Anthropic principle in physical models without time and dynamics

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Annotation

The construction of space-time in a physical system without time and dynamics is considered. It is shown that the anthropic principle and causality principle inevitably arise in models without time and dynamics. It is shown that for any physical model based on a system without time and dynamics, the anthropic principle is a scientific principle and, in principle, can be falsified. It is shown that, in principle, there is the possibility of experimental verification of what is true - realism or idealism.

Introduction

Currently, there are many hypotheses concerning time. In some of them, time is a fundamental phenomenon, and in some the observed macroscopic time is a derivative phenomenon of the dynamics at the micro level. There is one common feature for modern hypotheses in the field of physics - in one form or another, or time or dynamics in them are considered as fundamental phenomena.

Many options concerning time are also considered in the field of philosophy. If considering only those that try to solve the issues of combining quantum physics and the general theory of relativity, then to one extent or another either of these concepts has either time or dynamics.

The author is not aware of any physical hypothesis that tries to construct space-time in the absence of both time and dynamics as fundamental phenomena.

Is it possible to construct a physical system with observed time and dynamics based on a system where there is no time and dynamics at the fundamental level?

This article deals the construction of such a system with observed time and dynamics based on a physical system without time and dynamics at the fundamental level.

System without time and dynamics

Consider a physical system without time and dynamics.

What should such a system have at least? There should be space. Without space, we can only talk about an empty set. There are no visible ways how to construct any non trivial system based on an empty set.

A system in which there is only space can be considered. Again there are no visible ways how to construct any non trivial system based on space alone. It means that something else needs to be added to the space.

Add some field to the system with space and make the field defined at each point in space. Since the system does not have time and dynamics, the value of the field at each point in space cannot be changed.

We are talking about a physical system. Therefore, it seems logical that the value of the field at each point should be determined by the values of the field at the surrounding points. The assumption of smoothness and differentiability of the field can be added. Then it can be said that the field should be described by some partial differential equations.

What is the simplest model for the described system? A scalar field is the simplest possible field. The value of the field belongs to the set of real numbers. The simplest case for space is Euclidean space. Here it should be noted that the considered scalar field is not the same as in the textbooks on quantum field theory. It has no quantum properties and no dynamics.

Although a scalar field and Euclidean space is the easiest choice, more complex fields, systems with more than one fundamental field, and more complex, non-Euclidean, spaces can be considered. For what is described below, there is no difference in the consequences, but the considered system with Euclidean space and a scalar field defined on this space is easier to describe.

An example of a system without time and dynamic: a two-dimensional plane in Euclidean space with a field defined on the plane $f(x, y) = x + y$. It is obvious, that in such a system there is neither time nor dynamics.

The next step is to find time and dynamics in the 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 using the model without time and dynamics in physics, it is necessary to find time in the model.

Since the system does not have time and dynamics, it does not allow the use of time as a fundamental phenomenon. We usually think of time as a fundamental phenomenon. In a model without time and dynamics, time cannot be a fundamental phenomenon. Thus, time must be derived from something else. What is time in the equations of physics? This is the changing parameter for the equations. If derive something as a changing parameter, it can be considered as time. I will call this parameter the emergent time in order to distinguish it from time as a fundamental phenomenon. Changes are mentioned above. But changes in a system without time and dynamics are impossible. Thus, it is necessary to find something that can be used as a replacement for change.

Divide the space of the system into parallel hyperplanes. The hyperplanes should not intersect, and they should completely cover the entire space. Take hyperplanes with the number of dimensions as n-1, where n is the number of dimensions for the space of the entire system. The hyperplanes must be constructed in such a way that it is possible to calculate the values of the field on each following hyperplane, if the values on the previous hyperplane are known. Instead of calculating the values of the field on each following hyperplane, the values of some part of the field can be calculated, if the projection of the field on the hyperplane can be split into separate parts. As a parameter for equations to calculate the values of the field on the following hyperplanes, it should be possible to use the distance between the hyperplanes. Consider only those fields that allow to do the ones described above.

Does the above described look like space and time? There are changes on hyperplanes, and there is a changing parameter as it exists in physics. The hyperplane here acts as a space where changes occur. Therefore, it can be talked about emergent space and emergent time.

Let me return again to the example with the field $f(x, y) = x + y$ on the two-dimensional plane.

The question is how to rearrange the space (x, y) into space-time (z, t), where z is the spatial coordinate, t is time. Apply the method described above to this example and see the result.

For the two-dimensional case, according to the method described above, it is necessary to take a hyperplane with the number of dimensions (n=2) 2-1=1. A one-dimensional hyperplane is a line. Take a line. For example, consider a vertical line that satisfies the equation $x=2$. This line acts as a space in which changes occur. So it can be said that $z=y$. How to calculate the values of the field at the point y on the following parallel lines at a distance l? $f(x + l, y) = f(x, y) + l$ Making the transition to (z, t), where l acts as t, it results: $f(z, t) = f(z, t = 0) + t$

Thus, from a two-dimensional plane without time and dynamics, we have made a transition to a one-dimensional line with time and dynamics. Another line that is not parallel to the considered line can be taken – and in this case, a slightly different space-time will result.

It is clear that the example considered is as simple as possible and is given to demonstrate the ideas.

Is the described method of finding emergent space-time the only one? It can be seen that hypersurfaces can be used instead of hyperplanes. Instead of Euclidean space, other topological spaces can be used. Instead of surfaces with dimension n-1, the surfaces with a smaller dimension can be used. However, although the details of obtaining space-time may change, the principle of obtaining emergent space-time in a physical system without time and dynamics remains unchanged.

What prevents us from using the above found as time, space and dynamics? It is considered that time is necessary for the existence of consciousness, and this time should be a fundamental phenomenon.

Thus, in order to try applying the found emergent space-time, it is necessary to somehow find consciousness and the possibility of the existence of intelligent life in this model.

I will add a postulate: a system without fundamental time and dynamics can contain an intelligent observer based on emergent space-time.

The postulate states that an intelligent observer can exist in the system without time and dynamics based on emergent space-time. The postulate does not state that an intelligent observer exists in every system without time and dynamics.

Anthropic principle

What if some system does not allow an intelligent observer to exist? In the above example with the field $f(x, y) = x + y$, it is obvious that this system cannot contain an intelligent observer, the field is too simple to maintain states for the body of an intelligent observer. If the system does not allow an intelligent observer to exist, the found emergent space-time 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. They are the mathematical abstraction without an observer. Thus, they do not exist objectively in a system without fundamental time and dynamics, they exist subjectively.

That which results the emergent space-time is an intelligent observer in space-time. Thus, an intelligent observer in the considered model is necessary for the existence of the Universe. And this means the anthropic principle.

Is the obtained anthropic principle philosophical or scientific?

The demarcation problem is a complex one. Perhaps the most common criterion for determining scientific value is the Popper criterion. To be considered scientific, a hypothesis must be falsifiable.

According to the results obtained above, any scientific hypothesis based on a physical system without time and dynamics must contain an anthropic principle. Since only scientific hypotheses are considered, they must be falsifiable. Then it means the indirect falsifiability of the anthropic principle, for a system without time and dynamics. The falsifiability of the anthropic principle is potentially visible for systems without time and dynamics in general. To do this, it is necessary to prove that there is no way to construct space-time that satisfies observations based on systems without time and dynamics. All this means that the anthropic principle can, in principle, be falsified for the considered systems. Based on this, I conclude that for any physical model based on a system without time and dynamics, the anthropic principle is not a philosophical principle, but a scientific one.

If the fundamental basis of our Universe does not have time and dynamics as fundamental phenomena, then this means that the conclusions described above apply to our Universe as well.

The anthropic principle was proposed [1] [2] to explain from a scientific point of view why in the observable Universe there are a number of non-trivial relations between the fundamental physical parameters necessary for the existence of intelligent life. There are different formulations; usually there are weak and strong anthropic principles.

The strong anthropic principle is the anthropic principle of participation, formulated by John Wheeler[3]:

> « *Observers are necessary to bring the Universe into being).*

The anthropic principle of participation in the system without time and dynamics is a direct consequence of the subjective existence of observed space-time.

Principle of causality

All models of intelligent life known to the author require the implementation of the principle of causality. Observers, according to this model, are necessary for the existence of the Universe. Only an intelligent being can be an observer. This means that intelligent life is necessary for the existence of the Universe. Based on this, hyperplanes (or hypersurfaces, etc.) with projections of the fundamental field changing on them must be constructed in such a way that the principle of causality is fulfilled. Thus, the principle of causality arises in systems without time and dynamics as a consequence of the anthropic principle of participation.

Realism and idealism

As described above, in any model based on a system without time and dynamics, the observed space, time, and matter are products of consciousness. This means subjective idealism. At the same time, it can be said about the fundamental possibility of falsification of subjective idealism. For falsification, it is necessary to prove that there is no way to construct space-time that satisfies observations based on systems without time and dynamics. Thus, a fundamental opportunity appears to verify whether we live in a world of realism or idealism.

Conclusion

The questions of constructing physical models based on physical systems without time and dynamics are considered. A method is found how it is possible in such systems to obtain space and time as emergent phenomena. As far as the author is aware, these issues have never been considered before.

It is shown that the principle of causality and the anthropic principle arise in such systems. It is proved that for any physical model based on a system without time and dynamics, the anthropic principle is a scientific principle. It is shown that, in principle, there is the possibility of experimental verification of what is true - realism or idealism.

The systems without time and dynamics show interesting properties, and their study can help in understanding nature.

References

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