Master 2: ***International Centre for Fundamental Physics***

INTERNSHIP PROPOSAL

Laboratory name: **ONERA-DPHY**
CNRS identification code: /
Internship director'surname: **Yannick BIDEL**
e-mail: **yannick.bidel@onera.fr** Phone number: **0180386174**
Web page: **www.onera.fr**
Internship location: **Palaiseau**

Thesis possibility after internship: **YES**
Funding: **YES** Type of funding: **DGA, ONERA, CNAM, SIRTEQ**

Title

Development of an inertial unit with cold atoms

Nowadays, the wave-like nature of matter is used to make interferometers to measure accelerations and rotations with extreme precision. In these sensors, the source of matter wave is a gas of atoms cooled by laser. The interferometer is then produced by subjecting the cold atoms to a succession of laser pulses which divide and then recombine the matter wave. With this technology, it has been possible to produce gravimeters allowing gravity to be measured up to an accuracy of 10^{-8} m/s². Onera played a major role in the development of this technology, notably with the first marine and airborne gravity measurements. At present, Onera is developing an inertial unit with cold atoms meaning an instrument measuring the three accelerations and the three rotations. This type of sensor is still in an upstream research phase with a unique experimental demonstration in the world. However, it is of great interest in the field of inertial navigation where the aim is to determine the position and movement of a vehicle. As in the case of gravimetry, matter wave sensors could revolutionize the field of inertial navigation.

The internship we are offering focuses on participating in the development of a cold atom inertial unit and in particular a gyroscope. The student will set up a rotation measurement experiment by atomic interferometry. It will characterize the measurements in terms of accuracy and noise. Then, the student will hybridize the atomic sensor with an accelerometer and a conventional gyroscope. Here, the work will focus on the development of a method to take the best parts of atomic and conventional sensors in order to obtain the most precise inertial measurement possible. The internship may continue with a thesis on the further development of the cold atom inertial unit.

Condensed Matter Physics:	**YES**	Soft Matter and Biological Physics:	**NO**
Quantum Physics:	**YES**	Theoretical Physics:	**NO**