

Hypotheses

ON FUNDAMENTAL CONSTANTS OF THE UNIVERSE

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Abstract

The report includes analysis about constancy of the fundamental physical constants – gravity, relativity and quantum. It presents the reason about the change of their values during the evolution of the Universe.

One of the possible development directions of modern physical science is associated with the creation of a quantum theory of gravity by which to achieve the unification of the gravitational interaction with the other three types of interaction – strong and weak nuclear forces and the electromagnetic interaction, united in the so-called "Standard Model". According to the author of one of the most serious books on Cosmology [1], there is no more universal theory than the General Theory of Relativity. However, if such a theory would be built in future, stated he, three known cosmic constants should be set at its foundation: the gravitational or Newton's constant, marked in most sources through **G**, the relativistic or Einstein's constant (**c**) and the quantum or Planck's constant (**h**). Unfortunately, such a general theory has not yet been created, despite the efforts of modern physical science and a number of leading scientists in the creation of "Theory of Everything", "Grand Unification", "Superstring theory" and other ambitious exertions.

The values of the specified constants, determined as "fundamental" in the measurement system CGS have the following meanings:

- $2,97 \cdot 10^{10}$ cm/s – for the speed of electromagnetic interaction, in particular of the light, **c**;
- $6,68 \cdot 10^{-8}$ cm³/g.s² – for the gravitational constant of Newton **G**;
- $6,67 \cdot 10^{-27}$ erg.s – for the Planck's constant (**h**).

From the combination of these three constants in physics other fundamental basic physical values and parameters are derived, such as **density**,

elementary or Planck **length**, the characteristic **time** and elementary **mass**, assuming that accordingly they are unchangeable and of constant values. Using the formulas, presented in [1], p. 170 to calculate them, the following meanings are obtained of the specified physical values:

- $5 \cdot 10^{-93} \text{ g/cm}^3$ – for the density;
- $1,6 \cdot 10^{-33} \text{ cm}$ – for the elementary or Planck length;
- $0,5 \cdot 10^{-43} \text{ s}$ – for the characteristic or Planck time;
- $2 \cdot 10^{-5} \text{ g}$ – for the “graviton” mass.

It should be noted that two of these parameters and values, namely, the density and the time associated with the supposed Big Bang, laid by one of the directions in modern science the beginning of the Universe. This study and publication is not intended, but through their formulations wavered in a sense, the foundations of the theory and everything related to the Big Bang.

The values obtained for the specified physical quantities seem to be paradoxical - enormous or too small, but there can be no doubt that they reflect deeply embedded in the structure of the Universe ratios and proportions of the structuring and interaction. It is indicative for example, the connection or rather the ratio between the masses and dimensions of elementary particles, in particular protons and electrons and the average masses and sizes of large configurations, the Sun and the planets [2], p. 41-42, and many others ratios and proportions, shown for example in [3], [4]. In these ratios and proportions, and the analytical expressions for the calculation of almost all physical quantities, invariably present the fundamental or cosmic constants. That is why the question of their consistency over time, or during the process of the Universe evolution is interesting from a scientific and philosophical point of view because there is decisive importance for building a complete and comprehensive picture and outlook for the structure and processes in it.

Once it is obvious in view of the processes of the world around and the completed knowledge that everything in there changes over time, due to some, generally speaking, development, the question logically arises concerning the possibility of the of physical quantities and parameters availability of specified over the time values, as these considered as fundamental constants. In this respect, two publications [5] and [6] develop the idea and propose the hypothesis of the existence in the Universal space of fundamental physical Essence, as a basis and source of all structures and processes. In the first article the basic physical parameters of this Essence have been defined and their values have been calculated. Furthermore, the ability of changing their values over time was grounded, as a result of the objective development of the basic cosmological cycle of the Universe.

Consistent analysis on the question of the constancy of the three basic constants in the merger of the information from the known works into a single

information massif leads to the following conclusions and findings. The gravitational constant of Newton G , as shown in [5] by its dimensions, it reflects a specific volume, or volume assigned to the unit of mass, filling this volume, i.e. the reciprocal of density. On this basis, it was calculated the density of the occupying the universal space physical content, termed "Essence". The resulting value is in the range of $1,49 \cdot 10^7 \text{ g/cm}^3$. According to the hypothesis of [5], the density of this Essence is variable over time, due to the fact that it is given rise to the structures of substance as we know about, the particles, through a process of "condensing" or compacting the masses from the Essence into discrete volumes.

In [6] it is determined analytically the range of variation or dispersion of the values of the fundamental Essence's density and the average density of the substance in the course of the Universe's evolution, due to overflow of masses (energy) from the Essence to the substance and vice versa. The periodicity of this process is defined as a major cosmological cycle. Once the value of the well known and confirmed experimentally gravitational constant (G) in the present stage of the Universe 's evolution, then based on the determined density values during the cycle, it could be calculated also the value of the gravitational constant. It is obtained the following variation range of the gravitational constant value in the course of the Universe evolution: 10^{-5} – $10^{-8} \text{ cm}^3/\text{g} \cdot \text{s}^2$, i.e. according to the proposed hypothesis the gravitational constant is not a steady one during the evolution, but changes slowly over time value and only for relatively short periods of time may conditionally be considered constant.

As a consequence of the change of the Essence density, i.e. the transmission medium of the different known interactions, it should be changed as well as and the value of the speed of propagation of electromagnetic oscillations or i.e. the light. If the actual values of the density of Essence as defined according to [5] are adequate, and the actual (current) velocity of the electromagnetic oscillations, denoted by the symbol c , as is well known is in the range $3 \cdot 10^{10} \text{ cm/s}$, then the velocity of electromagnetic interactions in the range of possible values for the density of the Essence over time can be calculated by simple mathematical rule and should have values as follows:

- $2 \cdot 10^8 \text{ cm/s}$ - at the Essence density 10^5 g/cm^3
- $2 \cdot 10^9 \text{ cm/s}$ - at the Essence density 10^6 g/cm^3
- $2 \cdot 10^{11} \text{ cm/s}$ -at the Essence density 10^8 g/cm^3

It turns out that in the early stages of the current cycle of the Universe circle, the speed of electromagnetic oscillations was two orders of magnitude less than the current one, and the future value will reach magnitude of an order higher. This explains or rather discourages one of the main phenomena, supporting the idea of an expanding Universe, namely infrared displacement (redshift) of the spectrum of the electromagnetic radiation. No moving apart and dispersion of the cosmic objects, but the propagation of electromagnetic oscillations in an

environment with less density back in time and a correspondingly lower speed of spread is the reason for the spectrum of electromagnetic oscillations shift from distant sources to infrared area, reaching us in this era. The tendency also shows an increase in the speed of light in one order of magnitude in the future with all the consequences from this.

Since there are serious arguments and reasons to believe that at least two of the three main cosmic constants, namely (**G**) and (**c**) are time-varying values, and hence as a consequence, the above mentioned derivatives should be of variable in time values.

Proceeding also to the issue of consistency of the third fundamental constant - Planck's constant **h** should be noted here that things appear different. The studies show that one could not reveal compelling reasons or grounds for it to be considered a value of a variable meaning.

According to science, **h** appears distinctive, responsible and determining in structuring and in the processes, arising at the micro level of organization of the matter - substance and radiation, and as noted at the beginning, also indirect at macro level. Its importance in the physics of elementary particles and quantum mechanics is essential and therefore its value is determined strictly and accurately, and also the physical meaning and dimension it as a quantum of action. What can the value of **h** depend on, what other values and parameters can be connected with, can it be to such an extent independent and is really its value unchangeable. In a first approximation, it is not directly related and not associated with the physical parameters of the Essence and therefore is not subjected to the influence of other factors in the formation of its value. This conclusion may not be fair and may not yet have established a relationship of **h** with other physical values. Now seem to accept **h** for immutable constant value i.e. fundamental. In the absence of theoretical and experimental results on the matter, should be satisfied with the expression of some assumptions that can be used in our efforts and work on the problems of cosmology and particle physics.

In the context of the proposed hypothesis for the transformation of the fundamental Essence in substance, **h** is probably linked and influences the process of formation and synthesis of primary structures of substance by the process of condensation, leading to sampling, quantization and separation of the structures of the substance in the middle of the Essence. One of the guiding points on the way to clarify the question of the influence of **h** on the processes of the Universe is connected with the specifying whether each new cycle of universal circulation, quantization of the Essence and the structuring of the substance's component is performed at the same space (and perhaps energetic) level, or there is a difference in the space and energetic parameters of quantization from cycle to cycle.

There are only two possibilities: if **h** is actually constant, the Universe has evolved and will always develop by the same way in its cycle. While if **h** due to

reasons, which are a subject to future studies, takes different values in each new cycle, then there are many possibilities for its structure and development.

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ОТНОСНО ПОСТОЯНСТВОТО НА МИРОВИТЕ КОНСТАНТИ

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Резюме

Докладът представя анализ относно постоянството на фундаменталните мирови константи – гравитационната, релятивистката и квантовата. Представени са доводи, подкрепени с числови изрази, за промяна на стойностите на поне две от тях в процеса на еволюцията на Всемира, а именно гравитационната константа на Нютон и скоростта на електромагнитните колебания, в частност светлината. За гравитационната константа е коментиран и обоснован физическият смисъл, не като величина свързана с гравитацията, а свързано със специфичния обем, реципрочно плътността, на основополагаща физическа същност, от която се допуска и като хипотеза е заложено, че произхожда и се формира всичко във всемирното пространство. Интерпретирана е възможността и вероятността за постоянство във времето и на третата фундаментална физическа константа – квантовата или константата на Планк.