University of California, Santa Barbara

Special Seminar

Friday, June 4, 2004 11:00 am

Broida 3302

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Wave-number Selection by Target Patterns and Side Walls in Rayleigh-Benard Convection

We present experimental results for Rayleigh-Benard convection patterns in a cylindrical container with static side-wall forcing induced by a heater. This forcing stabilized a pattern of concentric rolls (a target pattern) with the central roll (the umbilicus) at the center of the cell after a jump from the conduction to the convection state. A quasi-static increase of the control parameter (epsilon) beyond 0.8 caused the umbilicus of the pattern to move off center. As observed by others, a further quasi-static increase of epsilon up to 15.6 caused a sequence of transitions. Each transition began with the displacement of the umbilicus and then proceeded with the loss of one convection roll at the umbilicus and the return of the umbilicus to a location near the center of the cell. Alternatively, with decreasing epsilon new rolls formed at the umbilicus but large umbilicus displacements did not occur. In addition to quantitative measurements of the umbilicus displacement, we determined and analyzed the entire wave-director field of each image. The wave numbers varied in the axial direction, with minima at the umbilicus and at the cell wall and a maximum at a radial position close to 2/3 Gamma. The wave numbers at the maximum showed hysteretic jumps at the transitions, but on average agreed well with the theoretical predictions for the wave numbers selected in the far field of an infinitely extended target pattern.