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Challenges in superconducting quantum computing

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Biography

Yasu Nakamura started his research career at NEC Fundamental Research Laboratories in 1992, where he demonstrated the first coherent manipulation of a superconducting qubit in 1999 and met quantum information science. He also spent a year as a Visiting Researcher at TU Delft from 2001 to 2002. Since 2012, he has been a Professor at The University of Tokyo. He has also been leading his research team at RIKEN since 2014. He is currently the Director of the RIKEN Center for Quantum Computing and the Project Leader of the MEXT Q-LEAP Flagship project on Superconducting Quantum Computing.

Abstract

Research and development of superconducting quantum computing have made significant progress since the first demonstration of a superconducting qubit in 1999. Thanks to the nearly six orders of magnitude improvement of the coherence time and more sophisticated circuit designs and operations, the fidelities of gate control and readout are now approaching and surpassing the threshold for fault-tolerant quantum computation. Many groups worldwide are competing intensively toward larger-scale superconducting quantum computing with better coherence and fidelity that allow for quantum error correction and fault tolerance. At the RIKEN Center for Quantum Computing, we pursue a scalable architecture using all-microwave control and readout on a two-dimensional array of frequency-fixed

transmon qubits. Our scheme uses a substrate pierced with a dense array of through-silicon vias and vertical access of coaxial cables from the backside of the substrate. We present the current status of our research and discuss the challenges ahead.