One way speed of light test – is it possible?

Doug Marett, 2017

It has long been recognized that the earth is hurdling through space at a high rate of speed. Our velocity around the sun is 30 km every second, and it is estimated that the velocity of our galaxy towards the Virgo cluster is 650 km/s! Scientists in the 19th century came up with the idea that it might be possible to detect earth's motion through space using a beam of light. Young's double slit experiment of 1805 had convinced scientists of that era that light behaved as a wave, and since waves generally travel in *something*, it stood to reason that space must be filled with some kind of medium that served to propagate light. Experiments had shown that the velocity of light was independent of the motion of its source, so assuming we are travelling at a high speed through this medium of space, it made sense that if we shone light into the oncoming medium, the light would be received later at a receiver at some fixed distance in that direction. If we shone the light in the opposite direction, it would be received earlier than expected at a receiver at the same distance. We could call this a one-way speed of light test: the speed of light should be C-v, or C+v, with v being our velocity through space. As is well known now, the Michelson-Morley experiment of 1881 and 1887 sought to detect the velocity v through space, and mysteriously failed to do so.

At the time, the greatest minds in physics were perplexed by this null result, and a new theory emerged that hypothesized that it would actually be impossible to detect our motion through space using a terrestrial light experiment, since the lengths of rulers and the counting of clocks would be affected by our motion, in such a manner as to make this motion invisible to detection. One of the main proponents of this theory was Hendrik Lorentz, who stated:

"In order to explain this absence of any effect of the Earth's translation (in the Michelson/Morley experiment), I have ventured the hypothesis, that the dimensions of a solid body undergo a slight change, of the order of v2/c2, when it moves through the ether. From this point of view it is natural to suppose that, just like the electromagnetic forces, the molecular attractions and repulsions are somewhat modified by a translation imparted to the body, and this may very well result in a change of dimensions. The electrons themselves become flattened ellipsoids. .. This would enable us to predict that no experiment made with a terrestrial source of light will ever show us an influence of the Earth's motion. (**Lorentz**,1906)"

Of course, not long after Lorentz's theory was proposed, Einstein published his papers on special relativity, which made the claim that the speed of light is constant "for all frames of reference for which the equations of mechanics hold good," and further argued that there was no absolute stationary space medium required for the propagation of light.

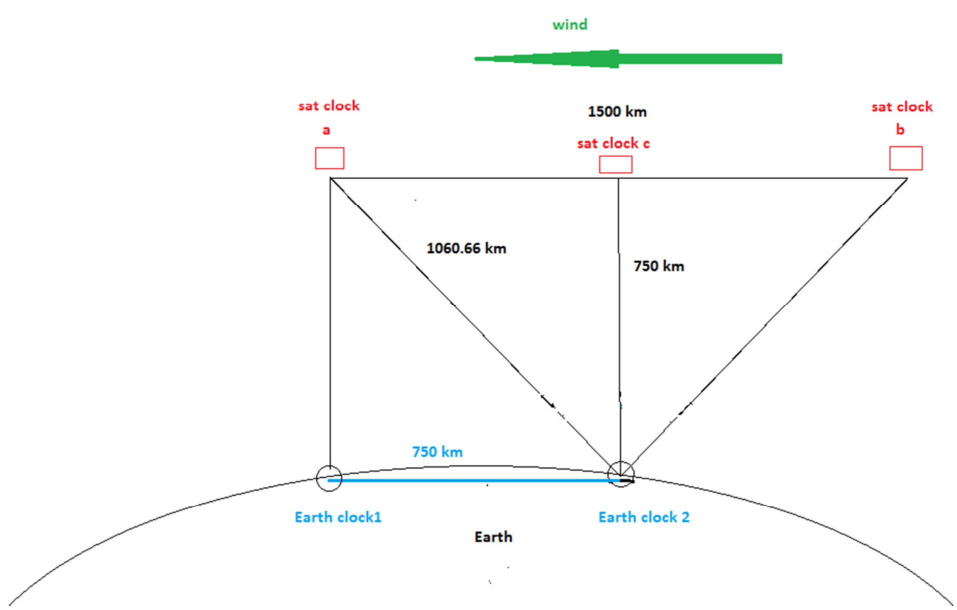
It is a commonly held belief that Einstein's idea that the speed of light is constant for inertial observers has been proven beyond any doubt, since no terrestrial light experiment has ever succeeded in detecting the long sought C+v and C-v due to our motion through space . The conviction of relativists on the matter is so absolute that anyone questioning these axioms in modern times is fit to receive ridicule, admonishment, and even sanction.

However, there is another school of thought that can be found in the scientific literature that quietly suggests that proving the constancy of the speed of light may actually be impossible despite what we are being told. These doubters are not heretics or troublemakers, but rather are in most cases accomplished scientists and engineers who understand the problem at a very deep level. The dilemma turns out to be somewhat complicated and intricacies of it are quite often misunderstood even by the so-called experts in the field.

Herein I would like to start by discussing one of these papers explaining the problem which deals explicitly with the attempted measurement of the one-way speed of light. This is a paper by Herbert Ives (the inventor of the television) called “The measurement of the velocity of light by signals sent in one direction.” (1) In order to understand Ives’s argument, I am going to use a modern example, namely the use of GPS satellites, and clocks synchronized by them. We are going to use as our hypothetical universe one that has a universal rest frame for light and is not-expanding.

Herbert Ives 1943 Paper:

Consider two earth clocks, 1 and 2, that are separated from each other by 750 km. Each clock is a GPS disciplined clock; it relies on a series of GPS satellites in various positions 24,000 km away to tell it what time it is to a high degree of accuracy. The satellite clocks are all atomic clocks that are synchronized to terrestrial time (TT). Let assume for the moment that the earth is moving to the right at say 30 km/s (our orbital velocity), and that light moves in a medium of space that remains static. So space (the “wind”) can be considered to be moving to the left at this same speed as our motion to the right. Ives’ asked, what will happen to the time counted by a clock when it moves from sat clock A position to sat clock B position? (Ives doesn’t use satellites, but we will here). Ives argues that the moving clock will undergo a velocity time dilation, as would be called for by both the theory of Lorentz and the theory of Einstein.



The amount of this time dilation is a little complicated to arrive at, suffice it to say we used Ives's equation (10) from page 882 of his paper, which is reproduced below:

$$\Delta = \tau[1-(W^2/c^2)]^{\frac{1}{2}} - \frac{\tau[1-(W^2/c^2)]^{\frac{1}{2}} - \dfrac{WD}{c^2[1-(W^2/c^2)]^{\frac{1}{2}}}}{\left(1+\dfrac{q^2}{c^2}\right)^{\frac{1}{2}}}$$

$$= \frac{\tau\left(1-\dfrac{W^2}{c^2}\right)^{\frac{1}{2}}\left[\left(1+\dfrac{q^2}{c^2}\right)^{\frac{1}{2}}-1\right] + \dfrac{WD}{c^2[0-(W^2/c^2)]^{\frac{1}{2}}}}{\left(1+\dfrac{\dot{q}^2}{c^2}\right)^{\frac{1}{2}}}. \qquad (10)$$

Where W is the wind velocity, c is the vacuum speed of light, and q is a rod/ clock quotient calculated separately that arises from the slow clock transport. We plugged all of Ives's equations and numbers into an Excel spreadsheet and we found that when the clock arrives at position B, it has lost 5 E -7 seconds with respect to the clock at position A (see blue box in Table 1 below). Following the same logic, the clock at position C, if it had also moved from position A, would have lost 2.5E-7 seconds. This loss of time is due to the motion of the clocks "against the wind" so to speak, the wind again being the motion with respect to a hypothetical absolute space where the medium of light propagation would reside. The light arrives later than expected (C-v) so the clock B is now behind clock A in time counting.

Table 1:

	A	B	C–G	H	I–J
1	**The Measurement of the Velocity of Light by Signals Sent in One Direction - Herbert Ives**				
2	**Part 1: The two way velocity of light calculation:**				
3	D'	1500000	platform length based on rods laid end to end on it	calculation	
4	t1	0.0050005	time of transit from a to b meaured by a clock stationary in the medium	t1	t2
5	t2	5.00E-03	return b to a as above	5.00E-03	5.00E-03
6	lo	0.1	length of a stationary rod		
7	l	0.1	length of a moving rod = lo[1-v^2/c^2]^ 1/2	t1+t2	t'
8	vo	1	frequency of stationary clock in medium	1.00E-02	1.00E-02
9	v	0.999999995000	frequency of moving clock = vo[1-v^2/c^2]^ 1/2		
10	c	3.00E+08	speed of light in the medium		
11	W	3.00E+04	velocity of medium past the platform		Y by calc
12	gamma	0.999999995000			1.00000277E+00
13	t'		elapsed time for round trip as measured at a		τ'
14	D	1499999.992500000000	true length of platform		0.9999994950
15	**Part 2: One way speed of light calculation**				Δ
16	Q1	3.00E+08	Rod/Clock quotient, where one clock is at point a		5.0000E-07
17	Q2	300000000.00	Rod/Clock quotient, where one clock is at point a and one at b		Q2
18	q	1.000002777791	Rod/Clock quotient, where one clock is moved with respect to the platform		300000000.00
19	Y	1	the velocity of the moved clock as measured by the moved clock		actual c eq. 15
20	factor	2.78E-06	this factor establishes the value for q when Y = 1		299999999.5
21	τ'	0.999999495000	the interval indicated by the moving clock		v
22	τ	1	the interval indicated by the clock at a		299970000.00
23	diagonal	1060660.172	distance from sat clock a to earth clock 2		

So according to Ives, we have a strange situation. It is assumed in the GPS system that an atomic clock moved from position A to B or from A to C would always maintain Terrestrial time, i.e. it would be unaffected by its position in "space.". However, a model based on time dilation in the face of an aether wind would lead to an entirely different prediction, that the three clocks would all register different times. This may be summarized in the chart below:

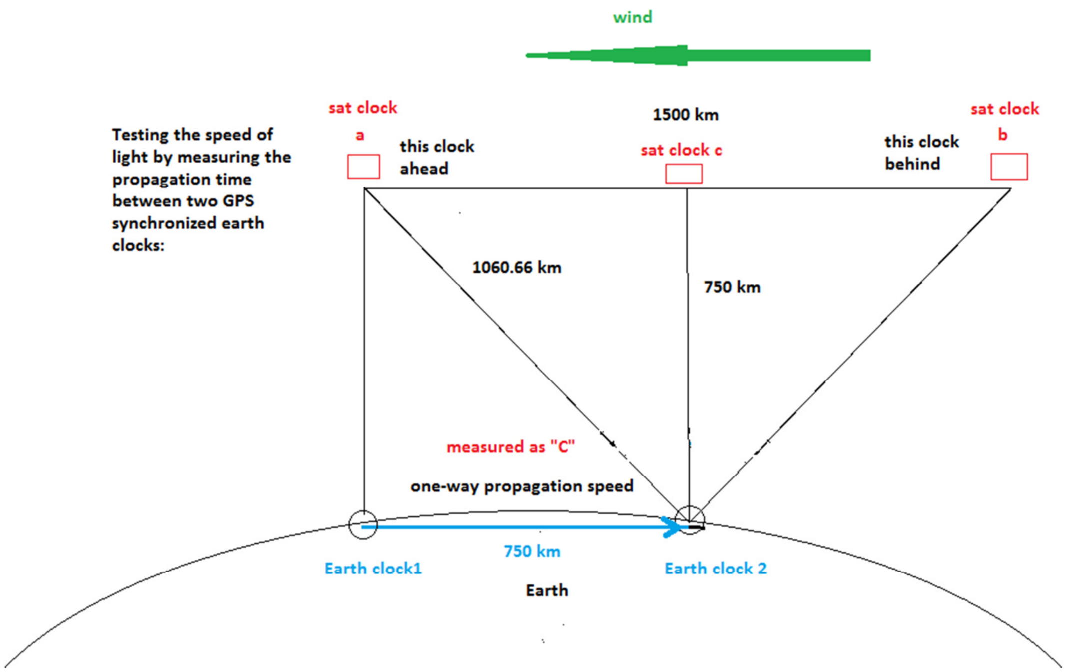
Table 2:

Comparison of the clock times after synchronization		
	Sat clocks	
A	C	B
1.00000000	0.99999975	0.99999950
1	1-Δ/2	1-Δ
	Earth Clocks	
	clk1	
	Sync by A	
	1.00000000	
	clk2	
Sync by A	Sync by C	Sync by B
0.99999975	0.99999975	0.99999975
A+L'/c-L'/((c-v)*cos(45))		C+L"/c-L"/((c+v)*cos(45))

In the top blue section, if we assume that clock A reads 1 second, clock C would read 0.99999975 seconds (=1 - 2.5 E -7) and clock B would read 0.99999950 seconds (=1 – 5 E-7). It is important to note that it may not be immediately apparent to an earth observer that the clocks A, B and C are not reading the same time, as will be explained as we proceed.

We now consider what will happen when satellite clocks A, B and C are used to synchronize earth clocks 1 and 2. If satellite clock A sends a time signal to Earth clock 1, it will be largely unaffected by the presumed wind (since the signal is perpendicular) so after accounting for the vacuum speed of light, earth clock 1 is synchronized to sat clock A and reads 1.000000 second. If we have sat clock C send a signal to earth clock 2, it will also be synchronized to 0.99999975 seconds (since again the wind has no effect being perpendicular). Now what happens if we instead try to synchronize earth clock2 with either sat clock A or sat clock B? The earlier count of B (0.99999950) exactly balances the shorter propagation time due to the wind of L''/ ((c+v)*cos(45)), so that the synchronization exactly agrees with the sync by sat clock C. Conversely, the later time of sat clock A (1.000000) exactly balances the longer propagation time of L'/((c-v)*cos(45)). So regardless of where the satellite clock is in the sky, its individual bias will balance the propagation time such that clock 2 will differ from clock 1 by exactly the amount necessary to arrive at the seemingly erroneous conclusion that the speed of light is C in all directions.

This leads us to two understandings of "time." One is Newtonian time, which would be a kind of absolute time, and clocks would agree on Newtonian time if synchronizing signals could be sent instantaneously. At a given instant in Newtonian time, all of the clocks would display the readings shown in Table 1 after EM signal synchronization. Contrary to this conclusion however, is the presumption of the times based on Einstein synchronization and the de facto constancy of the speed of light. In this case all of the clocks would be presumed to be synchronized to read “1 second” at the same instant. Charles Hill (2) coined the term “Einstime” to denote these readings.



If we now perform our actual one way speed of light test, by sending a beam of light between our GPS synchronized earth clocks, we would expect the speed of the light signal from clock 1 to 2 to be C-v (slowed by the oncoming wind), but clock 2 is behind of clock 1 by precisely the amount to cancel out any measurable speed of light difference due to v, so again the experiment would measure the speed of light to be C, not C-v.

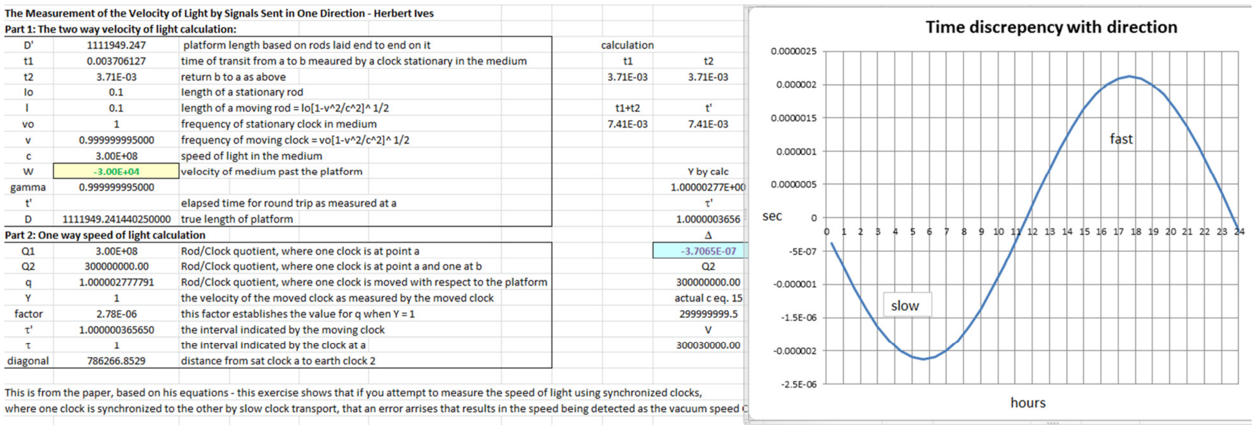
Propagation speed of light from earth clock 1 to 2:

1	2	3	4	5	6	7
Reading Clock1	Reading Clock2	Clk 2 behind Clk 1 by:	Propagation Time C-v	Propagation Time at C	C-v signal delayed by:	Difference Box 3-6
1.000000 s	0.9999995 s	2.5E-7 sec	3.53578 s	3.53553E-3 s	2.5E-7 s	0.0000 s

This is why the one way speed of light test is considered impossible by some – because any attempt to synchronize clocks in the presence of an aether wind will lead to clock biases that will exactly cancel out any measureable velocity with respect to space, even if the speed of light is different in different directions. Any attempt to send a synchronizing signal between satellites A, B and C will all give the illusion that the clocks are displaying the same time if one assumes a constant speed of light. Ives also points out that altering the speed of light using a refracting medium doesn’t help.

Predicted Time Discontinuities Between Clocks on the Rotating Earth

Returning to our Excel simulation of Herbert Ives's paper, it is useful to try to understand how much earth clocks would be predicted to vary in their rates as the earth rotates with respect to a hypothetical aether wind. If we set the distance between the clocks as 10 degrees of earth circumference (1111.9 km) and presume an aether wind of 30 km/s due to earth's orbit around the sun, the spreadsheet calculates for us the amount of Newtonian time gained or lost each hour of the day. The graph is shown on the right of the figure below.

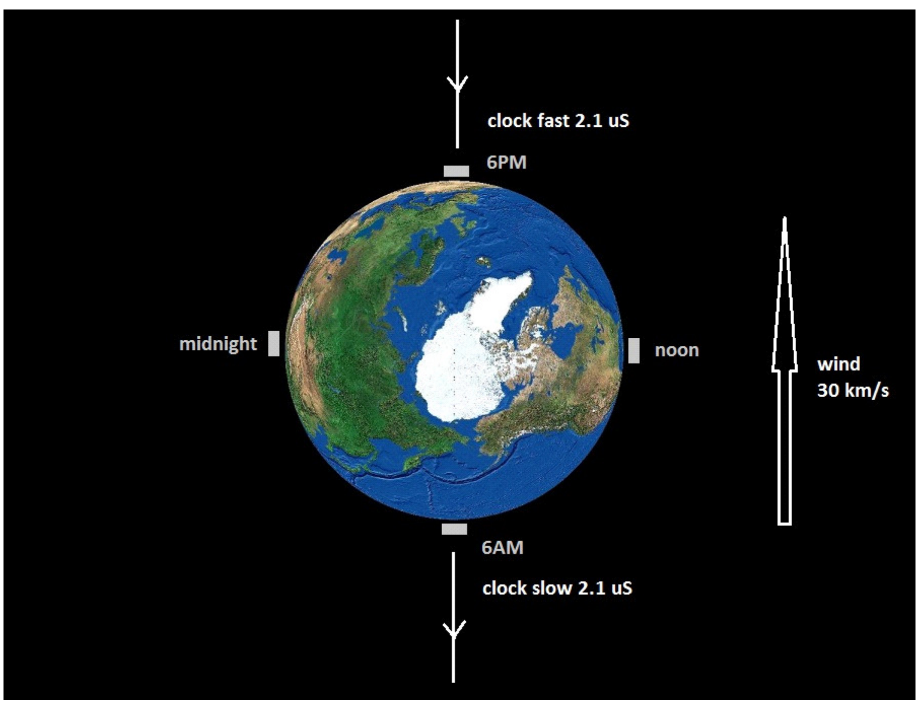


The Measurement of the Velocity of Light by Signals Sent in One Direction - Herbert Ives

Part 1: The two way velocity of light calculation:				
D'	1111949.247	platform length based on rods laid end to end on it	calculation	
t1	0.003706127	time of transit from a to b meaured by a clock stationary in the medium	t1	t2
t2	3.71E-03	return b to a as above	3.71E-03	3.71E-03
lo	0.1	length of a stationary rod		
l	0.1	length of a moving rod = lo[1-v^2/c^2]^ 1/2	t1+t2	t'
vo	1	frequency of stationary clock in medium	7.41E-03	7.41E-03
v	0.999999995000	frequency of moving clock = vo[1-v^2/c^2]^ 1/2		
c	3.00E+08	speed of light in the medium		
W	-3.00E+04	velocity of medium past the platform		Y by calc
gamma	0.999999995000			1.00000277E+00
t'		elapsed time for round trip as measured at a		τ'
D	1111949.241440250000	true length of platform		1.0000003656
Part 2: One way speed of light calculation				Δ
Q1	3.00E+08	Rod/Clock quotient, where one clock is at point a		-3.7065E-07
Q2	300000000.00	Rod/Clock quotient, where one clock is at point a and one at b		Q2
q	1.000002777791	Rod/Clock quotient, where one clock is moved with respect to the platform		300000000.00
Y	1	the velocity of the moved clock as measured by the moved clock		actual c eq. 15
factor	2.78E-06	this factor establishes the value for q when Y = 1		299999999.5
τ'	1.000000365650	the interval indicated by the moving clock		V
τ	1	the interval indicated by the clock at a		300030000.00
diagonal	786266.8529	distance from sat clock a to earth clock 2		

This is from the paper, based on his equations - this exercise shows that if you attempt to measure the speed of light using synchronized clocks, where one clock is synchronized to the other by slow clock transport, that an error arrises that results in the speed being detected as the vacuum speed C

What this shows is that an atomic clock at the equator would under these circumstances fluctuate in its rate of timekeeping over the course of the day, losing a maximum of 2.1 uS at 6AM and gaining a maximum of 2.1 uS at 6PM. This is despite the fact that any attempt to verify their rates using Einstein synchronization will always return the same answer that they are all counting at the same rate in Einstime. This is shown diagrammatically in the figure below.

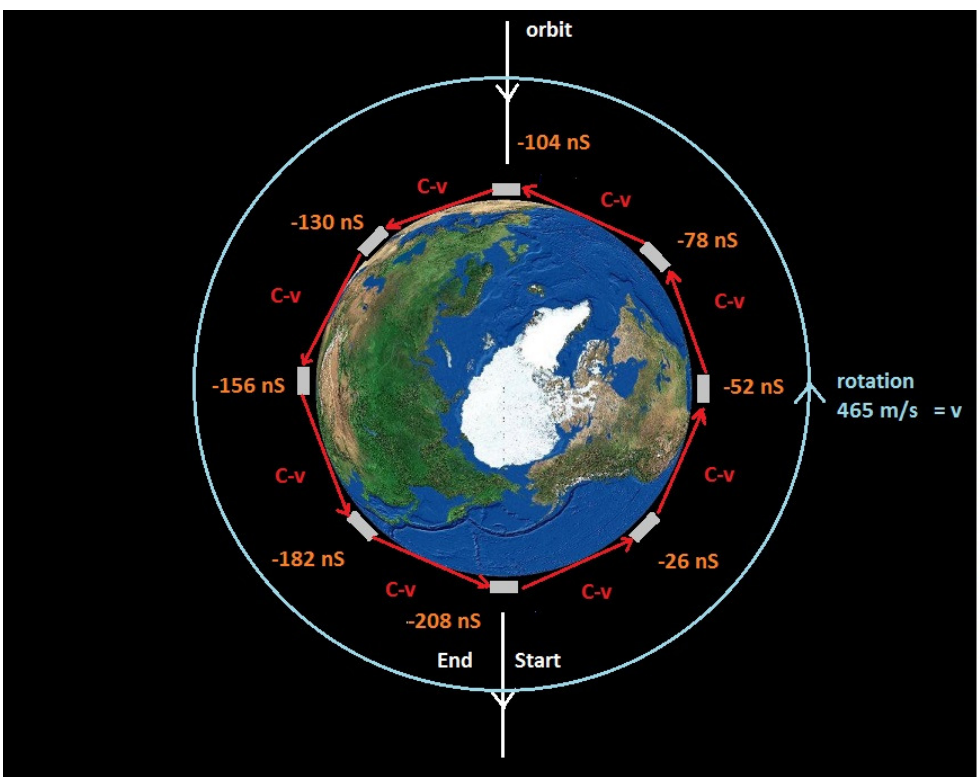


Some Possible Cracks in the "Conspiracy of Clocks."

1) Sagnac Effect:

An experiment was performed in 1976 by Saburi et.al (3) using the geostationary ATS-1 satellite which accidentally uncovered the Sagnac effect error between the satellite and the earth based clocks rotating with the earth. Saburi pointed out the problem of a "time discontinuity" which develops on the earth between clocks. If we have a series of clocks on the earth surface and send a one-way synchronization signal from one to the next to the next around the earth, the clocks will become progressively desynchronized due to the earth's rotation, such that when the synchronization signal arrives back at the starting clock, the reading sent by the last clock to the first clock does not match in time. This is because of the earth's rotational velocity and the motion of the clocks with respect to the earth centered inertial (ECI) frame. This is called a closure error. If the clocks were synchronized to eliminate this error, then a propagation range delay corresponding to an anisotropy in the speed of light is revealed. This amounted to C+/-v, where v was the velocity of the earth clock with respect to the ECI frame. So in a sense this is a positive realization of a one way speed of light test, although the velocity difference revealed is limited to the rotation rate of the earth. This effect is independent of how the first clock is synchronized, and implies just like in the Sagnac effect using a rotating interferometer, that the speed of light is not measured to be constant by the rotating observer, and the speed of light is found to be different in either direction. This is the same effect that was seen in the Hafele and Keating experiment with airborne clocks flown around the world.

Time Discontinuity of Clocks on the Rotating Earth:



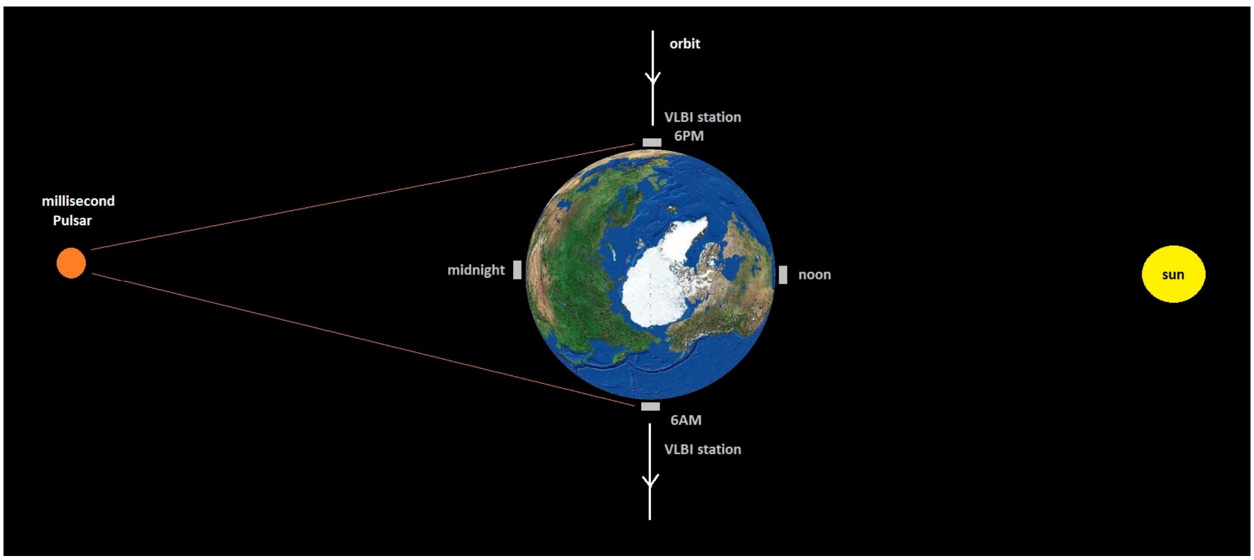
At each step, a synchonizing signal sent from one clock to the next will arrive late since it travels at C-v rather than at C. Each clock will then be 26 nS behind the previous one. When the final clock tries to synchronize the starting clock, it will then be a total of 208 nS behind where it started!

Similarly, if the synchronization signal is sent in the opposite direction around the globe, the final clock would be 208 nS ahead of the start clock!

The solution in the case of GPS is to assume that the speed of light is constant only in the non-rotating, Earth centered inertial frame, and to thereby add the appropriate correction to the propagation range calculation. The problem is also discussed by Ashby in a 1978 paper (4) that came out just after the establishment of the GPS system. Again, these values pop right out of Ives's Excel simulation by simply entering the velocity as 465 m/s and the distance between the clocks.

2) Earth's Motion Revealed by Pulsar Clock Sources:

It was first pointed out by Charles Hill in 1990, (5) and again in 1995,(2) that timing data from pulsar radio sources could reveal the hidden daily oscillation in Terrestrial Time (T). Imagine if a millisecond pulsar timing source is directly orthogonal to the earth's orbital motion, as shown in the figure below. If we have two very long baseline receiving stations at the 6AM and 6PM positions on the equator, then the timing signals from the pulsar should arrive simultaneously at the two stations.



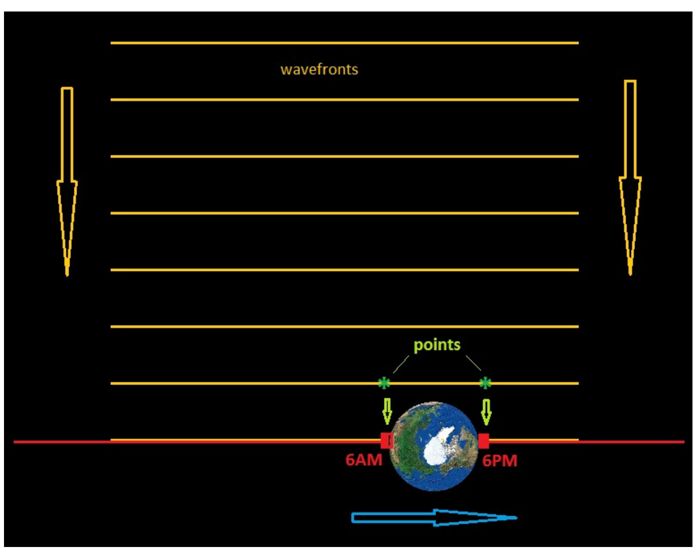
If the clocks at these two stations were not truly synchronized, then a time discrepancy for the arrival of the pulsar signal should be revealed. Ron Hatch, who was a good friend of the late Charles Hill, also made the same argument in his excellent paper "Those Scandalous Clocks." (6) Hatch describes how actual VLBI measurements would appear to confirm that pulsar signals received in the earth frame of reference would arrive about 4 uS sooner for a 6AM positioned station than for a 6PM positioned station. In other words, a +/- 2 uS bias for each station. This bias is what he predicts would occur as a result of our orbital motion with respect to space. Hatch points out that this bias is synonymous with the expected aberration of the pulsar wave front in the earth's frame, and disappears if the results are processed in the sun's barycentric frame instead. This bias is typically attributed (for example by Thomas 1971, 1974)(6) to the special relativity clock synchronization correction that accounts for the fact that "simultaneous events in one frame (a "solar system frame") are not necessarily simultaneous in a "geocentric frame" passing by with velocity v_e. " Hatch criticises this explanation by arguing that aberration is likely not the cause, since the tilting of a telescope on the earth would be required for the aberration of the incoming ray no matter which frame is used. He states:

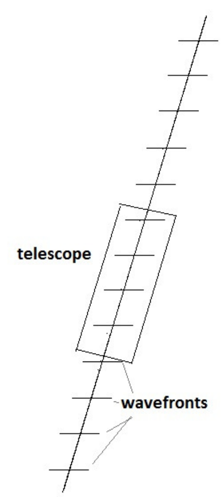
"However, in the earth's frame, the wave front and the incoming ray are orthogonal to one another when the SRT synchronization is used to set the clocks. In the sun's frame, the wave front as observed by the VLBI stations is not orthogonal to the incoming ray and it does not see any aberration of the incoming wave front. In the sun's frame, the aberration effect is clearly analogous to the classical falling raindrop description. The ray bending is caused by the composition of the velocities. Just as rain falling in layers, no bending of the layers would occur for a moving observer. The wave fronts, in this case, are not orthogonal to the direction of fall that a moving observer would see. If wave-front aberration in the earth's frame were real, as indicated by Einstein's special relativity theory (SRT), another problem would arise that seems to suggest an inconsistency in the theory. From the observations over a one-year interval, we know that the real direction of the quasar is exactly orthogonal to the earth's velocity vector at the winter solstice. If the light in the wave front travels at the speed of light, how can part of the wave front arrive early and part of the wave front arrive late? This contradicts the SRT claim that the speed of light is always given by the constant, c. "

Hatch concludes that the sensible alternative solution is that the wave-front bending is not real and that the clocks on the earth simply have a bias as a function of their position with respect to the earth's orbital velocity.

I have thought about Hatch's argument carefully, and I can see now that it makes logical sense. Consider a series of parallel wave-fronts of light traversing space from top to bottom. If we put a parallel line near the bottom, we can reasonable assume that as long as the source is distant and emitting light orthogonally, that all points on each wave-front will cross the line simultaneously. This is because they are all travelling rectilinearly at a uniform speed C. If we now take the earth, with its 6AM and 6PM clocks lying on this same line, and then move it at some velocity from left to right, we can only conclude that as long as the 6AM and 6PM positions remain on the line, that points on any given approaching wave-front will also arrive at the 6AM and 6PM positions simultaneously. This does not mean that the light does not appear to come at the earth observer from an angle, it certainly does, the apparent direction of the light is aberrated, but the arrival time of points on the same wave-front are not similarly distorted. The relativistic treatment of aberration doesn't appear to apply when modeling space as a medium for light waves.

Does the Theory of Wave-Front Aberration Contradict Reality?



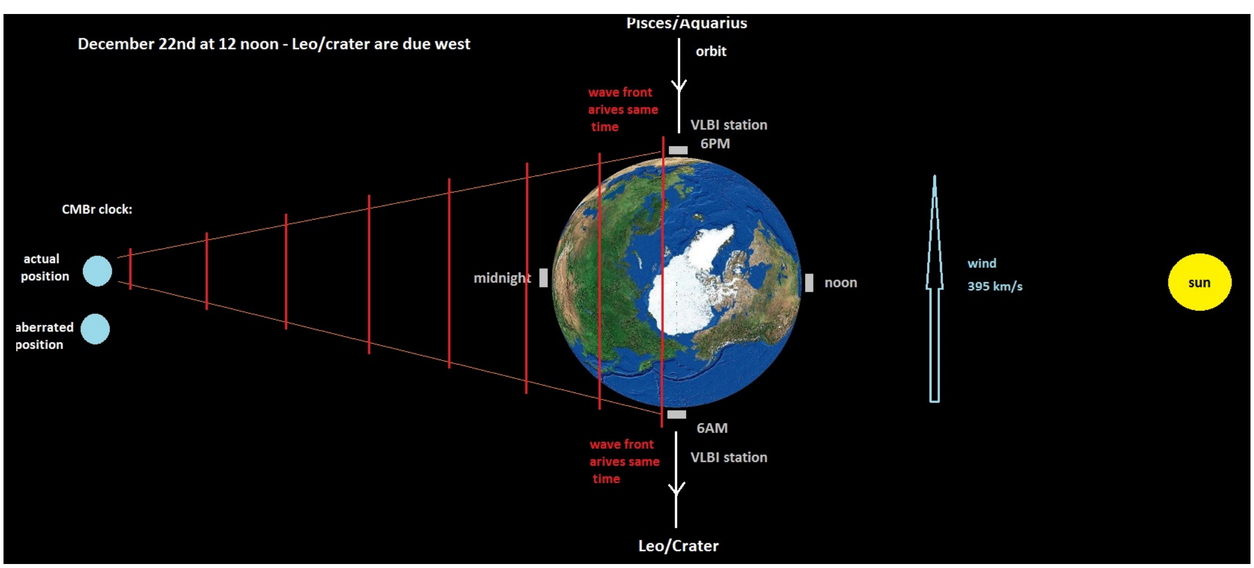


This argument is reinforced by the discussion by Janssen (7) of the correct model for stellar aberration developed in the 19th century based on an immobile aether and using Huygens' principle. He states that the motion of the aether wind insures that wave fronts approaching the moving earth will remain horizontal; the observer on the earth observes the horizontal wave fronts approaching not from their actual origin but from an origin displaced to the right. A telescope must change its angle to point in the direction of the displaced origin, *but the wave fronts still proceed down the telescope horizontally*. (as shown above). So Hatch's argument makes a lot of sense; the apparent non-simultaneous arrival of the pulsar pulses at the 6AM and 6PM stations could be due to the dis-synchronization of the earth clocks in Newtonian time. This also matches the predictions using Herbert Ives's equations. This +/- 2 uS bias in the clocks is exactly what we discovered earlier in our Excel simulation using the calculations on page 6. This backs up the theory that the disagreement in clock readings is a consequence of a variable one-way speed of light in the earth frame of reference.

Measuring the One-Way Speed of Light with Respect to the Universe

Although the pulsar data is useful, the pulsar cited in the example above (PSR 1937 +21) is a member of the milky way and is likely co-moving with our sun's (heliocentric) frame around the galactic center. This common motion could potentially restrict the detection of C+/- v to our orbital velocity. In order to detect our motion in the universe at large, we would likely need a stable clock source that is static in space as our reference. Current thinking has us moving at ~ 365 km/s with respect to the Cosmic microwave background radiation (CMBr), this frame being routinely referenced as a static frame to quantitate universal motion. What if we could use the CMBr itself as some kind of stable clock source? Let's consider that we have a clock at some distance from the earth that is stationary in the presumed preferred frame of reference for light – at rest in the CMBr frame. At December 22nd, 12 noon, our motion through the CMBr would be in line with our orbital motion, with the earth traveling at 365 + 30 = 395 km/s towards Leo/Crater, which would be due west to our earthbound observer. The wind would thereby be in the reverse direction, moving west to east.

Light Propagation Consistent with an Aether Model – No Wave-Front Aberration.

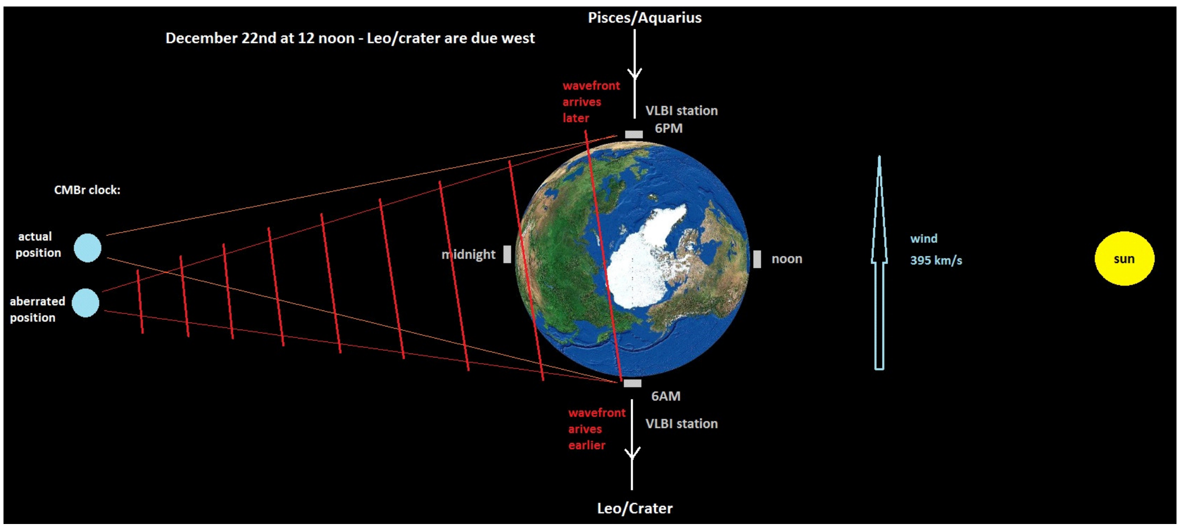


Using the Ives's calculation from our spreadsheet, the expected disagreement between the 6AM and 6PM clocks in an aether wind of 395 km/s would be 5.59 E-5 seconds. Using Einstein's method, there would instead be an aberration angle of 0.0754 degrees, implying a delay experienced by the 6PM station for the reception of the CMBr clock pulse compared to the 6AM station, which would be:

$2\pi D/360*0.0754 = 16.777$ km   is the propagation range diff to the 6PM station   (D= earth's diameter)

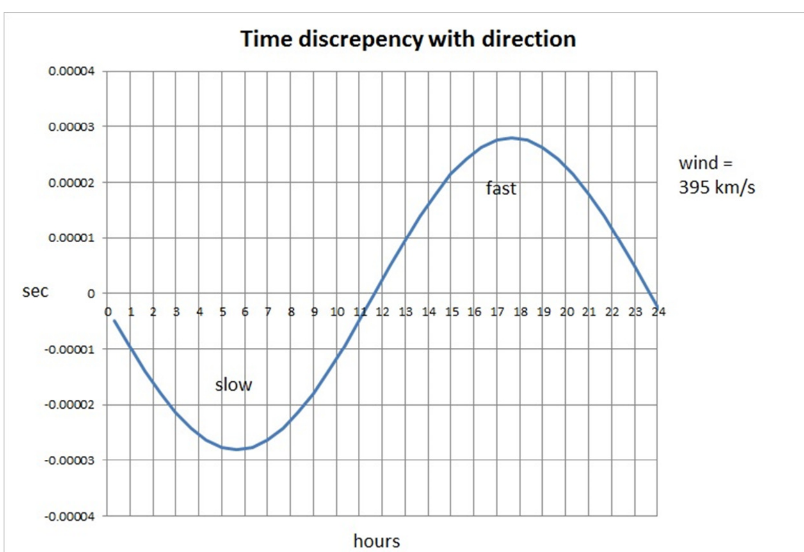
16777m / 3E8 m/s = 5.59 E-5 seconds $\text{Tan}^{-1}(v/c) = 0.0754$ degrees

Einstein Method -Aberration of a Light Signal Sent from a CMBr Clock to Earth Receivers:



In other words, without including an aberration delay, the CMBr clock would expose a large time discontinuity (56 uS). The application of Einstein's questionable wave-front aberration adds a calculated propagation delay that exactly cancels the disagreement between the clocks – preserving Einstime.

Expected Clock Discontinuity in a 395 km/s Aether Wind on Winter Solstice:



By ignoring wave-front aberration, two clocks synchronized on the earth by a CMBr clock should read identical Newtonian time, but differ from each other in Einstime. This is the reverse of the situation that we described in Table 2, where earth clock 1 and 2 read identical Einstime but differed in Newtonian time. If we now were to send a light signal between earth clock 1 and 2, the clocks would tell us that the light travels at C-v from clock 1 to 2, and C+v from clock 2 to 1, where v = 395 km/s. This is a remarkable result, as it suggests that the one way speed of light may be detectable depending on the frame of reference used for the synchronizing clock.

Determining if a Clock is Truly in the Rest Frame of a Non-Expanding Universe

There are some unusual aspects to the Cosmic Microwave Background anisotropy that may call into question if it could truly be the rest frame of a non-expanding universe. For example, the dipole anisotropy appears to line up with the ecliptic in a manner that seems beyond coincidence. Further, the quadrupole and octupole anisotropies of the CMBr align perpendicular to the dipole alignment, in the direction of the earth's motion toward the solar apex (our current galactic orbital direction). Finding the CMBr anisotropies to be neatly aligned with our solar motion seems to suggest that the CMBr multipoles could be due to a local phenomenon. If this were the case, then synchronizing clocks to this a source in its frame of reference might lead to an erroneous result. In fact, this could serve as an independent method of determining the velocity difference between the CMBr and our own frame. Effectively, the simplest method of determining the frame of zero velocity is to find a relative velocity frame where the in-frame clock rate is fastest, and this would likely also correspond to the frame for a synchronizing clock that then leads to the highest synchronized difference between the two clocks separated on the equator, and the largest C-v propagation range time difference between them.

In any event, this exercise seems to suggest that it should be possible to detect a measurable, variable one way speed of light between synchronized clocks if a universal rest frame for light does exist. An actual determination of our true speed with respect to this rest frame would require the synchronizing signal to come from this same frame, as any common velocity between the synchronizing source and the synchronized receivers will subtract from the detectable space velocity v. This is a reassuring conclusion since it implies the experiment is not necessarily "impossible."

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Einstein on Lorentz:

“Whatever came from this supreme mind was as lucid and beautiful as a good work of art and was presented with such facility and easy as I have never experienced in anybody else. If we younger people had known H. A. Lorentz only as a sublime mind, our admiration and respect for him would have been unique. But what I feel when I think of H. A. Lorentz is far more than that. He meant more to me personally than anybody else I have met in my lifetime.”

http://www.vigyanprasar.gov.in/scientists/HAntoonLorentz.htm