QUANTUM COMPUTING

# Tunable circulator on a chip

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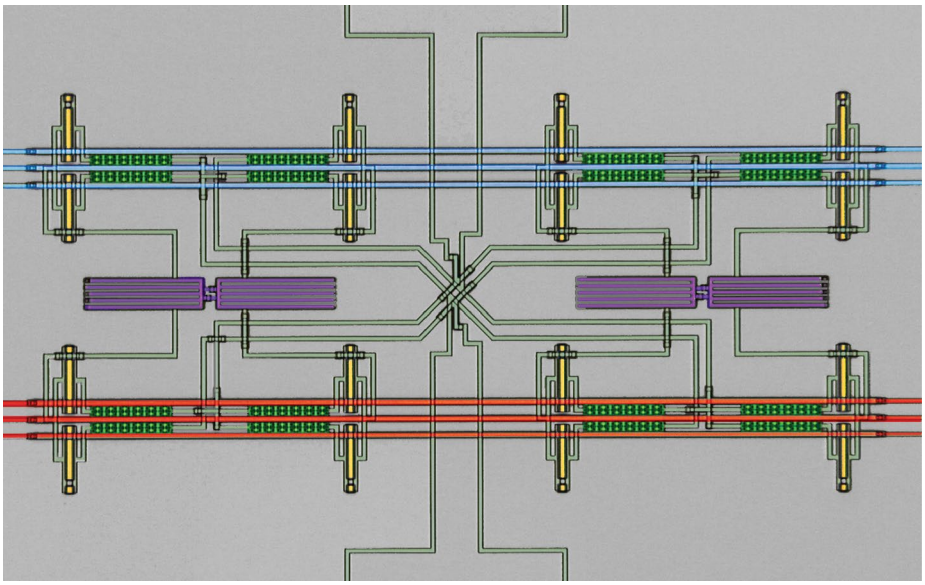

Credit: APS

In a future quantum computer, information will be encoded using quantum bits. These qubits are generally vulnerable to decoherence effects due to their interaction with the environment, which makes the manipulation of signals a demanding task. Circulators are multi-port systems that can be used to route signals while isolating them from unwanted fields. Specifically, qubits enter the circulator and follow a one-way direction to exit from the next port. These devices are important in the scaling-up of quantum computing schemes, but the current size of commercial circulators makes them difficult to integrate on-chip in systems with many qubits. Benjamin Chapman and colleagues now report a compact on-chip microwave circulator with a tunable operation frequency.

The researchers — who are based at the University of Colorado, the National Institute of Standards and Technology in Colorado, Université de Sherbrooke and the Canadian Institute for Advanced Research — developed a device that combines multiplication and delay functionalities on a 4-mm chip to simulate the operation of a circulator. Unidirectional routing is, in particular, achieved by applying frequency conversion and relative phase shifts on the signals. With their approach, Chapman and colleagues experimentally demonstrate signal transmission and isolation, with tunable operation over a range of 2 GHz.

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