Long(er) Live the Fluxonium Qubit

Researchers demonstrate a fluxonium qubit that retains its quantum information for 1.43 milliseconds, 10 times longer than the previous best lifetime for this system.

By **Katherine Wright**

In 2019, Vladimir Manucharyan and his colleagues made a prediction. The team had just demonstrated a so-called fluxonium qubit that could maintain its quantum properties for about 100 microseconds, which at that time was a factor-of-10 improvement over previous demonstrations with qubits of this type (see **Viewpoint: Fluxonium Steps Up to the Plate**). But the researchers thought they could up that time even further. They have now confirmed their prediction by demonstrating a fluxonium qubit that can keep its quantum information for 1.43 milliseconds [**1**]. This record-breaking "coherence" makes the qubit more attractive for future quantum computers.

A fluxonium qubit is a lesser-known cousin of the transmon, Google's favored qubit. Both are superconducting qubits, but they have different internal circuitry, which gives them different quantum properties. Until 2019 the best coherence times for fluxonium qubits were too small to be useful in future large-scale quantum circuits, leading to the transmon's rise. That disadvantage has now disappeared with Manucharyan's team's demonstration.

The improvement is mostly because of an increase in the time it takes the qubit to relax from its excited state to its ground state. The team achieved this increase by slightly lowering the operating frequency of the qubit and by optimizing the circuit parameters. The team showed that these minor adjustments increased the relaxation time from the 500 microseconds achieved in 2019 to over 1 millisecond. The relaxation time places an upper limit on the coherence time, so raising one raises the other, Manucharyan says. And he doesn't think the gain will stop here. "This [time] is not even the limit," he says. "We are likely to see 10-millisecond coherence times in the next few years."

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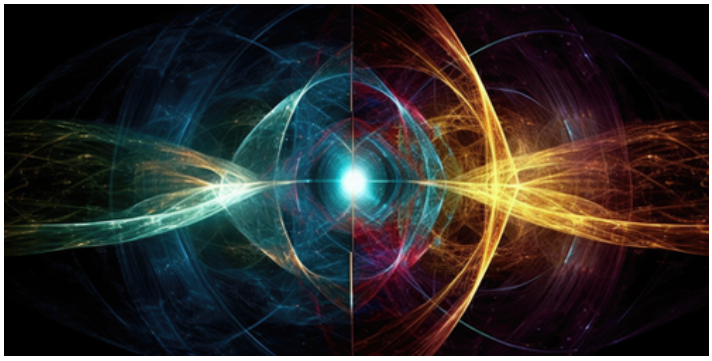

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REFERENCES

1. A. Somoroff *et al.*, "Millisecond coherence in a superconducting qubit," **Phys. Rev. Lett. 130, 267001 (2023).**