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Stability of a pancake vortex in a stratified fluid M. ELETTA NEGRETTI, PAUL BILLANT, LadHyX, CNRS, Ecole Polytechnique, France — Vortices in stably stratified fluids have generally a pancake shape with a small vertical thickness compared to their horizontal size. Such vortices exhibit a high vertical shear which may induce Kelvin-Helmholtz instabilities. The pressure and density anomaly in their core might trigger also gravitational instabilities. In order to understand which mechanism determines the minimum thickness of the vortex, we investigate the three-dimensional linear stability of an axisymmetric pancake vortex in a stably stratified fluid. The angular velocity of the base flow has a Lamb-Oseen radial profile with a Gaussian distribution in the vertical direction. We find that the vortex becomes unstable when the aspect ratio is below a critical value, which scales with the Froude number. We show that the instability is gravitational by looking at the classical criteria for each instability, which predict larger critical aspect ratios for the gravitational instability as compared to the shear instability. The numerical results agree well with the gravitational instability theory. We have generalized this result to any vertical distribution of the angular velocity and almost any profile of the vortex. We show that the properties of the gravitational instability can be explained by considering an unstably stratified fluid in solid body rotation. The influence of the Reynolds number will be also discussed.

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