

Press Release

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NEW APPLICATIONS OF QUANTUM COMMUNICATION FOR EUROPE

New devices and applications for sustainable quantum communication successfully demonstrated in the European project UNIQORN

(Vienna) Over the past three and a half years, new devices and applications of quantum communication for the mass market have been developed within the multidisciplinary EU project UNIQORN. The project is now coming to an end at the end of this month. In it, the research consortium was able to show that quantum optical setups can be miniaturized to a size of just a few centimeters. This opens up new application scenarios that can help solve key European challenges such as data sovereignty and sustainable technology use. The development work was carried out as part of the ramp-up phase of the European Quantum Technologies Flagship initiative.

Quantum communication is an important cornerstone of the second quantum revolution and opens up enormous potential for information-theoretic data security. However, to deliver on this promise, powerful, compact and cost-effective modules must be available for practical implementation. The European Horizon 2020 project "UNIQORN - Affordable Quantum Communication for Everyone: Revolutionizing the Quantum Ecosystem from Fabrication to Application" was selected by the European Commission in 2018 for the ramp-up phase of the European Quantum Technologies Flagship initiative. The goal of UNIQORN was to combine innovative user-oriented pioneering research in the field of quantum technology with the timely exploitation of prototype components and system-on-chip solutions in a growth market with enormous potential. The completion of the project also marks the end of the ramp-up phase of the "Quantum Technologies Flagship".

The project successfully demonstrated the miniaturization of optical setups. A fully functional quantum key distribution (QKD) transmitter was realized together with lasers, modulators and optical attenuators on a photonic chip measuring only 2x4 mm. Since this technology guarantees absolutely secure data encryption, small and inexpensive QKD components can be integrated into almost all optical communication devices in the future.

Quantum communication to be used industrially in the future

In addition to chip integration, the experts in UNIQORN also researched new applications and the network capability of quantum key distribution. Various QKD links were set up in an inner-city fiber optic network in Bristol (UK) to test the future encryption of 5G stations. This network had a

novel controller that monitored the performance of the QKD links and could actively switch links between stations to bypass or compensate for broken links, increasing the resilience of the entire QKD network. The project was also able to demonstrate that QKD services could be made available to the general public via flexible residential fiber networks.

The milestones achieved in UNIQORN are an important step towards realizing the vision of a quantum internet for Europe. Entangled photon sources, which are essential for connecting widely separated quantum computers and quantum repeaters, have been realized on small polymer platforms and designed for mass production. Since the quantum internet is expected to enable other new applications besides QKD, quantum-secured methods for one-time tokens were also developed, which can be used in financial transactions as well as in online commerce.

Hannes Hübel, coordinator of the UNIQORN project and head of the Quantum Technologies research group at the AIT Austrian Institute of Technology, is proud of the results achieved in the project. "Thanks to advances in photonic integration, systems for absolutely secure quantum communication can be easily integrated into existing communication devices such as modems, bringing quantum technology into every living room," says the expert. "The UNIQORN project may be ending now, but it will still live on - as most of the partners will continue their research in the next phase of the 'Quantum Technologies Flagship' and will also participate in the creation of a European quantum network under the EuroQCI initiative."

Tap-proof communications for Austrian authorities

The first steps toward an operational quantum network are already being taken in Vienna. As part of the "QKD4GOV" project, which is funded under the KIRAS security research funding program of the BMLRT and the FFG, ministries and authorities in Vienna are being connected with QKD links and the technology is being tested under conditions suitable for everyday use. The first strategic locations of various authorities are already connected to the QKD network. The full roll-out together with the first demonstrations of QKD secured communication between security authorities is planned for the fall. Further information: <https://www.kiras.at/gefoerderte-projekte/detail/qkd4gov>

About UNIQORN

The UNIQORN consortium included 17 partners from 9 European countries. The AIT Austrian Institute of Technology was responsible for project coordination and the Institute of Computer and Communication Systems Athens for technical management. Other partners were research institutions (Fraunhofer Heinrich Hertz Institute/HHI, Interuniversity Microelectronics Centre/imec) with many years of experience in transferring basic research into applications and quantum researchers with theoretical and experimental know-how (University of Vienna, University of Paderborn, University of Innsbruck, Technical University of Denmark). In addition, the project was able to draw on experts in the fields of photonics and electronics, integration and packaging (Eindhoven University of Technology, Micro-

Photon-Devices, Politecnico Milano, SMART Photonics, VPI Photonics, Cordon Electronics). The perspective of industrial end-users was brought in by the system provider Mellanox and the mobile operator Cosmote. Field evaluation was carried out in the Smart City test environment at the University of Bristol.

About the European Quantum Technologies Flagship (QT Flagship) initiative

The European QT Flagship was launched in 2018 as one of the largest and most ambitious European Union research initiatives. With a budget of €1 billion over 10 years, the Flagship brings together research institutions, academia, industry, businesses and policy makers in a collaborative initiative of unprecedented scale. The main objective of the QT Flagship is to consolidate and extend Europe's scientific leadership in this field of research, and to translate the findings of quantum research into commercial applications and innovative technologies, thus bringing them from the laboratory to the marketplace. With over 5,000 researchers from academia and industry, the program aims to lay a foundation for a competitive European industry in the field of quantum technology and position Europe as a dynamic and attractive location for innovative research, business and investment in this area. <https://qt.eu/about/>

About the EuroQCI Initiative

The goal of the EuroQCI (European Quantum Communication Infrastructure) initiative is to build a secure quantum communication infrastructure for the entire territory of the European Union. As of June 2019, all 27 EU member countries have signed the European Quantum Communication Infrastructure (EuroQCI) Declaration, committing to the EuroQCI initiative and its goal of data sovereignty for Europe. Participating countries are working with the European Commission and the European Space Agency (ESA) to develop and implement EuroQCI, which is expected to be fully operational by 2027.

<https://digital-strategy.ec.europa.eu/en/policies/european-quantum-communication-infrastructure-euroqci>

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