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ZONAL FLOW IN THE ROTATING SPHERICAL CAVITY WITH FLUID AND FREE INNER CORE
UNDER LIBRATIONS**Abstract**

Zonal flow generated by librations (periodic change in the rotation rate) of a spherical cavity with fluid and free inner solid core is experimentally investigated. The cavity rotates around the horizontal axis. The core has lower density compared to the fluid and occupies a stable position near the cavity center under the action of centrifugal force. Due to the gravity force the core performs circular oscillations in the cavity frame herewith the fluid comes into the steady retrograde differential rotation [1]. Librations of the cavity lead to the generation of an additional zonal flow. In the central part of the cavity, the retrograde flow associated with the oscillations of the core increases, at the same time at the equator near the cavity wall the prograde flow appears. The free core responds to the changing in the fluid motion and performs additional differential rotation. In a wide range of librations frequency, the intensity of the differential rotation of the core and the fluid is proportional to the square of the amplitude of librations. In the case when the frequency of librations is close to the rotation frequency of the cavity, the oscillations of the core becomes non-circular, their amplitude varies during the period of the cavity rotation whereby the axisymmetric flow takes the form of a spiral.

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References

1. V.G. Kozlov, N.V. Kozlov and S.V. Subbotin. Motion of fluid and a solid core in a spherical cavity rotating in an external force field // Doklady Physics. 2014. V. 59. No 1. P. 40–44.