



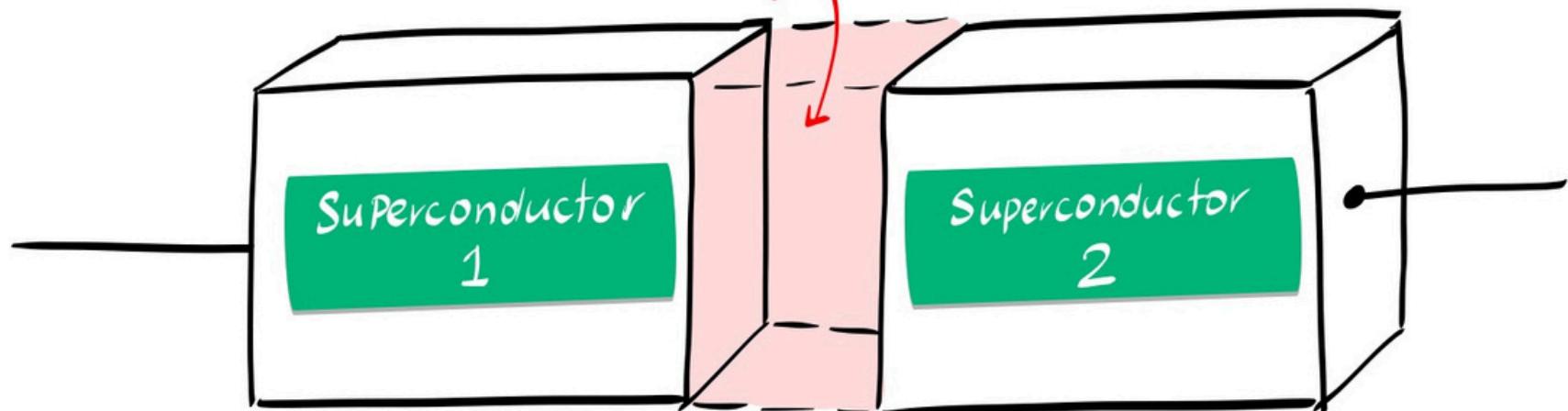
Nobel Prize in Physics 2025

In 1984 and 1985, John Clarke, Michel Devoret, and John Martinis conducted a series of experiments with superconducting circuits using the

thing non-conductive barrier

Josephson

Junction



Josephson
Junction

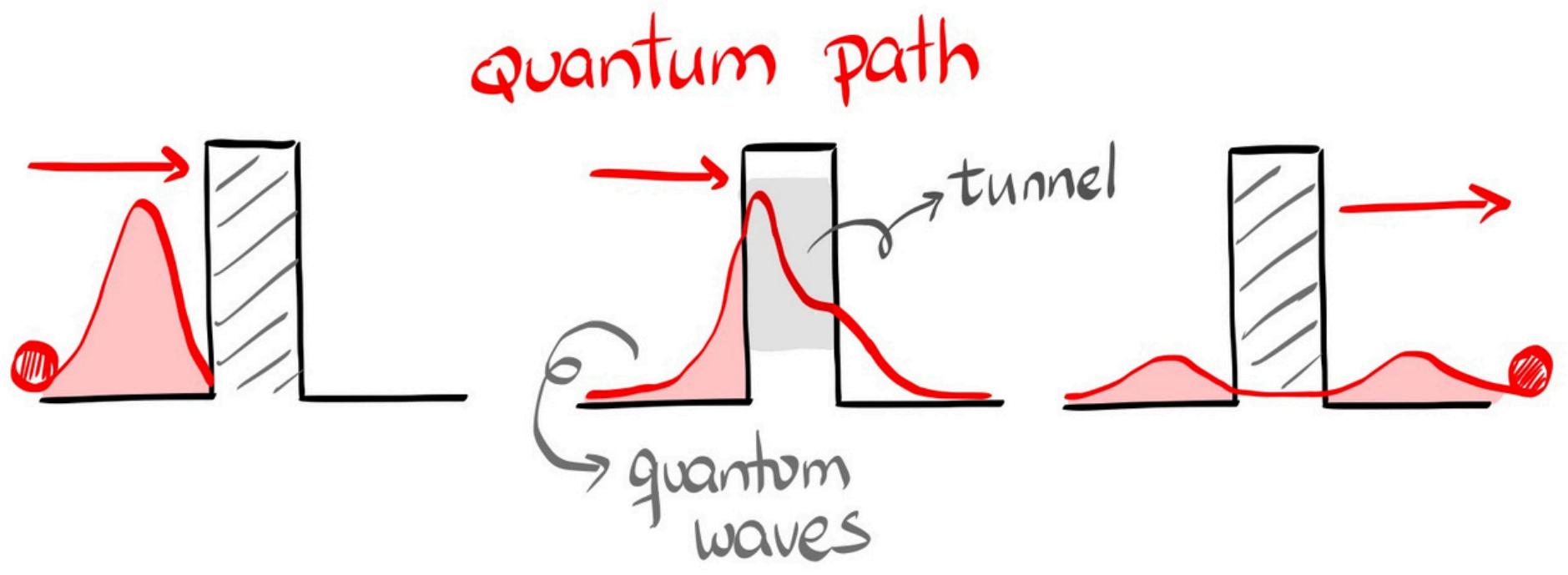
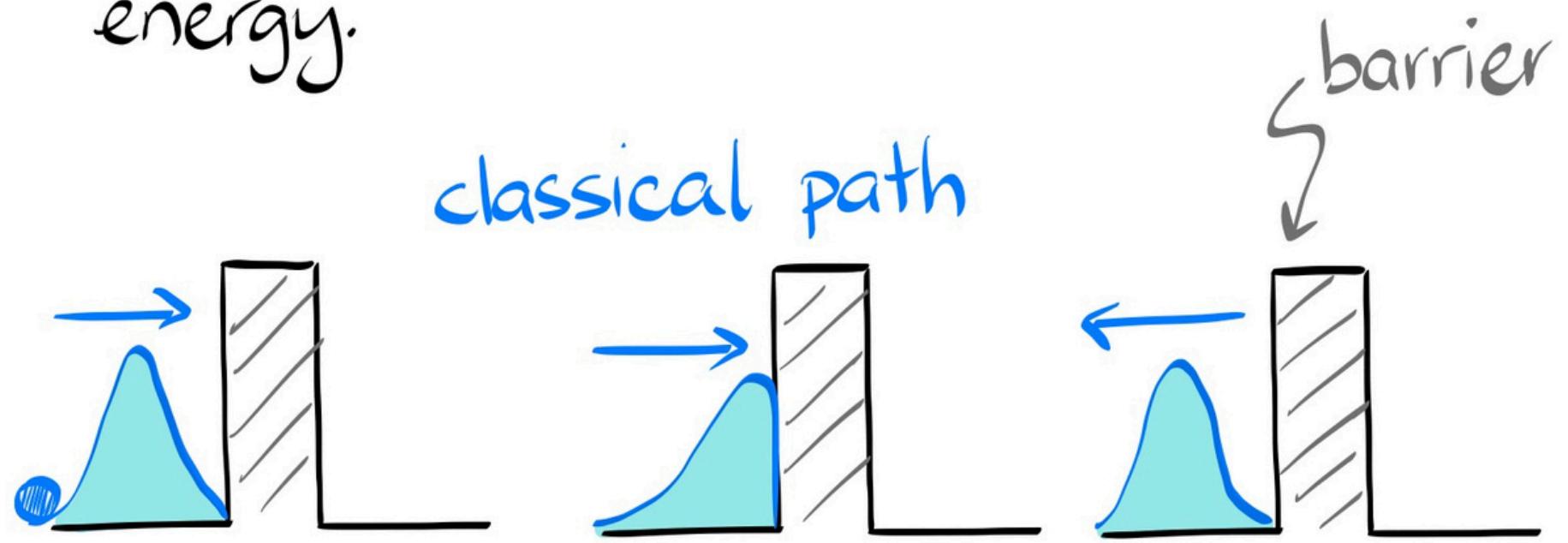
= superconductor + non-conductive barrier + superconductor

The Josephson effect occurs when a current passes through the non-conductive barrier between superconductors thanks to

quantum tunneling!

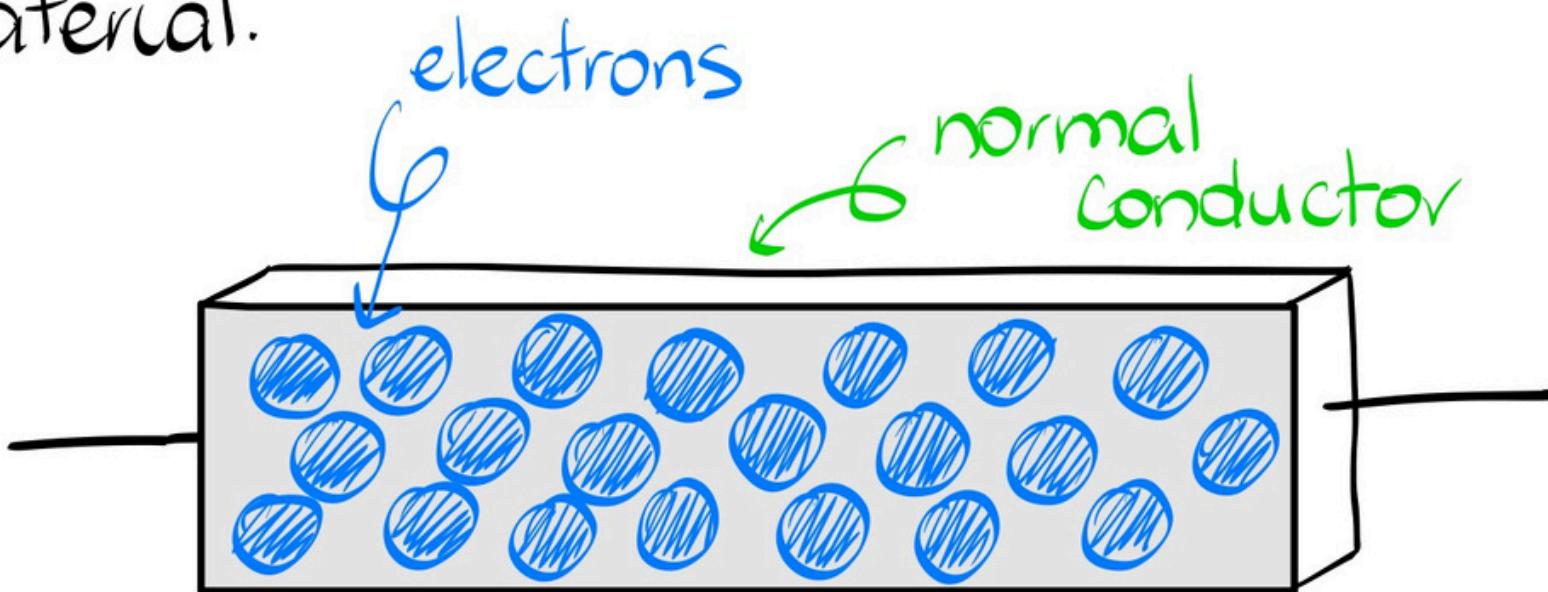


Quantum tunneling allows a particle (microscopic scale) to pass through a barrier that classically would be impossible to cross without enough energy.

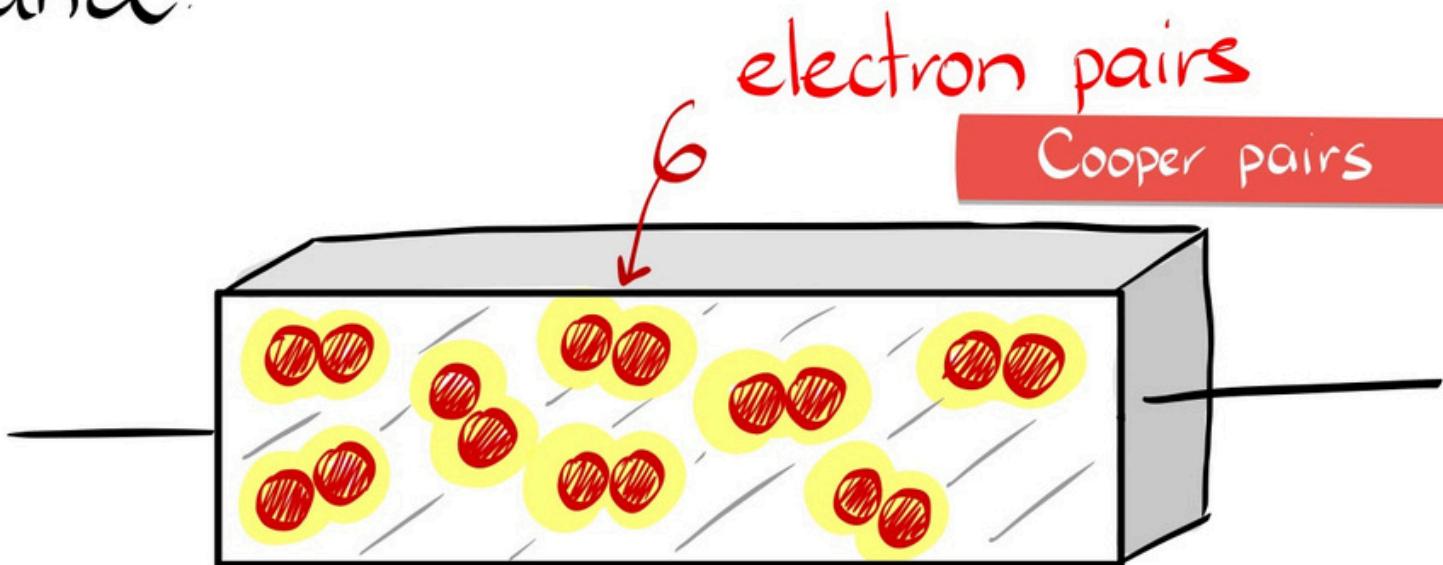


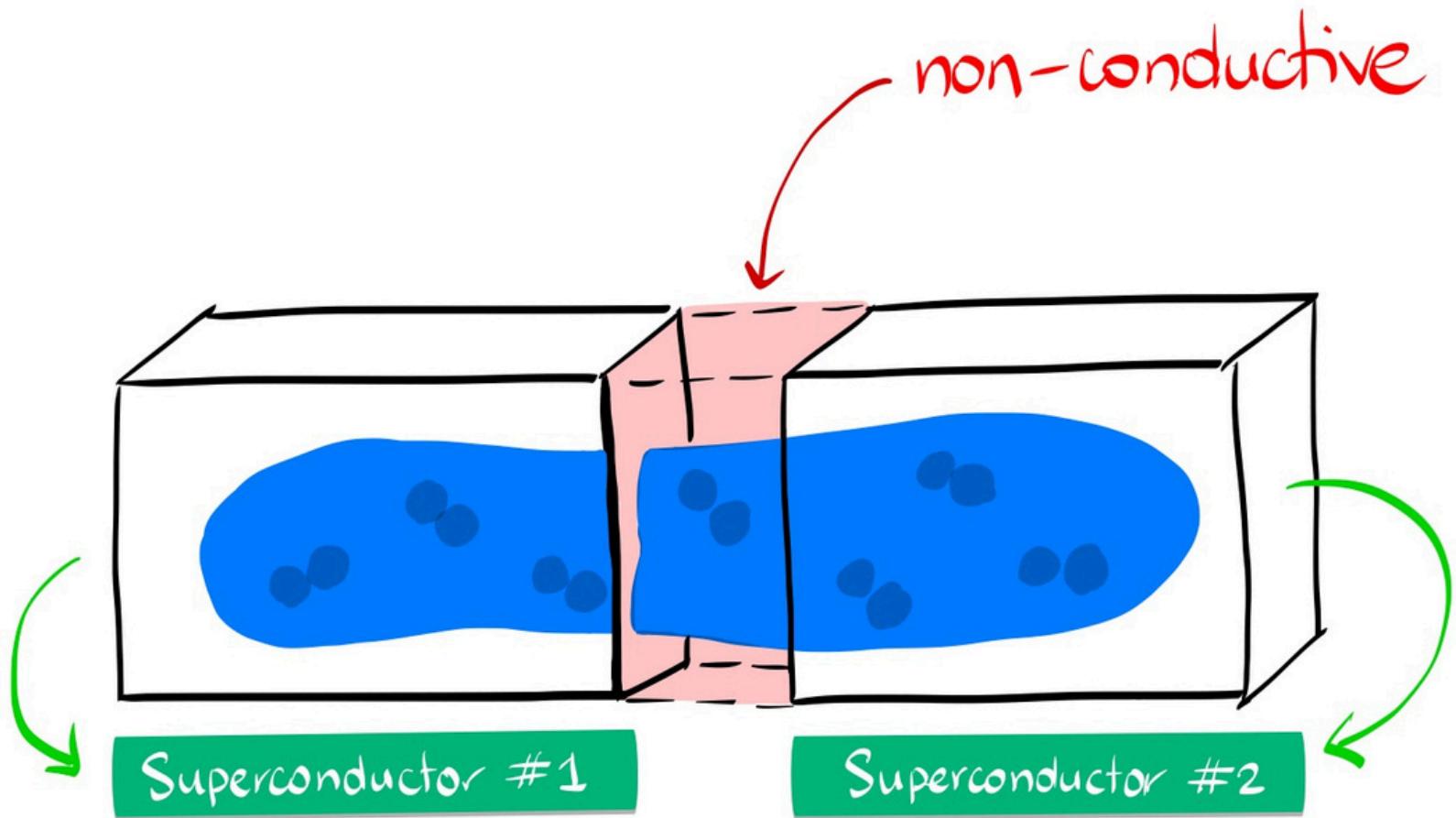


In a **normal conductor** electrons collide with each other and with the material.

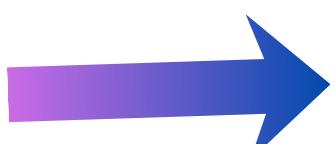


In a **superconductor**, electrons form pairs and move without resistance.





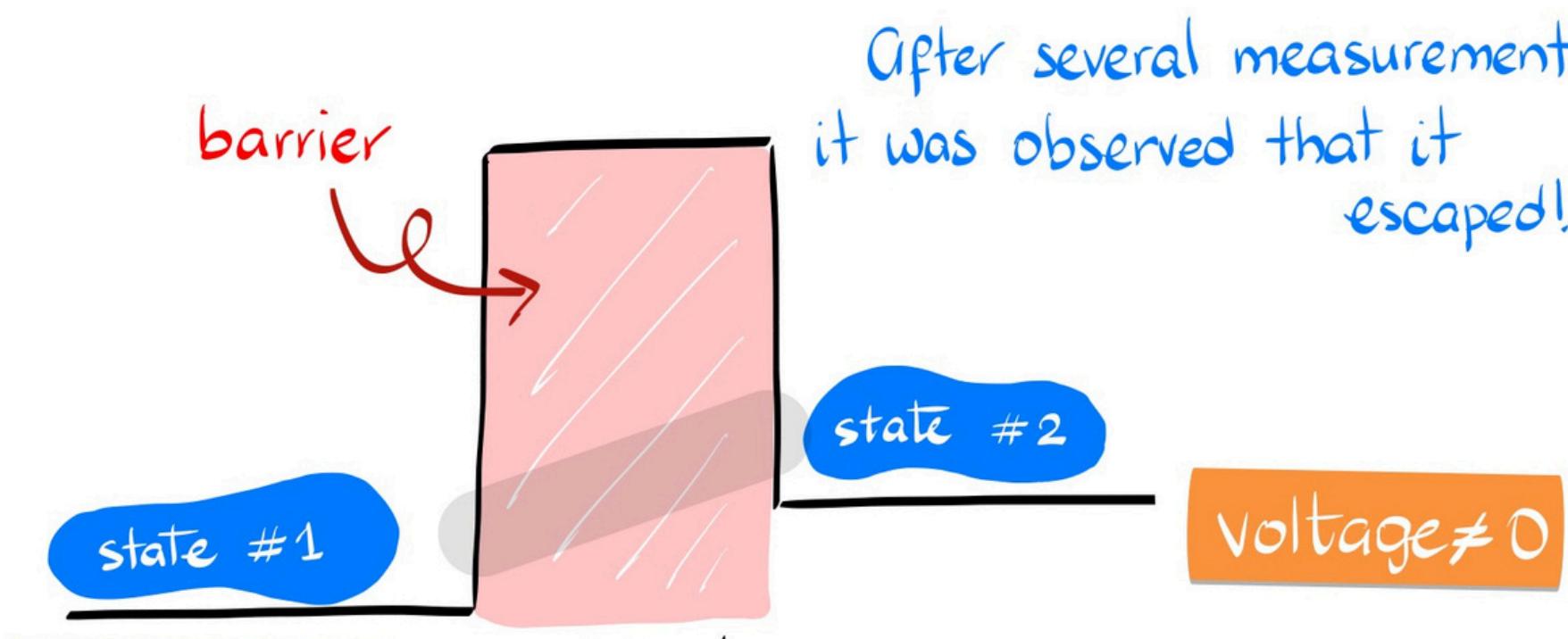
Under certain conditions, these pairs exhibit collective behavior, acting as a **single particle** that fills the entire circuit (macroscopic scale).





In the experiments, they passed an electric current through the junction and measured the voltage.

Initially, the particle was trapped in a state with zero voltage meaning it did not have enough energy to escape.



Suddenly, a voltage different from zero appears due to the

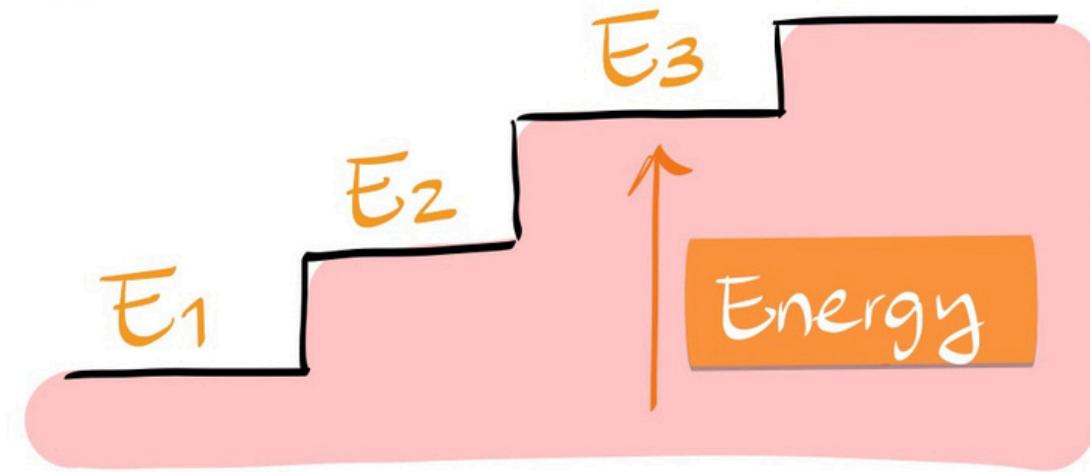
macroscopic

quantum tunneling effect!





Additionally, the measured that the energy is **quantized**, meaning it can only take certain specific values.



This discovery impacts the development of new quantum technologies that will revolutionize computing, cryptography, and sensors, and it advances fundamental physics on a scale that connects the

microscopic world

with our

everyday world!



The best part ?

This celebration takes places during



INTERNATIONAL YEAR OF
Quantum Science
and Technology

declared by United Nations, which seeks to recognize and promote these advances that are already changing

our FUTURE



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