Press Release

Launch of PASQuanS2:

Transforming the Landscape for Programmable Quantum Simulation in Europe

- *PASQuanS2 (Programmable Atomic Large-Scale Quantum Simulation) aims to develop next-generation programmable, large-scale atomic quantum simulators operating with up to 10,000 atoms building on the successful European Quantum Flagship project PASQuanS*

- *Coordinated by the German Max Planck Institute of Quantum Optics, PASQuanS2 unites 25 academic and technology partners from Austria, France, Germany, Italy, Slovenia and Spain*

- *The European Union funds PASQuans2 with € 16.6 mil over the next 3.5 years under the Horizon Europe Framework Programme*

Garching/Germany, 3 April 2023 – Quantum technologies have evolved rapidly over the past years producing numerous substantial scientific breakthroughs. With several future application areas in sight, one of the most promising fields is the simulation of many-body quantum systems, such as quantum materials, molecules for drug research and the fundamental constituents of matter in extreme conditions. These problems can be addressed by dedicated quantum computers, known as quantum simulators. The development of analogue and digital quantum simulators has made significant progress in recent years. As different platforms become more mature in terms of scalability, stability and programmability, quantum simulation is moving from being a means for physicists to answer particular scientific questions towards a powerful tool to help address real-world problems and provide practical applications for industry. For instance, quantum simulators can potentially be used to develop new materials, analyse chemical processes, and solve optimisation problems in the future.

A research effort that has significantly contributed to the advancement of quantum simulation technologies and applications is the European Quantum Flagship project PASQuanS (2018-2022). Linking experimental groups, theoretical teams and industrial partners, the project successfully scaled up quantum simulation platforms based on atoms and ions, making them the most advanced to date. The mission initially started by PASQuanS is now continued and expanded by the successor project PASQuanS2.

Stimulating a vibrant ecosystem for quantum simulation across Europe

Teaming up most of the original consortium members with additional leading experts from research institutes, industry, small to medium-sized enterprises and start-ups from six EU member states, PASQuanS2 sets out to transform the development of programmable quantum simulation in Europe further over the next seven years. Led by the Max Planck Institute of Quantum Optics, the 25 partners have formed a Framework Partnership putting forward an ambitious seven-year research programme: the team will advance hardware and software for relevant scientific and industrial problems, so that verified next-generation, large-scale quantum simulators with up to 10,000 individual quantum systems can be demonstrated running stably in an end-user accessible form by the end of the Partnership.

Following a two-stage approach, PASQuanS2 is now kicking off its first project phase: the so-called PASQuanS2.1. Running for the next 3.5 years, one of the major objectives of this initial phase is the development of quantum simulators with at least 2,000 atoms and a path towards 10,000 while improving

control, stability, and scalability. Alongside advancing the platforms technologically and developing a first version of a corresponding software stack to control the devices, PASQuanS2.1 will continue exploring industrial applications and mapping real-life problems while establishing a sustainable ecosystem of end-users and open quantum simulation platforms. “Addressing these challenges calls for a concerted effort between experimentalists and theorists from the academic world and engineers from industrial partners, including hardware and software technologists working together with prospective end-users,” underlines Project Coordinator Immanuel Bloch, Director at the Max Planck Institute of Quantum Optics and Chair at LMU Munich.

Summing up the main activities and objectives of the next 3.5 years, he continues: “At the end of this first phase, we plan to have a quantum simulation ecosystem involving hardware platforms and corresponding bespoke software, enabling us to demonstrate a quantum advantage in academic and industrial problems in the second phase of PASQuanS2. Moreover, this ecosystem will comprise an integrated hardware supply chain helping to advance modular systems, which we will further implement as building blocks on experiments during PASQuanS2.2, and a pipeline transferring these building blocks to industrial partners for industry-driven production of quantum simulators and open online platforms.”

As part of the European Quantum Technology Flagship, PASQuans2 will continue to exchange and liaise with other EU-funded quantum endeavours and national programmes across Europe, thus enabling technology transfer and promoting collaboration between academia and industry on the technology and end-user level.

Key Facts

Project Title: Programmable Atomic Large-Scale Quantum Simulation

Project Acronym: PASQuanS2.1

Duration: April 2023 – September 2026

Budget: €16.6 mil

Partners: 25 partners from six EU member states

Coordinator: Max-Planck-Institut für Quantenoptik **(**Max Planck Institute of Quantum Optics), Immanuel Bloch

Website: www.pasquans2.eu

Social Media: Twitter I LinkedIn

Partners

Austria

- Alpine Quantum Technologies GmbH
- Österreichische Akademie der Wissenschaften
- Parity Quantum Computing GmbH
- Universität Innsbruck

France

- Atos BULL
- Azur Light Systems
- Centre National de la Recherche Scientifique
- Electricité de France
- Institut d´Optique Théorique et Appliquée
- Exail
- PASQAL

Germany

- Eberhard-Karls-Universität Tübingen
- EURICE – European Research and Project Office GmbH
- Forschungszentrum Jülich GmbH
- Freie Universität Berlin
- Ludwig-Maximilians-Universität München
- Max-Planck-Institut für Quantenoptik
- Menlo Systems GmbH
- Qruise GmbH
- Ruprecht-Karls-Universität Heidelberg
- TOPTICA Photonics AG

Italy

- Consiglio Nazionale delle Ricerche
- Università degli Studi di Padova

Slovenia

- Univerza v Ljubljani

Spain

- ICFO - The Institute of Photonic Sciences

Contact

Project Management

Max Planck Institute of Quantum Optics

Nicola Goerke-Schwindt

Email nicola.goerke-schwindt@mpq.mpg.de

EURICE GmbH

Mirna Vela

Email m.vela@eurice.eu

About the European Quantum Flagship

The European Quantum Flagship was launched in 2018 as one of the largest and most ambitious research initiatives of the European Union. With a budget of €1 billion and a duration of 10 years, the flagship brings together research institutions, academia, industry, enterprises, and policymakers, in a joint and collaborative initiative on an unprecedented scale. The main objective of the Flagship is to consolidate and expand European scientific leadership and excellence in this research area as well as to transfer quantum physics research from the lab to the market by means of commercial applications and disruptive technologies. With over 5,000 researchers from academia and industry involved in this initiative throughout its lifetime, it aims to create the next generation of disruptive technologies that will impact Europe's society, placing the region as a worldwide knowledge-based industry and technological leader in this field.

Funded by
the European Union