New Religion Called Science

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Introduction

All religions are just a faith not supported by corporeal facts. Isaac Newton's proclamation that the Bible is a code given to us by God could be the first, collaterally introducing the role of science into the existing scene.

New science challenged the century old practice of just believing, but in essence, much of today's science is still based on faith. For example, we still believe what we are being told by the educational institutions.

The prevailing situation today is to avoid any prestige-cost corrections, and keep what was already accepted, even if it was accepted wrongly. The following extract found on the Internet demonstrates this situation very aptly:

'... (The situation is) no different from the times when people went against the idea the Earth was round. It's not about what is true. It's about what the educational and governing authorities say they want you to believe and say is true. As a result, almost all professors and scientists are too afraid of being ostracized from their communities and face losing their jobs to speak out against the preposterous "science"'.

The methods of suppressing the truth are the same, as they were used by religions during the dark ages: *'the repeated lie eventually becomes the truth, '* and 'if the presented arguments cannot be disapproved, discredit the bearer.'

In their desperate attempt to justify erroneous theories, blindly promoted from hypotheses without tangible proofs, many scientists resort to classifying anybody thinking outside 'their square' as 'cranks', and label any opposing arguments as 'pseudoscience'. The general trend is to accuse anybody not agreeing with a given doctrine to be a conspirator, and not believing is branded as a conspiracy.

Logically, it is the other way around. Not believing is not conspiring, but substituting a lie for the truth definitely is.

How desperately today's science clings to inaccurate doctrines could be demonstrated on the example of Einstein's special theory of relativity. It is based on incorrect and incomplete understanding of Michelson-Morley experiment and Lorentz's calculations.

It is hard to understand how a simple, and even erroneous substitution of the time delay for the change in the rate of time flow, could be overlooked and considered as a valid base for modern physics?

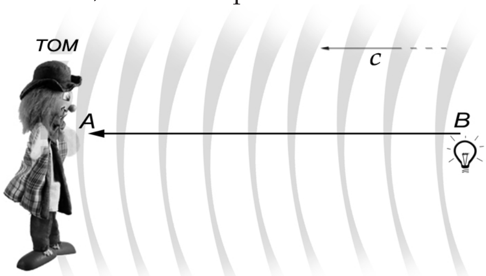
How the unexpected result of Michelson–Morley experiment could be used to justify elevating time to a status of eternal mystery?

The following pages were taken from my book '*Hmm ...*', which deals with these topics in more detail. The purpose of this document is to concisely present the content of this book, without the need to buy it.

This extract contains just corrected basics of some wrongly used concepts, and opens the way for a new, already overdue understanding of our world.

The Universe Is Not Infinite

I believe it is humanly impossible not to make any mistakes. Those making them should be judged not by the mistakes they made, but by their intentions, and mistakes they try to correct. Some mistakes are trivial, but the mistakes included in foundations of ever improving knowledge are fatal. The general consensus is to accept them, and pass them over to new generations, without scrutinizing them, and without accepting responsibility for them. For example, it is still believed that the universe is infinite and nobody seems to question this belief, since we simply cannot see, or even imagine the vastness of our universe. We are similar to fish in the ocean, which could be forgiven for considering the ocean as infinite. They could swim forever, and they still be swimming in never-ending water. We are in the same situation with our universe, yet to turn this statement from just a belief to a substantiated fact, we need a proof.



The light emitted by the bulb to reach Tom has to cover the distance ***AB***. Considering that the vacuum filling the universe limits the speed of light to its constant value *c*, then $c = \frac{AB}{t}$

t it the time needed for the light to cover the distance ***AB***.

Should the universe be infinite, then ***AB*** could be also infinite, i.e., $AB = \infty$, and for the light it will take an infinite time to cover this infinite distance $t = \infty$.

Then the speed becomes $c = \frac{\infty}{\infty}$. The ratio of two infinities is not defined, what is easy to prove: Adding two infinities is infinity and then the speed could be rewritten as: $\infty + \infty = \infty$

$$c = \frac{\infty + \infty}{\infty} = \frac{\infty}{\infty} + \frac{\infty}{\infty}$$

If this ratio is defined, then $\frac{\infty}{\infty} = 1$, and $c = 1 + 1 = 2$

We could continue to add infinities, and finish with increasing numbers 3,4,5 ..., which proves that the ratio of infinities is not defined.

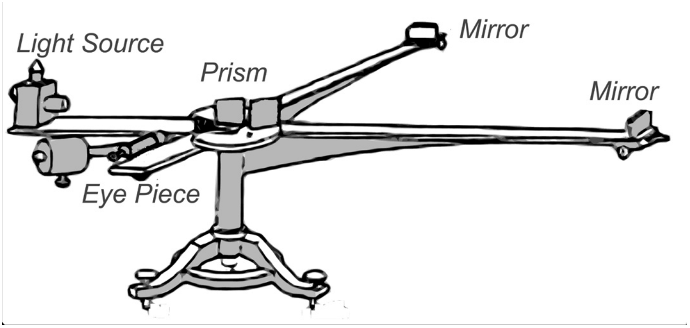
We have just proved that the speed of light in the infinity is not defined, and therefore the light in the infinity cannot exist. Since light exists in our universe, then the universe cannot be infinite.

This first revelation is only the beginning of the quest to correct many blunders, still being part of scientific dogma today.

Mysterious experiment

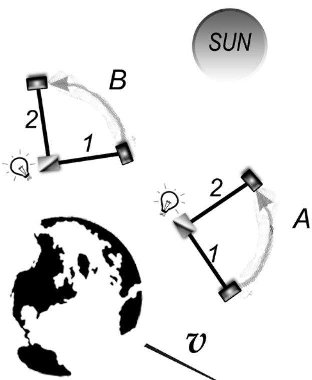
The modern science is very uneasy with any mysteries, and does not accommodate their existence. Yet, one mystery is still with us, and what's more, it was created by the science itself!

Towards the end of the 19th century, the scientific community was divided in two camps, one believing that the universe is filled with a substance called aether, and the opposing camp believed the universe is filled with nothing. There was no proof supporting either belief, and finally, in 1887 two English scientists, Michelson and Morley decided to end this quarrel. They were encouraged by the latest discoveries involving the light, and decided to use it to confirm the presence or the absence of the aether in the universe.



They used an apparatus with two arms, forming a right angle between them. At their intersection was a prism, dividing the beam of light in two, and sending each beam to the mirrors, fixed at the end of each arm. The expectations were that the returning beams will form a light pattern, observed through the eyepiece.

During the experiment the arms were slowly rotated as the following diagram indicates, which also reveals the reasoning behind the experiment.



The vacuum in space and the Sun are stationary, and the Earth is orbiting the Sun at the speed of 30 Km/sec. In relation to the vacuum, the apparatus moves with the same speed as does the Earth.

Two positions ***A*** and ***B*** represent two different directions the apparatus was turned to. In position ***A***, the arm ***1*** is pointing approximately in the same direction as the orbiting Earth. Should the aether fill the universe, then arm ***1*** is progressing directly against the aether, and should experience some resistance, caused by 'aether wind'. That should logically slow down the speed of traveling light. It is a similar situation to riding a motorbike, and experiencing the wind caused by the motion.

This is not the case for arm 2 though, where the direction of the traveling light is not the same as that of the traveling arm.

At that time, the independence of constant speed of light from its source was not proved yet, and therefore it was believed that the light traveling on arm ***1*** will be slower than the light traveling on arm 2. That would cause beam ***1*** to arrive at the prism later than beam 2. That is, should the aether exist.

Should it not, then apparently both beams will be traveling at the same speed. During turning the arms, the expectation was that the displayed spectrum on the display will form a sinusoidal pattern of differently spaced fringes, corresponding to distinct interference of two waves, arriving at the different time

Despite many repeated attempts and modifications to the apparatus, the resulting spectrum was always almost uniform. That resulted in the belief that in the universe the aether does not exist.

That belief prevails even now, despite that some years later the original calculations used in the experiment were corrected and they predicted that there should be distinct patterns, even if the aether doesn't exist. (Detailed description of the experiment with corrected calculations are included in *appendix 1*.)

For a long time, nobody could explain why the experiment did not achieve the predicted results, and at the time of writing this article, the experiment remains still not properly explained.

The scientists were faced with three variable entities, all relative to the vacuum in stationary universe:

1. Speed of light.
2. Speed of the orbiting Earth and the apparatus.
3. Time.

In 1913 Willem de Sitter proved that the light is propagating through the universe with its constant speed, relative to the stationary vacuum filling the universe, and independent of the speed of its light source. (Explained in *appendix 1*.)

That excluded the effect of *'aether wind'*, and the speed of light was also excluded from the suspected variables. Since the speed of the orbiting Earth is also constant, the only culprit left was the time.

The concept of time was always an enigmatic subject, and at the time of the experiment the science accepted the concept of time put forward by Isaac Newton, named after him the *'Newtonian time'*. That was a concept involving time flowing in one direction only and at constant, unchangeable rate.

This rigid, unchangeable time could have not been used to explain the mysterious results of Michelson-Morley experiment and Albert Einstein therefore discarded this concept of *'Newtonian time'* entirely.

He used calculations derived from an abstract experiment put forward by H. A. Lorentz. In its essence, this experiment was simple to follow, but it was more difficult to interpret correctly.

The experiment consisted of a light beam, sent to a distant mirror, and then the time for the beam to return was calculated.

Lorentz found that there was a substantial difference between time of arrival $\underline{t_0}$ of the beam sent from a stationary light source, and the time $\underline{t_1}$ of the beam sent from a moving source.

He then calculated and defined their ratio, $\underline{t_1} / \underline{t_0}$ as *Lorentz Factor* γ:

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$\underline{c}$ is the speed of light in vacuum
$\underline{v}$ is the speed of the light source

It seems to me that for many of us it is difficult to distinguish between the delay in time, what *Lorentz Factor* represents, and slowing the rate of flow of time. It is obviously clear that the *Lorentz Factor* does not slow, or speedup the rate of time flow at all.

This formula is incorrectly used to calculate the slowing of the rate of time flow on a fast-moving object. For example, it was believed that on interplanetary voyages, the time in a moving spaceship will proceed at a slower rate than the time on the Earth. For some hard to understand reasons, Albert Einstein also used *Lorentz Factor* γ to define the concept of relativistic mass:

$$m_r = \gamma m_0 = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

With increasing speed of the light source the relativistic mass also increases and should the speed of the light source increase to $\underline{c}$, then the relativistic mass becomes undefined. All that only because the light, when compared to a stationary observer, will reach a moving observer in delayed time, .

This simple formula was also wrongly interpreted that nothing could move faster than the light because its mass becomes infinitely large.

The concept of relativist mass cannot be correct and any calculations involving cannot be correct either. This is particularly true for the mathematical derivation of Einstein's famous equation $\boldsymbol{E = mc^2}$. (*More on this in appendix 3.*)

We can conclude:

- *The universe is not infinite.*
- *The Michelson-Morley experiment produced exactly what it should - there should not be any distinct fringes on the display.*
- *The maximum speed of light is set by the physical attributes of the restrictive medium, in which the light propagates. (Situation is similar to light propagating in a glass, or water.)*
- *The universal time, i.e. Newtonian time, does not change its rate of flow. The only time which does change, is the 'subjective time'.*
- *(Defined in the book 'Hm ...', www.dlouhy.info)*

Appendices

1. The Michelson–Morley Experiment in Detail

I always tried to turn every disaster into an opportunity.
(John D. Rockefeller)

The apparatus used by Michelson–Morley in the experiment was named *interferometer:*

They were encouraged by the latest discoveries involving the light and decided to use it to confirm the presence or the absence of the *aether* in the universe.

They used an apparatus with two arms, forming a right angle between them. At their intersection was a prism, separating the beam of light in two, and sending each beam to the mirrors, fixed at the end of each arm. The expectations were that the returning beams will form on a display a light pattern, observable through the eyepiece.

During the experiment the arms were slowly rotated as the following diagram indicates, which also reveals the reasoning behind the experiment.

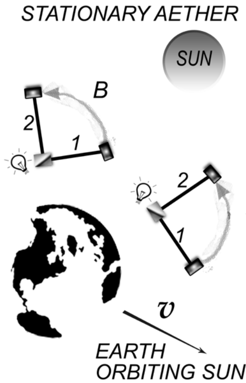


***FIGURE A2.2** The rotating interferometer stationed on the Earth.*

The general consensus was that in the presence of the aether, the longitudinal beam sent in the direction of the moving Earth will be exposed to an *'aether wind'*. It will encounter greater aether resistance, and should therefore arrive at the display later than the transversal beam.

In the figure above are illustrated two positions, ***A*** and ***B*** of the instrument. In the position ***A***, the arm ***1*** is pointing longitudinally in approximate direction of the orbiting Earth, i.e. directly against the apparent *'aether wind'*. The resistance created will slow down the progressing light beam **1** more than the light beam progressing on the arm **2**. It was expected that in the first position ***A***, the beam on arm ***1*** should arrive at the display later than the beam on arm **2**.

This discrepancy in the time of arrival of both beams would then affect the light pattern, formed on the display and observed through the eyepiece. To ascertain that the arm ***1*** points in the same direction as the moving Earth, the arms of the instrument were rotated, while the displayed light patterns were observed.

At some point during the rotation, arm ***1*** was definitely pointing in the same direction as the moving Earth, and arm **2** was pointing directly to the Sun. At that point, the possible resistance of the aether wind would be greatest. That should be seen on the reflected light pattern as a distinct interference of two waves, arriving at different times.

The instrument was turned even further to position ***B***, and after every changed position, the resulting observed interference should have been obvious. At least that was generally believed and expected.

To a great surprise, no interference was observed and conclusion was that both light waves arrived more or less at the same time:

'But when the experiment was made, it was found that the two beams arrived back at the same time. ... Now it must be recognized at once that this was a most extraordinary thing. Here was an experiment, performed with every care and apparently with full understanding of what was being done, which completely failed to give the result that common sense would have thought inevitable.

... If any explanation is to be given, therefore, it must necessarily involve something revolutionary.' [1]

Evidently, something '*extraordinary*' and '*revolutionary*' always deserves a sensible explanation. Since the whole situation is part of our physical world, all relevant physical laws must apply. Then the convincing justification for the obtained results has to be found in some understandable and logical terms.

At the time of the experiment, Michelson, Morley, and all the others in the scientific community, based their conclusions on a simple, common sense example, where a body traveling against the wind will be slowed down by the wind more than the body traveling in a transverse direction.

That would be true, for example, for the sound traveling through the air, due to the physical nature of the sound waves and the medium. Probably for the same reasons it was assumed that the light progressing in longitudinal direction, i.e., against the *'aether wind'*, would take longer to return than in the transversal direction. Based on the apparent failure of this test, this assumption was considered not to be valid any more, and the conclusion was that there is only a vacuum and no aether filling the universe.

This conclusion is still considered as valid even now, and the presence of the aether in the universe is not generally accepted.

At the time of the experiment it was believed that the speed of light will be affected by the friction created by light moving through the aether, i.e. the speed of light will slow down.

Due to the nature of the propagating light, i.e. it needs to dislodge a particle in an atom to a higher orbit, it is obvious that the space is filled by the aether, whatever that is. *(Explained in the book 'Hm ...', www.dlouhy.info)*

[1] As described by *Herbert Dingle* in 1922, in his book 'Relativity for All'.

It was also assumed that the Earth and the instrument are both moving with the same speed $\underline{v}$, relative to the universal reference frame. The Earth's orbiting speed $\underline{v}$, which is approx. 30 Km/sec, is used in calculations, but in reality, this speed does not represent the real speed of the Earth in space.

It is believed that the speed of the solar system in the universe is 200 Km/sec, which was not included in the original calculations. Since we are analyzing the experiment as it was performed at that time, we will ignore this additional speed component.

Considering that speed of light is not constant through the universe was the first error made, and then corrections to original calculations used by Michelson and Morley eliminated the second error, not known at the time of the experiment.

The corrected calculations proved that even in the absence of the *aether*, for the constant speed of light $\underline{c}$ the longitudinal beam arrives later than the transversal.

The whole experiment, and all the relevant calculations, could be presented in a simplified scenario, as illustrated by the following figure:

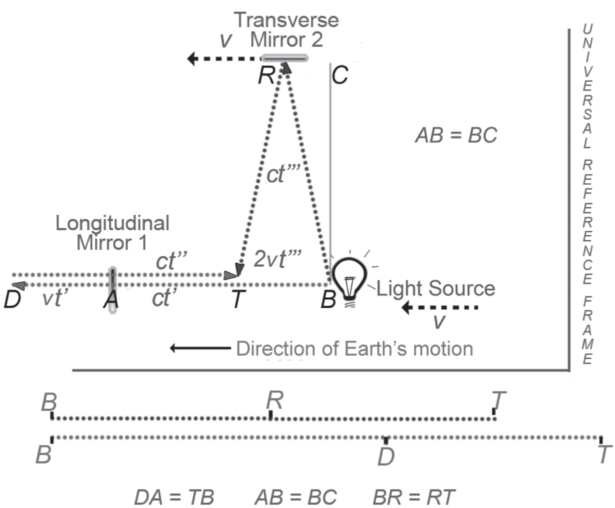


FIGURE A2.3 *The diagram of the Michelson-Morley experiment.*

To simplify the process, we will presume that the conclusions drawn from the experiment were correct, and both beams arrived at the display at the same time.

Then the longitudinal beam of light from the source will travel from ***B*** to ***D***, and then reflects to ***T***. The transversal beam will also start at ***B***, travel to ***R***, and then reflect to ***T***.

By comparing the lengths of the distances traveled by both beams it becomes obvious that the longitudinal beam travels a longer distance, and for given constant speed of light *c*, it will travel longer. In other words, the transverse beam will arrive at the display sooner.

To verify this, the time taken by both reflected beams to return back to the moving light source can be calculated using Pythagorean Theorem and simple mathematics.

Beam sent to mirror ***1***, along longitudinal direction will at speed *c* and in time *t′* cover distance *ct′*:

$$ct' = AB + vt', \text{ i.e., } \quad t' = AB/(c-v)$$

On return journey, in time t'' covers distance $ct'' = AB - vt''$

Total time $t_1 = t' + t''$ $\qquad t'' = AB/(c+v)$

$$t_1 = \frac{AB}{c-v} + \frac{AB}{c+v} = \frac{AB(c+v) + AB(c-v)}{(c-v)(c+v)}$$

$$= \frac{ABc + ABv + ABc - ABv}{c^2 - v^2} = \frac{2ABc}{c^2 - v^2} = \frac{2AB}{c\left(\frac{c^2 - v^2}{c^2}\right)} = \frac{2AB}{c}\frac{1}{\left(1 - \frac{v^2}{c^2}\right)}$$

Traverse beam, sent to mirror **2** in time t''' at speed *c* covers distance $ct''' = BR$, *i.e.*, $t''' = BR/c$

$$BR = RT = \sqrt{(vt''')^2 + BC^2}$$

$$t''' = \frac{\sqrt{(vt''')^2 + BC^2}}{c} \qquad t'''^2 = \frac{(vt''')^2 + BC^2}{c^2}$$

$$t'''^2 c^2 - v^2 t'''^2 = BC^2$$

$$t'''^2 = \frac{BC^2}{c^2 - v^2} \qquad t''' = \frac{BC}{\sqrt{(c^2 - v^2)}} = \frac{AB}{\sqrt{(c^2 - v^2)}}$$

Total time: $\qquad t_2 = 2t''' = \dfrac{2AB}{\sqrt{(c^2 - v^2)}}$

Comparing both results reveals that $t_1 > t_2$.

It is obvious that even without any interference from the '*aether wind*', it takes longer for the beam of light to return from longitudinal direction than from transverse, i.e., the beam from transverse direction arrives sooner than the beam from longitudinal direction.

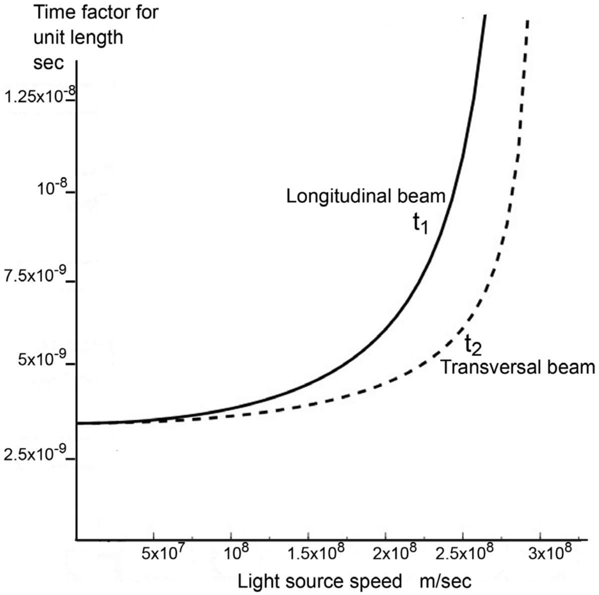


FIGURE A2.4 *Michelson-Morley experiment.*
The time taken by the longitudinal beam is greater than for the transverse beam.

In the graph the distance ***AB*** was set to 9 m[1], since that was the original length the light traveled. The dotted line represents the transverse movement, with corresponding values of $\underline{t}_2$, i.e., the time of arrival of the transverse light beam. The full line represents the longitudinal movement, with corresponding values of $\underline{t}_1$, the time of arrival of one of the longitudinal light beams.

Both precise moments of arrival depend on the speed $\underline{v}$, at which the source of the light is moving. There will be a small difference for low speed $\underline{v}$, and only at higher speeds the difference becomes noticeable.

The following graph depicts the difference in time $\underline{t}_1$ - $\underline{t}_2$, taken by the longitudinal beam and by the transverse beam. The speed of the light source and the observer is relative to the vacuum, i.e., the universal reference frame.

[1] For more precise results, the beam was reflected across the arms more than once. For a greater simplification, we used 9 m length only.

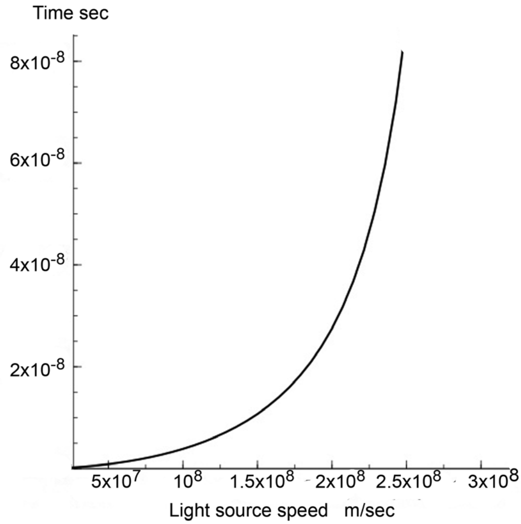


***FIGURE A2.5** The time difference* t_1 *-* t_2*, between beams, traveling in longitudinal and transverse direction. The speed of the light source and the observer is relative to the vacuum, i.e., the universal reference frame.*

For the Earth's orbiting speed 30,000 m/sec, the distance traveled by:

Longitudinal beam	18.000000180000001 m
Transverse beam	18.000000090000000 m
Difference	9.0000000341206032 $\times 10^{-8}$ m

This represents 0.18 of a typical wavelength of 500 $\times 10^{-9}$ m.

Because of this shift, the returned combined light beams in the eyepiece should produce a pattern of interference. For this particular length of the instrument's arms, the separation between areas of the same density is expected to be 0.18 fringes. This number does not include any shift due to the *aether* resistance, though.

Michelson expected that Earth's motion would produce a more pronounced shift, but in the published results of this experiment, the greatest separation they achieved was only 0.018 fringes.

Corrections to original calculations were later made by Alfred Potier and Hendrik Lorentz, which confirmed there should be clearly visible interference. Yet, the measured resulting separation was less than 0.01 fringes, and in addition it was also misplaced. That indicated that beams arrived more or less at the same time.

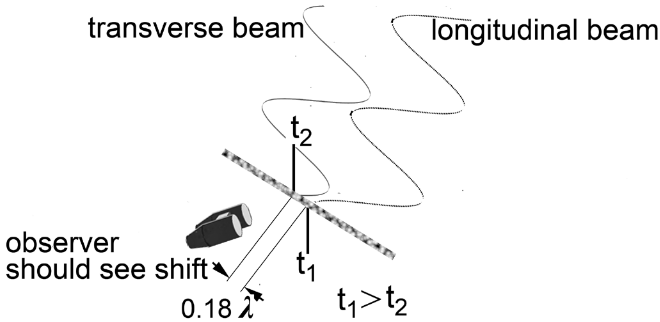


FIGURE A2.6 The longitudinal beam arrived at time $\underline{t}_1$ *and transverse beam sooner at time* $\underline{t}_2$.

The longitudinal beam arrived at time $\underline{t}_1$, and transverse beam sooner at time $\underline{t}_2$.

Since we have already established that there is nothing mysterious about our physical world, there must be some convincing, and reasonable explanation for these results. If such an explanation cannot be found, then obviously the whole concept of the experiment must be flawed.

Let's look at the Michelson-Morley experiment again, this time from a different point of view.

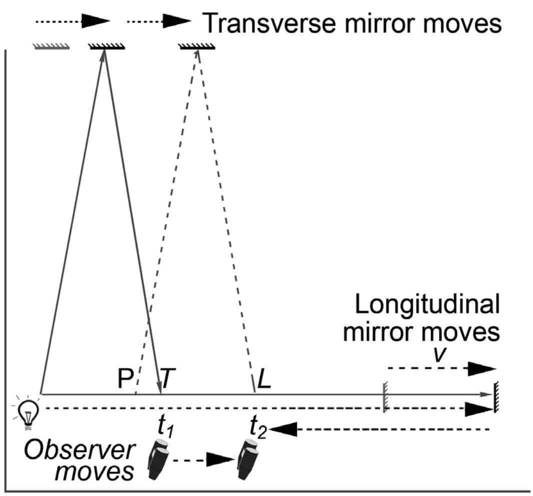


FIGURE A2.7** The instrument moves to point* ***P, *then* ***T*** *and then to* ***L***.

At point ***T***, the observer will see only the original transverse beam, and at point ***L*** will see not only the returned, original longitudinal beam, but also another transverse beam, emitted at point ***P***.

In this experiment, the beam of light is treated as a one-dimensional entity, adequate for some theoretical calculations. Since one-dimensional entities do not exist in our world, this is not applicable for real situations. In our physical world the source of light does not consist of one singular point, sending only a single, one-dimensional beam. It consists of many of such points, each sending a unique light beam towards the mirrors. These point sources are spread over the whole three-dimensional area of the light source, and therefore the created beams are not synchronized, and the distance they travel slightly differs.

It was also wrongly assumed that only one such beam of light, reflected from a longitudinal mirror will reach the observer at point ***L*** in time t_2.

The light source does not send only one beam to be split, but in reality, in time t_2 the observer sees the delayed beams from the transverse mirror, and also the original beams from the longitudinal mirror.

It is obvious that the observer sees all the beams of light, arriving almost simultaneously. Since they are originating from a three-dimensional light emitting area, they could not be ideally synchronized, and some minor discrepancies will occur.

Some discrepancies will be also introduced by the movements of the observer, as defined by the concept of 'observed light'. [1]

This explanation agrees with the results achieved by the Michelson-Morley experiment, and explains its apparent failure. Unfortunately, the failure to achieve the expected results was at that time interpreted as non-existence of the aether, which by itself could not be considered as a valid explanation.

For this apparently peculiar result, some other explanation had to be found:

'Various suggestions were offered, but, in the light of future investigations at any rate, none of them was so satisfactory or farreaching as the most revolutionary of all – the principle of relativity.' [2]

[1] The concept of *observed light* is outside the scope of this article, and it is discussed in my book 'Hmm ...' ISBN 9781697759891 in chapter 12. and in book's appendix 5: 'More on Light'.

[2] Taken from '*Relativity for All*' by *Herbert Dingle*.

In this experiment three basic attributes were analyzed: the light and its speed, the speed of moving apparatus, and the time. By consensus it was incorrectly agreed that the culprit must be the time. Albert Einstein then included this conclusion in his special theory of relativity. He wrote about this experiment: *'If the Michelson–Morley experiment had not brought us into serious embarrassment, no one would have regarded the relativity theory as a (halfway) redemption. '*

However, the failure of this experiment cannot be explained by slowing the rate of the *universal time*, and proves nothing about the aether, which was the intended aim of the experiment. The obtained results do not even agree with previously included simple calculations.

The simultaneous arrival of the light beams does not prove that the aether does not exist, but also it does not prove that it exists. Despite all that, the Michelson–Morley type experiments form one of the fundamentals of the special theory of relativity.

After this experiment, the interest in the behavior of the light had intensified, and in 1908, Walther Ritz suggested that the light progresses through the space with constant speed $\underline{c}$, relative to its source. That was refuted in 1913 by Willem de Sitter, who based his conclusions on observations of a double-star system.

He reasoned that if the speed of light $\underline{c}$ was relative only to its source, then if observed from different parts of the orbital path, the light from the star would travel away and toward us at different speeds.

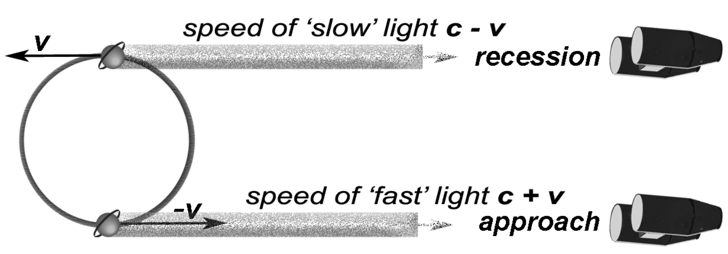


FIGURE A2.8 *W. de Sitter - double star system. During approach, the revolving star moves toward the observer, and during recession it moves away with speed* $\underline{v}$.

If the light emitted by the orbiting star changes its speed at which approaches the *observer* on our planet, then the *observer* would see that '*the "fast" light given off during approach would overtake "slow" light, emitted during a recessional part of the star's orbit.*'[1]

Since this is not the case, Willem de Sitter's observations imply that the light must be propagating with its constant speed, regardless of the speed of its source.

In another words, he stated that the light propagates in the space with a constant speed ***c***, which is independent of the speed of the light source.

This plausible conclusion was soon incorrectly interpreted as '*nothing can move faster than the light*' and '*no matter how fast the observer travels, the light will be always passing with its constant speed*'.

Albert Einstein also characterized these observation in his book as: '*VII THE APPARENT INCOMPATIBILITY OF THE LAW OF PROPAGATION OF LIGHT WITH THE PRINCIPLE OF RELATIVITY... By means of similar considerations based on observations of double stars, the Dutch astronomer De Sitter was also able to show that the velocity of propagation of light cannot depend on the velocity of motion of the body emitting the light. The assumption that this velocity of propagation is dependent on the direction "in space" is in itself improbable.*' [2]

The special theory of relativity is with us for almost a hundred years, and it seems that it is infallible. However, in an essence its credibility relies heavily on the failure of the *Michelson–Morley experiment,* on the results of Willem de Sitter's observations of a double-star system and finally on Lorentz's calculations.

The facts remain that the vacuum still limits the speed of light, and therefore it must have some speed-limiting properties, as for example the water and glass have.

One of the remarkable differences between the sound waves and the light waves is that with increased density of the restrictive medium, sound speeds up, but the light slows down.

	Sound	*Light*
Vacuum	-----	*300,000,000*
Air	*343*	*300,000,000*
Water	*1,490*	*225,000,000*
Glass	*5,600*	*200,000,000*

[1] From Wikipedia, W. de Sitter - double star system.

[2] Book 'RELATIVITY THE SPECIAL AND GENERAL THEORY' by Albert Einstein, 1920

The results of *Michelson–Morley experiment* were misinterpreted, and conclusions drawn are thus inexact and even erroneous.

We can conclude:

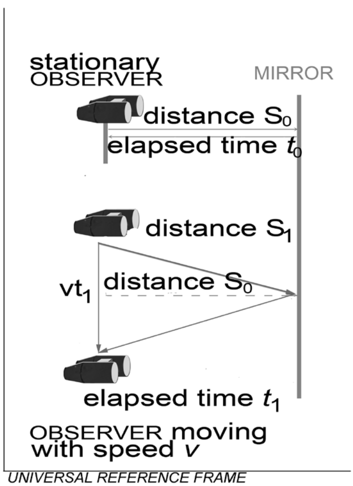
- *The Michelson–Morley experiment 'failed', because it was wrongly interpreted. In reality, it progressed exactly as it should have.*
- *The light propagates through space with its constant speed **c**, which is valid only in relation to the restrictive medium in which the light propagates.*
- *The restrictive medium found in the universe is the vacuum, which could be filled by the aether. The experiment did not prove, or disapprove aether's physical existence.*
- *We do not know the real characteristics of the vacuum, but we know that it restricts the speed of light to its constant value **c**. This ability could be probably attributed to the basic nature of the light propagation.*

2. Lorentz's Transformation

Reality continues to ruin my life. (Bill Watterson)

Well before Albert Einstein defined his special theory of relativity[1], Dutch physicist H. A. Lorentz was already attracted by the relationship between the light and time. He conducted an abstract experiment, in which he used the light, propagating relatively to a universal reference frame with constant speed $\underline{c}$, to calculate a delay in time caused by the observer's movement.

In the first part of his abstract experiment, in the *universal reference frame*, i.e., relatively to the stationary medium in which the light propagates, a stationary *observer* sends a beam of light over distance $\underline{S}_0$ to a distant mirror, and measures the time $\underline{t}_0$ it takes for the beam to return.



In the second part of this experiment, an *observer* moves on a straight line with speed $\underline{v}$, sends a beam of light to the mirror and measures the time $\underline{t}_1$ it takes for the light to return. The light travels the distance $\underline{S}_1$ which is greater than $\underline{S}_0$. The resulting *Lorentz factor* γ then describes how much longer it takes for the light to reach a moving *observer,* instead of a stationary *observer*.

[1] Book 'RELATIVITY THE SPECIAL AND GENERAL THEORY' by *Albert Einstein*, 1920, Ph.D., translated by *Robert W. Lawson*, M.Sc. University of Sheffield,

Calculations of *Lorentz Factor*:

$$t_0 = \frac{s_0}{c} \quad t_1 = \frac{s_1}{c} \quad \text{and} \quad S_0^2 + v^2 \cdot t_1^2 = S_1^2 \quad \text{therefore} \quad S_1 = \sqrt{s_0^2 + v^2 t_1^2}$$

$$t_1 = \frac{\sqrt{s_0^2 + v^2 t_1^2}}{c}$$

$$t_1^2 = \frac{s_0^2 + v^2 t_1^2}{c^2}$$

$$t_1^2 \cdot c^2 = s_0^2 + v^2 t_1^2$$

$$t_1^2 \cdot c^2 - v^2 t_1^2 = s_0^2$$

$$t_1^2 (c^2 - v^2) = s_0^2$$

$$t_1^2 = \frac{s_0^2}{(c^2 - v^2)} = \frac{t_0^2 c^2}{c^2 \left(1 - \frac{v^2}{c^2}\right)} = \frac{t_0^2}{1 - \frac{v^2}{c^2}}$$

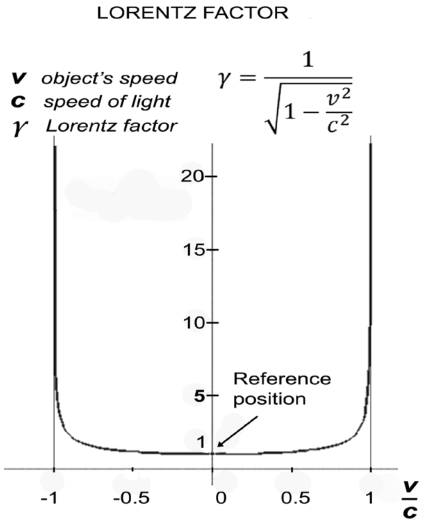
$$\frac{t_1}{t_0} = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Some selected values of *Lorentz Factor*.

v/c	Lorentz Factor γ		v/c	Lorentz Factor γ
0.5	1.15		0.99999	223
0.8	1.7		0.9999999	2236
0.95	3.2		0.99999999	7071
0.98	5.02		0.999999999	22360
0.99	7.08		1.0	? (infinity)

Lorentz in his calculations assumed that relative to the *universal reference frame*, the speed of light is constant. He also assumed that the *observer's* clock, measuring the time delay, is not affected by the *observer's* speed. (This possibility was firstly, and mistakenly introduced in the special theory of relativity.)

Graph of *Lorentz Factor*. It uses observers' speed $\underline{v}$ and constant speed of light $\underline{c}$:



It is important to note that all what Lorentz achieved with his calculations was to calculate the time delay. For the light wave, progressing with constant speed, he calculated the time difference between reaching a moving *observer*, instead of a stationary observer.

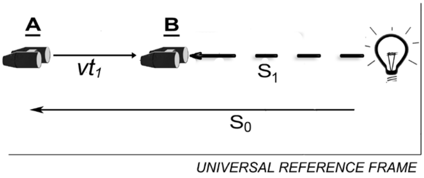
It is also important to note that in this experiment, the flow of time does not change. During travel, the same clock with the same rate of time flow is used, as during the stationary part of this experiment. Should the time flow on this clock change, Lorentz's calculations would be meaningless. If the same clock used for measuring the elapsed time will go slower, there will be no time delay.

In the following years, the first incorrect assumption made by many physicists was to mistake this delay in time for a change in the rate of time flow. They believed that the rate of time flow, measured by the *observer*, observing a beam of light, would change due to the *observer's* movement.

The second incorrect assumption was to consider the Lorentz factor in only one special case: The *observer* is moving along a straight line, perpendicular to the line connecting the *observer* and the light source, and from the position closest to the light source.

That excludes any other movements, but in reality, the *observer* could move in whatever direction, and from whatever position.

The simplest case to investigate is the *observer's* movement along the line, connecting the *observer* with the light source. The movement could be in both directions, toward and away from the light source. This option traveling on a collision line, directly toward, or away from the light source, was missing entirely from Lorentz's experiment. This situation is illustrated in the following figure:



Observer moves from **A** to **B** in time t_1. The light travels distance S_1, and the *observer* vt_1.

The light emitted by the bulb will reach the stationary *observer* in time t_0 and cover distance S_0. To reach moving *observer*, the light would have to cover distance S_1 in time t_1, while the *observer* would travel the distance vt_1

1. Stationary *observer*:
   The light will reach the *observer* at position **A** in time t_0
   Distance traveled by light will be $S_0 = ct_0$
2. Moving *observer*: Moving with speed v from position **A** to **B**.
   At **B** the light will reach *observer* in time t_1
   Distance traveled by the light $S_1 = ct_1 = S_0 - vt_1$
   In time t_1 the *observer* will move $AB = vt_1$

Again, the similar calculations could be used as used by Lorentz:

$$t_0 = \frac{S_0}{c} \qquad t_1 = \frac{S_1}{c} = \frac{S_0 - vt_1}{c}$$

$$t_1 c = S_0 - vt_1$$

$$t_1 c + vt_1 = S_0$$

$$t_1 = \frac{S_0}{c + v}$$

$$\frac{t_1}{t_0} = \frac{\frac{S_0}{c+v}}{\frac{S_0}{c}} = \frac{c}{c+v} = \frac{1}{1+\frac{v}{c}}$$

Now we have two formulas, both depicting *Lorentz factor*.

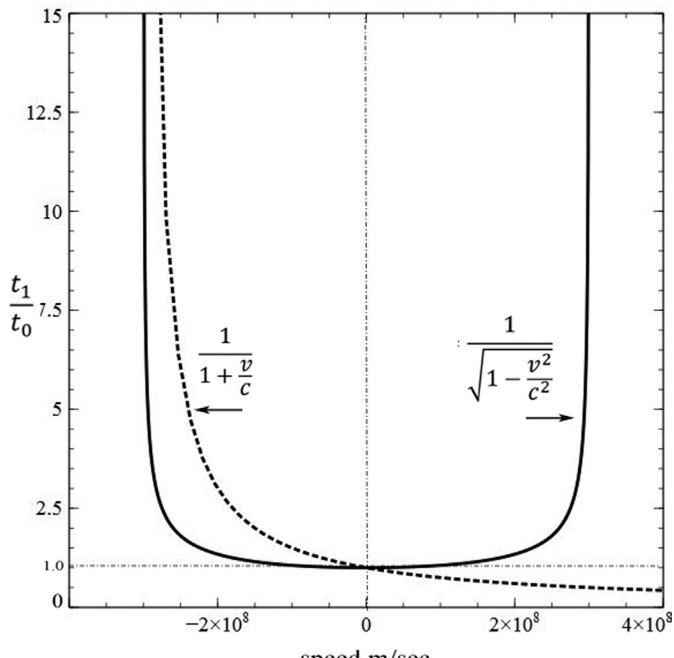
Original *Lorentz factor:* Extended *Lorentz factor:*

$$\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \qquad \gamma' = \frac{1}{1+\frac{v}{c}}$$

In the graph below, the right-hand side of the dotted line represents a situation, where the observer moves on a collision course with the light source. In this scenario the Lorentz factor γ' will infinitely decrease. That means the light will reach the observer in a shorter period of time than in a situation, where the observer is not moving directly toward the light source.

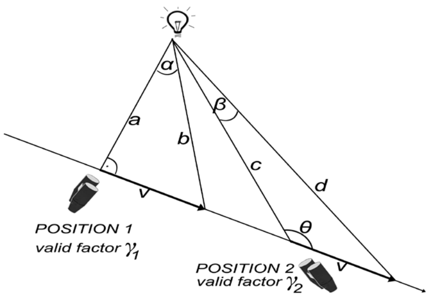
Full line represents the original formula for calculating the *Lorentz factor*. Dotted line represents the extended formula of *Lorentz factor* γ'.

This dotted right-hand part of the graph is vastly different from other parts and yet, all that makes such a difference is only a very slight change in the direction the observer travels. The second formula includes not only delay, but also reduction in time interval, needed for the light to reach a moving observer. The difference between these two factors is obvious



Should we incorrectly use this extended factor to calculate the rate of time flow, then the time will speed up, which is contrary to what was deduced in the special theory of relativity. This factor is valid only for observers moving towards the mirror on a direct line, connecting both the observer and the light source.

It is also easy to prove that the *Lorentz factor* will change with the starting position, as illustrated in the following figure.



Observer moves with speed $\underline{v}$ in the same direction. Separate measurements are taken for position ***1*** and **2**.

Starting from position ***1***, comparing ***b*** and ***a*** will produce the value of the originally defined *Lorentz factor* $\boldsymbol{\Upsilon}$.

Should the *Lorentz factor* describe movement initiated at any other position on that line, for example position **2**, then the ratio of ***d*** and ***c*** should be the same as ***b*** and ***a***.

Using some properties of a triangle and some trigonometric functions, we could compare these two ratios.

$$\frac{v}{\sin\alpha} = \frac{b}{\sin 90} = b \qquad \frac{v}{\sin\beta} = \frac{d}{\sin\theta}$$

$$\sin(180-\theta) = \frac{a}{c} = \sin\theta$$

$$\text{For both factors to be equal: } \frac{b}{a} = \frac{d}{c}$$

$$\frac{\frac{v}{\sin\alpha}}{a} = \frac{\frac{v\sin\theta}{\sin\beta}}{c}$$

$$\frac{1}{a\cdot\sin\alpha} = \frac{\sin\theta}{c\cdot\sin\beta}$$

$$\frac{1}{a\frac{v}{b}} = \frac{\sin\theta}{c\cdot\sin\beta}$$

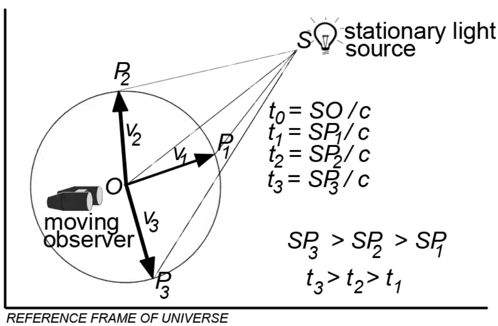
$$\frac{b}{av} = \frac{\frac{a}{c}}{c\cdot\sin\beta} = \frac{a}{c^2\sin\beta}$$

$$\frac{b}{a} \neq \frac{av}{c^2\sin\beta}$$

We can choose any position and evidently, the angle $\underline{\beta}$ and resulting distance $\underline{c}$ could have any value, provided $\underline{a} > \underline{\beta}$. As a consequence of that, the value of ***a/b***, which proportionally represents *Lorentz factor* γ, could vary with the position, and can have an infinite number of values. The correct formula for the *Lorentz factor* γ, would be also different and would have to include the angles $\underline{\beta}$ and $\underline{\theta}$.

The following example illustrates the general case, when the observer could move in any direction, not just on the line perpendicular to the line connecting the observer and the light source.

The observer could move with the same speed $\underline{v}$ to any of the positions ***P1***, ***P2*** and ***P3***. To reach the *observer*, the light has to travel a different distance, and therefore it will reach the *observer* with different delays.



The *observer* starts from position $\underline{O}$ and could move to positions ***P1***, ***P2*** and ***P3*** The distances traveled: $\underline{OP}_1 = \underline{OP}_2 = \underline{OP}_3$

When the *observer* is stationary, the light will travel the distance $\underline{SO}$, in time $\underline{t}_0 = SO/c$

Similarly: $\underline{t}_1 = S\underline{P}_1/c$ $\underline{t}_2 = S\underline{P}_2/c$ $\underline{t}_3 = S\underline{P}_3/c$

Since $S\underline{P}_1 < S\underline{P}_2 < S\underline{P}_3$, the light will travel a shorter time interval, therefore: $\underline{t}_1 < \underline{t}_2 < \underline{t}_3$

The *Lorentz factor* is defined as a ratio of time taken by the light to reach moving *observer*, to time taken to reach stationary *observer*.

Then, for different directions of travel and the same *observer*'s speed, we would have different values of *Lorentz factor*:

$\gamma_1 = (t_1 / \underline{t}_0)$ $\gamma_2 = (t_2 / \underline{t}_0)$ $\gamma_3 = (t_3 / \underline{t}_0)$

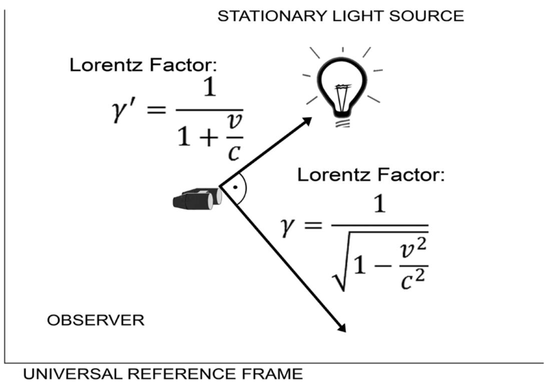
resulting in $\gamma_1 < \gamma_2 < \gamma_3$

These differences are not due to the different observer's speed, since $\underline{v}_1 = \underline{v}_2 = \underline{v}_3$, therefore, they would have to be calculated using a different formula for *Lorentz factor* γ.

We have already calculated one such factor γ', for a simplified situation, and obviously, the difference is substantial.

It is obvious that the values of the *Lorentz factor* depend not just on the *observer's* speed v, but also on the position and direction the *observer* is heading. The starting position and direction of movement plays a vital role, and if the *Lorentz factor* should be used in any calculations, it has to be included in the formula.

The following is the simplified diagram of the Lorentz experiment. Observer travels in two different directions and for each situation, different versions of the *Lorentz factor* exist.



We can conclude:

- *The Lorentz factor does not represent any changes in the rate of flow of time. Furthermore, it is incomplete and has no use in any real-world calculations.*
- *To use the Lorentz factor to define the relativistic mass is erroneous.*

3. $E = mc^2$ ... ?

The eternal mystery of the world is its comprehensibility.
(Albert Einstein)

We have already scrutinized two building blocks, on which the special theory of relativity was constructed:

- The apparent failure of the Michelson-Morley experiment,
- Lorentz calculations.
-

Yet, the experiment proceeded as it should, and its explanation did not need any changes to the rate of time flow.

The Lorentz calculations were proved to be incomplete and limited in their use, and they also did not involve any changes to the rate of time flow.

Despite all that, the special theory of relativity was formed, using exactly these two blocks. In this part we will scrutinize the famous construct built on these blocks, namely the Einstein's equation: $\underline{E} = mc^2$

What this equation describes is that the energy is equal to the multiple of an object's mass, and the square of the constant speed of light in vacuum.

The very first question we should answer is what kind of energy $\underline{E}$ actually represents? It cannot be for example, the heat of combustion, since the heat of combustion of 1kg ethanol is 7086 kcal/kg, or 3x104 kJ/kg. When we use Einstein's formula, the energy $\underline{E} = c^2 = 9x10^{16}$ kg m^2 /sec^2 = $9x10^{13}$ kJ for each 1kg of mass. The enormous difference eliminates $\underline{E}$ from being just the heat of combustion.

The viable possibility left is that $\underline{E}$ is the energy of some nuclear reaction, where the loss of mass is accompanied by a release of energy. But, is this possibility really feasible? The constant $\underline{c}$ of the speed of light is valid only in the vacuum, and for different media the speed changes. For example, in glass the speed of light is 2x108 m/sec, and in water is 2.25x108 m/sec. Does it imply that the release of energy, conducted under water or in a glass, will produce much less energy? To measure exactly the released energy is not possible, and we cannot verify calculations based on different constant speeds of light.

Therefore, the second question to answer would be the choice of the appropriate speed of light $\underline{c}$. Why is the speed of light in vacuum so special? Why not the speed in water, for example?

Since Einstein was the one, who selected for his equation the speed of light in vacuum, we would have to leave this question unanswered, and proceed regardless.

To derive his equation, Einstein used the *'relativistic mass'*[1]

$E = mc^2 = \gamma m_0 c^2$ γ is *Lorentz factor* and m_0 is mass at rest.

The *Lorentz factor* describes how much longer it will take for the light to reach a moving *observer*, instead of a stationary observer.

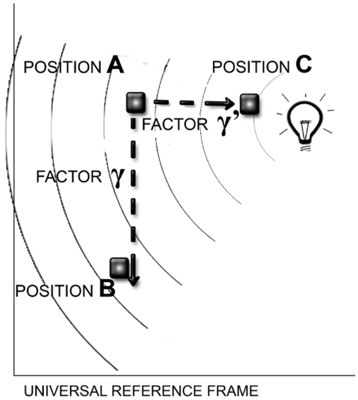
We already defined another such factor γ', which describes the same for the observer traveling on a direct line, connecting it with the light source. *Lorentz factor*: $$\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$$ Extended: $$\gamma' = \frac{1}{1+\frac{v}{c}}$$

The relativistic mass then becomes either this $$m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}$$ or this: $$m = \frac{m_0}{1+\frac{v}{c}}$$

Using different formula for the *Lorentz Factor* will produce completely different results: $$E = mc^2 = \frac{m_0 c^2}{\sqrt{1-\frac{v^2}{c^2}}} \neq \frac{m_0 c^2}{1+\frac{v}{c}}$$

To recapitulate the difference between these two factors:

When an object travels from position ***A*** toward position ***B***, then *Lorentz factor* γ applies. When the same object travels toward the position ***C***, then the extended factor γ' applies.



[1] *Mass in special relativity incorporates the general understandings from the concept of mass–energy equivalence. The word "mass" is given two meanings in special relativity: one ("rest mass" or "invariant mass") is an invariant quantity which is the same for all observers in all reference frames; the other ("relativistic mass") is dependent on the velocity of the observer. Roche states that about 60% of modern authors just use rest mass and avoid relativistic mass.*
John Roche "What is mass", European Journal of Physics 2005 pp 239

The extended factor confirms that the time taken for the light to reach a traveling object will dramatically change, with even a slight change in the direction the object travels. As we proved in the previous appendix already, the formula, and therefore the value of *Lorentz Factor* also changes with a different position of the object.

$$\underline{E = mc^2 = \gamma m_0 c^2}$$

Contrary to Einstein, the energy E of an object moving with the speed $\underline{v}$ changes not only with changes in the speed, but also with the position and direction the object travels.

Whatever energy $\underline{E}$ represents, it will change with any changes in the object's movement, even if the speed $\underline{v}$ remains the same. The result of this equation is then a widely fluctuating magnitude of the object's energy $\underline{E}$, as defined by the equation.

The relativistic mass is just a pure mathematical construct and I cannot see why some formula, representing time delay in a light beam reaching a moving object, compared to a stationary object, would change the mass of the object. Obviously, the *Lorentz factor* is credited with some very mysterious powers, which it does not possess.

Inevitably: $E \neq mc^2$