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Research funding for photonic quantum chips

Jena researchers receive 12.6 million euros in funding

Ditzingen / Vaihingen / Munich / Jena (Germany)

The German Federal Ministry of Education and Research (BMBF) is funding a consortium led by the Stuttgart-based quantum start-up Q.ANT with 45 million euros. The consortium partners are contributing a further eight million euros. The funding will be used to build a demonstration and test facility for photonic quantum computer chips and other quantum computing components. The consortium also includes the Institute of Applied Physics (IAP) at Friedrich Schiller University Jena and the Fraunhofer Institute for Applied Optics and Precision Engineering IOF. Both are taking on development tasks worth 12.6 million euros in the project.

The consortium headed by Q.ANT is developing technologies for photonic quantum computing and preparing them for industrial use. Q.ANT, a wholly owned subsidiary of machine tool manufacturer TRUMPF, has recently presented a process that enables the production of very powerful quantum computer chips. By depositing highly specialized light channels on silicon wafers, quanta can be guided, controlled, and monitored in these so-called "photonic integrated circuits" with virtually no losses, even at room temperature.

Current quantum computer chips have to be cooled down to temperatures close to absolute zero (-273.15 °C). Thus, they are not suitable for direct on-chip coupling with classical computer architectures. The new photonic chip process will simplify the symbiosis of quantum computers and conventional mainframe computers. It also forms the basis for the joint research project "PhoQuant".

"The funding is an important signal for Germany as a location for innovation," says Michael Förtsch, CEO of Q.ANT. "We are at the beginning of the quantum computing age and the global race for market share of this future technology has begun. This funding is an important building block for a quantum computer made in Germany." The "PhoQuant" research project will run for five years.

Researchers from Jena contribute know-how of light sources

The consortium under the industrial leadership of Q.ANT is made up of a total of 14 German companies as well as applied research institutes and universities – including the IAP of the Friedrich Schiller University Jena and Fraunhofer IOF: "Within the framework of this project, the Friedrich Schiller University and Fraunhofer IOF are developing

Editorial Notes

Desiree Haak | Fraunhofer-Institute for Applied Optics and Precision Engineering IOF | Phone +49 3641 807-803 |
Albert-Einstein-Straße 7 | 07745 Jena | Germany | www.iof.fraunhofer.de | desiree.haak@iof.fraunhofer.de

integrated optical quantum light sources and low-loss integrated optical and fiber-optic interferometers as elementary building blocks of photonic quantum computers," explains Prof. Dr. Andreas Tünnermann, director of Fraunhofer IOF. "In addition to expertise in quantum optics and photonics, this requires know-how in hybrid assembly and integration technology. We introduce our expertise to this highly dynamic project in order to reach our common goal together with all participating companies and institutions: to realize a powerful photonic quantum computer."

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Quantum computer chips and vacancies

From today's perspective, fields of application for a computer with quantum computer chips are, for example, in the chemical industry, biomedicine, or materials science. "Cooperation between top researchers and companies is the key to quantum computer chips from Germany and related jobs. Only if industry, universities, and applied research institutes cooperate closely can successful industrial products also emerge from the know-how of Germany as a science location," says Förtsch. The project partners want to present a first prototype within two and a half years. In five years at the latest, a quantum computer chip is to be created which can perform far-reaching calculations.

The research project involves a total of 14 partners:

- Q.ANT GmbH
 - Paderborn University (UPB)
 - University of Münster
 - Fraunhofer Institute for Applied Optics and Precision Engineering IOF
 - Friedrich Schiller University Jena
 - Ulm University
 - HQS Quantum Simulations GmbH
 - Humboldt University of Berlin
 - Fraunhofer Institute for Photonic Microsystems
 - Swabian Instruments GmbH
 - TEM Messtechnik GmbH
 - ficonTEC Service GmbH
 - FU Berlin
 - Menlo Systems GmbH
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Contact

Dr. Fabian Steinlechner
Fraunhofer IOF
Department Emerging Technologies

Phone: +49 (0) 3641 807-733
Email: fabian.steinlechner@iof.fraunhofer.de

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About TRUMPF

The high-tech company TRUMPF offers manufacturing solutions in the fields of machine tools and laser technology. The company is driving the digital networking of the manufacturing industry through consulting, platform, and software offerings. TRUMPF is the technology and market leader in machine tools for flexible sheet metal processing and in industrial lasers.

In 2020/21, the company generated sales of 3.5 billion euros with around 14,800 employees (preliminary figures). With more than 80 subsidiaries, the Trumpf Group is represented in almost all European countries, in North and South America, and in Asia. Production sites are located in Germany, France, Great Britain, Italy, Austria and Switzerland, in Poland, the Czech Republic, the USA, Mexico, and China.

For more information about TRUMPF, visit: www.trumpf.com

About the Institute for Photonic Quantum Systems (PhoQS) at Paderborn University

The Institute for Photonic Quantum Systems (PhoQS) at Paderborn University conducts research into photonic quantum technologies at the interface of basic research and practical application. The aim is to develop new research approaches to the development of both technology for photon-based quantum applications and theoretical and experimental concepts. The ultimate focus is on understanding, controlling, and manipulating photonic quantum simulators and quantum computers. The institution – a central research institution of the university – is highly interdisciplinary, with researchers from the fields of physics, mathematics, electrical engineering, and computer science working together on second-generation quantum technologies. These technologies are based on the targeted manipulation of single and coupled quantum systems and will open up new possibilities beyond classical physics in the future.

For more information about the Institute for Photonic Quantum Systems (PhoQS) at Paderborn University, visit: www.uni-paderborn.de/phogs

About Fraunhofer IOF

The Fraunhofer Institute for Applied Optics and Precision Engineering IOF in Jena conducts application-oriented research in the field of photonics and develops innovative optical systems for the control of light - from its generation and manipulation to its application. The institute's range of services covers the entire photonic process chain from opto-mechanical and opto-electronic system design to the production of customer-specific solutions and prototypes. At Fraunhofer IOF, around 330 employees work with an annual research volume of 40 million euros.

For more information about Fraunhofer IOF, visit: www.iof.fraunhofer.com

Press photos

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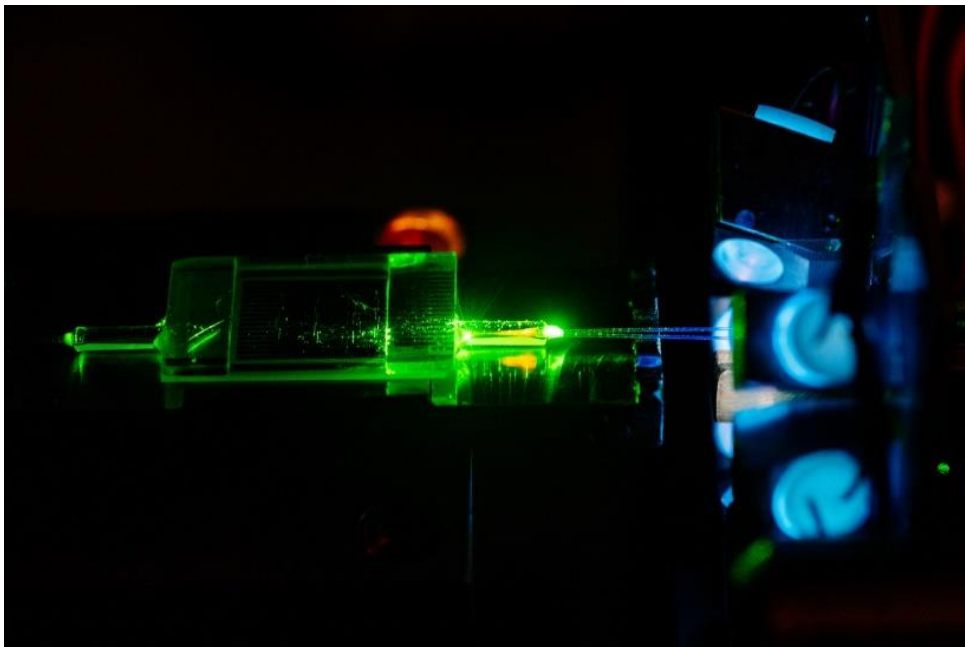


Fig. 1: In the "pigtailling" process, fiber-optic cables are permanently fused to an integrated-optical quantum device. © Universität Paderborn, Besim Mazhiqi

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