

Majorana 1: A New State of Matter, a Breakthrough Quantum Technology, and a Look Behind the Scenes of How the Science Machine Operates

Dr. Sergei Frolov

Department of Physics and Astronomy

University of Pittsburgh

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Abstract

In 2012 when I was a postdoc, I and a small team discovered a signal that held great promise to be from a never-before-seen synthetic particle called a Majorana fermion. It is its own antiparticle, combining matter and antimatter in one. And because it can be realized on a computer chip, it can be harnessed for robust and ultra-fast quantum computing. This topic has defined my independent career but things turned out to be not so simple. A short while later, another effect was identified that could give a very similar signal, without the Majorana physics. And this explanation became the dominant hypothesis for all our existing samples. But the community had a lot of inertia and proceeded convinced that Majorana has been found, even now in 2025. I will explain why this would be such an awesome discovery, and why there is hardly a bigger outstanding goal in my field of quantum nanoscience. I will also talk about how discovery of new materials, and techniques, is the way to find Majorana, as well as to bring closer the practical quantum computing at large.