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Homogeneous internal wave turbulence driven by tidal flows[1]

THOMAS LE REUN, BENJAMIN FAVIER, MICHAEL LE BARS, IRPHE, Marseille, ERC FLUDYCO TEAM — We propose a novel investigation of the stability of strongly stratified planetary fluid layers undergoing periodic tidal distortion in the limit where rotational effects are negligible compared to buoyancy. With the help of a local model focusing on a small fluid area compared to the global layer, we find that periodic tidal distortion drives a parametric subharmonic resonance of internal. This instability saturates into an homogeneous internal wave turbulence pervading the whole fluid interior: the energy is injected in the unstable waves which then feed a succession of triadic resonances also generating small spatial scales. As the timescale separation between the forcing and Brunt-Visl is increased, the temporal spectrum of this turbulence displays a -2 power law reminiscent of the Garrett and Munk spectrum measured in the oceans (Garett & Munk 1979). Moreover, in this state consisting of a superposition of waves in weak non-linear interaction, the mixing efficiency is increased compared to classical, Kolmogorov-like stratified turbulence. This study is of wide interest in geophysical fluid dynamics ranging from oceanic turbulence and tidal heating in icy satellites to dynamo action in partially stratified planetary cores as it could be the case in the Earth.

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