PRESS RELEASE

MAX PLANCK INSTITUTE
FOR THE SCIENCE OF LIGHT

Conclusion of the QuNET initiative: Federal Minister of Research Bär launches Quantum Communication Network between Bavaria, Thuringia, and Berlin

ERLANGEN, 28 OCTOBER 2026

The QuNET Research initiative, which received 125 million euros in funding by the German Federal Ministry of Research, Technology and Space (BMFTR), concluded its final key experiment today with a live demonstration. Together with representatives from the federal states of Bavaria, Berlin, Saxony, and Thuringia, Germany's Federal Minister of Research, Technology and Space Dorothee Bär activated a cross-state experimental network for quantum communication in Berlin.

Since 2019, the German Federal Ministry of Research, Technology and Space (BMFTR) has been supporting research into the technological foundations for highly secure communication through the QuNET initiative. At the heart of the initiative is quantum key distribution (QKD). The core consortium includes the Fraunhofer Institute for Applied Optics and Precision Engineering IOF, the Fraunhofer Heinrich Hertz Institute for Telecommunications HHI, the Max Planck Institute for the Science of Light (MPL), the Institute of Communications and Navigation at the German Aerospace Center (DLR), and Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU).

Dorothee Bär, Federal Minister of Research, Technology, and Space, stated: "Today, with the conclusion of the final key experiment of the QuNET initiative, we have reached an important milestone of the High-Tech Agenda Germany. I am delighted that we were able to see here live today how quantum communication can help us protect our sensitive data from attack, even in the quantum age of the future. This is how we are strengthening our technological sovereignty and value creation. The task now is to quickly translate this research into broad application for the cybersecurity of tomorrow."

Minister President Dr. Markus Söder adds: "Quantum computing is a completely new technology that will enable computing power on a scale that is almost unimaginable. As a hightech state, Bavaria is resolutely driving this research forward. The quantum communication network is intended to lay the foundation for secure communication, the defense against cyber-

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Minister President Dr. Markus Söder with the mission badge for the QuNET key experiment "End-User Connection Network."

attacks, and digital sovereignty well into the future. Two Bavarian hightech hubs – Munich and Erlangen – are playing a key role in this effort. In the Free State of Bavaria, we are making a massive commitment to research and science: Through the High-Tech Agenda, we are investing seven billion euros in our universities and cutting-edge research throughout the state – in AI and quantum computing as well as in bio-life sciences, defense tech, and aerospace. Together, we are advancing the technologies of the future. Congratulations on the launch, and best of luck!"

Federal states provide sub-networks, federal minister connects them

Marking the official conclusion of the QuNET initiative, researchers conducted their final and largest key experiment in Berlin on October 28 in the presence of the Federal Minister. Working alongside partners from industry, academia, and society, they successfully demonstrated the exchange of quantum-encrypted data across a realistic, cross-state network.

To this end, political representatives from the participating federal states first activated their regional subnetworks on site in Erlangen, Erfurt, and Berlin. For Bavaria, this was done by

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Minister-President Dr. Markus Söder; for the State of Berlin, by Governing Mayor Kai Wegner; and for Thuringia, by Minister-President Mario Voigt. Also represented was the state of Saxony, represented by Dr. Babett Gläser, Head of the Research Division at the Saxon State Ministry of Science, Culture, and Tourism. Through their respective state initiatives, the federal states contributed significantly to the development of local research infrastructures for quantum communication, upon which the cross-state QuNET network was built.

Following the successful deployment of the regional subnetworks, Federal Minister of Research Dorothee Bär gave the start signal in Berlin for the interconnection of these subnetworks into a joint Quantum Communications network, followed by a live demonstration.

Live demonstration using fictitious health data

Several key experiments paved the way for this: As early as 2021, QuNET researchers in Bonn had demonstrated a quantum-secure communication link in the government district. In 2023, they combined free-space and fiber-optic links in Thuringia to create a hybrid quantum connection. This was followed in 2024 by a network with multiple nodes in Berlin, and by 2025, a mobile quantum network node was demonstrated in Bavaria using an aircraft.

During the most recent live demonstration in Berlin, which was conducted under the technical leadership of MPL and FAU, various quantum cryptography systems were interconnected to form a network. The demonstration focused on a real-world application scenario: Fictitious pharmacy invoices were transmitted in a quantum-secure manner from Jena University Hospital via DATEV to the Bundesdruckerei. The transmission itself took place over conventional communication networks consisting of fiber-optic cables. This is because QuNET investigated not only components and systems for Quantum Communication but also their integration into real-world and already widely existing communication infrastructures.

“The future of Quantum Communication will be shaped by a hybrid, quantum-secure infrastruc-ture consisting of fiber-optic networks, free-space networks, and satellite networks,” said Prof. Dr. Andreas Tünnermann, spokesperson for the QuNET Initiative. “In this final QuNET key experiment, we are demonstrating exactly that: that different systems and regional networks can function together. This brings us a crucial step closer to the goal of a practically usable network infrastructure for

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Federal Minister of Research Dorothee Bär (center), Prof. Dr. Andreas Tünnermann (left), spokesperson for the QuNET initiative, and Prof. Dr. Christoph Marquardt (right), scientific director of the live demonstration in Berlin, are connecting various quantum cryptography systems into a network.

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highly secure communication."
Prof. Christoph Marquardt, scientific director of the live demonstration in Berlin, adds: "With QuNET, we have created a strong ecosystem for quantum-secure communication networks. The key to this success lies in the close collaboration between research institutions and numerous companies throughout Germany, with whom we have jointly laid the technical foundation for a reliable and marketable security architecture."

Prof. Florian Marquardt, Chair of the Chemical-Physical-Technical Section of the Max Planck Society and Director at MPL: "These results show how fundamental research can lead to groundbreaking technologies. What was driven purely by curiosity just yesterday is now becoming the key to new economic sectors, true to Max Planck's motto: 'Application must be preceded by understanding.' This also explains why the Max Planck Society, despite its clear focus on fundamental research, occupies a leading position in European technology transfer."
Prof. Joachim Hornegger, president of FAU: "The QuNet initiative demonstrates what is possible when researchers pool their ideas and expertise. FAU and MPL are collaborating to apply the findings of quantum research to develop new technologies for secure communication. In this way, scientific discoveries are transformed into new technologies for secure communication. Especially in times when secure communication is of central importance to the government, the economy, and society, we are proud that our research contributes to the digital sovereignty of Germany and Europe. The live demonstration of the cross-state quantum network shows that when science takes responsibility and pools its resources, it creates security for the communications of tomorrow."

QuNET+ brings technology closer to practical application
To integrate quantum communication into real-world communication infrastructures, the QuNET Initiative has always strengthened close collaboration between academia and industry, thereby making a significant contribution to the development of an innovation ecosystem for quantum communication in Germany. To this end, the so-called QuNET-Plus projects (QuNET+) were launched alongside the initiative to bridge the gap between research and industrial application. Since 2022, as part of QuNET+, companies and research institutions have developed building blocks for future Quantum Communication networks in a total of twelve projects – ranging from detector modules and laser sources to data post-processing, optical routing, and key management, as well as test laboratories and

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Prof. Christoph Marquardt (third from the left) is serving as the scientific director of the live demonstration in Berlin.

optical ground stations, such as those located in Oberpfaffenhofen and Jena.
QuNET+'s industry partners include renowned companies from the fields of cybersecurity, telecommunications, electronics, photonics and aerospace. The industry partners also focus on standardization and scaling. This includes standardized, interoperable interfaces for key management systems as well as the development of methods for testing, qualifying, and certifying Quantum Communication technologies.

After QuNET comes the next generation
With the live demonstration in Berlin, the QuNET initiative is now nearing the end of its seven-year research period. At the same time, the next phase is beginning – moving from an experimental quantum communication network focused on QKD applications toward value creation for the technologies and research results in Germany.
"The expertise, technologies, and industry partnerships established through QuNET and QuNET+ form the foundation for further developing key technologies for secure communication in Germany and translating them into commercial applications," concludes QuNET spokesperson Andreas Tünnermann. "This is not just about protecting sensitive data, but also about technological sovereignty and the opportunity for German and European companies to participate in a future market for highly secure communications. In addition to scientific and technical findings, the initiative's output is reflected not only in patents but also in several startups that have transformed the initiative's developments into marketable products," says Tünnermann.

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Questions and answers about the QuNET initiative (FAQ)

Why this initiative?

Increasingly powerful digital technologies are impacting today's data networks and pose a growing threat to the security of the critical infrastructure of the modern information society. Added to this is the ongoing development of quantum computers. With their ability to calculate and analyze a multitude of potential options simultaneously, they create not only new opportunities but also risks. Many of the core components of encryption are currently in widespread use – and upon which security is based – can be broken as a result. Therefore, government organizations, the healthcare system, and security-critical companies must rethink and modernize their security infrastructures.

What is the goal of the initiative?

The QuNET initiative was launched in 2019 and has since received 125 million euros in funding from the Federal Ministry of Research, Technology, and Space.

QuNET's primary goal is the application-oriented development of fundamental physical and technical principles, as well as the necessary technologies, for highly secure communication networks under real-world conditions using quantum physics. The initial focus is on practical applications for quantum-secure networking, such as for government agencies. However, QuNET enables more than just secure communication: The potential applications of quantum state transmission extend all the way to networked quantum computers, the so-called quantum internet.

How does quantum encryption work?

Quantum encryption takes advantage of the property of every individual quantum particle that it cannot be fully characterized by measurement and therefore cannot be perfectly copied. For example, a quantum source generates light pulses with variable properties that are exchanged between two locations. The results of a quantum mechanical measurement can reveal any manipulation or eavesdropping on the light pulses. Building on this, a key can be generated that is known only to the sender and receiver and that can be used for encryption. The core of this method is also resistant to future attacks by a quantum computer. To bridge greater distances, satellites equipped with quantum sources can generate quantum keys over intercontinental distances, or quantum repeaters currently under development can be used.

What is the current state of the art in Quantum Communication?

Quantum communication offers many potential applications that benefit the economy and society. Among these, quantum key distribution (QKD) is arguably one of the most thoroughly studied and internationally advanced examples.

What QuNET key experiments have been conducted so far?

The live demonstration in Berlin on October 28, 2026, marks the final key experiment (SE4) of the QuNET Initiative. It was preceded by a pioneering experiment in Bonn (SE0) and three other key experiments (SE1–SE3):

- **Pioneer Experiment (SE0), Bonn 2021:**
  First quantum-secure video conference between the BMFTR and the BSI in Bonn
  More information: https://s.fhg.de/QuNET-Pionier
  Scientific Contact for the Pioneer Experiment, led by MPL: Christoph Marquardt (christoph.marquardt@mpl.mpg.de)
- **Key Experiment 1 (SE1), Jena 2023:**
  Ad hoc metro network for quntum secure communication
  More information: https://s.fhg.de/QuNET-SE1
  Scientific Contact SE1, led by Fraunhofer IOF: Fabian Steinlechner (fabian.steinlechner@iof.fraunhofer.de), Matthias Goy (matthias.Goy@iof.fraunhofer.de)
- **Key Experiment 2 (SE2), Berlin 2024:**
  Securing critical infrastructure and dgital identities
  More information: https://s.fhg.de/QuNET-SE2
  Scientific Contact SE2, led by Fraunhofer HHI: Nino Walenta (nino.walenta@hhi.fraunhofer.de)
- **Key Experiment 3 (SE3), Oberpfaffenhofen/Erlangen 2025:**
  Dynamic QKD transmission from a mobile aerial platform
  More information: https://s.fhg.de/QuNET-SE3
  Scientific Contact SE3, led by DLR-IKN:
  Friederike Fohlmeister (friederike.fohlmeister@dlr.de) /
  Florian Moll (florian.moll@dlr.de)

Which research institutes are participating in the initiative?

The Fraunhofer Institute for Applied Optics and Precision Engineering IOF, based in Jena, uses its core areas of expertise in the generation, guidance, and measurement of light to, among other things, lay the technological foundations for Quantum Communication. Founded in 1992, the institute translates quantum-optical phenomena from the laboratory into practical applications by developing precision hardware components – such as sources of entangled photon pairs – for secure com-

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munication networks. Through close collaboration with academia and industry, the institute is developing systems ready for practical application in terrestrial and satellite-based quantum key distribution.
Press Contact Fraunhofer IOF:
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Innovations for tomorrow's digital society are at the heart of the research conducted by the Fraunhofer Heinrich Hertz Institute (HHI) in Berlin. Founded in 1928, the institute is a global leader in research on mobile and optical communication networks and systems, as well as video signal coding and data processing. Together with international partners from research and industry, the Fraunhofer HHI works across the entire spectrum of digital infrastructure – from basic research to the development of prototypes and solutions. The institute makes significant contri-butions to standards for information and communication technologies and creates new applications as a partner to industry.
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The Max Planck Institute for the Science of Light (MPL) in Erlangen covers a broad spectrum of research, including nonlinear optics, quantum optics, nanophotonics, photonic crystal fibers, optomechanics, quantum technology, biophysics, and – in collaboration with the Max-Planck-Zentrum für Physik und Medizin – interfaces between physics and medicine. MPL was founded in January 2009 and is one of more than 85 institutes of the Max Planck Society that conduct fundamental research in the natural sciences, life sciences, humanities, and social sciences for the benefit of the general public. Today, nearly 400 people from around 50 countries work at the institute. Some of the researchers have decades of experience in the field of Quantum Communication. They also use telecommunications technology for the exchange of quantum keys, which allows these methods to be rapidly commercialized. In addition, for more than ten years, the institute has been investigating how keys can be transmitted on the ground using laser light over several kilometers (known as a free-space link) or via satellite over greater distances. In this context, the MPL – also in collaboration with the national industry – plays a key role in many major national and international projects.
Press Contact MPL:
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The Institute of Communications and Navigation at the German Aerospace Center (DLR) is dedicated to mission-oriented research in selected areas of communication and navigation. The work conducted at the Oberpfaffenhofen and Neustrelitz locations ranges from fundamental research to the demonstration of new methods and systems. The DLR institute develops solutions for human-machine interaction, high-precision positioning for future navigation applications, and methods for autonomous and cooperative systems. Key areas of focus in cybersecurity include post-quantum cryptography and the transmission of quantum keys via satellite.
Press Contact DLR Institute of Communications and Navigation:
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The Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) was founded in 1743 and is the third-largest university in Bavaria. This highly innovative university offers a wide range of academic disciplines. The research-intensive Department of Physics collaborates closely with the Max Planck Institute for the Science of Light (MPL). The Chair of Optical Quantum Technology, established in 2022 as part of the Bavarian High-Tech Agenda and headed by Prof. Dr. Christoph Marquardt, focuses on the fundamentals of quantum information and the implementation of quantum protocols. This research group is a key partner in numerous national and international projects on Quantum Communication and plays a leading role in satellite-based Quantum Communication and the practical application of quantum technology.
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Launch of the regional subnetwork from the Erlangen Application Center with Dr. Markus Söder

Opening remarks by Minister President Dr. Markus Söder and the kickoff from the Bavarian State Chancellery in Munich. © Marc Conzelmann/Bayerische Staatsregierung

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More information:

Homepage of the QuNET-Initiative:
www.qunet-initiative.de

Specialized Portal on Communication Technologies and Cybersecurity:
https://www.forschung-it-sicherheit-kommunikationssysteme.de/forschung/it-sicherheit/qunet

Quantum technologies:
Quantum technologies – BMFTR

Quantum Technology Roadmap:
Hightech Agenda Deutschland: Quantentechnologien

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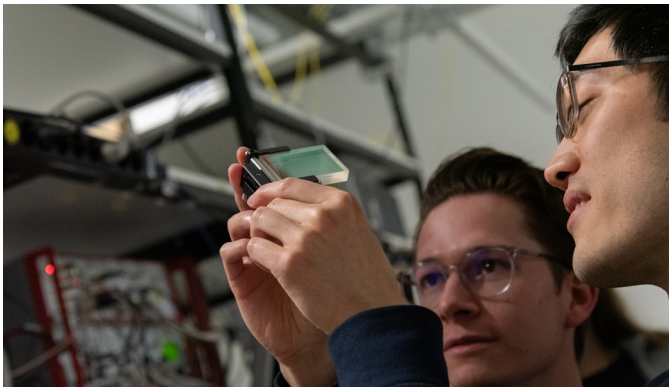
Highlights from Previous Key Experiments

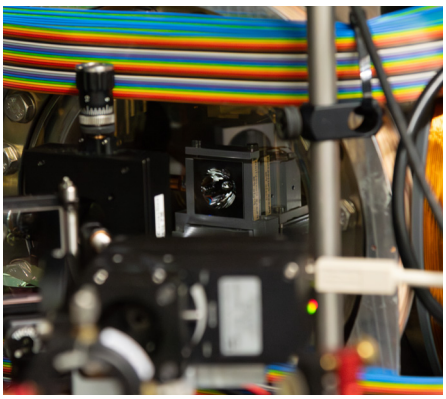
Fraunhofer IOF's QuBUS mobile ground station at MPL. © MPL



Scientists at MPL are examining an optical component of the ion trap experiment. © MPL

Optical setups developed by MPL and FAU for quantum experiments have been integrated and are ready for operation on an aircraft. © FAU

Green laser light is transmitted through a free-space optical channel within Berlin. © FAU / MPL



Close-up of the optical assembly of the ion trap at MPL. © MPL

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Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), established in 1743, is one of the largest universities in Germany, with roughly 40,000 students, over 600 professors and around 16,000 members of staff. At present, FAU is leading or contributing more than 100 projects funded by the German Research Foundation (DFG). FAU offers around 270 degree programmes, including nine Bavarian Elite Master's degree programmes and around 50 programmes with a distinct international focus. No other German university offers such a broad and interdisciplinary range of subjects on all qualification levels. FAU students enjoy global mobility thanks to partnerships with higher education institutions throughout the world.

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