

ON THE ORIGIN OF THE ROTATION OF CELESTIAL BODIES

Pavle Savić

Serbian Academy of Sciences and Arts

B e l g r a d e

Summary: Correlation of microstructure and macrophenomena (mass as a source of pressure, disturbance of electron shell, stratification of large masses independently of chemical composition, creation of magnetic field and origin of rotation) is discussed. Results and problems arising from such a hypothesis are surveyed.

1. Rotation plays an important role not only in dynamics, but in the evolution of celestial bodies too. In spite of this it has been paid little attention to so far. The origin of rotation has not been studied at all, because it was assumed that rotation was the original state of existence of the systems of large masses.

In my opinion such an attitude cannot be accepted. In my first paper (Savić, 1961), devoted to this question, I came to a conclusion that rotation was not the original feature of celestial bodies, but a motion created in the course of development of the celestial systems. Developing this idea I worked out, with R. Kašanin, a theory of the behaviour of materials under high pressure. I have been working with R. Kašanin and S. Pavlović, on the application of this theory to some celestial bodies, particularly the Earth. The list of these publications is given in the references.

I would like to expose here in brief the basic presumptions of my considerations and some results to which they led. There is still a series of unresolved questions and I would be glad to see a larger number of astronomers involved.

2. Let us proceed from cosmic clouds of gas and dust particles, from environments with very small densities, which do not rotate. Let us suppose that one of several condensation centres are created in them, playing the role of centres of stronger attraction. Under the influence of this one or those centres, namely of the gravitational attraction, as well as of the cooling off, condensation — a process with a general tendency to a continual decrease of the extent of systems — is brought about. At the same time it means not only the increase in density, but the increase in the pressure on internal parts of the systems. If this pressure

is sufficiently increased, it causes changes in the position of electrons in relation to the nucleus, which brings about the stratification of this body. These discontinuities in densities of materials, of which a system of particles or some celestial body is composed, are effectuated through jump-like changes. If pressures are not sufficiently big to produce the expulsion of electrons, i.e. to reach the ionization potential E_i , discontinuities of densities are created at resonance potentials, leading only to stratification. However, if the pressures are big, electrons are ejected from atomic shells, becoming free members of the system, and atoms will be electropositively polarized. In this way magnetic moments are created in atoms and the total of all these single moments creates one unique moment, which by its coupling of forces sets the layer into rotational motion; owing to friction the rotation at this layer is then transmitted to all other adjacent layers and finally to the whole celestial body.

The friction, normally, produces heat in the body's interior, which in turn leads to its expansion and decrease of density. Even when the system was originally at absolute zero, it now becomes, owing to the heat produced in its interior, the source of radiation into the surrounding space, thus losing its heat. It again condenses and this sequence of phenomena is repeated in oscillations, which means that the body simply breathes, general tendency being a decrease of volume and an increase of density.

We have thus found, starting from atomic structure, the explanation of one macrophenomenon in large masses — rotation. We have come, in the same way, to comprehension of another phenomenon — stratification of body, which precedes the rotational motion.

A conclusion follows that a strict relationship exists between the mass of body, producing pressure on atoms, the body's own magnetic field and rotation. Rotation consequently cannot exist without a previously created body's own magnetic field.

3. We would like to present here some results of the application of our theory to some celestial bodies. As it will be seen our anticipations satisfactorily agree with the results of geophysical and astronomic measurements. We, naturally, think of the global agreement of theoretical and measured data.

It is well known that the distribution of electrons in atoms is of the quantum character. Changes from one to another state are jump-like. Because the increase of density takes place only after the ejection of electrons from the shell, the quantum character of electron distribution is reflected on the change of density character. From these considerations results this empirical law on the character of density of particular celestial bodies and the layers in them:

$$\rho = \frac{4}{3} 2^\varphi$$

where ρ is density and φ function dependant on the structure of electron shell which takes values of whole numbers. Table 1 shows the comparative survey of ρ calculated in this way, with measured ρ^* . With the exception of Mars, satisfactory agreement can be seen. This discrepancy, in my opinion, can be explained by

Table 1

Body	φ	ρ	ρ^*
Mercury	2	5.32	5.60
Venus	2	5.32	5.21
Earth	2	5.32	5.52
Mars	2	5.32	3.94
M e a n		5.32	5.07
Sun	0	1.33	1.41
Jupiter	0	1.33	1.34
Uranus	0	1.33	1.36
Neptune	0	1.33	1.36
M e a n		1.33	1.36
Saturn	- 1	0.66	0.65

assuming that the visible size of Mars is larger than that corresponding to the size in which the major part of the planet's mass is placed — but this question needs further study and it is necessary to determine Mars's diameter and mass more precisely.

According to our calculations the Sun has 11 layers. We have also given a series of physical indices of this body.

I have stated that the Moon, as a body of small mass, has only 2 layers, which is not sufficient to create its own magnetic field (there is not enough internal pressure to press electrons and create magnetic field). These my conclusions have been later confirmed by direct astronomical investigations. Because it has not its own magnetic field, it is understandable why the Moon has not its own rotation (by which I understand a period different from the revolution period).

We have studied the Earth in several of our papers.

Our theory established that the Earth has 4 layers, of which the last one, core, has not been completed yet. The beginning of rotation is connected with the formation of the third layer. If we take into account data of paleontological investigations, which confirm the existence of rotation before about 3 billions years, then it can be said that the formation of the third layer began at least before 3 billions years.

The theory provides two models of the Earth, depending on which mean thickness is taken for the superficial layer — the crust: 39 or 55 km. If 55 km is taken, then for diameters of all three layers such data are obtained which completely agree with the present geophysical knowledge. A remark can be made here concerning depth of the first layer, because the depth of 55 km is rather too large, but in a more profound analysis it can be accepted, as it has been done by the well-known Hungarian geophysicist Professor Dr G. Barta.

It should be stressed that not only the number of layers, but other indices of the Earth, deduced from our theory, satisfactorily agree with geophysical knowledge.

A. Mohorovičić was the first to state the existence of one discontinuity in the Earth. From our theory it follows that phenomena analogous to the Mohorovičić discontinuity must occur, not as a result of a change in chemical composition, but because of discontinuous structure of atoms of which this system is composed.

We have analysed the distribution of volcanic foci on the Mohosurface. In our opinion material is eruptively transferred from one layer to another in both directions, but in the last issue interior layers are enlarged at the expense of the outer ones. It would mean that the thickness of the Earth's crust decreases in the course of time and that the zone of the Mohosurface comes increasingly nearer to the Earth's surface. We thereby explain the increase in the number of volcanic regions on the Earth in the course of geological epochs.

R E F E R E N C E S

- Kašanin, R., 1961, Bulletin, Acad. Serbe des Sc. et des Arts, Cl. des Sc. et Natur., Sc. naturelles, **26**, 8, 127.
- Savić, P., 1961, *ibid*, 107.
- Savić, P., Kašanin, R., 1962, Monographs, Serbian Ac. of Sc. and Arts, Section for Nat. Sc. and Math., **351**, 29, 1.
- Savić, P., Kašanin, R., 1963, Monographs, Serbian Ac. of Sc. and Arts, Section for Nat. Sc. and Math., **360**, 31, 1.
- Savić, P., Kašanin, R., 1964, Monographs, Serbian Ac. of Sc. and Arts, Section for Nat. Sc. and Math., **378**, 34, 1.
- Savić, P., Kašanin, R., 1965, Monographs, Serbian Ac. of Sc. and Arts, Section for Nat. Sc. and Math., **393**, 35, 1.
- Savić, P., Kašanin, R., 1965, Problemy geohimii, Moskva, 28.
- Savić, P., Kašanin, R., 1968, Symposium on Mohorovičić's Discontinuity, Zagreb, 169.
- Savić, P., Pavlović, S., 1972, I Mežd. geohim. kongres, AN SSSR, Moskva, 181.