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Wave patterns in convection

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In this work we describe a detailled experimental study of the transition from a homogeneous linearly stratified fluid to a cellular or layered structure by means of stirring. Patterns arise by setting up a convective flow generated by a buoyant heat flux. The experiments described here investigate high Prandtl number mixing using brine and fresh water in order to form a density interface and low Prandtl number mixing with temperature gradients. They include a novel technique, using termoelectric (Peltier) heating- cooling elements in order to generate a lateral heat flux gradient (time dependent) Good thermal control and high reliability are a mayor advantage of the termoelectric modules used in the experimental convective box. The formation of a vertical layered structure by both thermal and mechanical stirring is discussed in terms of the Phillips(1972) relaminarization mechanism. Spectral analysis is performed on the digitized shadowgraph and pearlescence tracers used to enlight the flow patterns. See in the figure the evolution in time of the convective cells and their spectra. Relationships between the type, frecuency and characteristics of basic turbulent instabilities, and the characteristics of the flow are presented. Quantitative information from the video images is accomplished using the DigIFlow video/PC processing system. Images can be digitally enhanced before analysis. The video may be controlled by the computer, allowing remote control of the processing. Spectral analysis on the images has been used in order to estimate dominant wave periods as well as the dispersion relations of dominant instabilities. The fractal aspects of turbulent isolines is compared with spectral analysis and the aspect ratio of the patterns is described in terms of Rayleigh and Richardson numbers.