

Quantum supremacy: checking a quantum computer with a classical supercomputer

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TA key step in the roadmap to build a scientifically or commercially useful quantum computer will be to demonstrate its exponentially growing computing power. I will explain how a 7 by 7 array of superconducting xmon qubits with nearest-neighbor coupling, and with programmable single- and two-qubit gate with errors of about 0.1%, can execute a modest depth quantum computation that fully entangles the 49 qubits. Sampling of the resulting output can be checked against a classical simulation to demonstrate proper operation of the quantum computer and compare its system error rate with predictions. With a computation space of $2^{49} = 5 \times 10^{14}$ states, the quantum computation can only be checked using the biggest supercomputers. With modest improvements in qubit performance, we plan to demonstrate this experiment in 2017. (arXiv:1608.00263).