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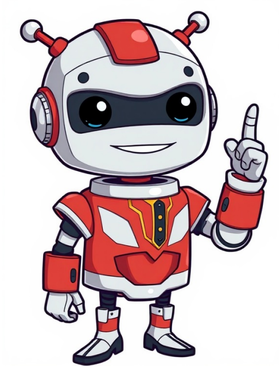

A consortium of joint research partners including RIKEN, the National Institute of Advanced Industrial Science and Technology (AIST), the National Institute of Information and Communications Technology (NICT), Osaka University, Fujitsu Limited (Fujitsu) and Nippon Telegraph and Telephone Corporation (NTT) have announced the development of Japan's first superconducting quantum computer. Starting March 27, 2023, users in Japan will be able to access the technology as a cloud service for non-commercial use.The new technology is a significant step towards the wider adoption of quantum computing in Japan and represents a major achievement in the field of quantum information science.A novel design for the wiring of qubits in a chip has been devised to address the limited space available, enabling individual qubit control and readout. The joint research group employs perpendicular wiring packages, allowing for efficient control and measurement of qubits on a two-dimensional planar surface. Furthermore, a new wiring package is being developed to enable simultaneous wiring to multiple qubits. This innovation results in a highly scalable system, where the number of qubits can be easily increased without altering the fundamental design.1NICTRIKENNICTRIKENQIQBQunaSysVCSELVCSEL3DLEDMBEMBEMBEVCSELNICTFETVCSELThe development of a structure leveraging tunnel junctions enables efficient light emission and extraction without electrodes, allowing for optimized device performance. Without a tunnel junction, current flows towards the bottom of the electrode, exciting the quantum dot but obstructing light extraction. In contrast, with a tunnel junction, the current path can be redirected to electrode-free regions, facilitating light extraction.The threshold current is the minimum current required to initiate stable lasing in a semiconductor laser. It is determined by factors such as material properties, structure, and temperature. Improved efficiency of current-to-light conversion or reduced light loss through enhanced materials or designs can decrease the threshold current. The use of quantum dots enhances this process, increasing the efficiency of converting current into light.A low threshold current contributes to reduced power consumption and extended device lifetime, making it crucial in applications requiring stability and low power consumption.

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