Google has created the world's most powerful computer

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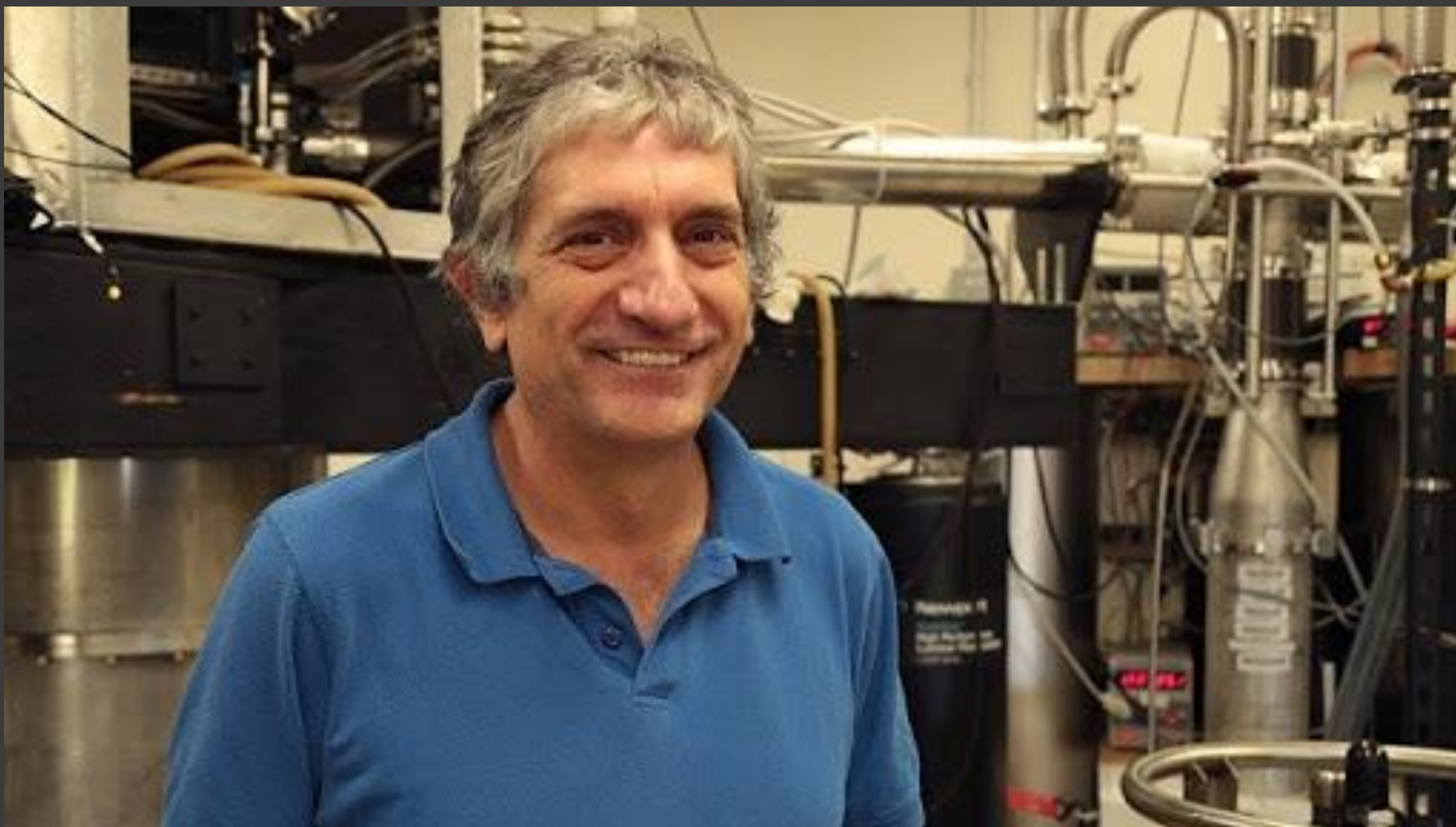
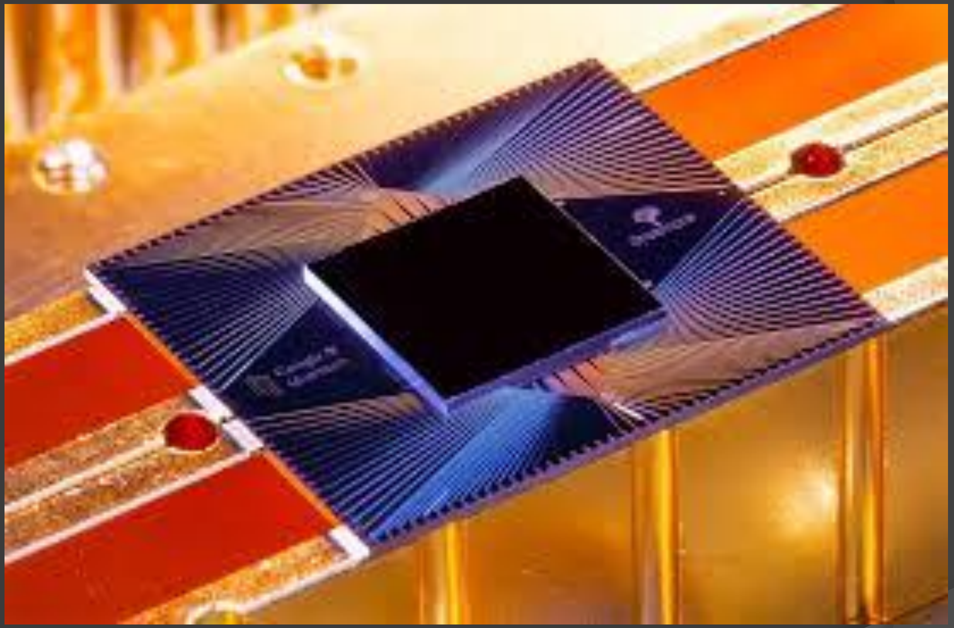
The group of physicist John Martinis from Google announced on the pages of the journal Nature about the achievement of " quantum superiority» - scientists, according to them, managed to use a new device called Sycamore to solve a problem that is not available even for the most powerful "ordinary" supercomputers. The result obtained by physicists in 200 seconds, on the Summit supercomputer (the current record holder), would have to wait 10 thousand years.



What exactly did Google do?

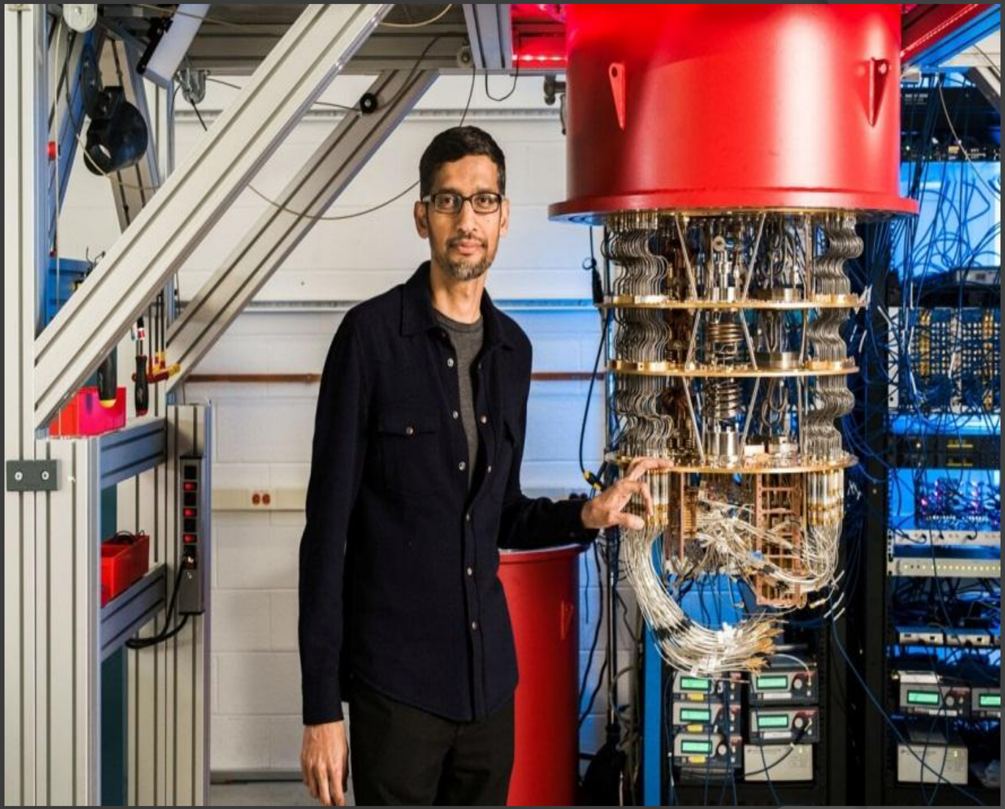
- Engineers of the California company created a new processor, called Sycamore. It consists of 53 "qubits" - so-called elements that store quantum bits of information. This is not a record, but the standard number of elements for today.



Sycamore 53-qubit quantum computer

How to understand what a quantum computer is correctly decided, when it cannot be validated?

- Calculations on Sycamore were made in three ways — when all the qubits were connected in the device, when it was divided into two parts that did not communicate with each other, and when these parts were connected, but the connection between them was limited. Only the first, full-fledged version was not available for simulation, and the predictable results in the other cases were in good agreement with the theory.



Google CEO Sundar Pichai with one of the quantum computers. October 2019

How do quantum computers work? How are they better than regular ones?

- Quantum computers are no better or worse than classical computers. They're just different. There are many important differences, but here are three fundamental ones.

- First, they store information in quantum form — that is, instead of ones and zeros, engineers are dealing with a mixture, a "superposition" of both variants. The result of calculations scientists get, of course, in the form of ordinary ones and zeros, but at the stage of calculations in each qubit, the ones and zeros are mixed — and it is important to be able to maintain this state, because it is the power of such devices. Second, in quantum computers, memory and processor are not separated from each other — qubits simultaneously interact with each other and store information.

- Third, quantum computers cannot replace conventional ones in everyday life. Their purpose is primarily concerned with modeling quantum systems (for example, studying the interaction of drugs with other molecules in the body), creating new materials (for example, superconductors), and machine learning (where a long search of options is required).

- All quantum computers are arranged on a basic level quite simply. They consist of qubits and connections between them. Qubits can be very different — quantum information can be stored in charged ions, in neutral atoms fixed in a special laser trap, and even in defects inside diamonds. In this case, the Martinis group used a variant that is both externally and in terms of future production possibilities closest to conventional transistors — a chip consisting of superconducting antennas, immersed in a special refrigerator. Information is loaded into the qubit using a magnetic field or laser, and read in the same way. When calculating the information is loaded, then the quantum system is left to itself, the qubits somehow interact with each other and at the end, during the measurement, they come to the usual classical state: what was a mixture of zeros and ones "collapses" into zeros or ones.