Postdoctoral position in quantum inertial sensing with cold atoms

ONERA / LCM-LNE-Cnam

Our research group focusses on harnessing the wave-like properties of cold atoms to realize quantum inertial sensors based on cold atom interferometry for real-word applications such as gravity mapping or navigation.

Our team is at the international forefront in developing cold atom gravimeters for onboard applications [1-3]. Currently, we are working on the development of a compact and complete hybridized cold atom inertial measurement unit (IMU). Our goal is to have a single atomic sensor that will alternately measure each inertial component (3 accelerations and 3 rotations), instead of having six independent atomic sensors each measuring one inertial component. Every atomic measurement will be hybridized with its corresponding classical sensor in order to benefit from the advantages of both technologies.

To date, our experimental setup can measure the vertical and the horizontal accelerations with hybridized cold-atom interferometric sensors [4-5].

We are looking for an experienced researcher to aid the ongoing development of the **compact cold atom gyroscope** [6] of the IMU.

The postdoc project aims to push further the **development the metrological characterization of the cold atom gyroscope** in terms of sensitivity, long-term stability and accuracy.

Additionally, **the technique of Bloch oscillations will be implemented** on the setup to increase the performance of the cold atom gyroscope.

Responsibilities:

* Development of the cold atom gyroscope using Bloch oscillations.

* Develop simulations to predict the performance of the sensor.

* Work with Ph.D. students and other members of the group.

* Actively participate in the publication of research results in high-quality scientific journals and their presentation at national and international conferences

Qualifications:

* Ph.D. in physics

* Strong background in cold atom interferometry.

* Experience with cold atom experiments.

* Experience with simulation software.

* Ability to work effectively in a team.

The position is available starting from the beginning of 2025, and the initial appointment is for one year, renewable. The salary is based on French regulations.

Interested candidates may contact **Malo CADORET (**malo.cadoret@lecnam.net **) or Yannick BIDEL** (yannick.bidel@onera.fr**)** as soon as possible. The application should contain a CV, a list of publications, a short research statement (cover letter), and contact information for two senior researchers who can provide recommendation letters.

[1] Y. Bidel, N. Zahzam, C. Blanchard, A. Bonnin, M. Cadoret, A. Bresson, D. Rouxel, and M-.F. Lalancette. « Absolute marine gravimetry with matter-wave interferometry ». *Nature Communications*, 9, 02 2018

[2] Y. Bidel, N. Zahzam, A. Bresson, C. Blanchard, M. Cadoret, A. V. Olesen, and R. Forsberg. « Absolute Airborne Gravimetry with a Cold Atom Sensor ». *Journal of Geodesy*, 94, 02 2020.

[3] Y. Bidel, N. Zahzam, A. Bresson, C. Blanchard, A. Bonnin, J. Bernard, M. Cadoret, et al. « Airborne Absolute Gravimetry With a Quantum Sensor, Comparison With Classical Technologies ». *Journal of Geophysical Research : Solid Earth*, 128, 4, 04 2023.

[4] I. Perrin, J. Bernard,Y. Bidel, A. Bonnin, N. Zahzam, C. Blanchard, A. Bresson, and M. Cadoret. Zero-velocity atom interferometry using a retroreflected frequency-chirped laser. Phys. Rev. A 100, 053618, 2019.

[5] J. Bernard, Y. Bidel, M. Cadoret, C. Salducci, N. Zahzam, S. Schwartz, A. Bonnin, C. Blanchard and A. Bresson ”Atom interferometry using σ+ − σ− Raman transitions between |F = 1,mF = ∓1⟩ and |F =2,mF =±1⟩” Physical Review A, vol. 105, p. 033318, 2022

[6] Clément Salducci, Yannick Bidel, Malo Cadoret, Sarah Darmon, Nassim Zahzam, Alexis Bonnin, Sylvain Schwartz, Cédric Blanchard and Alexandre Bresson « Stabilizing classical accelerometers and gyroscopes with a quantum inertial sensor» arXiv:2405.13689 2024.