PRESS RELEASE

LASER World of PHOTONICS

Fraunhofer showcasing innovations at the World of Quantum

The World of Quantum is celebrating its premiere this year at the world's leading trade fair for photonics. The LASER trade fair is thus taking the rapidly growing market for quantum technologies into account. From April 26 to 29, several Fraunhofer institutes will be presenting their latest developments in this field and their respective areas of application in Hall A4, Booth 180.

Impressive market forecasts by analysts, billion-dollar investments by tech corporations and immense public funding programs worldwide clearly prove that quantum technologies are becoming a key technology for many fields. These technologies have the potential to secure communications, improve measurement technology, make the invisible visible as well as to speed up complex calculations in logistics, medicine, chemistry and many other fields. All of this works based on the practical application of the bizarre laws of quantum physics, such as the entanglement or superposition of particles. Under the slogan "We know quantum technologies," seven Fraunhofer institutes in the Quantum Technologies Fraunhofer Strategic Research Field will present their latest research results in the fields of quantum computing, sensing, communication and imaging in Hall A4.180.

Quantum computing

Around the world, science, industry and politics have high hopes for the potential of quantum computers. Although first quantum computers already exist, it remains to be seen which base technology will prevail in the long term. In addition to the superconducting qubits, which have been commonly used so far, approaches based on photons, ion traps and spin are also promising. Compared to superconductors, the major advantage of these newer qubit technologies is that quantum computers can operate at room temperature and do not need to be cooled down to –271 C. Photonic quantum chips, for example, also make the coupling of quantum computers and conventional mainframe computers easier. At the World of Quantum, the Fraunhofer institutes will show laser-optical setups for photon and ion trap-based quantum processors as well as diamond wafers that are used as components for spin-based quantum computers. They will also be demonstrating how quantum algorithms could help to significantly improve medical diagnostics and how a quantum annealer can be used to solve complex optimization problems faster and more efficiently. In addition, the Fraunhofer Competence Network Quantum Computing will present its range of services with the IBM Quantum

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System One research platform in Ehningen and introduce the first application-oriented projects.

Quantum communications

At the interface of quantum computing and communications, Fraunhofer researchers will showcase how qubits can be transmitted between distributed quantum processors with low noise and low loss on existing telecommunication networks. This is made possible by a quantum frequency converter that translates the wave-lengths of the quantum processors into those of the networks and was developed as part of the Fraunhofer ICON project QFC-4-1QID. It is an important building block for a European quantum Internet, which could increase computing capacities and allow secure communication as well as completely new innovations in the future. The Fraunhofer researchers will also display systems for quantum-technological, tap-proof communications via cable and free beam, which were also developed in the QuNET initiative. As part of this project, the first quantum-secured video conference was held between two German federal agencies last year.

Quantum imaging

Entangled light particles offer new possibilities for imaging techniques, microscopy and spectroscopy because they can make the invisible visible. For the first time, the quantum experts will present their results from the QUILT lighthouse project, which recently came to an end. This includes a quantum optical counterpart to the classical Fourier transform infrared (FTIR) spectrometer, which is used in areas such as process analytics to examine gas samples, for example. With quantum holography, Fraunhofer will be presenting a new method that allows light-sensitive tissue samples to be observed for longer periods of time at high resolution and with high levels of contrast and information but without damaging sensitive living cells.

Quantum sensor technology

Quantum sensing is the field with the greatest technological maturity. Initial results from the QMAG lighthouse project include new applications based on quantum magnetometry. These applications are made possible by particularly sensitive optically pumped magnetometers. For example, Fraunhofer scientists enable a contactless “look in the pipe” for flow measurements in industrial process monitoring. In materials science the sensors can also be used to detect impending material fatigue damage at an early stage. Also on display will be the world's first nitrogen-vacancy (NV) laser system with improved sensitivity. This can be used to measure minute currents in the body or tiny defects in components.

Lectures at the World of Quantum

The Fraunhofer presence in the Quantum Hall will be flanked by numerous lectures on two stages. The World of Quantum forum will showcase mainly industrial applications on various theme days. On the other stage, the German Federal Ministry of Education and Research (BMBF) will be presenting promising projects from the last three major national calls for proposals relating to the development of quantum computers and their components, including 25 projects where Fraunhofer is involved.

In Hall B4, Booth 239 and in Hall A6, Booth 441, the Fraunhofer institutes will be showcasing further innovations in the fields of laser technologies and optics.
More information about the entire Fraunhofer presence at the LASER trade fair can be found at www.fraunhofer.de/en/events/fraunhofer-at-trade-fairs/2022/laser.html.

Lecture program at the World of Quantum:
Application panels: Topic overview (world-of-photonics.com)

Fig. 1 The quantum frequency converter developed by Fraunhofer ILT allows qubits to be transmitted with low noise and loss between distributed quantum computers via existing telecommunications networks.

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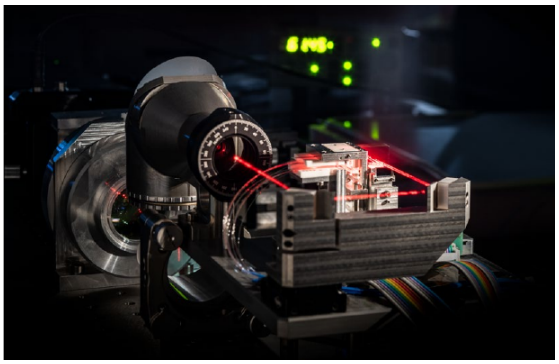

Fig. 2 Addressing optics for an optical quantum computer from Fraunhofer IOF in Jena

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