Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Recent experiments with ring Bose-Einstein condensates S. ECKEL, A. KUMAR, N.W. ANDERSON, G.K. CAMPBELL, Joint Quantum Institute (UMD/NIST) — Here, we present three recent results of our experiments with ring-shaped ^{23}Na Bose-Einstein condensates. First, we present results of the effect of temperature on the decay of persistent currents in the presence of a local, stationary perturbation, or weak link. When the weak link rotates, it can drive transitions between quantized persistent current states in the ring, that form hysteresis loops whose size depends strongly on temperature. We find that that our data does not fit with a simple model of thermal activation. Second, we present a new method to measure the quantized persistent current state of the ring in a minimally-destructive way. This technique uses phonons as probes of the background flow through the Doppler effect. Finally, we present a set of experiments designed to reproduce the horizon problem in the early universe. Supersonic expansion of the ring creates causally-disconnected regions of BEC whose phase evolves at different rates. When the expansion stops and these regions are allowed to recombine, they form topological excitations. These excitations can be predicted using a simple theory that shows excellent agreement with the data.

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Date submitted: 29 Jan 2016 Electronic form version 1.4