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ANCIENT PROTOTYPES OF THE BIG BANG AND THE HOT UNIVERSE (TO THE PREHISTORY OF SOME FUNDAMENTAL IDEAS IN COSMOLOGY)

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Gamov's cosmological (as a matter of fact, cosmophysical!) Hot Universe theory, which shocked the astrophysics by its unusual universality at first, had "predecessors" in the antiquity. In spite of the ancient natural philosophers' poor scientific knowledge, their apprehension of the world as a whole helped them to catch some profound analogies and to express some surprising guesses concerning the process of the birth of the Universe.

KEY WORDS The history of the cosmology, the history of the cosmogony, the ancient cosmogonical ideas, the ancient natural philosophy, the Hot Universe theory, the Middle Age cosmogonical and cosmological ideas

The oldest science, astronomy, was forming itself in the style of some ultramodern inventions in the XXth century architecture: from the roof leaning on a framework of the building being created. The primary step to forming astronomy was the creation of the primitive whole world's picture as the result of the contemplation of the starry sky and of the cognition of regularity of main celestial phenomena by ancient men.

The cyclic character of main celestial phenomena showed the strict regularity of the Universe to the humanity. And it was the contemplation of the sky that formed man as a logically thinking being. The picture of Cosmos became the primary example of the beauty and perfection, for humanity.

The sky developed simultaneously the emotional (qualitative, integral, based on the whole) and the rational (quantitative, analytical) aspects of cognition. The latter consisted in revealing the order, sequence, correlation of phenomena, the reasons of phenomena themselves.

At first the conclusions about the world were conclusions by analogy with everyday phenomena. The events on the Earth and social relations in the primitive tribal society were extrapolated to the celestial phenomena. As the result, the prehistoric world picture, the ideas on cosmology and cosmogony were of mythological character.

The world's picture created by natural philosophers of ancient Greece also had similar features.

But during that age, on this background of primitive forms of knowledge, astonishing breakthroughs to areas of high abstraction occurred, where these primitive anthropomorphic analogies and shapes changed into striking cosmological and cosmogonic guesses. This depth is revealed in that, for example, during subsequent long epochs of differentiated development of science they stayed misunderstood and were completely forgotten, or perceived as naive fantasies, a play of mind.

The differentiated development of science led not only to incredible deepening of knowledge but also to loss of integrity in perception of Nature (that was common for ancient natural philosophers).

Understanding main traits of the world was also complicated by the mixture of meanings attached to the worlds "World" and "Universe". During thousands of years, two different concepts: that of the Universe as Cosmos, i.e. a regular system of material bodies; and that of the Universe as the total of all substances in all different forms, including primary substance, were mixed. Only there comes understanding of difference between finiteness of the first (Cosmos) as a part of the whole and the infiniteness, or at least being something undeterminable (for us), of the second. Understanding our Universe (Cosmos, Metagalaxy) as temporary state of the part of the whole ("physical vacuum") made the picture of "birth" and evolution the Universe logically clear for human mind. (It seemed impossible for philosophers-materialists until quite recently). We understand now "the birth of the Universe" as a change of state of the "part", i.e. formation of our World from a "singular" state in local area of the physical vacuum. By the way, Aristotel was the first to understand it!

In spite of the great difference of methods, means, and results between modern astronomy and the primitive astronomy of the epoch when the first large civilizations were formed, several cosmological and cosmogonic ideas of ancient philosophers (the 1st millenium B.C.) of the West and of the East strike with their resemblance with the recent ideas and achievements in the modern evolutionary cosmology.

Here are some examples.

Anaximander (7th-6th cent.B.C.) imagined the birth of the regular Universe from an embryo, which appears in the bosom of the original illimitable medium (apeiron) as a cool nucleus, surrounded by a fire cover. Under the influence of this cover, the nucleus evaporates and its steams inflate the cover and finally destroy it. The cover breaks into several rings (or layers) and forms the visible Cosmos. This process was imagined as a cycle: from the birth to the birth after development and diffusion in the infinite medium (Rozhansky, 1989).

Anaxagor (5th cent.B.C.) imagined the picture of the birth and evolution of the Universe as an appearance of a vortex in the homogeneous mixture of qualitatively different elements. This vortical motion separated the elements and, occupying the more and more distant parts of the medium, formed the whole variety of bodies in the Universe. So the Universe was quasi-expanding in the process of its evolution. But this process was imagined as non-cyclical, but only evolutionary, single-stage one (Rozhansky, 1972).

Leukip and Demokrit applied the idea of the primordial vortex to the medium consisting of chaotically moving atoms having no qualities and appended it with the idea of infiniteness of such a process of birth and death of local universes (for example, in mutual collisions). Isotropic space of the infinite Universe as a whole becomes unisotropic in such local universes (Rozhansky, 1985). (Almost the same picture of cosmology and cosmogony was restored and developed by Immanuel Kant in the 18th century (Kant, 1975)).

The stoics (3rd century B.C.) thought that the world space was full of a very thin medium (they named it "pneuma"), that was in the state of tension (compare with modern cosmology's idea of negative pressure in the primary medium – "physical vacuum"). This medium, from their point of view, guided the development of all things in the Universe.

Suddenly another old pythagorean cosmogonical idea became ring actual in our days. According to it, the embryo of the Universe was "a Fire Unit", which was forming in lines, surfaces, and at last in bodies occupying the surrounding medium. (Compare to the modern idea of "the rolled spaces" ...).

In one of the hymns in the ancient religious–philosophical texts "Rigveda" (12th–10th centuries B.C.) the birth of "the Existence" ("Sat") from "the Non-Existence" ("Asat") was proposed. And in the materialistic philosophical doctrine "sankhya" (2nd century B.C.) the existence of the primary material substance in the undemonstrable form ("avyakta") was proposed that later came into the demonstrable form of substance ("vyakta"), i.e. into the visible world of things.

In Indian philosophy of Nature, there also was an idea of a cosmic "embryo" of the Universe, and the main role was attributed to the cosmic heat ("tapas"), which sometimes had a common meaning to the words "tension", "wish" ...

"The Law (rita) and the Truth were born.
From the inflamed Heat. . ."

(Bongard–Lewin and Ilyin, 1985).

Some new ideas and conceptual models of the Universe born "from one point" were proposed already in the middle ages, namely in the 13th century, on the base of achievements in the geometrical optics. The analogy between optics and mechanics played an essential role in the revival of the atomistic concept in that age.

The English natural philosopher and physicist, Robert Grossetat (1175–1253), applied this optical–geometrical analogy to explain the phenomenon of spreading light, and its fading with increasing distance from the source. According to Grossetat, the rays of light, emerging from any point, instantaneously fill in the light sphere bounded with the ends of light rays. And this sphere may extend infinitely. But the surface density of the secondary light points (the light ray ends) will therefore decrease being inversely proportional to "r" (where "r" is the distance from the light source). Therefore, the atomistic concept (in this case, concerning the nature of light) was revived by this model. Grossetat extended this model to the process of the birth of Universe as a whole.

Here he revived some pythagorean ideas concerning a body forming from a point: first a line is forming as result of the motion of the point; then a surface is forming by the motion of the line; finally, a body is a result of the motion of the surface. The whole material World, according to Grossetat's concept, had arisen as light sphere which had expanded instantaneously before different celestial bodies were formed in it. The size of the World was however non-infinite, since the density of the primary substance of the World, being the greatest in its center, decreased with the increase of its size, by the analogy with the light-spreading phenomenon. By this Grossetat's concept, it was the difference of the local density of primary substance in different places of the world space that was the main cause of formation of celestial bodies themselves (Zubov, 1947).

Grossetat's disciple, the famous philosopher Roger Bacon (1214–1294) supplemented this optical-cosmological concept with new idea. He proposed universal (central) forces existing on the Earth and in Heavens and acting according to a similar law, i.e. decreasing with distance increasing, and forming therefore an expanding sphere of forces (Ib).

It is well known that Johann Kepler was the first to apply this idea of the sphere of forces to explain the motion of planets.

Of course, all these ideas did not play a direct role in the development of the modern relativistic cosmological concept. They were forgotten completely with time. But this history demonstrates that the humanity proposed similar solutions of the cosmological problem at different ages again and again, and may be therefore the human mind might already reflect some true features of the surrounding World at the early stage of his development.

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