

Towards climate studies using quantum technologies



CARIOQA-PMP Kick-Off meeting

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The impact of climate change is one of the most severe challenges of the 21st century. It is therefore of high importance to understand the underlying processes and causalities. A powerful tool to gain this vital knowledge on a global scale is the satellite-based observation of changes in Earth's mass distribution e.g. from melting glaciers or loss of groundwater. The required high-precision measurements are reachable with novel quantum sensors. Due to the extensive European heritage and a close collaboration within the European Union an independent development and operation of a quantum sensor based space mission shall be realised.

On December 14th, 2022, the CARIOQA-PMP project (Cold Atom Rubidium Interferometer in Orbit for Quantum Accelerometry – Pathfinder Mission Preparation) under the European Commission's Horizon Europe program was kicked off with the aim to develop such a quantum sensor for space application. European industry in collaboration with European research institutions will build an engineering model of an accelerometer based on atom interferometry for a Quantum Space Gravimetry pathfinder mission. Benefitting from the heritage of its research institutions, this project aims to bring Europe into a leading position for sustainable quantum technologies in space.

A quantum accelerometer enabled satellite gravimetry mission is a powerful tool for high-precision measurements of the Earth’s gravitational field. It profits from the quantum properties of atoms that serve as a test mass. The sensitivity of atom interferometers with respect to accelerations can be increased using long free-fall times that are available in space. In orbit, these devices can be used to observe mass changes in the Earth system caused by global processes like a rise of the sea level with unrivaled sensitivity. However, their adaptation and qualification for space is challenging. The CARIOQA-PMP project will mature these quantum sensors and therefore prepare the ground for future high-precision gravimetry missions in space.

CARIOQA-PMP brings together leading players from five EU countries. These include experts in satellite instrument development (Airbus, Exail, TELETEL, LEONARDO), quantum sensing (LUH, SYRTE, LP2N, LCAR, ONERA, IESL/FORTH), space geodesy, Earth sciences and users of gravity field data (LUH, TUM, POLIMI, DTU), as well as impact maximization and impact assessment experts (PRAXI Network/FORTH, G.A.C. Group). The pathfinder mission preparation is coordinated by the French and German space agencies CNES and DLR under CNES lead.

THE CARIOQA-PMP CONSORTIUM



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