Meeting: 1001, Evanston, Illinois, SS 6A, Special Session on Nonlinear Partial Differential Equations and Applications

1001-35-277 **Hailiang Liu*** (hliu@iastate.edu), Department of Mathematics, Iowa State University, Ames, IA 50011. *Critical Thresholds in Hyperbolic Balance Laws.*

A variety of nonlinear phenomena in fluid dynamics problems is often the product of delicate balance between nonlinear convection and different forcing mechanism. When dealing with the questions of time regularity for underlying model equations, one encounters several limitations with the classical stability analysis. In order to address these difficulties we propose a new notion of critical threshold (CT), which serves to describe the conditional stability for a class of fluid equations, in which the forcing mechanism could be in the form of diffusion, relaxation, global potential or the dispersive rotation.

In this talk I report the recent development on the study of this remarkable CT phenomena associated with a range of hyperbolic balance laws, where the answer to questions of global smoothness vs. finite time breakdown depends on whether the initial configuration crosses an intrinsic critical threshold. Our approach for multi-D setting is based on a main new tool of spectral dynamics, where eigenvalues of velocity gradient and associated eigenpairs are traced by a forced Ricatti equation. The dependence of the CT on the initial spectral gap is revealed via analyzing the spectral dynamics of the underlying equation. (Received August 29, 2004)