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## General Relativity For Teletubbys

### Why Special Relativity

And

### Why Not Special Relativity

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#### Why Special Relativity?

A core motivation for Special Relativity, was the apparent violation of Maxwell's Equations with the Newtonian Principle of Relativity (POR). That is, Newtonian Mechanics holds that forces between co-moving objects do not depend on their common velocity with respect to other inertial observers.

However, although experimentally EM phenomena are independent as to what object is considered moving, Maxwell's Equations hold that the velocity of propagation of light was dependent on the velocity of observers, for example, as derived here [Galilean Transformation Of Maxwell's Equations.html](#)

Attempts to measure this anticipated change in velocity were unsuccessful, for example [The Michelson- Experiment](#)

To resolve this issue, The Lorentz Transform (LT) set of Equations were formulated by Lorentz and Poincaré. These equations were attributed to a physical "Aether" and formed what was referred to as "[The Lorentz Ether Theory](#)". These equations solved the inability to detect the Aether, however, they are actually independent of any physical details of any particular Aether.

Although historically, the Aether was conceived as some sort of cogs, wheels and pulleys, such a viewpoint is entirely incidental. In 1905 there was no knowledge of the massless Quantum Fields of QFT. All that is required for a background view, is a physical background that is Lorentz Invariant. A physical background of course, physically explains  $\mu$  &  $\epsilon$ , which determines the SOL.

The Lorentz Transformations are able to account for an inability to detect motion in any background field. The LT applied to Maxwell's Equations, now allowed for the "prediction" of an invariant velocity of light, and resolved the apparent conflict with the Newtonian POR.

Now already armed with the correct Lorentz Transform Equations, Einstein then back calculated and showed that one only had to assume two principles to derive them. These were:

- 1) *The Principle Of Relativity (POR) Postulate/Axiom*

*The Laws Of Physics are independent of inertial frames (non accelerated motion).*

## 2) *The Speed of Light (SOL) Postulate/Axiom:*

*The SOL, in a vacuum, is an invariant. That is, the SOL is always measured to be the same irrespective of the source of the light's velocity or the observers velocity.*

Einstein's approach was to simply dispense with any physical reasoning as to why or how, the SOL was, apparently invariant, and just take the principle at face value. Indeed, Einstein's position was expressed as:

*"...but in addition to this most weighty group of theories, there is another group consisting of what I call theories of principle. These employ the analytic, not the synthetic method. Their starting-point and foundation are not hypothetical constituents, but empirically observed general properties of phenomena, principles from which mathematical formula are deduced of such a kind that they apply to every case which presents itself. The theory of relativity is a theory of principle..."*

That is, Einstein simply created a *behavioral*, mathematical model that accounted for the observations. He wasn't concerned with any physical mechanism that would account for the principle axioms. Indeed, Einstein did not even deny that an Aether existed:

*"...The introduction of a "luminiferous ether" will prove to be superfluous inasmuch as the view here to be developed will not require an "absolutely stationary space" provided with special properties, nor assign a velocity-vector to a point of the empty space in which electromagnetic processes take place."*

It is important to understand that the axioms of Special Relativity (SR), result in the identical equations that were constructed to explain why an Aether might actually exist, but that velocities with respect to it cannot be detected. These equations explain why any physical background approaches, referred to as neo-ether theories, are still viable.

Special Relativity is thus only an *interpretation* of the Lorentz Transform. It is not a unique interpretation. It is an interpretation that holds that geometry "explains" physical reality. Such a viewpoint is false, as shown here: [Geometry & Relativity](#).

### **What is Special Relativity?**

The vast majority of the pop media accounts of Special Relativity describe Special Relativity incorrectly. The most notable incorrect claims are:

- 1 Moving clocks run slow
- 2 Moving rods become shorter

### **Time**

*Time* is the concept that is used to account for the fact that ***real physical, separate measurable objects change their state such as position and momentum***. If no individual mass-energy

objects changes their state, including the quantum vacuum, time does not exist. That is, “time” is how *change* of a physical object’s state is accounted for.

Time may be modelled abstractly, but it is meaningless if it doesn’t resolve to referencing changes in real physical, mass-energy objects.

The SR model of observations hold that there is a physical, invariant, characteristic to the universe named “**Space-Time**”, *in a strictly empty universe*, that different inertial observers can experience different amounts of, at different times of their own time, that is their “proper time”.

To emphasize, this claim of “**Space-Time**”, is made despite that in a strictly empty universe there are no clocks and rulers that can construct or identify such an entity. Specifically, SR claims that there is a velocity  $c$ , the Speed Of Light, that has meaning in a truly empty universe.

The standard phrasing for the experience of “space time” is “takes a different path in space-time”.

It’s computed by noting the “proper time” of the “mover” with respect to the “non-mover”:

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

That is, tau, the time experienced by the “moving” observer is less than that experienced by the “stationary” observer.

Proper time is an invariant:

$$cd\tau^2 = cdt^2 - (dx^2 + dy^2 + dz^2) = \frac{c}{\gamma} dt^2$$

Or alternatively:

$$\frac{dt}{d\tau} = \gamma$$

Expresses the rate through “**Space-Time**” at which the moving observer travels with respect to the non-mover traveling through “**Space-Time**”. For example, the mover might travel through “**Space-Time**”, at a rate of 100 secs/sec with respect to the non-mover.

The elephant in the room here, is that the SR model of observations is *necessarily time travel into a deterministic future*. The mover can get to the future of another observer, before them. It is physically identical to the Dr. Who and his TARDIS conditions when Dr. who travels into the future.

This is the only physical interpretation of SR consistent with the Principle Of Relativity.

The characteristics of “**Space-Time**”, is that it is a physically necessary structure of the SR model, referred to by the concept of the “**Block Universe**”. This “**Block Universe**” of physical structure must always exist such that different observers can travel through it, differently.

Some commentators dispute this “**Block Universe**” viewpoint and claim it is a philosophical position, however, without such a structure, there is no reference to which meaning is given to different observers experiencing different final clock readings. What are the clocks actually measuring, if there is not an invariant such as a “**Space-Time**”, constructing a “**Block Universe**”?

Clocks are not time, they measure time, that is, changes in physical states of physical objects. If they read different, they must be reading something physical that is different. What is it that is different, if not “**Space-Time**”, that is the physical structure of a “**Block Universe**”.

## Clocks

The [POR](#) holds that “*the laws of physics are independent of inertial frame*”. This mandates that moving clocks must always tick at the same rate.

It is experimentally known that moving clocks measure “as if” they are ticking slow. If this was the actual case, then the POR would be proven false, and hence the SR interpretation of the Lorentz Transformation would be false. As, according to SR clocks must tick at the same rate, the only way that they can record different times from other clocks, is if they are travelling through “time” at different rates, where “time” is now an invariant property of “**Space-Time**”,

The analogy is, much like an odometer can read different if it goes from London to Edinburgh via different routes. A relatively moving clock covers more time, i.e. instead of traveling into the future at a rate of 1sec/1sec, it might travel into the future at say, 100sec/1sec.

Thus, the pop media accounts of “clocks run slow” are actually the properties of the neo-ether theories/neo-background field, not Special Relativity.

Neo-Ether, that is, any approach that postulates a physical background which interacts with physical objects to effect an actually slowdown of time processes is the only rational alternative to the experimental evidence that clocks appear to run slow.

Thus there are two options:

1 SR - Clocks time travel into the future, lengths are invariant

2 neo-Lorentz-background-field – Clocks slow down, lengths contract

Where it is noted that some modern approaches to [QFT](#) hold that “**Space-Time**”, is simply a behavioral “as if” model of an emergent phenomena of quantum fields. Such knowledge was not known in 1905, thus standard objections to background fields as a physical cause to Lorentz Invariance are no longer relevant.

## Space

*Space* is the concept that is used to account for the fact that **real physical, measurable objects do not all merge into one object**. It expresses the fact that **there are discrete, separate objects that can be identified from other objects**. Without individual physical objects, *space* does not exist. That is, “space” is how *separation* of physical objects is accounted for.

## **Length**

According to SR, length is an invariant. That is, the length of an object does not change. It is defined by:

$$ds^2 = dx^2 + dy^2 + dz^2 - cdt^2$$

which, according to the LT, is an invariant.

The analogy to this is this, if a pole that is longer than the height of a doorway is held vertically, it can go through the doorway, by tilting the pole either towards or away from the doorway. In SR, the pole is tilted into the time dimension when it goes through a hole that is shorter than the pole. That is, due to the concept of relative simultaneity, *the front and back ends of the pole are effectively at different points in time relative to different observers*. This means the pole tilts in time when viewed by the observer taken as stationary, i.e. the back end goes through the hole before the front end. It does not therefore have to "shrink" in order to fit into the hole. The crux of this, is that the LT time equation has a  $vx/c^2$  term.

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## **Discussion**

Crucial to the SR interpretation of the LT is that *there are physical properties to space and time that exist in an absolutely empty universe*. It demands that length and time can be defined without any actual physical rulers and physical clocks. It holds that the virtual concept of “Geometry” is sufficient to account for the physical property of a definite speed of light. It’s at the level of claiming that the color of the [Emperor’s New Clothes](#) are blue, yet many professional Physicists firmly hold to such a nonsensical viewpoint. This is addressed here [Geometry & Relativity](#).

Such a viewpoint is metaphysical and at the level of magic. Laws of physics are clearly, only relations between real physical objects, created by interactions between the physical objects themselves. A law of physic such as:

$$E = mc^2$$

Clearly cannot exist if objects with  $m$  or  $c$  don’t exist. It’s somewhat astounding that many claim that the “space-time” of Special Relativity is real in that it dictates physical properties to objects, yet “space-time” itself, is not a physical object, that is generated by a background “Ether”. To wit:

## **Fields & Aether**

## **Why Is The Measured Speed of Light Invariant?**

An anthropic argument as to why the *measured* Speed of Light (SOL)  $c$  must, realistically, be an invariant is noted here:

The structure of atoms are determined by the laws of physics. The laws of physics contain numerous constants, such that these constants form part of the laws of physics. Many contain the fine structure constant, which contains  $c$ .  $c$  is the only “constant”, that, if it were not for Lorentz Invariance, would not be a constant.

These laws of physics dictate how atoms are constructed, behave and decay. The [fine tuning](#) problem shows that changes in these constants will have drastic effects on the ability of a universe, with the properties for atoms to remain stable, to exist.

As noted, [Maxwell's Equations](#) indicate that the SOL is not invariant. This means that the laws of physics for atoms in relatively motion would not be independent of inertial motion, which would mean that atoms would lose their fine tuning status and dismantle themselves.

Thus realistically, this universe requires a measured invariance of the SOL. As noted, this can be achieved by the time traveling Dr. Who SR interpretation of LI or by the clocks slow down, neo-Lorentzian background field interpretation, to wit, the [Quantum Vacuum](#).

That is, if the only result of a change in the constants forming the laws of physics for atoms, was that all processes simply slowed down in a background field, the local observer would be none the wiser.

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### **Lee Smolin – Time Reborn**

Smolin covers the fundamental variable time problem of Relativity in his book “Time Reborn” (p.168).

A resolution that Smolin presents is the reformulation of GR by an approach referred to as “[Shape Dynamics](#)”

The essential point being that Shape Dynamics essentially, swaps over the invariant space of GR with its variant time, to variant space with invariant time. It's in effect, an expanded Lorentz contraction view of a velocity unobservable background Aether in hiding.

Noting that:

$$c = \frac{L}{T} \rightarrow \frac{(\gamma L)}{(\gamma T')}$$

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

That is, measured length and clock processes are taken to vary to explain the apparent invariance of the SOL. That is, the SOL can only be determined with clocks, if the “real” SOL and clock readings change together, so one is any wiser.

Whence it must be appreciated that the known measurements of moving clocks directly indicates that clocks do indeed tick slower. *It requires an actual argument based on the POR to claim that no, clocks do not actually tick slow, they cover more space-time, that is time.*

Noting that Smolin holds in the book that the “**Block Universe**” is an inherent property of the relativistic space-time approach to modelling observations:

*"...And by making the clock's tick relative - what happens simultaneously for one observer might seem sequential to another - Einstein's theory of special relativity not only destroyed any notion of absolute time but made time equivalent to a dimension in space: the future is already out there waiting for us; we just can't see it until we get there. This view is a logical and metaphysical dead end..."*

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[Petkov-BlockUniverse.pdf](#)

[Time Reborn](#) – Lee Smolin

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