HAO Colloquium Series

(Refreshments served)

Speaker: **Zbigniew Piotrowski—NCAR/GTP**

Time: **1:30 pm**

Date: **Wednesday, January 19, 2011**

Location: **CG-1, South Auditorium**

Title: **Under-resolved simulations of Rayleigh-Benard convection; effects of anisotropic viscosity and Prandtl number Problems**

Abstract: The main stream of interest in studies of geophysical and astrophysical convection falls in the regime of large Rayleigh numbers. Rapid progress in computational technology already enables global-scale simulations of convective fields at unprecedented mesoscale resolutions. This in turn enables calculations free of convection parameterizations, in the spirit of large-eddy-simulation (LES). Ironically, the simulated (as opposed to parameterized) convection can be largely under-resolved at the mesoscale resolutions, making numerical solutions sensitive to ad hoc filtering present in some form in all computational models. The latter shifts the virtual reality of convection toward moderate and low Rayleigh number regimes, rich in intriguing and attractive forms of the structural organization, yet unrealistic for the specified external parameter range. In the recent paper [Piotrowski et al., On numerical realizability of thermal convection, J. Comput. Phys. 228 (2009) 6268-6290], the authors have documented the sensitivity of convection organization to the anisotropic viscosity at a fixed finite Prandtl number. The current work, in progress, extends the linear stability theory of Piotrowski et al. on the Rayleigh-Benard convection at low-to-moderate Rayleigh numbers and anisotropic Prandtl numbers, with an aim to mimic disparate approximations to the governing equations, not uncommon in geophysical fluid solvers. Asymptotic predictions of the linear theory are discussed and illustrated with numerical examples.