

LNE-SYRTE, Observatoire de Paris, France, is proposing an M2 internship in experimental Physics on:

# Ultrastable laser for a transportable Ytterbium optical lattice clock

## Description

**Description:** The frequency of Optical Lattice Clocks - based on the probing of the narrow transition  $^1S_0 \rightarrow ^3P_0$  of  $\sim 10^4$  neutral cold atoms trapped in a "magic" optical lattice - can now be controlled at the 18 digits level. This makes them the most precise instruments ever built, which opens the possibility of applying this capacity to new fields of science: tests of General Relativity (Lorentz invariance, possible drift of fundamental constants), quest for dark matter, or sensing of the geopotential (chronometric geodesy). In this perspective, LNE-SYRTE is starting the development of a transportable optical lattice clock based on Ytterbium: the device will exploit the Equipex REFIMEVE+, a fiber network disseminating an ultrastable reference at 1542 nm over the French territory, in order to perform measurements of the Earth gravitational potential. The clock will be notably equipped with a transportable optical frequency comb allowing the referencing of all the necessary lasers and radio-frequency signals to the 1542 nm reference.

The intern will develop the stabilization of a 578 nm laser to a high finesse ( $\sim 300\,000$ ) Fabry-Perot optical resonator by the Pound-Drever-Hall control technique. She/he will notably be in charge of the optical setup, she/he will benefit from the support of the electronics department to implement the feedback loop, and she/he will develop a Python software to allow the automatic control of the system. Finally, the candidate will evaluate the sensitivity of the system to vibrations with the assistance of seismometers.

**Start date:** Spring 2021

**Work place:** LNE-SYRTE, Observatoire de Paris, France

**Field:** ultrastable lasers, atomic clocks, cold atoms.

**Framework:** The project is funded by ANR (Agence Nationale pour la Recherche), and by DIM SIRTEQ (Science et Ingénierie en région Île-de-France pour les technologies quantiques)

## Profile

The candidate must have a strong interest for experimental work, lasers, electronics and Python programming. The candidate will work in an international team of about 4 people, a good team spirit, as well as a good knowledge of English, are therefore absolutely necessary.

## Contact

Send a motivation letter and a CV to **Rodolphe Le Targat**, [rodolphe.letargat@obspm.fr](mailto:rodolphe.letargat@obspm.fr), +33 (0)1 4051 2344