



复旦大学数学科学学院 数学综合报告会

报告题目：**Gyroscopic analogy of Coriolis effect for stabilizing a rotating stratified flow confined in a spheroid**

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摘要： In the investigation of the Rayleigh-Taylor instability (RTI) in a rotating frame, Chandrasekhar (1961) claimed that rotation does not affect the instability or stability of a stratified flow. However, the dispersion relation of the internal inertia-gravity wave reveals the stabilizing action of the Coriolis force. 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 misalignment 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 a 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.

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