SYRTE l'Observatoire de Paris | PSL
SYstèmes de Référence Temps-Espace

M1 or M2 Internship

FIRST TF

SYRTE, Observatoire de Paris, France, proposes an M1 or M2 internship in experimental Physics on:

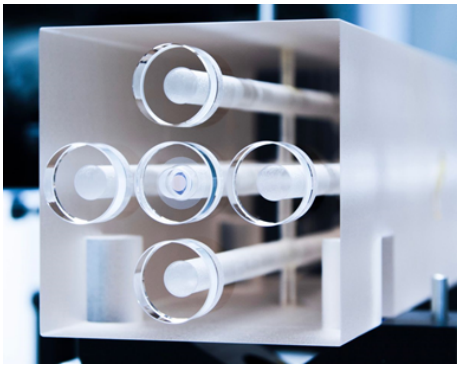
1542 nm ultrastable laser for probing an ensemble of atomic clocks

Description

The frequency of Optical Lattice Clocks - based on the probing of the narrow transition $^1S_0 \rightarrow {}^3P_0$ of $\sim 10^4$ 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, with applications in General Relativity (Lorenz invariance, possible drift of fundamental constants), quest for dark matter, or sensing of the geopotential (chronometric geodesy).
In order to fully benefit from the quantum projection noise limit set by the atoms, an ultrastable laser as spectrally narrow as possible is required to probe the reference transition. In this perspective, SYRTE has started the development of a high finesse ($\sim$ 300 000) 40-cm long 1542 nm ultrastable Fabry-Perot cavity equipped with mirrors featuring a crystalline coating in order to decrease the thermal noise limit. Once all the technical sources of noise are under control, a laser locked to this device is expected to reach a linewidth below 10 mHz, which would be a world record.

The intern will experimentally work on aspects that presently limit the performance of the setup, notably:

- development of a stabilization technique to control the residual amplitude modulation affecting the symmetry of the error signal
- quantify the sensitivity of the cavity to vibrations and measure them with seismometers
- program (Python) a feedforward loop to control the vibrations



She/he will notably be in charge of the optical setup, the acquisition and the exploitation of the data of seismometers. She/he will benefit from the support of the electronics department to implement the feedforward loop, and from assistance of the optical frequency combs teams to measure the stability of the cavity.

Start date: Early 2023, possibility for M2 students to start a PhD thesis on the application of ultrastable lasers to a transportable Ytterbium lattice clock.

Work place: SYRTE, Observatoire de Paris, 77 Avenue Denfert-Rochereau, 75014 Paris, France

Field: ultrastable lasers, optical frequency combs, Fabry-Perot cavities

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