

MAJORANA 1 L^AT_EX Package By SREEHARI K

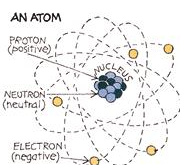
Microsoft today introduced Majorana 1, the world's first quantum chip powered by a new Topological Core architecture that it expects will realize quantum computers capable of solving meaningful, industrial-scale problems in years, not decades.

It leverages the world's first topoconductor, a breakthrough type of material that can observe and control Majorana particles to produce more reliable and scalable qubits, which are the building blocks for quantum computers.

In the same way that the invention of semiconductors made today's smartphones, computers, and electronics possible, topoconductors and the new type of chip they enable offer a path to developing quantum systems that can scale to a million qubits and are capable of tackling the most complex industrial and societal problems, Microsoft said.

"We took a step back and said 'OK, let's invent the transistor for the quantum age. What properties does it need to have?'" said Chetan Nayak, Microsoft technical fellow. "And that's really how we got here – it's the particular combination, the quality, and the important details in our new materials stack that have enabled a new kind of qubit and ultimately our entire architecture."

This new architecture used to develop the Majorana 1 processor offers a clear path to fit a million qubits on a single chip that can fit in the palm of one's hand, Microsoft said.



The Atom

This is a needed threshold for quantum computers to deliver transformative, real-world solutions – such as breaking down microplastics into harmless byproducts or inventing self-healing materials for construction, manufacturing, or healthcare. All the world's current computers operating together can't do what a one-million-qubit quantum computer will be able to do.

Another Headline

"Whatever you're doing in the quantum space needs to have a path to a million qubits. If it doesn't, you're going to hit a wall before you get to the scale at which you can solve the really important problems that motivate us," Nayak said.

The topoconductor, or topological superconductor, is a special category of material that can create an entirely new state of matter – not a solid, liquid, or gas but a topological state. This is harnessed to produce a more stable qubit that is fast, small, and can be digitally controlled, without the tradeoffs required by current alternatives.

A new paper published Wednesday in *Nature* outlines how Microsoft researchers were able to create the topological qubit's exotic quantum properties and also accurately measure them, an essential step for practical computing.

This breakthrough required developing an entirely new materials stack made of indium arsenide and aluminum, much of which Microsoft designed and fabricated atom by atom. The goal was to coax new quantum particles called Majoranas into existence and take advantage of their unique properties to reach the next

horizon of quantum computing, Microsoft said.

The world's first Topological Core powering the Majorana 1 is reliable by design, incorporating error resistance at the hardware level, making it more stable.

Commercially important applications will also require trillions of operations on a million qubits, which would be prohibitive with current approaches that rely on fine-tuned analog control of each qubit. The Microsoft team's new measurement approach enables qubits to be controlled digitally, redefining and vastly simplifying how quantum computing works.

This progress validates Microsoft's choice years ago to pursue a topological qubit design – a high-risk, high-reward scientific and engineering challenge that is now paying off. Today, the company has placed eight topological qubits on a chip designed to scale to one million.

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