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GPS Experiment to Detect the Speed of Light Greater than C

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More than 100 years ago, Einstein proposed a synchronisation method to measure the speed of light with the movement of the beam "there" and "back". This method, in principle, does not allow measuring the speed of movement in one direction: if light travels in one direction at a speed C + V greater than C, and in the opposite direction at a speed C-V less than C, and covers a distance L for different time intervals t1 and t2, the average speed L / (t1 + t2) in accordance with elementary algebra you always get less than C. As the only argument for using this method of measurement, relativists still cal impossibility to accurately synchronize clocks separated by some distance, since "the speed of the clock changes with a change in the gravitational potential or their speed of movement". The experiment we proposed with two GPS satellites will allow us to measure the travel times of signals between satellites both in the forward and backward directions and prove that the distance between the satellites the signal travels in one direction at a speed less than C, and in the other at a speed greater than C, which unambiguously proves the fallacy of the basic postulate of SRT - the postulate of the invariance of the speed of light.

The creation of the GPS system became possible only thanks to the invention of high-precision atomic clocks and the use of a measurement method with a message to the receiver of the moment the signal was sent. Synchronized before launch into orbit, the atomic clocks of four GPS satellites moving in the same orbit show the same time with an error of less than one nanosecond. The use of satellite clocks allows you to measure the time it takes for a signal to arrive from one satellite to another, and from the known distance between the satellites, calculate the speed at which the signal travels.

When the source moves relative to the atmosphere, the speed of light propagation does not depend on the speed of its movement and is determined only by the refractive index of the air: light from a moving source propagates in all directions at a speed of **C / n**. In the orbit of GPS satellites, the density of the atmosphere is 10-12 orders of magnitude less, but nevertheless, millions of atoms are contained in each cubic centimetre of the gaseous medium. Although such rarefaction allows satellites to move at a speed of 3.874 km / s, it has the same effect on the propagation of light: the speed of light relative to this medium is also determined by the re-emission of photons, and the refractive index of the medium turns out to be even closer to unity.

The experiment is as follows

Two GPS satellites move in the same orbit and send signals to each other. The signal of the satellite that sends the signal contains information about the moment the signal is emitted. The receiver of the second satellite, as well as the GPS receiver on Earth, determines the moment of receiving the signal by its clock and calculates the time difference that is the time for which the signal arrives from the first satellite.

GPS satellites A and B with the same speed V = 3.874 km/s move in the same orbit at an altitude of 20 000 km from the Earth (Figure 1).

Satellite B at time tB' (according to its clock) sends a signal to satellite A moving in front of it and together with the signal tells satellite A the time tB'. Satellite A , when a signal comes to it, determines the moment tA' by its clock and calculates the time t (BA)' during which the signal travels the distance AB **in the direction from** B to A :

$$t\,(BA)' = tA' - tB' . \qquad (1)$$

Similarly, at time tA”, satellite A sends a signal to satellite B following it and, together with the signal, tells it the time tA”. Satellite B, when a signal comes to it, determines the moment tB” in its clock, calculates the time t (AB)”, during which the signal covers the distance AB **in the direction from** A to B :

$$t\,(AB)'' = tB'' - tA'' . \qquad (2)$$

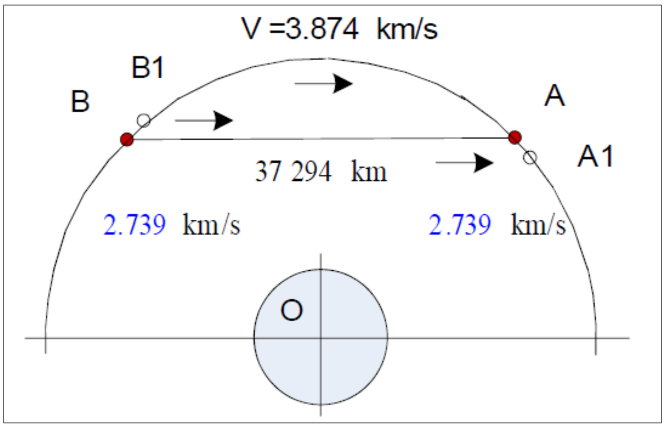
There are 4 satellites in each GPS orbit. With a radius R= 26.371 km and an orbit length of 165 693.9 km, the distance between the satellites along the orbit turns out to be 41 423.47 km, and the distance AB, which the light travels in a straight line, is equal to

$$AB = R / 0.707 = 37\,299.9 \text{ km}. \qquad (3)$$

If to assume that the invariance postulate is valid, the distance in vacuum 37,299.9 km light must travel in time

$$t(0) = 37\,299.9 / 299\,792.\,458 = 0.\,124\,419\,074 \text{ сек} . \qquad (4)$$

In fact, due to the fact that the satellites are moving, during the time that the signal travels the distance between them, they are displaced relative to their initial positions and therefore the signal from satellite B arrives at satellite A after a time t (BA)' , greater than **t(0)** = 0.124 419 073 sec, and it takes time t (AB)" from A to B, less than **t(0)**= 0.124 419 073 sec.



Due to the fact that the orbital velocity V=3.874 km/s turns out to be directed at an angle of 45 degrees to the direction AB, in which the signal propagates, the velocity component in the direction of the signal turns out to be smaller and equals 0.707 x 3.874 = 2.739 km/s (Fig.) .

Thus, in the direction of signal propagation, satellites A and B move relative to the atmosphere at a speed of 2.739 km/s and the shortest distance between them is AB = 37,299.9 km.

The clocks of the satellites are strictly synchronized and show the same time. Satellites A and B move in the same orbit at the same speed and at the same height, and therefore the so-called "relativistic effects", even if they existed, cannot affect the measurement results.

When the signal goes from satellite B to satellite A

Since during the time t(0)= 0.124 419 074 sec the satellite A has time to move **along the orbit** by a distance

Vt(0) = 3.874 x 0.124 419 074 = 0.482 km, (5)

photons with speed C relative to the atmosphere cover a distance **greater than** AB.

The projection of the displacement 0.482 km onto the direction AB 0.482 x 0.707 = 0.341 km **adds** to the distance AB and the signal going from B to A covers a path of

AB + 0.341= 37 299.9 + 0.341 = 37300.24 km.

Photons with speed C relative to the atmosphere cover this path for

37300.241 / 299 792.458 = 0.124 420 211 s

that is by 1,138 nanoseconds **more than t(0)** = 0.124 419 074 sec

Thus, the signal going **in the direction of the movement** of the satellites comes to A in **0.124 420 211** s and with a **speed of** 37 299.9 / **0.124 420 211** = **299 789. 718** km/s, which is by **2.74** km/s **less than** C.

When the signal goes from satellite A to satellite B

The photons emitted by satellite A travel relative to the atmosphere at a speed C and cover a distance less than AB, since during the time t(0) = 0.124 419 074 s satellite B has time to move along the orbit by a distance Vt = 0.482 km and the projection of this shift onto the direction AB , equal to 0.341 km, reduces the distance covered by photons:

AB - 0.341= 37 299.9 - 0.341 = **37299.559** km.

Photons with speed C relative to the atmosphere cover this path in the time

37299.559 / 299 792.458 = **0.124 417 936** s , (7)

which by **1.137** nanoseconds **less than t(0)** = 0.124 419 074 s

Thus, the signal going **towards** satellite B comes to B in **0.124 417 936** s, and goes at a speed of **37 299.9** / **0.124 417 936** = **299 789. 718** km / s, which is by **2.742** km/s **more than C**.

Conclusion

An experiment with two GPS satellites makes it possible to measure the speed of light with great accuracy when the signal propagates in one direction. The sensitivity of the equipment used in GPS is several orders of magnitude higher than that required in this experiment, since it is necessary to measure changes in time intervals larger than one microsecond. The experiment will prove that in the direction opposite to the movement of the GPS satellites, the signal relative to the satellites propagates at a speed more than **299 789. 718** km/s, which by **2.742** km/s greater than C=**299 792. 458** km/s, which unambiguously refutes the basic postulate of the special theory of relativity.

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