Internship project : Stabilized laser sources for spatial interferometry

Starting date: 2024 - Duration: 3 - 6 months. Location: SYRTE Observatoire de Paris, Paris, France

Project description:

Quantum inertial sensors based on cold atom interferometry have reached a level of performances and maturity allowing for scientific and commercial use in various applications [1]. Their sensitivity and accuracy are expected to increase dramatically in microgravity, where the interrogation time is no longer limited by the size of the instrument. This triggered a recent interest in developing this technology for space with potential applications in geodesy [2], fundamental physics , navigation and gravitational wave observation.

In advance of the deployment of such breakthrough missions, a pathfinder mission (CARIOQA PMP [3]) will allow to demonstrate the potential of the technology in space. The maturation of the various subsystems needed for a space mission is one of the first objectives of CARIOQA. This project focuses on the development of the laser source frequency stabilization for rubidium cold atoms systems. The objective of the activity is to improve laser stabilization for matter-wave interferometry with the development of a compact frequency stabilized laser @ 780.24 nm and detailed characterization.

Context: This project will be undertaken in the frame of an ESA financed collaboration between the SYRTE and the MuQuans/IxBlue company. The trainee will work in the SYRTE IACI group laboratory, on a home built laser stabilization system. His task will be to optimize and characterize the performances of the system. He will be supervised by the research engineer of the group, and will work in collaboration with the laser engineers of MuQuans/IxBlue.

Profile of the applicant: we are looking for a candidate motivated by this challenging interdisciplinary project, ideally with a training in lasers and/or atomic physics.

Application: Contact Quentin Beaufils (quentin.beaufils@obspm.fr)

Franck Pereira (email: franck.pereira@obspm.fr))

[1] R. Geiger, A. Landragin, S. Merlet, and F. P. D. San-tos, High-accuracy inertial measurements with cold-atomsensors, AVS Quantum Science2, 024702 (2020).

[2] O. Carraz, C. Siemes, L. Massotti, R. Haagmans, andP. Silvestrin, A spaceborne gravity gradiometer conceptbased on cold atom interferometers for measuring earth'sgravity field, Microgravity Science and Technology26,139 (2014).

[3] T. Leveque, C. Fallet, J. Lefebve, A. Piquereau, A. Gau-guet, B. Battelier, P. Bouyer, N. Gaaloul, M. Lachmann,B. Piest, E. Rasel, J. M uller, C. Schubert, Q. Beaufils,and F. P. D. Santos, Carioqa: Definition of a quantumpathfinder mission 10.48550/ARXIV.2211.01215 (2022)