MONTANA STATE UNIVERSITY | College of LETTERS & SCIENCE

Physics Colloquium

Tuesday, February 14, 2017
4:30 – 5:20 PM
Barnard/EPS 103

Superfluid flow and turbulence in configured Bose-Einstein condensates

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Abstract:

First experimentally realised in 1995, Bose-Einstein condensates present highly controllable and clean systems for studying macroscopic quantum effects, such as superfluidity and the behaviour of quantised vortices. The most versatile methods for manipulating these gases utilise structured optical fields. I will discuss how structured light fields can be produced and applied to the trapping and dynamic manipulation of ultracold atoms. In particular, I will describe our technique that utilises simple direct imaging of a digital micromirror device (DMD) to project complex and dynamic optical patterns. This method results in optical potentials that can be configured with 630(20) nm FWHM resolution (532 nm illumination) across an area of 130 μm x 207 μm at the BEC plane, resulting in near-arbitrary dynamic control of the BEC configuration.

We apply these techniques to study coherent superfluid flow in a "dumbbell" Josephson junction, where the shedding of quantised vortices results in dissipation of the flow. With the ability to image vortices, I will describe our recent efforts to explore an interesting phenomenon of two-dimensional quantum turbulence -- the emergence of quantum and classical von Kármán vortex streets in the wake of a translating barrier.

Host: Rufus Cone

****** Refreshments served in the EPS second floor atrium at 3:45 ******

Dr. Neely is a candidate for a Physics Faculty Position