Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Gyroscopic analogy of a rotating stratified flow confined in a tilted spheroid and its implication to stability of a heavy symmetrical top[1] YASUHIDE FUKUMOTO, Institute of Mathematics for Industry, Kyushu University, YUKI MIYACHI, Graduate School of Mathematics for Industry, Kyushu University — We address the suppression of the gravitational instability of rotating stratified flows in a confined geometry in two ways, continuous and discontinuous stratification. A rotating flow of a stratified fluid confined in an ellipsoid, subject to gravity force, whose velocity and density fields are linear in coordinates, bears an analogy with a mechanical system of finite degrees of freedom, that is, a heavy rigid body. An insight is gained into the mechanism of system rotation for the ability of a lighter fluid of sustaining, on top of it, a heavier fluid when the angular velocity is greater than a critical value. The sleeping top corresponds to such a state. First we show that a rotating stratified flow confined in a tilted spheroid is equivalent to a heavy symmetrical top with the symmetric axis tilted from the top axis. This tilting effect of the symmetric axis on the linear stability of the sleeping top and its bifurcation is investigated in some detail. Second, we explore the incompressible two-layer RTI of a discontinuously stratified fluid confined in the lower-half of an upright spheroid rotating about the axis of symmetry oriented parallel to the vertical direction. The gyroscopic analogy accounts for decrease of the critical rotation rate with oblateness.

[1]This work was supported in part by a Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science (Grant No.16K05476).

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Date submitted: 01 Aug 2017 Electronic form version 1.4