《天使粒子的发现堪称科学界的里程碑》

A Chinese-American scientist and his team discovered a particle that can be both matter and antimatter, which can potentially lead to more advanced quantum computers.

The particle, called Majorana fermion, is named after Italian theoretical physicist Ettore Majorana, who first predicted its existence in 1937. Typically, when a particle — the basic building block of matter — and an antiparticle — its identical twin but with an opposite charge — collide, they will annihilate each other, releasing a burst of energy.

The Majorana fermion, however, is a strange exception that can simultaneously exist both as a particle and as its own antiparticle. This hypothesis has fascinated and puzzled scientists ever since.

The latest discovery "concludes one of the most intensive searches in fundamental physics, which spanned exactly 80 years," said Zhang Shoucheng, a Stanford University physicist and a foreign academician of the Chinese Academy of Sciences, who proposed the experiment plan.

The research team, led by Associate Professor Jing Xia of the University of California, Irvine, and UCLA Professor Kang Wang, dubbed the fermion the "angel particle" in reference to Dan Brown's 2000 thriller novel Angels & Demons, which involves a bomb made from a combination of particle and antiparticle.

"Our team predicted exactly where to find the Majorana fermion and what to look for as its 'smoking gun' experimental signature," Zhang said in a news release from Stanford University. The team published its findings on Thursday in Science magazine.

In the future, Majorana fermions could be used to build quantum computers that are more resilient to environmental disturbance, which has been a major obstacle in their development.

Unlike conventional computers that store data in 1 or 0 binary bits, quantum computers use qubits — subatomic particles that can be both 1 and 0 at the same time.

Since each Majorana fermion can behave like half of a subatomic particle, a single qubit could theoretically be stored in two widely separated fermions, decreasing the chance of both fermions being disturbed and losing their data, Zhang said.

This could lead to new and more stable quantum computers, he said. However, research on the famous fermion is largely theoretical, and practical applications are still decades away.

Frank Wilczek, a theoretical physicist and Nobel laureate at the Massachusetts Institute of Technology, said in an evaluation of the experiment: "It's not fundamentally surprising, because physicists have thought for a long time that Majorana fermions could arise out of the types of materials used in this experiment.

"But they put together several elements that had never been put together before, and engineering things so this new kind of quantum particle can be observed in a clean, robust way is a real milestone."

Stanford physicist Thomas Devereaux called Zhang's research a "landmark" in the field of condensed matter physics.