International Journal of Advanced Research in Physical Science (IJARPS)
Volume 8, Issue 1, 2021, PP 20-25
ISSN No. (Online) 2349-7882
www.arcjournals.org

11-Dimensional Continuum and Hidden Measurements

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Abstract: *The article is an answer to the question of Clifford Johnson and Brian Green: "Does M-string theory describe the real Universe?" and to the call of Professor Lee Smolin to find a way to unfreeze time - to imagine time without turning it into space. Only time, represented by two-component numbers and, in particular, by complex numbers, allows us to describe reality in its dynamics. Based on the mathematical apparatus of modern projective geometry, the article proposes to combine the coordinate space and the space of impulses into a single geometric structure, considering them within the framework of an 11-dimensional continuum. Assessing the prospects of recent gravitational-space experiments and experiments related to the search for hidden dimensions, it can be argued that within the framework of the standard cosmological model and Einstein's invariant equations of general relativity, it is fundamentally impossible to detect gravitational perturbations and hidden measurements.*

Keywords: *M-theory, imaginary time, real time, stratified space, base, layer, stationary systems, invariant processes.*

PACS Number: *01.10.Fv, 95.36. + X, 97.60.Bw, 98.80.Es*

1. Introduction

My article is a response to numerous mathematical tests for constructing a discrete model of the world: the Akhmavaar r-model, the geometry of the causal sets by Raphael Sorkin, the quaternionic geometry of A.P. Efremov, the Penrose twistor program for an alternative description of the Minkowski space, which emphasizes the rays of light, not points space - time. The elementary spinor structure of matter (elementary particles) was in the focus of attention of the Penrose twistor program [1] and the relational theory of binary geometrophysics by Yu.S.Vladimirov [2]. However, in the theories of the authors, the axioms of systems of relations are postulated, which indicates the a priori incompleteness of the theory, and physical processes are considered from the point of view of an observer. The incompleteness of the theory may be the result of a subjective approach and the absence of experimentally substantiated physical data. Numerous versions of string theory are also at an impasse, primarily because they are based on Einstein's SRT and GRT. String theory is a complex mathematical apparatus. In 1995, during the second superstring revolution, Edward Witten proposed M-theory that combined all five different types of string theory [3]. This is an 11-dimensional theory that includes supergravity. As Clifford Johnson and Brian Greene pointed out in an interview for Naked Science it's hard to say that this theory actually describes reality. But even if it turns out that it has nothing to do with reality, then it will definitely be an important step towards something bigger - towards a theory that describes the Universe more accurately and more elegantly than anything we knew before. Let me disagree with this statement. Even the fact that M-theory includes gravity, which was originally based only on gauge theory, does not make it more reliable. M-theory lacks exact equations of motion, but in 1996 Tom Banks of Rutgers University and his colleagues proposed a description of it as a "matrix theory" whose basic variables are matrices. Compactifying this 11-dimensional theory to four changes, that is, "folding" additional dimensions to obtain a four-dimensional Minkowski continuum, proved to be difficult. In the M-theory it is assumed that we are talking about dimensions of the order of 10^{-33} centimeters, which, in turn, in no way can be registered with modern equipment. Although compactification of measurements with Calabi-Yau manifolds helps to avoid some of the complications of matrix theory, the number of manifolds discovered, as one of the string theorists Brian Greene recently noted, has already increased to 10500. Moreover, M-theory is based on imaginary frozen time. Lee Smolin, an American theoretical physicist and associate professor of physics at the University of Waterloo, writes: "We must find a way to unfreeze time - to imagine time without turning it into space. I have no idea how to do this. I cannot imagine mathematics that cannot imagine the world as if it were frozen in eternity "[4]. Stephen Hawking suggested introducing the imaginary time $\tau = ict$ into the metric of general relativity. If in Euclidean space the metric has the form $ds^2 = dx^2 + dy^2 + dz^2$, then in general relativity the metric has the form $ds^2 = c^2dt^2- (dx^2 + dy^2 + dz^2)$ and Hawking's imaginary time c^2dt^2 goes into $-d^2\tau$ [5]. At the same time, the differences between time and space disappear in the interval ds^2 of the GRT metric. This is frozen time. On the basis of the mathematical apparatus of modern projective geometry, the report proposes to combine the coordinate space and the space of impulses into a single geometric construction, considering them within the framework of a five-dimensional continuum (two time coordinates and three spatial coordinates). Complex time, consisting of imaginary cyclic time and real cosmological time in a space consisting of a base and a layer, offers the researcher a way to overcome the stationary approach of symmetric invariant equations of SRT and GRT of Einstein in describing reality and propose a new mathematical apparatus for describing evolutionary processes in the Universe, starting from the birth of particles to the evolution of stars and galaxies [6]. Using the theory of linear sets, Professor of St. Petersburg University I.N. Taganov proved that if the state of physical processes is always measured with a finite uncertainty of the Heisenberg uncertainty relations between the coordinates and momentum of a particle and the time and energy of particles in the microworld, then the moments of physical time can be represented only by two-component numbers, in particular, complex numbers. A spiral with a variable step and diameter in a pseudo-Euclidean three-dimensional space with the signature (–1, 1, 1) can serve as a geometrical image of complex physical time [7].

2. 11-Dimensional Continuum and Hidden Measurements

The discovery of the quantum vacuum (dark matter and dark energy) as a galactic and intergalactic medium, which, according to observations by the Planck Space Observatory published in March 2013, accounts for 95% of the total energy mass of the observed Universe (the remaining 5% is accounted for by ordinary baryonic matter), allows declare that it is the quantum vacuum that determines the geometry of space - time [8]. How are the geometric properties of space and time related to physical interactions and the material environment? After all, I. Kant connected the three-dimensionality of space with the law of decreasing forces inversely proportional to the square of the distance. If particles and charges interacted according to the directly proportional law $F = k \times R$ (Hooke's law), then space would turn, according to Kant, into straight lines diverging from the observer to infinity. Such a space would no longer have continuity, but would be discrete. The discovery of the accelerated expansion of the Universe, made on the basis of the results of astronomical observations carried out by a group of researchers in 2000-2010. with the Habble Space Telescope (HST), has sparked a huge amount of theoretical research. However, the 2011 Nobel Prize winner Brian Schmidt in his article "Accelerated expansion of the Universe from observations of distant supernovae", was forced to state: "The discovery of the accelerated expansion of the Universe has caused a huge amount of theoretical research. Unfortunately, a clear breakthrough in our understanding of this problem has not yet happened - the cosmological acceleration remains as mysterious as in 1998. Future experiments will more accurately test the agreement of the flat ΛCDM model with observational data. It is possible that a disagreement will arise that rejects the cosmological constant as the cause of the accelerated expansion, and theoretically it will be necessary to explain this fundamental result. We will have to wait for a theoretical insight that will reinterpret the standard cosmological model, perhaps with the help of information obtained from a completely unexpected source." [9]. In 1917, Albert Einstein introduced the cosmological constant, a dimensionless constant, into the equations of general relativity to counter the forces of gravity in the universe. The cosmological constant, a physical constant characterizing the properties of the vacuum, was introduced by Einstein so that the equations of general relativity admit a spatially homogeneous static solution as a counteraction to gravitational attraction, which can lead to the collapse of the Universe, in which all matter will gather at one point. Thus, the cosmological constant should perform the function of antigravity (repulsion) [10]. The interpretation of the cosmological expansion of the Universe in the spirit of the concept of an anti-gravitating medium (dark energy) with constant density was taken as the basis for the standard cosmological model (Λ-Cold Dark Matter). Cosmological antigravity in the model is described by the linear dependence of the force on distance:

$$F = (c^2/3) \times \Lambda \times R, \quad (1)$$

where Λ is Einstein's cosmological constant and R is the distance.

In the modern extended model of the Universe, which includes the quantum vacuum (dark energy and dark matter), Einstein's cosmological constant (Λ) can characterize the elastic properties of dark energy and play the role of the elasticity coefficient in Hooke's law. Obeying this law, according to Kant, cosmological time is linear and discrete, this is Eddington's so-called "arrow of time", describing the real processes of evolution of each object in the Universe individually, for the entire period of time from its birth to its disappearance. Moreover, time is two-dimensional. The duality of time was noted by the Nobel Prize laureate I.R.Prigozhin in his book "Time, Chaos, Quantum". He wrote: "We need to go beyond the concept of time as a parameter describing the movement of individual systems. In harmonic oscillators (classical and quantum), time is uniquely related to the laws of motion, but in non-integrable systems, time plays a dual role. If stable stationary systems are associated with the concept of deterministic cyclical time, then for unstable, developing systems the concept of probabilistic vector time is applicable "[11]. This means that the system can further develop at a new level or disappear. This reveals the discreteness of time. On the basis of the mathematical apparatus of modern projective geometry, scientists come to new, more general conservation laws inherent in the physics of open systems [12]. In addition, in the five-dimensional continuum, the synchronous interdependence of changes in the state of the system (body) is provided when describing its motion in an impulse representation with a description of its motion in a coordinate representation. First of all, this is a theoretical justification of a space with bundles Xm (Xn) for geometrization of dynamical systems. The basis of the presentation of a layered space: the base is a -dimensional differentiable manifold Xn (space of base coordinates), and a layer is an m-dimensional manifold (a layer is an impulse space). The return of the system to its initial state is of decisive importance in the formation of the concept of "base" and allows one to describe the behavior of the system (classical and quantum oscillators) with the help of Einstein's symmetric invariant equations of general relativity. This state of the system corresponds to the concept of a time horizon, during which we can predict the behavior of the system, the path of its development. The transition of the system to a qualitatively new level, at which the system becomes non-integrable, irreversible processes prevail in it, and time loses the property of invariance, and its behavior is probabilistic, the vector character corresponds to the concept of "layer" [13]. If we are guided by the concept of a layered space consisting of a base and a layer, then we can assume that the flat four-dimensional world of Minkowski - Einstein describes a "base" in which symmetric and invariant equations dominate and the system is in a stationary, integrable state. The imaginary part of complex time - cyclical time - corresponds to this state. The proposed five-dimensional continuum, which includes two time coordinates and three spatial coordinates, has incorporated all the advantages of the five-dimensional world of Kaluza over the flat four-dimensional Minkowski continuum. Its predecessor can be considered the five-dimensional Eddington continuum (Uranoid), which includes, in addition to the four-dimensional Minkowski continuum, the fifth time coordinate [14]. Eddington's uranoid is the medium under study (the entire universe, consisting of elementary particles). It contains, in addition to four dimensions of the Minkowski continuum (x1, x2, x3, t), the fifth dimension - time t0. Eddington writes: "The E-frame provides a fifth direction perpendicular to the x1, x2, x3, t axes; and the position vector can be extended t0:

$$X = E15\ ix1 + E25\ ix2 + E35\ ix3 + E45\ t + E05\ t0, \quad (2)$$

where according to the reality conditions t0 should be real" [14].

Consider the benefits of a fifth-dimensional continuum, which includes two dimensions of time and three dimensions of space, over a fifth-dimensional continuum of Kalutza, which includes one dimension of time and three dimensions, as well as one pseudo-space. Here I will allow myself to supplement the comprehensive analysis of the five-dimensional theory of Kalutza, given by Moscow State University professor Yuri Vladimirov, in his monograph "Space - time: explicit and hidden dimensions" [2], from the standpoint of a new five-dimensional continuum, which includes two dimensions of time and three dimensions space. In the 20th century, many scientists, including Albert Einstein, made repeated unsuccessful attempts to geometrically combine gravity and electromagnetism within the four dimensions of the Minkowski continuum. T.Kalutsa managed to do this, but in the five-dimensional formal world of four spatial dimensions and one time. In this case, 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, where the size coefficient includes G - the Newtonian gravitational constant. The fifth equation of the geodesic line means the constancy of the q / m ratios for the current state of the planets in the solar system (the current time horizon). It is even true that the particle momentum along the fifth coordinate has the meaning of an electric charge (up to the dimensional constant $c / 2\sqrt{G}$) [2].

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

G00 G01 G02 G03 G05

G10 G11 G12 G13 G15

GAB = G20 G21 G22 G23 G25 (3)

G30 G31 G32 G33 G35

G50 G51 G52 G53 G55

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 hypothetical dark matter particle X-boson [13].

However, despite all the successes of Kaluza's theory, it remained unclaimed for a long time. What is the reason for this:

First, in Kaluza's five-dimensional theory, even the author himself did not understand the physical meaning of the fifth coordinate. Here are the closing words from Kaluza's article: "It is still difficult to come to terms with the idea that all these relationships, which can hardly be surpassed by the degree of formal unity they have achieved, are just a capricious game of deceptive randomness. But if it can be shown that there is more than an empty formalism behind the supposed interrelationships, then this will become a new triumph of Einstein's general theory of relativity "[15]. We managed to show that the fifth coordinate (pseudo-spatial fourth for Kalutz) is the time of evolution of the system (t), divided into segments - time horizons (T). Horizon time is the time during which we can predict the behavior of the system, the trajectory of its development, and then the initial state of the system can no longer serve as a basis for forecasting. The fifth dimension has a special status. It does not allow inscribing the Universe into the Procrustean bed of symmetric invariant solutions of Einstein's theory. The proposal of Einstein and Bergman to improve Kaluza's theory, to close the fifth dimension and represent the world as cyclic, closed or compactified in the fifth coordinate, leads to the wrong law of decreasing gravitational forces in the five-dimensional world [16]. But if we allow to select the fifth coordinate (in particular, the metrics do not depend on the fifth coordinate), then the same 5-dimensional solutions of Einstein's equations give a different solution, as a result of which $F_r \sim 1 / r^2$, which does not contradict the experiment [2].

Second, why are the manifestations of the extra dimension so limited, that is, why is the fifth dimension practically unobservable? In Kaluza's 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 cylindricity in the fifth dimension, which is necessary to obtain the tensor of the electromagnetic field strength, was achieved in the five-dimensional Kaluza theory by postulating the independence of all geometric quantities from the fifth coordinate. From our point of view, there was a substitution of concepts in Kaluci's theory. Cyclic invariant time of Minkowski replaced evolutionary non-invariant time of the fifth coordinate. We will return spatial and temporal dimensions to their respective places and try to answer the second question based on our 5D continuum. The independence of the 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 - this is the base. A completely different picture is observed at the boundaries of time horizons. There the system moves to a qualitatively new evolutionary level, it is in a nonequilibrium, non-stationary state, it is non-integrable, irreversible processes prevail in it, it is looking for a new equilibrium state, which will correspond to new values of the main parameters - this is a layer. It is at the junctions of time horizons that the dependence of the values of the continuum on the fifth coordinate should be expected. In this case, time loses the property of invariance and becomes probabilistic, that is, the system can either develop further in a new quality, or cease to exist. It receives the energy necessary for the system for evolutionary transformations from the cosmic environment of the Universe (dark energy and dark matter). Further development of the pseudo-Euclidean three-dimensional space may lie in the way of taking into account the variety of processes associated with the rotation of bodies. First of all, because Newton's geometry is Euclid's geometry, it is Cartesian rectangular coordinates. In order to take into account the rotational effects, it was required to connect the Cartesian coordinate system with the six angular coordinates of Euler. This was done by Gennady Shipov in his theory of “Physical vacuum” [17]. It turned out that within the framework of the 11-dimensional geometry, it is possible to explain the experiments in the course of which the law of conservation of energy in open systems is violated.

3. Conclusion

The mathematical abstraction of the modern M-theory of Professor Edward Witten, which combined all five different types of string theory, although it allows you to extract a large number of mathematical varieties (their number has already increased to 10500), which make it possible to build a physical theory based on fundamental relations, cannot replace physical reality comprehended in natural phenomena and experiments. The incompleteness of the theory may be the result of a subjective approach and the absence of experimentally substantiated physical data. On the contrary, the 11-dimensional theory proposed in the article, based on a five-dimensional continuum, including three spatial coordinates of Euclidean geometry, two coordinates of time and six angular coordinates of Euler, is based not on the game of pure reason, but on the latest achievements of experimental physics, non-geometric gravity and dark matter. Researchers of the nature of gravitational forces can be conditionally divided into two groups - those who continue to search in line with the geometric approach that underlies the general theory of relativity and those who refuse to link the gravitational field with the geometry of space-time and develop the field concept of gravity. Today it is no longer possible to hush up the fact that in nonequilibrium systems and irreversible processes there is a violation of the principle of equivalence, and hence the geometric meaning of Einstein's general relativity [18]. The observations of astrophysicist Vivek Venkatraman Krishnan on January 30, 2020 buried the results of the Michelson-Morley experiments, and with them Einstein's gravitational theory of relativity [19]. It is safe to say that the cosmic fabric of space-time is made of the same material as the clothes of the naked king in the tale of the Danish writer Hans Christian Andersen “The new costume of the king” [19]. It's time for Clifford Johnson and Brian Green to evaluate M-theory in terms of modern experimental cosmology.

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Citation: *S.I.Konstantinov (2021). 11-Dimensional Continuum and Hidden Measurements. International Journal of Advanced Research in Physical Science (IJARPS) 8(1), pp.20-25, 2020.*