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Cascade processes in stratified media: experiment and direct numerical simulation.

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Internal gravity waves may transfer substantial part of energy in oceans and astrophysical objects, influence the background stratification, and angular momentum. Internal waves can be generated by convection in astrophysical objects, by tidal motion and interaction with orography in oceans. Internal and inertial waves obey similar system of equations. Due to very particular type of dispersive relation and the way internal waves are reflected from surfaces, in confined domains the monochromatic internal waves after sequence of reflections may form closed paths, the "wave attractors" [1]. Presently, linear theory of wave attractors is quite elaborated and a principal interest of research is focused on nonlinear regimes and unstable configurations, overturning events and mixing. We have performed direct numerical simulation of wave attractors which closely reproduces experiments [2] being carried out in Ecole Normal Superior de Lyon (ENS de Lyon). Direct numerical simulation is realized with the help of spectral element approach and code nek5000. Triadic resonance is confirmed as the first instability which appears on the most energetic ray of the attractor at sufficiently large forcing. With further increase of the forcing amplitude the daughter waves also become unstable resulting in a sophisticated cascade process which was first observed experimentally. For very high forcing amplitude interaction of focused waves with the walls results in appearance of small-scale folded structures. Their interaction with principal flow is the subject of further research.

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