Review Article

Is Einstein Still Misunderstood?

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Abstract

Constancy of the light velocity in different inertial systems and areas of space with different gravity implies that relativistic effects of relative velocity of material change start with massive particles. In Special Theory of Relativity and in General Theory of Relativity time t is a numerical order of material change i.e. motion in a 4D space. Time is not part of the space. Time is a numerical order of change that runs in space.

Key words: time, space, space-time, numerical order of material change, velocity of light, relativistic effects of relative velocity.

Today's physics understands space and time as being coupled in "space-time"; a fundamental arena in which universe takes place. Einstein himself has never considered time as being part of space; he was talking about a "four-dimensional continuum" in which physical events occur. In his Special Theory of Relativity Einstein used Minkowski's 4-dimensional space that has four coordinates:

$$X_1, X_2, X_3, X_4 \text{ where } X_4=ict.$$

Physicist Gerard 't Hooft is defining space-time being four dimensional space where forth coordinate $X_4=ict$ (1). X4 is formulated as a product of an imaginary number i ($i=\sqrt{-1}$), light speed c, and time t: $X_4=ict$. In this formula, time t represents the numerical order of a physical event which is measured with clocks. Comparing the formula $X_4=ict$ with fundamental physical formula which expresses the relation between distance, velocity, and time d = vt (distance is velocity multiplied by time) we see that X_4 is a distance. Considering time as being the fourth dimension of space does not look appropriate.

X_4 is not a "temporal coordinate", X_4 is not the time t that is measured with clocks. In the formula $X_4=ict$, time t is only a component. Out of this mathematical formalism one can conclude that in the Special Theory of Relativity time t is not part of space. Minkowski space is not 3D+T, it is 4D (2, 3, 4).

Einstein used to say: ""Time has no independent existence apart from the order of events by which we measure it". He is perfectly right: time is the numerical order of material change, i.e. motion. Time is not a part of cosmic space. After 105 years this misinterpretation has come to an end.

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Let us see how the idea of "space-time" as the fundamental arena of the universe has entered into physics. Experiments with light carried out in the last decades of the 19th century confirmed that for an observer, light has the same speed regardless of whether the source of light is coming closer to the observer or is moving away from the observer. The Galilean transformation which has served physicists for centuries to describe the position of two inertial systems proved unfit to describe this unusual property of light. Let us suppose that one observer is standing on a train station (observer O), and another observer is on the train itself (observer O'). At the moment the train passes the station, we start measuring the numerical order of train's motion with a clock. At any distance from the station we can describe the position between these two observers in terms of Galilean transformation, where:

$$X' = X - v*t \qquad Y' = Y, \qquad Z' = Z$$

The clock on the train-station and the clock on the train run with the same speed: t' = t. This works just fine when the velocity of train is such as we are used to, i.e. between 100 and 200 kilometers per hour. If we imagine a train with a speed close to that of an airplane or higher, we can no more describe the position of observers O and O' with a Galilean transformation because light still has the same speed for both observers.

To solve this puzzle of the constancy of light speed, Einstein in his Special Theory of Relativity used the Lorentz transformation which exactly describes the position of observers O and O' also when O' on the train moves with a speed v which is close to the light speed c. According to the Lorentz transformation, the relations between coordinates of the observers are the following:

$$X' = \frac{X - v*t}{\sqrt{1-\frac{v^2}{c^2}}}, \quad Y' = Y, \quad Z' = Z$$

According to the Lorentz transformation, the clock on the super fast train runs slower than the clock on the train station:

$$t' = \frac{t - \frac{v*X}{c^2}}{\sqrt{1-\frac{v^2}{c^2}}}$$

The higher the speed of the train, the slower is the speed of the clock on it in comparison to the speed of the clock on the train-station. Different clock speeds have been proved experimentally, clocks do run slower on the surface of the Earth than on a fast airplane.

Our observers O and O' are linked by means of two cameras and two displays. The first camera is monitoring the clock on the station and is sending the image of it to the second display on the train. The second camera, which is monitoring the clock in the train, is sending the image to the first display on the station. Both observers O and O' see exactly the same image on their displays. For both observers, the clocks run with the same speed. In inertial systems there is no "local time". The train moves in space only, not in time. On a super-fast train the clock runs with a lower speed than the clock on the train station. This difference in the clock speed is true for both observers.

We can see that the Galilean and the Lorentz transformations both describe the relation between three coordinates X, Y, Z and the speed of clock t of two inertial systems. In both transformations, time t is considered as time measured with clocks. And with clocks we measure the numerical order of physical events. There is no time existing behind numerical order of material change i.e. motion. Time is not a part of the space-time as a fundamental arena of the universe, time is merely a numerical order of material change that run in cosmic space and numerical order of material change of cosmic space itself.

According to the quantum gravity theory, the cosmic space in which stellar objects exist is made of fundamental packets of energy that build the cosmic space, called the "quanta of space" (QS). In this quantum space, time t is only the numerical order of physical events. Material change, i.e. motion occurs in a timeless quantum space.

Let us take a look at light. A photon moves in a timeless quantum space. We observe a photon moving from the point A to the point B in the quantum space. The smallest distance a photon can move on the distance from A to B d_{AB} is the Planck distance d_p: $d_{AB} = \sum d_{p1} + d_{p2} .... + d_{pn}$. Each motion on the distance d_{px} corresponds exactly to one Planck time t_{px}. Planck time t_p is here considered to be the fundamental unit for measuring the numerical order of photon motion. The velocity of a photon is calculated by dividing the distance d_{AB} with the numerical order of photon motion t_n: $c = \frac{d_{AB}}{t_n}$.

The concept of space-time is now replaced with the concept of timeless quantum space made of infinitely small fundamental quanta of energy (the size of Planck scale) called quanta of space QS (5). In quantum space, time exists merely as a numerical order of material change that we measure with clocks. Quantum space is a medium of immediate information transfer by quantum information events where two particles communicate between themselves instantly without a clock "ticking" even once (6). The numerical order of these immediate events is zero: $t_n = 0$. At Planck scale, physical events happen instantly, at the scale of photons, physical events happen in a "short time", the numerical order t_n of these events is generally small. The numerical order t_n of physical events at the atom scale is already bigger, and it is even bigger at the scale of massive objects.

Material changes have relative velocity regarding different inertial systems and areas of space with different gravity at the scale above the size of the photon. At the scale under the size of the photon velocity of material change is independent on gravity and inertial system. This means that Einstein's Relativity is valid above the scale of the photon.

Material changes on the all different scales from the Planck size to the galaxy size run in a timeless 4D space. The universe is timeless, as predicted by Einstein and Gödel. In a timeless universe, the past and the future exist only as numerical orders of physical events. The universe does not take place in the time; on the contrary, time is the numerical order of universal change. For us humans this means: the universe is an eternal "here and now" wherein time measured with clocks is merely a numerical order of change.

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