Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage

Date de la proposition : 22/09/2018

Responsables du stage / *internship supervisor*:

Nom / *name*: Pereira dos Santos/Merlet — Prénom/ *first name* : Franck/Sébastien

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Nom du Laboratoire / *laboratory name*: SYRTE

Code d'identification : UMR 8630 — Organisme : Observatoire de Paris

Site Internet / *web site*: https://syrte.obspm.fr/spip/science/iaci/

Adresse / *address:* 61 av de l'Observatoire 75014 PARIS

Lieu du stage / *internship place*: **Paris**

Titre du stage / *internship title*: **HIGH RESOLUTION GRAVITY GRADIOMETER**

Résumé / *summary*

In our team at SYRTE, we are developing inertial sensors (gyrometers, accelerometers…) based on atom interferometry technics. The development of this technology is linked to the use of cold atoms and laser beamsplitters, easy to implement and efficient, namely two photon transitions and more specifically stimulated Raman transitions. These methods allow now for the development of commercial products with applications in geophysics on the field, and of onboard instruments in ships or planes for inertial navigation and geoscience.

Increasing significantly the performances of such instruments remains possible, in particular if using large multiphoton transitions, which increases the separation between the two arms of the interferometer and thus the sensitivity to inertial forces. We are carrying on a new project of an atomic gradiometer based on these new technics. In this instrument, that measures the earth gravity gradient, two ultracold atomic clouds will be prepared on atom chip traps, and launched upwards thanks to an accelerated lattice. During their free fall, they will undergo a sequence of laser pulses which creates two simultaneous interferometers. The detection of the atomic state at the output of the interferometers allows to measure the difference of the interferometer phase shifts, which is proportional to the difference in the accelerations felt by the two atomic clouds.

The experimental setup is now operational and we have recently performed a first series of interferometry measurements with two clouds of laser cooled atoms, being individually prepared in independent chambers. One of these chambers accomodates an atom chip, which we still have to put at work. The first task of the intern will consist in trapping the atoms on the atom chip and prepare ultracold atoms by evaporative cooling. Using this source, he will implement large momentum transfer beamsplitters, based on the combination of high order Bragg diffraction and Bloch oscillations, and optimize their efficiency. Finally, he will realize measurements of the gravity gradient and find the interferometer parameters that optimize the sensitivity of the measurement.

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

Si oui, financement de thèse envisagé/ *financial support for the PhD***: CNES/CNRS**

Lumière, Matière, Interactions	**X**	Lasers, Optique, Matière	**X**