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The Zombie Instability: Using Numerical Simulation to Design a Laboratory Experiment MENG WANG, SUYANG PEI, CHUNG-HSIANG JIANG, UC Berkeley, PEDRAM HASSANZADEH, Harvard University, PHILIP MARCUS, UC Berkeley — A new type of finite amplitude-instability has been found in numerical simulations of stratified, rotating, shear flows. The instability occurs via baroclinic critical layers that create linearly unstable vortex layers, which roll-up into vortices. Under the right conditions, those vortices can form a new generation of vortices, resulting in "vortex self-replication" that fills the fluid with vortices. Creating this instability in a laboratory would provide further evidence for the existence of the instability, which we first found in numerical simulations of protoplanetary disks. To design a laboratory experiment we need to know how the flow parameters — shear, rotation and stratification, etc. affect the instability. To build an experiment economically, we also need to know how the finite-amplitude trigger of the instability scales with viscosity and the size of the domain. In this talk, we summarize our findings. We present a map, in terms of the experimentally controllable parameters, that shows where the instability occurs and whether the instability creates a few isolated transient vortices, a few long-lived vortices, or long-lived, self-replicating vortices that fill the entire flow.

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