Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

A Model of Convective Taylor Columns in Rotating Rayleigh Benard Convection IAN GROOMS, KEITH JULIEN, JEFFREY WEISS, University of Colorado, Boulder, EDGAR KNOBLOCH, University of California, Berkeley — Many real fluid flows are nearly incompressible and are influenced by both rotation and thermal forcing. Rotation tends to suppress variation along the axis of rotation, while strong thermal forcing often gives rise to thermal plumes that travel vertically (in the direction of gravity). When the axis of rotation and gravity are aligned, or nearly so, these effects can combine to produce long lived columnar structures which have been observed in laboratory and numerical experiments; these "Convective Taylor Columns" can be interpreted as the effective particles "convectons" of the flow, accounting for a significant proportion of the vertical heat and momentum flux in the fluid and for the enhanced lateral mixing otherwise absent in non-rotating flows. However, due to the experimental challenges of 3-D data acquisition and the numerical challenges of simulation at low Rossby number, these structures remain poorly understood. We here present a nonlinear model for these columnar structures in the context of rotating Rayleigh-Bénard convection; our model makes use of multiscale asymptotics, complex variables, and special functions.

Ian Grooms
University of Colorado, Boulder

Date submitted: 07 Aug 2009 Electronic form version 1.4