Logical Analysis of Relativity Theory

Abstract for Invited Presentation for "Physics Beyond Relativity 2019"

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Summary

0 Prelude

0.1 Discussion: Newton v.s. Galileo I

1. Galileo's view: When dropped from the same hight, two masses will reach the ground in the same time period regardless of the magnitude of the mass. No explanation but the famous "the Tower of Pisa experiment."

2. Newton's view: The heavier the larger acceleration and so the faster. Formerly: Assume m and $m\prime$ are mass with $m > m\prime$. Let r be the distance from the centre of earth to m and $m\prime$. Let M be the mass of earth. The gravitational force between the earth and m is $F = GMm/r^2$. So,

$$a_m = GM/r^2, \quad a_M = Gm/r^2$$

where a_m is the absolute acceleration of m due to the gravitational pull by M. The absolute acceleration for M in the absolute space is $-a_M$. Therefore the relative

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acceleration between M and m is $a_M + a_m = GM/r^2 + Gm/r^2$. Thus, the time t_m needed for m to reach M is such that $(a_M + a_m)t_m^2 = 2r$. So

$$t_m = \sqrt{\frac{2r}{GM/r^2 + Gm/r^2}} \qquad t_{m\prime} = \sqrt{\frac{2r}{GM/r^2 + Gm\prime/r^2}}.$$

The time required for m and $m\prime$ to reach M is not the same unless $m = m\prime$. If $m > m\prime$, we have

$$t_{m\prime} > t_m.$$

This means "*The heavier a mass is the faster it falls.*" *So, Aristotle was correct.*

Remark 1 *This is a striking example of how inaccurate experiment could readily lead us to the wrong conclusion. Physics community believed in this wrong prediction by Galileo for four centuries until the we brought up this problem just a few years ago.*

0.2 Discussion: Newton v.s. Galileo II

Though Newton was born on the very day Galileo passed away, the concept of relativity which Galileo started took long time beyond his death to develop and conceptually it is more appropriate to start with Newton's absolutism and then compare it with the so called Galilean relativism.

0.2.1 Newton's absolutism:

1. Newton considered absolute *3D space* R^3 and *time coordinate* T. Time has its own inexplicable flow forward only.

2. "Motion of a point object" is defined as a (1-1) function from T to R^3.

3. Observation is done only by an observer standing on the shoulder of a Giant (God) out of the physical universe. This implies that unlike Goethe-Heisenberg's world, observation does not impact the physics inside the universe. (*no uncertainty*!)

4. Relative motion is a difference of two absolute motions. So, relative speed and relative accelerations are defined accordingly.

5. Under this setting, Newton introduced the concept of "point mass" and "force" upon it. Associated with is the famous *second law* of dynamics as

$$\mathbf{f} = m\boldsymbol{\alpha}.$$

where $\boldsymbol{\alpha}$ is the acceleration. The so called the *first law* is a special case where $\boldsymbol{\alpha}$ is a null vector.

6. When m exerts force $\mathbf{f}$ to $m\prime$ then $m\prime$ exerts force $-\mathbf{f}$ to m. This law is called the *third law*.

0.2.2 Galileo's relativism:

1. Galileo considered a system of $3D$ spaces R^3 such that one "moves" inside the other. This is to facilitate the concept of *reference frame* for each point object.

2. In Galilean relativity theory, it is not only a massive body which is idealized as a point mass which moves in a relativistic reference frame F but also the entire reference frame F_m of a point mass m which moves inside F.

3. To avoid complete anarchy which naturally comes into the picture by allowing this entire reference frames moving inside the other, Galilean relativity theory assumes the grand *Principle of Relativity* which asserts that the "Laws of Physics" must be invariant under the choice of the reference frame. At least, relativists had some sense to prevent anarchy of "relative liberalism" pulling the carpet under.

4. As the third law of Newton is violated by the consideration of reference frames of an accelerating mass, Galilean relativity theory bans accelerating bodies and accelerating reference frames.

It is unfortunate that theory of physics is not just the collection of laws of physics. These laws are introduced over the metaphysical assumptions (concepts) such as geometric spaces and time. *Nobody in the camp of relativity theory saw that Principle of Relativity and subsequent exclusion of acceleration is not sufficient to prevent this "radical" anti-absolute ideology leading theoretical physics into catastrophic collapse.* Moving metaphysical concept of reference frames is invalid extension of the concept of physical motion of point masses in theoretical physics.

This deadly blow came from Aristotle again. He said that a point in a line would not be a part of the line. This sophisticated message was to wait until late 20th century to be understood in terms of topology. Topologists say that a point is not a part of the line as we need infinite process of limit to reach a point on a real line. In short, if we move point 3 to the location of point 5 and vice versa, we no longer have the topology of real lines.

So, the introduction of relativism in theoretical physics was done only at the cost of the *Principle of Geometry* that no point moves in a geometric space. The Galilean relativity theory, in violation of this Principle of Geometry, immediately yields a most fundamental paradox in the theory.

0.2.3 The fundamental paradox of relativism (Power-pole Power-line Paradox: PPP):

Assume a train runs and when the tip of the power in take pole of the train touches the power line at point A a spark occurs. An observer X located in the train straight down the tip A of the power pole will observe that the spark light comes straight down from the tip

of the power pole. Also X will observe that the light comes diagonally from the rest point A on the power line.

This paradox is the most fundamental one which applies to all existing relativity theories. This leads to a categorical denial of all forms of relativity theory. *Relativity theory is untenable.* Despite all persecution, Newton's absolutism prevailed.

This paradox immediately kills the hope to unify Newton's absolute frame theory and Galileo's relative frame theory as such unification creates a Galilean frame moves inside the absolute frame only to trigger the PPP.

0.3 Constancy of the speed of light (MM experiment)

As a strong believer of Newton dynamics, Michelson-Morley felt urged to measure the absolute speed of our planet in the Newtonian universe. Their idea was such that when we measure the speed of light in all possible directions possible on this planet, then the direction of the maximum speed measured is the direction of the absolute motion of motion of our planet and $v = c\prime - c$ is the absolute speed of our planet where $c\prime$ is the maximum measured speed.

Due to the technical difficulty of synchronizing two clocks apart precisely enough to measure the enormous speed of light, they had to use reflected light as in this way they had not to use two clocks. To their surprise, the experimental result was all negative. In all directions, the speed of light was c. Reluctantly, they adopted the hypothesis that the speed of light is c regardless of the speed of the emitter or receiver of light. This in turn gave birth to the hypothesis of *Fitzgerald contraction* and *Lorentz transformation* in classical em field theory.

Remark 2 *This idea later was adopted as Constancy of the Speed of Light (CSL) axiom in Einstein's Special Theory of Relativity. The only difference was that the CSL axiom was applied to all inertial reference frames while Fitzgerald Contraction and "original Lorentz transformation" were applicable only to the em field theory.*

Remark 3 *We showed that it is technically possible to measure the speed of light using two clocks without being hindered by the claimed technical difficulty of synchronizing two clocks at distance. The direct method fails as we have to know the speed of light to do that by sending light signals to a distant clock. We can always find the mid point between two clocks and from the mid point we send light signals to the clocks in opposite direction.*

About a half decade ago, we also showed that MM experiment was misinterpreted and it did not show that $c+v = c$ at all. When we use MM apparatus, the speed v of the apparatus to measure the speed of light always cancels in total. So, MM experiment did not prove the CSL axiom.

1 Chapter 1: Special theory of relativity kinematics

1.1 The fundamental inconsistency of STR kinematics and derivation of LT

Einstein generalized the work of Lorentz to the setting of all inertial reference frames. He applied the CSL axiom to all inertial frames to form the Special Theory of Relativity (STR). The fatal misfortune for him was that just like everybody else, he had no idea that the Galilean theory of inertial frames is inconsistent at the pain of the PPP. This makes STR inconsistent. As we said, all relativity theories are inconsistent because of the PPP.

To illuminate what went wrong with Einstein's TD, let us consider the PPP experiment. Assume there is another observer Y on the embankment as Einstein did. Einstein concludes that Y will observe that the light travels from the point A on the power line to the observer X diagonally. He ignores that this is one possibility for the observer X too and he single-handedly conclude that X will observe that the light travels from the tip A of the power pole to X straight down. In short, this thought experiment implies two contradicting conclusions regarding what X observe and Einstein chose only one of them for his convenience. As TD implies LC, LC is also unfounded.

What is striking about the work of Einstein is that he obtained Lorentz Transformation (LT) from TD alone without using em theory at all. He did it using inconsistent theory STR which is Galilean relativity theory plus CSL.

1.2 Unexpected fall out of the derivation of TD from LC

Without knowing the falsity of TD and LC, Einstein showed us that from TD and LC alone, without relating to electromagnetic field theory, we can obtain Lorentz transformation. From Time Dilation $t' = t/\sqrt{1-(v/c)^2}$ and Length Contraction, $v' = \sqrt{1-(v/c)^2}x$ the Lorentz Transformation is obtained as

$$x' = (x - vt)/\sqrt{1-(v/c)^2}, \quad y' = y, \quad z' = z', \quad t' = (t - vx/c^2)/\sqrt{1-(v/c)^2}.$$

Common argument for proving TD from LT on time

$$t' = \left(t - vx/c^2\right)/\sqrt{1-(v/c)^2}$$

goes as follows: Set $x = 0$, then we have

$$t' = t/\sqrt{1-(v/c)^2}.$$

More careful logical analysis shows that what this "proof" really showed was that transformed time depends upon the location of the clock! *It did not prove that LT implies TD.*

Instead, it refuted this claim. To be precise, it showed that when observed at $x = 0$, time dilates with the gamma factor. Instead, TD says that observed from anywhere on the x-axis, time dilate with the gamma factor. This is an interesting instance of the same formula means entirely different things depending upon the context it was obtained. This is possible because there is more going on in physics behind mathematical symbol pushing.

Remark 4 *This puts us in a delicate situation where we have to question the equivalence between Minkowski's Special Theory of Relativity which does not use TD and LC and Einstein's Special Theory of Relativity which uses them. This further makes us wonder the validity of the current belief that General Theory of Relativity is a generalization of Einstein's Special Theory of Relativity. General Theory of Relativity includes not Einstein's Special Theory of Relativity but Minkowski's Special Theory (tangentially).*

1.3 Lorentz transformation v.s. principle of relativity

Despite the "claimed" advantage of conserving wave equations, Lorentz transformation fails to conserve more fundamental the second law and the law of gravitation as we can see in what follows:

$$F = m\frac{d^2x}{dt^2} \Longrightarrow Fm\frac{d^2}{dt^2}\frac{(x-vt)}{\sqrt{1-(v/c)^2}} \neq m\frac{d^2x}{dt^2}.$$

$$F = \frac{GmM}{(x_m - x_M)^2} \Longrightarrow F = \frac{GmM}{(\frac{(x_m - vt)}{\sqrt{1-(v/c)^2}} - \frac{(x_M - vt)}{\sqrt{1-(v/c)^2}})^2} = \frac{GmM}{(\frac{(x_m - x_M)}{\sqrt{1-(v/c)^2}})^2} \neq \frac{GmM}{(x_m - x_M)^2}.$$

This means that *Lorentz transformation is not relativistic transformation as it violates the Principle of Relativity.*

1.4 Is wave equation invariant under the Lorentz transformation?

We can further show that the claimed invariance of wave equations under Lorentz Transformation is false. To make the argument more articulate, let us discuss the issue under a general situations.

$$\begin{aligned}
\frac{\partial\psi(x',t')}{\partial x} &= \frac{\partial\psi(x',t')}{\partial x'}\frac{\partial x'}{\partial x} + \frac{\partial\psi(x',t')}{\partial x'}\frac{\partial t'}{\partial x} \\
&= \frac{\partial\psi(x',t')}{\partial x'}\frac{\partial\gamma(x-vt)}{\partial x} + \frac{\partial\psi(x',t')}{\partial x'}\frac{\partial\gamma(t-\frac{vx}{c^2})}{\partial x} \\
&= \gamma\frac{\partial\psi(x',t')}{\partial x'} - \frac{\gamma v}{c^2}\frac{\partial\psi(x',t')}{\partial t'}
\end{aligned}$$

Similarly

$$\frac{\partial\psi(x',t')}{\partial t} = -\gamma\frac{\partial\psi(x',t')}{\partial x'} - \gamma\frac{\partial\psi(x',t')}{\partial t'}$$

$$\frac{\partial \psi^2(x',t')}{\partial x^2} = \left(\gamma \frac{\partial}{\partial x'} - \frac{\gamma v}{c^2}\frac{\partial}{\partial t'}\right)\left(\gamma \frac{\partial}{\partial x'} - \frac{\gamma v}{c^2}\frac{\partial}{\partial t'}\right) = \gamma^2 \frac{\partial^2}{\partial x'^2} - 2\frac{\gamma^2 v}{c^2}\frac{\partial^2}{\partial x' \partial t'} + \frac{\gamma^2 v^2}{c^2}\frac{\partial^2}{\partial t'^2}$$

Similarly

$$\frac{\partial \psi^2(x',t')}{\partial t^2} = \gamma^2 v^2 \frac{\partial^2}{\partial x'^2} - 2\gamma^2 v \frac{\partial^2}{\partial x' \partial t'} + \gamma^2 \frac{\partial^2}{\partial t'^2}$$

This is valid only under the condition $v = c = \omega$. The second equality comes from that ω is the wave speed. The first equation implies that the frame speed is c which is not possible in Special Theory of Relativity. This means that Einstein's claim that the electromagnetic wave equation is invariant under the Lorentz transformation is invalid. It is a well "understood" fact that there is no reference frame for light at the pain of contradiction. If $v = \omega$ then the gamma factor becomes undefined and there is no Lorentz transformation for such frame.

1.5 More paradoxes of STR

1.5.1 Deductive paradox

GTR deduces $c + v = c + v$. Einstein added the CSL axiom $c + v = c$ to GTR to form STR kinematics. The outcome is that the STR kinematics prove both CSL and its negation. This is a deductive inconsistency The problem here is that by adding new axiom to an old theory, one can not block any theorem deducible from the old theory. It is called the monotonicity of deduction, a most basic law of formal reasoning.

1.5.2 Speed paradox

Assume A observes that B is moving with constant speed $v = d/t$ relative to each other, where d and t are classically observed length and time by A. Then B will observe that A is moving with speed $v\prime = d\prime/t\prime$ where

$$d\prime = d/\sqrt{1-(v/c)^2}, \qquad t' = t\sqrt{1-(v/c)^2}.$$

Then we have $v \neq v'$. The problem here is that [speed] is determined by the [length] and [time] as

$$[speed] = [length]/[time].$$

So, [speed] can not alter [length] and [time] as in length contraction and time dilation This is to say that STR kinematics violates a most fundamental law of dimensional analysis.

This can be argued in a more ontological way as follows: Assume an object O in the other frame moves inside our frame distance d in time t. Let A and B be the positions of O at time 0 and t in out frame respectively. According to the perspective of O, A and B are moving points. So, O will observe that the distance d' between A and B is less than d. Also O will observe that the time interval t' which took A to be in front of it and B to be in front

of it is more than t. So, O will observe that the speed of our frame is d'/t' which is not d/t. This failure means that according to the relativity theory an observer observe the speed of a reference frame as v and as $v\prime$ such that $v \neq v'$.

It is needless to say that this paradox is absolutely fatal for special theory of relativity. There is an expression for this comedy. "Shooting one's own foot." The lesson here is that *"time is sacred and we must not mess with it for our own mental health."* Violating time seems to be a deeply psychological desire a modern human suffers. When we asked how long it will take to move from now to 50 years ago, contemporary cosmologists suddenly found that they had some important experiments to attend and left.

2 Chapter 2: Special theory of relativity dynamics

2.1 Einstein's ambition and its fall out

Putting aside the PPP, Galilean theory of relativity did not consider reference frames which are under acceleration relative to each other. This was because acceleration, through the second law, violates the Principle of Relativity. This kinematics only restriction on relativity theory was too limiting for Einstein. Considering that way before this set back, already at the most basic level of Galilean Theory of Relativity (GTR), relativity concept is inconsistent, Einstein should have abandoned the idea of relativity. Instead, ambitious young Einstein crossed the line and pushed into relativistic dynamics ignoring the inconsistency problem.

2.1.1 Relativistic collision, relativistic mass relativistic momentum and relativistic energy

Einstein's first move towards STR dynamics was to consider "relativistic collision problem". To make sure the conservation of momentum holds for relativistic collision, he defined relativistic mass as follows:

$$m = m_0/\sqrt{1-(v/c)^2}$$

where m_0 is the rest mass and v is the speed of the mass to the observer. From this he obtained the famous relativistic energy formula as follows: The relativistic second law is $\mathbf{F} = d\mathbf{p}/dt$ where $\mathbf{p} = m\mathbf{v}$ is the relativistic momentum. Then

$$dE = \mathbf{F}\cdot d\mathbf{r} = \frac{d(m\mathbf{v})}{dt}\cdot d\mathbf{r} = d(m\mathbf{v})\cdot\mathbf{v} = dm(\mathbf{v}\cdot\mathbf{v}) + m(d\mathbf{v}\cdot\mathbf{v}).$$

From this he calculated that $E = mc^2$. The mistake here is that Einstein forgot that up to here $\mathbf{v}$ is constant. For mathematical sanity, in collision problem, we do not consider accelerated bodies. The moment of impact is excluded from the consideration. So, what we should have here is $E = 0$ rather. One of the largest casualty of this mistake is the famous and powerful relativistic energy momentum relation

$$E^2 - c^2p^2 = m_0^2c^4.$$

However, there is no reason to think that the dimension of energy and that of momentum are related. *Indeed, energy is not even a physical dimension. It is a modality, it is the "potential" to do [work].* So, [work] is a physical dimension but "energy" is not.

2.1.2 Impact on quantum field theory

All of this means the tragic end of the entire 20th century theoretical physics. Einstein correctly said that when his relativistic energy equation $e = mc^2$ fails, the entire 20th century theoretical physics fails.

Indeed, upon this energy equation the famous Einstein's *photon-em wave duality*

$$E = h\nu = pc \qquad h = h/\lambda$$

and de Broglie relation are based, paving way to what is called Quantum Mechanics. More seriously as we will discuss later, Gordon-Klein's patch up theory of relativising QM by replacing E and p with quantum operators $\mathbf{E}$ and $\mathbf{p}$ in the energy momentum relation is now invalid. The entire quantum field theory also collapses. The same convention used by Dirac in his QED also is invalid for the same reason.

2.1.3 More contradictions coming from $e = mc^2$

The Quantum Mechanics which was built upon the Special Theory of Relativity quantized light as em wave and presented what we now call "photon" as the particle dual of light wave. To avoid the famous relativistic formula

$$e = mc^2 = m_0c^2/\sqrt{1 - v^2/c^2}$$

diverge for photon with $v = c$, Einstein assumed that for photon the rest mass $m_0 = 0$. This lead to $e = 0/0$ which Einstein thought can be any number as the linear equation $0x = 0$ has any number as its solution. This is wrong as $0x = 0$ does not involve the division by 0 while $e = 0/0$ involves division by 0 which is impossible. This rather expectedly ends up with the following contradiction:

$$E = \sqrt{(cp)^2 + (m_0)^2c^4} = cp = m_0vc/\sqrt{1 - vc^2} = (0/0)cv = c^2h\nu = h\nu.$$

We can derive yet another contradiction:

$$E = \sqrt{(pv)^2} = \sqrt{c^2m_0/\sqrt{1 - (v/c)^2}} = \sqrt{0/0} = \sqrt{h\nu} = h\nu = 1.$$

Without knowing this problem, photons are now introduced as a legitimate particle dual to light wave with rest mass 0 and speed c. What is truly paradoxical is that a particle which never rest now has a rest mass 0. This is what philosophers and logicians call a category error.

3 Chapter 3: Minkowski relativity theory?

3.1 Conceptual issues

It appears to be that Minkowski's 4D spacetime relativity theory was a serious effort to make these inconsistency problems in Einstein's special theory of relativity "magically" disappear (or hidden) mathematically.

It is a mathematical and logical common sense that when we have an inconsistency problem, it is usually not the matter of errors in formalization. It comes from the deep conceptual issues. We have shown that all confusions we faced in STR of Einstein came from the concept of moving spaces. The issue is simple. As Aristotle said, we can not move even a single point in a geometric space, how can we move the entire space. Newton, as a brilliant Orthodox theologian, knew this problem well and he never touched any point in the geometric space.

For Einstein, the Lorentz transformations are transformations from one inertial 3D frame which are moving inside the other 3D frame with relative speed v and associated transformation of time. This immediately lead to the flooding of contradictions which we discussed in the forgoing. Most of such paradoxes originate from the PPP which is deeply embedded in the theory of Galilean inertial reference frames upon which Einstein's STR was built. As a logical triviality, *inconsistency problems will not disappear by adding one extra axiom of CSL.* This is to say that Einstein was also a victim of the error of Galilean relativity theory.

The reason behind Minkowski's "apparent" success is that his theory "appeared" to have little to do with the troubled part of Einstein's STR which is based upon mutually moving 3D reference frames which succumbs to the PPP. Minkowski played a controversial mathematical game which eluded most mathematicians including himself.

Here is "one possible interpretation" of his work as a mathematical physicist. He used only one 4D spacetime as a reference frame (plus time) and from his single reference frame, he "*not formally but conceptually*" derived two reference frames say F1 and F2. First he placed F1 as the "mother frame" and defined a LT from to itself where v in the gamma factor is the mutual speed between F1 and F2. *In this way he "simulated"* F1 *and* F2 *with just* F *and the* LT *from* F *to itself.*

But then, it is not clear what is the advantage of this "formalism" over native Galilean theory of relativity. It appears that it had an effect of "covering up" certain fundamental issues with Galilean relativity theory at best and as planned. In effect, Minkowskian relativity theory with Minkowski distance dominated the entire theoretical physics for nearly a century as the "deepest" theoretical foundation of physics which "apparently" evaded the contradiction associated with Einstein's STR.

What is interesting here however is that this Minkowskian 4D spacetime approach can be adopted to formulate the issue of Fitzgerald contraction (LC) by considering the unique 4D spacetime as the universe and the LT as a representation of a specific observer frame and v representing the speed of the observer frame inside the universal frame. So, Minkowski's theory integrates the issue of relativity in the setting of electromagnetic field theory. However, all we could do for this new formulation of Einsteinian STR was to hope that the equivalence of LT and (TD,LC) will hold. *It is unfortunate that this hope was denied as we have shown in the foregoing.*

After all, all of this is an empty discussion as (TD, LC) pair deduce "physical paradoxes". Deducing (TD, LC) from LT simply removes apparent capacity of Minkowski theory to be a consistent alternative to Einstein's relativity theory. Moreover, even if LT did not deduce (TD, LC) and saved itself from inconsistency, we ended up with the question of the relevance of such theory in theoretical physics. Under the standard interpretation of inertial reference framers, as we have discussed LC implies TD.

As Einstein's original SRT is plagued by the inconsistency, the uncertainty of the status of LT in Minkowski's theory seems to be the only "hope" left. *Ironically, the apparent discrepancy between LT and (TD, LC) is still giving us some hope.*

Unfortunately, the problem here is that we do not know what LT means physically if v is not relative speed of two reference frames and Minkowski did not define LT using two reference frames. Nevertheless, there is an understandable reason why he did not use two 4D spacetime frames. If we use two then there is not much point in using 4D spacetime. Einstein's theory is easier to handle. In Einstein's theory, 3D space and time are independent and separate. So, technically it is easy to consider a 3D space move inside the other and vice versa. The only problem with this is that this leads to the geometric paradox which killed Einstein's STR. But there is yet another question here. It is mathematically impossible to discuss the motion of 3D space inside the 4D spacetime. All we can do is to express motions in the 3D space as geodesics inside the 4D spacetime. But is this not all we need, is this?

It is not quite clear how theoretical physicists reason. We are sure that this issue gets rather delicate and complex as physicists ought to take the other aspect of physics, namely empiricism, seriously. These issues are absolutely essential to build satisfactory physical theories. *We hope that we have shown that there are more to mathematics and philosophy than just a language for physics.* An opposite direction warning should also be issued to mathematics community and philosophy community. Main stream mathematicians played a different kind of elitism ignoring physics limiting our own activity to increasingly narrower domain. In the end there seems to be no more substantial challenge left for mathematics. Mathematics is reduced to occasional "success" in solving rather irrelevant "open problems" such as the Fermat last theorem.

We have a mountain of non-technical, extremely challenging deep problems on the border of physics, mathematics and philosophy. Literally nothing has been done.

3.2 Technical issues: Invariance under LT finally

One of the most important contribution of Minkowski was the "metric" on his 4D spacetime. This came from the mathematical argument that his "metric" $d\tau$ such that

$$(d\tau)^2 = (dt)^2 - (1/c)((dx)^2 + (dy)^2 + (dz)^2)$$

is invariant under the LT. It was understandable that *Minkowski had to look for such "metric" as LT changes the metric on [time] and that on [length] relative to the [speed]* v. Luckily he found one. It is not a space metric nor time metric as LT operates upon 4D spacetime. There are some issues:

1. This metric does not form a topological metric space over the 4D spacetime and this is totally expected as Minkowski adopted the irregularity inherent in relativity theory that [speed] = [length]/[time] redefines [time] and [length], which leads to contradiction. That LT conserves this metric is yet another indication of the highly questionable status of LT.

2. This metric could be negative, which makes no sense at all. There is no such thing as distance which is negative. Regardless of the direction of an arrow, the length of the arrow is always positive. However, of course an inconsistent theory can produce any result. This is why such theory is useless.

3. Minkowski's metric is appreciated as it defined light cone interpretation. Light cone is formed inside absolute space time. After the introduction of the light corn, thus, relativists stop using relativity theory and just stick to the absolute frame. a very distorted absolute frame.

Mathematically and philosophically what this metric means is an open question. It means "may be" Minkowski relativity theory is consistent but with the cost that it has no relevance to anything including physics at all. After all LT came from TD + LC which is inconsistent. There are more questions than answers.

By the way, there is an interesting thing to ask. The famous equation of Minkowski

$$(d\tau)^2 = (dt)^2 - (1/c)((dx)^2 + (dy)^2 + (dz)^2)$$

is invariant under the Lorentz transformation. Is it so under the TD and LC? The answer is NO. Proof goes as follows:

$$dt' = \sqrt{1 - v^2/c^2}dt \quad dx' = dx/\sqrt{1 - v^2/c^2} \quad dy' = dy \quad dz' = dz$$

Therefore

$$\begin{aligned} & (dt')^2 - (1/c)((dx')^2 + (dy')^2 + (dz')) \\ = \; & (1 - v^2/c^2)(dt)^2 - (1/c)((dx)^2/(1 - v^2/c^2) + (dy)^2 + (dz)^2)) \\ \neq \; & (dt)^2 - (1/c)((dx)^2 + (dy)^2 + (dz)^2). \end{aligned}$$

This reconfirms that Einstein's STR and Minkowski's STR are different theories. There is no such thing as Minkowski distance in Einstein's STR. There is no light cone either. This is a good news in a sense as the inconsistency of Einstein's STR will not kill Minkowski'd STR. However, as we said many times, nobody knows what Minkowski's STR is and what it is for. There is no "ontology" associated with it. Furthermore we now have to cleanly detach Minkowski's STR from Einstein's STR. It is a lot of work especially because most of popular results in STR came from Einstein's version. This is totally expected as we have no idea what Minkowski was talking about. It is quite certain that he did not know it either. Physicists should learn a lesson from this. Minkowski was an algebraist and physical reality requires a little more than just formal algebra.

Remark 5 *In fact, there is big confusion on this issue among relativists. Most of them think that despite the inconsistency of Einstein's STR, Minkowski's STR does not produce paradoxes and so Einstein's STR also is consistent. When the "occupational hatred of logic" reaches to this point, we have some serious problems.*

4 Chapter 4: General Theory of Relativity

Einstein "resolved" the problem of the limitation of STR kinematics by violating the Principle of Relativity, as in the development of the STR dynamics leading the entire theoretical physics to the fallacy of $e = mc^2$. His ambition did not stop there. He ventured into a new theory in which accelerating frames can be treated as inertial frames with acceleration induced gravitational field.

4.1 Principle of equivalence

Einstein thought that if an accelerating reference frame can be reduced to an inertial frame in which acceleration induces "gravitational field", it is possible to treat accelerating frames as inertial frames inside the Theory of Relativity which rejects reference frames which are under acceleration for a legitimate reason. He called this the **Principle of Equivalence.** Towards this he proceed as follows:

Assume a spaceship is in inertial motion in our reference frame. Moreover a force accelerates this spaceship with rate $\boldsymbol{\alpha}$. A body m in the spaceship experiences a force $\mathbf{f}$ which is due to the acceleration of the spaceship which makes the body m move with an acceleration of rate $\mathbf{a}$ in the frame of the spaceship. Putting aside what the force $\mathbf{f}$ is, this means $\mathbf{f} = m\mathbf{a}$. Then from our perspective, m in the space ship experiences the acceleration with rate $\boldsymbol{\alpha} + \mathbf{a}$. So, m will experience $\mathbf{f} = m(\boldsymbol{\alpha} + \mathbf{a})$. Therefore,

$$\mathbf{f} - m\boldsymbol{\alpha} = m\mathbf{a} \qquad \text{(IF)}$$

This means that "from our perspective" the acceleration $\boldsymbol{\alpha}$ on the spaceship induces an "additional" force $-m\boldsymbol{\alpha}$ on m, which he called "inertial force" upon the mass m and the equation (IF) yields the force m experiences in the accelerating spaceship. This Einstein called the second law in the accelerating frame of the spaceship. According to Einstein, upon the modification of $\mathbf{f}$ to $\mathbf{f} - m\boldsymbol{\alpha}$, the second law is conserved under the choice of accelerating reference frames.

There are several issues to be considered.

1. According to the special theory of relativity, even addition of speeds is not classical addition. One has to use the so called relativistic addition of speeds $v \oplus v'$.

2. This inertial force is also closely bound up with the issue of "fictitious force" on a mass inside an orbiting object. Fictitious force means a "force in fiction", not reality. The reason why we have a problem with the fictitious force for an orbiting spaceship is because orbiting spaceship is under centripetal acceleration. It is not an inertial frame.

3. This fictitious force is the creation of the "relativistic interpretation of the second law of Newton". This law can be interpreted in two ways. First, when force $\mathbf{f}$ is applied to a mass m , it accelerates the mass with the rate $\mathbf{a} = \mathbf{f}/m$. Second, when m is accelerating with rate $\mathbf{a}$, a "*fictitious force*" $\mathbf{f}$ appears. Ontologically the second interpretation is invalid as the term "*fictitious*" indicates. When we consider the case of an accelerating train, it is clear. Assume a stationary train accelerates then a passenger in the train will feel that he is pushed back (against the direction of the train's acceleration). This is simply because he tries to stay where he is in the train due to the First Law of Newton. If he can see the outside which is not moving he will see that it is not him but the train which is moving under the force.

4. Now it is clear that the problem of inertial force (fictitious force) is caused by *the relativistic interpretation which is faulty of the second law of Newton.* This is to say that the second law is not "relativistic", further confirming that the "ideology" of relativism as par Galileo and Einstein is untenable. It now is not only the third law but also the second law is violated by the relativism.

5. It also is important to notice that the fictitious force violates the third law of Newton.

4.2 Violating the point mass assumption

Even more fundamental issue here is *considering the spaceship (or train).* In the theory of dynamics as Newton made it clear, all physical bodies must be point mass as Newton rightly said. There is no such thing as "a mass m inside a space ship" for this reason. In dynamics, there is no such thing as "space ship". This kind of opportunistic undisciplined thinking typical of physics (not natural philosophy) as an antithesis to logicism.

Therefore, "a body attached firmly to the wall of a spaceship" does not exist in the theory of dynamics. Any compromise of this principle will wreck dynamics. This is because when we consider the dynamics of the space ship it is just a point mass and there is no "inside" of it to which this extra mass is to be attached. Moreover, the concept of a mass attached to inside of a spaceship is a gigantic complexity in dynamics. Even if we very reluctantly allow space ships, according to the law of inertia without force exerted, a mass will continue constant speed motion in a frame. So, what force is supposed to be exerted upon this body "inside" the spaceship"? Does this firmly attached mass move inside the space ship?

The usual response is that we experience such force even if we are firmly attached to the inside wall. This again is a typical failure to be articulate in the situational analysis. Our body is not just a solid. *Our body is beyond the category of physical objects.* Our body has incredibly complex internal system for feel. This is why we feel such pressure. So, "our body" is not the issue of dynamics. Materialistic simple-mindedness is sticking its ugly head.

The most fundamental reason why Newton reduced all moving mass to point masses is purely mathematical and conceptual. Newton correctly observed that. Without the assumption that a physical body as a point object with size of geometric point, we can not define motion mathematically. Moreover, for dynamics, we have yet another important reason to reduce a mass to a point mass; it is because force is a vector, a pointed entity. So, the only entity to which we can exert a force is a point object (mass).

4.3 Acceleration induced gravitational field

There are some more issues to be discussed regarding the "gravitational field" Einstein introduced to a "space which is under acceleration". The concept of any force field, in general, violates the action reaction law, in turn violate the Principle of Relativity. Moreover, the gravitational field Einstein introduced to an accelerating space is a force field which has no source for the gravitational forces spreading all over the space. This is yet another violation of the Third Law in a different sense.

More seriously, the "force field", whatever it may be, which Einstein introduced to "the frame under acceleration" is not gravitational at all. Gravitational fields are to be the modal representation of the effect of gravitational force created by Newton's law of gravity. So, it is not a uniform field. The "well expected" response that near the surface of the earth the gravitational field is "almost" uniform is not acceptable in precise science such as theoretical physics which is to reveal the truth about the universe.

It appears that this idea of associating "acceleration" with "gravitational force" (beyond the connection as par acceleration-force as in the Second Law) seems to have come from the old idea of "aether" by Desecrates. Desecrates wrongly considered the spaceship which contains an object which is under acceleration and identified the fictitious (inertial) force with gravitational force. As the name "fictitious force" clearly indicates such force is just an imaginary force which in fact does not exist. It is not that the acceleration exerts such force but as the object in the accelerating frame is not a part of the frame (space ship) it appears that everything in the spaceship moves with acceleration relative to the object. It is not a real force. It is a fictitious force.

4.4 Red shift and energy issue

Einstein assumed a laboratory which is free falling under the gravitational force. Assume we emit a light beam upward from the floor of to the ceiling. Due to the acceleration, by the time the light reaches the ceiling, the ceiling is moving faster than the source on the floor was when the light beam left it. In other words, the receiver at the ceiling is approaching the source (where it was when light left). Therefore we should expect that blue shift due to the Doppler effect. *Therefore the observer in the lab notice the blue shift.* This will make

this observer notice the downward acceleration. This contradicts the Equivalence Principle which says that thee free falling body will not notice its free falling. So, Einstein postulated that there must be a red shift due to the light moving upwards against the gravitational force to compensate this blue shift. Unfortunately, it is not the observer in the lab who sees that the ceiling is moving towards the floor. It is an observer outside of the falling lab who will see that the ceiling is falling towards where the floor used to be. So, the observer inside the lab will not observe the blue shift. This is how Einstein obtained the red shift effect.

The situation is rather complex and we have to consider many elements involved in this apparently simple thought experiment. This is an instance of the confusion coming from the ambiguity that a rest point in a frame F1 is also a moving point in the in a referenced frame F2 which is moving relative to F1. The problem which haunted Special Theory of Relativity as the "power pole power line paradox" in the context of Time Dilation and Length Contraction came back to haunt General Theory of Relativity, in the context of accelerating frames this time. As inertial frames and accelerating frames are both moving frames, the same problem hits both of them. So the Equivalence Principle which is to reduce an accelerating frame to an "inertial frame" with induced gravitational frame has no capability to avoid this fatal contradiction.

Moreover, the connection between Relativistic Dynamics and General Theory of Relativity is not clear at all. Are they equivalent? Both of them are supposed to be the relativity theory of dynamics dealing with more than relativistic kinematics which is known as the Special Theory of Relativity. We know the former is inconsistent as it violates the no accelerating frame restriction badly needed to avoid the contradiction against the third law of dynamics which is an absolutely essential assumption for any dynamics.

Putting aside this problem associated with the inconsistency of the Relativistic Dynamics, we have some more lessons we can learn from using inconsistent theories such as Special Theory of Relativity, Relativistic Dynamics and General Theory of Relativity. Neither Special Theory of Relativity nor Relativistic Dynamics can handle energy, we have left out the question of what about General Theory of Relativity. So, what about the General Theory of Relativity based upon the Equivalence Principle? Unfortunately the answer is negative. As we have discussed at the beginning of this section, the Special Theory of Relativity claims that the addition of speed should not be $v + v'$ but $v \oplus v'$. This contradicts the second law of dynamics.

All of this clearly suggests that Newton's dynamics is a theory of dynamics in the absolute frame only. Relativity is introduced not in the way Galileo and Einstein did in their relativity theory. Relative motions are defined as the difference of two absolute motions. All attempts to relativize Newton's dynamics failed rather expectedly.

4.5 Centre of masses in general relativity theory

As discussed above, when we represent a constant speed motion in 3D Euclidean space as its graph, it becomes a straight line in the 4D space-time. If the motion is accelerating , then the

graph becomes a curved line in the 4D space-time. Einstein represented gravitational force field which will cause accelerating motions as the 4D space-time manifold so that all motions caused by the gravitational field will appear as straight lines (geodesics) in the manifold. Applying this idea to gravitational fields created by the system of masses, Einstein obtained the so called Gravitational Field Theory. In this theory the spacial distribution of masses determines the 4D space-time manifold representing all possible "motions".

According to the classical dynamics, when we have a system of masses in a space, the mutual gravitational pull make them converge to a single point called the *centre of gravity*. *It is curious to know how this process of convergence is dealt with in the Gravitational Field Theory of Einstein.* This question is asking the capacity of this theory to express dynamic process.

4.6 Light bend

Einstein studied the rest mass 0 photon under constant acceleration. He considered a photon moving with speed c in the x-direction while it is in a frame which is under acceleration a in the y-direction. So, we have

$$x\prime = ct \qquad y\prime = -(at^2)/2.....(1)$$

If θ is the angle made by a tangent of the light ray to the x-axis, we have

$$tan(\theta) = -ax'/c^2,$$

and we can assume that θ is very small. So we have

$$\theta \doteqdot -ax'/c^2.....(2)$$

But the GTR predicts otherwise, i.e.

$$\theta = -(3a/2c^2)x'^2.....(3)$$

Eddington experimentally "proved" that the GTR's prediction (3) is correct.

It is clear that *all of this uses nothing but the kinematic concept of acceleration and in kinematics there is no concept of mass.* Putting aside the issue of inconsistency coming from the assumption of the mass 0 point mass as discussed in 2.1.3**,** the concept of photon belongs to dynamics. Photon is a point mass of mass 0. Having no mass and having mass 0 are entirely different category. *The problem with considering a point object whose mass is* 0 *is that the second law fails for the mass* 0 *point object. So, it makes no sense to say that the light (trajectory of photon) bends due to the gravitational force of sun.* So, Einstein's argument here "diverted" this difficulty by replacing the "gravitational force upon mass 0 photon" with the "reference frame of photon accelerated by sun's gravitation". It is truly astounding that this even worse confusion was never detected till now. *The reference frame*

of this photon can not be accelerated unless there is some mass stationary in it! Second law was never meant to be applied to mass zero object.

So, the only "apparently" appropriate thing to say here that the light bends due to the acceleration of the reference frame caused by the gravitation force is also false. In the end, we do not know what is really happening here. If the curved 4D spacetime GTR predicts the equation (3), clearly there is something which went wrong in the development of 4D spacetime GTR. Unfortunately, Einstein's rest mass 0 particle which moves with speed c was brought in to physics with serious consequences.

4.7 "Induced gravitational field" revisited

As discussed in the foregoing, the concept of *any force field in general violates the action reaction law and in turn violates the Principle of Relativity.* Moreover, *the gravitational field Einstein introduced to an accelerating space is a force field which has no "external source" creating the "gravitational forces per unit mass" spreading all over the space.* This is yet another violation of the third law in a different sense.

Remark 6 *The "uniform gravitational field" g near the surface of our planet which we live in is a gravitational field in "approximate". It is "not" a gravitational field. So, it is wrong to call Einstein's "induced" force field a gravitational force field.*

In classical "post Newton" dynamics, they considered a field of gravitational force applied to each location on a unit mass placed there. This concept itself fundamentally violates the action reaction law and must be abandoned. The situation here with Einstein's gravitational field created by the empty reference frame under acceleration makes things even more appalling. The former ignored the source mass which created the force field. Here such source mass to be "ignored" does not exist at all.