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Geneva recognised as a key hub for quantum physics

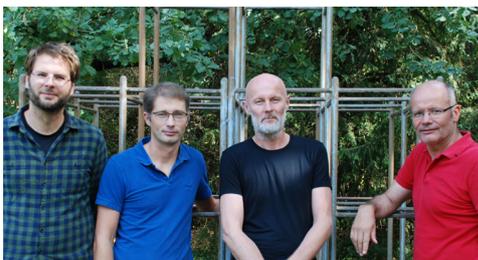
The European Commission is launching the € 1 billion *Quantum Flagship* programme to support quantum physics research and its industrial applications – and the initiative includes three UNIGE projects.

The discovery of the quantum world has shaped our daily lives: computers, telecommunications, satellite navigation, smartphones and modern medical diagnostics are all areas that could not have been developed without an understanding of quantum physics. And a second quantum revolution is now underway: the capacity to detect and manipulate “unique quanta” – atoms, photons and electrons. The European Commission (EC) has set up the *Quantum Flagship* programme to support research while linking it directly to industry. Twenty projects were selected by the EC for the first phase of the ten-year flagship initiative, including three from the University of Geneva (UNIGE), Switzerland. It is a fitting reward for the university, which has been a pioneer and leader in the field of quantum physics for over twenty years.

The *Quantum Flagship* has a budget of € 1 billion for ten years of research in quantum physics. The goal is to build synergies between academic research, applied research and industry. European scientists submitted their research projects for the launch phase of the Quantum Flagship, which runs from 2017 to 2020. During this first stage, three UNIGE projects will be backed among the 20 selected by the EC, with an overall budget of € 130 million over three years. From 2021, the remaining € 870 million will be invested in the second phase of projects for a period of seven years. “This is a great recognition for our university,” says Robert Thew, researcher in the Department of Applied Physics in UNIGE Faculty of Science and a partner in two of the selected projects. “Historically, UNIGE was the first institution to conduct quantum communications outside the protected environment of the laboratory, when, for instance, it used optical fibres under Lake Geneva. As a result, our university has been recognised as a world leader in the area for over two decades, and these three new projects will help maintain our reputation.”

Quantum random number generation

UNIGE will play a pivotal role in the QRANGE (Quantum Random Number Generation) project coordinated by Hugo Zbinden in partnership with Robert Thew, Florian Fröwis and Nicolas Brunner, researchers in UNIGE’s Department of Applied Physics. “The aim of QRANGE is to advance the academic and industrial aspects of quantum random number generation for applications in the Internet of Things (IoT), quantum cryptography and high-performance computing,” explains Zbinden. Generating random numbers can guarantee a high security level for encryption keys, and in particular ensure the confidentiality of internet transactions. “The idea is to develop high security and the generation of high-speed random numbers, and, in addition, to market inexpensive applications



From left to right: Nicolas Brunner, Mikael Afzelius, Rob Thew and Hugo Zbinden, whose research projects have been selected by *Quantum Flagship*.

High definition pictures

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for everyday use,” continues Zbinden. Nine partners from five different countries will join forces with UNIGE for QRANGE with total funding of € 3.2 million.

Quantum Internet Alliance

Is it possible to cultivate a European or even global quantum telecommunication network? The Quantum Internet Alliance (QIA) is designed to answer this question and to refine the technologies devised in the laboratory. QIA, which is coordinated by the University of Delft in the Netherlands, will bring together 23 partners from nine countries, including the team headed by Mikael Afzelius, a researcher in UNIGE’s Department of Applied Physics. “One of the major challenges in creating a network like this is the repetition of the quantum signal over long distances,” says Afzelius. “My team will focus on developing quantum memories and repeaters to provide the technologies needed for a quantum Internet” – a key new research area for European industry in this emerging field. € 10 million have been assigned by the EC to support QIA.

Quantum Flagship Coordination and Support Action

The third UNIGE project supported by the EC – to the tune of € 3 million – is the Quantum Flagship Coordination and Support Action (QFlag). “Our goal is to facilitate the coordination of all stakeholders – the EC, member states, academic researchers and industry players – and to reach out to the public and end-users of quantum technologies,” says Robert Thew, a researcher in UNIGE’s Department of Applied Physics and head of QFlag at UNIGE. A wide range of events, including meetings, conferences and workshops, will bring together the world of academia and industry to draw up a strategic research agenda, strengthen the leadership of European research and help create business opportunities to address the new challenges facing society. “We also want to focus on training a workforce that is familiar with quantum issues,” says Thew. QFlag includes seven partners from six countries and is led by VDI Technologiezentrum from Düsseldorf in Germany.

All three projects will benefit from the strong innovation ecosystem that has been fostered in Geneva, which originated in the group led by Professor Nicolas Gisin, co-founder of the start-up ID Quantique, which markets the quantum technology generated by Geneva’s university research. The synergy between UNIGE and ID Quantique is a model of innovation for the *Quantum Flagship*, which could now be replicated at European level.

About the Quantum Flagship

The 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 policy makers, 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 5000 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.

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