## *Special Seminar*

UNIVERSITY OF NOTRE DAME
Department of Mathematics

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**Speaker:** Kevin Grady
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Thursday, April 7, 2016
11:30 AM
258 Hurley Hall

**Title:** Effective Low-Order Models for Atmospheric and Climate Dynamics

**Abstract:**

The governing equations of atmospheric and climate dynamics present enormous mathematical challenges when studied analytically. Following Kolmogorov, Lorenz, and Obukhov, a popular approach to handle the governing PDEs is to approximate them with finite systems of ODEs, called low-order models (LOMs). One such LOM is the celebrated Lorenz 1963 model of just three ODEs, but attempts to extend it to larger, more realistic models of atmospheric dynamics have sometimes led to LOMs exhibiting unphysical behaviors, such as a lack of energy conservation in the dissipationless (frictionless) limit. In this presentation I will provide an introduction to LOMs and show how to derive LOMs from the governing PDEs. I will also showcase how effective LOMs can be constructed through the use of 3-mode nonlinear dynamical systems known in mechanics as Volterra gyrostats (G-models, the simplest one equivalent to the Lorenz model). G-models guarantee energy-conservation, and all LOMs from recent publications that are physically sound can be converted to G-models. This suggests that G-models may offer a general framework for deriving effective LOMs for atmospheric dynamics.