Abstract for an Invited Paper
for the DAMOP11 Meeting of
The American Physical Society

Superflow in Toroidal Condensates

GRETCHEN CAMPBELL, JQI, NIST and the University of Maryland

Persistent currents are a hallmark of both superfluidity and superconductivity. Just as a current in a superconducting circuit will flow forever, if a current is created in a superfluid condensate, the flow will not decay. Recently, we have created long-lived persistent currents (>30s) in toroid-shaped Bose-Einstein Condensates. The all- optical toroidal trap is created using a Laguerre-Gaussian beam, and circulation is created by transferring quantized angular momentum from optical fields using a two- photon Raman process. A repulsive optical barrier intersects a portion of the torus, creating a tunable weak link in the condensate circuit, which can be used to control the current around the loop. As the barrier strength is increased, we find that the superflow stops abruptly when the local flow velocity at the barrier exceeds a critical velocity. These results demonstrate an essential step toward realizing an atomic SQUID analog.