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Abstract

The main problem of understanding time is that the word "time" is understood in different senses, for example: 1. time as a measure or standard of duration; 2. Time as a measure of changes in the object, "own time of the object". The article describes the content of both understandings. The time of the object, in accordance with the ideas of Aristotle, is considered as the amount of movement in the object. The time of the object is a relative magnitude that reflects the measure of the transition of the object from the fact of the beginning to the fact of the end of its existence. Time shows what part of its potential of existence the object was expended at the moment of observation. The clock shows the duration of the rhythms. Hours are viewed as objects which expend energy on rhythmic fluctuations. Accordingly, it is proposed to measure the speed of change in objects, including in clocks, by the amount of energy expending by objects per unit of duration by the hours of the observer. The author distinguishes the following types of clocks: a) "gravitational", b) "gravitational-kinetic", c) overcoming gravity. The features of the functioning of these watches are described depending on gravity. The connection between gravity and time is shown. On the basis of the above explains the fallacy of hypothesis about the existence of "twin paradox" in physics.

Keywords: time, clock, gravity, speed, time machine, twin paradox

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1. Introduction

To answer the question: how gravity affects "acceleration" or "slowing down" of time, it is necessary to define such initial concepts as "time", "clock", which, as is known, are not completely defined in physics, see, for example: [Burke, 1985: 20; Bunge, 2003: 25].

2. What is time

The main problem of understanding time is that the word "time" is understood in different senses. Let's select the following:

1. Time as a measure or standard of duration.
2. Time as a measure of changes in the object, "own time of the object."

There is also a number of word-combinations where the concept of time is not defined, but various assumptions are made, for example, on the "beginning of time", on the independent existence of the "substance" of time, "absolute time", "time arrow", etc.

In physics, always known properties of certain objects are subject to measurement, for example, length, mass, etc. Time in physics is understood as what is measured (show) the "clock". However, the very concept of "time" is not determined, that is, it remains unknown which property of what object the clock measures. In other words, in the case of a clock, it turns out that they measure an unknown property of an unidentified object.

With any understanding of time, researchers are similar in opinion that time can be measured. In physics, as noted above, only the properties or characteristics of an object can be measured. Consequently, time is a characteristic or property of some object. However, physics does not consider questions of the type: a) the characteristic of which object is time; b) which object parameter reflects the time.

In accordance with the understanding of Aristotle [Aristotle, 1999], time is the amount of changes occurring in the observed object. That is, time is an attribute property of any object.

With a strict approach, changes in the object are always observed with respect to the states of the object itself, and not relative to the "clock". The time of the object is a relative magnitude that reflects the measure of the transition of the object from the fact of the beginning to the fact of the end of its existence. Time shows what part of its potential of existence the object was expended at the moment of observation. In other words, the time of the object is its (relative) age. Time can exist only as the own time of the object.

The time of the object with this understanding can be measured in percentages or fractions. We take a mechanical clock as an observable object. The beginning of the existence of this object is the beginning of the movement of the arrows after wind up the clock, the end of existence - when the energy of the spring is over and the clock stops. If at the time of observation the clock expended, for example, 60% of the spring energy, then the "age" of this object at the time of observation will be 60%.

In physics, the basic and derived quantities are distinguished. The basic quantities include, for example, length, weight, temperature and time. With the help of basic quantities, derived quantities, for example, speed, are obtained. Speed = distance / time. Proceeding from this, it can be concluded that time itself can not have a speed parameter. The duration of the rhythms of the observed object can change when comparing them with the standards of duration (clocks) of the observer. The observer at the same time measures the speed of some movement in a given object, but not the time of the object [Iliassov, 2015].

3. What is a clock?

The essence, nature of clocks in physics is also not completely described. The phenomenon of "time measuring instruments" - "chronometers", hours, is based on the fact that in some objects, because of their nature, there are rhythmic (cyclic) movements (rhythms). If from the point of view of the observer, rhythmic movements in two independent objects occur simultaneously, or synchronously, then he can regard these objects as "clocks". And the duration of the individual rhythms of the clock is considered as a unit of duration. That is, the clock does not measure "time" as such, they measure the duration of the rhythms. Therefore, the clock is by nature not a chronometer, but a rhythmometer.

Thus, the clock is a specific object that generates rhythms of equal and specific duration. Under "normal" physical conditions, the duration of these rhythms has a strictly defined extent. It is possible to assume that when the physical conditions change, the duration of the rhythms of different clock can vary in different ways, including depending on the factor of gravitation. It is important to note that there is no acceleration or slowing down of "time", but the duration of rhythmic movements, that is, the speed of physical processes, in individual objects considered as "clock" changes. It is important to note that there is no acceleration or slowing down of "time", but changes the duration of rhythmic movements, that is, the speed of physical processes, in individual objects considered as "clock".

Clock can be defined as objects that expend energy on making rhythmic movements. According to the type of energy spent, the clock can be conditionally divided into three types: A). which use the energy of gravity ("gravitational"); B) which overcome the force of gravity - use "internal" energy; C) which use a combination of gravity and "internal" energy.

Consider several models of clocks. The duration of their rhythms is compared with the duration of the rhythm of the clock of the observer.

4. "Gravitational" clocks

Consider two types of "gravitational" clocks, that is, clocks using the force of gravity, the "energy of gravity". The simplest model is the "hourglass". It is clear, with a decrease in gravity (the force of gravity), the course of the hourglass slows down, and in conditions of approaching the gravity of the sand to zero, they stop working.

Some pendulum clocks use the weight (mass) of the kettlebell. The kettlebell by "energy its weight" activates the clockwork mechanism. If the weight of the kettlebell decreases, it "gives less energy" and the course of the clock slows down. When the weight of the kettlebell is approaching zero, the clock with the kettlebell stops working. Thus, with decreasing gravity, the duration of the rhythms of the "gravitational clock" increases, they "slow down their course". When gravity decreases to a certain critical level, the number of rhythms decreases to zero, that is, the clock stops.

5. "Gravitational-kinetic" clock

As a "gravitational-kinetic" clock can be considered a sundial. The dial of this clock reflects the process of uniform, rhythmic movement of the Earth around the Sun, caused by the ratio of the kinetic energy of the Earth and the force of gravity of the Earth and the Sun. With a decrease in the gravitational force, the duration of the rhythms of the "gravitational-kinetic" clocks will increase, their course will slow down. They will stop working when the gravity decreases to a certain critical level.

6. Clocks overcoming gravity

Mechanical (spring) clocks can be considered as a clock, expending "their own" energy to work on the movement of the arrows of the clock. Gravitation affects the course of such clocks, increasing the cost of energy spent for the work of the watch movement. As the gravity decreases, the clock will increase the frequency of oscillations - reduce the duration of the rhythms, by releasing the energy spent on that part of the work that was caused by gravity.

"As is known, any two bodies are attracted to each other. This property of bodies is due to their mass. Since other forms of matter (fields, radiations) also have mass, they also obey the law of gravity" [Kuhling, 1985: 105]. Accordingly, the "atomic clock" also refers to the clock that overcomes gravity.

7. Gravity and time

If time is understood as a measure of the changes in the object from its occurrence to its disappearance, then gravity here can influence so that identical objects, according to the clock of the observer, can have different lifetimes depending on the force of gravity.

Consider a car with a fully fuel tank as a model of Time reference systems. We take as a measure of the "lifetime" of this model the total distance that the car can travel. With "ordinary" gravity, it can travel, for example, 500 km. If gravity increases, the distance that the car can pass will decrease, that is, the "lifetime" of the model will decrease.

8. Clocks and spending of energy

"Consider a pair of twins. - writes Stephen Hawking, - Suppose that one twin goes to live on the top of a mountain while the other stays at sea level. The first twin would age faster than the second. Thus, if they met again, one would be older than the other" [Hawking, 1988: 43]. If twins spent the same amount of energy for life, they will live "with the same intensity," then none of them will be older. Their "own age" will be the equal. However, the one who lived below will do less work, as he will have more energy to overcome the difference in gravity. That is, there is no "twins paradox" in reality.

Hawking indicates: «Another prediction of general relativity is that time should appear to slower near a massive body like the earth» [Hawking, 1988: 43]. In fact, Hawking speaks of slowing the speed of motion when measured by the clock of observer, and not about the "speed of time". The "own time" of the clock as an independent object is determined by the amount of energy spent by the clock on the movement of the arrows. Consequently, the time in clocks should be determined not by the speed of the movement of the arrows, not by the duration of the rhythms, but by the amount of energy that the clock spends on the movement of the arrows. If two identical clocks spend the equal amount of energy on the arrow’s movement, then their own time flows at the equal speed. In this case, if the clocks are in a different gravity, the speed of their arrows may not coincide.

If from the point of view of the observer's clocks the observed clock began to move more slowly, this means that the observed clock began to spend more energy on overcoming gravity. In accordance with the law of universal gravitation, processes which speed depends on gravity, with a change in gravity, will accordingly change their speed. But this is not directly related to the phenomenon of time.

It was pointed out above that the clock can be defined as objects that expend energy on making rhythmic movements. Proceeding from this, the clock should not be viewed from the point of view of the duration (frequency) of the rhythms, but from the point of the amount of energy spent on these rhythmic movements. After all, the movement of the arrows of the clock is the result of the manifestation of the energy expended. Consequently, the speed of the clock should be measured not by the duration (frequency) of oscillations, but by the amount of energy expended on these oscillations. The duration of the rhythms can vary, while the energy expenditure can be maintained at the same level. Within the framework of the "energy approach" to understanding the clock, it does not matter at what speed, from the point of view of the observer, rhythmic movements occur in the object viewed as a clock, but it is important how fast the clock spends energy on these movements. That is, the primary, direct indicator of the speed of the work of the clock is the rate of expenditure of energy spent on rhythmic movements.

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