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Models of planet's origin and distribution of planetary distances and orbits in the Solar System based on the statistical theory of spheroidal bodies

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Abstract

In this work, we consider a statistical theory of gravitating spheroidal bodies to explore and develop a model of forming and self-organizing the Solar System. It has been proposed the statistical theory for a cosmological body forming (so-called *spheroidal body*) by means of numerous gravitational interactions of its parts (particles) [1] – [6]. The domain of investigations within framework of the proposed statistical theory of gravity includes Newtonian gravity and Newtonian quantum gravity [6].

The proposed theory starts from the conception for forming a spheroidal body inside a gas-dust protoplanetary nebula; it permits us to derive the form of distribution functions and mass density [1], [2], [5], gravitational potentials and strengths both for immovable and rotating spheroidal bodies [1] – [3] as well as to find the distribution function of specific angular momentum [4], [5]. As the specific angular momentums are averaged during conglomeration process, the specific angular momentum for a planet of the Solar System (as well as a planetary distance) can be found by means of such procedure [5]. The problem of gravitational condensation of a gas-dust protoplanetary cloud with a view to planetary formation in its own gravitational field is also considered here [4]. This work considers a new law for the Solar System planetary distances which generalizes the well-known Schmidt' law [7]. Moreover, unlike the well-known planetary distances laws the proposed law is established by a physical dependence of planetary distances from the value of the specific angular momentum for the Solar System [4], [5].

The proposed simple statistical approach to investigation of our Solar System forming describes only a natural self-evolution inner process of development of protoplanets from a dust-gas cloud. Naturally, this approach however does not include any dynamics like collisions and giant impacts of protoplanets with large cosmic bodies. Henceforth, the presented statistical theory will only be able to predict surely the protoplanet's positions according to the proposed ent[n/2] rule [4], [5], i.e. the findings in this work are useful to predict if today's position or orbit of a considered planet coincides with its protoplanet's location or not.

As V.S. Safronov noted [8] orbits of moving particles into the flattened rotating protoplanetary cloud are circular ones initially. However, these orbits could be distorted by collisions with planetesimals and gravitational interactions with neighboring originating protoplanets during evolutionary process of protoplanetary formation [7], [8]. Really, at first the process of evolution of gravitating and rotating spheroidal body leads to its flattening [5], after that the evolutionary process results in its decay into forming protoplanets [4], [5].

Consequently, the orbits of moving particles are formed by action of centrally-symmetrical gravitational field mainly on the later stages of evolution of gravitating and rotating spheroidal body, i.e. the particle orbits become Keplerian ones. In this connection, this work investigates the orbits of moving planets and bodies in centrally-symmetrical gravitational field of gravitating and rotating spheroidal body during the protoplanetary stage of its evolution (in particular, the angular shift of the Mercury's perihelion is estimated, too).

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