

# PIMS DISTINGUISHED CHAIR LECTURE SERIES CRG-CLIMATE MODELLING

UNIVERSITY OF VICTORIA  
MATHEMATICS & STATISTICAL SPECIAL COLLOQUIUM

## Information Theory, Statistical Mechanics, and Predicting Jupiter's Red Spot

**DISTINGUISHED VISITOR:**

**DR. ANDREW J. MAJDA,**

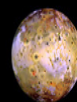
**COURANT INSTITUTE OF MATHEMATICAL SCIENCES**

**NEW YORK UNIVERSITY**

**TUESDAY, FEBRUARY 12, 2008**

**3:00PM-4:00PM, CORNETT B111**

This lecture blends ideas from probability theory, PDE's, numerical analysis and physical reasoning in the style of modern applied mathematics. First elementary concepts of information theory involving the lack of information in one probability measure relative to another are introduced. These ideas are then applied to give a unified explanation of the competing equilibrium statistical theories for coherent structures in fluids. The potential application of these ideas to predict coherent structures in flows with random forcing and dissipation is then discussed briefly including the first theorem (Xiaoming Wang and Majda, CPAM 2006) justifying the approach. All of this is utilized to develop a successful prediction for the exact location and structure of Jupiter's Red Spot in agreement with the Voyager Mission of the 1970's by utilizing a physically based prior encoding the key features of small scale observations from the Galileo mission of the 1990's. An a priori independent justification of this overall strategy is presented through novel numerical methods for detecting statistically relevant conserved quantities in fluid flow (Abramov and Majda, 2003, 2004.) The lecturer's recent book with X. Wang, Nonlinear Dynamics and Statistical Theories for Basic Geophysical Flow, Cambridge Univ. Press (2006) discusses in detail most of the material presented here.



Io — Tvashtar Catena

I25 (26 Nov 1999)  
+ C21 low-resolution color

I27 (22 Feb 2000)  
visible wavelength data  
+ IR data of active lava flow

