

Post-doctoral position at FEMTO-ST

FEMTO-ST – CNRS UMR6174 – Time and Frequency Dpt.

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Compact optical clock with trapped Ytterbium ions

We are looking for an experienced AMO experimentalist with a background in ion trapping to join our compact optical clock project. We are currently developing an optical clock based on the Yb⁺ 435.5 nm transition frequency, with a target fractional frequency stability below $10^{-14}\tau^{-1/2}$ and < 500 L volume. The apparatus is based on a surface-electrode trap similar to those traditionally used in QIP experiments [1], with a high ion-to-electrode distance to reduce the impact of anomalous heating. We have developed the optical bench for ion manipulation, including laser frequency stabilization [2] and optical second harmonic generation to reach the clock frequency [3].

We are currently testing our ion trapping setup with a prototype chip, and an upgraded trap will soon be produced at our local cleanroom. The successful candidate will join the experimental work on the trap characterization, including lifetime and heating rate measurements. He will then implement the frequency stabilization of the clock laser on one of the laboratory ultra-stable Fabry-Perot cavities at 1.5 μm , using an optical frequency comb to bridge the gap between the two optical frequencies, and perform the first spectroscopic characterization of the clock transition

The clock is being developed within the OHMS team (Oscillators, Clocks, Metrology and Systems) from the Time and Frequency Department of the FEMTO-ST institute. Among other works, the OHMS teams develops ultra-stable Fabry-Perot cavities, Cs cell CPT atomic clocks, as well as cryogenic sapphire oscillators. The candidate will have the opportunity to work in a high-level environment in an internationally recognized time and frequency metrology laboratory, benefiting from high-end metrological characterization equipment and know-how. The team is a first-circle member of the French metrology network FIRST-TF, and a member of the REFIMEVE+ project, which physically links our institute to the SYRTE laboratory in Paris.

Preference will be given to candidates with experience in ion trapping. Other useful skills include:

- Atom laser cooling and trapping
- Optics and guided optics
- Frequency metrology
- Optical frequency combs - femtosecond lasers

References:

- [1] Compact Yb⁺ optical atomic clock project: design principle and current status, C. Lacroûte *et al.*, *J. Phys.: Conf. Ser.* 723(1), 012025, 2016.
- [2] Frequency stability of a wavelength meter and applications to laser frequency stabilization, K. Saleh *et al.*, *Applied Optics* 54 (32), p. 9446-9449, 2015.
- [3] Residual Phase Noise Measurement of Optical Second Harmonic Generation in PPLN Waveguides, M. Delehaye *et al.*, *IEEE Photonics Technology Letters* 29 (19), p. 1639-1642, 2017.