical devices with potential to reach tens of nKHz−1/2 in the Hz-0.1mHz window, as well as the test-bench designed for the characterisation of such a challenging noise floor requirement. The sensor itself is a Whispering Gallery Mode Resonator (WGMR), that is a MgF2 birefringent monolithic disc shaped cavity whose resonant modes are very sensitive to environment fluctuations. This makes them very precise sensors for temperature, humidity, pressure and as bio-sensors. This kind of opto-mechanical device has already been used as thermal sensor before, achieving remarkable sensitivities in the order of nKHz−1/2 in high frequency band (Hertz). We also investigate orthogonally polarized mode interactions in this type of optical cavity, to explore novel means for sensitivity enhancement.

Author: Mr GUALANI GUALANI, Vivek (Institute of Space Sciences - CSIC)

Co-authors: Ms MORAS, Alba (Institute of Space Sciences - CSIC); Mrs SALVANS TORT, Josep (Institute of Space Sciences - CSIC); NOFRARIAS, Miquel

Presenter: Mr GUALANI GUALANI, Vivek (Institute of Space Sciences - CSIC)

Session Classification: Parallel Astro