Quantum

To unlock the transformative power of quantum, the EU should develop a solid industrial base that builds on its tradition of excellence in quantum research.

In the next few years, quantum technologies will make it possible to do things that simply cannot be done today. With quantum, we could be able to look far beneath the ground or under the sea and perform complex computational tasks, like modelling biomolecular and chemical reactions, that the most powerful supercomputers cannot currently manage. Quantum will help us send sensitive information safely to anywhere, and diagnose diseases more quickly and accurately by looking inside cells.

In the first quantum revolution during the early twentieth century, scientists learned to understand and apply the properties of quantum mechanics – the interactions of molecules, atoms, and even smaller particles like photons and electrons. This ultimately allowed them to create transistors, lasers and microprocessors: foundational technologies for computers, telecommunications, satellite navigation, smartphones, modern medical diagnostics, and much more.

Now, the second quantum revolution is underway. Researchers can detect and manipulate individual particles and their physical interlinkages and interactions, and build new technologies and systems that make use of the properties of the underlying quantum mechanics. These developments have led to major technical advances in many different areas, including quantum computing, sensors, simulations, cryptography and telecommunications. A whole generation of new quantum technologies
with the potential for far-reaching economic and societal impact is starting to emerge. Some are already in development, while many others will be developed in the next few decades.

**The Quantum Technologies Flagship**

Europe has a long tradition of excellence in quantum research. It is now crucial to develop a solid industrial base that builds on this tradition. Without coordinated research and funding efforts at European level, Europe would risk falling behind its global competitors.

To meet this challenge, the Quantum Technologies Flagship was launched in 2018. It is a large-scale, long-term research initiative funded by the EU that brings together research institutions, industry and public funders, consolidating and expanding European scientific leadership and excellence in this field.

**Quantum computing**

As part of the European High Performance Computing Joint Undertaking (EuroHPC JU), the Commission is now planning to build state-of-the-art pilot quantum computers by 2023. These computers would act as accelerators interconnected with the Joint Undertaking’s supercomputers, forming ‘hybrid’ machines that blend the best of quantum and classical computing technologies.

In 2021, work will begin on the Joint Undertaking’s first quantum simulator, which would also be interconnected with a supercomputer. This will be the first element of a European quantum simulation infrastructure available via the cloud on a non-commercial basis to public and private European users. The infrastructure will be used to address complex simulation and optimisation problems, especially in materials development, drug discovery, transportation and other real-world problems of high importance to industry.

**EuroQCI**

Since June 2019, all 27 EU Member States have signed the EuroQCI Declaration, agreeing to work together, with the Commission and with the support of the European Space Agency, towards the development of a quantum communication infrastructure covering the whole EU (EuroQCI).

Discover more about EuroQCI.

**Read more on quantum**

Brochure on Quantum
Factsheet on quantum
FAQs on Quantum Communication Infrastructure
Follow the latest progress and learn more about getting involved.
Follow our thematic account @FutureTechEU

Latest

DIGIBYTE | 28 July 2021
All Member States now committed to building an
EU quantum communication infrastructure

Ireland is the 27th EU Member State to sign the
EuroQCI Declaration. This means that all 27 EU
Member States have signed it.

PRESS RELEASE | 16 June 2021
Commission to invest €14.7 billion from Horizon Europe for a healthier, greener and more digital Europe

The Commission has adopted the main work programme of Horizon Europe for the period 2021-2022, which outlines the objectives and specific topic areas that will receive a total of €14.7 billion in funding. These investments will help accelerate the green and digital transitions and will contribute to sustainable recovery from the coronavirus pandemic and to EU resilience against future crises. They will support European researchers through fellowships, training and exchanges, build more connected and efficient European innovation ecosystems and create world-class research infrastructures.

PRESS RELEASE | 18 September 2020
State of the Union: Commission sets out new ambitious mission to lead on supercomputing

Today, the Commission takes further steps in the Digital Decade agenda to strengthen Europe's digital sovereignty, as announced by President Ursula von der Leyen in her State of the Union Address on Wednesday. The Commission has proposed a new Regulation for the European High Performance Computing Joint Undertaking to maintain and advance Europe’s leading role in supercomputing and quantum computing.

DIGIBYTE | 27 February 2020
Austria, Bulgaria, Denmark and Romania join initiative to explore quantum communication for Europe

The four countries have agreed to work together with 20 other EU Member States towards the development of a quantum communication infrastructure (QCI) across Europe. The purpose of the QCI will be to boost European capabilities in quantum technologies, cybersecurity and industrial competitiveness.

Browse Quantum
EU investment in high performance computing and computing technologies will enable Europe to lead the way in supercomputing in the Digital Decade.

**Dig deeper**

The European Quantum Communication Infrastructure (EuroQCI) Initiative
The EuroQCI initiative aims to build a secure quantum communication infrastructure that will span the whole EU, including its overseas territories.

Quantum Technologies Flagship

The Quantum Technologies Flagship is a long-term research and innovation initiative that aims to put Europe at the forefront of the second quantum revolution.

See Also

Destination Earth

Destination Earth (DestinE) aims to develop a high precision digital model of the Earth to monitor and simulate natural and human activity.

Electronics

Micro and nano-electronics take us to the world in miniature, where big things are facilitated by the smallest and smartest electronic components and systems.

Photonics

We are on the verge of a new photonics era, and the European Commission is working to ensure citizens and businesses enjoy the full benefits of this technology.

High Performance Computing

In the digital decade, high performance computing is at the core of major advances and innovation, and a strategic resource for Europe's future.

Source URL: https://digital-strategy.ec.europa.eu/policies/quantum