FRAUNHOFER INSTITUTE FOR APPLIED SOLID STATE PHYSICS IAF

PRESS RELEASE

Application-oriented research for the next generation of high-performance computers

Start of the Fraunhofer Competence Center "Quantum Computing Baden-Württemberg"

In order to advance application-oriented research on quantum computing, the Fraunhofer-Gesellschaft is founding a national network on quantum computing with regional centers in seven German states. The first center to start is the Competence Center "Quantum Computing Baden-Württemberg". The federal state government will support the center with up to € 40 million over the next four years. Fraunhofer IAF takes over the coordinative management of the Competence Center Baden-Württemberg together with Fraunhofer IAO.

The aim of the national competence network of the Fraunhofer-Gesellschaft is the development of quantum-based computing strategies for the next generation of high-performance computers. The cooperation includes cloud access to IBM quantum computers in the USA as well as the establishment of an IBM quantum computer in Germany, operating under German law. The access to quantum computers enables research on technology, application scenarios and algorithms. In addition, the center wants to stimulate competence development and generate competitive advantages for economy and science.

State-of-the-art quantum computer in Baden-Württemberg

With the participation of currently eleven Fraunhofer Institutes, technical expertise in the research field of quantum computing is pooled in regional competence centers throughout Germany. Within the Competence Center "Quantum Computing Baden-Württemberg", an IBM quantum computer will be established in Ehningen near Stuttgart. For this purpose, IBM will provide a state-of-the-art quantum computer (IBM Q System) as computing platform starting 2021.

The location allows the quantum computer to operate under German law and to comply with European privacy regulations. Furthermore, Baden-Württemberg's high-tech landscape of large- and medium-scale industry, SMEs and start-ups offers a wide range of possibilities for the application-oriented use of the high-performance computer.

"The early development of specialist competences in Baden-Württemberg and Germany offers a competitive advantage that should not be underestimated. It will allow us to participate in the value creation in the field of quantum computing at an early stage," says Prof. Dr. Dr. Ambacher, Director of the Fraunhofer Institute for Applied Solid State Physics IAF in Freiburg and Manager of the Competence Center Baden-Württemberg.

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"The Competence Center Quantum Computing is an important part of the federal strategy to strengthen its leading role in key technologies. We want to stimulate the close collaboration between university and applied science with the state's economy as much as possible and thus advance the future use of quantum technologies. The center gives Baden-Württemberg's industry a head start, which we need to capitalize on", adds Prof. Dr. Wilhelm Bauer, Director of the Fraunhofer Institute for Industrial Engineering IAO and Commissioner for Technology of the state government of Baden-Württemberg.

State to found Competence Center Baden-Württemberg with up to € 40 million

The state government of Baden-Württemberg will provide up to € 40 million over the next four years to support the establishment of the Competence Center "Quantum Computing Baden-Württemberg". "The quantum computer is an important step for Baden-Württemberg on the way to the early and successful development of decisive future technologies. The potential and possibilities are vast, many of which we cannot even imagine today. With the quantum computer in Ehningen, we contribute to a quantum technology ecosystem in Germany with international significance. It is a milestone for the technological sovereignty of Germany and Europe," says Prime Minister Winfried Kretschmann.

"We want to make the great innovative potential of quantum computing available for economic and scientific applications as early as possible in Baden-Württemberg, and also gain an important locational advantage internationally. Baden-Württemberg is the state of hidden champions and the leading innovative region in Europe. We therefore offer excellent conditions and a multitude of application areas for which quantum computing can be of practical use," says Minister of Economics, Labor and Housing Baden Württemberg, Dr. Nicole Hoffmeister-Kraut.

Collaboration projects and training offers

Interested regional university and non-university institutions as well as companies will be involved in the Competence Center through joint projects, contract research or a membership. "The aim is to offer a well-organized access and an efficient use of the IBM quantum computer to as many researchers as possible," says Prof. Ambacher.
By the end of the year, the Competence Center "Quantum Computing Baden-Württemberg« will have laid the organizational and technical foundation to enable scientific projects and contract research using IBM quantum computers. During the initial phase, a computer pool with workstations will be set up at Fraunhofer IAF (Freiburg) and Fraunhofer IAO (Stuttgart). In addition, Fraunhofer experts will offer training courses on

quantum computing to members and partners of the Competence Center. The scientific projects are scheduled to start in January 2021.

Information on the Competence Center »Quantum Computing Baden-Württemberg«:
https://www.iaf.fraunhofer.de/en/networkers/KQC.html

Interested parties are invited to contact the Competence Center:
kqc@iaf.fraunhofer.de

Quantum Computing at Fraunhofer IAF

Within the Competence Center "Quantum Computing Baden-Württemberg", Fraunhofer IAF will set up a computer pool and offer a corresponding training program in Freiburg. Furthermore, Fraunhofer IAF wants to contribute significant advancement in the performance of entangled qubits and quantum memories. Through research and development of novel quantum hardware, Fraunhofer IAF aims to increase the reachable computing times of quantum computers while decreasing the error rate.

Research and development of Fraunhofer IAF will focus on the development of quantum hardware along its entire value chain: This includes the development of novel material structures and process technologies, the establishment of accompanying analytics and quality management of quantum electronic devices as well as the research of innovative packaging technologies. IAF will also focus on the demonstration of high-performance quantum memories and processing components.

Quantum Computing at Fraunhofer IAO

Fraunhofer IAO will set up and supervise the computer pool in Stuttgart within the Competence Center »Quantum Computing Baden-Württemberg« and offer corresponding training courses for industry and science. The expert at Fraunhofer IAO are researching how companies can utilize quantum computers in the future.

The research and developmental work focuses on the necessary software solutions and the programming of quantum computers as well as the corresponding algorithms and tools. In addition, Fraunhofer IAO will investigate the use of simulation possibilities, develop new solutions and make tools and demonstrators available to industry.

About Fraunhofer IAF

The Fraunhofer Institute for Applied Solid State Physics IAF is one of the world's leading research institutions in the fields of III-V semiconductors and synthetic diamond. Based on these materials, Fraunhofer IAF develops components for future-oriented technologies, such as electronic circuits for innovative communication and mobility solutions, laser systems for real-time spectroscopy, novel hardware components for quantum computing as well as quantum sensors for industrial applications.
With its research and development, the Freiburg research institute covers the entire value chain - from materials research, design and processing to modules, systems and demonstrators.

www.iaf.fraunhofer.de/en

About Fraunhofer IAO

How will people live and work in the future? Asking this and similar questions, researchers at Fraunhofer Institute for Industrial Engineering IAO apply their findings in practice to achieve concrete results. Our experts shape the interaction between humans, technology and organization with a view to the whole, keeping each customer's specific needs in mind. The Fraunhofer IAO helps companies and institutions recognizes the potential of new technologies, harnesses them for profit, and opens up attractive future markets.

www.iao.fraunhofer.de/lang-en/

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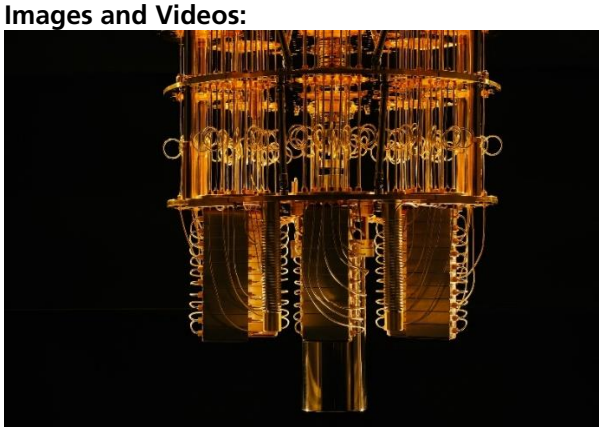

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Video statements by Prof. Dr. Dr. Oliver Ambacher, director of Fraunhofer IAF and manager of the center of competence »Quantum Computing Baden-Württemberg«, on the cooperation between Fraunhofer and IBM.

- **About the benefits of the access to the IBM quantum computer:**
  https://www.iaf.fraunhofer.de/content/dam/iaf/multimedia/videos/Quantencomputing/08-nutzen-kooperation-ibm-quantencomputing_EN.mp4
- **Expertise of the Fraunhofer-Gesellschaft in the field of quantum computing:**
  https://www.iaf.fraunhofer.de/content/dam/iaf/multimedia/videos/Quantencomputing/07_staerken-fraunhofer-quantencomputing_EN.mp4