

QUANTUM BREAKTHROUGH: HOW MICROSOFT CREATED A NEW STATE OF MATTER FOR THE MAJORANA CHIP 1

Veko D.A.

Belarusian State University of Informatics and Radio Electronics, Minsk, Republic of Belarus

Markosyan E.I. – Cand. of Sci., Associate professor at the Department of Foreign Languages

Annotation. The creation of the Majorana 1 quantum processor based on the new topological state of matter. Thanks to the development of unique — top-guide materials, the company was able to create stable and scalable topological cubes. The Majorana 1 chip paves the way for processors with a million dice capable of solving problems inaccessible to classic computers. The article discusses the scientific basis of the breakthrough, its technological advantages and potential application in materials science, chemistry and ecology.

Keywords. Majorana Quantum Processor 1, topological state of matter, quantum computing.

Introduction. For centuries, humanity has recognized only four states of matter: solid, liquid, gas, and plasma. These states have formed the foundation of our understanding of physics and have shaped the development of technology. However, after 17 years of groundbreaking research, Microsoft has achieved what was once thought impossible: the creation of a fifth state of matter – the topological state. This revolutionary discovery has not only redefined our understanding of physics but has also paved the way for the development of the Majorana 1 quantum processor, a chip that could change the course of computing forever (shown in Figure 1).

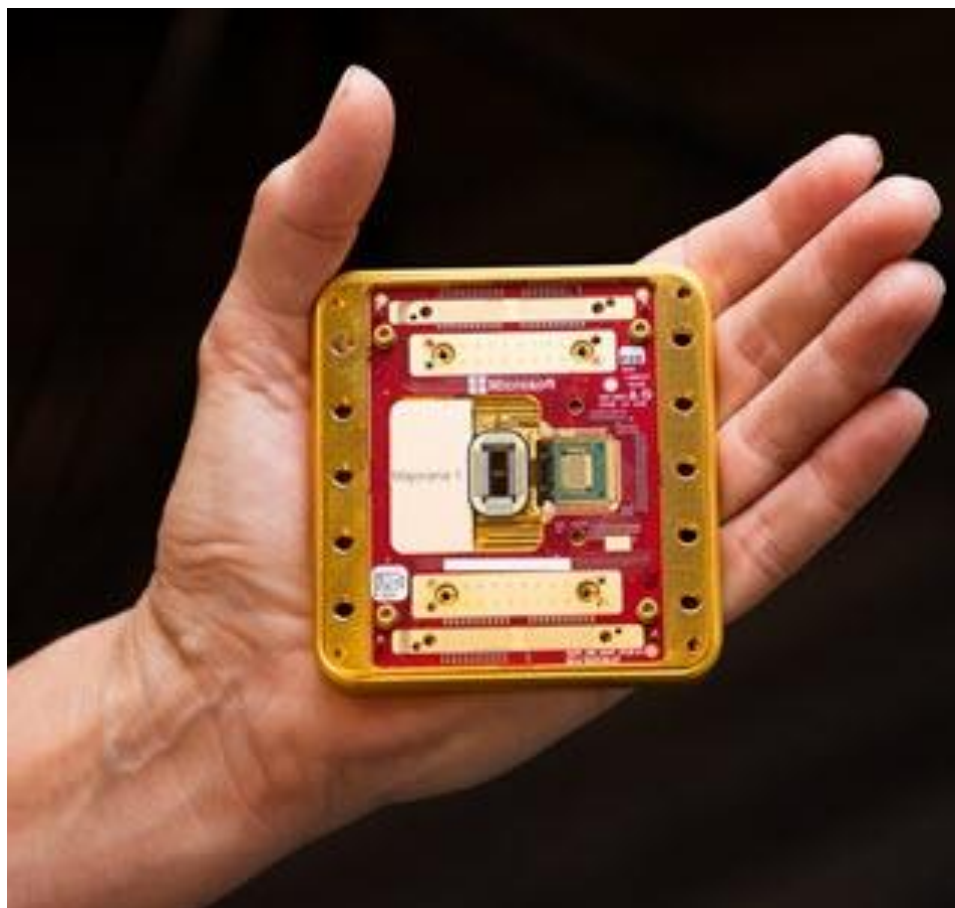


Figure 1 – The Majorana 1

Main part. The journey to this breakthrough began with a simple yet profound question: What would the transistor of the quantum age look like? Microsoft's researchers realized that to build a quantum computer capable of solving real-world problems, they needed a fundamentally new approach. This led them to explore the concept of topological quantum computing, which relies on the unique properties of Majorana particles – exotic quantum particles that had never been observed in nature. To create these particles, Microsoft had to develop an entirely new class of materials called topological superconductors, or topoconductors. These materials, made from a combination of indium arsenide and aluminum, were engineered atom by atom to exhibit a topological state of matter. Unlike the traditional states of matter, the topological state is not a solid, liquid, gas, or plasma. Instead, it represents a new quantum phase that can be harnessed to create topological qubits, the building blocks of quantum computers.

The Majorana 1 chip is not just a scientific curiosity; it represents a clear path to practical, large-scale quantum computing. Microsoft's researchers have demonstrated that the chip's architecture can be tiled out, allowing for the integration of millions of qubits on a single device. This means that within a few years, we could see the development of a quantum processor with one million qubits – a milestone that would enable quantum computers to tackle problems that are currently unsolvable.

For example, such a processor could revolutionize fields like materials science, chemistry, and environmental sustainability. It could help design self-healing materials for construction, develop catalysts to break down microplastics, or optimize enzyme behavior to improve agricultural yields. The potential applications are vast, and the impact on industries ranging from healthcare to energy could be transformative.

Conclusion. The creation of the Majorana 1 chip is not just a technological achievement; it is a testament to the power of innovation and perseverance. Microsoft's decision to pursue topological qubits, despite the immense scientific and engineering challenges, has paid off in ways that could reshape the future of computing. By inventing a new state of matter and leveraging it to build a scalable quantum processor, Microsoft has brought us closer to a world where quantum computers are not just theoretical constructs but practical tools for solving humanity's most pressing problems.

As we stand on the brink of this new era, it is clear that the Majorana 1 chip is more than just a piece of hardware. It is a symbol of what is possible when we push the boundaries of science and technology. In the words of Chetan Nayak, Microsoft's technical fellow, «It's one thing to discover a new state of matter. It's another to take advantage of it to rethink quantum computing at scale».

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