Differential rotation in slowly dissipating systems. (English) Zbl 0105.39101 Phys. Fluids 5, 57-68 (1962). For a scan of this review see the web version.

Keywords: hydrodynamics

Full Text: DOI

References:
[2] This, by the way, furnishes athermodynamicalproof that for a freely rotating body rigid rotation corresponds to thermal equilibrium if differential rotation is associated with a dissipation. For, in this case the internal dissipation will make the system to diminish and its entropy increase, until it is zero then the body rotates rigidly, the dissipation ceases, and the entropy is a maximum. Hence, as long as there is a dissipation rigid rotation can be reached; moreover, once it has been reached the body will continue in that state, since otherwise it must increase again, and this can happen only if heat is transformed back into kinetic energy with a corresponding loss of entropy contrary to the second law.
[4] It is likely that for the sun the initial state was an even one. Evisage a thin rotating gaseous layer which is breaking up to form the solar system. If the top and the bottom of the layers are rotating in the same sense (even state) after breaking up, the bodies formed will have their axis of rotation normal to the plane of the original layer. If, however, the top and the bottom of the layer rotate in the opposite direction, the resulting bodies will have their axis of rotation in the plane of the original layer. In the solar system, all planets except for Uranus have their axis of rotation very nearly perpendicular to the plane of their orbit.
[5] How the convexity enters can already be seen by the following counterexample. Suppose this proposition is true for a convex body. Construct now a new body by putting two of these together so that the north pole of one should touch the south pole of the other. This will be the new equatorial region of the new compound body which is not convex. Obviously, if originally the equatorial regions rotated faster, for the new body the equatorial region will rotate slower.
[6] If the heat conductivity cannot be neglected we proceed as follows. In Eq. (23) we divide the integrands with $T$, the absolute temperature, and introduce an additional term $\kappa(T) dT/(\tau)$, the dissipation due to heat conduction; $\kappa$ is the thermal conductivity. Now the variation leads to an additional equation for the determination of $T(x, y, z)$. If there are also internal heat sources present a further term $(qT) dT/(\tau)$ is needed which is the rate at which heat is generated in unit volume. Thus the inclusion of heat generation and heat conduction does not invalidate our variational approach; it only makes the solution more difficult.

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.