Low-Loss Quantum Buses for Photons

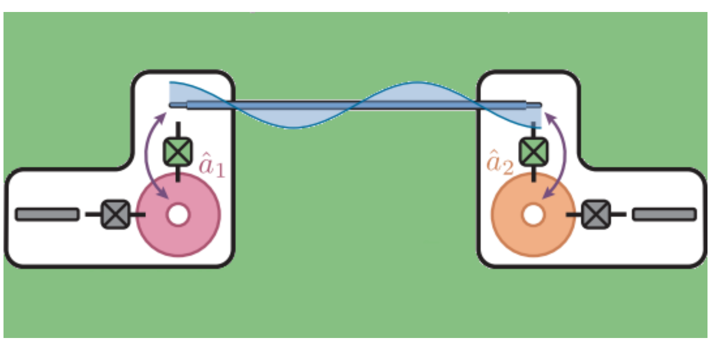
Researchers demonstrate a way to shuttle photons between modules of a quantum processor that can detect and correct communication losses.

By Rachel Berkowitz

Future quantum computers will contain many qubits that will all need to interact with one another in a controlled way while remaining isolated. One approach toward realizing such a system is to build it in a modular fashion, meaning that parts of the computer are housed in separate containers, or modules. The key challenge in building a modular quantum computer is developing robust devices to transfer information between modules. Luke Burkhart at Yale University and colleagues now present a low-loss prototype hardware and method for shuttling qubits between modules via a coaxial cable [**1**].

Burkhart and his colleagues started with two microwave cavities, which each hosted a superconducting qubit. They then linked the cavity modules with a coaxial cable. The cable served as a resonance cavity that acted as a quantum "bus," shuttling information between components.

To demonstrate their approach, the team applied microwave pulses to each qubit, switching on interactions between the modules and the cable that controlled the flow of information between them. They then performed error correction on the transferred data, measuring the parity of the number of photons—whether the number is even or odd—to determine whether loss errors had occurred.



Credit: L. D. Burkhart *et al.* [**1**]

The team showed that their error-corrected information-transfer protocol performs on par with uncorrectable methods. They say that the design provides a pathway toward robust operations, which will allow quantum computers to operate with fewer qubits.

Rachel Berkowitz is a Corresponding Editor for ***Physics*** based in Vancouver, Canada.

REFERENCES

1. L. D. Burkhart *et al.*, "Error-detected state transfer and entanglement in a superconducting quantum network," PRX Quantum 2, 030321 (2021).

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