Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

A Spectral Quadrilateral Subdomain Penalty Method Model for High Reynolds Number Incompressible Flows JORGE ESCOBAR-VARGAS, PETER DIAMESSIS, Cornell University — We report our latest results in the development of a novel spectral multidomain penalty method model for the simulation of localized high Reynolds number incompressible flows in doubly non-periodic domains. The target flow for model application is the unstable boundary layer in the footprint of a nonlinear internal wave. Numerical stability, without loss of spectral accuracy, is ensured through the implementation of a penalty scheme and spectral filtering in the Legendre polynomial-based discretization in individual quadrilateral subdomains. The penalty coefficients are computed through a stability analysis based on the energy method. The design of efficient preconditioners for the solution of the 2-D Helmholtz and Poisson equations, in the context of a discontinuous element-based scheme, will be discussed in detail. The efficiency of the penalty model will be illustrated through comparisons with exact solutions of the linear advection-diffusion equation and the shallow water equations.

Peter Diamessis
Cornell University

Date submitted: 26 Jul 2007 Electronic form version 1.4