Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Complex dynamics in binary mixture convection with weak negative Soret coupling ORIOL BATISTE, ARANTXA ALONSO, ISABEL MERCADER, Dept. Fisica Aplicada, Universitat Politecnica de Catalunya — Thermal convection in a binary fluid layer heated from below is a system that exhibits a great variety of pattern forming phenomena when driven away from equilibrium. Results on direct numerical simulations of convection in binary fluids in large aspect ratio containers are presented. Periodic boundary conditions have been considered in the horizontal direction, modelling the annular cells frequently used in experiments. We have focused on binary mixtures with negative values of the separation ratio S, for which the primary bifurcation is subcritical and oscillatory, and with weak Soret coupling (S close to zero), so that nonlinear dispersion is important. Highly resolved spectral methods were used to solve the hydrodynamic equations in the two-dimensional approximation. The weakly nonlinear states arising very close to the onset of convection, the strongly nonlinear bursts of amplitude that precede the small-amplitude states, and the dispersive chaotic states encountered further above onset in experiments for mixtures with a weak negative Soret coupling, are analyzed in detail in extended domains of aspect ratio $\Gamma = 80$. Steady localized states surrounded either by quiescent fluid or by small-amplitude waves are also obtained, and the role they play in the dynamics is elucidated. Our numerical study using the full convection equations completes former experimental and numerical works on such states.

Oriol Batiste

Date submitted: 02 Aug 2006 Electronic form version 1.4