**Date:** **April 21st**

**Time:** **11:00 AM**

**Location:** **Maryland Hall 110**

**Speaker:** **Dr. Sergey Smirnov**
**Mechanical Engineering Department**
**Texas Tech University**

**Title:** **"Stratified Spin-up Flows"**

## Abstract

The present work is focused on stability of an impulsively forced baroclinic current in axisymmetric geometries (an axisymmetric cylinder, annular channel and cone). The current is initiated via incremental spin-up of a linearly stratified fluid. It is demonstrated that the formation of cyclonic and anticyclonic vortices may occur under certain conditions at late spin-up times. The vortices facilitate transport of angular momentum from the solid boundaries to the bulk of the fluid and substantially reduce the spin-up time compared to the spin-up viscous time scale of a homogeneous fluid. Most of the previous studies of stratified spin-up have been restricted to the analysis of axisymmetric perturbations or early times of the flow development, while the non-axisymmetric phase was left unexplored.

The long-time flow evolution is governed by the Rossby and Burger numbers. Observations demonstrate that isopycnals experience large vertical displacements near the lateral boundaries. The density gradient reduces to nearly zero in the corner regions, where the fluid is stirred, and increases above/below them near the outer/inner sidewalls respectively. The relative height of the corner regions is found to be determined by the relative values of the Rossby and Burger numbers. A flow regime diagram is presented. The extended Eady model of baroclinic instability, in which the sheared wall layers are taken into account, is advanced to explain the mechanism of eddy formation. The presence of a sloping wall modifies significantly the flow behavior, i.e. it stabilizes the spin-up flows, while the spin-down flows still remain unstable at late times.