Compact and ultrastable infrared laser for ground tests of the LISA payload

Joannès Barbarat[1], Jonathan Gillot*[1], Hector Alavarez-Martinez[1], Rodolphe Le Targat[1], Paul-Eric Pottie[1], Philip Tuckey[1], Peter Wolf[1], and Ouali Acef[1]

[1]Systèmes de Référence Temps Espace – Université Pierre et Marie Curie - Paris 6, Institut national des sciences de lÚnivers, Observatoire de Paris, Centre National de la Recherche Scientifique : UMR8630, Institut national des sciences de lÚnivers, Institut national des sciences de lÚnivers, Institut national des sciences de lÚnivers – France

Résumé

We plan to develop a compact and transportable iodine frequency stabilized laser setup, as part of the French activities by a consortium of several partners for assembly-integration and ground tests of the LISA payload. We take advantage of an existing laser frequency stabilization experiment based on a Telecom laser diode at 1542 nm, frequency tripled and stabilized against a narrow iodine line at 514 nm. The residual frequency noise already achieved for this experiment is below the LISA mission requirements. We achieve a reproducible frequency stability below 5x10-14t-1/2 decreasing to 3.5x10-15 level after 200 s of integration time. It corresponds to an amplitude spectral density of the frequency fluctuations < 20 Hz/(Hz)ˆ(1/2). Furthermore, we demonstrate the ability to transfer the frequency stability achieved around 1.5 μm to the near infrared range, close to 1 μm, in a simple manner, using the usual phase locking loop technique associated to a second harmonic generation process. Thus, we propose to provide a 1064 nm laser source phase-locked to an iodine stabilized Telecom laser operating at 1596 nm. The compact design of the whole setup will make it easily transportable to different sites and could be readily used for ground tests of the LISA payload.

*Intervenant