Post Doc Proposal

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Ultra-stable frequency laser development
For ground tests of the payload of LISA mission

Iodine frequency stabilized laser sources on narrow hyperfine transitions in the visible have demonstrated -over the two last decades-, residual frequency instabilities which can meet the requirements of many ground or space projects, such as LISA, mSTAR, GRACE FO, or for inter-satellite or ground to space optical links, etc.....
Usually, these developments involve frequency doubled lasers emitting around 1 µm (Nd: YAG or laser Yb) to interrogate the iodine vapor. We have recently demonstrated the ability to bridge the frequency gap between the Telecom and the green ranges of the optical domain, using a highly efficient frequency tripling process, yielding to an optical conversion efficiency $P_{3w}/P_w > 36$ % [1]. Our approach makes possible the frequency stabilization of any laser source emitting in the C or L Telecom bands (1535 nm to 1600 nm), on one among thousands narrow iodine hyperfine transitions located in the green range. We have already demonstrated a frequency stability of $\sim 2 \times 10^{-14}\, t^{-1/2}$, conferred to a laser diode at 1542 nm.
We offer a one-year post-doc position, which may be extended, to develop an ultra-stable frequency laser setup dedicated to the ground tests of the payload of the LISA mission (Laser Interferometer Space Antenna). The experimental architecture is based on a combination a pair of 1064 nm lasers, phase locked to a Telecom laser frequency reference [2].
This work, based in part on previous work [3], will use an innovative approach for the frequency stabilization purpose. At the end, the whole experimental setup will be transferred to the french space agency CNES (Centre National d'Etudes Spatiales), which coordinate activities of LISA-France consortium gathering more than ten french laboratories for the AIVT of the LISA mission.

[1]: Ch. Philippe, « Efficient third harmonic generation of a CW-fibered 1.5 µm laser diode », Appl. Phys. B (2016), https://doi.org/10.1007/s00340-016-6542-5
[2]: N. Chiodo, « Optical phase locking of two infrared CW lasers separated by 100 THz", Opt. Lett., Vol. 39, N°10, 2014. http://dx.doi.org/10.1364/OL.39.002936
[3]: J. Barbarat, "Compact and Transportable Iodine Frequency Stabilized Laser", Proceedings International Conference on Space Optics , ICSO 2018; Vol. 111800T (2019), https://doi.org/10.1117/12.2535948