R&D internship (M2)
Multi-axis atom interferometry using ultracold gases

Most atomic sensor measurements are one-dimensional, meaning they can measure only a single axis of rotation or acceleration at a time. For inertial navigation, reconstructing the trajectory of a moving body requires simultaneous measurements of accelerations and rotations along three mutually orthogonal directions—the basis of a full inertial measurement unit (IMU). The goal of this project is to realize a miniaturized cold-atom interferometer capable of measuring the full three-dimensional acceleration and rotation vectors.

On the pathway to a full quantum IMU, the candidate will prepare the experimental implementation of new multidimensional inertial sensing methods with free-falling cold-atom interferometers (CAIs). Our method relies on a recently developed formalism for multidimensional atom optics and interferometer geometries that creates coherent superpositions of matter waves along three spatial directions and enables the simultaneous measurement of accelerations and rotations in 3D. This new arsenal of atom optical tools is based on two or three mutually orthogonal excitation beams that exchange momentum with atoms along more than one spatial direction at a time. After analyzing the theoretical performance of an optimized multi-axis quantum sensor and comparing it to a commercial IMU, he/she will tackle the experimental challenges arising from these new atom optical tools, including the efficiency of the atomic mirrors and beam-splitters, the contrast of the interferometer, detection and signal extraction, and parasitic momentum transfer to the atoms.

The project takes place in the framework of iXatom which is a joint research lab between the LP2N laboratory (www.lp2n.institutoptique.fr), specialized in novel atom interferometry techniques, and iXblue (www.ixblue.com), a world industrial leader in the fields of photonics, inertial navigation and cold atom sensors.

Background

- Master degree student
- Theoretical or experimental knowledge in optics and/or quantum physics
- General interest for instrumentation

PhD position available after the internship (secured funding from the PEPR CAFQA project: Capteurs Quantiques à Atomes Froids : Mesure du Champ de pesanteur A toutes les échelles).

Practical information

- Duration : 4 to 6 months
- Location : Institut d'Optique d'Aquitaine, Talence (France)

Contacts

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