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Zombie Turbulence and More in Stratified Couette Flow PHILIP MARCUS, University of CA Berkeley, JOE BARRANCO, San Francisco State Univ, SUYANG PEI, Texas A M Corpus Christi, CHUNG-HSIANG JIANG, University of CA Berkeley — Zombie turbulence occurs in rotating, shearing vertically-stratified flows such as stratified Couette flows. The turbulence is triggered by a neutrally-stable eigenmode with a critical layer receptive to finite-amplitude perturbations. Once excited, the critical layer becomes a vortex layer pair that rolls up into discrete vortices. Those vortices excite new critical layers, and the process repeats ad infinitum. When the vortex amplitudes become sufficiently large, the flow becomes turbulent. Although possessing a mid-range energy spectrum with $E(k) \propto k^{-5/3}$, the turbulence is non-Kolmogorov, highly anisotropic, and with large turbulent, but coherent, structures that retain the length scales of the spacing between the critical layers. The motivation for this study is protoplanetary disks (PPDs) where new stars form. In the PPD the Brunt-Vaisala frequency N increases as a function of distance from the midplane where it is zero. We cannot trigger the initial finite amplitude instability where N is small (close to the midplane). However, computations in PPDs and Couette flows show that zombie turbulence forms where N is large, and then a new type of turbulence, that is neither zombie nor Kolmogorov turbulence, fills in the remainder of the domain even where $N = 0$.

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