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Epistemological Optimism of Knowledge of the Physics of the Universe

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ABSTRACT

In my article, I speak in defense of the thesis of self-sufficiency of the physical world, i.e. the thesis that the reasons for the existence of the world and the reasons for everything that happens in it are in it. Until the illusory nature of our world is proven, scientists have hope to understand the laws of the universe. At the same time, the physical world should not be limited to the framework of the now prevailing scientific paradigm.

Keywords: *hologram, time, space, continuum, resonance, mass, energy, information.*

INTRODUCTION

Recently, more and more scientific articles have appeared on the philosophical aspect of the knowledge of the physics of the Universe [1,2,3]. This interest is quite understandable: the paradigm of modern science meets more and more modern challenges associated with the latest research, including in the field of quantum-relativistic physics, which reveals the phenomena of non-causal correlation of quantum systems.

This motivates researchers to think about the non-linear, non-local nature of our reality. However, in their criticism of the vulgar-materialist paradigm of modern science, or rather the thesis prevailing in modern science, of the invariance of Universe development processes associated with Albert Einstein's rejection of the concept of irreversibility, the authors risk losing the true development dialectic of the Universe. Relativistic invariance, which has at its core the subjective space-time presentation, is not consistent with the quantum-mechanical non locality, which has an objective character.

This reflects a deep internal contradiction of quantum-relativistic field theory and leads to insurmountable difficulties in solving the problems of the quantum theory of gravity unified theories and space-time representations in of the physics. The incompleteness of the theory may be a consequence of the subjective approach, and the physical processes are considered from the perspective of an observer.

This is facilitated by the methodology of physics, based on the postulation of the relationship between undefined concepts, which is clearly speculative in nature, setting the level of development of science. In the book "Physics Philosophy" M.Bunge stated: "In physics established the philosophy operationalism. It is considered that character as well as the equation has the physical meaning only to the extent that it relates to some possible operations person.

This leads to the assertion that physics as a whole – is the science of operations, mainly measuring and computing, not the science of nature.

That is to say, physics is related precisely to the subjective experience rather than objective reality."[4]. The most famous representatives of the "anthropic principle" in which the observer is the key to the existence of the process are the physicist John Wheeler. According to professor Wheeler, it turns out that this is not the Universe that you are exploring now consists of elementary particles, but the elementary particles appear in the Universe because you study it. Martin Ries, the cosmologist and the astrophysicist, President of the Royal Society of London, believes that the birth of the Universe will remain a mystery to us forever. He declares: "We do not understand the laws of the universe. And never

know how the universe appeared and what awaits it. The hypotheses about the Big Bang, which allegedly gave rise to the world around us, or that there may be many others in parallel with our Universe, or about the holographic nature of the world, will remain unproved assumptions. " For the first time, the "insane" idea of the illusiveness of the Universe was born to the physicist of the University of London, David Bohm, a colleague of Albert Einstein, in the middle of the 20th century. According to his theory, the whole world is about the same as a hologram. Bohm's "insane" idea was pushed by a sensational experiment with elementary particles [1].

Alan Aspect, a physicist at the University of Paris in 1982, discovered that under certain conditions electrons can instantaneously communicate with each other, regardless of the distance between them. Bohm found an explanation for this effect. According to him, elementary particles instantly interact at any distance, not because they exchange signals between themselves, but because at a deeper level of reality, such particles are not separate objects, but actually a hologram of the expansion of something more fundamental. At the same time, Bohm proposed to consider the holographic level of the world as one of the stages of the infinite evolution of the Universe.

The starting point for Bohm's articulation of what he means by a "new order in physics" is his notion of wholeness. Thus crucial for understanding the holomovement is his notion of how interconnected phenomena are woven together in an underlying unified fabric of physical law [1]. The next stage in the development of this idea is the book "The Holographic Universe" by Michael Talbot [2]. In this book, the entire material world does not have its own reality but is a projection of the deep level of the universe. The universe is a giant hologram, where even the tiniest part of the image carries information about the general picture of being and where everything is interconnected and interdependent. According to many modern scientists and thinkers, the holographic model of the universe is one of the most promising pictures of reality at our disposal today. The authors of the new theory of the emergence of the universe N. Anshordi, R. Mann and R. Purhasan suggested that our Universe could have been born as a result of the implosion (explosion inward) of a star from the four-dimensional predecessor of the universe [3]. Such an explosion could create a three-dimensional shell around a four-dimensional black hole, and thus the Universe is a hologram of the collapse of a four-dimensional star into a black hole. The singularity of the Big Bang is forever hidden from us by a three-dimensional horizon of events. " The proposed model solves the most important problems of cosmology: flatness and homogeneity. The flatness of our Universe is the result of the collapse of a very massive four-dimensional star. The larger the mass of the black hole, the larger flatness the tribranus will be.

And the homogeneity is explained by the fact that in the four-dimensional embracing Universe, long before the appearance of our Universe, temperature equilibrium was to be established. Balk should be smooth enough and could transfer this property to our three-dimensional Universe. Here I would like to recall the statement of I. Prigogine that the "thermal death" of the Universe according to Clausius does not threaten us since all the entropy was developed even before the Big Bang.

Scientists from the Center for Astrophysical Research in the Fermi Laboratory (Fermilab) are now working on creating a Holometer device. With the help of the Golometer device, experts hope to prove or disprove the insane assumption that the three-dimensional Universe, as we know it, simply does not exist, being nothing more than a kind of hologram. In other words, the surrounding reality is an illusion and nothing more. Until the illusory nature of our world is proven, scientists have hope to understand the laws of the universe. At the same time, the physical world should not be limited to the framework of the now prevailing scientific paradigm. With the adoption of a new paradigm in theoretical physics, in the center of which there will be a quantum vacuum (dark energy and dark matter) participating in all interactions in nature, up to scientists will open new time horizons, new symmetries and conservation laws inherent in open systems. Then the illusory nature of the universe will be forgotten until a new crisis in the knowledge of the physics of the universe.

The Duality of Time and The Separation of Space

In the agenda of modern fundamental theoretical physics with all sharpness, there is a problem of deriving classical space-time concepts from the concepts and laws of the physics of the micro world. Applying the theory of linear sets of measures, the professor I.N. Taganov proved

that, if the state of the physical processes are always measured with the ultimate uncertainty (Heisenberg uncertainty relation between the coordinates and momentum of a particle and the time and energy), that the moments of physical time can be represented by only complex numbers [5]. In 1955, M. Bunge introduced the complex time into the theory of electron [4]:

$$T = (t + i\tau) \quad (1)$$

Where,

t is the time of an electron live in an atom;

τ is the imaginary cyclic time , equal to an electron spin period ($\tau=h/4\pi mc^2$, $\tau = 10^{-21}$s.)

The geometrical image of the complex physical time can serve as a helix with variable pitch and diameter in a pseudo-three-dimensional space. The concept of the spiral of time in physics microcosm eliminates the problem of the spreading of the wave packet representing the micro particles with finite masses and dimensions. In the new interpretation of quantum mechanics, not the problem, "wave-particle duality" - with the free movement of individual micro particles in each moment of complex time the particle has a well-defined complex coordinates [6].

Regarding the understanding of the dual nature of the time, S. Hawking wrote: "There is such a need to understand what is imaginary time – just it is different from the time that we call reality." A more profound justification of the duality of time was given by the laureate of the Nobel Prize I.R. Prigogine in his book "Time, chaos, quantum". He wrote: "We need to go beyond the concept of time as a parameter describing the motion of individual systems. In harmonic oscillators (classical and quantum), the time is unambiguously connected to laws of motion, while in non-integrable systems it plays a dual role. If sustainable systems are associated with a notion of the deterministic symmetric time, then unstable chaotic systems are associated with a notion of the probabilistic time, implying a violation of symmetry between the past and the future." [7]. So, we can talk about the two-dimensionality of time, similar to the three-dimensional space. Duality the time can be a theoretical basis for the introduction to the physics concepts of the multilayer space, consisting of a base (the coordinate space) and layer (momentum space). First of all, it is a theoretical justification the separation of space Xm (Xn) when geometrization of dynamical systems. The basis of it is n-dimensional differentiable manifold Xn (a base- coordinate space), and layer-m-dimensional manifold (a layer - momentum space). In the formation of the concept of the "base" Of return to the initial state is decisive and allows you to describe the state of the system (classical and quantum oscillators) of the symmetric invariant equations, while the system is in a steady state. This system corresponds to the concept of the time horizon within which we can predict the state of the system, its development path, and then the initial state of the system cannot serve as a basis for prediction. Of the transition system to a new level, in which the system to become non-integrable, it is dominated by irreversible processes and she is losing time invariance property, corresponds to the concept of "layer". To describe the state of the system (classical and quantum oscillators) in the base can be used symmetrical, invariant equations, but in the layer to describe irreversible processes require a different mathematical apparatus [6].

Five-Dimensional Continuum (two Temporal Coordinates and three Spatial Coordinates) and its the Advantages over of The Minkowski's Flat Continuum

In the 20th century, many scientists including Albert Einstein undertook repeated unsuccessful efforts to unite gravitation and electromagnetism geometrically in the framework of four dimensions of Minkowski continuum, and only T. Kaluza has managed to do it, but in the five-dimensional formal world of four spatial dimensions and one-time dimension. In the 21st century, science faces the task of linking five types of interactions into a single theory: the fifth interaction added to the gravitational, electromagnetic, weak and strong interactions, due to the fifth force generated by the scalar field in a quantum vacuum (dark matter).

At the same time, geometrization in the unified theory of five types of interactions requires the introduction of additional dimensions. Consider the advantages of the five-dimensional continuum of Kalutza over the flat four-dimensional Minkowski continuum [8].

The fifth component of the particle velocity has the physical meaning of the ratio of the electric charge q to the mass m of the particle. The fifth equation of the geodesic line means a constant q / m ratio for the current state of the planets in the solar system (current time horizon). It is even true that the momentum of particles in the fifth coordinate is an electric charge [8].

Spatial and temporal diversity of different dimensions different properties introduced into these discrete transformations P-space conversion, the conversion time T and C charge conjugation.

The 5-dimensional manifold instead of the square of the 4-dimensional interval $ds^2 = g_{a\beta}\, dx^a dx^\beta$ should take $dI^2 = GAB\, dx^A\, dx^B$, where the indices A and B have the meanings: 0,1,2,3,5.

GAB values are components of the five-dimensional metric tensor. They form a square matrix having a generally 15 independent components:

$$GAB = \begin{matrix} G00 & G01 & G02 & G03 & G05 \\ G10 & G11 & G12 & G13 & G15 \\ G20 & G21 & G22 & G23 & G25 \\ G30 & G31 & G32 & G33 & G35 \\ G50 & G51 & G52 & G53 & G55 \end{matrix} \quad (2)$$

In the curved Riemannian space-time, operating with the components of five-dimensional metric tensor, one can obtain ten components of metric tensor of the Einstein's general theory of relativity, four components of electromagnetic vector potential $\bar{\mathbf{A}}$ of the Maxwell theory, and one component which theoretically can describe any new scalar field [8].The five-dimensional continuum proposed in the article, which includes two temporal coordinates and three spatial coordinates, absorbed all the advantages of the Kaluza five-dimensional world over the flat four-dimensional Minkowski continuum, revealed the connection of the macrocosm, including temporal representations, with microcosm, charge and mass of elementary particles, with the presence of the space environment (dark energy and dark matter), with the existence of vector and scalar fields. His predecessor can be considered the Eddington's Five-Dimensional Continuum (Uranoid), which includes, in addition to the four-dimensional continuum of Minkowski, the fifth time coordinate [9]. Eddington's Uranoid is the object under study environment (the entire universe is composed of elementary particles). It contains, in addition to the four dimensions of the continuum Minkovsky (x1, x2, x3, t), the fifth - time t0. "The E-frame provides a fifth direction perpendicular to the axes x1, x2, x3, t; and the position vector can be extended t0:

$$X = E15\, ix1 + E25\, ix2 + E35\, ix3 + E45\, t + E05\, t0, \quad (3)$$

where according to the reality conditions t0 should be real" [9].

Yu. Vladimirov in the monograph [8] clearly stated why the Kaluza theory did not become a working tool of physicists. It should be noted here that, although the Kaluza five-dimensional theory made significant progress in creating a unified theory of gravitational and electromagnetic interactions, it did not find sufficient support and understanding in scientific circles and was forgotten for a long time.

The same fate befell the Eddington's Fundamental Theory, but the reasons for this are largely subjective. The scientific elite still does not accept such concepts as "Uranoid" (in the sense of a quantum vacuum) and "arrow of time" (in the sense of the evolution of open systems) [6].

Consider the advantages of the five-dimensional continuum, which includes two dimensions of time and three dimensions of space in front of the five-dimensional continuum of Kalutza, which includes one dimension of time and four spatial dimensions. First, in the five-dimensional Kaluza theory, even the author himself was not clear about the physical meaning of the fifth coordinate.

Here are the final words from Kaluza's article: "It's still hard to come to terms with the idea that all these relationships, which can hardly be surpassed by the degree of formal unity achieved in them, are just a capricious game of deceptive randomness. But if it is possible to show that behind the assumed interconnections there is something more than an empty formalism, then this will be a new triumph for Einstein's general theory of relativity "[10].

We managed to show that the fifth coordinate (pseudo-spatial fourth in Kaluza) is the time of the system evolution (t), divided into sections - time horizons (T). The time of the horizon is the time during which we can predict the behavior of the system, its development trajectory, and further then the initial state of the system can no longer serve as a basis for prediction. The fifth dimension has a special status. It does not allow the Universe to be inscribed in the Procrustean bed of symmetric, invariant solutions of Einstein's theory. The proposal of Einstein and Bergman to improve the Kaluza theory, to close the fifth dimension and to represent the world cyclic, closed or compactified by the fifth coordinate leads to the wrong law of decreasing gravitational forces in the five-dimensional world [11]. But if we allow the fifth coordinate to be singled out (in particular, the metrics are independent of the fifth coordinate), then the

same 5-dimensional solutions of the Einstein equations yield a different solution, resulting in $F_r \sim 1/r^2$ and not contradicting the experiment [8].

Secondly, why are the manifestations of the additional dimension so limited, that is, why the fifth dimension remains practically unobservable? In the Kaluza theory, there is no answer to this question, although in it all electromagnetic phenomena can be interpreted as manifestations of the fifth dimension.

The condition of cylindricality in the fifth dimension, necessary for obtaining the tensor of the electromagnetic field strength, was achieved in the five-dimensional Kaluza theory by postulating the independence of all geometrical quantities from the fifth coordinate.

In later interpretations of the Kaluza theory, the dependence of quantities on the fifth coordinate is allowed, but the period of cyclic dependence is extremely small $T=10^{-}31s$ and practically does not appear in the formulas used. The reason for the non-observability of the fifth dimension is explained by the property of the cyclical nature of the world in the fifth coordinate with a very small period. But all these explanations are suitable for the world closed in the fifth coordinate [8]. However, the author of the evolutionary paradigm of the Universe, the laureate of the Nobel Prize I.R. Prigogine established that "isolated, closed systems evolve to chaos, and open systems evolve to ever higher forms of complexity." [7]. Thus, closing the fifth coordinate of Einstein dooms the Universe to degradation. From our positions in the above explanations, there was a substitution of concepts. The Minkowski cyclic, invariant time replaced the evolutionary, non-invariant time of the fifth coordinate. We will return spatial and temporal measurements to our places and try to answer the second question, based on our five-dimensional continuum. The independence of values from the fifth coordinate is possible only on time intervals T, forming time horizons. In these areas, the system is in a stationary, equilibrium state, it is integrable, all its main parameters retain their values and time is cyclical and invariant. A completely different picture is observed at the boundaries of time horizons.

There, the system moves to a qualitatively new evolutionary level, while the system is in a non-equilibrium, non-stationary state, it is non-integrable, irreversible processes prevail in it, it searches for a new equilibrium state to which the new values of the basic parameters will correspond. It is at the junctions of the time horizons that the dependence of the continuum values on the fifth coordinate should be expected. In this case, time loses the invariance property and becomes probabilistic, that is, the system can either develop further in a new capacity or cease to exist. The energy needed by the system for evolutionary transformations, it receives from the outside from the cosmic environment of the Universe (dark energy and dark matter) [6].

ENERGY AND THE INFORMATION

In the traditional physical description of the universe, the major factor is energy.

However, it has recently become clear that information is just as important. Information sets the form that a substance takes and determines the transformations to which energy is subjected. Dark energy and dark matter create the observed density of matter in the Universe $\rho v = (0.721 \pm 0.025) \cdot 10^{-29}$ g /cm³ and connects all objects of the Universe in one information field [12]. In the infinite universe, energy and information are equal partners [13].

Ultimately, information and energy complement each other: energy causes physical systems to change, and information indicates in which direction changes will occur. Each molecule, atom, and elementary particle, and even more macroscopic objects, are capable of storing information. The acts of the interaction of objects with each other and with energy fields of any nature can be described as elementary logical operations in which quantum bits change their values - elementary units of quantum information. The paradoxical but promising approach of Seth Lloyd makes it possible to elegantly solve the problem of the constant complication of the universe [13].

The universe is constantly processing information - being a huge quantum computer, it always calculates its own future. The universe is the biggest thing there is and the bit is the smallest possible chunk of information. The universe is made of bits. Every molecule, atom, and elementary particle registers bits of information. Every interaction between those pieces of the universe processes that information by altering those bits. That is, the universe computes, and because the universe is governed by the laws of quantum mechanics, it computes in an intrinsically quantum-mechanical fashion; its bits are quantum bits. The history of the

universe is, in effect, a huge and ongoing quantum computation.

It is only in the last years, however, with the discovery and development of quantum computers, that scientists have gained a fundamental understanding of just how that information is registered and processed.

Building on recent breakthroughs in quantum computation, the professor Seth Lloyd shows how the universe itself is a giant computer and that further progress in understanding physics can be achieved by considering entropy as an informational, rather than a thermodynamic phenomenon [13]. Every atom and elementary particle stores these bits, and every collision between those atoms and particles flip the bits into a new arrangement and effortlessly spins out beautiful and complex systems, including galaxies, planets, and life itself. The quantum computational model of the universe explains a variety of observed phenomena not encompassed by the ordinary law of physics. In particular, the model shows that the universe automatically gives rise to a mix of randomness and order, and to both simple and complex systems.

The ability of the universe to calculate explains one of the greatest mysteries of nature: how from very simple laws of physics arise complex systems, such as living beings. These laws make it possible to predict the future, but only as a probability, and only in general terms. The quantum-computational nature of the universe is such that the specific details of the future always remain unpredictable. Quantum technologies - technologies of controlling matter at the atomic level - have received remarkable development in recent years.

Now we have fairly stable lasers, fairly accurate production methods, and fast electronics - all this allows us to perform calculations at the atomic level.

To realize any physical system from the point of view of its bits, it is necessary to understand well the mechanism by which each element of this system records and processes information. And then the question arises whether it is legitimate to assume that Seth Lloyd's quantum technologies, by means of which he records and processes information in a quantum computer, similar to the mechanism by which the Universe performs these operations in nature. In his book "Time, chaos, quantum", Nobel Prize laureate Ilya Prigogine revealed the mechanism by which matter is born in the Universe and how energy is associated with matter and information in the large-scale Poincare's systems (LSP) [7].

Resonances and the Birth of Matter in the Large-Scale Poincare's Systems

The quantum vacuum is a global field of oscillators' super-positions with the continuum of frequencies. In contrast to the field, a particle oscillates with the same fixed frequency. In front of us, there is an example of the non-integrable Poincare system. Resonances will occur whenever the frequency of the field and the particle are will coincide. The evolution of dynamical systems (the particles) up to the self-organized matter depends on available resonances between degrees of freedom. This was a conclusion by I. Prigogine and I. Stenger in their monograph the "Time, Chaos, Quantum" [7]. They revived an idea by N. Tesla on a theory of global resonance.

Nevertheless, if the Tesla's resonance theory of the matter birth in the ether had been based on an intuition of the ingenious experimenter, then in case of I. Prigogine, this theory acquired rigorous mathematical view. Proved by Poincare the non-integrable dynamical systems and the theory of resonant trajectories by Kolmogorov-Arnold-Moser allowed Prigogine to conclude that the mechanism of resonance interaction of particles in large-scale Poincare systems (LPS) was "essentially" mandatory and not probabilistic. With increasing communication parameters, there is an increase in the likelihood of resonance outcomes. It is such LPS dynamic systems, to which systems of particle interaction with the space environment and with each other belong. Nobel Prize winner I. Prigogine wrote, "If the systems are independent, then for coherence and self-actualization, there would be simply no place as all dynamic movements would essentially be isomorphic movements of free (non-interacting) particles. Fortunately, the LPS in nature prevail over other systems." [7]. Einstein's universe is a closed universe with constant entropy since in such a universe there are no irreversible processes. For a description of the birth of matter in Einstein's general relativity is necessary to be considered variations in the density of matter due to the production of particles. This leads to disruption in time symmetry. Prigogine proposed to add the number of variables included in the standard model (the pressure P, the mass-energy density σ and the radius of the universe R (t)) an additional variable n - the density of the particles and an additional equation, which

would tie the Hubble function of radius of the universe R (t) and the birth of particles n. In the case of the universe, consisting of particles of the same type of mass M, when the mass-energy density is simply equal to σ, and the pressure P - vanishes, Prigogine offers a simple equation that takes into account the creation of particles:

$$\alpha H^2 = \frac{1}{R^2}\frac{\partial nR^3}{\partial t} \quad (4)$$

where α - kinetic constant equal to zero or positive.

In this equation (4), the value of α and H are positive since we are talking only about the birth (and not destruction) of the particles. In Minkowski's space, where H = 0, the production of particles cannot be (equation Hψ = 0 equation is often called the Wheeler - DeWitt Equation). Furthermore, in Einstein's Universe the total number nR^3 constant irrespective H values, α = 0 [7]. Further, considering how the birth of the particles leads to a modification of Einstein's equations of GTR in terms of the first and second laws of thermodynamics, we have an entropy production proportional to the rate of particle production [7]. In the modern physics, it is generally accepted that the structural function of particles (and even the wave function of the universe in the Schrödinger's equation) can be represented either as a function of time (temporal representation) or as a function of the amplitude of harmonic frequency components (spectral representation). However, these representations are equivalent only for invariant processes, when time is uniquely associated with cyclic motion.

When describing non-invariant, irreversible processes that go beyond the time horizon and are associated with the birth or disappearance of particles, the use of a temporal representation would be an error. In this case, an adequate description of the processes gives only a spectral representation [6, 14].

CONCLUSION

Epistemological optimism as a philosophical doctrine, asserting the possibility of an absolutely complete, exhaustive knowledge of the world, is the opposite of agnosticism as a philosophical doctrine that denies the possibility of knowing the objective world and its laws. Physicists in their work are guided by skepticism, as a philosophical position, raising doubts as the basic principle of theoretical thinking, in particular, doubts about the attainability of absolutely reliable and true knowledge of reality.

Skepticism and relativism have played a positive role in science by calling into question everything that has no rational justification. Doubt and criticism were aimed at overcoming dogmatism, absolutization of truths.

However, extreme skepticism that prevails today in theoretical physics is connected with agnosticism. The reason for this is the crisis of the scientific paradigm that prevails today in physics. Neither the standard cosmological model of ΛCDM (Λ- Cold Dark Matter) nor the Standard model of SM interactions of elementary particles can adequately explain the irreversible processes of the evolution of the Universe.

The reason for this is the general theoretical base chosen for both standard models. Researchers need a new strategy, it is necessary to step over the prohibitions and dogmas of Einstein's Special and General Relativity and the outdated Bohr principle of "complementarity", which prohibits even thinking about the internal structure of an elementary particle [14]. SM does not have theoretically proved algorithm for spectrum mass computation and no ideas how to do it! More worse that SM contains from 20 to 60 adjust in arbitrary! - Parameters (there are different versions of SM). All these bear strong resemblance to the situation with Ptolemaic models of Solar system before appearance of Kepler`s laws and Newton s mechanics.

These earth-centered models of the planets movement in Solar system had required at first introduction of so called epicycles specially selected for the coordination of theoretical forecasts and observations. Modern quantum theories such the Leo Sapogin's Unitary Quantum Theory (UQT) [15] or the Yuri Baurov's Theory of the Byuon (TB) [12] competing with it reject the Bohr's antiquated complementarity principle and give an idea of the internal structure of an elementary particle.

Such an approach allowed these theories to propose new algorithms for calculating the mass spectrum of elementary particles and theoretically calculate the value of the masses of all elementary particles, both discovered experimentally and so predicted in the future. The model of the open Universe proposed in the article leaves no room for illusions.

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