Time-invariant Eternal Multiverse

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Abstract

In the time-invariant multiverse model, material changes run in time-invariant n -dimensional superfluid quantum space (SQS). Changes have no duration on their own. Time as the duration of changes enters existence only when measured by the observer. Time-invariant superfluid quantum space (SQS) has a variable energy density that defines the velocity of material changes. More SQS is dense, faster is the velocity of changes. Every physical object is diminishing energy density of SQS exactly for the amount of its energy E and correspondent mass m . In the centre of AGNs' energy density of SQS is so low that atoms become unstable. They fall apart into elementary particles in the form of jets. These jets are the raw material for the formation of new stars. AGNs' are rejuvenating systems of the universe that is non-created and eternal.

Keywords: multiverse, superfluid quantum space, CMB, cosmological redshift, AGN.

1. Introduction

The result of several pieces of research is that the superfluid quantum vacuum also named superfluid quantum space (SQS) is the physical origin of the universal space, the fundamental arena of the universe [1,2,3,4]. Considering that with clocks we measure the duration of a material change, i.e., motion in SQS one can conclude that time is not the fourth dimension of SQS. We do not have a shred of single experimental evidence that time is the 4th dimension of the universal space and it is time that in physics we postulate time on the basis of its measurement; time is the duration of the change in time-invariant universal space. This

means that time as the duration in order to exist needs to be measured from the side of the observer. There is no physical past nor physical future in the universe, a time when measured, is a duration of the change in time-invariant universal space. Considering that universal space is time-invariant, it means that we cannot study the universe from the perspective of a system that runs in some physical time. The universe is time-invariant in the sense that time is not the dimension in which the universe would run. Changes in the universe are irreversible, when change $X+1$ enters existence, the change X is not existent anymore. When change $X+2$ enters the existence the change $X+1$ is not existent anymore. Universe runs in time-invariant space [5,6,7]. Cosmology progress is based on the insight that the universe is time-invariant. Seeing universe in some physical time is not a good perspective because such a physical time does not exist. The cosmological principle states that we have the same picture of the universe regardless of the position from which we see it. From any point of the universal space, we will have more or less the same picture. Universal space is a time-invariant and cosmological principle too is time-invariant. This means that our view on the universe that in some remote physical past was totally different as we observe it today needs to be re-examined.

Figure 1: Big Bang cosmology model.

The beginning of the universe in some remote physical past is questionable because we do not have any experimental evidence of the physical past existence. What we observe is that universal changes are irreversible and run in the time-invariant universal space. Physical past was never observed and never detected, and cannot represent the basic stone of cosmology.

As Albert Einstein has told us: “People like us who believe in physics know that the distinction between past, present and future is only a stubbornly persistent illusion”. Einstein was aware that time has no physical existence, however, he kept time as the 4th dimension of space-time as the fundamental arena of the universe. In this article, we propose a paradigm shift from the space-time model where time is the 4th dimension of space to the time-invariant

space model when time is the duration of change running in a time-invariant space. Duration, in order to exist, needs to be measured by the observer [5,6,7].

Back in 1916 Einstein has interpreted the time t as the 4th coordinate X_4 of a Minkowski manifold. He wrote: “If we replace $x, y, z, \sqrt{-1} ct$ by x_1, x_2, x_3, x_4 , we also obtain the result that $ds^2 = dx_1^2 + dx_2^2 + dx_3^2 + dx_4^2$ is independent of the choice of the body of reference. We call the magnitude ds the “distance” apart of two events or four-dimensional points. Thus, if we choose as time variable the imaginary variable $\sqrt{-1} ct$ instead of the real quantity t , we can regard the continuum space-time, in accordance with the special theory of relativity, as an “Euclidean” four-dimensional continuum, a result following by the consideration of the preceding section”. In the above citation, Einstein suggestion that we can choose the time variable t as the imaginary variable can be written as follows:

$$t = \sqrt{-1} ct \quad (1).$$

Eq. (1) is false because on the left side of the equation we have t and on the right side we have $\sqrt{-1} ct$. Combining Eq. (1) with equation well know equation $X_4 = ict$ we get:

$$X_4 = itc^2\sqrt{-1} \quad (2).$$

Equation (2) is false and confirms that Einstein did a mistake keeping and interpreting time as the dimension of a four-dimensional continuum [4]. Physics is still today suffering this misinterpretation of time that is solved in this article: time is the duration of a given physical object motion in time-invariant space. There is no “distance in time” in the universe because there is no physical time in which events happen.

The only past that exists is the human memory. It makes no sense to think that something in the universe has happened in some remote physical past. Everything that ever has happened in the universe has happened in the same time-invariant space. Past tense "In have seen this last year" does not mean the physical past exists. What we have seen last year has happened in time-invariant space, what we will see next year too will happen in the same identical time-invariant space. My grandfather and my father, me, and my son were born in the same identical time-invariant space.

The progress of physics and cosmology requires the paradigm shift from the space-time model to the time-invariant space model. We understand today space-time model as four-

dimensional continuum where time is the forth coordinate despite the fact that 4th coordinate X_4 is a product of imaginary number i , light velocity c and time t as the duration of photon motion: $X_4 = ict$. The right understanding of Minkowski's manifold is that the 4th coordinate is not temporal, it is spatial too. Because of the wrong name “space-time” that was given to Minkowski manifold for more than 100 years, we think time is the 4th dimension of the space-time model. It is not.

Figure 2: Space-time model and time-invariant space model

In the space-time model, the fourth coordinate X_4 is imaginary, X_1, X_2, X_3 are real coordinates. In the time-invariant space model, the 4th coordinate Z_4 is a complex coordinate as the other three coordinates Z_1, Z_2, Z_3 : “Time-invariant superfluid quantum space (SQS) has a general n -dimensional complex structure $\mathbb{C}^n$; every point of it has complex coordinates:

$$z_i = x_i + i y_i \quad (3).$$

(x_i, y_i) ($i = 1, \dots, n$) is an ordered n -uple of real numbers $((x_i, y_i) \in \mathbb{R}^n)$; for the purpose of this paper, we consider its subset $\mathbb{C}^4$ where all elementary particles are different structures of $\mathbb{C}^4$ SQS and have four complex dimensions z_i “[4].

In this article we develop a cosmology model based only on the astronomical observations without speculations of what has happened in some hypothetical physical past that is non-existent. The Big Bang model is based on some hypothetical physical past events as the initial explosion and inflation that have not been directly observed. The time-invariant space model is confirming the principle of time translation symmetry (TTS) which states that laws of physic are independent of time [7]. In the time-invariant universe there is no physical past and there is no physical future. Changes run in time-invariant SQS. The idea that gravity

immediately after the big bang was acting as the repulsive force has no experimental evidence. The idea of how the initial super-force with the cooling of the universe has been transformed into four fundamental forces has no experimental evidence.

Figure 3: Hypothetical super-force transformation into four fundamental forces.

The only universe that really exists is the one the observer can perceive and measure. The ideas of the beginning, inflation, and recombination are unproven speculations. We will develop in this article the cosmological model of the multiverse that is based only on a direct reading of astronomical data.

2. Cosmological redshift is “tired” light effect

The redshift of the light coming from distant galaxies is today understood as the experimental proof of the universal space expansion. We do not have in scientific literature a theoretical model with mathematical evaluations that exactly predict how the light would behave when moving in the opposite direction of expanding space. This is a serious inconvenience and a puzzle that needs to be solved. The Doppler effect is observed on the Earth’s surface and Earth is moving around the Sun in the stationary space. In the area of our solar system, the space is not expanding; if it would expand, this would change the trajectories of the planets orbiting around the Sun.

Recent research suggests that the SQS has the value of Planck energy density ρ_{EP} [1,5,6]. The gravitational constant G can be expressed with Planck energy density ρ_{EP} and Planck time t_P as: $G = \frac{1}{\frac{\rho_{EP}}{c^2} t_P^2}$. If the universe would expand, the energy density of the SQS would diminish and consequently the gravitational constant would increase. The gravitational constant was measured first back in 1798 by Henry Cavendish. Since then, the value of

gravitational constant is stable, meaning that the density of SQS is also stable. This is suggesting that the universe is not expanding.

Not only the gravitational constant, also the magnetic permeability μ_0 and the electric permittivity ε_0 of the SQS are defined by its energy density. The increase and decrease of the energy density of the SQS would be a cause for the change of magnetic permeability μ_0 and electric permittivity ε_0 and would consequently change the light speed. This last was exactly measured by English astronomer James Bradley back in 1729 [8]. The constancy of μ_0 , ε_0 and light speed is suggesting that the energy density of the SQS is constant and that universe is not expanding.

Stephen Hawking has predicted that the universe started by the mathematical point [9]. Back in 2014, NASA has measured with the 0,4% of error that the SQS has Euclidean shape by measurement of the sum of angles between three stellar objects and getting 180° : “Recent measurements (c. 2001) by a number of ground-based and balloon-based experiments, including MAT/TOCO, Boomerang, Maxima, and DASI, have shown that the brightest spots are about 1 degree across. Thus the universe was known to be flat to within about 15% accuracy prior to the WMAP results. WMAP has confirmed this result with very high accuracy and precision. We now know (as of 2013) that the universe is flat with only a 0.4% margin of error. This suggests that the Universe is infinite in extent; however, since the Universe has a finite age, we can only observe a finite volume of the Universe. All we can truly conclude is that the Universe is much larger than the volume we can directly observe” [10]. This means that the SQS can be considered infinite in its volume. On the question how a mathematical point could extend into infinite space of the universe has no answer; we know in mathematics that the mathematical point is dimensionless and cannot be transformed into a given volume. Also, the expansion of the universe is contradictory to NASA results, meaning that the SQS does not have Riemann shape, but Euclidean shape and cannot expand. The Euclidean space, infinite in volume, cannot expand. Only finite spheric Riemann space can expand.

We have a plausible explanation of cosmological redshift. When light is coming to us from remote galaxies, it moves against the space fluctuations which are carrying gravity force. Every physical object is diminishing the Planck energy density ρ_{EP} of the superfluid quantum vacuum (SQS) that is the physical origin of the SQS in its centre exactly for the amount of its mass m and energy E :

$$E = mc^2 = (\rho_{EP} - \rho_{Emin})V \quad (4) [4],$$

where ρ_{Emin} is the energy density of the SQS in the centre of the physical object and V is the volume of the object. Superfluid quantum space fluctuations are flowing from outer interstellar space where SQS has maximum energy density towards lower energy density of SQS in the centre of stellar objects; these SQS fluctuations are carrying gravity force [2,3,4]. Light is moving in the opposite direction of these space fluctuation and is that why losing some of its energy. The result is the cosmological redshift. Swiss astronomer Zwicky has named this effect “tired light effect” (Figure 4) [11].

Figure 4: Light is losing some of its energy when moving in the opposite direction of the space fluctuations that carry gravity.

Theory of vector gravity is a model that supports the reinterpretation of gravitational redshift: “Similarly to general relativity, vector gravity postulates that the gravitational field is coupled to matter through a metric tensor f_{ik} which is, however, not an independent variable but rather a functional of the vector gravitational field. In particular, action for a point particle with mass m moving in the gravitational field reads:

$$S_{matter} = -mc \int \sqrt{f_{ik} dx^i dx^k} \quad (5)$$

where c is the speed of light. Action (12) has the same form as in general relativity, however, the tensor gravitational field g_{ik} of general relativity is now replaced with the equivalent metric f_{ik} (f_{ik} is a tensor under general coordinate transformations)” [12].

Our model provides the physical origin of vector gravity that is in the SQS quantum fluctuations that are directed from the higher energy density of SQS towards the lower density of SQS. These fluctuations interact with photons to diminish their frequency, which is referred to as ‘gravitational redshift.’ When light from distant galaxies reaches the Earth, its frequency

is lower. On its path to Earth, light loses some of its energy because it is moving against the SQS fluctuations that points toward the direction of galaxies, so that

$$E_{\text{photon Earth}} = E_{\text{photon galaxy}} - \Delta E \quad (6),$$

where $E_{\text{photon galaxy}}$ is the energy of the photon at the galaxy, $E_{\text{photon Earth}}$ is the energy of the arrived photon at the Earth, and ΔE is the loss of energy due to the fluctuations of the SQS,

$$\Delta E = h\Delta\nu \quad (7),$$

where h is Planck's constant and $\Delta\nu$ is the decrease of the photon frequency due to SQS fluctuations (Figure 3). Because of different densities of the SQS, the frequency of light also changes when moving from the source to the receiver above the Earth's surface. In a Harvard University experiment, a source on the Earth's surface and a receiver at the height of 22,5 meters were positioned, as illustrated in Figure 5.

Figure 5. The redshift of light moving from the Earth's surface upwards.

The Mössbauer effect was used to measure the difference between y-ray emission and absorption frequencies at each end of the experiment. The measurement accuracy was $\Delta\omega / \omega \approx 10^{-15}$, which shows a change of light frequency as

$$\frac{\Delta\omega}{\omega} = \frac{GM}{R^2 c^2} h \quad (8),$$

where M and R are the mass and radius of the Earth, respectively [13].

We can substitute into Equation (8) for the Earth mass M with the $\frac{(\rho_{Emax}-\rho_{Emin})V}{c^2}$ from Equation (4) as:

$$\frac{\Delta\omega}{\omega} = \frac{G(\rho_{Emax}-\rho_{Emin})V}{R^2 c^4} h \quad (9),$$

which can be expressed as:

$$\frac{\Delta\omega}{\omega} = \frac{G(\rho_{Emax}-\rho_{Emin})4\pi R^3}{3R^2 c^4} h$$

$$\frac{\Delta\omega}{\omega} = \frac{4\pi RG(\rho_{Emax}-\rho_{Emin})}{3c^4} h \quad (10).$$

Equation (10) confirms that gravitational redshift at Mössbauer effect depends on the minimal energy density of the SQS ρ_{Emin} in the Earth's centre.

SQS quantum fluctuation in distant galaxies in the direction from ρ_{Emax} (outer space) towards ρ_{Emin} (centre of galaxy) are the physical origin of so called “tired light” model of astronomer Fritz Zwicky. What we call “cosmological redshift” is “tired light effect”. Our model is suggesting the universe is not expanding.

Research group Ming-Hui Shao, Na Wang, and Zhi-Fu Gao is proposing another explanation of the “tired light effect”, namely, photons are losing energy because of interaction with the particles that are in intergalactic space: “Hubble employed the Doppler effect to interpret the cosmological redshift in his study. It was a bold move which he might not have made if he had considered the issue deeply. Zwicky however did not think the Doppler effect was suitable for the interpretation of the cosmological redshift. The Doppler effect says nothing about the nature of matter. It is only a problem in kinematics. The redshift induced by the Doppler effect is caused by relative motion between the light source and the observer. Zwicky thought the things are not so simple. He proposed the “tired light” hypothesis that the cosmological redshift is caused by the interaction of the light with a latent feature of the Cosmos. The tired light hypothesis claims that while the light propagates, it must be affected by all matters of the Cosmos. The idea came from Mach who thought that all of the matter in the Cosmos is related, so that any part of the matter is affected by all the other parts. Although Zwicky objected to the Doppler effect interpretation of cosmological redshift, the tired light hypothesis was vague on physical mechanics, so few people took the hypothesis seriously. But there have been a few people contemplating tired light, keenly working to find the physical mechanics thereof, without success. The physical mechanics of tired light was not clearly

described until 2013 when M. Shao published his paper. Shao pointed out that the physical mechanics of tired light should be the Lorentz electric force produced by the electromagnetic field of photons acting on material particles” [14]. M. Shao's model of the tired light effect was published in *Physics Essays* [15]. Their model is different from ours, however, both models have in common the proposal that cosmological redshift is not because universal space is expanding and so the distance between galaxies is increasing. In order to progress cosmology, our proposal and M. Hao and his team's proposal deserves attention and deepening.

3. The model of inflation has no direct experimental evidence

The idea that universal space has been inflating immediately after the hypothetical explosion is inspired by the fact that in mathematics, we can increase the radius of the Riemann manifold, and its volume will increase. We cannot apply this model in cosmology because we show in this article universal space is energy. Inflation is contradicting the law of energy conservation. We do not have a single direct measurement that would prove that universal space is expanding. Interpretation of cosmological redshift is false and is not proving expansion of the universe. Doppler law was tested in the stationary space around the Earth where we do not have a single data of space expansion. Also, we do not have in physics a mathematical model of how Doppler law would function in an expanding space. The idea that universal space could expand has no solid mathematical basis and has no support in the direct observations.

Back in 2011 Steinhardt published an article in *Scientific American* questioning if inflation is flawed model: “Is the theory at the heart of modern cosmology deeply flawed?” [16]. In his article he did not give final conclusions. He pointed out that inflation model has some unbridgeable problems that seems are no solvable.

Back in 2017 Steinhardt published together with Anna Ijjas and Abraham Loeb another article in *Scientific American* titled “Cosmic Inflation Theory Faces Challenges - The latest astrophysical measurements, combined with theoretical problems, cast doubt on the long-cherished inflationary theory of the early cosmos and suggest we need new ideas”. Their article has opened a feverish debate among world-leading cosmologists: The trio’s aggressive reappraisal of a scientific consensus inspired an energetic rebuttal, also in *Scientific American*, from 33 prominent physicists, including four Nobel laureates [17].

We are proposing in this article a new way of solving the problems of the inflation model and also other problems of Big Bang cosmology, namely, let’s build a cosmological model that will be based on the direct reading of abstained data. Mössbauer effect is directly observed and measured. It confirms that light when moving in the opposite direction of gravity

force diminishes its frequency. This is the so-called “gravitational redshift”. Cosmological redshift has the same physical origin. When light is pulling out of the strong gravitational fields of distant galaxies their frequency diminishes.

Alan Guth’s view is that universe run in some physical time. With the Big Bang this physical time has entered into existence. How this has happened we do not know yet: “There is much evidence that at earlier times the universe underwent inflation, but the details of how and when inflation happened are still far from certain. There is even more uncertainty about what happened before inflation, and how inflation began. I will describe the possibility of “eternal” inflation, which proposes that our universe evolved from an infinite tree of inflationary spacetime. Most likely, however, inflation can be eternal only into the future, but still must have a beginning [18]. In the same article Guth has continued: “Since inflation is eternal into the future, it is natural to ask if it might also be eternal into the past. The explicit models that have been constructed are eternal only into the future and not into the past, but that does not show whether or not is possible for inflation to be eternal into the past” [18]. Guth sees universe running in some physical time that we show is non-existent. His speculations about eternal inflation into future and possible eternal inflation from the past are strictly theoretical and have no experimental evidence. In the time-invariant universe model, past events have happened and future events will happen in the same identical time-invariant space. The old image of time as a physical dimension in which events appear is replaced by the image of the time-invariant space in which events run. "Temporal distance" between events is kept, one has to understand that this temporal distance occurs in time-invariant space. As universal space is time-invariant the beginning of the universe as suggested by Guth is out of question.

Guth and the co-authors admitted that inflation model is not self-consistent: “Thus inflationary models require physics other than inflation to describe the past boundary of the inflating region of spacetime” [19]. Cosmology model presented in this article is self-consistent.

Guth’ way of incorporating gravity in his inflation model is not convincing: “The expansion of the universe may be described by introducing a time-dependent “scale factor,” $a(t)$, with the separation between any two objects in the universe being proportional to $a(t)$. Einstein’s equations prescribe how this scale factor will evolve over time, t . The rate of acceleration is proportional to the density of mass-energy in the universe, ρ , plus three times its pressure, p : $\frac{d^2 a}{dt^2} = -\frac{4\pi G(\rho+3p)a}{3}$, where G is Newton’s gravitational constant (and we use units for which the speed of light $c = 1$). The minus sign is important: ordinary matter under

ordinary circumstances has both positive mass-energy density and positive (or zero) pressure, so that $(\rho + 3p) > 0$. In this case, gravity acts as we would expect it to: All of the matter in the universe tends to attract all of the other matter, causing the expansion of the universe as a whole to slow down” [20]. By adding the negative mathematical sign in the formula gravity in the universe will not change. In our model gravity cannot be seen as positive or negative in the mathematical sense. Gravity is the result of the diminished energy density of SQS in the centre of a given physical object [4].

The radius of the mapped universe measured on the basis of astronomic observations is about $4,4 \cdot 10^{26} m$. The age of the universe is about $4,35 \cdot 10^{17} s$. According to these data the universe should expand with a velocity of $1,011 \cdot 10^9 m/s$, that is about 3,3 light speed to reach the mapped size of the universe [21]. The idea that the universe could expand with the average velocity of a 3,3-time of light speed seems unacceptable; we do not have a single theory in physics that would predict such a velocity. The discrepancy between the measured mapped universe and the hypothetical size and expansion of the universe is a big unresolved question of the Big Bang cosmology model.

4. Hubble law and Doppler effect in an expanding space

Hubble law states that acceleration of the universe increases by the distance:

$$v = H_0 D \quad (11),$$

where v is the velocity typically expressed in kms^{-1} , H_0 is Hubble constant and D is the distance of the galaxy from the observer measured in megaparsecs (Mpc). One Mpc is $3,261 \cdot 10^6$ light-years. Velocity v of the expansion is defined on the basis of the redshift of a given galaxy. Universal space is expanding and so distances to the galaxies are increasing. The velocity of the galaxies is determined by their redshift that occurs because of Doppler effect. We have shown in chapter 2. that there is no appropriate mathematical model existing that would describe the Doppler effect in an expanding space. Equation of the Doppler effect is following:

$$f = \left(\frac{c \pm v_r}{c \pm v_s} \right) f_0 \quad (12),$$

f is observed frequency, f_0 is emitted frequency, v_r is the speed of receiver relative to the medium, c is the light speed, and v_s is the speed of the source relative to the medium. Eq. (12)

is valid when the medium is at rest. Doppler effect is observed only in the stationary space where electric primitivity ϵ_0 and magnetic permeability μ_0 of space that define light speed are unchanged. We do not know how the Doppler effect would work in an expanding space where the energy density of the SQS would diminish and electromagnetic properties of space would be changed. Masanori research confirms that gravity influences the electromagnetic properties of space: “It is known that the speed of light depends on the gravitational potential. In the gravitational fields, the speed of light becomes slow, and time dilation occurs. In this discussion, the permittivity and permeability of free space are assumed to depend on gravity and are variable” [22]. Applying the Doppler effect in Hubble law without knowing how the expansion of the universe changes electromagnetic properties of expanding space seems unacceptable.

Back in 2019, NASA has reported on universe expansion: “The new estimate of the Hubble constant is 74 kilometers (46 miles) per second per megaparsec. This means that for every 3.3 million light-years farther away a galaxy is from us, it appears to be moving 74 kilometers (46 miles) per second faster, as a result of the expansion of the universe. The number indicates that the universe is expanding at a 9% faster rate than the prediction of 67 kilometers (41.6 miles) per second per megaparsec, which comes from Planck's observations of the early universe, coupled with our present understanding of the universe” [23].

In chapter 3. we calculated the average velocity of the universe expansion that is according to the size of the mapped universe and age of the universe 3.3-time of light speed which yield $9.893 \cdot 10^8 ms^{-1}$. Hubble constant is measured to be 74 kilometers per second which yield $7.4 \cdot 10^4 ms^{-1}$. According to the value of the Hubble constant universe should be much smaller. This is the second weak point of Hubble law.

Hubble law predicts the existence of the Hubble sphere, a spherical region of the observable universe beyond which objects recede at a rate greater than the speed of light due to the expansion of the universe [24]. How galaxies could have velocity higher than light speed is also an unanswered question of Hubble law. Research published in 2013 has confirmed that photons form matter [25]. This means that every physical object accelerated to the light speed would turn into light. No physical object can move with light speed. Only photons can move with light speed. The Hubble sphere model is suggesting that beyond the Hubble sphere there are only photons in the universe and that they move faster than light speed. This seems unacceptable.

Since NASA measured that universal space has Euclidean shape [10], the models of the universe that use Riemann geometry seems inadequate. Universal space has Euclidean shape and is time-invariant. This means that the cosmological principle is time-invariant also. The cosmological principle means that the physical properties of the universe are the same in the entire universe: “Viewed on a sufficiently large scale, the properties of the universe are the same for all observers. This amounts to the strongly philosophical statement that the part of the universe which we can see is a fair sample, and that the same physical laws apply throughout. In essence, this in a sense says that the universe is knowable and is playing fair with scientists” [26]. About cosmological principle, Andrew Liddle said: ”The cosmological principle means that the universe looks the same whoever and wherever you are” [27].

We show in this article that the universe exists in the time-invariant space which means that the cosmological principle is time-invariant. The picture of the universe as we see it today does not depend on time, because time enters existence when measured by the observer. Universe has no begging in some remote time when its picture was totally different. The universe is non-created and its picture is the same ever and will be the same forever. The idea of some begging of the universe is the biggest mistake of cosmology ever. The aim of our article is to bring an understanding that the universe is a non-created system, with no beginning, and no end. We will present the model of the eternal universe in chapter seven.

5. Super-fluid quantum space and dark energy

Super-fluid n-dimensional complex quantum space $\mathbb{C}^n$ -SQS is the primordial energy of the universe. According to the law of energy conservation, this energy cannot be created and cannot be destroyed. Every physical object with the mass m is diminishing the energy density of $\mathbb{C}^4$ -SQS in its centre exactly for the amount of its energy E . Variable energy density of $\mathbb{C}^4$ -SQS is generating inertial mass m_i and gravitational mass m_g of a given physical object: “From the macro to the microscale, it holds that a given physical object is interacting with the $\mathbb{C}^4$ -SQS in which is existing; the result of this interaction are the inertial mass m_i and the gravitational mass m_g :

$$m_i = m_g = \frac{(\rho_{EP} - \rho_{Emin})V}{c^2} \quad (13) [4].$$

The inertial mass of a given physical object is not its rest mass, it is the result of the interaction of rest mass with the $\mathbb{C}^4$ -SQS [4]. Gravity force between two physical objects is as follows:

$$F_g = \frac{m1_g m2_g G}{r^2} \quad (14),$$

where $m1_g$ is the inertial mass of the first object and $m2_g$ is the inertial mass of the second object:

Figure 6: Gravity for acts from outer space towards the centre of physical objects

Higher pressure of outer $\mathbb{C}^4$ -SQS is pushing together physical objects. $\mathbb{C}^4$ -SQS is the “unknown fluid” of the universe. It cannot have negative pressure as suggested in recent research: “This acceleration in the universe may driven by an exotic type of unknown fluid that have positive energy density and huge negative pressure. This fluid is usually known as Dark Eneergy (DE) but its nature is still unknown. The most suitable candidate of this DE is the Λ . However, there is a huge dissimilarity in the value of Λ predicted by observations and particle physics ground that leads tuning problem” [28]. Negative pressure of the “unknown fluid” is a theoretical proposal that was never observed in experimental physics and cannot be taken as a stable ground to build cosmology.

Dark energy, also named “unknown fluid is 68% of the energy in the universe. About 5% of the energy in the universe is in the form of matter, dark energy and represent about 68% of the energy of the universe. Since the 1980s, the dominant paradigm for the nature of dark matter has been that of the weakly interacting massive particle (WIMP) that represents around 27% of the energy of the universe [29].

Superfluid quantum space model offers the solution for the discrepancy between measured and theoretically valued cosmological constant: “The measured value of cosmological constant $\Lambda = 5.96 \cdot 10^{-27} \text{ kg/m}^3$ is different from its calculated value following the Planck metrics for the magnitude of 10^{123} ; this discrepancy is an unsolved subject of physics for decades. Regarding the suggested energy density of space proposed in this article, we are defending our proposal by the fact that the gravitational constant G is obtained by measurement and is expressed by the Planck energy density ρ_{EP} and the Planck time t_P as:

$$G = \frac{c^2}{\rho_{EP} t_P^2} \quad (15).$$

This means that the Planck energy density ρ_{EP} reflects the real energy density of a 4-D universal space. In the absence of stellar objects, the energy density of the universal space has a value of Planck energy density which is $\rho_{EP} = 4.64 \cdot 10^{113} Jm^{-3}$ “[4]. We cannot measure exactly the energy density of the universal space as the $\mathbb{C}^4$ -SQS is four-dimensional and apparatuses for the measurement three-dimensional.

6. CMB is the radiation of the existent universal space

We propose also that CMB should not be interpreted as a proof of recombination period. Astronomical observations confirm that the SQS is radiating uniform CMB radiation [30]. The Big Bang model suggests that the CMB radiation is the relic radiation from some remote physical past. The SQS is time-invariant; no signal can move through some hypothetical physical time; all signals move in the time-invariant space. The idea that CMB is radiation from some remote physical time is not falsifiable and should be abandoned in the name of cosmology progress. CMB has its source in present time-invariant universal space. Experimental physics is confirming a given signal we can only reach from the existent physical source, and the remote physical past is physically non-existent. Any kind of radiation must have a physical source; the remote past event cannot be this physical source. The proposal that the CMB signal is relic radiation that was created in some remote physical past and is still present is an ad-hoc proposal that was never confirmed by an experiment. The discovery of CMB absolutely does not prove the existence of a recombination period that should be existing around 380000 years after some hypothetical Big Bang. The scientific fact on the basis of observations is that CMB is the radiation of existent universal space that has its physical origin in SQS that is time-invariant. The CMB has a thermal black body spectrum at a temperature of $2.72548 \pm 0,00057K$ [31].

7. Big Bang cosmology and Einstein’s steady-state cosmology have no answer about matter creation

Alan Gut hypothesis is that the energy of gravity and that of matter have been multiplying in inflation period. The energy of gravity E_g is negative, the energy of matter E_m is

positive, their sum is zero and in inflation on the contrary they multiply [32]. We can describe his idea mathematically as follows:

$$n E_m + (-n E_g) = 0 \quad (16).$$

Firstly, we never observed negative gravitational energy. Secondly, we never observed that energies are multiplying out of nothing. Gut's idea is against the first law of thermodynamics and is not bijective. There is no logical answer also about where both energies came into existence in the hypothetical inflation. Eq. (16) is mathematically right, but it does not fulfil the test of bijectivity, meaning that it does not correspond to some real process in physical world. The Big Bang model is not falsifiable.

The model of the universe presented in this article is based only on the obtained experimental data, is falsifiable. There are no theoretical speculations as in the case of the Big Bang model. The cosmology model presented in this article is based only on direct reading of experimental data. Thinking that the gravitational energy could be negative is logically inconsistent, because we never observed to date positive or negative energy in the universe. We know that there are precise conventions on the sign of energy, conventions adopted in all areas of physics, such as thermodynamics (absorbed energy = positive; energy released energy = negative). But these are adopted conventions, no one has ever measured that energy has an associated mathematical sign. This is also in line with the principle of bijectivity introduced in the article. Also, the idea that the energy of the universe is multiplying in the hypothetical inflation is logically inconsistent, because we have no experimental evidence that energy can get multiplied. The inflation is against the first law of thermodynamics.

In the past century, gravity was understood as the force produced directly by the matter, the idea was that universe must be finite. We can read in the article of Sir James Jeans in Nature back in 1943: "If, however, the distribution is uniform throughout the whole of space, then space must be finite; otherwise, it would contain an infinite amount of matter, and the gravitational force from this would be infinite, which is contrary to the fact" [33].

NASA has measured that the universe has Euclidean shape and is infinite [10]. The idea of SQS being infinite does not mean that gravity should be infinite, as suggested by Sir James Jeans. Considering universal space is infinite there is no gravity force between the stellar objects that are on the infinite distance.

The energy of the infinite universe in the form of matter E_m and in the form of superfluid quantum space energy E_{SQS} is infinite:

$$E_m + E_{SQS} = \infty \quad (17).$$

The human mind can only imagine a finite amount of matter and a finite amount of energy and finite space which is not the case with the universe. The universe is infinite by means of matter, energy, and volume. That's why is opportune we study the universe that is at a finite distance and we predict that the rest of the unobservable universe on the infinite distance is behaving in the same way as our observable universe.

Mass of every physical object in the universe diminishes the energy density of space, the variable energy density of space is carrying gravity that is the fundamental force of the universal dynamics. Defining gravitational energy negative, as done by Hawking and Guth, is questionable; energy is not positive, it is not negative, energy simply is, it cannot be created and it cannot be destroyed, it transforms continuously.

Einstein has proposed on his steady—state theory of the universe that matter is continuously created out of the universal space: “In the final part of the manuscript, Einstein proposes a physical mechanism to allow the density of matter remain constant in a universe of expanding radius - namely, the continuous formation of matter from empty space: “If one considers a physically bounded volume, particles of matter will be continually leaving it. For the density to remain constant, new particles of matter must be continually formed within that volume from space” [34]. How the matter is formed out of space Einstein did not explain. Both, Hawking's and Einstein's solution for how matter appears in the universe are pure theoretical speculations. In our model appearance of matter in the universe is not questionable. In AGNs' matter is constantly disintegrating in elementary particles that are fresh energy for matter formation.

8. Time-invariant Multiverse is eternal and non-created

SQS is multidimensional. All elementary particles are different structures of a 4-dimensional layer of SQS that is the physical origin of universal space [4]. Physical objects are made out of atoms that are three-dimensional. Different layers of SQS are coexisting, they are interwoven. In our view of the multiverse theory, we do not have some parallel universes that are coexisting in some unexplainable way. The universe we perceive and observe is a

multiverse. We can only perceive and measure the 3D and the 4D realms of the multiverse. Higher dimensions are not reachable with apparatuses but this does not mean that they are non-existent. The idea of the multiverse or “multiple universes” is present in the human culture for ages: “Widely propounded in cosmology, physics, astronomy and hypothesized in philosophical and religious literature, the concept of multiple universes under the names of multiverse, parallel universes, quantum universes or interpenetrating dimensions has been under the debate among the prominent physicists since middle ages” [35]. 5D and higher dimensionalities of SQS represent the mathematical model that can describe “hidden variables” of Einstein: “Albert Einstein never liked some of the counterintuitive predictions of quantum theory, arguing instead that there was a further, hidden layer to reality it failed to describe” [36], and “implicate order” of David Bohm [37].

In the cosmology model proposed in this article the energy density of SQS in interstellar space has a value of Planck energy density $\rho_{EP} = 4.64 \cdot 10^{113} Jm^{-3}$. Every stellar object is diminishing energy density of the 4th dimension of SQS in its centre exactly for the amount of its mass m and energy E accordingly to the Eq. (3). Let’s see the values of SQS energy density in the centre of some stellar objects on the table below [5]:

Table 1. Comparation values of the energy density of space with respect to the centre of indicated objects.

Centre of objects	$\rho_{EP} = 4.64 \cdot 10^{113} Jm^{-3}$
Black hole with mass of the Sun	$\rho_{EP} = 1.58 \cdot 10^{36} Jm^{-3}$
Earth	$\rho_{EP} = 4.94 \cdot 10^{20} Jm^{-3}$
Moon	$\rho_{EP} = 3.00 \cdot 10^{20} Jm^{-3}$
Sun	$\rho_{EP} = 1.26 \cdot 10^{20} Jm^{-3}$

In the centre of a black hole with the mass of the Sun and corresponded Schwarzschild radius $r_{Sch} = 3 \cdot 10^3 m$, the minimal energy density of SQS is for the order of 10^{16} lower than in the centre of the Sun. Because of this special physical circumstance atoms become unstable. In the huge black holes in the centre of AGNs matter is falling apart into elementary particles that form jets. Black holes in the centre of galaxies are throwing these jets into intergalactic space. These jets are fresh energy for new stars formation; black holes are rejuvenating systems of the

universe [5]. AGNs in the centres of galaxies are keeping entropy of the universe constant: “old” matter is transformed into “fresh” energy in the form of elementary particles (Figure 7).

Figure 7: Energy circulation in the universe is permanent.

This process did not start and will never end, it is in permanent transformation. There was no creation of the energy of the universe and there will be no destruction of the energy. An increase of matter entropy in the universe is only a partial process that does not influence the total entropy of the universe that is constant. In AGN-s the universe is rejuvenating itself.

There is a strong astronomical evidence that the star HD 140283 has an age of 14.27 billion years [38] that is a new difficulty for Big Bang model according to which the age of the universe is calculated by about 13.7 billion years. This astronomical observation is another puzzle Big Bang cosmology should solve.

The main misunderstanding of Big Bang cosmology is that the universe has started in some remote physical past. We prove in this article there is no physical past. Universal changes are irreversible and run into time-invariant space. Universe has no physical past. Humans are thinking about the universal past as something real albeit it is non-existent. The only existent universe is the one we can observe. Cosmology's and astronomy's models about the physical past of the universe are not well understood. For example, we have a detailed model of how the Solar system was developed. But it was no developed in some physical past. It was developed in time-invariant space. Time-invariance of space we experience as what Einstein called NOW. Albert Einstein said: “...there is something essential about the NOW which is just outside the realm of science. People like us, who believe in physics, know that the distinction between the past, present, and future is only a stubbornly persistent illusion. Time has no independent existence apart from the order of the events by which we measure it” [39]. Considering time-invariant superfluid space in which is always NOW as the only existent

physical reality means that the cosmological principle is time-invariant too. Thinking that the universe was different in some remote past seems inappropriate because the physical past is non-existent. The universe as we observe it in the moment of observation is the only real universe that exists. The initial explosion, inflation, and recombination are non-observed and remain theoretical speculations. We developed a cosmology model without the beginning of the universe, the problem of creation is solved. Penrose and Gurzadyan's "Conformal cyclic cosmology" (CCC) model also suggest that the universe is non-created, eternal, and in the permanent cyclic transformation [40]. CCC cosmology is accepting the inflation period that the "CPT – Symmetric universe" model is denying. CPT model predicts that before the big explosion there was an anti-universe in some negative time [41]. We categorically exclude that universe could exist in some negative time or could exist in some positive time. CCC cosmology model and CPT – Symmetric universe model weak points are that both models predict some events in the past that were never observed directly, their existence is questionable. The time-invariant multiverse (TIM) model is advanced in the sense it is based only on astronomical observations; it has no theoretical speculations about some past events in some remote physical past that does not exist. TIM model is based on the astronomical observations of the existing observable universe. In TIM model atoms are 3D structures composed out of elementary particles that are different 4D structures of SQS [4]. 5% of the energy in the universe is in the form of matter that is 3D and 95% is in the form of 4D and higher dimensional layers of SQS; dark energy and represent about 68% of the energy of the universe, the weakly interacting massive particle (WIMP) that represent around 27% of the energy of the universe [29]. In a TIM model, the relationship between ordinary matter, dark energy, and dark matter is more or less constant. A multiverse is a dynamic system in permanent equilibrium. The transformation of mater into elementary particles in the centre of AGNs is permanent; the multiverse is continuously recreating itself. The TIM model is the result of a paradigm shift from space-time to the time-invariant space [39,42], and is the realization of what Barbour has announced as "The Next Revolution in Our Understanding of the Universe" [43]. Multiverse has not started in some physical time. Multiverse is non-created and eternal.

9. Conclusions

Universal space is time-invariant. This means that the cosmological principle too is time-invariant. The universe as we see it today has the same face ever and forever. Humans have a huge power of imagination. In cosmology, this imagination went over the rational limits. Our research shows that the discrepancies between the Big Bang model and the obtained astronomical data are so huge that the Big Bang cosmology can be regarded as outdated. Seeing the universe as a system that exists in some physical time seems not right. The universe runs in the time-invariant superfluid quantum space. AGNs are rejuvenating systems of the eternal universe.

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