

Stage de master de physique / Physics Master Internship

Proposition de stage/ Internship proposal

Date de la proposition : 31/10/2023

Responsable du stage / internship supervisor:

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Nom du Laboratoire / laboratory name:

Code d'identification : UMR8630 Organisme : SYRTE, Observatoire de Paris
Site Internet / web site: <https://syрте.obsрm.fr/>
Adresse / address: 77 avenue Denfert-Rochereau, 75014 Paris
Lieu du stage / internship place: SYRTE, Observatoire de Paris

Titre du stage / internship title: Physics package for a field-deployable optical lattice clock

Résumé / summary

Optical lattice clocks, which consist in probing an ultra-narrow optical transition of a set of ultra-cold atoms in a dipolar optical lattice are now the best frequency standards, with uncertainties in the 10^{-18} range, and are well positioned to replace the Cs atom for the next definition of the SI second. They now have enough maturity and potential applications (e.g. in time keeping, geodesy, and fundamental physics) to be developed by companies specialized in quantum sensors. A European consortium has been funded by a EC Quantum Flagship project, gathering industries (Menlo Systems, EXAIL, NKT photonics, Vexlum, Quix quantum), metrology institutes (SYRTE, PTB), academic partners (University of Amsterdam, University of Toruń). Its name: "The AQuRA clock" <https://www.aquclock.eu>. Its goal : developing a prototype for a field-deployable strontium optical lattice clock. In this project, SYRTE is responsible for designing and building the clock's physics package, i.e. the vacuum environment in which the atoms are produced, cooled, trapped and probed, together with the associated optical system and control software.

The aim of this internship is to participate to the assembly of the physics package, including the Ultra-High-Vacuum environment, and the optical benches and collimators. The intern will be in close contact with the Sr lattice clocks teams at SYRTE, with PhDs and post-doc working on high performance laboratory optical clocks.

The internship can be followed by a PhD thesis, whose aim is to demonstrate the operation of the transportable clock in field conditions, including :

- validation of the physics package of the AQuRA clock at SYRTE (atom trapping and probing)
- interaction with the industrials responsible of integrating the physics package to the clock system
- acquisition of expertise in operating an optical lattice clocks, with a stationary Sr clock at SYRTE for metrology (accuracy evaluation, comparison campaigns, demonstration of an improved atom flux)
- participation to the laboratory operation and characterization of the AQuRA clock (Menlo systems, Munich)
- participation to the field operation of the AQuRA clock (VLBI station, Poland)

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : yes

Si oui, financement de thèse envisagé/ financial support for the PhD: AQuRA EC project