

Quantum Computers: Masters of Simultaneity

Forschungszentrum Jülich is a European hotspot for quantum research. Its vision is to develop a quantum computer that takes data processing to a new level. In the future, these innovative computers will be able to perform highly complex tasks with unprecedented speed and efficiency.

They have huge potential for a range of applications, for example in medical research, climate research, or cryptography.



In order for quantum computers to provide accurate results, the qubits must be controlled in a targeted manner. The precise control and monitoring of the extremely sensitive quantum states still poses major challenges. The world of the smallest particles has its own rules, which often contradict our understanding of the everyday world. A great deal of research and development work is therefore still required before quantum computers can become widespread.

Here at Jülich, we are working on making this vision a reality, whether it be in basic research, theory, or technology development. Our scientists' findings are incorporated into our endeavours to build a quantum computer, for example in the design of special circuits or the development of cryoelectronics, which continue to work even at extreme sub-zero temperatures. This is because many types of qubit have an operating temperature of -273 °C, which is close to absolute zero.

JUNIQ

Alongside quantum computers, other quantumbased computing systems exist, such as quantum annealers, quantum simulators, or quantum computer emulators. A unique aspect here at Jülich is that all these quantum systems are integrated into a single high-performance computing environment. With JUNIQ, the JUelich User Infrastructure for Quantum Computing, we already have demonstration facilities and prototypes of quantum-based computer systems at different stages of development. JUNIQ supports internal and external scientists in developing algorithms and applications for quantum computing. The aim is to further improve quantum systems and make them available for application on a large scale.





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