The GPS Sagnac Correction Disproves Isotropy and Constancy of the Speed of Light and the Relativistic Clock Synchronization Procedure

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Abstract

Light speed experiments involving moving detectors/observers have been some of the controversial topics in the Special Relativity Theory. The relativistic arguments are inconsistent and are usually ad hoc mixtures of relativistic and classical views. Researchers trying to use such experiments to disprove relativity haven't been particularly successful either because the arguments usually left room for (not always consistent) relativistic counter-arguments. In this paper, I present a decisive disproof of special relativity by applying the assumption of isotropy of the speed of light to a thought experiment. The result is in direct conflict with experience and well-known facts.

Introduction

Light speed experiments involving moving detectors/observers are rightly perceived as a promising way to disprove the Special Theory of Relativity (STR) among researchers looking for alternatives to the STR. One such experiment is the GPS and the GPS Sagnac correction. There have been numerous papers, articles and debates on this over the decades. The relativistic arguments are inconsistent and are ad hoc mixtures of relativistic and classical views as usual. But researchers seeking to disprove relativity by using moving source experiments haven't been particularly successful either, as the arguments usually left room for (not usually consistent) relativistic counter-arguments. In this paper, I present a new evidence against the theory of relativity and isotropy of the speed of light by applying the relativistic procedure of clock synchronization to a thought experiment. The result is in direct conflict with experience and facts. Other theoretical evidences against special relativity are also presented in the APPENDIX.

A Disproof of the Theory and Principle of Relativity

<u>Galileo's ship thought experiment:</u>

Consider a light source emitting a light pulse from some point in the Earth's frame, at $t = 0$. The velocity of the source is irrelevant. At the instant of light emission, an observer is at distance D from the source and is moving away from the source with velocity v, in the Earth's frame.

We know that the light will catch up with the observer at $t = D/(c - v)$. This is a well-known and accepted fact even in the Special Relativity Theory (SRT) and has been confirmed by experiments. Now I will use this in my argument against the theory of relativity.

Consider Galileo's ship thought experiment (Fig.1). An observer in a closed room of the ship is doing a physics experiment. There are two light sources S_1 and S_2, with the distance between

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them equal to *2D*. The line connecting the sources is parallel to the longitudinal axis of the ship, and hence to the velocity *v* of the ship. S_2 is in front of S_1. There are clocks C_1 and C_2 at the same location as S_1 and S_2, respectively. A detector is placed at the midpoint between the sources, at distance *D* from each source. The light sources each emit a short light pulse simultaneously every second. The detector detects the time difference between the pulses. If the time difference is zero, then we may conclude that the isotropy of the speed of light is proved. Otherwise, both the theory and principle of relativity are disproved.

For this, the clocks C_1 and C_2 need to be synchronized first. A short light pulse is emitted from S_1 towards S_2. Suppose that S_1 emits the light pulse at $t = 0$. The observer in the closed room (a relativist) synchronizes the clocks based on the principle of isotropy of the speed of light, because according to SRT the speed of light is isotropic in Galileo's ship! However, unknown to him/her, we know that the clocks 'synchronized' by this procedure will be out of synch by an amount:

$$\frac{2D}{c-v} - \frac{2D}{c} = 2D\frac{v}{c(c-v)}$$

Actually the clock C_2 will be behind the clock C_1 by this amount.

It should be noted that, according to special relativity, the clocks synchronized by this procedure will be in synch. However, from experience we know that the clocks will be out of synch. I think even relativists implicitly accept this (i.e. the clocks being out of synch); they only claim that this does not contradict SRT, using inconsistent arguments as usual. Physicists usually describe SRT by using thought experiments in deep space, claiming that SRT is a correct theory of the universe. However, when it comes to terrestrial experiments, they usually switch their interpretation of SRT to a one that agrees with experimental outcomes. Note that in the above Galileo's thought experiment we assumed a terrestrial experiment. However, if a relativist was given the same problem, except that the experiment is done in deep space, he/she would say that the clocks will be in synch. Therefore, we know that the relativistic procedure is wrong, based on experience and inconsistency in the analysis of SRT. Therefore we analyze the experiment classically as follows.

The sources each emit a short light pulse 'simultaneously' (quoted because the clocks are not actually in synch), every second. The observer in the ship expects the pulses to arrive simultaneously, which they will not.

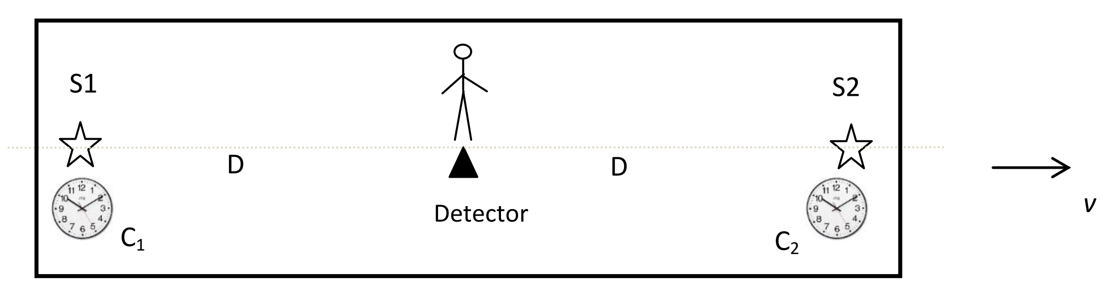


Fig. 1

Let S_1 emit the light pulse at $t = t_0$. Then S_2 will emit 'simultaneously' at the time,

$$t_0 + 2D \frac{v}{c(c-v)}$$

The light from S_1 arrives at the detector at the time,

$$t_1 = t_0 + \frac{D}{c-v}$$

The light from S_2 arrives at the detector at time

$$t_2 = [\ t_0 + 2D \frac{v}{c(c-v)}\ ] + \frac{D}{c+v}$$

The difference in the time of arrival of the two pulses at the detector will be:

$$t_2 - t_1 = \Delta = \left[t_0 + 2D \frac{v}{c(c-v)} + \frac{D}{c+v}\right] - \left[t_0 + \frac{D}{c-v}\right]$$

$$\Longrightarrow \Delta = \frac{2D}{c} \frac{v^2}{c^2} \frac{1}{1 - \frac{v^2}{c^2}} \quad . \quad . \quad . \quad (1)$$

The relativist observer synchronized the clocks by assuming isotropy of the speed of light, placed the detector at the midpoint between the sources and made the sources emit light pulses 'simultaneously'. He/she would expect the light pulses to arrive simultaneously at the detector, which they didn't. The light pulses always arrive with a time difference of Δ that depends on velocity v. The observer would have no way to explain this. To any one rejecting this argument, my response is this: let an actual experiment be done to test it. We know that the origin of the problem lies in the observer assuming isotropy of the speed of light while synchronizing the clocks. This disproves the theory and principle of relativity.

Let me make the difference between the new synchronization procedure being proposed and the standard synchronization procedure more clear.

In the standard clock synchronization procedure, synchronization light pulses would be sent from the mid-point to the clocks C_1 and C_2, which, on receiving the pulses, are immediately set to $t = 0$ and start counting.

In the new procedure, clock C_1 is set to $t = 0$ and at the same time sends a synchronization pulse to the clock C_2. The clock C_2 , upon receiving the pulse, is set to $t = 2D/c$, assuming isotropy of the speed of light , and starts counting from there.

If absolute motion doesn't exist, then both procedures are equivalent in principle and both clocks will be in synch, and therefore $\Delta = t_2 - t_1 = 0$.

However, if absolute motion exists, both procedures will result in out of synch clocks. However, in the standard procedure, this effect will be exactly canceled out as the sources emit the 'simultaneous' pulses to the detector, so that $t_2 - t_1 = 0$.

In the newly proposed procedure, the clocks will be out of synch and this will manifest in non-simultaneous arrival of 'simultaneously' emitted pulses from S_1 and S_2. That is, the unsynchronized clocks will manifest as: $t_2 - t_1 \neq 0$

GPS Sagnac correction as evidence for anisotropy of the speed of light

How does the GPS Sagnac correction support my argument that the pulses from S_1 and S_2 will not arrive simultaneously at the detector ?

Consider both the proposed thought experiment and the GPS in the ECI frame. In both cases, the source and the observer/detector are moving in the ECI frame. In both cases, the clocks are synchronized by assuming light speed isotropy. In the GPS , the point of signal emission is fixed in the ECI frame and the motion of the observer in the ECI frame is considered. (so called GPS Sagnac correction). Therefore, in the thought experiment also the point of signal emission is fixed in the ECI frame and the motion of the observer needs to be considered, and therefore we conclude that the pulses will not arrive simultaneously at the detector.

At this point one might invoke 'relativity of simultaneity' , 'length contraction' , 'time dilation' etc. as a counter-argument. However, we know that the special relativity theory is based on the two postulates:

1. The principle of relativity.
2. The constancy and isotropy of the speed of light

Everything else in SRT is a consequence of these two postulates: Lorentz transformations, relativity of simultaneity, length contraction, time dilation, etc. Therefore, these two postulates need to be tested and established experimentally before accepting their consequences, such as relativity of simultaneity, as facts.

If one or both of the two postulates is shown to be wrong, then we can conclude that the consequences (relativity of simultaneity, etc.) cannot be correct. If somehow it can be shown experimentally that the speed of light is not constant, one cannot bring, for example, relativity of simultaneity into the argument because the latter is a consequence of the former, and not the other way round.

A terrestrial experiment to test light speed isotropy

The time difference of the two signals ($\Delta = t_2 - t_1$) is so extremely small that it may not be possible to measure as described in the thought experiment. The time difference to be measured is so small for terrestrial experiments in which distances $2D$ can only be tens of kilometers. For example, from equation (1) , for D =1km, v =390 km/s (Fig.1), we get Δ = 11 picoseconds, which is difficult or impossible to measure with current technology.

Despite this difficulty, there is still hope for a feasible terrestrial experiment to test the isotropy of the speed of light. The solution is related to realizing the reason why the time difference of the two pulses at the detector is so small. The effect of absolute motion when C_1 sends a synch pulse to C_2 is almost (but not completely) cancelled by the effect of absolute motion when C_1 and C_2 later send pulses to the detector 'simultaneously'. It takes more time for the synch pulse to reach C_2 because C_2 is moving in the same direction as the synch pulse, resulting in clock C_2 lagging behind clock C_1. However, this (absolute motion) effect is *almost* completely (not completely) cancelled when C_1 and C_2 later send pulses to the detector. The pulse from C_1 will take longer time to catch up with the detector (the pulse and the detector are travelling in the same direction) , suppressing the effect of clock C_1 being ahead of clock C_2 . The pulse from C_2 will take shorter time to meet the detector (the pulse and the detector are travelling in opposite directions), suppressing the effect of clock C_2 lagging behind clock C_1 . That is, the absolute motion effect gained during clock synchronization is significantly lost when the clocks transmit pulses to the detector.

The question is: is it possible to retain the absolute motion effect gained during clock synchronization in the thought experiment? The solution is to do the 'synchronization' of the clocks when the axis of the experiment (the line connecting the clocks) is aligned with the direction of Leo (Fig.2), but to make the clocks send pulses to the detector when the axis is perpendicular to the direction of Leo! (Fig.3)

Therefore, at first the synchronization of the (atomic) clocks is done when the $C_1 C_2$ line is parallel with the direction of Leo (Fig.2).

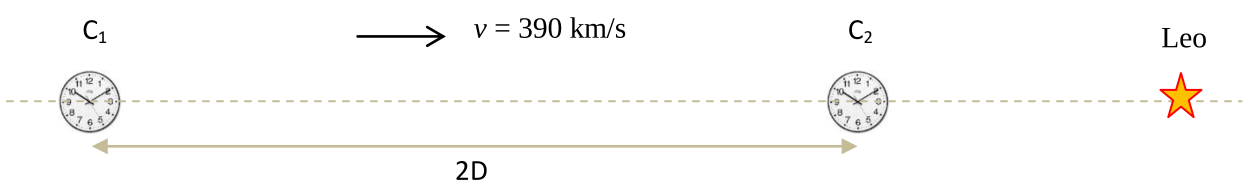


Fig.2

As already discussed, C_1 sends a synch time signal to C_2 , whose time is set by (wrongly) assuming isotropy and constancy of the speed of light. This synchronization procedure will result in clock C_2 being behind clock C_1 by an amount:

$$\delta = \frac{2D}{c-v} - \frac{2D}{c} = 2D\frac{v}{c(c-v)}$$

Next one of the two atomic clocks is transported to another place so that the line connecting the two clocks is orthogonal to the direction of Leo, as shown below (Fig.3). The detector is placed at the mid-point between the two clocks. Note that the detector does not necessarily have to be at the mid-point between the clocks. It can be at any point that is *equidistant* from the two clocks, that is at any point along the dashed line passing through Leo as shown in Fig.3, for example to avoid any obstacles somewhere between the clocks and the detector.

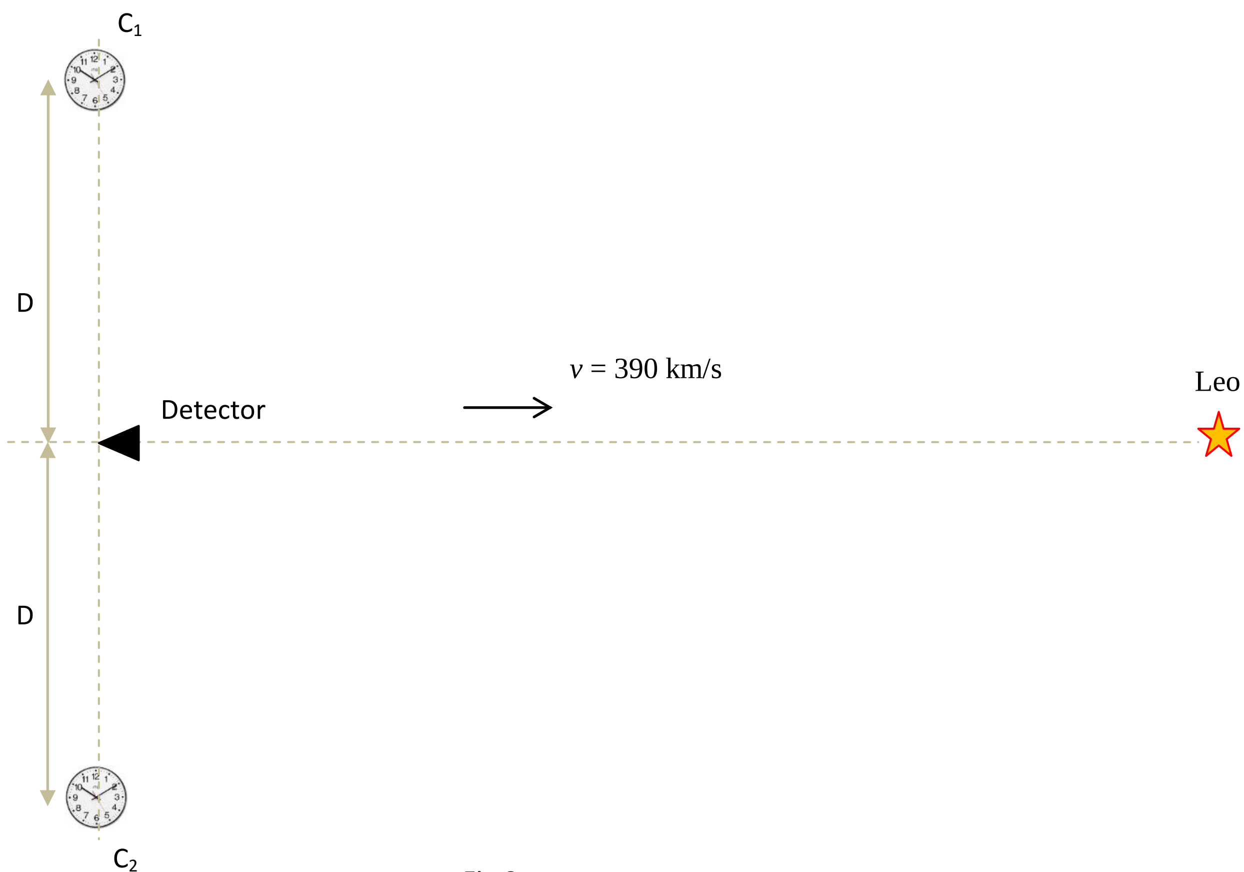


Fig.3

Let the distance between the clocks $2D = 50$ km (Fig.2). From the last equation , clock C_2 will be behind clock C_1 by an amount:

$$\delta = \ 2D\frac{v}{c(c-v)} \ = \ 50 * \frac{390}{300000(300000-390)} \ \cong 217 \ ns$$

Now when the line connecting the clocks is perpendicular to the direction of Leo, the effect of absolute motion is negligibly small and the speed of light can be approximated to be *c*.

$$c' = \ \sqrt{c^2 \ \pm v^2} \ = \ \sqrt{300000^2 \ \pm 390^2} = 300000.2535 \cong 300000 = c$$

Moreover, any absolute motion will affect the time of arrival of the pulses equally.

Therefore, when the two atomic clocks transmit pulses to the detector 'simultaneously' (Fig.3), the two pulses will arrive at the detector with a time difference of (theoretically) *exactly* $\delta \approx 217$ ns = 0.217 μs , which is the clock synchronization error. This is a relatively large time duration that should be detected and measured without difficulty.

Note that the distance (2*D*) between the two clocks at the time of synchronization (that is when the line C_1C_2 is parallel to the direction of Leo) need not be equal to the distance between the clocks when the clocks send pulses to the detector 'simultaneously' (that is when the line C_1C_2 is perpendicular to the direction of Leo). It is only required that the detector be at the mid-point between the clocks.

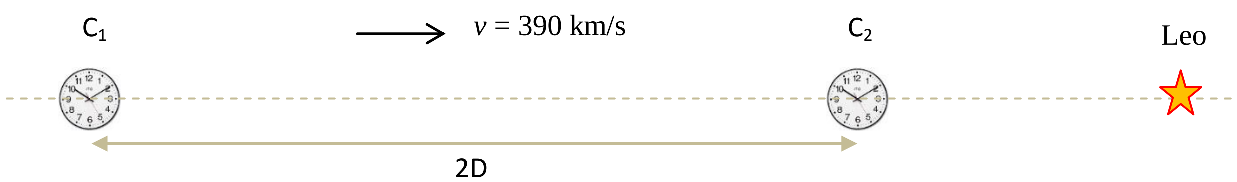
This experiment can be done by using three drones or three helicopters , two for the clocks and associated transmitter and detector, and one for the detector at the mid-point, at higher altitudes to enable larger distances *D* for larger time differences. For example, if distance 2*D* = 200km , the time difference of the two clocks will be 867.8 ns ≈ 0.87 μs . The requirement is that there should be minimum drift of the clocks between 'synchronization' (clock C_1 sending a synch pulse to clock C_2) and clocks C_1 and C_2 sending pulses to the detector. This could take, for example, one hour (the time taken for the helicopters or drones to change position) , during which the drifts of the clocks must be minimum. The experiment is to be done during one or two hours when Leo is on the horizon.

This experiment can also be done without placing a detector at the mid-point between the clocks. The clock C_1 sends a synch signal to clock C_2 when the C_1 C_2 line is aligned with the direction of Leo. Then the positions of the clocks are changed so that the C_1 C_2 line is orthogonal to the direction of Leo. Then clock C_2 sends time signal back to clock C_1 , which compares its own time and the time calculated based on the time signal from C_2 . For a distance 2*D* = 200 km, the discrepancy should be about 0.87 μs as discussed above. However, the experiment with a detector at the mid-point between the clocks may be better than that without the detector because the latter may be prone to error when calculating the time based on the time signal from C_2 , for example, due to an error in the value of the speed of light used in calculating time.

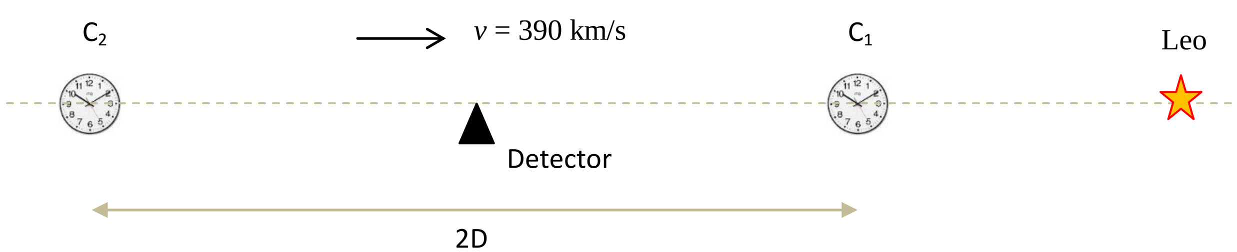
It is possible to improve the above experiment even more. The clock synchronization procedure is the same as above, that is clock C_1 sends a synch pulse to clock C_2 when the C_1C_2 line is parallel to the direction of Leo. However, clocks C_1 and C_2 send pulses to the detector when the C_1 C_2 line is *anti-parallel* (not orthogonal) to the direction of Leo. That is, once the clocks are 'synchronized' , they exchange positions and then send pulses to the detector 'simultaneously' (Fig.4) .

The time difference of the pulses from the clocks at the detector will be twice for the same distance $2D$.

$$\delta = 2\left(2D\frac{v}{c(c-v)}\right) = 4D\frac{v}{c(c-v)}$$



(a) 'Synchronization' of clock C_2 with clock C_1



(b) Clock C_2 and clock C_1 transmit pulses to the detector 'simultaneously'

Fig. 4

Therefore, for a distance $2D$ = 200 km , the time difference of the pulses will be, δ = 2*867.8 ns = 1.7356 μs .

To get a larger effect, the time difference obtained for one synchronization procedure can be multiplied by repeated re-synchronizations, accumulating the effect of absolute motion, as follows. Suppose that there is a third clock C_3 co-located and co-moving with clock C_1.

At first clocks C_1 and C_3 are set to $t = 0$ and at the same time a synch pulse is sent to clock C_2 . (see Fig. 4(a) , clock C_3 is not shown). On receiving the synch pulse, clock C_2 is set to $t = 2D/c$. Then the clocks exchange positions (Fig. 4(b)) and clock C_2 sends time signal to clock C_1 , which calculates and re-synchronizes its time based on the time signal sent from C_2 and assuming isotropy of the speed of light. Again the clocks exchange positions again (Fig.4(a)) and clock C_1 sends time signal to clock C_2 , which calculates the time and re-synchronizes based on the time signal from C_1 , by assuming light speed isotropy, and so on. Note that clock C_3 , unlike clocks C_1 and C_2 , runs freely and is not re-synchronized once started. This re-synchronization procedure can be repeated as many times as possible, say ten times. After ten re-synchronizations, the time of clock C_1 is compared to that clock C_3 . The time difference should be ten times that of a single synchronization procedure. For example, for a distance $2D = 100$ km , this time difference will be 8.678 μs. This experiment can be done by using two helicopters, one for clocks C_1 and C_3 and associated transmitters and detectors, another for clock C_2 and its associated transmitters and receivers/detectors.

These experiments need to be carefully designed. For example, precisely what value of the speed of light (c_x) is to be used to calculate time? Also, in a real experiment there is propagation delay (τ_x) in the electronic circuitry and this also needs to be taken into account. One way to determine these would be to do calibration with the C_1C_2 line orthogonal to the direction of Leo (Fig.3). As we have already discussed, the effect of absolute motion can be ignored in this orientation, that is the speed of light can be taken to be c_x which is the estimated value of the speed of light in air under the prevailing conditions (ambient temperature, pressure, humidity etc.), which is close to the vacuum speed of light. The procedure is as follows. We have three clocks C_1 , C_2 and C_3 . Clock C_3 is co-located and co-moving with clock C_1. The distance between C_1 and C_2 is $2D$. At first clocks C_1 and C_3 are set to $t = 0$ and at the same time a synch signal is sent from C_1 to C_2 . Upon receiving the synch pulse, clock C_2 sets its time to $t = \tau_{x1} + 2D/c_{x1}$, where c_{x1} is a tentative value near the nominal value of the speed of light in air and τ_{x1} is also a tentative value (based on a good estimate) of propagation delay in the specific electronic circuitry used. The precise values c_x and τ_x are yet to be determined. Then, after some time (or immediately), clock C_2 sends back time signal to C_1, which calculates the time by using the value c_{x1} , τ_{x1} and distance $2D$ and re-synchronizes. (Note that exchange of clock positions is not necessary in this case because the C_1C_2 line is orthogonal to the direction of Leo.) . Then C_1 sends a time signal to C_2, which re-synchronizes by using c_{x1} , τ_{x1} and the distance $2D$, and so on. Note that we have assumed that the clocks C_1 and C_2 and their associated (laser) transmitters and detectors and electronic circuitry are identical, so the propagation delays are assumed to be equal. These repeated exchanges of time signals and re-synchronizations can be done many times, say one hundred times. (Note that, unlike clocks C_1 and C_2 , clock C_3 runs freely and is not re-synchronized once synchronized initially at t = 0.) Then the time of clock C_1 is compared to the time of clock C_3 . Theoretically, since the effect of absolute motion is negligible in this orientation, the time of the two clocks (C_1 and C_3) should be the same at the end of the experiment. However, in reality this will not be the case on the first trial because the values of the speed of light (c_{x1}) and propagation delay (τ_{x1}) used in the time calculations are tentative and will not be precise enough.

The values c_{x1} and τ_{x1} are determined as follows. Let the distance between the two clocks in the last experiment be $2D_1$. From the above experiment,

$$100\left(\tau_{x1} + \frac{2D_1}{c_{x1}}\right) = T_{c1}$$

where T_{c1} is the time of clock C_1 at the end of the experiment.

If the values c_{x1} and τ_{x1} used in the calculations were exactly equal to the correct values, that is, if $c_{x1} = c_x$ and $\tau_{x1} = \tau_x$, then the time of clock C_1 would be equal to the time of clock C_3 . That is,

$$100\left(\tau_{x} + \frac{2D_1}{c_{x}}\right) = T_{c3}$$

Subtracting the last two equations:

$$100\left(\tau_{x1} + \frac{2D_1}{c_{x1}}\right) - 100\left(\tau_{x} + \frac{2D_1}{c_{x}}\right) = T_{c1} - T_{c3}$$

Then the above experiment is repeated for distance $2D_2$ between the clocks.

$$100\left(\tau_{x1} + \frac{2D_2}{c_{x1}}\right) - 100\left(\tau_{x} + \frac{2D_2}{c_{x}}\right) = T_{c12} - T_{c32}$$

where T_{c12} and T_{c32} are the times for clocks C_1 and C_2 at the end of the second experiment with distance $2D_2$ between the clocks, respectively.

From the last two equations c_x and τ_x can be determined. Note that these values are valid only if the conditions under which they have been determined, such as ambient temperature, air pressure, humidity, etc. , have not changed significantly. The above calibration procedure is repeated once again by using the values c_x and τ_x as the tentative values, in order to confirm these results or slightly readjust them as necessary. Once c_x and τ_x have been determined, they are used to calculate time based on a time signal sent from another clock.

Now that we have done the calibration, that is the determination of c_x and τ_x , we will return to the main experiment (Fig.4). Suppose that the exchange of time signals between C_1 and C_2 and re-synchronizations are done n times.

Then the time difference (δ) between clocks C_3 and C_1 at the end of the experiment will be:

$$\delta = n \left(\tau_x + 2D \frac{v}{c_x(c_x - v)} \right)$$

We know c_x and τ_x from the calibration, convenient and optimal values of n and distance $2D$ are chosen and δ is determined at the end of the experiment. Therefore, the only unknown is the absolute velocity v and can be determined from this equation.

Testing the relativistic clock synchronization procedure by transmitting time signals between an Earth clock and a satellite clock

Yet another opportunity to test the prediction is by exchange of time signals between an Earth clock and a satellite clock[1]. The big distance involved is a great advantage to test and detect the predicted effect. The experiment is described as follows.

Consider an atomic clock (C_1) on Earth and another atomic clock (C_2) on a satellite (a GPS satellite, for example). (Fig.5)

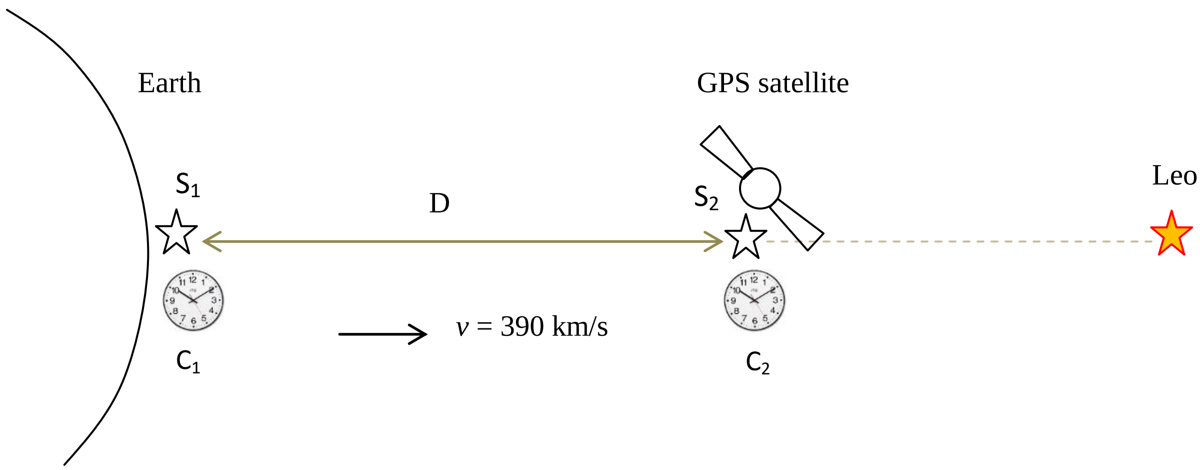


Fig. 5

The experiment is done when the Earth, the GPS satellite and Leo are aligned, as shown (Fig.5). However, alignment would be preferable but not a necessity, so a GPS satellite out of alignment but close enough to the Earth-Leo line can be used, with a component of the absolute velocity along this line calculated and used.

The distance D needs to be measured as precisely as possible, by radar ranging, that is by reflecting radar signal from the satellite (not by interrogation!). For this, the radial velocity of the GPS satellite relative to the Earth needs to be near zero to accurately compute the distance D from the radar round trip time (τ). In this case:

$$\tau = \frac{2D}{c}$$

If there is relative radial velocity between the Earth and the GPS satellite, using the above equation leads to erroneous distance *D*. (the Brian G. Wallace effect)

At time $t = 0$, the Earth clock (C_1) transmits a synch pulse to the GPS satellite clock (C_2). The satellite clock actually receives the synch signal at $t = D/(c-v)$, that is when the time of the Earth clock is $t = D/(c-v)$. However, due to the assumption of isotropy of the speed of light, the satellite clock is (wrongly) set to $t = D/c$. Therefore, the GPS satellite clock will be behind the Earth clock by an amount:

$$\delta = \frac{D}{c-v} - \frac{D}{c}$$

The (c - v) is because the satellite clock (C_2) is moving away from the synch signal (Fig.5).

Now, let the GPS satellite clock (C_2) transmit time signal to Earth at some later time $t = t_0$.

At this instant, the clock on Earth (C_1) will be ahead of the satellite clock (C_2) by the amount δ. That is, the time of the Earth clock when the satellite transmits the time signal will be:

$$t_0 + \delta$$

Therefore, the GPS satellite time signal arrives on Earth when the time of the Earth clock is:

$$(t_0 + \delta) + \frac{D}{c+v} = (t_0 + \frac{D}{c-v} - \frac{D}{c}) + \frac{D}{c+v}$$

The $c + v$ is because the Earth clock is moving towards the GPS time signal.

However, due to the assumption of isotropy of the speed of light, the GPS receiver on Earth *calculates* the 'correct' time to be:

$$t_0 + \frac{D}{c}$$

Therefore, the difference between the *actual time* of the Earth clock and the *calculated time* (using GPS signal) will be:

$$(t_0 + \frac{D}{c-v} - \frac{D}{c}) + \frac{D}{c+v} - (t_0 + \frac{D}{c}) = \frac{D}{c-v} + \frac{D}{c+v} - \frac{2D}{c} = \frac{2D}{c}\frac{\frac{v^2}{c^2}}{1 - \frac{v^2}{c^2}}$$

Substituting $D = 22000$ km, $v = 390$ km/s , we get about 0.248 micro seconds. This discrepancy can be easily detected and measured.

Conclusion

In this paper, we have applied the relativistic procedure of clock synchronization, that is by assuming isotropy of the speed of light, to a thought experiment. In the thought experiment, a detector is placed at the mid-point between two sources S_1 and S_2 in an inertial lab, a Galileo's ship moving with velocity v relative to the sea. Therefore, the lab is moving (at least) relative to the sea. Clocks C_1 and C_2 are co-located with S_1 and S_2, respectively. The two clocks are synchronized by sending a synch pulse from S_1 to S_2 and by assuming isotropy of the speed of light. I argued that, in reality, the two clocks will not be *actually* synchronized by this procedure because the clock C_2 is moving away from the synch pulse, which will take more time to reach C_2 than if C_2 was not moving. Despite this, let the clock C_2 , upon receiving the synch pulse, (wrongly) set its time to D/c, instead of $D/(c-v)$. Next we will see how this out-of-synch condition of the clocks will manifest. After some time, each clock 'simultaneously' emits a light pulse towards the detector. If the clocks are really in synch and if the speed of light is really isotropic, then the pulses will arrive simultaneously at the detector. The question is: will the pulses arrive at the detector simultaneously or not? One way to test this is to do an actual/physical experiment. Two experiments, one by sending time signals between two terrestrial clocks and another by sending time signals between a clock on Earth and a clock on a satellite , have been proposed. However, we can also use past experience to determine whether the time difference of the two pulses will be zero or not. One such experience is the GPS Sagnac correction. Consider the thought experiment described and the GPS system in the ECI frame. In both cases, both the source and the detector are moving. In both cases, the point where signal is emitted is fixed in the ECI frame. In both cases, isotropy of the speed of light is assumed to synchronize the clocks. We know that motion of the detector/receiver is considered in the GPS (so called GPS Sagnac correction) to account for the change in position of the receiver during the GPS time signal transit time. We conclude that motion of the detector needs to be considered in the thought experiment also and, therefore, the 'simultaneously' transmitted pulses will not arrive at the detector simultaneously, despite the fact that the sources are at equal distances from the detector. This disproves the isotropy of the speed of light and thereby the theory and principle of relativity.

Glory be to God and His Mother, Our Lady Saint Virgin Mary

Notes and references

1. I have discussed this experiment on internet forum:

https://www.scienceforums.net/topic/132749-a-disproof-of-the-principle-and-theory-of-relativity/page/4/#comments