Article

The Solution of the "Light Clocks Paradox"

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Abstract

In the 20th century, physics has understood space and time as being coupled into a "space-time", a fundamental arena in which everything takes place. Space-time was considered to have three spatial dimensions and one temporal dimension. Out of the mathematical formalism for the fourth space-time component X4 = ict one can conclude that time t is only a numerical order of material change, i.e., the motion that we obtain with clocks. Time is not a 4th dimension of space. For the description of the Special Theory of Relativity it is here proposed an Euclidian 3D space whilst time t is merely a numerical order of a photon motion in a 3D space. This view solves the "light clock paradox".

Key words: space-time, space, time, numerical order, time dilation, length contraction, light clock.

1. Fundamental unit of time t that we measure with clocks is a Planck time t_p

The Planck's time is a fundamental unit of numerical order of physical events. Let us take a look at light. A photon moves in space. We observe a photon moving from point A to point B in space. The smallest distance a photon can move on the distance from A to B d_{AB} is the Planck length l_p: $d_{AB}=l_{p1}+l_{p2}....+l_{pn}$. Each motion on the line segment l_{px} corresponds exactly to one Planck time t_{px}. The time t of photon motion across distance d_{AB} is the sum of all t_{px}

$$t = t_{p1}+t_{p2}....+t_{pn}= \sum_{1}^{n} t_p$$

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 c is calculated by dividing the Planck length l_p with Planck time t_p. For longer distances d_{AB}, c is obtained by dividing d_{AB} with the numerical order of the photon motion t

$$c = \frac{l_p}{t_p} = \frac{d_{AB}}{t}$$

The symbol of time t in all mathematical formalisms of physics is a number which represents the numerical order of material changes, i.e. motion (1, 2, 3).

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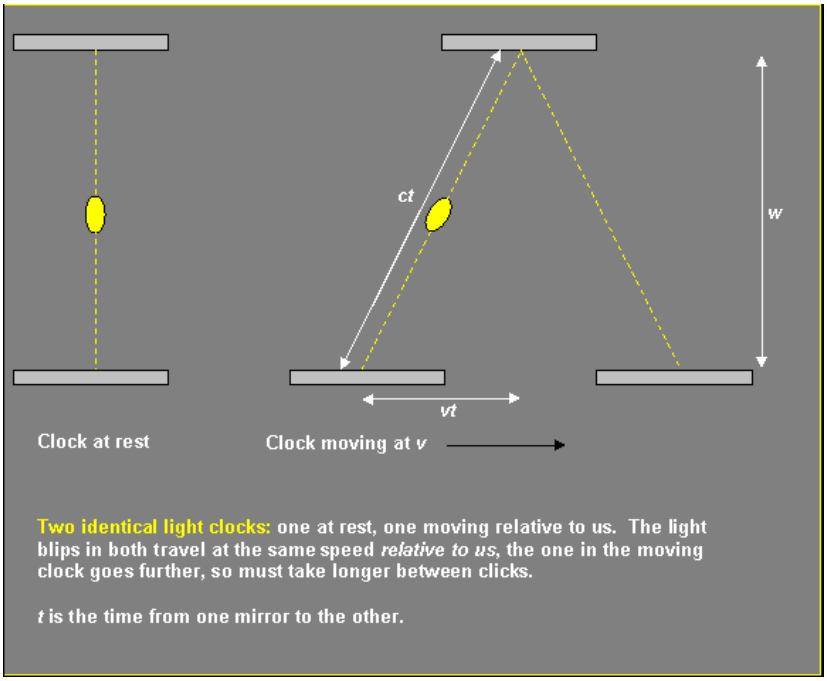
2. The common interpretation of how an observer at rest sees the "light clock" in a moving inertial system is not adequate

The picture below (4) shows a common interpretation of "light clocks" in Special Relativity from the point of the observer O who is at rest. The clock on the left is at rest, the clock on the right is moving. For the observer O on the station, the moving clock o' is supposed to run ("tick") slower than the clock at rest o because the path of the photon is longer than by the rest clock. One "tick" of the clock means a photon passes one distance between the two mirrors. If observer O sees photon of a moving clock o' has longer path between mirrors this is only on optical illusion and does not mean that for him moving clock o' will have a slower rate.



(4)

When we spill water from a glass on board of a flying airplane, water will fall down vertically from the glass. If a ball is thrown perpendicularly towards the floor in a flying airplane, it will bounce back from the floor vertically. Take a sand clock in an airplane. The sand will fall down vertically as if it were on the surface of the Earth. The same is supposed to be true for a photon. In the moving clock in the picture on the right, a photon also moves vertically as for the clock at rest on the left. This is valid for both observers O and O'. The light clock at rest and the moving light clock run (tick) with the same velocity, because the distance between the mirrors is the same for both clocks and for both observers, O and O'.

There is no "proper time" in different inertial systems. We measure only "proper velocity", in different inertial systems rate of clocks has different velocity that is valid for all observers. Inertial systems with observers move in space only, clocks run in space only and time t is a numerical order of their motion and rate. In physics time t is only a mathematical quantity and is not relative. Relative is velocity of material change that we measure with clocks.

3. Light clock paradox

You imagine we turn the moving light clock horizontally in the direction of its motion. According to the Lotentz "length contraction" this moving clock should shrink and therefore run faster than the clock at rest because the length photon has to pass is shorter. This moving shorter clock will run (tick) faster than rest clock. This is contradictory with the "time dilation" where it is proved experimentally that a moving clock runs slower than a clock at rest. To resolve this "Light clocks paradox", the Minkowski's X1, X2, X3, X4 space is replaced with Euclidian X1, X2, X3 space. The spatial relations between inertial systems O' and O are the following:

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

The time t is considered as a numerical order of material change i.e. motion in 3D space. Relation between t' and t in inertial systems O and O' is expressed by Lorentz transformation:

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

Length contraction has no place in this formalism. The rate of a moving photon clock is equal to the rate of a photon clock at rest regardless how the moving clock is turned, vertically or horizontally. By photon clocks and all other clocks relative is the velocity of clocks rate, time is merely a numerical order of their "ticking".

4. Conclusions

Within the existing formalism of Special Theory of Relativity by photon clocks, the thought experiment of "time dilation" is in contradiction with a "length contraction". To resolve this "Light clocks paradox" one can introduce a 3D space with Galilean transformation between two inertial systems where time t is a numerical order of material changes, i.e., motion. A photon moves in space only. Time t is the numerical order of its motion. 3D space is a medium of immediate quantum information transfer. Velocity of light as the maximum velocity in the universe is preserved.

References

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