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Formation of planetary systems around Sun-like stars (the advanced PFO–CFO hypothesis)

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Abstract

The advanced PFO–CFO hypothesis of planetary systems formation around Sun-like stars and, in particular, of Solar System (SS) formation is developed in an attempt to clarify some events over the period from the presolar star "middle age" to the SS formation. The hypothesis allows original explanations for the 11- and 22-year solar cycles, formation of chemical elements from the star matter, SS isotopic anomalies, formation of all SS planets on the basis of presolar star with no significant contribution of interstellar matter, extremely high solar corona temperature, and some other events.

1. Introduction

It is impossible to understand the mechanism of planet formation around any star after its explosion without understanding of, at least, the nature of this explosion, its scale and power, its causes, duration of the explosion period, and elemental composition of the exploding products and its variation during the explosion period. Therefore, the understanding of the stellar processes that precedes the explosion is necessary for understanding the variety and mechanism of formation of different objects of any planetary system. The observations over the Solar System (SS) lead to some paradoxes and require answers to a number of principle questions.

The most important paradoxes are as follows. (1) Any isolated star early in its life is electrically neutral, and its electron ($\bar{e}$) and proton (p) amounts are equal. As neutronization of a star proceeds, its $\bar{e}$ and p amounts decrease to the same degrees. At the stage of full neutronization, the collapsed neutron stars (n-stars) should have no e and should have zero magnetic moment (MM). Meanwhile, the measured MMs of n-stars are extremely high. Why is it so? (2) If the SS is the product of explosion of the pre-solar star, what is the mechanism of the transfer of the major portion of the star angular momentum (AM) to the planets, and, if the AM was received from any other source, what is its nature? (3) If the SS is the product of explosion of the pre-solar star, why is the total mass of all SS planets less than the Sun mass by a factor of almost 1000? (4) If only one nebula is the SS parent, why are the planets principally different?

Some of the questions are as follows. (1) What is the nature of the 11-year solar-activity cycle, and is there a causal relationship between the variations in the solar activity and solar MM? (2) What is the mechanism of formation of chemical elements, including the heavy ones? (3) Why do the SS celestial objects contain chemical elements in different isotopic compositions? (4) Why is the corona temperature much higher than the photosphere temperature? (5) Why are most of the biggest celestial bodies located within a space belt along the ecliptic plane? (6) Can the Earth's localizations of minerals result from any space processes? (7) Were the terrestrial planets melted at the initial step of their origin?

2. Planetary systems formation PFO–CFO hypothesis

2.1. General provisions

The objects of any planetary system we divide into Physically Formed Objects (PFO) and Chemically Formed Objects (CFO) [1–7]; all they originate as a result of the stellar fore-explosion prominence-matter ejections and star explosion, the last destroying not the entire star but its radiation over-core zone, only with the subsequent resetting of the major portion of the radioactive matter on the star core and recuperation of the radiation zone and the processes characteristic for it. The approach with consideration of the two-mechanism explosion events is initiated by the recently-discovered [8] excess in the revolve speed for the sun core over that for the sun radiation zone. This discovery means that these two sun zones are separated from each other by a cushion, the

nature of which is considered in our hypothesis. We consider the p–n–ē matter in which an amorphous p–n positive mass is in a negative ē-field (similarly to the giant atoms theory [9]) as the primary stellar material, the processes of slow neutronization and thermal ionization as the moving cause of stellar transformations, and the electron layer as the "cushion" between the core and radiation zone. The p–n–ē matter transforms steadily to chemical elements by the mechanism that will be presented. On this hypothetical basis, the most of the above-listed paradoxes are explainable and questions are answerable. The explanations and answers will be given. The rate of thermal ionization of the p–n–e matter is higher than the rate of its neutronization. This increases the e-pressure in the "cushion" and leads from time to time to eruptions of prominences through the radiation zone. Together with electrons, the prominences carry out atoms of chemical elements, ions, etc. into the space. The proportions between the temporal changes in the radiation-zone hydraulic resistance and the rate of increasing in the concentration of the electrons that come into the "cushion" as a result of core neutronization are such in value that the periodicity and power of the prominences increase steadily in time. Finally, the explosive destruction of the radiation zone proceeds. Thus, the solar nebula is multi-cloud.

2.2. Formation of PFO and CFO

Briefly, the hypothetical PFO and CFO formation mechanisms are as follows. The nebula expands. The heavier are the atoms, the slower they move away from the star core. The lightest He and H_2 molecules and also not so numerous Li, Be, and B atoms move away from the hot space more quickly than the heavier ones. When the lightest atoms and molecules reach the cold relict-temperature Universe region, condensation of H_2/He begins. H_2/He drops grow, merge together, form agglomerates that absorb other light atoms and molecules, such as Li, Be, B, LiH, and BeH, which form the agglomerate core. The agglomerates increase in size competing with each others for the mass and gravitational attraction and approach to the star core, obeying the angular momentum conservation law. These processes give start for the PFO formation and overall nebula compression. Heavy atoms and hydrides remain in the nebula section in which the temperature is too high for their physical agglomeration and their concentrations are too low for chemical reactions to proceed. With time, in the middle region of the nebula, the matter density increases as a result of compression and the temperature increases as a result of this compression and of intensification of the stellar activity.

CFO formation starts: combination reactions between metal and metalloid atoms, heat evolution, and local concentration of matter accelerate exponentially and local giant compressible vortexes arise. Within these vortexes, hot cores of the future sky objects localize. The reaction heat is capable of melting the cores. The pressure depletion in the vicinities of the vortexes and the gravitational attraction of the last stimulate flows of light cold vaporous and gaseous substances and asteroid-like agglomerates from the outer space and also of asteroid-like agglomerates of not so light substances from the intermediate regions of the space to the hot cores. The flows precipitate over the hot cores and cool their surfaces. Thus formed spherical "thermoses" steadily evolve the internal heat obtained during formation and as a result of chemical reactions, densify, and transform to the young CFO, namely, to the terrestrial planets, their satellites, etc.

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