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3D Vortices in Rotating Stratified Flows XYLAR ASAY-DAVIS, SUSHIL SHETTY, PHILIP MARCUS, University of California at Berkeley —
We have carried out high resolution numerical simulations of 3D vortices in rotating flows in which stratification is strong in the sense that the Brunt-Vaisala frequency N, the Coriolis parameter 2Ω and the inverse of the turn-around time of the vortex $1/\tau$ are all the same order. Although these vortices are of importance in protoplanetary disks around forming stars, the vortices can also be created in the laboratory. Most previous analyses of laboratory vortices have been for weak stratification, ie, $N \ll 1/\tau$. The focus of this talk is on the theoretical predictions of scaling laws for laboratory vortices and the numerical validation of the scalings. Of most importance is how the prediction for the aspect ratio (height to average horizontal diameter) of the allowable equilibria depends on the non-dimensional ratio of the 3 times scales (ie, Rossby number, Froude number, etc.). We also discuss the stability of the allowed equilibria as functions of these same dimensionless numbers. For example as stratification becomes weak, the aspect ratio becomes large (and the vortices look more like Taylor columns), but instabilities, rather than the phase space of allowable equilibria, set the maximum aspect ratio.

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