Finnish researchers claim quantum computing breakthrough

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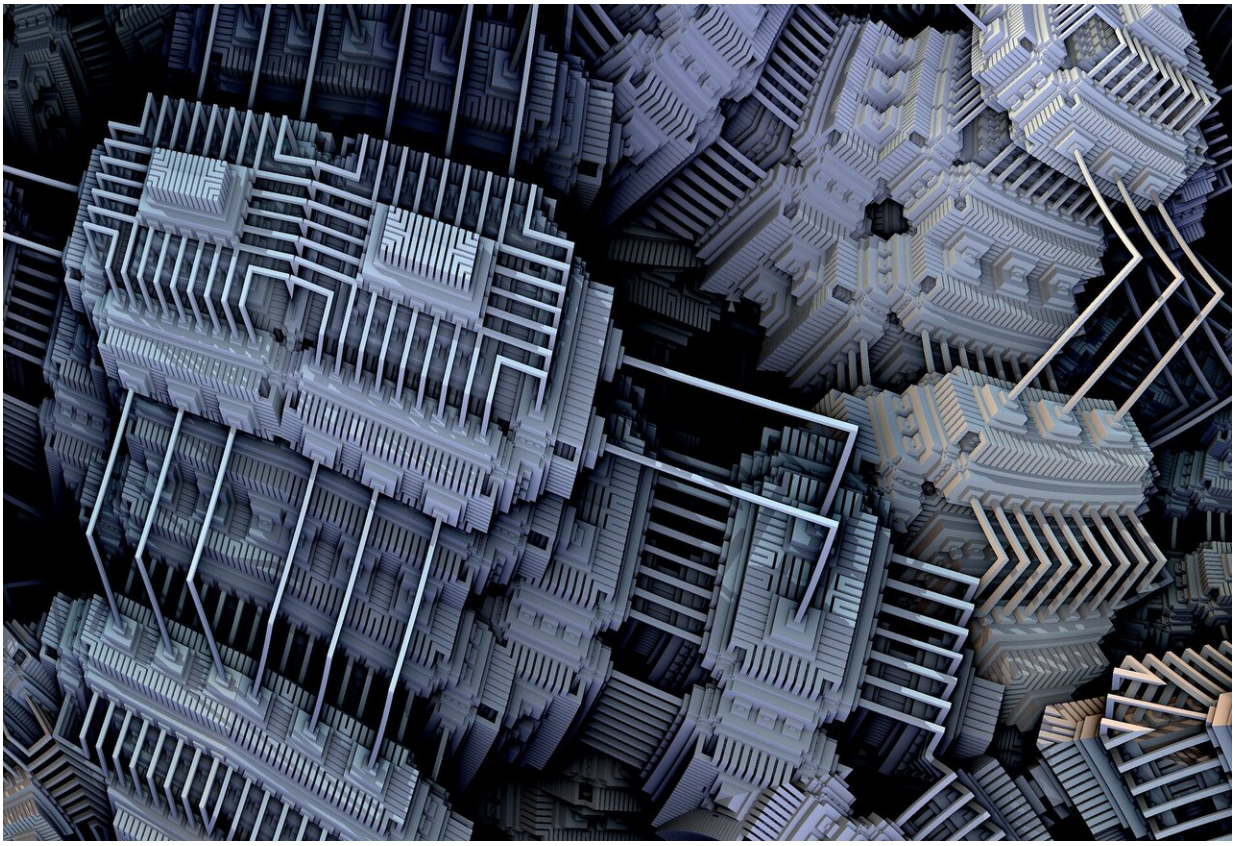

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Scientists have created a device which could make it easier to harness super-fast quantum computers for real-world applications, a team at Finland's Aalto University said on Wednesday.

Quantum computers are a new generation of machines powered by energy transfers between so-called "artificial atoms"—electrical circuits a fraction of a millimetre across.

Scientists believe the devices will eventually be able to vastly outperform even the world's most powerful conventional supercomputers.

Last October, Google announced it had reached "quantum supremacy" by creating a machine which executed a calculation in 200 seconds that would have taken a classic computer 10,000 years to complete.

Although a remarkable leap in the field, Google's Sycamore computer was held back by errors in its processing, caused in part by shortcomings in how the device measured the energy being stored in its memory.

Being able to accurately gauge the energy levels of the artificial atoms, known as "qubits", is central to a quantum computer's functioning, but until now this has required large amounts of circuitry, consumed huge amounts of power and been prone to errors from "quantum noise".

The Finnish team, whose findings will be published in the journal *Nature*, discovered that a device called a bolometer, containing graphene, can measure the qubits' energy state while consuming a million times less energy.

Regular computers, even the fastest, function in binary fashion: they carry out tasks using tiny fragments of data known as bits that only ever match the values 1 or 0, with calculations performed one after another.

This means that even the most advanced supercomputers struggle with tasks such as predicting large-scale traffic flows, where each car can move in an entirely random way all at once.

However the equivalent tiniest data units on a quantum computer, the qubits, can be both 1 and 0 at the same time, meaning the device can crunch an enormous number of potential outcomes simultaneously.

This allows for new computing applications, like predicting molecule movements in order to create new medicines or handling huge numbers to create extra-strong encryption.

Although some companies, including Google and Honeywell in the US, have said they are aiming to bring quantum computers to market, a viable machine with a low enough error rate is "years away", the leader of the Aalto University research Professor Mikko Mottonen told AFP.

Mottonen and his team have applied for grants to build a quantum computer using their bolometer technology, which they hope will mark a real step towards a quantum computer with real-world uses.

"All new discoveries are needed on the way to the quantum era," he said.

More information: R. Kokkoniemi et al. Bolometer operating at the threshold for circuit quantum electrodynamics, *Nature* (2020). DOI: 10.1038/s41586-020-2753-3