Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

Measuring the current-phase relationship of a rotating weak link in a superfluid, quantized atomtronic circuit STEPHEN ECKEL, AVINASH KUMAR, FRED JENDRZEJEWSKI, GRETCHEN CAMPBELL, Joint Quantum Institute (NIST/UMD) — We demonstrate a method of directly measuring the current-phase relationship of a weak link in a Bose-Einstein condensate formed into a closed atomtronic circuit. The current-phase relationship of a weak link that connects two superfluids (or superconductors) determines the transport properties and also dynamic effects such as phase slips or Shapiro steps. We create our circuit by combining a BEC of ^{23}Na atoms shaped into a ring with a rotating constriction, i.e. a weak link. Due to the single-valued nature of the condensate wavefunction, such a closed circuit exhibits quantized flow. The behavior of the flow is analogous to the electrical current in an rf superconducting quantum interference device (SQUID). By interfering our ring with a phase reference (formed as a disc), we can measure the phase of the BEC in the ring. This phase information yields both the phase drop across the weak link and average current flowing around the ring, thus allowing for a measurement of the current-phase relationship.

Stephen Eckel
NIST - Natl Inst of Stds & Tech

Date submitted: 31 Jan 2014 Electronic form version 1.4