Title: Quantum Hydrodynamic Instabilities in Rapidly Rotating Quantum gases

Abstract: *Quantum gases of atoms allow the study of macroscopic matter waves - Bose-Einstein condensates and fermionic superfluids - obeying non-linear equations of motion. As such, they can display hydrodynamic instabilities and feature turbulence, like ordinary fluids. Unlike normal liquids, however, circulation is quantized in a quantum fluid, a fact that may render the understanding of quantum turbulence a simpler task than for classical liquids.*

In particular, I will present an experiment on rapidly rotating Bose gases, where we observed a hydrodynamic instability from a smooth homogeneous condensate into a droplet crystal. It can be understood as the quantum analogue of the Kelvin-Helmholtz instability of counterflowing liquids.

Rapidly rotating quantum gases realize the physics of charged particles in high magnetic fields, which all occupy the ground state of cyclotron motion – the lowest Landau level. Life in the lowest Landau level is ruled by non-commutative geometry and topology, giving rise to the rich phenomenology of quantum Hall physics. As a striking display of topological protection in this regime, I will present our direct observation of chiral edge flows, which smoothly crawl around obstacles unscattered.