

# 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>			
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Tél :	05 57 01 72 24	Fax :	
Courriel / mail:	baptiste.battelier@institutoptique.fr		
<b>Nom du Laboratoire / laboratory name:</b> LP2N			
Code d'identification :	UMR 5298	Organisme :	LP2N
Site Internet / web site:	<a href="http://www.lp2n.fr/">http://www.lp2n.fr/</a>		
Adresse / address:	Institut d'Optique d'Aquitaine Rue François Mitterrand 33400 TALENCE		
Lieu du stage / internship place:	LP2N		

<b>Titre du stage / internship title: Rotation compensation in a quantum sensor for inertial navigation</b>
<b>Résumé / summary</b> The exploitation of quantum physics allowed the development of matter waves interferometers. Like classical optics, the idea is to split and recombine coherently these wave packets thanks to light pulses, to create multiple interfering paths. The phase of the fringes is sensitive to inertial effects due to the mass of the atoms. These quantum sensors have measurement noise and long-term stability excellent enough to make them candidate for a technological breakthrough in the field of inertial navigation.  Nowadays, substantial technical developments have been done and have allowed to bring to market atom gravimeters and clocks enabling static long-term measurements. Nevertheless, the use of cold atoms sensors for navigation and positioning still needs to solve a lot of scientific and technological challenges such as compliance with onboard applications and compactness, measurement continuity, operating these sensors in relevant environment and in contact with other measurement instrumentation. In this context, the Joint Laboratory iXAtom which brings together the knowledge of a French company of very high technological added value- iXblue, expert in photonics and inertial navigation of very high performance – and a public laboratory specialized in atom interferometry at the highest worldwide level- LP2N. Our team are currently developing a three-axis cold atom accelerometer for inertial navigation. Constraints due to onboard functioning must be considered. Unlike the quiet environment of the laboratory, residual acceleration and rotations of the vehicle implies a strong loss of contrast of the atom interferometer.  The goal of the internship will consist in developing a solution to prevent the loss of contrast due to rotations. The student will evaluate different solutions. The rotation of the reference mirror is a first option. By measuring the rotation of the vehicle with gyroscopes, we can compensate the effective angle of the mirror thanks to a tip tilt mount. Different technologies can be considered, and a specific study will be led to define the solution the most adapted to the specifications due to our application. Experimental test will be led to demonstrate the real time control of the orientation of the reference mirror. A new configuration of atom interferometer using multiple pulses is another option. For instance, we can imagine a four-pulse configuration which cancel the separation of the wave packets at the end of the interferometer. Some studies to increase the coherence length of the atom source are also possible. Finally, this study also includes data processing between the gyroscopes and the cold atom accelerometer.  The compensation system will be finally tested on a rotation platform. The student will evaluate the performances of the hybrid system in terms of dynamic range (rotation rate), interrogation time, short-term sensitivity and long-term stability. The candidate will be asked an expertise in the following fields: optics and photonics, electronics, servo lock systems, computer science. This research activity is funded by ANR and DGA program Astrid HybridQuanta.

<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: CIFRE iXBlue</b>			
Lumière, Matière, Interactions	X	Lasers, Optique, Matière	X

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