Laboratory name: **SYstèmes de Référence Temps Espace (SYRTE, UMR 8630)**
Internship mentor : **Luigi DE SARLO & Sébastien BIZE**
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Web : syrte.obspm.fr/spip/science/fop
Stage location : Observatorie de Paris – 77 avenue Denfert-Rochereau – 75014 Paris

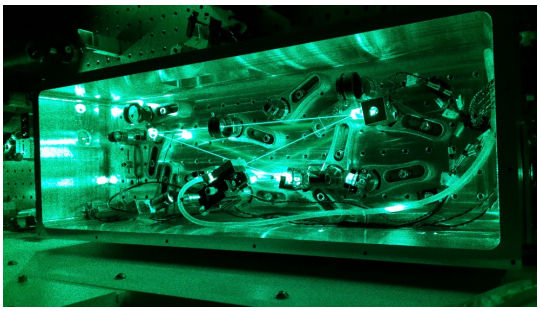
PhD position : **available** Paid internship: **YES**

New laser sources for a mercury optical lattice clock

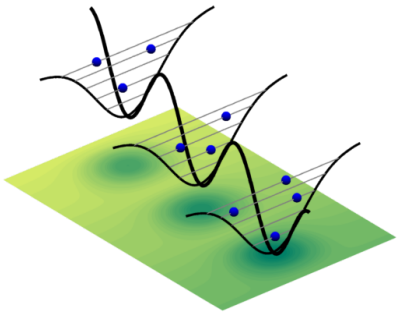
SYRTE is developing an optical clock based on neutral mercury that takes advantage of a lattice of optical dipole traps. Atoms are laser-cooled and confined in an array of traps created by a laser standing wave. The wavelength of the laser is cleverly chosen and very well controlled. This method, combined with the weak sensitivity of mercury to thermal radiation enables an ultimate accuracy beyond 10-18. Beyond this level of accuracy one needs to consider the atoms as a true space-time probe and take into account all the consequences of Einstein's relativity theory. Building up on these effects, new fundamental applications can be envisioned such as mapping Earth's gravitational potential or laboratory-based searching for physics beyond the Standard Model.

This kind of measurements relies on the experimental confidence created by a huge number of frequency comparisons both with the other atomic clocks at SYRTE (such as atomic fountains using Rb and Cs, and Sr optical lattice clocks) and with other clocks linked to the lab by new ultrastable optical fiber links.

The internship and the following thesis fit into this dynamics and will consist in developing the existing experimental setup in order to push the accuracy of the mercury clock to the level of the best optical frequency standards in the world (-5x10-18). The internship work shall consist in building new laser sources and will enable the study of the behavior of trapped atoms. This might lead to the development of new techniques for laser cooling of trapped atoms.



Optical cavity for UV light generation for laser cooling of mercury.



Picture of three lattice wells and atomic distribution in different Wannier-Stark states.