Quantum Technologies Flagship kicks off with first 20 projects

The Flagship will fund over 5,000 of Europe's leading quantum technologies researchers over the next ten years and aims to place Europe at the forefront of the second quantum revolution. Its long term vision is to develop in Europe a so-called quantum web, where quantum computers, simulators and sensors are interconnected via quantum communication networks. This will help kick-starting a competitive European quantum industry making research results available as commercial applications and disruptive technologies. The Flagship will initially fund 20 projects with a total of €132 million via the Horizon 2020 programme, and from 2021 onwards it is expected to fund a further 130 projects. Its total budget is expected to reach €1 billion, providing funding for the entire quantum value chain in Europe, from basic research to industrialisation, and bringing together researchers and the quantum technologies industry.

Andrus **Ansip**, Commission Vice-President for the Digital Single Market, said: *"Europe is determined to lead the development of quantum technologies worldwide. The Quantum Technologies Flagship project is part of our ambition to consolidate and expand Europe's scientificexcellence. If we want to unlock the full potential of quantum technologies, we need to develop a solid industrial base making full use of our research."*

Mariya **Gabriel**, Commissioner for Digital Economy and Society, added: *"The Quantum Technologies Flagship will form a cornerstone of Europe's strategy to lead in the development of quantum technologies in the future. Quantum computing holds the promise of increasing computing speeds by orders of magnitude and Europe needs to pool its efforts in the ongoing race towards the first functional quantum computers."*

In the early 20th century, the first quantum revolution allowed scientists to understand and use basic quantum effects in devices, such as transistors and microprocessors, by manipulating and sensing individual particles.

The second quantum revolution will make it possible to use quantum effects to make major technological advances in many areas including computing, sensing and metrology, simulations, cryptography, and telecommunications. Benefits for citizens will ultimately include ultra-precise sensors for use in medicine, quantum-based communications, and Quantum Key Distribution (QKD) to improve the security of digital data. In the long term, quantum computing has the potential to solve computational problems that would take current supercomputers longer than the age of the universe. They will also be able to recognise patterns and train artificial intelligence systems.

Next steps

From October 2018 until September 2021, 20 projects will be funded by the Flagship under the coordination of the Commission. They will focus on four

application areas – quantum communication, quantum computing, quantum simulation, quantum metrology and sensing – as well as the basic science behind quantum technologies. More than one third of participants are industrial companies from a wide range of sectors, with a large share of SMEs.

Negotiations are ongoing between the European Parliament, Council and Commission to ensure that quantum research and development will be funded in the EU's multi-annual financial framework for 2021-2028. Quantum technologies will be supported by the proposed Horizon Europe programme for research and space applications, as well as the proposed Digital Europe programme, which will develop and reinforce Europe's strategic digital capacities, supporting the development of Europe's first quantum computers and their integration with classical supercomputers, and of a pan-European quantum communication infrastructure.

Background

Since 1998, the Commission's Future and Emerging Technologies (FET) programme has provided around €550 million of funding for quantum research in Europe. The EU has also funded research on quantum technologies through the European Research Council (ERC). Only since 2007, the ERC has funded more than 250 research projects related to quantum technologies, worth some 450 million euro.

The Quantum Technologies Flagship is currently supported by Horizon 2020 as part of the FET programme, which currently runs two other Flagships (The Graphene Flagship and the Human Brain Project Flagship). The FET programme promotes large-scale research initiatives to drive major scientific advances and turn them into tangible innovations creating benefits for the economy and society across Europe. Funding for the Flagship project comes from Horizon 2020, its successor programme Horizon Europe and national funding.

The Quantum Technologies Flagship is also a component of the Commission's European Cloud Initiative launched in April 2016, as part of a series of measures to support and link national initiatives for the digitisation of Europe's industry.

For more information

Memo

The first 20 projects

Official website of the Quantum Flagship

Blog post by Vice-President Ansip on the Quantum Flagship

Joint statement on progress to build European supercomputers

European approach to Artificial Intelligence

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What are quantum technologies, and what is the second quantum revolution?

Quantum technologies use the properties of quantum effects – the interactions of molecules, atoms, and even smaller particles, known as quantum objects – to create practical applications in many different fields. The so-called first quantum revolution, which saw the creation of the field of quantum physics, happened in the first half of the twentieth century and shaped the world we live in today, For instance it led to the development of lasers and transistors,, two foundational technologies for building computers, telecommunications, satellite navigation, smartphones and modern medical diagnostics.

The second quantum revolution is now underway and involved the detection and manipulation of single quantum objects such as atoms, photons and electrons. We can for example now rotate an electron clockwise and anticlockwise at the same time, and can connect particles invisibly across space and time. In many cases, the level of our control has reached a point that allows the use of quantum systems for real-world applications in sensing, secure communications and for computing and simulation. This is the field of quantum technologies.

What is the EU's standing in the area of quantum technologies? What are the EU's biggest assets, and how are industry and business making use of them?

Europe has well-acknowledged excellent scientific and technical expertise and a long history in financing research in quantum. Europe's strength relies on the excellence of its scientists, but also on the high degree of collaboration of the scientists across the Union, maximizing the benefits of cooperative science in this highly interdisciplinary field.

From the very beginning, European industry participated in EU research and innovation programmes. However, twenty years ago, industry participation was highly speculative and essentially limited to telecommunication, laser and computing companies. Nowadays those companies no longer see quantum technologies as a scientific curiosity but are increasingly integrating them in their products or are actively turning towards academia in search of quantum solutions. The unprecedented developments are bringing more and more industrial payers into the field of quantum technologies.

Why is the Quantum Flagship needed?

Europe has a strong tradition in quantum research, which began with the creation of quantum physics in the first decades of the twentieth century. A key strength is Europe's focus on a range of different fields in quantum technologies, a major factor in attracting overseas researchers.

The Quantum Flagship will address so far unsolvable research challenges such as those of building a functioning quantum computer, developing ultra-secure communication systems or making major advances in quantum sensing technologies.

For some of these technologies, we are now at a turning point where science is ready to transfer to industry the knowledge and technologies required for delivering first products and services such as secure quantum communications, extremely accurate sensors, and very first quantum computers. Currently, there is a global race to create and conquer the market of these key technologies of the future. The U.S. is investing more than US$1.2 billion in the period 2019 – 2028 and China is building a US$10 billion National Laboratory for Quantum Information Sciences.

The Flagship aims to create a European ecosystem that will deliver knowledge, technologies and open research infrastructures to develop a world-leading knowledge-based industry in Europe. The big advantage of the Flagship is that it has established a research agenda that has been widely agreed by all the involved stakeholders and will be supported by the Member States and by the private sector in a well-coordinated manner.

What is the vision and what are the goals of the Quantum Technologies Flagship?

The long-term vision of the Flagship is to develop in Europe a so-called quantum web, where quantum computers, simulators and sensors are interconnected via quantum communication networks. There are three goals underlying this vision:

- To consolidate and expand European scientific leadership and excellence in quantum research, including education and training for developing the relevant know-how and skills;

- To kick-start a competitive European industry in quantum technologies in order to position Europe as a leader in the future global industrial landscape;

- To make Europe a dynamic and attractive region for innovative research, business and investments in quantum technologies, thus accelerating their development and take-up by the market.

How is the Quantum Technologies Flagship organised?

The Flagship will provide €1 billion of funding for quantum research over the next ten years. In its ramp-up phase (2018-2021), it funds 20 projects from 21 countries under the Horizon 2020 research framework programme.

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the EU's multi-annual financial framework for 2021-2028. Quantum technologies will be supported by the proposed Horizon Europe programme for research and space applications, as well as the proposed Digital Europe programme, which will develop and reinforce Europe's strategic digital capacities, supporting the development of Europe's first quantum computers and their integration with classical supercomputers, and of a pan-European quantum communication infrastructure.

The Flagship will ensure that there is close coordination between these projects and the ones funded by the Member States in their national quantum technologies programmes. The Flagship builds on the QuantERA initiative, co-funded by the Commission and funding agencies from 26 European countries. The Flagship also has a governance structure that will be set up in line with the recommendations provided by the Commission's High Level Steering Group on Quantum technologies.

The governance structure of the Flagship consists of:

- A Board of Funders, bringing together the Commission and the funding agencies of the Member States and Countries Associated to Horizon 2020, as a discussion forum to align national and European priorities and initiatives;

- A Strategic Advisory Board, a group of high level independent quantum experts. Their mandate will be to monitor the Flagship's progress and prepare, with the help of the research stakeholders, the next version of the Flagship's strategic research agenda that they will deliver, together with their recommendations, to the Board of Funders;

- A Science and Engineering Board, composed of the representatives of the Flagship's funded projects. Its mandate is that of coordinating the projects' common activities;

- A Coordination and Support Action, aiming to support the coordination of the different stakeholders who will be participating in the Flagship activities. One of such key players is the quantum community network, consisting of representatives of the national quantum communities.

What are the main research areas that the Flagship's projects address?

The 20 projects initially funded by the Flagship cover research and technology development in the following five complementary and interdependent areas:

- ***quantum computing***: using enormous computing power to solve otherwise insoluble problems, processing vast amounts of data faster than ever before to recognise patterns and train artificial intelligence systems,

e.g. for digital assistants to help doctors to diagnose and treat diseases or optimising traffic to reduce jams and emissions.

- ***Quantum simulation***: understanding the functioning of complex systems, which will be key to the design of new chemicals like drugs and fertilisers, and of new materials, such as high-temperature superconductors for energy distribution without losses.

- ***Quantum communication***: helping to protect data transmitted digitally, such as health records, financial transactions or other sensitive data sets by developing securest ways of communication, impossible to intercept without being perceived.

- ***Quantum metrology and sensing***: providing highly accurate measurements increasing the performance of devices and consumer services, such as medical imaging sensors, high-precision navigation and the Internet of Things.

- ***Fundamental quantum science***: complementing the projects in the four other areas and addressing related foundational scientific problems.

Who is participating in the Quantum Technologies Flagship?

In these first three years of the Flagship, the partners of the 20 funded projects come from EU Member States, associated countries to Horizon 2020, and Belarus (international partner).

What is the funding and duration of the Flagship's projects?

The duration of most of the projects funded by the Flagship is three years. Projects addressing quantum communication, quantum computing systems, quantum simulation, and quantum metrology and sensing will receive funding of up to €10 million, while projects in fundamental science are smaller and will receive funding of €2-3 million.

What advantages will future quantum technologies bring?

Within the next 10 years, the performance enhancements resulting from quantum technologies will yield unprecedented computing power, guarantee secure communications, and provide ultra-high precision measurements. Examples include the measurement of the tiniest variations of magnetic or electric fields for medical imaging below the cell level for less invasive diagnosis and treatments, or for searching raw materials (petroleum, minerals, etc.), ultra-precise atomic clocks in smart grids allowing energy savings, or yet quantum key distribution technologies to prevent eavesdropping in finance, banking and defence by establishing secure communication links, and supercomputers outperforming existing or future classical supercomputers and at a fraction of their energy consumption.

In the long term, quantum computing has the potential to solve computational problems that would take current supercomputers longer than the age of the universe. The scientific computing that this will enable could bring about breakthroughs in, for example, chemical process design, energy efficient materials, and energy harvesting, as well as machine learning and big data analysis.

What about quantum key distribution (QKD) – will the Flagship be able to provide ultra-secure data encryption for Europe?

The Flagship is currently funding, with a budget of about €34 million, four projects on quantum communication that include also research on faster and more secure quantum key distribution (QKD). The results of those projects will feed into the QKD pilot that will be funded by Horizon 2020 with €15 million, to test in real conditions the business cases for a telecommunication network with an additional layer of security provided by QKD. The expectation is that, after the Flagship's ramp up phase, this pilot will leads to an EU-wide deployment of a public QKD service. Such deployment is foreseen to be financed by the Digital Europe Programme in the period 2021 to 2028.

Will quantum computers replace current computers any time soon?

No. Initial prototypes of quantum computers are currently available in research labs, but they are only at a very early stage of development. They are built from up to a few dozen individual computing units (quantum bits of operation, or qubits), which are largely insufficient for resolving practical applications. In addition, the software and the algorithms that will exploit the computing capabilities of quantum computers are still in development. Larger quantum computers of up to 300 qubits are expected to be engineered by 2026-2027. Quantum computers with tens of thousands of individual computing units are expected to be operational only in 15-20 years.

For more information

Press release

The first 20 projects

Official website of the Quantum Flagship

Humanitarian aid: EU releases €58 million for the Sahel and the Central

African Republic

For 2018, the EU's total humanitarian response to the Sahel countries now stands at €270 million and €25.4 million for the Central African Republic.

"As the humanitarian situation in the Sahel continues to worsen, we are stepping up our assistance to address the major food crisis in the region. Ongoing violence and conflict, as well as the effects of climate change, are causing massive displacement, acute malnutrition and food insecurity that is affecting millions, especially children. We remain committed to show solidarity to the most vulnerable and to save lives," said Commissioner for Humanitarian Aid and Crisis Management Christos **Stylianides**. The EU funding will help provide food and nutrition to the most vulnerable and emergency assistance such as shelter, medical care and water.

Funding in the Central African Republic will enhance the EU's ongoing efforts to address the needs of the displaced populations. *"In the face of ongoing violence and displacement in the country, we must continue to do our outmost to cover the needs of all those forced to leave their homes,"* added Commissioner **Stylianides**.

The assistance announced today will go to seven countries in the Sahel region and to the Central African Republic: Nigeria (€10 million), Mali (€6 million), Niger (€6 million), Burkina Faso (€5 million), Mauritania (€5 million), Chad (€12 million) and Cameroon (€3 million), Central African Republic (€8 million). In addition, regional funding amounting to €3 million will be allocated to the Sahel to ensure life-saving malnutrition treatments. The EU is one of the largest contributors of humanitarian aid to the Sahel. The EU assists people in need of emergency food assistance and provides treatment for severely malnourished children as well as for conflict-affected populations.

Background

In the Sahel, 12 million people are estimated to be in need of emergency food assistance during the lean season, while 4.2 million children are in need of live-saving nutrition treatment. In addition, conflicts have forcibly displaced 3.1 million people throughout the region and created additional emergency needs. Thousands of newly displaced people have been recently recorded in Northeast Nigeria, with children showing alarming rates of acute malnutrition. Floods affecting Niger, Mali and Nigeria since mid-August, have further increased needs and pose serious health risks. A cholera epidemic has been spreading in Niger, Nigeria and Chad over the past few months.

In the Central African Republic, continuous insecurity and violence further increase humanitarian needs. About 2.5 million people, meaning half of the population, are in need of humanitarian aid and one in four – about 1.2 million people – has been forcibly displaced.

For more information

Sahel

Burkina Faso

Cameroon

Chad

Mali

Mauritania

Niger

Nigeria

Central African Republic

Main topics and media events 29 October – 11 November 2018

The European Commission has approved an investment package of €243 million from the EU budget for projects under the LIFE programme supporting nature, the environment and quality of life in Europe’s transition to a more sustainable and low-carbon future.

Concentrations: la Commission approuve la prise de contrôle exclusif d’EMI Music Publishing par Sony

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