# Analysis of the distribution of hydrogen and helium in the solar system during its formation.

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***Abstract:*** *The modern composition of the Earth and other planetary systems is the result of the use of various different chemical elements. However, at the moment there is no unified theory describing the distribution of chemical elements during the formation of the solar system. Among the previously proposed theories and hypotheses, there are contradictions regarding the distribution of chemical elements in the solar system. Therefore, there is a need to create a physical model, which, on the basis of empirical data, represents the initial distribution of chemical elements from which the planets of the solar system were formed. In this work, it is proposed to analyze the initial system of the bladder and helium in the Solar System, starting from the moment of the formation of the protoplanetary disk. Assuming that at the moment of formation of the nebula, these elements were evenly distributed, their distribution was determined to date. Analyzing the percentage in the solar system, it was assumed that the differentiation of the ionized protoplanetary matter of the proto-carrier's magnetic field (magnetic separation of particles) caused the difference in the compositions of the outer planets. It is shown that according to the estimates given in the graphs, it receives 76-78% of hydrogen in the composition of the Earth, which in turn differs significantly from the data given in reference books or specialized literature - less than 17%. It has been suggested that the hydrogen content on Earth is incorrect.*
***Keywords****: PROTOSPLAR SPACE, MAGNETIC SEPARATION, IONIZATION POTENTIAL,GRAVITATIONAL INSTABILITY*

## *1. Introduction*

At the moment, there are two main models for the formation of the solar system. The first model is the model of the formation of planets in the Solar System due to the accumulation of solids [1-3]. The second model is the model of large gravitational instabilities [4-9]. For 20 years, astrophysical research by the latest scientists to the discovery of gas and dust rings in protoplanetary stars. Gas-dust rings were predicted in models of large gravitational instabilities in protoplanetary disks [10-14]. As a result of cosmological observations of a solar-type star, the reliability of the hypothesis about the mutual formation of a solar-type star and its planetary system from one gas-dust protosolar fog was proved. Hence, these hypotheses follow [15-19]: the formation of planets began in a gas-dust protoplanetary disk; the law of rotation of the gas-dust protoplanetary disk is described (close) according to Kepler's law.

As the main process, it is associated with the formation of planetesimals in the dusty subdisk, which is determined by the boundaries, since the processes of unification of the formed solids are of a stochastic nature. From this we can conclude. that the model of solid-state accumulation of the formation of planets cannot explain the formation of gas-dust structures in the form of bright gas-dust ring structures separated by dark gaps. Analysis of the "bright" rings, which are observed in astrophysical studies of protoplanetary disks [20], shows bright rings, consisting of dust particles and gas. In the process of gravitational instability, the gas-dust medium passes from the space of the protoplanetary disk, which corresponds to the dark segments, and bright gas-dust rings with dark segments between them are formed in the bright rings. Then, in this process, the density of the gas-dust medium in the bright rings increases, and in the dark sections between them it decreases [11, 12]. It should be noted that during this process not only dust particles move, but also the gas component of the protoplanetary medium. With further development of gravitational stability, areas with increased density of the medium form gas-dust rings, and in the intervals between them, the gas-dust medium continues to decrease. In the process of evolution, protoplanetary rings are compressed, which may, due to gravitational instability [9], are distributed to gas and dust concentrations.

## *2. Ionization of protoplanetary disks*

At the moment, there are two approaches to calculating the ionized structure of the protoplanetary disk [21]. The first approach allows one to calculate the degree of ionization of a medium in which recombination occurs on the surface of dust grains [22]. The second approach assumes that in the rarefied atmosphere of the protoplanetary disk at its periphery, the main recombination occurs in the gas-dust phase [23]. Thanks to these approaches, it is possible to calculate the degree of ionization of the protoplanetary disk medium over the entire volume, as well as the ability to describe the process of plasma transition from the electron-ion state to the dust-ion state, where dust becomes the main charge carrier. Recently, a method has been put forward for ionizing protoplanetary disks by galactic cosmic rays, solar protons and supernova remnants [Ryuho Kataoka]. A strong influence on the formation of stars is created by strong ionization of the molecular cloud, due to the supernova remnant, changing the ambipolar diffusion time and the distribution of dead zones in the accretion disk [Fatuzzo et al., 2006]. According to the assumption, near the middle plane, where the ionization level is lowest, turbulence arises due to the magneto-rotational instability (Balbus and Hawley, 1991), which cannot exist due to the angular momentum.From this, the evolution of the protoplanetary disks themselves follows. dust grains and hence the origin of the planets (Sano et al., 2000, Okuzumi and Hirose, 2012). This means that many dead zones can exist in protoplanetary disks, given ionization from enhanced galactic cosmic rays or from enhanced solar protons [Turner and Drake (2009)].

Fred Hoyle suggested that the nebula's own magnetic field played a decisive role in the separation of the protoplanetary disk, consisting of ionized and neutral atoms of chemical elements. In his opinion, during the formation of the protoplanetary disk, the material ejected from the protosolar nebula should have moved. across the magnetic field lines (Fig. 1) [1].

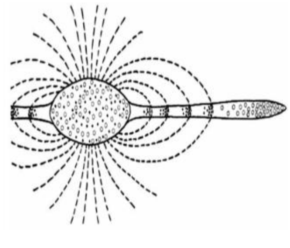

***Fig. 1*** *Magnetic separation of charged particles during the formation of a protoplanetary disk. (black dots are ionized particles, light circles are neutral atoms)*

Ionized, that is, charged, particles cannot cross magnetic lines of force, so they are captured by the magnetic field and stop in it, while neutral atoms freely pass through the magnetic field. The atoms of chemical elements differ in their ionization potential. Thus, if Hoyle's idea is correct, then during the formation of a protoplanetary disk, elements that are easily ionized should be captured by the magnetic field and stop in the circumsolar space, while elements that are difficult to ionize go to more distant zones from the center. protoplanetary disk.

## *3. The content of hydrogen and helium in the planets of the solar system*

Consider the distribution of hydrogen and helium in the solar system, since they are the main chemical elements that make up the sun's atmosphere. In addition, hydrogen and helium are also present on the planets of the solar system. Assuming that during In the formation of the nebula, these elements were evenly distributed, we determine their distribution by now in time. Moreover, we believe that all chemical elements were in an ionized state, that is, they did not interact with each other (there was no collision between ions of chemical elements). To determine the content of hydrogen and helium, we use reference data [12]. Consider the gas giants of the solar system - Jupiter, Saturn, Uranus and Neptune. These four large planets are located in the outer solar system after the orbit of Mars. Jupiter and Saturn are much larger than Uranus and Neptune, and each pair of planets has a slightly different composition, but the main chemical elements are hydrogen and helium. In fig. 2, 3 show the distribution of hydrogen and helium depending on the distance to the Sun.

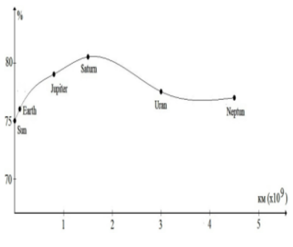


***Fig.2*** *Distribution of hydrogen in the solar system.*

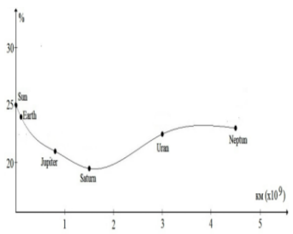


***Fig 3*** *Distribution of helium in the solar system.*

Analyzing the percentage of hydrogen in the solar system, we can make the assumption that the differentiation of ionized protoplanetary matter under the influence of the magnetic field of the proto-sun (magnetic separation of particles) causes a difference in the composition of the inner and outer planet. The inner terrestrial planets are enriched with metals, which are easily ionized and therefore "carried away" by the magnetic field of the protosun, while the outer giant planets consist mainly of easily ionized gases, such as hydrogen, helium, etc. methane. Thus, according to the calculations given in graphs 2 and 3, 76-78% of hydrogen atoms on Earth are expected to be obtained, which in turn differs significantly from the data given in reference books or special literature, which is less than 17%. The main confirmation of the incorrect estimate of the hydrogen content on Earth is the process of hydrogen evolution in nature [13, 18, 19].

## *4. Conclusions*

The report describes the models of the formation of a protoplanetary disk in the solar system and the distribution of hydrogen and helium during its formation. The main methods of ionization of protoplanetary disks are also described. Compiled graphs of the distribution of hydrogen and helium in the solar system, relative to their distribution data on the gas planets of the solar system. It is shown that according to the calculations given in charts 2 and 3, 76-78% of hydrogen atoms on Earth are expected to be obtained, which in turn differs significantly from the data given in reference books or special literature, which is less than 17%.

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