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Zombie Vortex Instability: Effects of Non-uniform Stratification & Thermal Cooling JOSEPH BARRANCO, SFSU, SUYANG PEI, PHIL MARCUS, CHUNG-HSIANG JIANG, U.C. Berkeley — The Zombie Vortex Instability (ZVI) is a nonlinear instability in rotating, stratified, shear flows, such as in protoplanetary disks (PPD) of gas and dust orbiting new stars. The instability mechanism is the excitation of baroclinic critical layers, leading to vorticity amplification and nonlinear evolution into anticyclonic vortices and cyclonic sheets. ZVI is most robust when the Coriolis frequency, shear rate, and Brunt–Väisälä (BV) frequency are of the same order. Previously, we investigated ZVI with uniform stratification and without thermal cooling. Here, we explore the role of non-uniform stratification as would be found in PPDs in which the BV frequency is zero in the disk midplane, and increases away from the midplane. We find that ZVI is vigorous 1-3 pressure scale heights away from the midplane, but the non-isotropic turbulence generated by ZVI can penetrate into the midplane. We also explore the effect of thermal cooling and find that ZVI is still robust for cooling times as short as 5 orbital periods. ZVI may play important roles in transporting angular momentum in PPDs, and in trapping dust grains, which may trigger gravitational clumping into planetesimals

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