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The Creation of the World: The Crossroads between Theology and Science [2] (Petros Panayiotopoulos)

Ξένες γλώσσες / In English

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As regards the origins of the universe, the scientific community traditionally believed in its eternal existence. Going as far back as Ancient Greek thought, the prevailing scientific concept was that the universe always existed and would continue to do so. Everything changed when Albert Einstein introduced his General Theory of Relativity (1915, 1917), and especially when the Russian mathematician Alexander Friedmann (1888-1925) solved its field equations, in 1922, with results which indicated an expanding universe[4].

A few years later, in 1927, the Belgian Roman Catholic priest and physicist Georges Lemaître (1894-1966), working independently of Friedmann, reached similar conclusions. Initially, his ideas were met with general indifference (in the case of Einstein with downright hostility), but an impressive discovery brought his proposition into the limelight. The astronomer, Edwin Hubble, noticed that all the galaxies, no matter what their position in the firmament, were moving away from us. Given the fact, also, that the Earth did not occupy a privileged position in the universe[5], the conclusion which could immediately be drawn was that the universe is expanding at an equal rate in all directions.

In 1931, Abbé Lemaître went one step further. He postulated that if, in an expanding universe such as ours, time were to go into reverse, we would end up with a state in which this universe, (that is all its material) would, at the beginning of time, be contained in a super-dense and super-hot state, which, in the course of its evolution, gave rise to everything which emerged thereafter. In contradistinction to these views was the model of the Steady State Universe, developed by the astronomer Fred Hoyle (1915-2001). His central idea was in line with the traditional scientific convictions concerning the eternal nature of the universe, and he interpreted the expansion as being due to the continuous creation of matter. Oddly enough, with the maelstrom of his efforts to combat the theory of Abbé Lemaître,

Hoyle unwittingly became its ‘godfather’ when, during the course of a radio broadcast in 1949, he referred to it dismissively as the ‘Big Bang’ the term by which it has since become best known.

The theoretical calculations which were made in the meantime, increasingly favoured the form of the Big Bang. There was competition over the years between the two opposing views until, in 1965, another astronomical discovery gave impetus to the Big Bang: the radio astronomers Arno Penzias and Robert Wilson located something which was forecast in the Big Bang Theory, Cosmic Microwave Background Radiation. CMBR goes through all the space in the universe and is the relic of the separation of material from radiation[6].

Since then, the established cosmological model has been the Big Bang[7] Some further problems which have been identified are to be found within the so-called ‘Inflation’ theory, according to which, in its first moments, the universe underwent a phase of exponential expansion[8].

As we mentioned earlier, the successes we’ve described do not mean that there are no more unresolved issues. From as early as the 1930s, many alternative suggestions have been formulated- apart from the Steady State universe- which have attempted to explain the observational data without adopting positions similar to those of Abbé Lemaître[9]. In recent times, particularly, what is of most concern to specialists is the initial state of the universe, which seems to be non-manageable, since it not transparent to the known laws of physics. This is precisely why it’s called an anomaly or ‘singularity’. Research propositions have been formulated to by-pass its presence, though none of these has gained universal approval[10].

(to be continued)

[4] ‘Über die Krümmung des Raumes’, Zeitschrift für Physik 10 (1), pp. 377–86.
[5] A principle going back to the (heliocentric) proposition of Copernicus.
[6] This event occurred some 380,000 years after the Big Bang. The forecast in question was made by G. Gamow and his associates at the end of the 1940s.
[7] Through this model we can interpret fundamental events in our world, such as Background Microwave Radiation, Hubble’s Law, the synthesis of chemical elements, the formation and evolution of galaxies and the large scale structures of the universe. See Gary Steigman, Big Bang Nucleosynthesis: Current Status’, in Anthony Mezzacappa (ed.), Stellar Evolution, Stellar Explosions and Galactic Chemical Evolution, Institute of Physics, Bristol-Philadelphia 2015, pp. 101-112, here pp. 102.
[8] This proposal was first put forward by Alan Guth at the end of the ’70s. One of the

successful forecasts of Inflation is the interpretation of the flatness problem of cosmic space-time.

[9] Such as the theories of the pulsating universe, relativistic kinematics, and that of tired light. See Simon Singh Big Bang: The most important scientific discovery of all time and why you need to know about it , Fourth Estate 2004.

[10] For example the 'no boundary proposal' in the Hartle-Hawking model; Hawking's use of imaginary time; the model of the exfoliating' universe; the proposal of quantum fluctuations; the theory of chaotic inflation and so on. In many instances, the problematical points are obvious. For example the pulsating universe model, once attractive to a public who are regularly satisfied with popular versions of science, exhibits serious difficulties, (related to the preservation of the homogeneity and isotropy of the universe, the existence of black holes and the more general mechanism that would cause explosion and contraction). See Evgeny Lifschitz – Isaak Khalatnikov, 'Investigations in Relativist Cosmology', Advances in Physics 12 (1963), p. 207; Katherine Freese et. al., 'The Phantom Bounce: A new proposal for an Oscillating Cosmology', in: Mersini-Houghton – Rudy Vaas (edas), The Arrows of Time. A debate in Cosmology, Springer, Heidelberg 2012, pp. 149-156, here p. 150. The leading physicists Stephen Hawking and Roger Penrose have also shown that it is not possible for anything at all to have existed before the anomaly. See Hawking – Penrose, The Nature of Space and Time, Princeton University Press, Princeton 1996, pp. 19-20.