Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

3D Zombie Vortices in Rotating Stratified Shear PHILIP MARCUS, SUYANG PEI, CHUNG-HSIANG JIANG, UC Berkeley, PEDRAM HASSANZADEH, Harvard, JOSEPH BARRANCO, SFSU, DANIEL LECOANET, UC Berkeley — We have shown that there is a finite-amplitude instability in linearly-stable, rotating, vertically-stratified, horizontally-shearing flows. The instability is due to excitations of baroclinic critical layers in which the vertical velocity of a neutrally-stable eigenmode is singular in the inviscid limit. This singularity coupled with the Coriolis and stretching terms in the vertical vorticity equation create intense vortex layers. Those layers roll-up into 3D vortices, which then de-stabilize other critical layers. These vortices, which we call *zombie* vortices, can fill the *dead zone* of a protoplanetary disk around a forming star. The vortices, either by themselves or by exciting inertio-gravity waves or acoustic waves, can transport angular momentum in a protoplanetary disk and thereby allow a protostar to form into a star. We find that the zombie vortices are similar in flows with Boussinesq, anelastic, and fully compressible equations of state. However, the rates of angular momentum transport and the mechanisms by which it is transported vary significantly in flows with different equations of state.

Philip Marcus
UC Berkeley

Date submitted: 02 Aug 2013 Electronic form version 1.4