

## **Experiments with superfluid atom circuits**

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Bose-Einstein condensates in ring geometries are essential ingredients to the ongoing effort of building increasingly complex superfluid circuits. Such circuits have previously allowed for the observation of persistent currents and hysteresis. Here we report on two new experiments that increase our abilities further. First, we report the observation of resistive flow through a weak link in a weakly interacting atomic Bose-Einstein condensate. We use two weak links to separate our ring-shaped superfluid circuit into two distinct regions, a source and a drain. At a critical value of the weak link velocity, we observe a transition from superfluid flow to superfluid plus resistive flow. Second, we demonstrate a new technique to directly observe the current-phase relationship through such weak links. By interfering our ring with a phase reference (formed as a disk), we show that we can measure the phase of the BEC around the ring and the average current.