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A More Accurate Determination of the Magnitude of Cosmic Inflation in the Big Bang Model

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Abstract

According to our hypothesis, at the very beginning of the Big Bang, a hyperenergetic spherical wave was created. We described its characteristics in our previous work, and the present work is based on them. Logically, we saw that in cosmic inflation the frequency of such a wave would decrease sharply. Based on the temperature that prevailed immediately after inflation according to the hot Big Bang model, we determined a measure of the size of the inflation in this model, in accordance with our hypothesis.

Keywords

Flat Space and Time, Hyperenergetic Spherical Wave, Primary Particles, Quantum of Speed

1. Introduction

The Big Bang [1] model does not offer the possibility of speaking with certainty about the period before cosmic inflation, because there are no astronomical data for that period. Working on the hypothesis in our previous five papers, we can now make it possible to describe this early stage in the development of our universe.

2. A Path That Necessarily Leads Us to the Need for Cosmic Inflation in Accordance with Our Hypothesis

In paper [2], we obtained a result that describes the hyperenergetic state of the very initial moment of our universe. In the four previous and continuing papers [3] [4] [5] [6], we obtained physical quantities that could describe the moment of the Big Bang itself based on our primary particle hypothesis.

In the hypothesis [3] we postulated the existence of primary particles in their ground state, in their flat space and time, moving with respect to each other at speeds much higher than that of light in a vacuum. Extrapolating Einstein's special theory of relativity, we deduced that these particles would have, in a way, properties symmetrical with those of the particles of our universe. Thus, the energy and momentum of the primary particles would increase sharply during deceleration in mutual collisions. Such dynamic properties of these particles led logically to the possibility of describing the very initial moment of the Big Bang. Thus, during some of these collisions, the speed of one of these two particles could drop to a speed very slightly higher than the limit speed *c*. The energy and momentum thus acquired would tunnel through the Big Bang into our universe, creating our energy and matter in our space and time.

Further on in [4], using the logically introduced new term in physics [7] "quantum of speed" $\varepsilon \approx 2.38\times10^{-114}\ \mathrm{m\cdot s^{-1}}$, we determined the energy of the primary particle in its ground state $E_p = m_p c^2 \approx 1.22\times10^{19}\ \mathrm{GeV}$, and the mass of the primary particle $m_p = m_P = \sqrt{\frac{\hbar c}{G}} \approx 1.22\times10^{19}\ \mathrm{GeV}/c^2 \approx 2.18\times10^{-8}\ \mathrm{kg}$ attributed to such energy, which is equal to the Planck mass m_P. The "quantum of speed" is a very small quantity by which the limit speed for our universe is greater than the speed of light in a vacuum.

Then, in [5] we quantitatively described the Big Bang through physical quantities that describe the very initial moment of the Big Bang. We obtained that the time corresponding to the initial moment of our universe $t_B \approx 9.51\times10^{-114}\ \mathrm{s}$ is much shorter than the Planck time. Also, the radius obtained for the Big Bang itself $r_B \approx 2.85\times10^{-105}\ \mathrm{m}$ is much smaller than the Planck length.

In paper [6], through modified uncertainty relations corresponding to the spherically symmetric, very initial moment of the Big Bang, we obtained the constant $\upsilon_p = 1.48\times10^{-43}\ \mathrm{J\cdot s}$, which corresponds to the reduced Planck's constant.

The hyperenergetic state of the very initial moment of our universe is characterized by a spherical wave of frequency $f_B = f \approx 1.05\times10^{113}\ \mathrm{Hz}$, *i.e.* an extremely high temperature. Thus, in order for nucleogenesis to occur, this spherical wave must undergo an extreme increase in wavelength, which is possible through cosmic inflation.

3. The Frequency of the Hyperenergetic Spherical Wave Created at the Very Beginning of the Big Bang Drops Sharply in Cosmic Inflation

According to [2], the hyperenergetic spherical wave created at the very initial moment of the Big Bang has energy E_B

$$E_B = E = \upsilon_p f = \upsilon_p \frac{c}{r_B} \approx 1.55\times10^{70}\ \mathrm{J} \quad (1)$$

and frequency f_B

$$f_B = f = \frac{c}{r_B} \approx 1.05 \times 10^{113} \text{ Hz.} \tag{2}$$

According to the model of the hot Big Bang [1], after 10^{-37} s after the expansion, cosmic inflation occurred during which the universe grew exponentially, unlimited by the invariance of the speed of light. Inflation stopped at about 10^{-33} s to 10^{-32} s, with the volume of the universe increasing by a factor of at least 10^{78}. Due to this inflation, its linear dimension, *i.e.* the wavelength of the original hyperenergetic wave, would increase by a factor of at least 10^{26}, its frequency decreasing by the same factor.

This time, longer than the Planck time, and this frequency shows us that, according to Wien's law, in cosmic inflation the volume of the universe must increase by a factor of at most 10^{225}, so that the frequency of the original hyperenergetic wave will drop to the frequency after inflation f_I at about 10^{38} Hz, with one or more possible phase transitions. This frequency corresponds to the temperature of the universe

$$T = \frac{bf_I}{c} \approx 1 \times 10^{27} \text{ K,} \tag{3}$$

where b is Wien's constant. This temperature corresponds to further predictions of the Big Bang model.

Such cosmic inflation would leave the universe extremely flat, which is consistent with many observed facts.

4. Results and Discussion

The value obtained for the frequency of the spherical wave created after cosmic inflation is the frequency that corresponds to the temperature at which the production of quark-gluon plasma and other elementary particles took place according to the Big Bang model. In the period until the end of cosmic inflation, besides the decrease in frequency of the original spherical wave, it could also undergo one or more phase transitions.

This decrease in the frequency of the spherical wave created at the very moment of the Big Bang to the value f_I, in accordance with our hypothesis, additionally confirms the need in the Big Bang model for cosmic inflation, which also gives a quantitative measure. The universe created after such inflation would be extremely flat, which corresponds to all observations.

Therefore, a more precise determination of the flatness of the universe could be indirect evidence for our hypothesis about primary particles.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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