Exploring nonclassical states of center-of-mass mechanical motion with superconducting magneto- and levitomechanics

Fact Sheet

Project Information

SuperMeQ

Grant agreement ID: 101080143

DOI
10.3030/101080143

EC signature date
18 August 2022

Start date
1 October 2022

End date
30 September 2026

Funded under
Digital, Industry and Space

Total cost
€ 2 988 644,00

EU contribution
€ 2 988 644,00

Investment in EU policy priorities

Digital agenda	●	Clean air	○
Artificial Intelligence	○	Climate action	○
Biodiversity	○		

Coordinated by
CHALMERS TEKNISKA HOGSKOLA AB
Sweden

Objective

SuperMeQ addresses three basic science goals in quantum technologies, targeting to gain new insights into quantum control over the center-of-mass motion of mechanical resonators: (i) We will push to the limits of decoherence mechanisms of massive objects, (ii) we will maximize the vacuum coupling of the center-of-mass motion of a mechanical resonator to a quantum system, and (iii) we will generate useful nonclassical states such as squeezed states or states with a negative Wigner function, which have direct relevance for quantum-enhanced force and inertial sensing. Our project follows a unique approach by realizing two complementary experimental platforms that are tailored to our goals and that are mutually beneficial through parallel development: (a) magnetically levitated superconducting microparticles that access a mass regime spanning more than seven orders of magnitude between picogram and sub-milligram masses, and that are expected to exhibit ultra-low mechanical decoherence, and (b) integrated clamped magnetic or superconducting mechanical resonators that are expected to reach strong vacuum coupling rates, two orders of magnitude larger than the state-of-the-art. Key in each of these approaches is that we will couple both types of mechanical resonator inductively to superconducting quantum circuits, which allow for full quantum control over the center-of-mass degree of freedom of the mechanical resonators. Our project results will lead to a breakthrough in the development and growth of novel quantum sensing technologies and give new insights into foundational aspects of quantum physics.

Keywords

decoherence | massive quantum systems | superconducting quantum circuits | nanomechanical resonators | optomechanics

Programme(s)

HORIZON.2.4 - Digital, Industry and Space MAIN PROGRAMME

HORIZON.2.4.2 - Key Digital Technologies

Topic(s)

HORIZON-CL4-2021-DIGITAL-EMERGING-02-16 - Basic Science for Quantum Technologies (RIA)

Call for proposal

HORIZON-CL4-2021-DIGITAL-EMERGING-02

See other projects for this call

Funding Scheme

HORIZON-RIA - HORIZON Research and Innovation Actions

Coordinator

CHALMERS TEKNISKA HOGSKOLA AB

Net EU contribution

€ 738 889,00

Total cost

€ 738 889,00

Address

-

412 96 Goteborg

Sweden

Region

Södra Sverige > Västsverige > Västra Götalands län

Activity type

Higher or Secondary Education Establishments

Links

Contact the organisation Website

Participation in EU R&I programmes

HORIZON collaboration network

Participants (4)

BAYERISCHE AKADEMIE DER WISSENSCHAFTEN

Germany

Net EU contribution

€ 562 500,00

Address

ALFONS GOPPEL STRASSE 11
80539 Munchen

Region

Bayern > Oberbayern > München, Kreisfreie Stadt

Activity type

Research Organisations

Links

Contact the organisation Website
Participation in EU R&I programmes
HORIZON collaboration network

Total cost

€ 562 500,00

KARLSRUHER INSTITUT FUER TECHNOLOGIE

Germany

Net EU contribution

€ 500 000,00

Address

KAISERSTRASSE 12
76131 Karlsruhe

Region

Baden-Württemberg > Karlsruhe > Karlsruhe, Stadtkreis

Activity type

Higher or Secondary Education Establishments

Links

Contact the organisation Website
Participation in EU R&I programmes
HORIZON collaboration network

Total cost

€ 500 000,00

OESTERREICHISCHE AKADEMIE DER WISSENSCHAFTEN

Austria

Net EU contribution

€ 1 051 000,00

Address

DR. IGNAZ SEIPEL-PLATZ 2
1010 Wien

Region

Ostösterreich > Wien > Wien

Activity type

Research Organisations

Links

Contact the organisation Website
Participation in EU R&I programmes
HORIZON collaboration network

Total cost

€ 1 051 000,00

UNIVERSITAT AUTONOMA DE BARCELONA

Spain

Net EU contribution

€ 136 255,00

Address

EDIF A CAMPUS DE LA UAB BELLATERRA CERDANYOLA V
08193 Cerdanyola Del Valles

Region

Este > Cataluña > Barcelona

Activity type

Higher or Secondary Education Establishments

Links

Contact the organisation Website
Participation in EU R&I programmes
HORIZON collaboration network

Total cost

€ 136 255,00

Last update: 6 September 2024