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Superfluid Atomtronic Circuits STEPHEN ECKEL, FRED JENDRZEJEWSKI, AVINASH KUMAR, Joint Quantum Institute (NIST/UMD), NOEL MURRAY, MARK EDWARDS, Georgia Southern University, GRETCHEN CAMPBELL, Joint Quantum Institute (NIST/UMD) — We have created a superfluid atom circuit using a toroidal Bose-Einstein Condensate. Just as a current in a superconducting circuit will flow forever, if a current is created in our superfluid circuit, the flow will not decay as long as the current is below a critical value. A repulsive optical barrier across one side of the torus creates a tunable weak link in the condensate circuit and can be used to control the current around the loop. By rotating the weak link, we have observed phase slips between well-defined persistent current states, which are analogous to transitions between flux states in an rf-superconducting quantum interference device (SQUID). We have demonstrated that these transitions are hysteretic. More recently, we have realized a geometry similar to a dc-SQUID using two weak links. In this case, we can move these weak links relative to each other and observe resistive flow when the current exceeds the critical current. This observation of resistive flow is an important step to realizing the atomtronic analog of the dc-SQUID. Lastly, we have developed techniques of measuring the current flow around the ring which allows us to measure the current-phase relationship of our weak link.

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