



## **QuCoM - Quantum Control of Gravity with Levitated Mechanics**

### **PRESS RELEASE**

A strong public-private partnership, supported by a 2.3 million EU grant, has started on October 1, 2022, a 3-year project to demonstrate the proof of concept of a levitated acceleration sensor and its ability detecting gravity of small masses and in the quantum-controlled regime.

The quantum-gravity interplay is one of the most fascinating open problems in modern physics. We know that matter, also in a quantum state, reacts to an external gravitational field as predicted by Newtonian gravity (or its generalization, General Relativity); what we do not know is what the gravitational field generated by a quantum superposition looks like: is it the superposition of the gravitational fields generated by the different terms of the superposition, as predicted by theories of Quantum Gravity, or something different? The reason for such a lack of experimental knowledge is that gravity is the weakest of all known forces, therefore it requires relatively large masses to be detectable. On the other hand, quantum effects are extremely fragile against external perturbations, and the larger the object, the more difficult it is to isolate it from the environment. The regime where an object is large enough to create an appreciable gravitational field, but still controllable in its quantum behaviour, must be carefully engineered. This is the goal of QuCoM.

QuCoM will explore the interplay between quantum mechanics and gravity in a parameter range accessible for cost-effective table-top experiments. It will suspend sub millimetre-sized particles in optical and magnetic traps and use them to detect gravitational forces in an unprecedented mass regime. Also, it will investigate quantum superpositions where such masses are delocalized in space quantum mechanically. The project will address some of the most popular theoretical proposals combining quantum physics and gravity in a nonstandard fashion, assessing their limits of validity and further constraining the values of their parameters.

QuCoM puts together 5 leading European research group and 2 companies with world-leading expertise in low temperature, low noise technology high tech measurement systems for Earth Observation. The involvement of private partners will drive the European opportunities for development of market-ready product based on quantum-technological sensing and metrology according to the ambitions of EIC Horizon Europe program. The project is one of only 56 funded proposals out of 868 evaluated by the Commission under the 2021 EIC Pathfinder call.

### **QuCoM Consortium**

University of Trieste (Italy)

Universiteit Leiden (The Netherlands)

Eberhard Karls Universitaet Tübingen (Germany)

The Queen's University Belfast (UK)

University of Southampton (UK)

Leiden Cryogenics BV (The Netherlands)

Leiden Spin Imaging BV (The Netherlands)