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*Spontaneously stochastic solutions for the Rayleigh-Taylor instability*

The Rayleigh-Taylor instability occurs at an interface between two fluids of different densities, when heavier fluid is placed above the lighter one. Propagation of a disturbance from smaller to larger scales due to nonlinear interaction generates a very complex turbulent dynamics in a growing mixing layer. Occurrence of the RT instability is abundant in nature, which includes astrophysical, geological and atmospheric phenomena, as well as various technological applications such as combustion. In this work we suggest that a turbulent phase of the Rayleigh-Taylor instability can be explained as a universal stochastic wave traveling with constant speed in a properly renormalized system. This wave, originating from ordinary deterministic chaos in a renormalized time, has two constant limiting states at both sides. The theoretical analysis is confirmed with extensive numerical simulations for a novel shell model of convection turbulence.