

# 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 :

<b>Responsable du stage / internship supervisor:</b>			
Nom / name:	BATTELIER	Prénom/ first name :	Baptiste
Tél :	05 57 01 72 24	Fax :	
Courriel / mail:	Baptiste.battelier@institutoptique.fr		
<b>Nom du Laboratoire / laboratory name:</b>			
Code d'identification :	UMR5298	Organisme :	Laboratoire Photonique Numérique Nanosciences
Site Internet / web site:	<a href="https://www.coldatomsbordeaux.org/ice">https://www.coldatomsbordeaux.org/ice</a>		
Adresse / address:	Institut d'Optique d'Aquitaine Rue François Mitterrand 33400 Talence		
Lieu du stage / internship place: :	Institut d'Optique d'Aquitaine Rue François Mitterrand 33400 Talence		

<b>Titre du stage / internship title:</b> Development of a fibered laser source for an on-board cold-atoms interferometer
<p>The ICE project aims to develop a matter wave interferometer with two atomic species operating in microgravity. The development of a portable experiment for free fall test (airbus 0g) is underway in collaboration with SYRTE and led to the world's first demonstration of the use of atomic inertial sensor onboard and microgravity. Ultimately, we will carry out an initial comparison of atomic accelerometers with two different atomic species (potassium and rubidium) at 10 pm/s<sup>2</sup>, allowing to test the universality of free fall (equivalence principle). The project objectives are the validation of the various technical and technological choices being made on the experiment and a new design of an improved version with a coherent source (Bose Einstein condensate) using the full potential of microgravity.</p> <p>The first test of the weak equivalence principle in microgravity thanks to a double species atom interferometer was achieved in May 2015. This technical prowess constitutes an important step, but there is still a lot of effort to supply in order to achieve a very high accurate test benefiting fully from micro-gravity. The development of this new generation of sensor is based on the using of an ultra-cold bi-species degenerated gas. To reach this goal, the setting up of a dipole trap with a fibered laser source to cool the atom cloud is planned. The second goal of the ICE project will be to push the development of a compact multi-axis inertial atom sensor. Indeed, beyond the tests of fundamental physics, the experiment also allows to explore potential applications with cold atom interferometers, such as inertial navigation. The realization of the multi-axis system will allow to do measurements of acceleration and rotation along the three axis of space and have a fully cold atoms inertial station to hand.</p> <p>To cool and trap the atoms, our laser system is based on telecom components and second harmonic generation in order to reach the wavelength of the atomic transition (respectively 780 nm for Rubidium and 767 nm for Potassium). During the internship, the student will work on this laser system. He will be in charge of the update of the Potassium laser, in order to go to a complete all fibered and integrated device fully compliant with onboard applications. More precisely, the work will consist in achieving a frequency and phase lock of multiple laser diodes, test the optical performances of the laser source in terms of optical power and polarization, and integrate the system in a compact apparatus.</p> <p>The work will take place at LP2N within Institut d'Optique d'Aquitaine, with regular contacts with the company iXBlue for inertial navigation points. The candidate will be asked an advanced expertise in the following fields: atom physics and ultra-cold gas, laser, electronics, servo lock systems, computer science and signal processing.</p>

<b>Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : YES</b>			
<b>Si oui, financement de thèse envisagé/ financial support for the PhD: CNES</b>			
Lumière, Matière, Interactions	X	Lasers, Optique, Matière	X

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