

Honda and Quemix Co-develop a New, World's First Quantum State Readout Technology

TOKYO, Japan, May 14, 2025 – Honda R&D Co., Ltd., a Honda subsidiary specializing in research and development, and Quemix Inc., a group company of TerraSky Co., Ltd. specializing in the research and development of quantum computer algorithms and software, have jointly developed a new, world's first quantum state readout technology.

As part of its initiatives toward the realization of carbon neutrality for all of its products and corporate activities by 2050, Honda has been conducting research on various energy components, which requires analysis of various materials. Performing computations necessary for material analysis on classical (binary) computers requires vast computational resources, therefore Honda has been exploring the possibility of using quantum computers which enable high-speed computations. However, one of the major challenges in performing computations on a quantum computer is that the quantum state tends to collapse during the readout process, which increases the number of readouts and consequently the time required for computations.

In an effort to address this challenge, Honda R&D and Quemix have successfully developed a new quantum state readout technology that only “scans” information (features) such as the intensity and shape, which characterizes the classical data from the X-ray absorption fine structure (XAFS) spectral data stored in the quantum computer as quantum state. This new technology eliminates the need to perform a direct “readout” of the quantum state itself and thereby enables high-speed and efficient quantum state readouts, opening the door to a wide range of applications in the field of quantum computer-based simulation.

Moreover, Honda R&D and Quemix have achieved a successful XAFS computation using an actual quantum computer. This is the world's first* case where practical computation for materials development was successfully performed on logical qubits using an actual quantum computer. The two companies realized this XAFS computation on an actual quantum computer by performing the computation by combining quantum and classical computers and leveraging their respective characteristics.

The construction of a XAFS computation algorithm and development of techniques for reducing the number of required logical qubits and gate operation counts toward the use of an actual quantum computer will enable not only the development of quantum algorithms, but also the accumulation of practical know-how for the use of quantum computers in the future and the development of technologies for bit and gate operation reduction. It is expected that future advancement of hardware and an increase in the number of logical qubits will enable the application of quantum computing to solve more complex problems.

Honda R&D and Quemix are planning to present the achievements and more details related to this new technology at the Q2B 2025 Tokyo, an international conference in the field of quantum technology.

Through the utilization of quantum computers and XAFS in its research and development, Honda is aiming to build a technological foundation for the future research and exploration of energy materials that contribute to the enhancement of performance, longevity and other features of battery materials. Honda is taking on various challenges with a multifaceted approach that includes, but is not limited to, the electrification of mobility products, working toward its goal to realize carbon neutrality by 2050.

■ About the Q2B 2025 Tokyo

Venue: Grand Hyatt Tokyo (6-10-3 Roppongi, Minato-ku, Tokyo, 106-0032, Japan)

Dates: May 15 – 16, 2025

Official website: <https://q2b.qcware.com/conference/2025-tokyo>

*As of May 13, 2025, based on Honda internal survey of publicly available research papers.