The Continuing Relevance of Lorentz Ether Theory in the Age of Relativity

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On line simulators and other information related to this talk are available at our website: **http://www.conspiracyoflight.com**

What is the experimental basis of the Special Relativity Theory?

From the website: http://www2.corepower.com:8080/~relfaq/experiments.html

- Prelude: Special Relativity and Experiments – 10 experiments
- I. Basic (Classic) experiments concerning SRT – 8 experiments
- II. Repetitions of the MMX – 13 experiments
- III. Repetitions of the Fizeau experiment – 3 experiments
- IV. Repetition of the Trouton-Noble experiment – 1 experiment
- V. Sagnac Effect – 1 review article
- VI. Repetition of the KTX – 1 experiment
- VII. Speed of Light independent of the velocity of the source – 4 experiments
- VIII. Isotropy of Space: Hughes Drever Experiments – 5 experiments
- IX. Isotropy of the Speed of Light – 4 experiments
- X. Relativistic Mass-Energy Relation – 11 experiments
- XI. Transversal Doppler effect – 10 experiments
- XII. Time Dilatation, Clock "paradox" – 14 experiments
- XIII. Some other Experiments – 7 experiments **Total: 91 Critical Experiments**

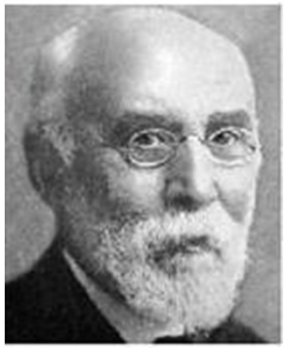
Question: How can any other theory be consistent with all this data?

Answer:

An ether theory would have to be:

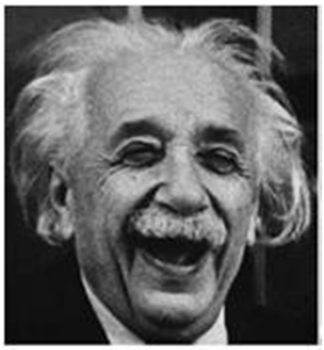
- so similar to Einstein's theory that it arrives at the same result for all these experiments, even if it presumes a different *physical* interpretation

The big switch



- The “prototype” for SR was Lorentz’s ether theory of 1904
- speed of light is variable, time is absolute.
- undetectable preferred frame for light due to confounding properties of nature:

1) change in the rate of a clock with velocity
2) inability to measure the one-way speed of light - natural mechanisms cancel out 1st and 2nd order velocity effects.
3) The contraction of matter with velocity



- Einstein reversed this!
- speed of light is constant in all moving frames
- rate of time variable.
- Undetectable ether irrelevant.
- switching v for t - theories now “mathematically equivalent”

Relativity is a Mathematical Equivalence of Lorentz Ether Theory

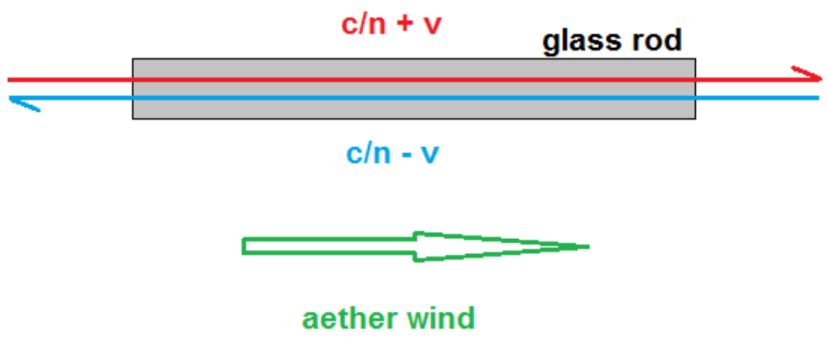
Lorentz Ether Theory		Relativity
Time Dilation Clocks slow due to motion because the speed of light changes in the clock Real time is absolute $\gamma T = T/\sqrt{1 - v^2/c^2}$		**Time Dilation** Clocks slow because real time slows for the moving observer Real time is relative $\gamma T = T/\sqrt{1 - v^2/c^2}$
Lorentz Contraction Length contracts with motion due to motional effect on molecular forces (dynamic explanation) $l' = l\sqrt{1 - v^2/c^2}$		**Lorentz Contraction** Length appears to contract with motion to a stationary observer (kinematic explanation) $l' = l\sqrt{1 - v^2/c^2}$
Fresnel Drag Coefficient Lorentz (1892) derives the Fresnel Coefficient from his electromagnetic theory, explaining how EM waves are dragged by matter and not by ether $c(v) = \frac{c}{n} + v\left(1 - \frac{1}{n^2}\right) - v = c/n - v/n^2$		**Fresnel Drag Coefficient** In 1905, Einstein replaces the Fresnel Coefficient with his Composition of Velocities Equation Ether drag is superfluous $c_{rel}(v) = \frac{\left(v + \frac{c}{n}\right)}{\left(1 + \frac{v}{nc}\right)} = \frac{c(1 + n\beta)}{n\left(1 + \frac{\beta}{n}\right)}$
Single Preferred Frame aether is a preferred frame for the speed of light, but is undetectable in conventional optical experiments		**All Relative Frames** no preferred frames for light What is undetectable need not be considered at all!

How does Lorentz Ether Theory (LET) hold up to the Experimental Evidence?

- 1st order tests for a preferred frame for light
- 2nd order tests for a preferred frame for light
- Tests for time dilation
- One-way speed of light experiments
- Sagnac experiments
- Tests for Lorentz violations

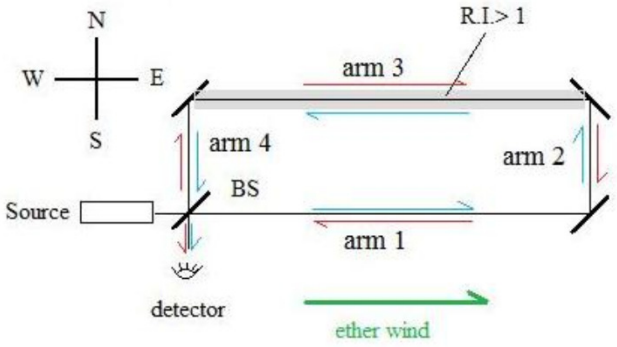
1st Order Tests Using Refractive Index Differences in the Optical Path

- Galilean addition of velocities:
- glass with RI of n = 1.5,
- speed of light in the glass is: c' = c/n,
- ether is moving with respect to the glass, then: c' = c/n +/- v.



- Can this reveal our motion with respect to space?
- Hoek tried it with water n = 1.33

Hoek Interferometer (1868)



Simple Galilean addition of velocities should give a positive result. However on turning the device with respect to our motion, the fringe shift is null. There must be some factor φ, an ether drag obscuring the expected fringe shift.

If $\varphi = 0$ then no ether drag, if $\varphi = 1$ then full ether drag.

Arm 3 in line W- E.

	Arm 1	Arm 2	Arm 3	Arm 4
Blue path	L1 / (c + v - φ)	L2 / c	L3 /(c/n - v + φ)	L4 / c
Red path	L1 / (c - v + φ)	L2 / c	L3 /(c/n + v - φ)	L4 / c

If the device is rotated 90 degrees so that arm 3 now lies N-S, we would get:

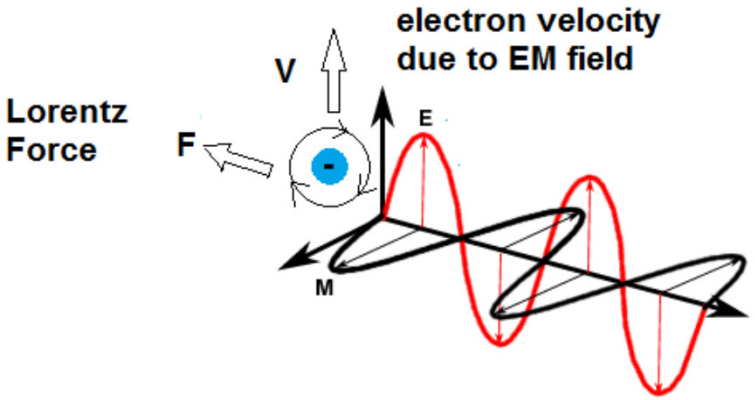
	Arm 1	Arm 2	Arm 3	Arm 4
Blue path	L1 / c	L2 / (c - v + φ)	L3 / (c/n)	L4 / (c +v - φ)
Red path	L1 / c	L2 / (c + v - φ)	L3 / (c/n)	L4 / (c - v + φ)

The value φ that exactly results in a null is: $\varphi = v(1-1/n^2)$ The Fresnel Drag coefficient.

Physical Mechanism of the Fresnel Drag Coefficient

Lorentz's Premise – Aether and matter interact via electrons

- The electric field of light displaces the electrons in glass creating a common motion.
- The moving electrons subjected to an additional Lorentz force from the magnetic field of the wave.

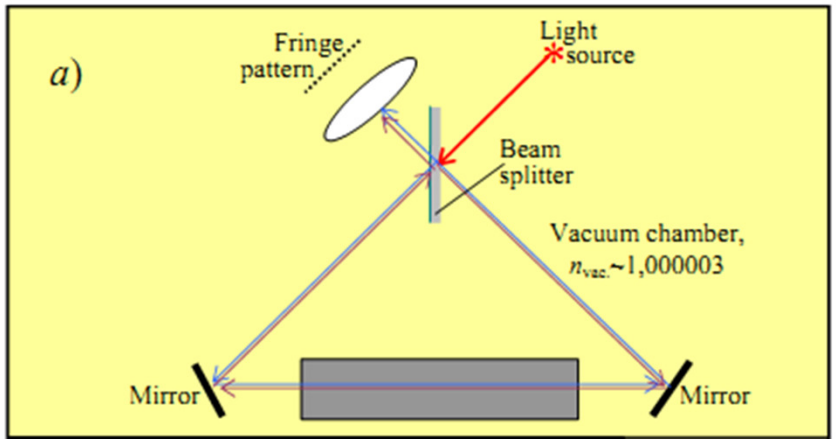


- Effect: reduces wave velocity to $c/n - v/n^2$ when light and glass co-moving with the ether.
- New treatment explains Arago, Fizeau, and Hoek experiments
- Fresnel drag coefficient: due to matter slowing light waves, not aether entrainment.

William S.N. Trimmer - Experimental Search for Anisotropy in the speed of Light

Physical Review D Volume 8, Number 10, 1973 P. 3321 -3326.

- triangular Hoek Interferometer with glass in one arm.



- the anisotropy cancels around the paths completely
- analyzed using Lorentz's method, the fringe shift for 375 km/s aether wind is zero. This is because the velocity of light in each arm is:

$$c' = c/n - v/n^2 .$$

First order tests cannot be used to distinguish between special relativity and ether theories…no such "experimentum crucis" is possible in principle…

Mansouri and Sexl, 1977

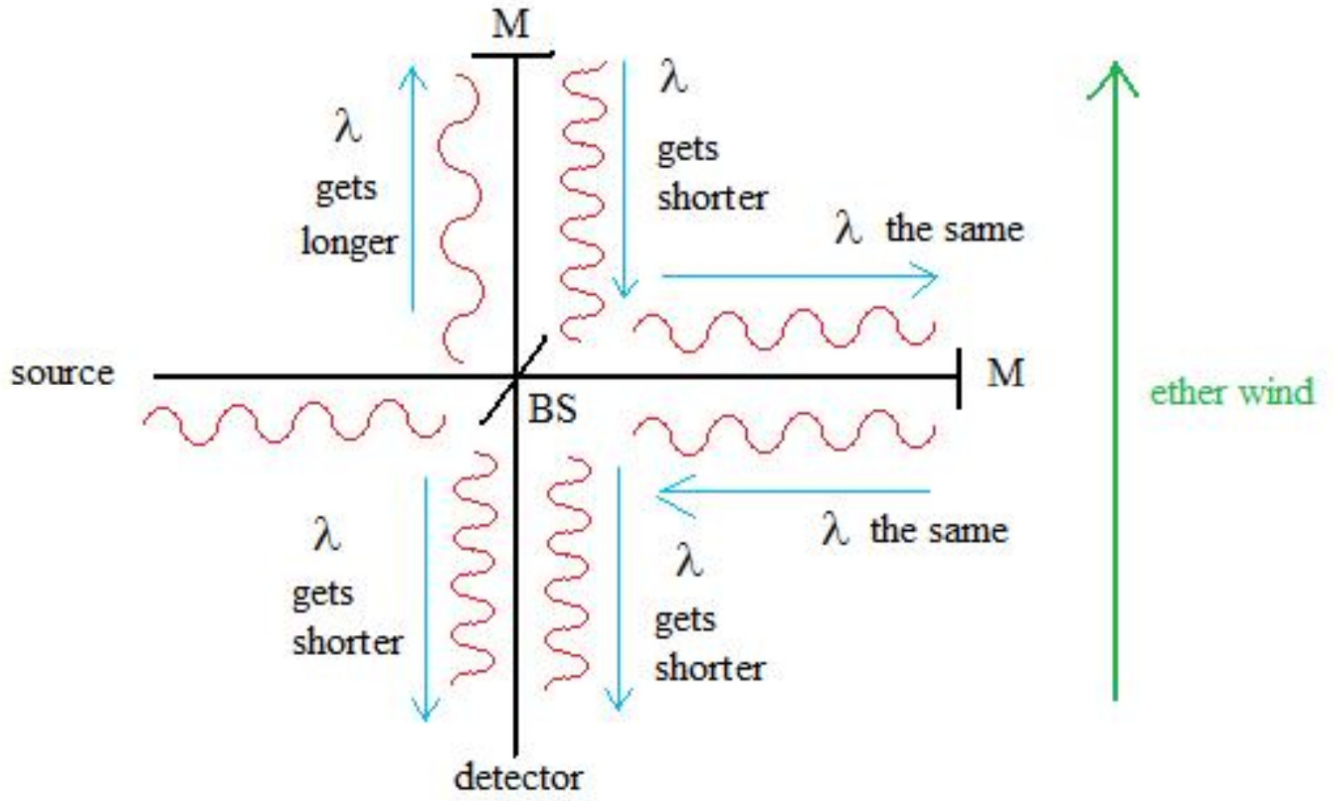
Experimental Evidence

- 1^{st} order tests for a preferred frame for light
- 2^{nd} order tests for a preferred frame for light
- Tests for time dilation
- One-way speed of light experiments
- Sagnac experiments
- Tests for Lorentz violations

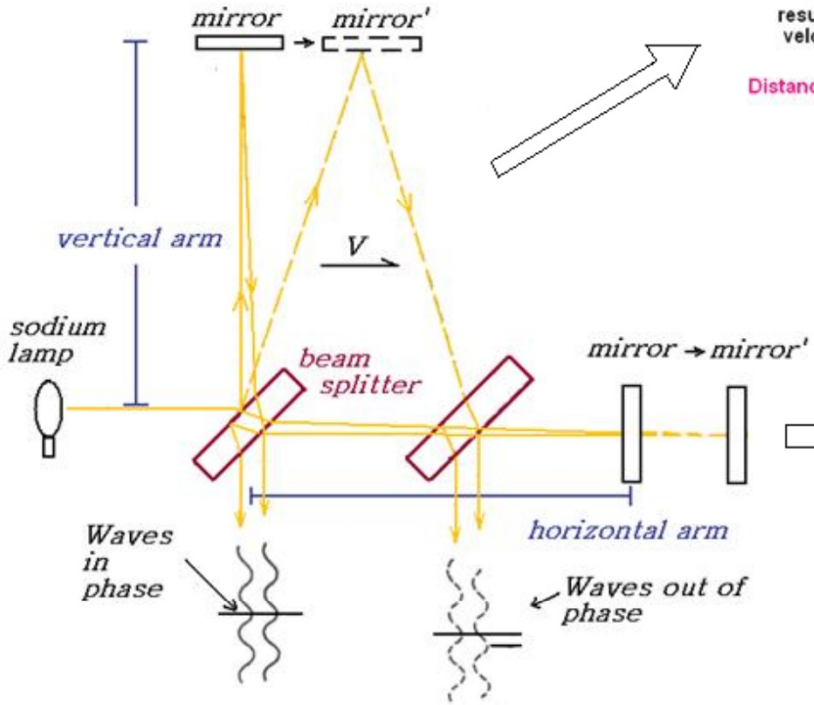
Why 1st Order Changes in Wavelength due to our Motion through Space are Invisible

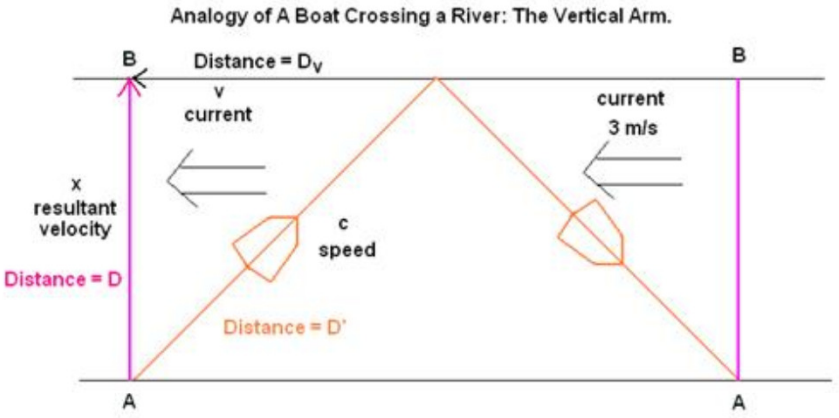
Since **C = f λ** , if the speed of light (**c**) decreases, then so does the wavelength (**λ**). The frequency (**f**) must remain constant .

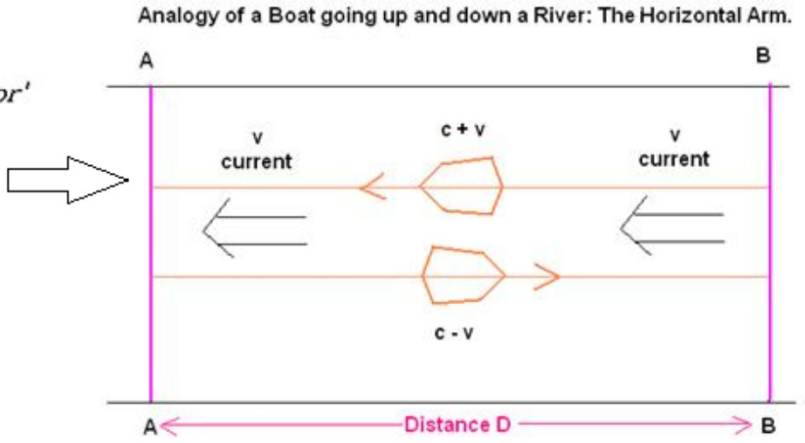
Michelson Interferometer: First Order Wavelength Changes Exactly Cancel:



Michelson-Morley Experiment: Premise for 2nd Order Effect







The time difference between the paths, and thus the phase lag, should be:

Vertical Path

$$2T \cong \frac{2D}{c} \times \left(1 + \frac{v^2}{2c^2}\right)$$

—

Horizontal Path

$$2T \cong \frac{2D}{c} \times \left(1 + \frac{v^2}{c^2}\right)$$

$$= \frac{D}{c} \times \frac{v^2}{c^2}$$

The phase lag is opposite when the device is turned 90 degrees, thus the time difference from one orientation to another is :

$$= \frac{2D}{c} \times \frac{v^2}{c^2}$$

The phase difference from one orientation to another is :

$$= \frac{2D}{\lambda} \times \frac{v^2}{c^2}$$

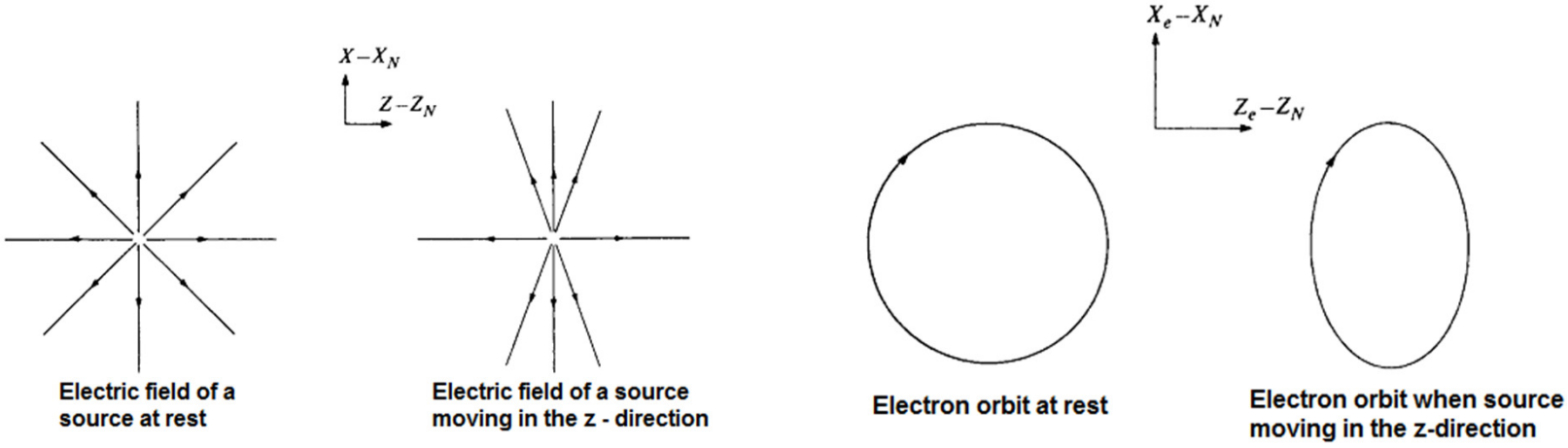
The null result can only occur if the horizontal arm contracts by $(1/2D)(v^2/c^2) =$ **$(1\text{-}v^2/c^2)^{1/2}$**

Results of Michelson-Morley Type Experiments

Name	Year	Arm length of the interferometer	Fringe shift expected	Fringe shift measured
Michelson	1881	1.2	0.04	0.02
Michelson + Morley	1887	11.0	0.4	0.01
Morley + Morley	1902-04	32.2	1.13	0.015
Miller	1921	32.0	1.12	0.08
Miller	1923-24	32.0	1.12	0.03
Miller (Sunlight)	1924	32.0	1.12	0.014
Tomascheck (Starlight)	1924	8.6	0.3	0.02
Miller	1925-26	32.0	1.12	0.088
Kennedy (Mt. Wilson)	1926	2.0	0.07	0.002
Ilingworth	1927	2.0	0.07	0.0002
Piccard + Stahel(Mt.Rigi)	1927	2.8	0.13	0.006
Michelson et al.	1929	25.9	0.9	0.01
Joos	1930	21.0	0.75	0.002

As techniques improve the measured fringe shift gets closer to zero.

Physical Justification for the Lorentz Contraction

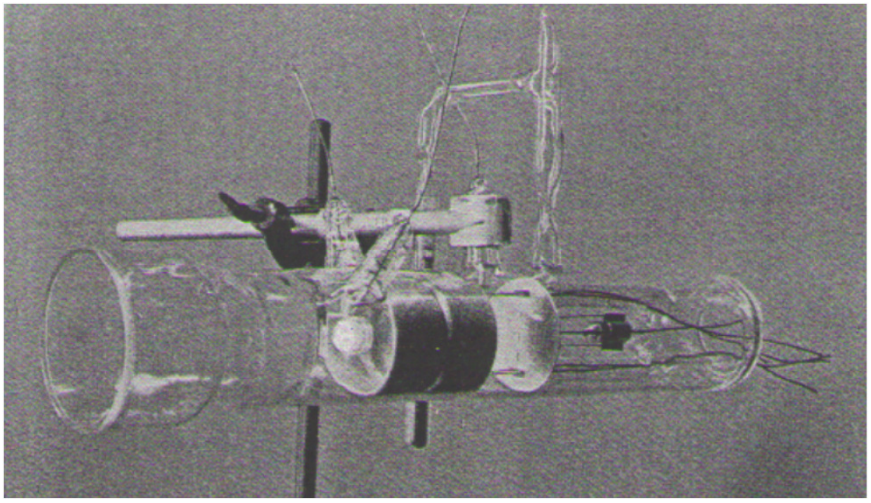


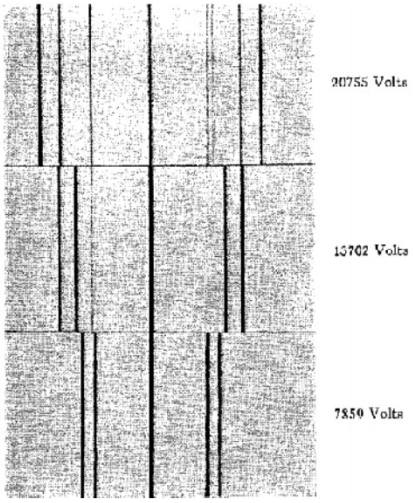
- Lorentz - intermolecular forces are altered by motion
- space between the electrons are contracted by $(1-v^2/c^2)^{1/2}$
- flattening of electric fields and magnetic vector potentials of moving charges - implied from Maxwell's equations.
- The particles themselves are not considered to contract.

Experimental Evidence

- 1^{st} order tests for a preferred frame for light
- 2^{nd} order tests for a preferred frame for light
- Tests for time dilation
- One-way speed of light experiments
- Sagnac experiments
- Tests for Lorentz violations

Experiments Verifying the Validity of Time Dilation (1): Ives and Stilwell (1938)





An Experimental Study of the Rate of a Moving Atomic Clock

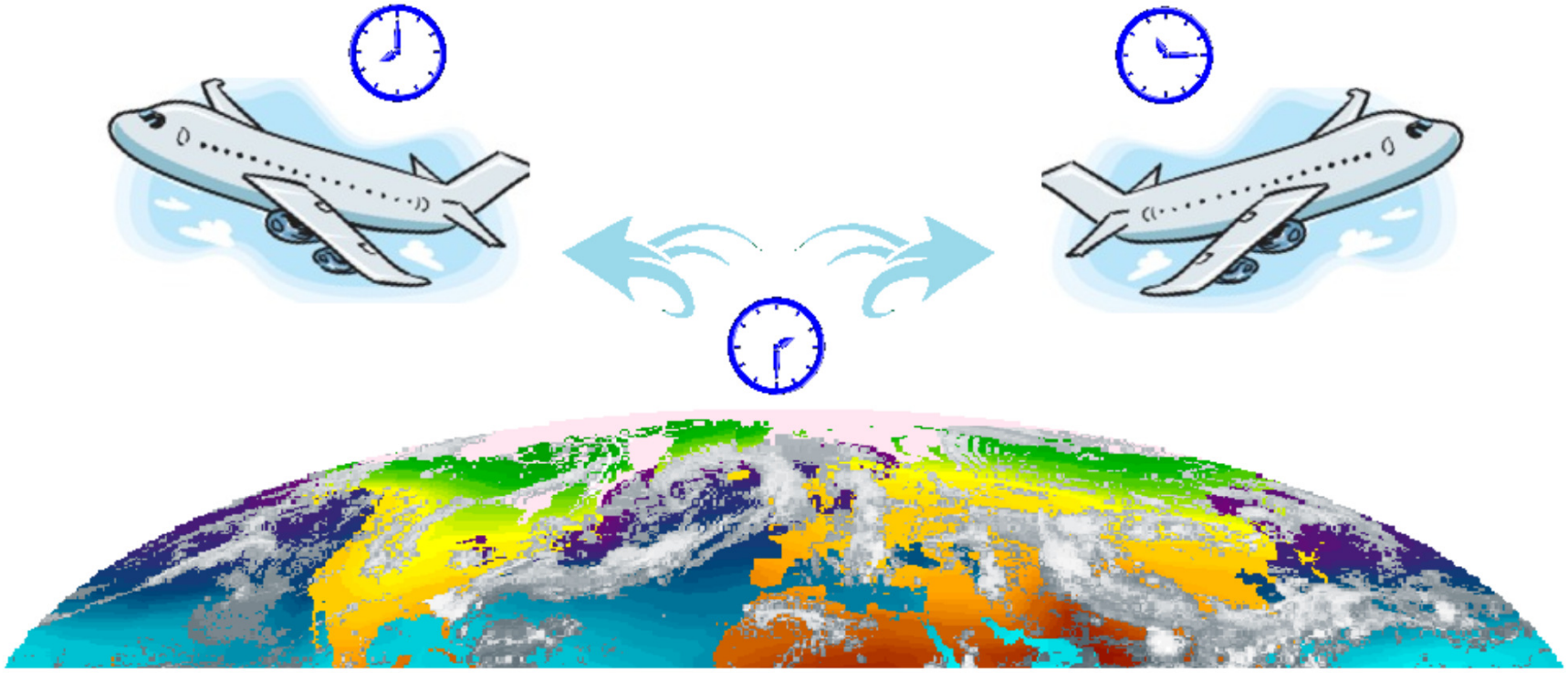
HERBERT E. IVES AND G. R. STILWELL
Bell Telephone Laboratories, Inc., New York, N. Y.
(Received April 12, 1938)

- Herbert Ives was an advocate of Lorentz Ether Theory
- demonstrated that a moving proton experiences a frequency shift of:

$$f = f_o*(1-v^2/c^2)^{1/2}$$

- results are consistent with the mechanical time dilation theory of Lorentz and Larmor, but also matches the predictions of Einstein.

Experiments Verifying the Validity of Time Dilation (2): Hafele and Keating



Carried caesium clocks in opposite directions around the world, and compared their time increments to a reference clock at the origin.

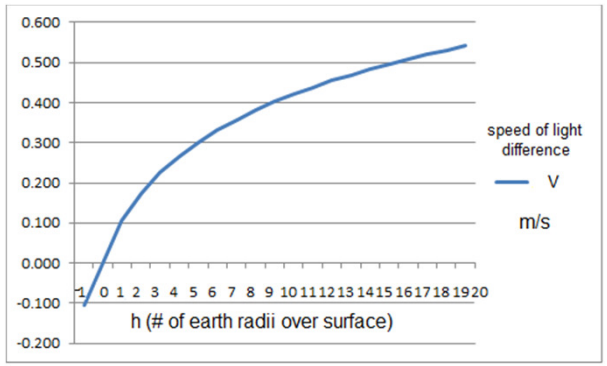
- The clocks ran faster at altitude and slowed with velocity
- rate dependent on their direction around the globe (a form of Sagnac Effect).
- On the face of it, supports Einstein's prediction of gravitational time dilation.

An LET Model of Gravitational Time Dilation

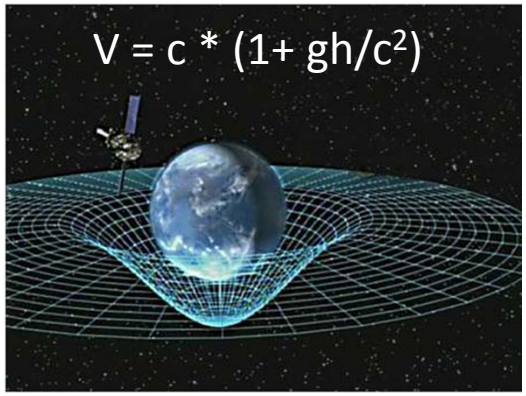
Although Lorentz never anticipated gravitational time dilation, it is a logical consequence of the mathematical equivalence of the two theories.

Lorentz Ether Theory

Speed of light increases with altitude

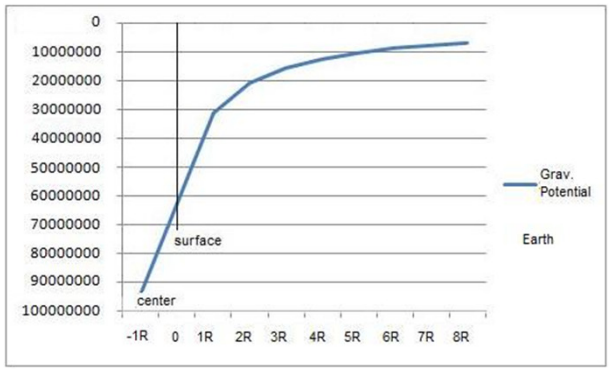


Gravity is a velocity well

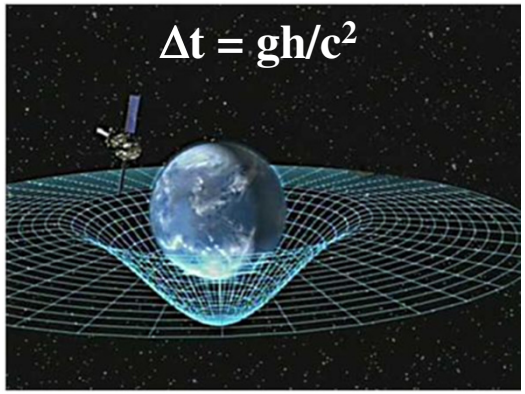


Relativity

Rate of time increases with altitude



Gravity is a time well



Experiments Verifying Time Dilation

Velocity Time Dilation

- *H.E. Ives and G.R. Stilwell, An Experimental Study of the Rate of a Moving Atomic Clock J. Opt. Soc. Am.* ***28*** *215-226 (1938)*
  An Experimental Study of the Rate of a Moving Atomic Clock. II J. Opt. Soc. Am. ***31*** *369-374 (1941)*
- *Bailey et al., "Measurements of relativistic time dilation for positive and negative muons in a circular orbit," Nature* ***268*** *(July 28, 1977) pg 301. Bailey et al., Nuclear Physics B* ***150*** *pg 1–79 (1979).*
- *Sherwin, "Some Recent Experimental Tests of the 'Clock Paradox'", Phys. Rev.* ***129*** *no. 1 (1960), pg 17.*

Gravitational Time Dilation

- *Hafele and Keating, Science Vol.* ***177*** *p. 166 - 170 (1972).*
- *Vessot, R.F.C. and Levine, M.W. 1979, "A Test of the Equivalence Principle Using a Space-borne Clock," Gel. Rel. Grav.,* ***10****, 181-204.*
- C. Alley, *"Proper Time Experiments in Gravitational Fields with Atomic Clocks, Aircraft, and Laser Light Pulses," in Quantum Optics, Experimental Gravity, and Measurement Theory, Proceedings Conf. Bad Windsheim 1981.*

Experimental Evidence

- 1^{st} order tests for a preferred frame for light
- 2^{nd} order tests for a preferred frame for light
- Tests for time dilation
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- Sagnac experiments
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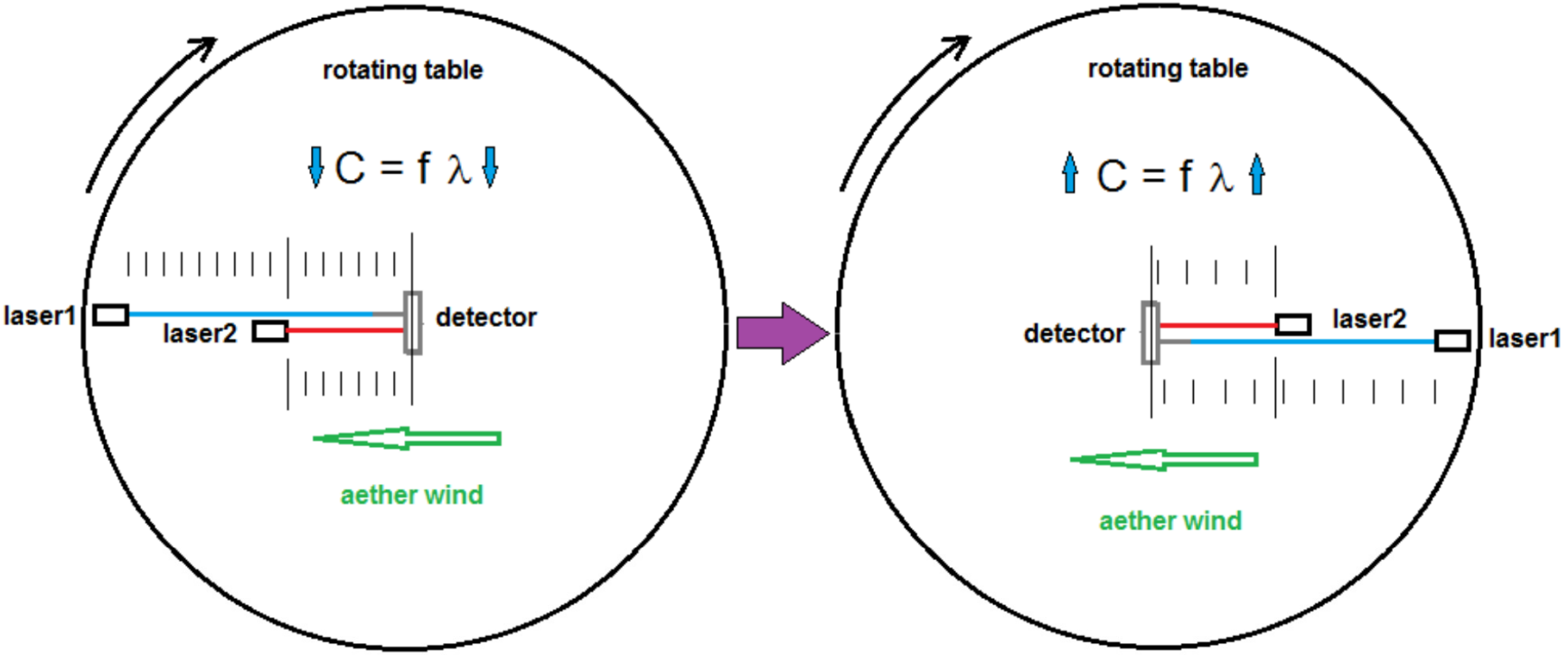
Other Attempts to Break the "Conspiracy of Light"

A Hypothetical One-Way Speed of Light Test Using Two Synchronized Lasers

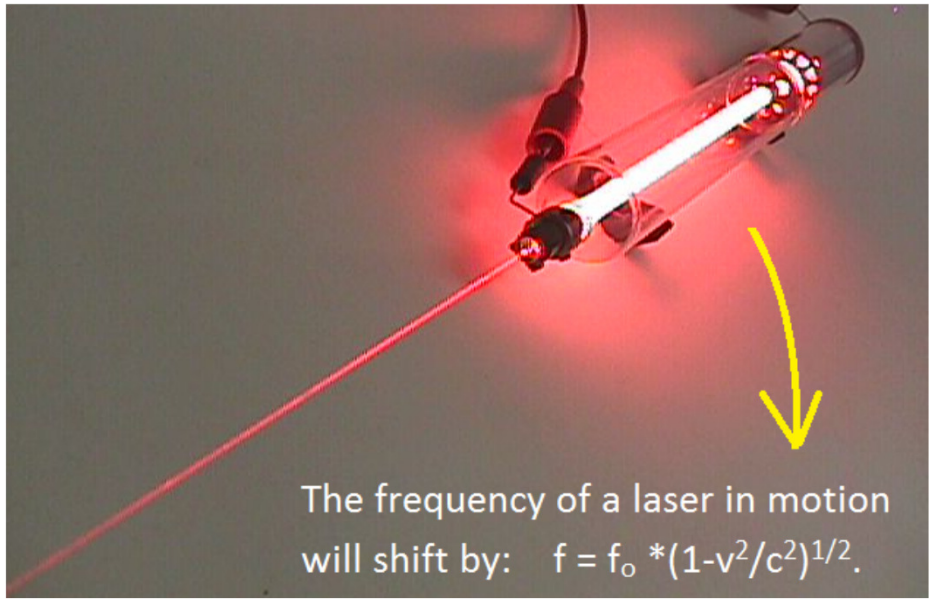


Wavelengths contracted - arrive at the detector in phase

Wavelengths expanded - arrive at the detector out of phase

Phase difference on rotation should be proportional to our velocity with respect to the aether as well as the distance between the two lasers

The Clock Effect in Moving Sources:



Reference:

LETTERE AL NUOVO CIMENTO VOL. 7, N. 15 11 Agosto 1973

On the Impossibility of the First-Order Relativity Test.

A. A. TYAPKIN
Joint Institute for Nuclear Research - Dubna

Time Effect:

$\Delta t = t*(1/(1-v^2/c^2)*(L/2c^2)*V*\omega rot*\sin(\theta)$

Fringe Shift:

$\Delta \text{ fringe} = t*(1/(1-v^2/c^2)*(L/2c\lambda)*V*\omega rot*\sin(\theta)$

Net Result:

The fringe shift along the optical path due to the change in the one-way speed of light will be exactly cancelled by the frequency shift in the laser due to it's rotation!

One Line Calculator of the Fringe Shift vs. Clock Effect

Two Laser One-Way Velocity of Light Interferometer

Arm 1 Length[L]	1.0000	Refractive Index Arm 1	1.0000	c' (with wind):	c" (Against Wind):
Arm 2 Length [L]	0.3000	Refractive Index Arm 2	1.0000	3.0003000000e+8	2.9997000000e+8
aether wind [V] (m/s)	30000	light λ (m)	6.328e-007	λ' (into wind):	λ" (against wind):
Lorentz Contraction [1/γ]:	9.99999995000000e-1	Freq. @ 632.8nm	4.740834e+14	6.3286328000e-7	6.3273672000e-7

Fringe Shift Due to Path Effect:

Method 1:

Angle to Wind:	Arm 1 forward Time	Δt Arm1-Arm2 (s)	Fringe Shift:
0	3.333000016665e-9	2.333100011665e-9	4π*(L/λ)*(v/c)
0	9.999000049995e-10	Fringe Difference:	221.23894
	Arm 2 forward Time	1.106084076327e+6	
	Arm 1 forward	Δt Arm1-Arm2 (s)	Time Difference:
180	3.333666683335e-9	2.333566678335e-9	-4.66667e-13
180	1.000100005001e-9	Fringe Difference	
	Arm 2 forward	1.106305315266e+6	

Method 2:

Angle to wind:	Phase at laser1 c*t/λ	Phase at Det. f*t+L1/gλ'	Fringe Shift:
0	4740834.38685209	11061788.88274257	4π*(L/λ)*(v/c)
	Phase at laser2 c*t/λ	Phase at Det. f*t+L1/gλ'	221.23894
0	4740834.38685209	9955704.80641569	
	Phase at laser1 c*t/λ	Phase at Det. f*t+L1/gλ"	Time Difference:
180	4740834.38685209	11062104.93836994	4.66667e-13
	Phase at laser2 c*t/λ	Phase at Det. f*t+L1/gλ"	
180	4740834.38685209	9955799.62310390	

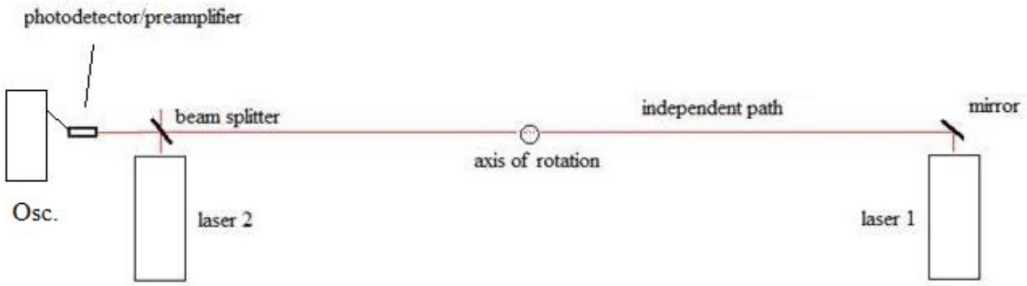
Measurement t (s):	Distance between lasers (m)	Change in Phase 0-180:	Final Δfringe:
1e-008	0.7000	316.05562737	Path-Clock Effect:
		Change in Phase 0-180:	0.0000
		94.81668821	

Fringe Shift Due to Clock Effect:

Laser 1	Laser 2
[t] (s)	[t] (s)
3.1415926	3.1415926
[sin(θ)] for 180 deg.	[sin(θ)] for 180 deg.
-1.273239566	-1.273239566
sin(θ)/2 for 90 deg.	sin(θ)/2 for 90 deg.
-0.636619783	-0.636619783
Velocity of Table m/s	Velocity of Table m/s
1.000	1.000
angular velocity [ωrot] Laser 1	angular velocity [ωrot] Laser 2
1.000	1.000
radius Laser 1 [L] (m)	radius Laser 2 [L] (m)
1.000	0.300
Vspin Laser 1 (m/s)	Vspin Laser 2 (m/s)
1.000	0.300
Δt on Laser 1 (s)	Δt on Laser 2 (s)
t*(1/(1-v^2/c^2)*(L/2c^2)*V*ωrot*sin(θ)	t*(1/(1-v^2/c^2)*(L/2c^2)*V*ωrot*sin(θ)
6.66667e-13	2.00000e-13
fringe shift on laser 1 due to Δf	fringe shift on laser 2 due to Δf
t*(1/(1-v^2/c^2)*(L/2cλ)*V*ωrot*sin(θ)	t*(1/(1-v^2/c^2)*(L/2cλ)*V*ωrot*sin(θ)
316.05563	94.81669
Δfringe laser1 - laser2:	Δt Laser1 - Laser2
221.23894	4.66667e-13

The two effects exactly cancel out!

The Cialdea One-Way Speed of Light Experiment

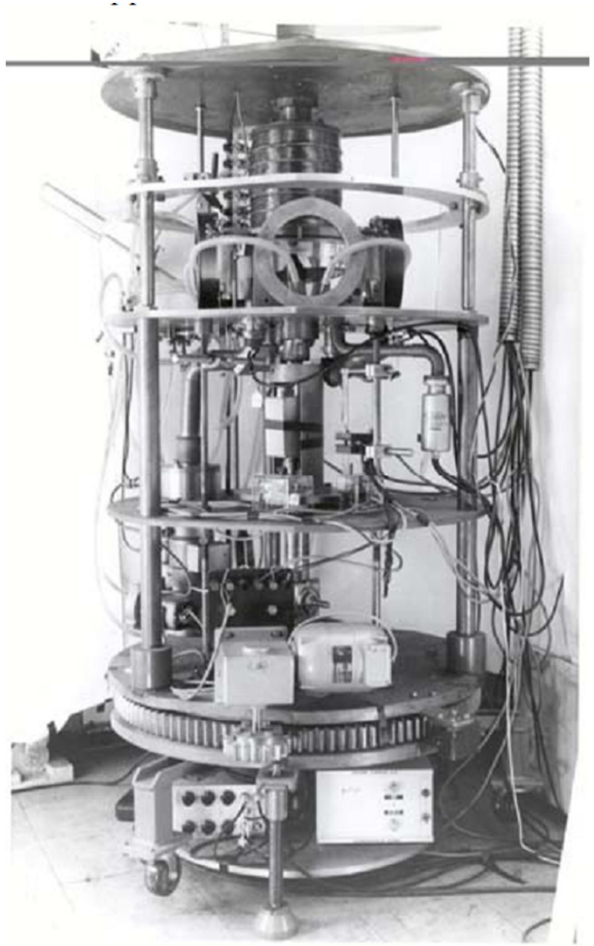


The experiment claims that the lack of phase shift between two independent lasers means that there is no detectable aether wind down to 0.9 m/s.

We replicated this experiment in 2010 and were able to show that it is incapable of detecting a phase shift induced by a reliable positive control – it fails on practical grounds.

This same experiment prompted A.A. Tyapkin to write his paper “On the Impossibility of the 1st Order Relativity Test ” demonstrating that the experiment also fails on theoretical grounds – due again to the “clock effect”.

The Clock Effect also Explains why Mossbauer tests fail to detect an Aether



" the proper interpretation of the predicted null result is that detection of an ether is precluded as required by the special theory of relativity and that existence of an ether is permitted as required by the (Lorentz) contraction theory. "

M. Ruderfer, Phys. Rev. Lett. , 7, 9, pp. 361 (1961)

Clock Effect – Also explains lack of Ether Drift in GPS One-Way Range Measurements

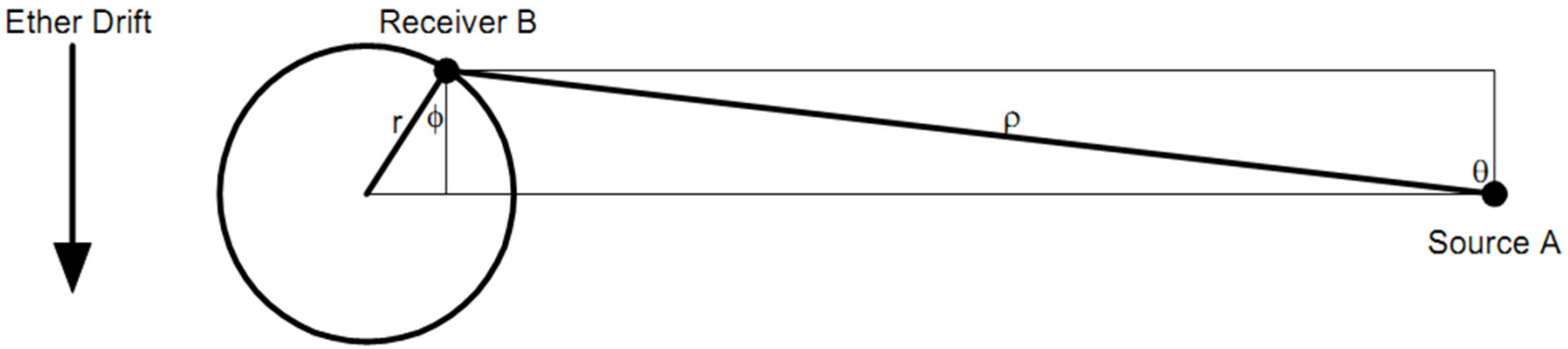


Figure 1 Ether Drift Geometry for GPS

The effect of an ether drift on the GPS one-way range measurements is exactly counteracted by the effect of the ether drift on the receiver clocks.

References:

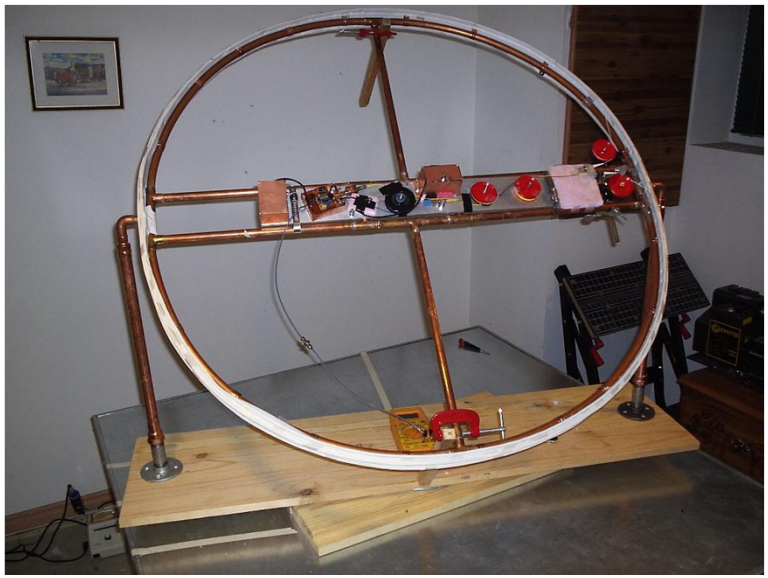
Ron Hatch – (2002) In Search of an Ether Drift.

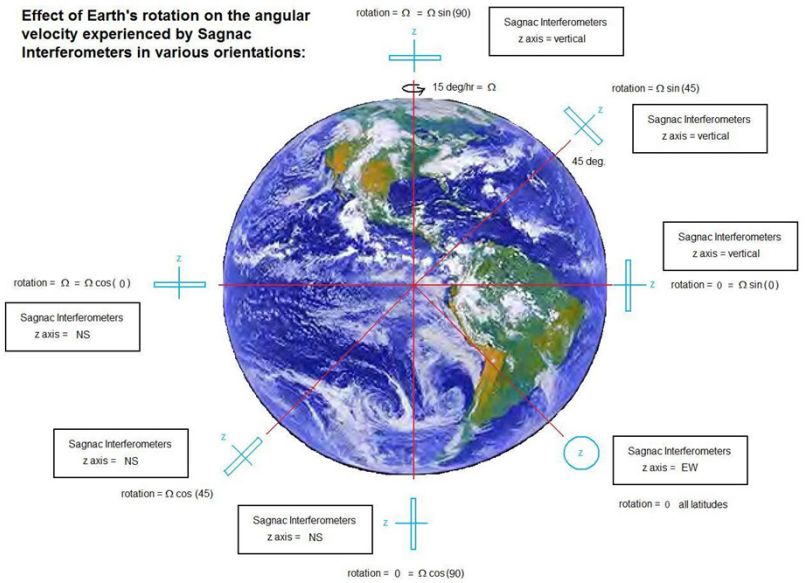
Ron Hatch – (2002) Clock Behaviour and the Search for an Underlying Mechanism for Relativistic Phenomena .

Experimental Evidence

- 1^{st} order tests for a preferred frame for light
- 2^{nd} order tests for a preferred frame for light
- Tests for time dilation
- One-way speed of light experiments
- Sagnac experiments
- Tests for Lorentz violations

The Sagnac Effect:





Proves: speed of light is not constant (in rotation).
Can it detect a preferred frame for the speed of light?

- On the bench, C is variable with respect to the lab (ECEF) frame.
- If bigger , can detect rotation diurnally – in the ECI frame
- Best detect our sidereal motion – in the heliocentric frame

With respect to what is the Sagnac interferometer rotating?!

The Sagnac Interferometer

The Sagnac Interferometer detects absolute rotation – with respect to the “fixed stars”.

Sagnac Interferometer / Fibre-Optic Gyroscope (FOG):

Sagnac loop Length (m)	1615	Refractive Index of fibre	1.0000		
Loop radius (m)	257.04	wavelength of light	5.700e-007		
number of loops	1.00	tangential v due to earth:			
frame Velocity w (m/s)	370000	z-axis = vertical	1.245e-2	m/s	
Rotational velocity v (m/s)	1.25e-002	z-axis = NS	1.394e-2	m/s	
area of loop (m2):	2.0756e+5	z-axis = EW	0	m/s	

Angle Wind:	Arm 1 forward Time	Arm 2 return Time	Time round trip:	Time Difference Blue -Red
0	2.689554095005677e-6	2.693780897919775e-6	5.383334992925452e-6	4.486115e-16
0	2.689554094781724e-6	2.693780897695117e-6	5.383334992476840e-6	Fringe Difference:
	Arm 1 forward Time	Arm 2 return Time	Time round trip:	2.361113e-1
	Arm 1 forward Time	Arm 1 forward Time	Time round trip:	Time Difference Blue-Red
90	2.693780897919775e-6	2.689554095005677e-6	5.383334992925452e-6	4.486115e-16
90	2.689554094781724e-6	2.693780897695117e-6	5.383334992476840e-6	Fringe Difference
	Arm 1 forward Time	Arm 2 return Time	Time round trip:	2.361113e-1

Earth Rotational Velocity:

Latitude (degrees):	min.
41	46
346.83	m/s

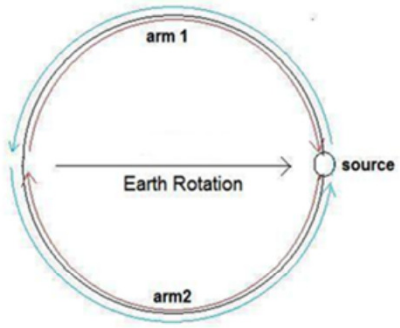
Lorentz Contraction γ : 0.99999969175840

0= YES, 1 = No: 0

ΔFringe due to γ : **7.278e-8**

.....Earth Rotation Values: ....Regular Rotation/Translation Values:.....

Using Eq. 1 Method:	Using Eq. 1 Method:	Using Eq. 2 Method:	Using Eq. 2 Method:
ΔFringe due to Earth Rot. :	Δt due to Earth rot. :	z-axis = vertical	z-axis = vertical
z-axis = vertical	4ΩAsin(lat)/c2	ΔFringe due to frame vel. w:	Δt due to frame velocity w:
2.360e-1	**4.485e-16**	**0.000e+0**	**0.000e+0**
z-axis = NS	4ΩAcos(lat)/c2	z-axis = vertical	z-axis = vertical
2.643e-1	**5.0219e-16**	ΔFringe due to rot. vel. v:	Δt due to rot. velocity v:
z-axis = EW	no Ω in this plane	**2.361e-1**	**4.486e-16**
0.00e+0	**0.00e+000**		



Equation 1 Method:

$\Delta t = \frac{4A\Omega}{c^2}$ $\Delta fringe = \frac{4A\Omega}{c\lambda}$

Equation 2 Method:

addition of velocities

$t = \frac{(\pi * r * \gamma)}{(c/n +/- (2/\pi)(w/n2) +/- v/n2)}$ per arm

Average frame velocity is $2w/\pi$ per arm.

note that: $\Delta fringe = 4A\Omega/c\lambda = 4Av/c\lambda r$

since $\Omega = v/r$ where v = rotational velocity and r = radius

It is perfectly incapable of detecting our translational motion through space.

Experimental Evidence

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- Tests for Lorentz violations

Mansouri-Sexl Test Theory of SR

- Tests for Lorentz Invariance: Second Order Coefficients:
- α = time dilation factor = -1/2
- β = Lorentz contraction factor = +1/2
- γ = contraction perpendicular to v = 0
- Michelson-Morley Type Experiments: Test ($\beta - \gamma$)
- Ives-Stilwell Type Experiments: Test (α)
- Kennedy-Thorndike Type Experiments: Test ($\alpha - \beta$)

Tests for Lorentz Invariance cannot distinguish between the predictions of Special Relativity and Lorentz Ether Theory.

Experiments Demonstrating Lorentz Invariance:

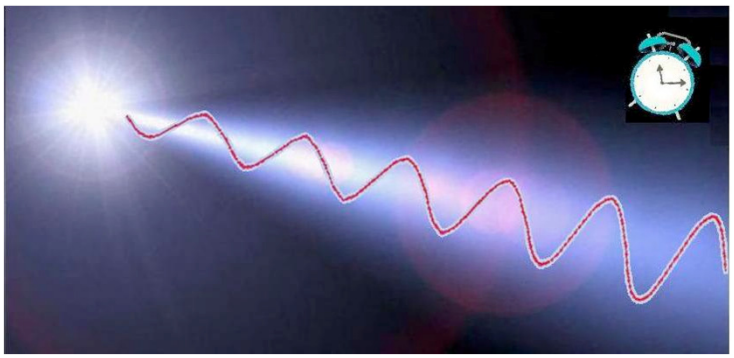
Group:	Type	Certainty
Ives and Stilwell (1938)	$(\alpha+1/2)$	0.5×10^{-2}
Riis (1988)	$(\alpha+1/2)$	1×10^{-7}
Reinhardt (2007)	$(\alpha+1/2)$	8.4×10^{-8}
Michelson-Morley (1887)	$(\beta - \gamma - 1/2)$	1×10^{-3}
Joos (1930)	$(\beta - \gamma - 1/2)$	3×10^{-5}
Mueller (2003)	$(\beta - \gamma - 1/2)$	-2.2×10^{-9}
Schiller (2005)	$(\beta - \gamma - 1/2)$	$(-0.6 \pm 2.1 \pm 1.2) \times 10^{-10}$
Antonini (2005)	$(\beta - \gamma - 1/2)$	$(+0.5 \pm 3) \times 10^{-10}$
STAR Mission (2010)	$(\beta - \gamma - 1/2)$	Expected 10^{-12}
Kennedy-Thorndike (1932)	$(\alpha - \beta + 1)$	2×10^{-2}
Essen (1955)	$(\alpha - \beta + 1)$	1×10^{-3}
Hils and Hall (1990)	$(\alpha - \beta + 1)$	6.6×10^{-5}
STAR Mission (2010)	$(\alpha - \beta + 1)$	Expected 10^{-10}

Uncertainties are now 10^{-6} to 10^{-9} less than in the original experiments.

Conclusions:

An ether theory can remain consistent with the evidence to date if it:

- Retains velocity and gravitational time dilation in concept
- The Lorentz contraction is real
- Fresnel Drag Coefficient is valid
- consistent with Sagnac effect (absolute rotation)



- Dragging of ether by gravity may be unnecessary

Lorentz Ether Theory remains viable by meeting these criteria