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Center for Environmental  
& Applied Fluid Mechanics

## Weekly CEA FM Seminar: Fall 2012

Date: **Friday, November 2, 2012**  
Time: 11:00 AM  
Location: Gilman 50 (Marjorie M. Fisher Hall)  
Speaker: **Prof. Brian Farrell** (Harvard University)  
Title: *"Emergence and Equilibration of Turbulent Jets in Planetary Atmospheres"*



### Abstract

Coherent large scale jets that are not forced directly at the jet scale are a prominent feature of planetary atmospheres. These jets arise from and are supported by systematic organization of turbulent Reynolds stresses. Understanding the mechanism producing the required perturbation momentum flux convergence, and how the jets and associated perturbation field mutually adjust to maintain a steady jet structure constitute fundamental theoretical problems. I will describe a theory for jet formation in planetary atmospheres that is based on a statistical mean state dynamics closed at second order. This theory reveals the existence of a manifold of nonlinear equilibria in planetary turbulence having the form of large scale jets and provides an explanation for how these jets arise and are maintained. The initial jet emergence is explained by linearization of the statistical mean state dynamics about a homogeneous turbulent state, which allows formulation of a structural stability theory that predicts jet formation as a bifurcation from homogeneous turbulence. The observed finite amplitude steady jet structure is then explained as corresponding to the fixed point equilibria associated with these bifurcations.