Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition : 23/10/2015

Responsable du stage / *internship supervisor*:

Nom / *name*:	**BATTELIER**	Prénom/ *first name* :	**Baptiste**
Tél :	+33 5 57 01 72 24	Fax :	
Courriel / *mail*:	baptiste.battelier@institutoptique.fr		

Nom du Laboratoire / *laboratory name*: Laboratoire Photonique Numérique Nanoscience

Code d'identification :UMR 5298 Organisme : CNRS/ IOGS/ Université de Bordeaux

Site Internet / *web site*: http://www.lp2n.fr/

Adresse / *address:* Institut d'Optique d'Aquitaine, rue François Mitterrand 33400 Talence

Lieu du stage / *internship place*: Institut d'Optique d'Aquitaine

Titre du stage / *internship title*: **Vibrations damping of the reference mirror within an atom interferometer aboard the ZERO-G plane**

Résumé / *summary*

The ICE project aims to develop a matter wave interferometer with two atomic species operating in microgravity. This apparatus use "classical" atom optics elements, that is to say laser beams creating superposition of atomic states. The development of a portable experiment for free fall test (airbus 0g) led to the first demonstration of the use of atomic inertial sensor onboard and in microgravity. Ultimately, we will carry out an initial comparison of atomic accelerometers with two different atomic species (potassium and rubidium) at 10 pm/s2, allowing to test the universality of free fall (equivalence principle).

The first test of the weak equivalence principle in microgravity thanks to a double species atom interferometer Rubidium/Potassium was achieved in May 2015. Today, the high level of vibrations on the plane is the main limitation of the experiment. We measure the trajectory of the atoms moving in a phase ruler define by a retro reflected mirror. If the mirror vibrates, the phase ruler will vibrates too which creates noise on our signal. We developed hybrid methods to measure and remove this noise from our measurement and we thus got the first onboard atom interferometer. Nevertheless, the level of the vibrations on the ZERO-G plane are so high that it is needed to tackle this problem beforehand. The internship will consist in developing a passive or active system attenuation on the retro reflected mirror mount. Firstly, the student will define the needed performances of the damping system according to the vibrations spectrum expected on the ZERO-G plane. He will particularly study the influence of the vibrations on the measurement of the atom interferometer. Secondly, the experimental realization of the apparatus will allow to check the specifications. We will specifically qualify the vibrations rejection ratio of the device in the measurement bandwidth of the interferometer (DC-100 Hz), thanks to accelerometers, we will study the different limitations such as the tilt, the rotations, the transverse displacement and we will determine their influence on the cold atom sensor. A test on the ICE experiment will be done at the end of internship to check the working of the dumping device on the atom interferometer itself.

The candidate will be asked an advanced expertise in the following fields: atom physics and ultra-cold gas, electronics, servo lock systems, computer science and signal processing.

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/IOGS**

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

*Fiche à transmettre (fichier pdf **obligatoirement**) sur le site http://stages.master-omp.fr*