Logical Analysis of Relativity Theory

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0 Prelude

0.1 Newton v.s. Galileo: Reclining Tower Experiment.

Through analysing Kepler's massive data on the observed motion of planets, Newton reached the conclusion that our planets are orbiting around our sun and the cause of such circular motion is the gravitational pull (centripetal force) exerted by the sun on the planets. Upon this discovery, Newton developed the first theory of dynamics in human history. *This should be understood as the first major example of how empiricism contributed to build a most important theory of physics.*

Interestingly this success also gives a stern warning to the popularized thesis that this process is one way. Indeed as we will show in what follows, that *Newton's dynamics refutes Galileo's famous Reclining Tower Experiment.*

Since the famous reclining tower experiment of Galileo, students of physics have been told that contrary to the ancient claim of Aristotle, the speed of falling light object and that of heavy object are are the same when they were dropped from the same height.

In what follows, we will see that according to Newtonian mechanics *Aristotle was correct.* The heavier the mass the faster it falls.

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

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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 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 the faster it falls.*"

This is a clear 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.

Remark 1 *Indeed, in more advanced stage of Quantum Mechanics, Kuhn pointed out that there is no such thing as the so called experimental verification or even refutation. This is because the prediction in QM is intrinsically probabilistic and the probability theory says that the relative frequency converges only at the limit. Indeed, one can not prove experimentally that the probability of getting head up is 0.5 in tossing a coin.*

0.2 Newton's absolutism v.s. Galileo's relativism: God v.s. human

Galileo assumed that each observer in this universe has its own reference frame in which physical phenomena takes place. He assumed that the observer is stationary in his own reference frame and some objects are stationary in his frame and others are in motion in his frame. This means that the entire frame of another observer moving in his frame is moving inside his frame.

All of this makes the observed phenomena in different reference frames appear different. To resolve this problem, he also assumed that every reference frame has its own independent status and they are connected to others through the so called the *Principle of Relativity* which asserts that all valid "Laws of Physics" must be shared by all reference frames.

Newton objected this view of Galileo and presented a strikingly different view of relativism (relative motion). To within the absolute theory of dynamics as discussed above, Newton defined "relative motion" as *the difference between two absolute motions in the absolute frame of the universe.* So, unlike Galileo's view, *relative motions are to be observed only by an observer standing on the*

shoulder of God from outside of the physical universe. For Galileo, the relative motions are to be observed by the moving observer.

Without this absolute perspective, Galileo's relativity theory suffered from a fundamental obscurity. It was always a controversial issue in relativity theory if A observes B moving with speed v, should B observe that A is moving with speed $-v$. Some relativists say yes and some others say no. *After all, assuming this is violating the most important assumption of "symmetry" which is essential to relativism.* Why difference in sign? To begin with this issue raises a fundamental question on the validity of Galilean relativity theory and its extension, Einsteinian relativity theory. This certainly gives rise to the most fundamental question of what do we mean by *"observation"*. As "empiricism", relativism has a duty to make this point clear.

For Newton, *it is the empiricism observed from outside of the absolute frame.* It is the God's eye perspective. Newton objected this view of Galileo and presented a strikingly different view of relativism (relative motion). To within the absolute theory of dynamics as discussed above, Newton defined "relative motion" as the difference between two absolute motions in the absolute frame of the universe. So, unlike Galileo's view, relative motions are to be observed only by an observer standing on the shoulder of God from outside of the physical universe. For Galileo, the relative motions are to be observed by the moving observer. Without this absolute perspective, Galileo's relativity theory suffered from a fundamental obscurity which no theoretical physicists wanted to think about seriously. It was always a controversial issue in Galilean relativity theory if A observes B moving with speed v, should B observe that A is moving with speed $-v$. Some relativists say yes and some others say no. To begin with this issue raises a fundamental question on the validity of Galilean relativity theory and its extension, Einsteinian relativity theory. This certainly gives rise to the most fundamental question of what do we mean by "observation". To begin with, as "empiricism" relativism has a duty to make this point clear. Newton made this issue very clear. it is the empiricism observed from outside of the absolute frame. It is the God's eye perspective.

In the fast developing phase of the theoretical physics this fundamental and religious difference between these views of two giants have been overlooked. A major purpose of this monograph is to make the relation between them articulate to clear the existing confusion from which modern theoretical physics has suffered.

Galileo had no articulated Laws of Physics as axioms. He "experimentally proved" that regardless of the magnitude of "masses", two masses take the same time to reach the ground when released from the same height. Naturally, he had no theory to precisely prove this "experimental fact". *So, it was impossible for his contemporary to evaluate the validity (or the effectiveness) of the Principle of Relativity.* A century later, Newton's Dynamics presented legitimate Laws of Physics and it was discovered that when we consider two Galilean reference frames which are in acceleration with respect to each other the Principle of Relativity fails. The standard argument goes as follows: Assume a train is in acceleration on a track. On the embankment, there is a tree. An observer on the

embankment will observe that the train is under force. Another observer on the embankment will observe that the tree is under acceleration. So, post Newton era Galilean relativists resolved this problem *by rejecting reference frames under acceleration*. In this way they abandoned most part of Newton Dynamics. After this point on, researchers stopped paying much attention to this problem until this problem resurfaced in the late 19th century when Michelson-Morley Experiment threw Physics into a serious crisis from which Einstein's Special Theory of Relativity emerged.

What is not clear is if this argument is the applicability of the Laws of Physics of Newton to Galilean Relativity Theory. Newton assumed these Laws only for the absolute frame. This problem can be more clearly explicated as follows: Assume we allow moving reference frames inside Newton's absolute frame. Assume m and M are attracting each other with the gravitational force. If we consider a reference frame for M which moves inside the absolute frame of Newton, we end up with violating the Third Law of Newton as M is not moving in this frame. So, there is no hope for expecting Newton's Law of Physics to be shared by all reference frames.

The Newtonian interpretation above is based upon the observation from outside of the universe. Galileo was observing it from the frame of himself and the reclining tower which is the frame of M. This will give us an entirely different conclusion. According to Galileo M does not move and so the acceleration a_m between m and M is GM/r^2. Similarly the acceleration $a_{m'}$ between m' and M is GM/r^2. So both m and $m\prime$ will reach the ground within the same time interval. This result is false as the reasoning ignored the action reaction law in between m and M. In classical dynamics we accept the assumption of point mass.

This deep philosophical problem will resurface in the modern setting when Einsteinian relativists present the light bend observation as the empirical verification of the claim of General Theory of Relativity.

0.3 Classical Electromagnetism

Electromagnetism theory was started by Coulomb as action at a distance theory of electromagnetic forces. The first systematic theorization was done by Gauss and Weber. As Faraday's work such as Faraday induction made the theory more complex than Newton's gravitational theory, Heaviside and Hertz moved towards the theory which was based upon electromagnetic force field diverting from the action at a distance theory. After having been influenced by Heaviside and Hertz, Maxwell reluctantly formalized em theory as a field theory. However, together with Lorentz, Maxwell was trying to deploy action reaction based interpretation of the field based theory to compensate some fundamental deficiencies of the electromagnetic field theory. This is known as "electromagnetic aether theory". Maxwell's em field equations are

$$\boldsymbol{\nabla}\times\mathbf{E}=-\frac{1}{c}\frac{\partial\mathbf{H}}{\partial t},\quad \boldsymbol{\nabla}\cdot\mathbf{E}=4\pi\rho,\quad \boldsymbol{\nabla}\cdot\mathbf{H}=0,\quad \mathbf{J}=\rho\mathbf{v},\quad \boldsymbol{\nabla}\times\mathbf{H}=\frac{4\pi}{c}\mathbf{J}+\frac{1}{c}\frac{\partial}{\partial t}\mathbf{E}$$

Here **J** is the current vector which transcends em force field and ρ is the charge density of the current.

The first major impact of the introduction of the force field concept in the formulation of the em theory was the apparent increase of the mass of a charge in the field in terms of the acceleration. This problem already appeared in the fluid dynamics of Stroke.

(1) J. J. Thomson discovered that "energy of electromagnetic field" E_{em} gives raise to an additional mass $m = 4E_{em}/3c^2$ to charged bodies and called it an *electromagnetic mass (renormalized mass).*

(2) Poincaré, using the "momentum of electromagnetic fields", showed that these fields contribute an additional mass E_{em}/c^2 to a charged body.

(3) J.J. Thomson further observed that electromagnetic mass (renormalized mass) increases as the velocity of the mass increases.

(4) Summing up these, Lorentz concluded that the ratio of the electron's mass in the moving frame and that of the ether frame is $k^3\epsilon$ parallel to the direction of motion (longitudinal), and $k\varepsilon$ perpendicular to the direction of motion (Transverse) where $k = \sqrt{1 - v^2/c^2}$ and ϵ is a constant. Setting $\epsilon = 1$, Lorentz calculated the expressions for the electromagnetic masses in these directions as

$$m_L = m_0/\sqrt{1 - v^2/c^2}^3, \quad m_T = m_0/\sqrt{1 - v^2/c^2} \quad \text{where } m_0 = (4/3)(E_{em}/c^2).$$

This means that well before Einstein's relativity theory, Thomson and Lorentz concluded that the "speed of charged mass" could not exceed c.

Indeed, what is astounding here is that this work on renormalized mass put electromagnetic theory in direct conflict with classical dynamics. In the latter, mass will not be affected by its speed. The direct link between speed and mass immediately violates the second law of Newton where force is determined only by acceleration as mass is invariant. This manifests further as the violation of the second law of Newton as in the so called Lorentz force we have $\mathbf{F} = q(\mathbf{E} + \mathbf{v}\times \mathbf{B})$.

All of this is saying that the issue of "electromagnetic mass" is still alive and to be investigated. The most urgent problem is that this Lorentz force makes the em field theory inconsistent as it also uses Newton's second law.

Regarding Poincarè's electromagnetic mass, what is outstanding is that he got it from the electromagnetic momentum instead of electromagnetic energy. J. J. Thomson got it from electromagnetic energy. We know energy is a modal concept, not physical reality.

0.4 Michelson-Morley experiment

As believers of Newton dynamics, Michelson-Morley felt urged to find out the absolute speed of our planet in the absolute space. Their idea was such that when we measure the speed of light in all directions possible, then in the direction of the motion of our planet the speed of light will be maximum. To their astonishment they found out that the measured speed of light is the same in

all directions. From this, they concluded that the speed of light is constant c regardless of the speed of the emitter of light, in symbols $c + v = c$. Regarding this apparent contradiction, there are at least two major issues to be discussed here before we jump into hasty conclusion.

(1) Experiment in general is not as simple minded matter as we tend to think. Indeed, a great mathematician/philosopher Russell already warned us that the so called experimental verification is viciously circular as to design experiment, we use a theory whose validity is to be verified by experiments. In the same sense, he pointed out that the so called experimental refutation of a theory is viciously circular. To design an experiment to refute a theory uses the theory to be refuted. This gives raise to the questioning on the most fundamental role of experiments in physics. Unlike engineering, physics is a theory. Logical coherence is a most important issue of physics.

(2) It is not quite clear what MM really wanted to do. Were they measuring the speed of light in the absolute frame or in the frame of the apparatus? All we can say at this stage is that as *Newton implied, the absolute speed of anything can not be empirically known unless we stand on the shoulder of God.* Was this not what made MM desperately want to measure the absolute speed of us in the universe?

It is alarming that physics, as the king of "empirical" science, tends to ignore the importance of reasoning (logic) in designing experiments and drawing conclusion from the experimental results.

All of these are rather philosophical and conceptual questions. One of the major deficiency of the current practice of physics is the failure to consider these conceptually important questions. MM experiment is one of the major examples of this deficiency of current physics. Despite its overvalued importance, the more we think, the more we get lost. Experiments and impressive but a little bit off mathematical calculations leading to "Nobel Prize". ... The whole routine appears to be not functioning well anymore.

0.5 Fitzgerald contraction and electromagnetic Lorentz transformation

The receivers of MM's grand result appeared to have been as confused as MM themselves. The first group of physicists who took this "result" very seriously were researchers in em field theory which is natural as the theory of light was a part of the em field theory of Maxwell. It was Fitzgerald we jumped into a "conclusion" that a moving body shrinks in the direction of the motion. Theoretically, there is no such thing as physical bodies as Newton reduced all of them to point mass to make the mathematics work to form theory of dynamics. This is to say, that a body is not the subject of theoretical study in dynamics. (In modern day term what Fitzgerald called body is a massively complex system of particles each of which obeys the laws of quantum mechanics.) It was Lorentz who embraced this revolutional idea of Fitzgerald and polished it up to the concept of what we now call Lorentz transformation. For Lorentz, who

was not a relativist, this transformation however was limited only between the absolute em field and a frame moving inside it.

1 Special theory of relativity: kinematics

1.1 Special theory of relativity: kinematics

Einstein thought that the Lorentz transformation limited just to the absolute em field frame and moving frame can be generalized to in between any two reference frames, thus removing the concept of absolute frame. As discussed above, after Newton's dynamics, relativists removed accelerating reference frames to avoid the violation of the Principle of Relativity, the action-reaction law in particular. Einstein was not an exception. Now the Galilean relativity theory is limited only to inertial reference frames.

1.2 Time dilation and length contraction

Upon this Galilean relativity theory of inertial frames, Einstein added the axiom of the Constancy of the Speed of Light (CSL) reflecting the MM experiment. It say that in all inertial frames, the speed of light is constant c. So, if a light in a frame F is observed by an observer A in an inertial frame F and another A' in inertial frame F', both A and A' will observe that the same light moves with speed c.

Remark 2 *One of the major issues regarding this claim is that we do not know what light is and so what do we mean by measuring the speed of light. This is a near fatal problem with the philosophy of empiricism which Newton questioned. The concept of measurement is not a definable concept and as Russell said such concept may well be viciously circular. We are not living in the time of industrial revolution where science needed not to be as articulate and abstract as now.*

Notwithstanding, upon this axiom of CSL, Einstein went on to obtain timed dilation and length contraction through thought experiment. It is truly ironic that the simplest way to explicate Einstein's argument for TD and LC is to present a thought experiment which exposes the fundamental inconsistency of the theory of inertial reference frames with CSL axiom. We call this thought experiment "The (power pole)-(power line) paradox.

Assume a train runs on a track. When the tip of the power pole of the train touches the power line at point P spark occurs at P. An observer located in the train straight down the point P will observe that the light comes straight down to him from the point P which is the tip of the power pole. Also he will observe that the same light comes to him diagonally from the point P which also is a stationary point of the power line This is a contradiction. This is consistent with the ancient Aristotle's warning that a point on a line may not be a part of the line. Contemporary topologists says the same thing in a more modern way. They say all real numbers (even rational numbers on the real line) are defined

through limit. Therefore there is no finite access to any real number on a real line. If we can not access it, how can we move it. If we can not move even a single point in our 3D space, how can we move the entire 3D space in other 3D space. In short, topologists say that a point does not exist on a topological space.

So what about the issue of TD and LC? The simplest way to refute these claims is that topology refute the possibility of moving 3D space inside other. So, the setting of the thought experiment for proving TD and LC is invalid. No wonder these two "results" of Einstein caused all kinds of contradictions.

We tend to take mathematics we use in physics lightly just as a language. This is a perfect example of the price we pay for our ignorance and arrogance. Mathematical results at the level of topology etc. are obtained with at most care and precision. So often unless we pay due attention and effort to understand, we take the results wrongly and end up with this kind of devastating mistakes. Mathematics at this level is no longer like the simple minded exercise of solving differential equations! Never mind get numbers correct mathematics. After all, theoretical physics have entered the realm of most abstract mathematics ever developed and it is unfortunate that almost all application of mathematics are carelessly done without making due effort to understand it.

1.3 Relativistic Lorentz transformation

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

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

The proof goes as follows: By applying the effect of Length Contraction on the Galilean transformation we get $x' = (x-vt)/\sqrt{1-(v/c)^2}$. Length Contraction in opposite direction goes as

$$x = (x'+vt')/\sqrt{1-(v/c)^2}.$$

Solving these two equations for t', we get

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

Common argument for proving TD from LT

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

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. 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.

This is a very good example of how the same formula can mean entirely different things in physics. One can not say mathematics is just a language. One has to be more careful when we use mathematics in physics.

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).

1.4 Lorentz transformation v.s. principle of relativity

The Lorentz Transformation plays yet other questionable roles. We can shown that this transformation fails to respect Newton's Law of Gravity, Coulombs' Law, Newton's second law and wave equations. For example despite the "claimed" advantage of conserving wave equations, Lorentz transformation astoundingly fails to conserve more fundamental the second law and the law of gravitation as we can see in what follows:

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

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

Considering the way how Lorentz transformation was obtained, it is not surprising that these two major laws of mechanics are not Lorentz invariant. This means that *Lorentz transformation is not relativistic transformation as it violates the Principle of Relativity.*

1.5 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

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

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

Similarly

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

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.

All of this was well expected logically. Lorentz transformation is defined in terms of the constant c, which is the speed of electromagnetic waves in vacuum. So, there is no convincing reason why this transformation will conserve wave equations which are not electromagnetic wave equations of Maxwell.

1.6 Inconsistency of Special Theory of Relativity

1.6.1 The power pole power line paradox

Assume a train runs and when the tip of the power pole of the train touches the power line at point A, spark occurs at this point. An observer in the train located straight down of the tip of the power pole will observe that the light comes straight down from the tip of the power pole. However as the point A is also a stationary point of the power line, he will observe that the light comes diagonally down from the stationary point A. This is a contradiction.

This contradiction will tell us that we can not move a reference frame which is a 3D space inside the other. Aristotle knew this 3,000 years ago and said that a point on a line will not be a part of the line. Modern topologists will say that a point on a real line is accessible only through infinite limit process and so we

have no finite access to any point on a real line. All of this means that we can not move a point in a space. Then how is it possible to move an entire 3D space inside the other. This paradox tells us that even Galilean Theory of Relativity is inconsistent.

1.6.2 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.

1.6.3 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 $v \neq v'$.

1.6.4 Dingle's paradox

Dingle knew STR kinematics extremely well. He was one of the top researchers of STR before he became a top critics of this theory. He knew well that we can not consider acceleration in this theory because of the Principle of Relativity. He thus considered two clocks which are already synchronized and moving towards each other with constant speed. He pointed out that due to the Time Dilation each clock will see the other slower.

Main stream relativists responded arguing that when one twin moves out and comes back, then it is this twin who went through time dilation and not the other twin. So, there is no paradox. This is a typical way of thinking of theoretical physicists who are not used to logical argument. We are discussing time dilation which is to occur in STR kinematics. So, the elements of acceleration is out of the issue. It might be that STR dynamics may support this argument. But certainly such theory if any should bring back the same problem for symmetric acceleration case. If both twins accelerate symmetrically and come back to see each other, we have the same problem. This means that the claimed generalization of STR kinematics to STR dynamics also has serious inconsistency problem.

When we consider logical issues, we must understand logic. Paradox is a purely logical issue. As long as physicists discuss paradoxes, they should study some basics of logic. As they are critics of logic, they should spend some time to understand what they criticize to make their criticism legitimate. It is interesting that a much more established discipline which has much longer history and much more universality, mathematics, has great respect to logic. It is a long established tradition of pure mathematics such that once a theory encounters contradiction, we abandon it as we do not want to live in "insanity in the name of creativity". Liberalism and freedom are different things.

1.7 Michelson-Morely experiment revisited I

There are two criticisms to the way how this historic experiment was treated in theoretical physics community. This experiment was interpreted under the assumption that light is electromagnetic wave as Hertz proposed. Even to this day, we are not sure what light is. Physicists were told to accept the view of Hertz without substantial proof.

Moreover, electromagnetic waves are not physical reality as the concept of electromagnetic field is not a physical reality. This concept is what logicians and philosophers call "modality", "counter factual modality" to be precise. The spacial distribution of electromagnetic force per a unit charge is not reality. Such distribution should appear in reality only when we place unit charge at everywhere in the space. But, if we place a unit charge at every point in the electromagnetic field, the source which created such "field" will be affected and the electromagnetic "field" will not be maintained. Moreover, the placed unit charge will react to each other making it impossible to sustain such configuration. *More mathematically, there is not enough charges to fill all points in a space. Pure mathematicians will put this as follows: There are uncountably many points in a geometric space and there are only countably many charges in the universe.* This says that the concept of electromagnetic field is a fantasy which does not exist in reality. To be precise the so called electromagnetic wave is an "action at a distance transmission" of the change in electromagnetism at the source to a charge placed at a certain location in the space. There is no wave. This is precisely why without wave medium the so called electromagnetic waves "travel" with speed c. So, there is no need for the fancy "aether". There

is no physical realism which supports the counter factual modality. All of this gives rise to questioning that Michelson-Morley treated light as electromagnetic wave.

2 Special Theory of Relativity: Dynamics

2.1 Einstein's ambition and its fall out

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, relativity concept is insurrectionist, Einstein should have abandoned the idea of relativity. Instead, ambitious young Einstein crossed the line and pushed into relativistic dynamics ignoring the consistency problem, deepening the wound to catastrophe.

2.1.1 Relativistic collision, relativistic mass relativistic momentum and relativistic energy

Einstein's first motive 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, from the point of view of the dimensional analysis, this is not surprising at all. 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 rather as it is the "potential" to do [work].* So, [work] is a physical dimension but "energy" is not. So, obviously *the famous energy-momentum relation of Einstein is false even conceptually.*

Remark 3 *Indeed, there is a complaint from wave mechanists regarding Einstein's energy-momentum relation. In wave mechanics of continuum medium, there is nothing moving in the direction of the motion of the wave. The only thing which is moving in this direction is the local vibration of the medium. This means simply that there is no momentum in waves.*

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:

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

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.

2.2 Michelson-Morley experiment revisited II

2.2.1 Light as photon interpretation of MM experiment

After all, as photon is now a particle dual to light wave. we are blessed to have yet another interpretation of Michelson-Morley experiment. "*Assume photons are particles.*" Then it must be the case that when we emit a photon to the vacuum from an emitter which moves with speed v, the speed of the photon must be $c + v$ in the vacuum. So, the photon emitted moves towards the reflecting mirror with speed $v + c$. But as the mirror itself moves with the speed v in the same direction, the effect of v cancels. When photon is reflected at the mirror, it comes out with speed $c - v$. But as the receiver of this photon is moving towards the photon with speed v. So, this v cancels again. This means that this experiment will not detect the v. In conclusion, $c+v = c+v$ but the experiment as set as it is can not detect this v.

2.2.2 Quantum mechanical interpretation of MM experiment

Among experimental physicists, it has been said that may be to understand MM experiment, one must consider the quantum mechanical process of light reflecting at the mirror surface. If reflection of light at the surface of a mirror is the consequence of energized (by the incident light) electrons inside the mirror surface recoiling, then it should take some time for the reflected light to come out of the surface of the mirror. Considering the Compton effect, it may not be the case that the reflected light is not of the sane frequency as the incident light. It is not clear how seriously these questions were taken by theoretical physicists.

Recently, Wheeler carried out an experiment which used an apparatus which is very similar to the Michelson-Morley apparatus which however used half-silvered mirror instead. This showed unexpected behaviour of this apparatus which current Quantum Mechanics cannot explain. The problem with the so called "splitter" (half-silvered mirror) is that it had an "explanation" only for a pure wave theory of light, but it has no explanation using the light quanta. Better said: if photons are deviated with probability of 50 %, we had no interference. But on the other side, if they are really split in two directions, this contradicts the Planck-Einstein hypothesis, as well as the two pieces of a photon are entangled and are evidently waiting for their halves to built a photon together. So to say, the interference does not indicate anymore some delay of a

half-ray relatively to the other, as planed by Michelson-Morley. This makes us wonder if Michelson-Morley's interpretation was correct.

According to the model used by Michelson-Morley, in the second splitter (or by twice passing the same splitter) one should have had again a 50 - 50 distribution, and not a 100 - 0 distribution, as observed by Wheeler. Without intending it, Wheeler shows with his experiment that the Michelson-Morley apparatus contains aspects nobody has thought about. So one cannot claim to have experimental proof of Constancy of Speed of Light using something that nobody on Earth understands.

This problem has exactly the same pattern as Michelson-Morley experiment which was conducted under the assumption that light was a wave. The irony is that using Michelson-Morley experiment through Special Theory of Relativity they introduced the "wave-particle duality" and then "particle theory of light" offered entirely different picture. In this way, *in the end, the empiricism proved that the wave particle duality hypothesis is invalid at the pain of contradiction.*

2.3 From Einstein, through Dirac to material science: particle-wave duality in full swing

The ultimate product of this highly questionable wave-particle duality manifested most dramatically in the Quantum Electrodynamics of Dirac. Quantum Electrodynamics seems to be the ultimate end product of Einstein's Special Theory of Relativity which is inconsistent. Here is a summary of the complication we have in all of this issue.

1. *The reflection of light on the mirror is a complex problem of statistical particle physics and only material science can bring us closer to the truth. The problem we have here is that we have not such material science. Also the material science which digs into this kind of problems must come from a satisfactory Quantum Mechanics which we have not, as our Quantum Mechanics is based upon Special Theory of Relativity which came from Michelson-Morley experiment. To make the matter even worse, now Wheeler's result seem to support the concern that MM could have been interpreted wrongly.*

2. *Even if Michelson-Morley experiment is limited to em waves, the em waves are not physical reality. They are counter factual modality. More over, when we operates upon wave particle duality, the Uncertainty Principle creeps in and this makes the Constancy of Speed of Light claim "statistical". When a most fundamental assumption of our theory is of statistical nature, we do have some serious concern. True, the original Constancy of Speed of Light argument is not statistical. It was based upon abstract (not physical) wave theory of counter factual modal waves. But the recent Wheeler's argument again is statistical.*

Early Quantum Mechanics in principle avoided getting into this kind of nasty but real problems when they considered the particle problem enclosed by walls

etc. Walls are represented not as a complex material, but as a potential barriers which is nothing but a mathematical entity. Here, they are trying to study the reflection of light at the mirror. Quantum mechanics can not really handle the reflection of light on a mirror as we do not know what mirrors are sufficiently enough to discuss these issues. To understand it requires perfect Quantum Mechanics which we have not.

We use macro materials which are microscopically incredibly complex to do our experiment. When we are doing macro level physics, no problem. But when we deal with micro level physics, we have no solution. Our experimental instruments belong to macro level physics. The cosmology shares the same problem. We can never do experiment or measurement at this incredibly large scale level. It is not promising to do physics of the cosmos through looking at billions of light years away distant stars. The only tool we have here is the relativistic Doppler effect and we do not even know what light is.

What is striking is that regardless of the status of Quantum Mechanics, Wheeler's experiment shows that when passing the second splitter, the light "knows" from which part it came in the first splitter. In the second splitter we get the Hadamard-Walsh gate, which is an "operator" in Quantum Computing. This is good for engineering. But it is unfortunate that our theory will not make us understand all of this.

Philosophically, what we are facing is a crisis where the most basic laws of physics are no longer macroscopic laws. To make it macroscopic make us go through statistical argument which makes us wonder what laws of physics are.

Moreover, all of this problems by which we are overwhelmed are making us wonder what do we really mean by experimental observation which is the essence of empiricism. To make experiment at micro level, we need a functional theory of micro level physics. But such theory must come from acceptable micro level experiment. We are going around a big circle. As we said above cosmology is facing the same difficulty at the other end of the spectrum. In case of micro level physics, we have a distinguished difficulty of uncertainty issue which makes the theory probabilistic. All of these issues have to be dealt with even after we manage to free Quantum physics from the inconsistency of relativity theory. It is a long way to go ahead of us.

So, it is no longer just isolated problem of theoretical physics. The dynamic linkage between theory and empiricism has to be re-examined and new working link must be established. We are not living in the 19th century.

3 Minkowski relativity theory

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 disappear mathematically.

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 "power line power pole paradox" 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.*

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. From this troubled assumption Einstein proved TD and LC which naturally lead to a mountain of paradoxes. Lorentz and Einstein in their own setting deduced LT from TD and LC. Unfortunately motion takes place inside a geometric space and so we can not move reference frames which are essential for defining such motion. This issue was already philosophically addressed by Aristotle. He pointed out that a point in a geometric space is "not" a part of the space. Modern topologists explicated this warning of Aristotle using topology. They proclaimed that there is no "point" in a geometric space. They said rightly that a point in a geometric space can be "accessed" only through limit. *If we can not reach it in finite means, how can we "move" it?* This kind of conceptual issues are quite well attended in pure mathematics as mathematicians experienced the horror of contradictions at deep levels. Also lack of empiricism made mathematicians focus on these conceptual problems. 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 thought he "*simulated*" F1 and F2 with just F and the LT from F to itself. Unfortunately, his formalism by itself did not explicitly support this interpretation. This is one possible but rather obscure interpretation of his formalism.

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. When under the "help" from Hilbert, Einstein accepted Minkowskian spacetime as a local tangential spacetime at each location in the Riemannian spacetime theory of General Theory of Relativity, the "consistency" of STR and GTR was "established" and Relativity Theory became the "ultimate truth" in theoretical physics.

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. The apparent discrepancy between LT and (TD, LC) is still giving us some hope.

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?

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 nontechnical extremely challenging deep problems on the border of physics, mathematics and philosophy. Literally nothing has been done.

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 algebra.

Remark 4 *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 hatred of ;logic reaches to this point, we do have some serious problems.*

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. Putting aside the invalidity of the Special Theory of Relativity as we discussed in the foregoing, there are some issues overlooked here. 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 $v \oplus v'$.

So, how can the addition of acceleration be the same as classical addition, hoping that in the word of Einstein, still acceleration is the time derivative of speed. This confusion is closely bound up with the issue of the disjointedness between the acceleration and relativistic reference frames for that reason the Special Theory of Relativity excludes the consideration of acceleration as we have been told.

2. As an important example, 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. It is wrong to say that just because inside the orbiting spaceship fictitious force called centrifugal force is "created?", the orbiting spaceship becomes an inertial reference frame, is it not?

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. It is always the case that a force applied to a mass causes the acceleration of the mass. 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, theoretically there is no such thing as a spaceship. 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 to begin with, for very good mathematical reasons as Newton incisively explained. Spaceship is an issue of engineering, pure pragmatism!

Remark 5 *Here it is important to notice that there are two kinds of the violation of point mass assumption in post Newton physics. First, mass as solid with volume. This situation can be dealt with ease by reducing the mass to a point mass as we are used to. Second, a mass with inside space such as spaceship or train. This case is a lot more complicated as it may allow other mass in the inside space. When we collapse the outer mass, what happens to the inside mas?.*

Moreover, a body attached firmly to the wall of a spaceship if any will "not" experience any special force upon it. 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. 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. This is way beyond simple minded physics.

The most fundamental reason why Newton correctly reduced all moving mass to point masses is simple. It is for purely mathematical and conceptual reason. Newton correctly observed that the best we can do is to consider a physical body as a point object with size of geometric point. Without this assumption, how can we define motion mathematically? With this assumption Newton found a solid mathematical representation of motion is a space as a function from time to space. With this he got the legitimate concept of speed as the first order derivative of the motion function, the legitimate concept of acceleration as the first order derivative of the speed function. Without all of this basics, we have no theory of motion upon which we build dynamics. Mathematics is an essential part of physics and is not just a language for physics.

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. As discussed in the foregoing, 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. The "uniform gravitational

field" near the surface of our planet which we live in is a gravitational field in "approximate".

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. Almost uniform is not uniform. Universe is not approximate!

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 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 acceptedly.

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. 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.

To simplify this already confusing situation, let us put it in this way. 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.

We must stop identifying entirely different things in approximate as they do in quantum field theory. In engineering, this is OK as engineers are not interesting in categorizing things. They just want engineering product which does certain task to certain degree of accuracy. When approximate becomes the "truth", there is a problem which the tradition of theoretical physics chose to ignore. Truth and functionality are different category. Physics may deal with material issues to be called material science. But the way we deal with material issues is not material issue. It is definitely metaphysics. Without solid build up in metaphysics, we will never built appropriate theory of matters. In essence, theory is never material but it is metaphysics. There is a lot more going on in deeper level of physics than just empiricism as Popper and Russell warned. More over, the force field which Einstein introduced to the frame of the spaceship is not gravitational at all. Gravitational fields are to be the field representation of the effect of gravitational force created by Newton's law of gravity. So, it is not a uniform field.

It was Minkowski's 4D spacetime theory of relativity which taught Einstein that the motion line (geodesic) in the 4D spacetime bends in the presence of acceleration. Combining this with the second law of dynamics which connects acceleration and force through mass, and the Law of Gravity, Einstein concluded that through gravitational force masses distributed in the 4D spacetime bend curves the 4D spacetime. Now the 4D space itself is curved and relatively the motion line is a straight line (geodesic) in this curved 4D spacetime. So, there is no need for TD, LC and LT. This makes life easier for relativists. But then what is Einstein's claim that Minkowski spacetime is a local tangential space-time in the curved spacetime?

5 General theory of relativity (II)

5.1 General coordinate system

Judging from the argument to claim the equivalence principle, it appears that Einstein was considering only local situations such as space ship as an accelerating frame. In this local setting it "looks like" possible to treat all accelerating frames as inertial frames. Without knowing the unfortunate truth which we explain above that the equivalence principle is false, Einstein made a move to represent all accelerating reference frames as "local inertial frames" in which acceleration is replaced by the induced gravitational field. *This ill fated idea lead Einstein to consider the general coordinate system upon which all accelerating frames are treated as local inertial frames with induced gravitational field.* Hence force, Einstein moved on to develop the concept of general absolute reference frames to which we will turn in what follows.

Einstein assumed that whole cosmos is occupied by a fluid whose molecules are "clocks" of any variety. This fluid can flow in any manner except that it will be assumed that there is no turbulence, so that neighbouring molecules always have almost equal "speed" and the velocity of the flow is a continuous function.

Remark 6 *This means that Einstein assumes a universal time and a universal space upon which clocks move.*

Each clock is allocated three coordinates (x_1, x_2, x_3) in such a manner that:

1. No two clocks will have the same coordinates, and
2. Neighbouring clocks have neighbouring coordinates, therefore, coordinates are also continuous with respect to spatial displacement.
3. It is understood that the coordinate of each clock remains the same through time. As time elapses at each clock, its readings assumed to increase but the rate of increase is not necessary uniform as compared with a local standard clock. No attempt is made to synchronize distant clocks, neighbouring clocks are assumed to be "sufficiently synchronized" so that the clocks readings are continuous with respect to spatial displacement.
4. The reading of a clock will be denoted by x_0.

It is unfortunate that this paradigm is not possible for the reasons we present in what follows:

a) No clock has any specific coordinate as it is not a point object.

b) In the continuum, there is no such thing as a point next to the other point. So, the concept of "neighbouring point" to a point is invalid concept. Luck of very basic understanding of what continuum means is sticking its ugly head. We do not need to discuss even continuum to understand this. There is no such thing as a rational number next to a given rational number.

This is because in between two rational numbers, we can always find a rational number. This property is called the density of the set of rational numbers.

c) As pointed out in **b**), there is no such thing as the coordinate of a clock in this setting. Clocks are made by continuumly many points. They are by themselves very complex infantry physical structure which certainly is way beyond the simple minded reasoning of theoretical physics. In **a**) Einstein assumes the fluid of clocks and in **c**) he says that the coordinate of each clock remains the same.

More generally, the following further questions remain to be answered.

(1) Upon what time and space the mechanics of such molecule clocks are defined? Each clock is a physical system and so, it is operating in a spacetime which is not the same as the spacetime defined by the clock. This is to say that the spacetime (x_0, x_1, x_2, x_3) does not define the inside dynamics of the clock at (x_0, x_1, x_2, x_3). Moreover, where is the clock which governs the spacetime in which this clock operates? According to the general theory of relativity, the time of this spacetime (x_0, x_1, x_2, x_3) and that of the spacetime in which this clock operates are not the same and how much they are synchronized depends upon the location of the clock which defines the spacetime which defines the clock. This problem is bound up with a more general problem associated with the instrumentalism view of time as clocks. This view falls into the following vicious circle: The clock which is supposed to define time must operate, as a dynamical system, upon some time and space. Then how this time and space are supposed to be defined?

(2) It is a common sense among researchers in "dynamical system theory" that time has a special status and different from all other coordinates of the system. This is in agreement with the idea of Newton in his classical dynamics. He said that time unlike other coordinates have natural flow which "moves" forward only. This makes it impossible to consider time as reading of clocks. Time is an entity which transcends empiricism and operationalism. The super creativity of modern physicists seem to defy this scientific common sense. This is how they consider things like "time travelling" with straight face as a pure scientists serving the appetite of the commercial and political empire of popular science. We wonder "how long" does it take to travel from now to 250 years ago? Once we violate the most fundamental assumption on time, anything can happen and relativity apparently made it happen.

(3) Clocks are physical entities. There are at most countably many clocks in this universe. No mater how closely we put clocks together, we can not form a continuum of clocks. No matter how one puts countably infinite particles together, he will not make mathematical continuum. This

is mathematically the same problem as the problem of photons which are supposed to exist for each frequency: as the frequency has continuum spectrum, there must be uncountably infinite particles called photons. Countably infinite points will never form real continuum. We need continuumly many points to form mathematical continuum.

(4) What does it mean to be sufficiently synchronized? The concept of synchronization presupposes external absolute time which contradicts the concept of relativism. Here, we have to check time of each clock at precisely the same moment in absolute time.

5.2 Minkowskian Local frame

Suppose, at a point P in a "gravitational field", which is sea of infinitely many clocks, a freely falling non-rotation (relative to distant stars) local inertial frame is "constructed". *We further assume that the axioms of special theory of relativity are valid within this frame as it is supposed to be an inertial reference frame.* So, we can set up Cartesian coordinate system *(Px,Py,Pz)* at this point P. Further more we can distribute clocks over the frame all synchronized to the clock at P.

As we assumed that the universe is a sea of clocks which are not over all synchronized, this implies that such coordinate system (Px, Py, Pz) is not universal. It is a local coordinate system around P.

Using this frame and clocks, events which occur in the vicinity of P over a suitably restricted time period, can be allocated space-time coordinates (t, x, y, z).

It is not quite clear why the time period must be restricted.

Now suppose that in this local inertial frame a pair of neighborhood events have space-time coordinates (t, x, y, z) and $(t + dt, x + dx, y + dy, z + dz)$. Then, if $d(\tau)$ such that

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

is Lorentz invariant. It also is called the *Minkowski distance*. This serves as the correct metric on the 4D Minkowskian spacetime.

Remark 7 *As we will discuss in 1.7.15, unfortunately Lorentz transformation is irrelevant to theoretical physics as the claim by Lorentz that this transformation maps wave equation to wave equation is false and Einstein's claim that all equational axioms of Maxwell are Lorentz invariant. So, Minkowski distance also is irrelevant to physics. Mathematical relevance of such transformation is highly questionable either.*

There are some mathematical problems regarding this "metric" on the "local" 4D spacetime. (1): It is not a topological metric which topologists use. This is to say that Minkowski 4D space time is not a metric space. (2): The Minkowski distance between two events which happen at the same time is zero

regardless of the 3D geometric distance between these two events. (3): Here, Einstein is assuming that in this "freely falling" local inertial frame, in which a gravitational field "is induced" by the "equivalence principle", all clocks are synchronized. The inertial frame local must be accompanied by a gravitational field. So, all of these clocks are under gravitational acceleration. How is it possible that all of these clocks are synchronized? It is him who also claims that all clocks under acceleration slows down. Do they slow down uniformly? As the acceleration is inertial "locally", and time dilation is relative to the inertial speed, this slowdown is not uniform at all.

After all, as we have shown in the forgoing, the Minkowski distance has no relevance to theoretical physics. It is mathematically irrelevant too as it is not a topological metric. This clearly shows where relativity theory should be placed in science. It is neither physics nor mathematics. It appears that it belongs to itself.

As the local inertial frame is suitable only for the description of very limited situations. For a larger scale (temporal, as well as spatial) issues, it is necessary to use one of the general reference frames. If x_i are space-time coordinates relative to such general frame, transformations of the form $x_i\prime = \pi(x_0, x_1, x_2, x_3)$ must exist relating (x_0, x_1, x_2, x_3) to (t, x, y, z) [the local inertial frame] such that

$$t = \theta(x_0, x_1, x_2, x_3),\ x = \pi(x_0, x_1, x_2, x_3),\ y = \psi(x_0, x_1, x_2, x_3),\ z = \gamma(x_0, x_1, x_2, x_3).$$

Then, if x_i are subjected to increments dx_i, the corresponding increments in t, x, y, z will be given by

$$dx = (\partial(\theta)/\partial(x_0))dx_0 + (\partial(\pi)/\partial(x_1))dx_1 + (\partial(\psi)/\partial(x_2))dx_2 + (\partial(\gamma)/\partial(x_3))dx_3$$

etc. and substitution in equation of proper time interval

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

will results in an expression $d\tau^2$ which is quadratic in the increments dx, i.e. whose terms will either involve squares of the dx_i or product of two different dx_i. Thus

$$d\tau^2 = \sum_{i=0}^{3}\sum_{j=0}^{3}(g_{ij})dx_i dx_j \qquad (R)$$

where the coefficients (g_{ij}) will be the functions of x_i.

Now, a continuum in which the interval between neighbouring points is given by a quadratic form like (R) is called a "*Riemannian space*" and the quadratic form like (R) is called its *metric*. Thus, the space-time continuum is a four-dimensional Riemannian space whose interval is everywhere identified with the proper time interval between neighbouring events in a local inertial frame.

Unfortunately, what we have seen here is an exhibition of "pseudo-mathematical elitism" or "proof by intimidation" for which authoritarian Göttingen school under Hilbert is solely responsible. Here are some issues to be discussed:

1. For physics what is important is not that we use 4D spacetime manifold of Riemann. What has been questioned here is the relevance of such mathematical structure to physics. This structure (R) is obtained by substitution

   $$dx = (\partial(\theta)/\partial(x_0))dx_0+(\partial(\pi)/\partial(x_1))dx_1+(\partial(\psi)/\partial(x_2))dx_2+(\partial(\gamma)/\partial(x_3))dx_3$$

   etc. in the equation of proper time interval

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

   As we have shown, this whole mathematical argument makes little physical sense. A most serious flaw in all of this flashy mathematical "show off" is that the theory of general relativity was obtained from the special theory of relativity which is mathematically inconsistent and ontologically inconsistent too. So, no matter how the general theory is decorated to look impressive it is false. To make the matter even more entertaining, as we discussed above, the Special Theory of Relativity yields the relativistic addition of speed which contradicts the addition of acceleration of a mass which is governed by the Second Law of Newton. The equivalence principle which is the most fundamental assumption of the general theory of relativity is based upon the second law of dynamics. This makes us seriously wonder what kind of reasoning system theoretical physicists use. Einstein explains the curved space in the general theory of relativity using a rotating disc; the radius of the disk does not contract as the motion of the disk is not along this direction. It comes under the influence of the length contraction around the perimeter of the disk as the motion is in the direction of the tangential speed of the point on the perimeter of the disk. There are tow errors in this argument. First the tangential speed of a circular motion is not inertial, it is under acceleration and so, the length contraction "should not" apply. Moreover, length contraction is false.

2. More fundamentally, as we pointed out in [8] General Coordinate System, Einstein was clearly not aware of the difference between countably infinite and continuum just like all other theoretical physicists. Cantor's diagonal argument clearly shows that there are more points in the geometric continuum than discrete collection of points. The Lebesque integral of the Weierstrass function over $[0, 1]$ shows that the geometric continuum has unimaginably more points than "space" of countably many points has. For example on the real number line almost all points are irrational points. So, one can not cover the entire global space with clocks as there are only finitely many clocks. This makes the most fundamental assumptions of Einstein's general theory of relativity untenable. There is no such

thing as the "global spacetime" prescribed by Einstein. Mathematics at this level is way more complex than theoretical physicists think. It is not just solving differential equations through mechanical symbolic equational calculations without understanding what we are doing at all. Physicists should learn that without correct continuum, we can not define either differentiation nor integration. The problem we have in today's education is that virtually nobody teaches how to define a^x when x is an transcendental number such as π. As Euclid said, there is no emperor's way to geometry. Mathematics is not mechanical calculation. It is deep understanding. Without understanding mathematics we tend to use mathematics, and at the advanced stage it backfires big like this. Likely, general theory of relativity is the first attempt by theoretical physicists to touch the depth of mathematical analysis and its theoretical base, the theory of continuum. It is clear that virtually none of them really understands the concept of continuum without which there is no mathematical analysis (calculus).

3. Also, Einstein's description of the clocks used to define the global spacetime is off. To begin with it must be required that the neighbouring clocks are of infinitesimal distance and the time difference between each neighbouring clocks must be infinitesimally small. Otherwise we can not use calculus to calculate on such structure. Physically, it is impossible to make enough clocks to do this and place them in the way expected as we stated above. If physicists understand that an infinitesimal means a number which comes in between 0 and any positive number, they will realize that what they are trying to do is ontologically untenable. Clearly Einstein did not know what infinitesimals are as this concept was articulated in 1960's by Abraham Robinson. Even in pure mathematics, the work of Robinson is understood only by small number of mathematical logicians. General theory of relativity was developed before the development of Robinson's infinitesimal calculus and so it is understandable that the Hilbert school of mathematics and physics did not know what infinitesimals are. By the time Robinson's work came in, the separation between pure mathematics and theoretical physics became material and communication between these two communities became non-existent.

4. In short, the universe is not a sea of clocks contrary to what Einstein proposed. At this deep level of understanding everything physicists are accustomed to must be re-examined. In addition to this topological problem general theory of relativity suffers, there is an even more fundamental issue of logical deficiency in this idea of the general reference frame which is the sea of clocks. Clocks are physical entities and it requires physics to make them. One can not use clocks to define clocks at the pain of vicious circle. So, there is no such thing as metaphysical clocks though time is certainly a metaphysical entity as Newton thought. It was relativity theory special and general which tried to use empirical clocks which lead the world of physics to the current confusion about time. Contemporary

leaders of theoretical physics such as Hawking and Penrose argue that theoretical physics made us understand the universe very well "except what is time". This clearly shows the illness of this discipline too arrogant to listen to the input from outside discipline such as mathematics, logic and engineering. Logically speaking, modern physics started with the wrong idea of what is time. Contrary to the special theory of relativity, time can not be defined in terms of speed as speed is defined in terms of time. And as we have discussed here, universe is not a sea of clocks contrary to the general theory of relativity. From the combination of these fatally wrong assumptions, it is totally expected that we ended up with scratching our head questioning "By the way what is time?" It is astounding that the "top physicists" of today are saying that though we now understand almost all about this universe except what time is. Our understanding of time as in relativity theory is completely wrong and how can we say that we understand everything but time. The lack of rational reasoning is sticking its ugly head here. We wonder if these scientific elites who call themselves the King have the concept of causation. Even elementary school students will understand that as physics is a theory of dynamical systems, time is the most fundamental concept. Then a naturally asked question is how the superior scientists with the name of theoretical physicists think that they understand everything in physics except time.

Some theoretical physicists say that may be special theory of relativity is false but the general theory of relativity must be correct. We made it clear that general theory came from special theory which is false and so this argument is false. Any theory which contains an inconsistent theory is inconsistent.

5.3 Geodesics

When we express a linear function of one variable on 2D space, then the function becomes a straight line graph. The coefficient of the first order variable is the slope of the line. This idea was extensively exploited by train companies to visualize the train's operation on a 2D space where one coordinate is time coordinate and the other coordinate is the location coordinate expressed at the distance from the origin station. It is called "operational diagram" and it was pure mathematicians who glorified it as 4D spacetime with a fancy name for the simple concept. In the 4D space time all constant speed 3D motions should be just straight lines and the slope of the line is the constant speed 3D motion.

So, in 4D spacetime geometry of 3D motions, the "Euclidean geometric distance" between two points $P_1(t_1, x_1, y_1, z_1)$ and $P_2(t_2, x_2, y_2, z_2)$ in the 4D spacetime is:

$$\overline{P_1P_2} = \sqrt{(t_1 - t_2)^2 + (x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}.$$

The slope of the line segment P_1P_2 is given as

$$((x_1 - x_2)/(t_1 - t_2),\ (y_1 - y_2)/(t_1 - t_2),\ (z_1 - z_2)/(t_1 - t_2))\,.$$

In general theory of relativity, this changes: the distance, as par Minkowski, between P_1 and P_2 is

$$\widetilde{P_1P_2} = \sqrt{(t_1 - t_2)^2 - (1/c^2)\{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2\}}.$$

It can be shown that this distance is smaller than any other "Euclidean distance" along any curve connecting between P_1 and P_2 in the 4D space. It follows as follows: Clearly,

$$\widetilde{P_1P_2} < \overline{P_1P_2}.$$

But for any path l_{P_1,P_2} between P_1 and P_2,

$$\overline{P_1P_2} \leq \overline{l_{P_1,P_2}}$$

where $\overline{l_{P_1,P_2}}$ is the Euclidean length of l_{P_1,P_2}.

From this, relativists conclude that the 4D spacetime with Minkowski metric is not an Euclidean space but a Riemann space which is curved. There are some unclear issues to be addressed here.

1. In Euclidean geometry, we define the distance between two points P and Q using Pythagorean formula and show that the length of any path connecting two points P and Q is longer or equal to the distance between them. We have not seen how to define the length of a curved path between P and Q in Minkowski 4D spacetime.

2. Putting this purely mathematical issue aside, the only reasoning for admitting $\widetilde{P_1P_2}$, the Minkowski distance between P_1 and P_2, is because this distance is invariant under Lorentz transformation. There are two questions to be answered here. (1) Why Lorentz transformation is the issue in the General Theory of Relativity? This transformation belongs to the Special Theory of Relativity. (2) This transformation is said to be essential for Special Theory of Relativity as it is said to preserves all wave equations and axioms of Maxwell's electromagnetic field theory. (3) We have shown that this claim is false in our paper "*Reference Frame Transformations and Quantization*" [KWP]. We discussed this issue in 1.7.10 too.

Nonetheless ,Einstein continued to develop his theory as follows: Under the equivalence principle,

$$d\tau^2 = \sum_{i=0}^{3}\sum_{j=0}^{3}(g_{ij})dx_i dx_j = (dt)^2 - (1/c)((dx)^2 + (dy)^2 + (dz)^2).$$

From this, he concludes that the free fall in the gravitational field is geodesics [in the 4D spacetime]. This is called "*geodesic principle*". Under this principle we obtain equations of motion for bodies falling freely in a gravitational field.

Using Riemannian geometry for the "general metric"

$$d\tau^2 = \sum_{i=0}^{3}\sum_{j=0}^{3}(g_{ij})dx_i dx_j$$

we can show the following "general equation of a geodesic"

$$\frac{d}{d\tau}\left(\sum_{j=0}^{3} g_{ij}\frac{dx_j}{d\tau}\right) = \frac{1}{2}\sum_{j=0}^{3}\sum_{k=0}^{3}\frac{\partial g_{ik}}{\partial x_i}\frac{dx_j}{d\tau}\frac{dx_k}{d\tau} \qquad (i = 0, 1, 2, 3).$$

For the metric

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

these equations reduce to

$$\frac{d^2x}{d\tau^2} = \frac{d^2y}{d\tau^2} = \frac{d^2z}{d\tau^2} = \frac{d^2t}{d\tau^2} = 0.$$

This is equivalent to

$$x = \frac{dx}{d\tau}t + a, \quad y = \frac{dy}{d\tau}t + b, \quad z = \frac{dz}{d\tau}t + c$$

where a, b, c are constants.

Remark 8 *According to the general theory of geodesic, light coming from a distant star passing near our sun has a geodesic (4D) which bends near the sun due to the gravity of sun. As it is 4D bending, we can not graphically express this bending. But when we drop the time bending, the light path bending in our 3D space. This is what we see in science museum exhibition everywhere. Then we have a problem to think about. This 3D bending is a phenomena which takes place in our 3D Euclidean space. This can be observed only from outside our 3D space. As we are inside the 3D space, in theory, we will be unable to observe this bending of light path . This was precisely what Gamow warned us. He basically said that unless we are in the position of Newton out of the universe observing, we will not observe this bending. This valid question was never answered scientifically. Late prof. Marmet presented a classical explanation of this observation using no bending space but bending light in unbent space interpretation. It was ignored. This means that we still do not know if space really bends as Einstein predicted due to the gravitation of earth.*

5.4 Einstein's equation of gravitation

The discussion above shows that g_{ij} determines the motion (geodesic) in general relativity theory. Given the energy-momentum tensor T_{ij} which describes the distribution of mass, energy and momentum of the system Einstein's equations of gravitation yields corresponding g_{ij} enabling to calculate the geodesics of the

system. It was Schwarzschild who first obtained an exact solution of Einstein's equations for a spherically symmetric field. He used the solutions to calculate the motion of a planet in the field of sun.

Putting aside the problems of the general theory of relativity as discussed above, this "impressive" result of Einstein and Schwarzschild has some issues to be considered. The question is what does this momentum-energy tensor is about. There are several issues to be cleared.

1. Momentum-energy relation is a problem. The former is a predicative concept but the latter, as the potential to do work, is a modal concept speaking and so, connecting them at the same category is not the right thing to do. Of course Einstein and his contemporaries had little idea that energy is modality, not physical reality.

2. Logically speaking waves in wave mechanics have no momentum. This is because momentum is the product of the mass and its speed. In wave mechanics, no mass moves in the direction of the wave. What is moving towards the direction of the wave is the local vibration of the medium. So, waves have no momentum. When it comes to energy, as the work needed to accelerate from $m0$ to mv is not necessarily $(1/2)mv^2$, the concept of kinetic energy is false. The work needed for this acceleration depends upon how we accelerate from $m0$ to mv.Unfortunately, what we have seen here is an exhibition of "mathematical elitism" or "proof by intimidation" for which Göttingen school under Hilbert is solely responsible.

3. So, energy-momentum relation does not represent the state of a physical system properly. Then how is it possible that the energy-momentum tensor will describe the physical system properly?

4. Is the energy-momentum relation as energy-momentum tensor used here classical or relativistic? If it is relativistic, the entire argument by Einstein is viciously circular at best. If not, what about that we were told by relativists that the classical physics is invalid. This is contradiction is it not? Where is logic in theoretical physics. Again we have to ask the same question. To make the matter even worse, classically we have some tension in between momentum and energy. Moreover, relativistic energy-momentum relation is also false. It is because $e = mc^2$ is false as we discussed in Section 1.6. This equation came from the false assumption that the v in the gamma factor in m is time dependent, which is not allowed in relativity theory. Considering that the concept of energy is not physical reality but modality and understanding the trivia of philosophy that the modality and reality are of different category, it is astounding that the Momentum-energy tensor plays the most fundamental role in general relativity theory. In serious mathematical sciences, coherent conceptual understanding is way more important than pushing formal symbols. Mathematics is not just a language for physics. It is the only way to understand physical nature around us. It is the most articulate way of thinking correctly.

5. What is the most fundamental issue here is that the practice of *bootstrapping* classical mechanics to relativistic mechanics is not a legitimate thing to do.

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