Some features of physical systems without time and dynamics

A.N. Smirnov

andreysxxxx@gmail.com

Annotation

Physical systems without time and dynamics have been considered. The principle of how to construct spacetime in a physical system without time and dynamics has been proposed. It has been found what can be objects in such a spacetime, and what can be an interaction between such objects. Within the framework of the considered class of systems, answers to the following problems of philosophy and physics have been found: the nature of consciousness and the connection of body and consciousness (mind-body problem), the nature of time, the anthropic principle and the problem of fine-tuning the universe, the effectiveness of mathematics in describing physical phenomena, the limits of knowledge. There are a number of indications that our Universe is not based on one of the systems of the class considered. The considered class of systems makes it possible to find answers to questions that cannot be answered for our Universe. This shows that it is fundamentally possible to find answers to these questions for our Universe as well.

Introduction

A large number of different physical systems have been considered in physics and philosophy. However, there is a whole class of systems that has never been considered before. These are physical systems without time and dynamics. Within the framework of this work, a number of interesting properties for philosophy that such systems possess are considered.

We will define the class of systems under consideration and the concept of a physical system later, first we describe this class of systems.

There should be no time and dynamics in these systems. By dynamics we mean the change of something. The absence of dynamics in the system means that nothing can change in the system. The absence of dynamics leads to the impossibility of obtaining macroscopic time as some emergent phenomenon based on dynamics at the micro level, as is done in some theories.

Space is needed. Although some of the features that we will get later are also true for a space without a metric, most of the features relate to systems with a manifold. Therefore, there must be an n-dimensional manifold in the system. The number of dimensions does not affect the features under consideration, if there are at least two of these dimensions. This will be shown when describing the principle of how time is derived from a system without time. Since we consider systems without time and dynamics, we consider an n-dimensional manifold without temporal dimensions, only with spatial dimensions.

So far, an empty space has turned out, in which there is nothing. We need to add something there. We add fields there. Each field must be defined at every point in the system space. Let the value of the field at each point be determined by the values of the field at neighboring points. Or, otherwise, the field is described by a partial differential equation. It does not matter what features each of the fields has, what kind of equation is described, we consider arbitrary fields.

We emphasize once again that we consider fields on a manifold without time and without dynamics. Any field, at each point on the manifold, has some value and cannot change. There is no time, time cannot be a parameter in the equation describing the field. The field cannot change, otherwise there would be changes, and hence the dynamics. Partial derivatives in equations describing fields can contain only derivatives in spatial coordinates. In the equations describing the fields, there can be no partial derivatives in time, because the manifold in the class of physical systems under consideration does not have a temporal dimension.

Next, in order to simplify, we will consider a system with a single field. Later, we will show that systems with many fields have the same features as systems with one field.

So, we get a physical system consisting of an n-dimensional manifold, without time and dynamics, at each point of which a field is defined, described by a partial differential equation.

It is important to note that the system does not contain anything other than the described, and there is nothing external to the system.

Suppose there is an observer external to the system in question. Time and dynamics are necessary for the existence of an observer. Then, there must be something external to the system in question, and there must be time and dynamics. Then this means that, in fact, the system in question is just a static part of some other system where time and dynamics exist. In this case, it is impossible to say that this system does not contain time and dynamics. Hence, an observer external to the system cannot exist.

Suppose the system is part of some other system. We have already found out that if something external to the system contains time and dynamics, it means that the system also contains time and dynamics. Therefore, the external system should also not contain time and dynamics. If the external system does not contain time and dynamics, then we combine these systems, we get one system without time and dynamics. And we are considering it. The resulting system may have different fields defined in different parts of space, the equations describing the fields may differ somewhere, the properties of the space may differ somewhere, but this does not affect the properties of the system considered in this paper. Therefore, we believe that the system in question cannot be part of some other system. The absence of an external system means that nothing external to the system in question exists.

The absence of an external observer, the absence of anything external, means that any universes can only be internal to this system, they cannot be external to it.

The concept of a physical system is usually used somewhat differently than in this work. This work examines what, as the study of literature shows, has never been studied before. Therefore, there are no ready-made established terms. The physical system in this work is an n–dimensional manifold, without time and dynamics, without temporal dimensions, at each point of which one or more fields are defined, described by partial differential equations, and having nothing external. The class of systems under consideration is all possible systems satisfying this definition. We assume that some of these systems objectively exist, despite all the difficulties of applying the concept of existence to where there is no time and no changes. The word “physical” in a physical system is used to emphasize the supposed objective existence of such a system. The concept of a physical system used is quite close to the concept of the universe, but there are a number of fundamental differences. When we talk about the universe, we usually mean something that contains spacetime and fields, and does not interact with anything else. There is no time in the class of systems under consideration, therefore it is impossible to identify the universe with the concept of a physical system used. In such systems, there cannot be an observer observing such a system, unlike universes. However, a way will be proposed how to construct time in such a system and get an observer. If this method works, then the universes are internal objects in relation to the physical systems under consideration. The term multiverse cannot be considered as an analogue to the definition of a physical system used, since it is a certain set of universes, each of which has spacetime. Perhaps, instead of the term “physical system”, it would be more correct to use the term metaverse to emphasize that something more fundamental than the universe is being considered.

Further, for brevity, a system means a physical system that satisfies the above definition.

We note as well that this paper does not aim to develop a physical theory for describing systems of the described class. The purpose of the work is to consider individual features of these systems that are interesting for philosophy.

Since we observe the flow of time, we see the dynamics, then a way will be proposed how an observer, the observed time and dynamics appear in such a model.

The class of systems under consideration is described, and we can proceed to consider those features that may be of interest to philosophy.

Further, unless otherwise indicated, we consider a system without time and dynamics, with an n-dimensional manifold without temporal dimensions, and a field defined on this manifold.

1. Basic features

The concept of existence is one of the most profound concepts of philosophy.

Let's take a field in the system. Is it possible to say that it exists? Existence usually implies existence in time. But there is no time here. The field does not change, but it cannot be said that it is eternal and unchangeable, because eternity implies time.

Here we come to the conclusion that the field has some kind of specific existence, different from what we usually mean by existence. The same can be said about the existence of the system as a whole.

The principle of causality is one of the most fundamental principles of physics. It connects causes and effects. The principle of causality states that one event can affect another event if some additional condition related to time is met. An event is something that happens in time and space. There is no time in the system. Then, there can be no events. It turns out that the principle of causality cannot exist without time. As a result, the principle of causality is not applicable to the system.

Later, after finding out how to add an observer to the system, we will return to discussing the issues of existence and the principle of causality.

2. Some features of time

We consider a system without time and dynamics. The system is completely deterministic, due to lack of time. In order to find a method for finding time in it, let's look at some features of time.

Considering the equations of physics, we can conclude that time for a deterministic system is a parameter describing the future state of the system based on the current state [1, 2].

There is a state at some point in time. To find the state at some subsequent point in time, we apply some operator to the state of the system, and get the desired state. Let the state of some system at time t be described by a set Φ consisting of various states. Then the state Φ at time $t + \Delta t$:

$$\Phi(t+\Delta t) = A\Phi(t) \qquad (1)$$

where A is some operator.

A more formal definition can be found in the relevant literature [3].

Note that if equation 1 is performed, then the causality principle is performed as well. States, events that were at a previous point in time, affect events at subsequent points in time.

3. Time and dynamics

We consider a system without time and dynamics.

We need to find time and dynamics in a system that does not have time and dynamics as fundamental phenomena. We feel the passage of time. We see changes. Therefore, in order to try to use a model without time and dynamics, it is necessary to find time in the model.

Since the system has no time and dynamics, it does not allow the use of time as a fundamental phenomenon. We usually think of time as some fundamental phenomenon. In a model without time and dynamics, time cannot be a fundamental phenomenon. So the time must be derived from something else.

In physics, time is a parameter of change for equations. If you output something as a change parameter, it can be considered time, if some additional conditions are met. Let's call such a parameter emergent time to distinguish it from time as a fundamental phenomenon. The changes are mentioned above. But in a system without time and dynamics, changes are impossible. So, it is necessary to find something that can be used as a substitute for changes.

For example, consider the following system: a two-dimensional plane with a field defined on the plane $f\ (x, y)\ =\ x\ +\ y$. Obviously, there is neither time nor dynamics in such a system.

Let's look at how to transform space (x, y) into spacetime (z, t), where z is the spatial coordinate, t is time, and where equation 1 is performed.

Let's take some line. For example, consider a vertical line satisfying the equation $x = 2$. This line acts as a space in which changes occur. Therefore, we can say that $z = y$. How to calculate the values of the field at point y on subsequent parallel lines located at a distance l? $f(x + l, y) = f(x, y) + l$. Passing to (z, t), where l acts as t, it turns out: $f(z, t) = f(z, t = 0) + t$

We have got an equation where there is a parameter of changes. This parameter can be called emergent time, since equation 1 is performed. The resulting space is called emergent space.

Thus, from a two-dimensional plane without time and dynamics, we moved to a one-dimensional line with time and dynamics, and found an emergent spacetime.

As can be seen, in order to construct spacetime, the original space must have at least two dimensions.

One can take another line that is not parallel to the considered line – and in this case, one will get a slightly different spacetime. Let the line be inclined at some angle α with respect to the considered line. Let for $t = 0$ the intersection of the lines is at the point z_0. Then, at another moment of time t, the intersection will be at a point with coordinates $z(t) = z_0 + t\ sin(\alpha)$. It turns out that the distance will grow evenly over time. One can say that analogues of velocity and inertial reference systems have been found. It is obvious that inertial reference systems have a number of other features that have not been touched upon here. But the result obtained is already enough to say that there is a possibility for the existence of velocity and inertial reference systems in physical systems without time and dynamics.

It is clear that the considered example with the field $f(x, y) = x + y$ is as simple as possible and is given to demonstrate ideas.

If the field is more complex, you can decompose the field according to some functional basis so that the field at each point is equal to the sum of functions with some coefficients. For example, when decomposed into a Fourier series, the function $f(x)$ can be represented as $f(x) = \sum_{k=-\infty}^{+\infty} \widehat{f_k} e^{ikx}$. After that, it can be checked whether it is possible, with a parallel transfer of a straight line to a certain distance l, to construct an equation for changing the coefficients of decomposition of the form

$$\Phi(\mathrm{l}) = A\Phi(0) \qquad (2)$$

Here $\Phi(0)$ is the set of expansion coefficients for some functional basis, for each point for some arbitrarily selected line, l is the distance at which the line was moved, $\Phi(\mathrm{l})$ is the set of expansion coefficients for each point for the selected line after its parallel transfer to the distance l. If such an equation turns out to be constructed, then we can say that a candidate for spacetime has been found. Next, you need to check that the same equations will work when the line is rotated at an arbitrary angle, so that you can talk about the existence of velocity. Note that equation 2 satisfies equation 1.

In equation 2, the state at the previous point in time affects the state at subsequent points in time. Therefore, we can talk about the emergence of the principle of causality.

Our goal is to show the fundamental possibility of constructing spacetime in systems without time, and not the construction of a theory that does this. This fundamental possibility has been shown. Therefore, we will not go further into the mathematical questions of how to do this.

The requirement that it is possible to construct an equation of the described form imposes a rather strong restriction on the possible fields. It is possible to weaken this restriction if we require that this equation be performed not exactly, but with sufficient accuracy. What is sufficient accuracy, we will discuss later.

In the space we observe, there are objects, events occur, there are interactions between objects. Let's look at how to find objects and interactions between objects in the class of systems under consideration.

It can be noted that objects exist in spacetime. If the object exists, then it has existed for some time. Further, the objects can interact with each other.

We believe that an object in emergent spacetime is some part of the decomposition of the field according to the functional basis, which has some general properties and retains them for a non-zero interval of emergent time.

With this definition of an object, the object can participate in interactions. If an object consists only of a part of the decomposition of a field, then the other parts of the decomposition belong to other objects. To perform equation 1, one needs a complete decomposition of the field. This means that other objects must participate in describing changes for an object. As a result, we can talk about the interaction between objects.

Is the described method of finding spacetime the only one? You can increase the dimension of the space. Use hyperplanes or hypersurfaces instead of lines. Instead of Euclidean space, other topological spaces can be used. You can take some kind of subspace of the system, and use it to search for spacetime. However, although the details of obtaining space time may change, the demonstrated principle of obtaining spacetime in a system without time and dynamics remains unchanged.

It is clear that not in any system without time can spacetime be found according to the described method.

Separately, we note that if the system contains several fields that are independent of each other, then spacetime can be searched independently for each field. As a result, there may be several emergent spacetimes.

Next, we only consider systems where it is possible to construct an emergent spacetime in the described way.

In systems without time and dynamics, the principle of causality cannot operate. Nothing changes. There is no time. There are no events. In the emergent spacetime constructed according to the described principles, time appears, events appear. Equation 2, in fact, contains the principle of causality. The configuration of the field decomposition at an arbitrary time determines the configuration at subsequent time points. Therefore, we can say that when constructing an emergent spacetime, the principle of causality as a consequence was obtained.

Some researchers [4, 5, 6] believe that causality metaphysically precedes the concepts of time and space. For the class of systems under consideration, causality and time are inextricably linked. It cannot be argued that one of them precedes the other.

So far, the found spacetime looks like some mathematical abstraction. We applied some mathematical techniques and got some equations where there is something that looks the same as time in the equations of physics.

4. Consciousness and universe

What prevents the emergent spacetime found above from being used as a spacetime? It is generally believed that time is necessary for the existence of consciousness, and this time should be a fundamental phenomenon.

Let's write the following postulate: in a system without time and dynamics, based on the emergent spacetime found according to the described principle, there can be a reasonable observer capable of self-awareness, a sense of Being.

Fully knowing the equations describing the system, it is impossible to either confirm or refute this postulate. Thus, it refers to a strong emergence [7].

Before that, we have already discussed the existence and the principle of causality. Now we have found an opportunity to add a reasonable observer to the system, and we can return to these questions again.

Next, we consider, as an observer, only a reasonable observer.

Suppose that there is a spacetime in the system constructed in the way described above, where an observer exists. The observer is observing something. The totality of what is available, directly or indirectly, to the observer for observations, and what is in the same spacetime where the observer is, can be called the universe.

If an observer exists, then he can observe this spacetime, with some fields. Here it can be noted that the fields that the observer will observe will differ from the fields in the system. What is quite obvious is that the fields in the system have no dynamics, the observed fields have it. At the same time, of course, the observed fields will be built on the basis of the fields in the system. The fields in the system can be called fundamental fields, the fields that the observer observes are observable fields.

The question arises about the existence of observable spacetime and observable fields.

Without an observer, this spacetime and observable fields are a mathematical abstraction. It follows from this that the observer, by his observation, generates spacetime and observable fields. Since the observer is a consequence of strong emergence, then the spacetime with the observed fields is a consequence of strong emergence. It can be said that the observer's consciousness is more fundamental than the observed spacetime and fields.

The observer observes, and by his observation generates spacetime. But the behavior of the observer, his actions/thoughts, are completely predetermined by the field of the system. The observer has no free will.

Spacetime and observable fields have a subjective character of existence, since they exist only when observed by a reasonable observer.

All models of intelligent life known to the authors require the principle of causality to be fulfilled. This means that spacetime must be constructed in such a way that the principle of causality is fulfilled. Consequently, the principle of causality also arises as a consequence of consciousness.

Realism requires that an entity exists independently of knowledge, thought, and understanding. Spacetime and observable fields exist only when observed by an observer. Therefore, the existence of spacetime cannot be attributed to realism. The existence of spacetime and observable fields can be attributed to idealism, since it depends on the observer and his consciousness.

The existence of an observer in the systems under consideration is difficult to attribute to realism or idealism. Spacetime, which is a consequence of observation by an observer, exists subjectively. The system exists objectively and independently of the observer. About the system, we can say that its existence belongs to realism. The observer is an epiphenomenon, so what he observes depends entirely on the system. Therefore, elements of realism and idealism arise here, which do not allow us to unambiguously attribute the existence of an observer to one of these two categories. This classification problem seems to arise from a postulate based on strong emergence.

It can be assumed that the addition of any statement based on strong emergence significantly expands the space of the concepts involved.

The question of the existence of an observer touches upon the mind-body problem. In the class of systems under consideration, the observer's body and the observed physical phenomena are a consequence of the observer's consciousness. However, the observer's consciousness is a consequence of the equations describing the system. One could say that physicalism describes the solution of the problem of body and mind in the closest way. However, the physics of the observed spacetime itself depends on the mind, on consciousness. Therefore, this is not physicalism. Epiphenomenalism is the closest to the proposed solution. But it is also not completely suitable, since the observed physical phenomena are the consequences of the mind. Therefore, it can be argued that a fundamentally new solution to the problem of body and mind has been proposed.

The question of the existence of an observer touches upon the problem of constructing a theory of Everything for our Universe. Some researchers [17] believe that the theory of Everything should include a theory of consciousness. For the class of systems under consideration, this is implemented. Perhaps an analysis of the properties of these systems will also help in understanding the nature of consciousness in our Universe.

5. The accuracy of the implementation of the principle of causality

When searching for how to find spacetime in a system without time, it has been noted that equation 2 and, accordingly, the principle of causality, may not be performed exactly, only sufficient accuracy is needed. Let us find out what determines this sufficient accuracy.

Since in the class of systems under consideration the principle of causality is a product of consciousness, it must be carried out with sufficient accuracy for the existence of consciousness.

Here questions arise about how long consciousness should exist, and a number of other questions. We do not consider these questions, since the answers to them do not have a significant impact on the model.

6. The anthropic principle and the problem of fine-tuning the Universe

There is an empirical fact [Refcarrees, 19, 20, 21] that the physical constants and cosmological parameters of our Universe are finely tuned for habitability, abiogenesis, and the appearance of observers like us. A small change in a few dimensionless fundamental physical constants or cosmological constants will make the universe radically different and uninhabitable; empirically, we are here, so the universe is inhabited, so these parameters and constants are limited to a small range of values, much smaller – even infinitely smaller in some cases than the interval in which they a priori could be.

The anthropic principle was proposed by [8, 10, 11, 12]:

1. to explain, from a scientific point of view, why in the observable Universe there are a number of non-trivial relationships between the fundamental physical parameters necessary for the existence of intelligent life;
2. to solve the problem of fine-tuning the universe.

There are various formulations; usually there are weak and strong anthropic principles [9].

A strong anthropic principle is usually formulated as follows: The Universe, and the fundamental parameters on which it depends, must be such as to allow the appearance of observers at some stage.

What if some system, from the class of systems under consideration, does not allow a reasonable observer to exist? In the above example with the field $f(x, y) = x + y$, it is obvious that such a system cannot contain a reasonable observer. The field is too simple to maintain states for the body of a reasonable observer. If the system does not allow a reasonable observer to exist, the emergent spacetime found can be considered simply as some mathematical abstraction.

The described model means that in a system without fundamental time and dynamics, the observed space, time and matter are the product of consciousness. Without an observer, they are a mathematical abstraction. Thus, in a system without fundamental time and dynamics, objectively they do not exist. They exist subjectively.

Consciousness generates an emergent spacetime. So, a reasonable observer in the model under consideration is necessary for the existence of the universe. This is close to a strong anthropic principle, although there are differences. The main difference is that the universe does not exist without an observer. This formulation is close to the anthropic principle of Wheeler's participation [13], but there are differences. The connection between the existence of an observer and the Universe for the class of systems under consideration can be formulated as follows: the observer generates the universe by his observation.

To solve the problem of fine-tuning the universe, some consider a Multiverse in which only a part of the universe is inhabited [14, 15]. In the mathematical Universe hypothesis [16], systems with self-awareness are secondary to equations. The equations, as postulated, describe something that actually exists. In some of the resulting universes there are reasonable observers. In some there are not. This solves the problem of fine tuning.

Our proposed solution does not require multiple universes. In the class of systems under consideration, the equations describing emergent spacetime are secondary to consciousness. They are built on the basis of equations describing the system, and are constructed in such a way that reasonable observers are obtained. Therefore, all possible ratios of physical quantities will inevitably be such as are necessary for the existence of reason.

7. Some analogue of gravity

In the class of systems considered, one can also find some analogue of gravity.

Suppose that it is impossible to construct spacetime using straight lines for two-dimensional space, or their analogues (plane, hyperplane) for a space with more than two dimensions. In this case, you can try to bend a line or an analog so that the described equations are performed on the resulting curved object to construct an emergent spacetime. And then a curved spacetime is obtained.

The curvature of the emergent spacetime can vary over time. The curvature can cause the trajectories of objects to change. The curvature of space is determined only by objects, because all the decomposition of the field refers to one or another object. Therefore, we can say that the curvature of spacetime is an interaction between objects. Since all the decomposition of the field refers to one or another object, this is a universal interaction acting on all objects.

The resulting interaction has a fundamentally different nature than other interactions. If the remaining interactions are obtained from equation 1 based on the analysis of the interaction of objects in emergent space, then this interaction is formed by all other interactions to fulfill the principle of causality, to perform equation 1. The analysis of this difference may be interesting for the analysis of attempts to construct quantum gravity.

It is impossible to assert that the interaction found is a complete analogue of gravity and general relativity. One can find a lot of objections showing that there may be differences between them. However, the analysis of the properties found above can help to understand our Universe.

8. Physical foundations of mathematics

The unreasonable effectiveness of mathematics in the natural sciences [22, 23] is one of the open questions.

Why does mathematics describe our world so well? Within the framework of the class of systems under consideration, an answer to this question can be found.

Let’s consider a system without time and dynamics with a single field. Let's call the field defined in this system a fundamental field. Let the fundamental field be defined at each point of space and described by some mathematical equation.

The equations of physics for emergent spacetime are consequences of this equation. It turns out that in order for mathematics to describe the observer's world well in this spacetime, it is enough that it describes the field of the system. Based on this, it follows that mathematics, in emergent spacetime, is a consequence of how the field is described. The whole mathematics is a consequence of the equation describing the field of the system.

Logic is also a consequence. Logic is a set of rules that allow you to draw conclusions based on certain facts. Any facts, including purely speculative constructions, in emergent spacetime are based on the field of the system and its features. Thus, we can conclude that logic is also a consequence of a fundamental physical system.

Let’s suppose that the fundamental field would be described by something other than mathematics. In this case, according to the statement written above, there would be neither mathematics nor logic in the emergent spacetime.

Is it possible to apply logic when there is no logic? For such a case, you can try to use plausible reasoning. Plausible reasoning can be close to truth if something similar to logic appears as a result of the application of this “non-mathematics”. The closer what turned out to be logical, can be expected to have a higher degree of the accuracy of plausible reasoning.

Using plausible reasoning, one can say that if the result was an emergent spacetime, then instead of mathematics there would be something based on the “non-mathematics” system describing the field, and something replacing logic.

Note that all the arguments have been in some framework:

1. A system without time and dynamics contains space. Both mathematics and “non-mathematics” must contain a space with some number of dimensions.
2. There is a field defined in the space of the system without time and dynamics.
3. The values of the field are determined by some mathematical equation for the case of mathematics, and determined “somehow“ for the case of “not mathematics".

9. Limits of knowledge

Let’s consider a system without time and dynamics, in which there is at least one field. Let such a field be described by a mathematical equation, and contain, in some emergent spacetime, a reasonable observer. Let's consider what limits of knowledge such an observer has. If there are more than one field in the system, we consider them independent, not affecting each other.

What can be immediately noted is that there are no ways in which an observer can find out about other fields, even if they exist. In order for the observer to learn about other fields, they must somehow influence the observer's spacetime. In the absence of this influence, there is no way to see how this can be done.

The observer's thoughts, for the system under consideration, are described by mathematics. From this one can conclude that any concepts that may arise in the observer's mind are also described by mathematics. In order to understand something that is not described by mathematics, you need the opportunity to move from mathematics to “non-mathematics". But if there is such a possibility, then we can say that “not mathematics” is either identically equal to mathematics, or is a subset of it. In both cases, “not mathematics” is reduced to mathematics, and we can talk about their isomorphism. If we call “not mathematics” what is not reduced to mathematics, is not an isomorphism of mathematics, then there is no possibility of transition between them. As a result, the observer will never be able to understand anything that is not described by mathematics.

We come to the conclusion that the observer, in principle, can describe other fields in the system described by mathematics, although he will not be able to check whether they exist or not. Any fields that are not described by mathematics, the observer cannot, in principle, imagine and describe.

Conclusion

The features of a class of systems without time and dynamics have been considered. It has been found that such systems cannot have something external. Such systems have an unusual type of existence, since they do not have time and cannot be observed by an external observer. Since their existence does not depend on observers, one can say that they exist objectively.

The principle of causality requires events and time. There is no time, as well as events, in the class of systems under consideration. Therefore, such a class of systems does not contain the principle of causality.

The principle of how to construct spacetime in a system without time and dynamics has been proposed. It has been found what can be objects in such a spacetime, and what can be an interaction between such objects.

Without an observer, the constructed spacetime will remain a mathematical abstraction. Therefore, a postulate has been proposed that allows adding an observer. The postulate uses the assumption of a strong emergence of consciousness.

The existence of spacetime and, in general, universes, has a subjective character. The observer generates them by his observation. At the same time, the observer is only an epiphenomenon that does not have free will. His behavior and thoughts are completely determined by the equations describing the corresponding system.

One of the interesting results is the answer to the question of the universe. The answer is very simple: the question of the universe does not make sense, since the principle of causality has a limited scope of definition.

Within the framework of the considered class of systems, answers to the following problems of philosophy and physics have been found:

- The nature of consciousness and the mind-body problem
- The nature of time
- The anthropic principle and the problem of fine-tuning the universe
- The effectiveness of mathematics in describing physical phenomena
- Limits of knowledge

There are two main reasons why it was possible to find answers to these fundamental questions. The first reason is the completeness of the system in question. Any system from the class of systems under consideration cannot have anything external to it. The second reason is the use of a postulate using strong emergence.

The postulate allows you to construct time and causality where time and causality are absent. It allows you to solve the problem of the nature of consciousness and the problem of the connection of the body and consciousness.

The completeness of the system under consideration, the absence of anything external to the system, has allowed us to find answers to questions about the effectiveness of mathematics in describing physical phenomena and about the limits of knowledge.

The answer to the question of the universe has been found because the principle of causality from the fundamental principle became a consequence of another postulate, and has a limited scope of applicability. Perhaps, in our universe, the principle of causality is also not fundamental, but is a consequence of something else.

The resulting causality principle does not necessarily have to be carried out exactly, it must be carried out with sufficient accuracy. This leads to the question of whether the principle of causality in our universe can be fulfilled not exactly, but approximately. If it is not fundamental, then it looks possible.

A new possible explanation of the nature of time has been found.

The solution to the problem of fine-tuning the universe arises from the subjective nature of the existence of spacetime and, accordingly, universes. It is unlikely that our Universe exists subjectively, and not objectively. However, another possible solution to the problem of fine-tuning the universe has been found.

Some analogue of gravity has been found. The resulting analogue of gravity seems to differ from the gravity of general relativity. This also indicates that the considered class of systems does not describe our Universe. This analogue of gravity is interesting because it and other forces acting in emergent spacetime are fundamentally impossible to combine within the framework of some single force in emergent spacetime. This shows that the construction of a unified field theory may be impossible without some very non-standard assumptions. Perhaps there is something in our Universe that is more fundamental than observable spacetime.

If our Universe was based on the system of the class considered, and humanity was the only intelligent civilization, then it could be argued that the Earth is at the center of the Universe. The observer generates spacetime and matter, the observers are on Earth, therefore, the Earth has already been distinguished. If there are no other civilizations in the Universe, then the entire Universe is generated only by humanity. Therefore, the Earth is the center of the Universe.

The solution of many of the described problems required the use of a postulate based on strong emergence. Perhaps, in order to solve many problems accumulated in physics, some assumptions based on strong emergence are needed. If this is the case, then further development of fundamental theoretical physics is impossible until these assumptions are found.

The considered class of systems makes it possible to find answers to questions that cannot be answered for our Universe. This shows that it is fundamentally possible to find answers to these questions for our Universe as well. Further analysis of this class of systems can improve the understanding of our Universe, and bring closer the time when answers to many seemingly eternal questions will be found.

References

1. Strogatz, S. H. (2001). Nonlinear Dynamics and Chaos: with Applications to Physics, Biology and Chemistry. Perseus.
2. Katok, A.; Hasselblatt, B. (1995). Introduction to the Modern Theory of Dynamical Systems. Cambridge: Cambridge University Press. ISBN 978-0-521-34187-5.
3. Giunti M. and Mazzola C. (2012), "Dynamical systems on monoids: Toward a general theory of deterministic systems and motion". In Minati G., Abram M., Pessa E. (eds.), Methods, models, simulations and approaches towards a general theory of change, pp. 173-185, Singapore: World Scientific. ISBN 978-981-4383-32-5
4. Robb, A. A. (1911). Optical Geometry of Motion. Cambridge: W. Heffer and Sons Ltd. Retrieved 12 May 2021.
5. Whitehead, A.N. (1929). Process and Reality. An Essay in Cosmology. Gifford Lectures Delivered in the University of Edinburgh During the Session 1927–1928. Cambridge: Cambridge University Press. ISBN 9781439118368.
6. Malament, David B. (July 1977). "The class of continuous timelike curves determines the topology of spacetime" (PDF). Journal of Mathematical Physics. 18 (7): 1399–1404.
7. Laughlin, Robert (2005), A Different Universe: Reinventing Physics from the Bottom Down, Basic Books, ISBN 978-0-465-03828-2
8. G.M. Idlis - Main features of the observed astronomical Universe as the characteristic properties of the inhabited space system // Izv. Astroph. of the Institure of Kaz. SSR. 1958. 7. 7. P. 40-53.
9. B. Carter - Coincidence of large numbers and the anthropological principle in cosmology // Cosmology. Theories and observations. M., 1978. P. 369-370.
10. Dicke, Robert H. ʿPrinciple of equivalence and the weak interactionsʿ Reviews of Modern Physics 29, 1957, 355-362.
11. Dicke, Robert H. (1957). ʿGravitation without a principle of equivalenceʿ Reviews of Modern Physics 29, 1957, 363-376.
12. Dicke, Robert H. ʿGravitation – an enigmaʿ American Scientist 47, 1959, 25-40.
13. Wheeler J. A. Genesis and Observership // Foundational Problems in the Special Sciences. Dordrecht,1977. P. 27.
14. Linde A. A brief history of the multiverse. Reports on Progress in Physics. 80 022001. 2017
15. Susskind L 2006 The Cosmic Landscape: String Theory and the Illusion of Intelligent Design (New York: Little, Brown and Company)
16. Tegmark M 2014 Our Mathematical Universe: My Quest for the Ultimate Nature of Reality (London: Alfred Knopf)
17. Yurchenko, Sergey B.. “Can ‘Theory of Everything’ Be Global Theory of Consciousness? Ontology and Psychodynamics of I-observer.” Neuroquantology 15 (2017): 118-131.
18. Carr, B., Rees, M. The anthropic principle and the structure of the physical world. Nature 278, 605–612 (1979).
19. Barrow, J.D. and Tipler, F.J. The anthropic cosmological principle. 1986, Clarendon Press, Oxford.
20. C. J. Hogan Why the universe is just so, 2000, Rev. Mod. Phys. 72, 1149

21. Barnes, L. A. “The Fine-Tuning of the Universe for Intelligent Life.” Publications of the Astronomical Society of Australia 29, no. 4 (2012): 529–64
22. Wigner, E, The unreasonable effectiveness of mathematics in the natural sciences, Communications in Pure and Applied Mathematics 13 (1960), 1–14.
23. Omnès, R. Wigner’s “Unreasonable Effectiveness of Mathematics”, Revisited. Found Phys 41, 1729 (2011).