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The CARIOQA Project - A Cold Atom Rubidium Interferometer in Orbit for Quantum Accelerometry

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The CARIOQA (Cold Atom Rubidium Interferometer in Orbit for Quantum) project aims for the preparation of a pathfinder mission with an atom interferometric accelerometer for a deployment in future missions for earth observation. Atom interferometers offers drift-free, long-term stable measurements, complementing established technology, and consequently the expectation of improved data recovery at low frequencies.

To date, commercialisation of atom interferometers is ongoing, they were deployed on mobile platforms, and atom optics payloads were adapted to and operated on a zero-g plane, a drop tower, sounding rockets, and a space station. The next step would be embarking such a system on a dedicated satellite to verify its functionality, the goal of CARIOQA.

The project is currently being worked on in two parts, the Pathfinder Mission Preparation (PMP) and the Phase A (PHA). The focus of PMP is on the development of an engineering model of the quantum accelerometer accompanied by the scientific background and considerations for the operation in orbit. PHA is investigating the feasibility of a quantum space gravimetry pathfinder mission within the next decade.

This contribution will outline the background and introduce the CARIOQA project.

CARIOQA is a joint European project, funded by the European Union, including experts in satellite instrument development (Airbus, Exail SAS, TELETEL, LEONARDO), quantum sensing (LUH, SYRTE, LP2N, LCAR, ONERA, FORTH), space geodesy, Earth sciences and users of gravity field data (LUH, TUM, POLIMI, DTU), mission analysis (GMV) as well as in impact maximisation and assessment (PRAXI Network/FORTH, G.A.C. Group), coordinated by the French and German space agencies CNES and DLR under CNES lead.

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Technical University of Denmark, Kongens Lyngby, Denmark; Leibniz University Hannover, Institute of Quantum Optics, Hannover, Germany; LNE-SYRTE, Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, Paris, France; Laboratoire Photonique, Numérique et Nanosciences (LP2N), France; Laboratoire Collisions Agrégats Réactivité (LCAR), Université Toulouse, France; DPHY, ONERA, Université Paris-Saclay, Palaiseau, France; AIRBUS Defence and Space, France, Germany; Exail, France; Teletel, Greece; Leonardo, Italy; GMV Innovating Solutions S.L., Madrid, Spain; Foundation for Research and Technology (FORTH), Greece; G.A.C. Group, France