Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Geometric squeezing into the lowest Landau Level by rotating a Bose-Einstein Condensate (BEC) AIRLIA SHAFFER, RICHARD FLETCHER, CEDRIC WILSON, PARTH PATEL, ZHENJIE YAN, VALENTIN CREPEL, BISWAROOP MUKHERJEE, MARTIN ZWIERLEIN, Massachusetts Institute of Technology MIT — A key feature of the physics of charged particles in a magnetic field, or equivalently neutral particles under rotation, is that translations along orthogonal spatial directions do not commute. By rotating a BEC, we observe the dynamics of a single wavefunction living in this geometry and use the noncommutativity to squeeze in real space. We demonstrate the incompressibility of guiding center flow and squeeze the guiding center distribution by more than 7dB below the standard quantum limit. This squeezing procedure dynamically creates a BEC in the lowest Landau level, signaled by the density distribution changing from Thomas-Fermi to Gaussian as well as the cloud width saturating to the size of cyclotron orbit's zero-point motion. The condensate attains an angular momentum of more than 1000 $\hbar$ per particle and an interparticle spacing approaching the size of the cyclotron orbits, offering a new route towards bosonic quantum Hall states.

Airlia Shaffer
Massachusetts Institute of Technology MIT

Date submitted: 31 Jan 2020 Electronic form version 1.4