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Four Laws of Inertia in 'variable' Spacetime Field

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ABSTRACT: *All science theories and physics laws are derived and described in the 'fixed or straight' space-time. Nobody thinks what will happen to these laws and theories if the space-time itself gets varied (curved). The fundamental laws of physics certainly not going to hold in the varied field of spacetime and will get modified. There are mysteries of physics such as* ***inertia*** *and* ***gravity*** *which cannot be explained in fixed spacetime. Many people believed that asking 'what cause inertia' is as unanswerable as asking 'what cause gravity' or asking 'why does matter exist?' They argued that these things are so fundamental that there is no explanation (or atleast no satisfactory explanation from modern science). This paper tries to reveal the origin mysteries of inertia and gravity (two greatest mysteries of science) through the concept of 'variable' spacetime (ST) field. The law of relativity and its cause can also be understood as intrinsic property of ST field. The concept of 'spacetime' as quantum field is introduced and a vital modification been proposed to the fundamental forces of the Nature. Three new types of Energy based on relativity are proposed and explained. Finally four laws of 'inertia' are proposed in which first and third law of inertia explains the 'origin of inertia and gravity'. The second law of inertia explains the relation of energy with spacetime field. At the end, a thought experiment of* ***'two parallel trains'*** *discussed and shown the violation of energy conservation law analytically in isolated system. In short, the theory discover that the things are living in the quantum field of spacetime and 'Mass' can cause 'variation' to the spacetime field and the variation of spacetime field leads to the generation or destruction of Energy.*

Keywords*: Inertia, Gravitoinertia (GI) theory, Energy paradox, inertial reference frame (IRF), accelerated reference frame (ARF), variable spacetime (ST) field, Noether's theorem*

I. SPACETIME AND HIGGS FIELD

The concept of quantum spacetime (ST) field is already there in quantum field theory[1,2]. Through this paper the existence of property of inertia is proposed to be caused by the interaction of matter with the 'spacetime (ST)' field itself. Spacetime or 'Minkowski space' has three real dimensions (x, y and z) and one imaginary dimension (*ict*)[3]. Like other quantum field its intensity (or field quanta density) can varies from point to point. It remains a scalar field but gets vectored (temporal or permanent) when influenced by mass, which destroy the uniform (fixed) nature of ST field. The acceleration of any mass can disturb the intensity of ST field but nobody (from their rest frame of reference) can distinguish the difference occurs in the field because everything and every measurable quantity change with ST field. Mass is only quantity which can make changes/disturbs the intensity of the ST field. Just like the 'charge' in electromagnetic (EM) theory can affects the electromagnetic field same way 'Mass' can affect ST field. In case of EM theory, field is generated by 'charge' and it is vector in nature whereas in the GI theory 'mass' is generated by ST field and it is scalar in nature. But in both cases, fields are influenced by their mass/charge. Later the paper will disclose from first and third laws of inertia how Inertia and Gravity (both) are unified and explained by the same ST field. That is why the proposed theory is called 'Gravitoinertia (Gravity + Inertia) or **GI theory**' as similar to electromagnetic (electrostatic +magnetic) or EM theory. In general the theory may be called as *Variable Spacetime Field Theory.*

In the Higgs mechanism, a scalar field called 'higgs-field' was hypnotized and its boson was finally confirmed experimentally[4]. Higgs theory gives mass to the fermions in standard model and proposed theory explains the generation of inertia for mass due to ST field. Owning property of inertia of a body indicate that the

body have mass because of inertia being an 'interim property' of mass. In this way both **higgs field** and **spacetime field** responsible for generation **mass** and **inertia** for the objects hence does the same thing. Conclusion of above concept suspects that 'Higgs field' may actually be the 'Spacetime field'. In this way 'higgs boson' should be the 'field quanta' of ST field too[4-5]. Above conclusion indicates that only two fundamental forces and fields will exist in nature viz**.** 1) **Electromagnetic force** (exit due to electromagnetic field in which 'photon' being the field quanta) and 2) **Gravitoinertia force** (gravitational force + Inertial force) (exit due to ST field or higgs field in which 'higgs boson' being the field quanta).

Here inertial forces are of temporal nature as far as ST field is disturbed by acceleration of mass whereas gravitational force is due to permanent deformation of ST field by the mass. The weak nuclear force and strong nuclear force had been already unified with the electromagnetic force. Inertial forces are proposed to be real force in this theory. So the current understanding of inertial forces in physics to be 'pseudo or fictitious force' is completely eliminated in the GI theory. This paper directs the relation of probabilistic nature of quantum world with relativity due to the flexible nature of ST field. The theory proposed is based on two principles; the **first** is principle of relativity (all things in the universe are relativistic in nature i.e. irrespective of the reference frame of any observer; all laws of physics are same for all observers) and the **second** is principle of probability i.e. all the events in the universe are probabilistic in nature (the quantum theory). The GI theory is consistent with both theory of relativity and quantum mechanics.

1.1. Relativity as intrinsic property of spacetime field

Everything in the universe exists in the field of spacetime. The intensity of ST field for any region or any event cannot be zero since 'region' or 'event' it itself a part of space-time. No one can imagine anything if there is no ST field. Even vacuum could not exist in the absence of ST field. The ST field is flexible, it can expands and contract[6-8]. In other words the field intensity can increase (get stronger) or decrease (get weaker). Since everything living in that ST field, it is impossible to tell whether its intensity have increased or decreased at any point of space or time because all the measurement is done within the space and time itself. If the space at some location contracts (intensity get weaker), and then our measuring scale also gets contracted. Similarly if the time for any system slows, one cannot feel the slowness of time since one's watches will also get slowed accordingly. In this way one can tell about the contraction/expansion of spacetime *only by comparing*. Hence 'no absolute' space or time could exist in spacetime (ST) field. All are relative to each other[8-16]. ST field is so flexible that it get deforms just by shaking a person's hand in the field but person can't identify the change.

1.2 Probabilistic nature of sub-atomic particles because of quantum nature of spacetime field

Probability and relativity are the two most fundamental property of the universe. Probability of occurrence/finding of sub atomic particles (i.e. their duality of wave and particle nature) can be explained by their linkage with the spacetime field. A particle linked with more ST field quanta, will have more 'mass'. Similarly weak linkage with the ST field of particle will result in decrease its 'mass'. In extreme small scale of these sub-atomic particles, spacetime itself is in quantum (discrete) form. We can also say that a more or less massive particle is linked with more or less quanta of ST field respectively. In that tiny scale of space and time, length and time both becomes discrete and particle lost while traveling from one ST quantum to another ST quantum as there exist 'nothing' between two ST quanta. So the re-existence of lost particle, when or where (in nearby ST quanta) is just become a random phenomenon. Thus the quantum nature of ST field results into probabilistic nature of sub-atomic particle. In this way particle attains wave nature along with particle nature. A massive particle is linked up more ST quanta and hence their finding nearby ST quanta is more probable. So the massive particle or group of particles goes on decreasing of their wave nature. In classical world of normal objects, things are living in very large spacetime field where spacetime looks continuous field and hence we didn't see probabilistic or wave nature of objects.

II. ENERGY CONCEPT AND TYPES OF ENERGY BASED ON RELATIVITY

The current definition of Energy (ability to do work) is not adequate and it does not tell what energy is actually. No one surely knows the real nature of Energy. In GI theory, energy is not a fundamental quantity as in

other theories. In this GI theory, ST field is fundamental element and energy is derived quantity. Let's try to understand this concept by simple analogy of springs.

Since ST field being flexible, just imagine the ST field is being 'mechanical spring' and Energy being the 'force' which can compress or expands the spring. To make spring compress/expands an observer need to apply continuous force upon it. Same way when an observer try to compress/expands (deform) the ST field, he need to apply continuous energy and this way energy get absorbed by ST field or can be said energy destroyed or used to deform ST field. Now imagine second case when a compressed spring delivers continuous force to the observer. Same way a compress (deform) spacetime field give off continuous supply of energy to the observer and this way the energy is originated from ST field (out of nothing). When this generated energy is stored in electromagnetic (energy) form, it gets totally conserved. Electromagnetic phenomena do not affect ST field hence energy can change or transform from/to any electromagnetic energy forms without violating energy conservation law.

Energy could be considered as the composite form of spacetime and mass. In fact we can say that the whole universe is made of two components viz. 'Spacetime' and 'Mass (fermions/fundamental-particles)'. Before this theory reveals the relation of energy with spacetime field, three new types of energy on the basis of its relative nature are proposed as given below.

2.1 Inertial Energy *(Potential Energy)*

This type of energy is associated with mass (matter) and so have inertia. Space-time component is missing in this type of energy. It is always in interaction with Higgs Field so inertia prevents it to change from one reference frame to another inertial reference frame. It is not relative in Galileo's relativity (at low speed). One of the importance characteristic of this energy is that extra energy (next type of 'kinetic energy') is required to transfer this kind of energy from one frame to another reference frame. For example, energy of rest mass, potential energy, chemical energy, nuclear energy etc. The main characteristic of this type of energy is that it remains 'invariant' to any other inertial or accelerating frame.

2.2 Kinetic Energy *(Momentum Energy)*

This kind of Energy is associated with body's speed or momentum in general. This energy is composed of both mass and space-time component. It is the energy that requires for 'Inertial Energy' (first type) to go from one frame into another. This type of energy is only which is Relative in Galileo's Relativity[17]. So this Energy is 'Variant' quantity among different reference frames at low speeds and varies from observer to observer. Own kinetic energy of a body or system in the inertial frame is always zero since the body with constant velocity considers itself always to be at rest.

2.3 Non-Inertial Energy *(Radiant Energy)*

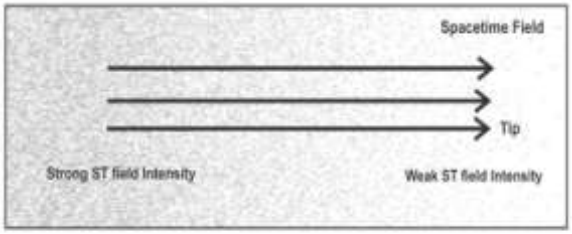
All electromagnetic (EM) energies come under this category. Obvious mass component (mass-effect) is missing here and only 'space-time' dominates in radiant energy. This energy doesn't interact with Higgs field so, no inertia can affect this type of energy. This energy is 'invariant' amongst any reference frames in Galilean relativistic mechanics. One of the importance characteristic of this energy is that in contradiction to 'inertial energy' no extra energy is required to transfer this energy from one frame to another reference frame.

Obviously all above type of Energies based on relativity are not equivalent to each other. The categorization of these types of energies intuitively suspects that there must be some problem with the energy conservation law as whole. Energy conservation law cannot hold logically among all reference frames either globally or locally.

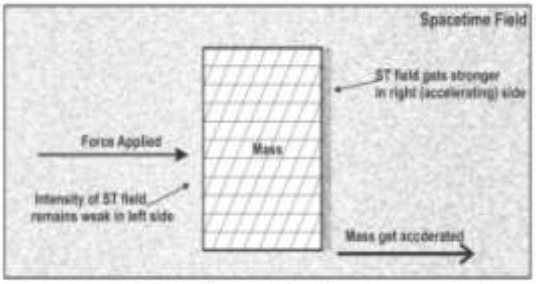
III. ORIGIN AND FOUR LAWS OF INERTIA

First of all, in order to figure out variation in the intensity of spacetime (ST) field, gradient field can be shown by 'inertial lines of forces (ILoF). The arrow tip depicts weaker intensity side whereas tail of arrow depicts stronger intensity side of spacetime field as shown in Fig.1. The difference in the intensity results in pressure force for the mass in the direction of arrow. So the stronger intensity ST field pushes the mass to go towards weaker intensity of ST field. In GI theory, 'inertial lines of forces' may consider as analogous to the

'magnetic lines of forces' of the EM theory. Inertial lines of forces make the concept easy to grasp and avoid confusion as this theory being paradoxical in nature.



Figure/1 : Inertial Lines of Force (ILoF). Arrow denots the variable (gradient) ST field. (Since spacetime field is unimaginative, so it order to ease the concept dots are assumed and shown in the figure as the quantum particles of spacetime field. More denser of dots means strong intensity of ST field)



Figure/2 : Origin of inertia due to difference of ST field intensity across accelerated mass. The strong ST field in right side resist the acceleration by inertial force.

It is known that inertia puts resistance against the change in body's velocity but considers this a fictitious force. In the GI theory 'inertia' is the **real** and the most fundamental force of Nature. There are four laws of inertia proposed, which explain its nature in detail by simple imagination. Two of the laws explain the origin of inertia and gravity and other explains condition behind law of conservation of energy and momentum.

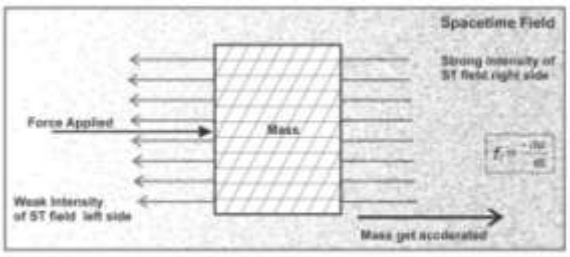
When a body of mass (m) is acted upon by a real force (f), body gets accelerated by acceleration say (a). As per GI theory, mass is in a flexible quantum field of spacetime and as the mass gets accelerated, the ST field particles in front facing hits more and puts resistance for the acceleration of mass as shown in Fig.2. In other words, the ST field intensity in the front portion of mass (body) increases (become stronger temporarily) whereas in back portion intensity decreases (get weaker). Hence the concentration of spacetime field particles is higher in front side and creates a force pressure across mass which tends to push the mass in back direction of the acceleration. This field pressure multiplied by the mass of body creates inertial force which is equal and opposite to the initial force applied upon the body. This concept is expressed mathematically in the first law of inertia given below along with other three laws of inertia.

3.1 First Law of Inertia

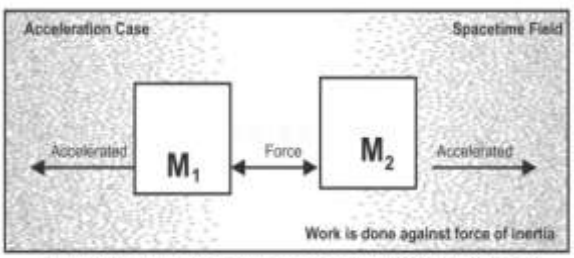
This law explains origin of inertia which is fundamental force of nature in this theory. An object of mass (**m**) is being accelerated at **(a)** in ST field as shown in Fig.3, this phenomena breaks (deforms) the uniform ST field and intensity of ST field in forward direction get stronger. This difference in 'ST field intensity' creates a pressure across the accelerated mass (object) which puts resistive force in opposite direction of the accelerated object, known as 'inertial force'. This phenomenon is temporal as far as the body is accelerated. Mathematically inertial force ($\boldsymbol{f_i}$) is equal to the negative of Change of momentum **(p)** of the object i.e.

$$\boldsymbol{f_i = -\frac{dp}{dt}} \tag{1}$$

The inertial force is the first 'fundamental force' of nature mediated by spacetime field quanta (higgs boson). When a body accelerates, inertia puts a resistive force in opposite direction to that of acceleration generated by ST field quanta and hence **inertial forces are real**.



Figure/3 : Dipiction of inertia (inertial force) by ILoF (inertial lines of forces) in which direction of ILoF's shows the direction of inertia (inertial force)



Figure/4: When two bodies depart from each other (case of acceleration)

(The equation is similar of the faraday's equation of emf generated in changing rate of magnetic flux linked with a coil as $\mathcal{E} = -\frac{d\Phi}{dt}$)

3.2 Second Law of Inertia

This law explains energy conservation and energy paradox. The 2nd law of inertia explores the law behind the energy conservation in the vicinity of ST field. It has three statements viz.

1) Energy gets destroyed when work is done against force of inertia,
2) Energy gets generated when work is done by the force of inertia and
3) Energy conservation law holds only (of isolated system) in uniform spacetime field.

3.2.1 Energy gets destroyed when work is done against force of inertia

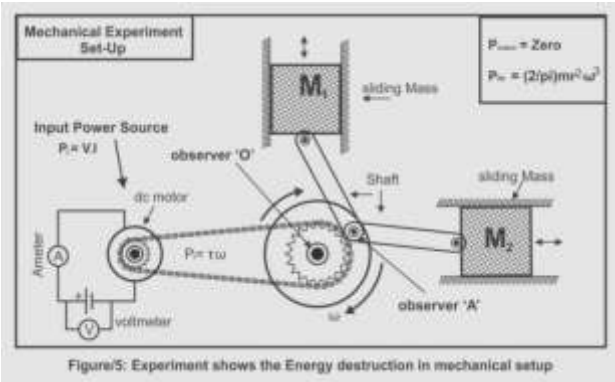
When the observer is in gradient or variable ST field (accelerated reference frame ARF), energy gets consumed by ST field in order to change the object's inertial frame of reference and observer who measures the energy be at the side of weaker intensity of spacetime field. There is a general case of acceleration when two or more bodies get apart from each other.

3.2.1.1 Case of acceleration when objects (bodies) depart from each other

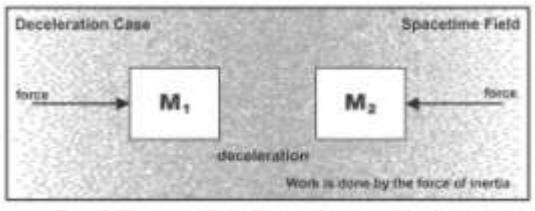
Consider two bodies of mass M_1 and M_2 initially at rest (See Fig. 4). Suppose anybody exert a force to accelerate other body and finally moving opposite to each other. As per the law of relativity, each body considers itself to be at rest. So if a body (M_1) exerts force in between and spends equals to energy say (E), that energy (E) is gained by other departed body as kinetic form of body (M_2). Each body consider as it loses its energy and other departed body gains kinetic energy. This is further explained by a mechanical experimental setup (See Fig.5) in which energy supplied is continuously going to nothing (energy destroyed completely).

3.2.1.2 Experimental setup showing Energy destruction (direct violation of Energy conservation law)

This may be consider as the proof of the proposed theory. As per the first part of 2nd law of inertia, the energy must get destroyed when body is in variable ST field (curved spacetime as per Einstein's concept) subject to the observer should be in weak intensity of the spacetime field (i.e. observer accelerates anybody). Suppose observer itself applying energy to accelerate it. The total energy spend is used to provide kinetic energy to the observer as well as accelerated body. But observer considers himself to be at rest hence kinetic energy increase is zero for him and total energy spend transform to the KE of accelerated body. Now suppose in next move, observer has reversed the direction of force and acceleration, equal amount of energy spend in this process too. Since observer again considers itself to be in rest, it has to again accelerates (actually decelerate) the body to come back its original position of rest. In the whole process observer has to accelerate again and again and continue doing work against force of inertia. Hence total energy in this process is gone out to nothing and also final kinetic energy of the observer remains zero.



Figure/5: Experiment shows the Energy destruction in mechanical setup



Figure/6: When two bodies collide together (case of deceleration)

We have a simple experimental setup in which two bodies of mass M_1 and M_2 are connected to a paddle wheel (**r** as the radius) through crank and shaft arrangement (as shown in Fig.5.) Paddle is rotated by torque (τ) by hand or motor at angular speed of ω. Body is free to move forward/backward on the frictionless surface. Suppose there is observer 'O' situated at the centre of rotating paddle and observer 'A' is at a point on

the circumference of paddle wheel of radius (r) and is connected with masses M_1 and M_2 through shafts. In rotating the paddle, input power is applied ($P_{in} = \tau. \omega$) by the observer 'A' to accelerates the masses. For observer 'O' both masses accelerate and decelerate alternatively. Continuous input energy is supplied by observer 'O' (through Motor which is rest to observer 'O') to observer 'A' as rotational energy connected each other by rigid crank mechanism. No outputs work (output power) comes out of the setup in any forms of energy for any observer since masses oscillates forward/backward and left/right on a frictionless surface only. As the observer 'A' accelerates the masses, its frame change with the accelerating masses since it is connected with masses through shafts and remains always at rest to the masses. In this way observer 'A' always have to accelerate the masses which continue requires energy to do work (accelerate) against the force of inertia. The continuous applied input power is transforming to nothing and hence applied power is destroying to nothing which shows the direct 'Violation of Energy Conservation Law' experimentally.

Mathematically, Input power for this setup been derived as

$$P_{in} = \frac{2mr^2\omega^3}{\pi} \quad (2)$$

Output power taken out of the setup $P_o = 0$ (Hence energy destroyed)

3.2.1 Energy gets generated when work is done by the force of inertia

In this case observer is in the gradient/variable spacetime field (decelerated reference frame). Energy is generated by spacetime field in order to makes the object's inertial frame of reference to rest and observer who measures the energy be at the side of stronger intensity of spacetime field. Initially it requires two reference frames which finally combine by colliding in a perfectly inelastic way (stick together). This is cases when two or more bodies decelerate to come together and become single body.

3.2.2.1 Case of two objects (bodies) comes together

When two bodies of masses M_1 and M_2 come together like each one falling into other and stick together (in a perfectly inelastic collision) as shown in Fig.6, as per the law of relativity, each body consider itself at rest and hence gains (generated) energy from other body.

It is not possible to explain exactly which body looses energy because both bodies consider that it get energy from each other body. It explores the concept of 'Energy Paradox' since it is not possible to tell the energy generated from which frame. Energy conservation law breaks in the case again, in general when two or more reference frame (IRF) taken together for measurement. This law generates energy out of nothing without violating Energy conservation law for each observer (bodies) separately. This concept is paradoxical in nature and explained mathematically through 'two opposite traveling parallel trains' thought experiment discussed in section 5 of this paper.

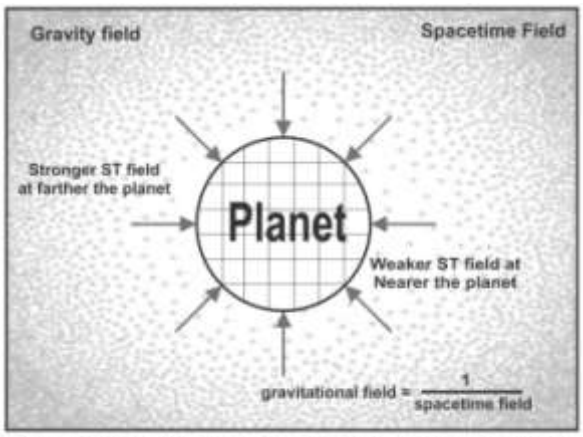
3.2.2 Energy conservation law holds only in an isolated system and 'uniform' spacetime (fixed or flat) field

In simple words law of energy conservation holds only when measurements are done through a single (rest observer to itself) inertial reference frame (IRF). In this case observer can equally accelerate and decelerate the body in two times. The above discussed two laws applied one by one here and finally conserve the total energy. This is the most common situation what everyone looks in most of the phenomena in the world.

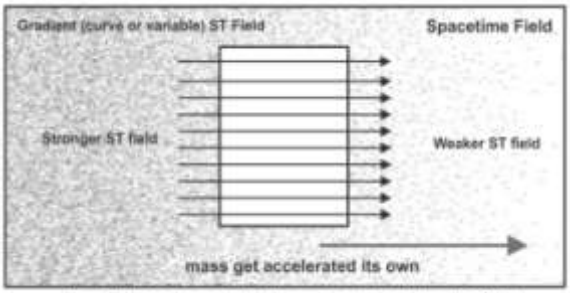
3.3 Third Law of Inertia (origin of gravity)

This is the important section which explained the origin mystery of gravity. The gravity is considered to be the fundamental force of nature but in this theory, gravitation force is proposed to be a same force as of inertial force. Difference is only that gravitation is of permanent nature whereas inertial forces are of temporary nature and Spacetime field is responsible for both gravity as well as inertia. It can be understood like the relation of electrostatic and magnetic force. Previously these two forces are known as separate forces but Maxwell unified these two forces and termed as 'Electromagnetic Force' whose mediating field quanta (boson) is 'photon'. Same ways gravitational force can be unified with inertial force and may call it 'Gravito-inertia Force' whose field quanta be 'spacetime field quanta' or higgs boson.

Inertial force arises due to temporal deformation of 'uniform spacetime field' because of acceleration of matter whether 'Gravitational force' arises due to permanent deformation of the spacetime field (get gradient) in the presence of 'fermions' (say planet of matter). When matter (fermions) is kept in 'spacetime' field, it links up with the field and gives rise to the 'mass effect' of the fermions. This phenomena may be dynamic and in this process field intensity of 'spacetime field' near the 'fermions' getting weaker. For example in the case of any planet, near the surface of planet intensity of ST field becomes weaker but getting stronger as go farther away from the centre of planet. In the outer space the intensity of spacetime field approaching maximum where gravitational field approaching zero (See Fig.7) and it is depicted through density of dots as assumed the density of spacetime field quanta. The field of gravitation and spacetime are inversely proportional to each other. We can say gravity field is nothing but the 'gradient' field of spacetime.



Figure/7: Gradient spacetime Field for gravity field. Higher density of dotes denotes the strong intensity of ST field. Near the Planet ST field intensity getting weaker and as to go in outer space ST field gets stronger.



Figure/8: Mass get accelerated its own in gradient (curve) ST Field

Near the surface of any planet there are different values of spacetime field at different points. Across any object the difference of this spacetime field intensity across the object (mass) puts pressure on the object (mass) towards its centre and we call this force, arising due to difference in spacetime field intensity, as 'gravitational force'.

Mathematically, gravitational field is written as

$$g_f = \frac{1}{\Phi} \tag{3}$$

or

$$\textbf{gravitational field} = \frac{1}{\textbf{spacetime field}}$$

where '$\mathbf{g_f}$' be the gravitational field and '□' be the spacetime filed

General theory of relativity explains gravity as the curvature of spacetime in 2D (two dimensions) flexible fabric whereas GI theory explains the gravity in 4D assuming spacetime as quantum field whose intensity may be stronger or weaker at different points (stronger or weaker will always be relative). When intensity of the field is not uniform it can be said as curve spacetime. And the same curve or variable spacetime is responsible for inertial forces too. Mass have a property by which it makes the spacetime field weaker nearby it and hence spacetime field get stronger in outward (farther) side. This creates just a pressure which pushes the mass inwards (towards centre) and this way generates gravitational force. We can see that for gravity we need pressure from large number of spacetime field particles hence, gravity will be negligible at quantum scale of space. GI theory eliminates the hypothesis of 'graviton' particles for gravity to exist. *The unification of gravity with inertia because of variable spacetime field must be the reason for equivalence of inertial and gravitational masses.*

3.3.1 Explanation of 'Black Holes' in space-time field through 3rd law of inertia

Let us try to understand the nature of 'black holes' through 3rd law of inertia. As explained in the theory, the gravity is (negative) **gradient of spacetime field** (scalar) in 4-dimentional coordinate (x, y, z, *i*ct). As the intensity of gravity field increases the intensity of spacetime field decrease (field get weaker). Since everything is measure in terms of space and time, the intensity of spacetime field is only distinguishable when compared to other places of field intensity. In black holes the intensity of spacetime field is decreasing (getting weaker) continuously forever. It is in suspect whether the event of horizon will happen or not in the back holes theory. Decreasing intensity of spacetime field means the 'space' anybody acquired become less (small) and 'time' get slow down (dilates) for an observer in the other frame (space with zero gravity) who looks the black holes. Now when a much bigger star or other heavenly body falls in the field of black hole gravity, it seems as its size decreasing and time is slowing down. Before it reach to the event horizon its size approaching zero since at event horizon intensity of spacetime approaching zero. From any observer in the Inertial Reference Frame (IRF), it seems continuously fallings of star into the black holes and time it takes to reach in the event horizon is just approaching infinity. Since, in the almost absence of ST field, there is almost having 'no time' at event horizon. The inertial mass of falling body also decreased as spacetime field around the mass decreases. In quantum scale too, the space & time for fermions particles when falls in gravity field go on reducing as spacetime field decreases. Near the event horizon, space and time tends to zero i.e. time stood till at the event horizon. But for the observer or body which had fallen in the black hole feels as normal space, time and its mass as earlier since observer in the falling body cannot measure the intensity of spacetime field its own (due to relativistic nature of spacetime). Space & time changes observed only when comparing with other point of spacetime. In this way it can be said that the whole galaxy could fall and collapse in the black hole and their size reduced to negligible but increases the gravity strength of the black hole as normal.

3.4 Fourth law of inertia

This law explains **l**aw behind conservation of momentum which further explains the feasibility of artificial gravitation. The 4th law of inertia can be seen as the 'inverse law of 1st law of inertia'. The first law explains that the acceleration of matter (mass) causes the deformation of spacetime field whereas the fourth law tells that when any matter (mass) is put in a 'non-uniform/gradient spacetime field', it would get accelerated its own. *The natural existed gradient/variable spacetime field is* ***gravity***, when an object is put in gravity it gets accelerated its own. However it must lead the failure of law of conservation of momentum for the observer in zero gravity.

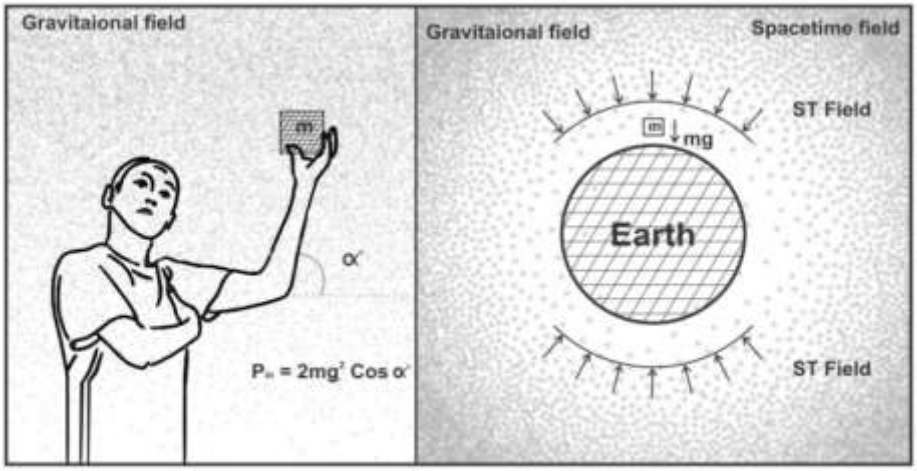
Remember the Law of conservation of momentum and energy (both) applied only when there is uniform spacetime field as explains earlier[18-20] and also as per the Emmy Noether's theorem of conservation laws[20-22]. The 3rd law of inertia explains that the mass makes the spacetime field gradient (deform) or 'non-uniform' (curve spacetime) permanently and 1st law of inertia says the acceleration of mass makes the spacetime field non-uniform (curve) temporarily (as far as the acceleration is present). It is clear from both laws that the 'only mass' can disturb (deforms) the ST field. If a body puts in that gradient or curve spacetime field, it gets accelerated by its own (See Fig. 8). In case of gravity, spacetime field deforms by any planet (say Earth planet) all around the sphere equally and permanently. Any object lying on earth (or connected rigidly with earth) does not exhibit violation of conservation of energy or momentum since the deformation of spacetime field around object and its opposite side of earth sum up to zero. Now if we could make ST field variable across any object it feels the same effect of gravitation and the object starts accelerating without any external force as the 'artificial gravitation'.

As per 4th Law of inertia, the acceleration/deceleration of mass in an asymmetrical path can lead to generate artificial deformation of ST field and hence creates artificial gravitation. Mass could be accelerated/de-accelerated in such a asymmetric way that spacetime in the forward direction is compressed (get weaker) and in back direction expands (get stronger) and the system will accelerates in forward without any external force. Actually in gradient ST field, higher intensity of ST field pushes or accelerates the body towards lower intensity and no external force is requires.

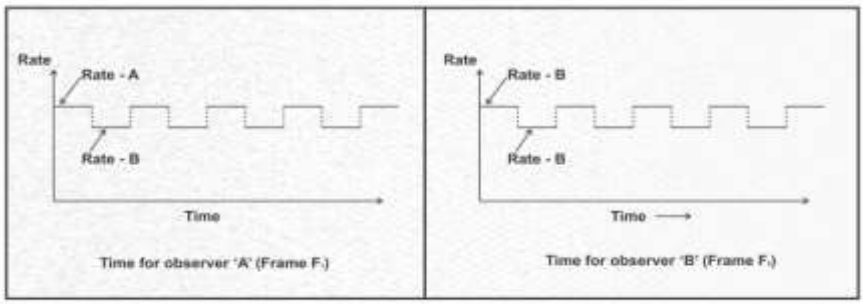
IV. MASS HOLDING AGAINST THE FORCE OF GRAVITY

This section says for application of laws of inertia. Let consider a typical application of proposed laws of inertia and explain the phenomena through 2nd and 3rd law of inertia. Suppose a boy hold an object of mass (m) at some height in the earth's gravity. This is the most controversial example of energy conservation.

It is very clear that no work (output work) being done upon or by the object (m) but continuous (muscular) energy is require to hold the object (m) in air. Since no work being done by the boy on the object, so the input energy supplied to the mass going where is unclear. When the object (m) is kept on table, no continuous supply of input energy is required. But when that object (m) is held in air at any height the boy need to supply continuous energy to hold the object in air (See Fig.9).



Figure/9 : Mass (m) holding against force of gravity (gradient ST field)



Figure/13 : Toggling of time of Energy Paradox in case of thought Experiment of two opposite traveling parallel Trains

Most of the people explain the phenomena saying that energy is spend in the muscle of human body which is one of the most common false explanations. As per the 2nd law of inertia, conservation of energy holds only in a fixed spacetime field. As per the 3rd law of inertia (law of gravitation), ST field is *variable* in the gravity field so here energy conservation should not obey. In other words, work is done against the force of gravity (inertia) and total energy must destroy to nothing.

The mass kept on table requires no energy however it is also laying in the same field of gravity (curve or variable ST field). The ST field around the Earth is curved (concave). If the body is not connected with the earth, body remains in gradient (concave) field of spacetime. The body needs continuous force and energy to remains in air. But when body gets connected with the earth, the body becomes a part of earth and opposite side of earth having also (concave) gradient field of spacetime. Now two concave fields cancel each other and body is can be said as kept in flat spacetime with earth. So no energy is requiring here.

Power consumed in the process of holding a mass (m) against the force of gravity by human muscle power is derived as

$$\mathbf{P_{in} = 2m\,\square^2\ Cos\ (\ \square)} \qquad (4)$$

Where P_{in} = power supply to hold the mass
m= is mass of body held in air
g= 'gravitational acceleration initiate' whose numeric value is equal to g (gravitational acceleration) with different dimensional formula i.e. 9.8 $m/s^{3/2}$
α= angle of contact =$\cos^{-1}$(R/mg), R is the reaction force
(Angle of contact is the angle between holding line with the horizontal axis of earth).

When mass is hold by a person in vertically downward direction, angle of contact (α) is zero degree. Here reaction force is almost equal to the weight of body. Little power is required which get burnt in human muscle for supporting the mass. As hand, holding the mass going upward angle of contact increases and becomes 90^0 and reaction force is negligible when hand is in horizontal direction. In this position, power required to hold the mass is maximum as per above derived formulae. Most of the case angle of contact cannot be measured only by observing the situation. Correct angle of contact will be calculated with the value of reaction force measured. We can derived situation when the body is kept suspended (hover) in air by using momentum of electromagnetic radiation subject to whole EM waves are absorbed by mass. Power delivers for holding any mass or hover it against force of gravity (g) is derived as

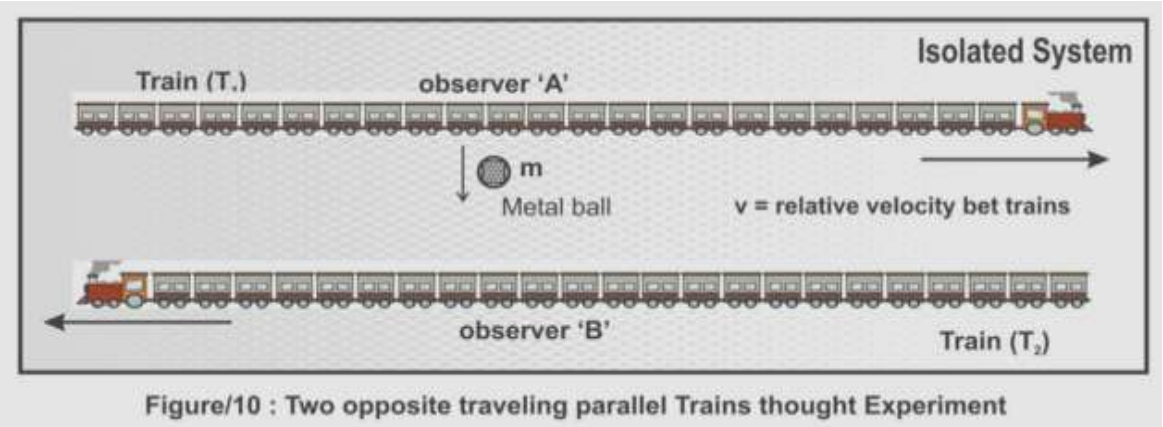
$$\mathbf{P_{in}=mgc} \tag{5}$$

where P_{in} = the power supply to hover the mass
m= mass of body held in air
c= the speed of light

The Einstein's theory general relativity leaves an open question whether law of energy conservation will be followed or not. The GI theory clears this point that law of conservation of energy is finally not followed in general relativity.

V. TWO PARALLEL TRAINS THOUGHT EXPERIMENT

This is the most important (thought) experiment of this paper. As told in second part of the 2nd law of inertia, energy can be generated for an observer out of nothing by using the concept of 'Energy paradox' in exchange of mass between two inertial reference frames (IRF). The above concept is paradoxical in nature and explained in the following thought experiments. Consider two very long Trains T_1 and T_2 moving opposite, parallel (and very close) to each other with their relative velocity of (v) as shown in Fig.10. Let M_1 and M_2 are their masses of trains T_1 and T_2 respectively. Effect of gravity and 'small vertical speed' of mass (m) is neglected in order to make analysis simple to explain the concept. Let observer '**A'** is on train T_1 and observer '**B'** on train T_2. Suppose trains T_1 and train T_2 are in reference frames F_1 and F_2 and there is a metal ball of mass (m) kept on train T_1 initially. So the relative velocity of metal ball (m) w.r.t. to train T_2 is also equal to (*v*) and its kinetic energy be ($\frac{1}{2}mv^2$) for observer B. Let, the metal ball of mass (m) exchange activity between these two trains are performed and observed in two frames of reference.

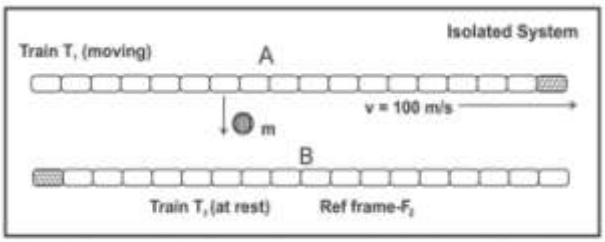


Figure/10 : Two opposite traveling parallel Trains thought Experiment

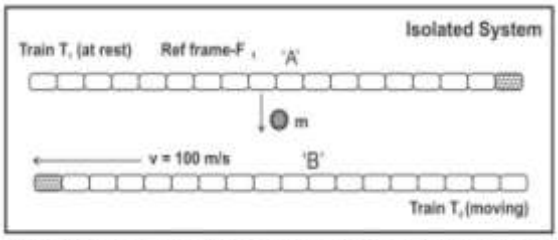
5.1 Case-1: When metal ball of mass (m) thrown from train T_1 towards Train T_2

5.1.1 ***Observation in reference to frame F_2*** **(Observer B)**

For the observer 'B' on train T_2, which consider itself to be at rest and train T_1 and metal ball is moving with the velocity =v relative to train T_2. Let metal ball (m) is thrown into train T_2 and get stopped in train T_2 by losing all its kinetic energy **(** $\frac{1}{2}mv^2$ **)** into say heat after perfect inelastic collision (ball gets stick with train) between T_2 and metal ball of mass (m) as shown in Fig. 11.



Figure/11 : mass (ball) exchange in two parallel trains thought Experiment between trains when Ref frame taken as F_2 (train T_2 at rest)



Figure/12 : mass (metal ball) exchange between two parallel tains thought Experiment when ref frame taken as F_1 (train T_1 at rest)

Suppose the velocity of train T_2 becomes v' after colliding with metal ball (m). By applying conservation of momentum of the collision, we have

Total Initial momentum = Total final momentum

i.e $[M_2.0] + [m.v] = (M_2 + m).v'$

$$\Longrightarrow v' = \frac{mv}{(M_2+m)} \tag{6.1}$$

$$\boldsymbol{kinetic\ energy\ of\ metal\ ball\ (m)\ for\ observer\ B\ before\ collision} = \frac{1}{2}mv^2$$

Initial velocity of train T_1= *v*; Final velocity of T_1=*v*

Initial Kinetic Energy of T_1 (with metal ball) is $KE_{T1i} = \frac{1}{2}(M_1 + m)v^2$

Final kinetic energy of T_1 $KE_{T2f} = \frac{1}{2}M_1v^2$

Initial velocity of T_2=0; Final velocity of T_2= -*v'*

Initial Kinetic Energy of T_2 = 0.

Final Kinetic Energy of T_2 $= \frac{1}{2}(M_2 + m)(-v')^2 = \frac{m^2}{2(M_2+m)}v^2$

Applying Energy conservation for observer 'B' for the whole isolated system,

Total initial energy of system= Total final energy of system

(Initial KE of T_1 with metal ball) + (initial KE of Train T_2) = (final KE of Train T_1) + (Final KE of Train T_2 with metal ball) + (Heat Q_1 Released)

$$[\tfrac{1}{2}(M_1 + m)v^2] + [\tfrac{1}{2}M_2 0^2]] = [\tfrac{1}{2}M_1v^2] + [\tfrac{1}{2}(M_2 + m)(-v')^2] + Q_1$$

$$\Longrightarrow \frac{1}{2}(M_1 + m)v^2 + 0 = \frac{1}{2}M_1v^2 + \frac{m^2}{2(M_2+m)}v^2 + Q_1$$

$$\Longrightarrow Q_1 = \frac{1}{2}mv^2 - \frac{m^2}{2(M_2+m)}v^2 = \frac{1}{2}mv^2\{1 - \frac{m}{(M_2+m)}\} \tag{6.2}$$

Which is the amount of heat (radiation) Q_1 released during collision. These results can be put in Table 1 and assign some numeric values to the parameters in order to understand the concept with ease to find heat released in collision as given in Table 1.

Let, masses of trains be M_1=M_2=1000 kg

Mass of metal ball be m=1 kg

Initial Relative velocity between two Trains be *v*= 100 m/s

Table1 I Calculation of velocity, Kinetic Energy & Heat Q_1 Released for observer 'B' of the collision of metal ball with Train T_2 in respect to inertial frame F_2 (rest frame of train T_2)

Train	**Velocity**		**Kinetic energy**		**Heat Released In collision**
	Initial	Final	Initial	Final	
T_1 M_1=1000 kg m=1kg (ball)	v =100 m/s	v =100 m/s	$\frac{1}{2}(M_1+m)v^2$ =5005000 Joule	$\frac{1}{2}(M_1)v^2$ =5000000 Joule	-------
T_2 (Rest) M_2=1000 kg	0 (Rest)	$-v'$ =0.10 m/s	$\frac{1}{2}M_2(0)^2$ = 0 Joule	$\frac{1}{2}(M_2+m)(-v'^2)$ =5 Joule	$Q_1=\frac{1}{2}$m $v^2\{1-\frac{m}{(M_2+m)}\}$ = 4995 Joule

5.1.2 Observation in reference to frame F_1 (Observer 'A')

The observer 'A' on Train T_1 consider itself to be at rest. Observer A through the metal ball of mass (m) towards train T_2 which collides (hit) with the train at velocity of (v) in perfectly inelastic way as shown in Fig.12. Let (after collision) the velocity of train T_2 be v'' w.r.t. observer 'A'. By applying conservation of momentum of the same collision for observer 'A',

Total Initial momentum = Total final momentum

i.e. $[M_2.v]+[m.0] = (M_2+m).v''$

$$\Longrightarrow v'' = \frac{M_2 v}{(M_2+m)} \tag{6.3}$$

kinetic energy of metal ball of mass (m) for observer A after collision $= \frac{1}{2}mv^2$

Initial velocity of T_1= 0; Final velocity of T_1=0

Initial Kinetic Energy of T_1 (with metal ball) is $KE_{T1i} = \frac{1}{2}(M_1+m)0^2 = 0$

Final kinetic energy of T_1 $KE_{T2f} = \frac{1}{2}M_1 0^2 = 0$

Initial velocity of $T_2 = v$, Final velocity of $T_2 = v''$

Initial Kinetic Energy of $T_2 = \frac{1}{2}(M_2)v^2$

Final Kinetic Energy of train T_2 $= \frac{1}{2}(M_2+m)v''^2 = \frac{1}{2}(M_2+m)(\frac{M_2 v}{(M_2+m)})^2 = \frac{M_2.M_2}{2(M_2+m)}v^2$

Applying Energy conservation for observer 'A'

Total initial energy of system= Total final energy of system

(Initial KE of T_1 with metal ball) + (initial KE of Train T_2) = (final KE of Train T_1) + (Final KE of Train T_2 with metal ball) + (Heat Q_2 Released)

$$[\tfrac{1}{2}(M_1+m)0^2] + [\tfrac{1}{2}M_2 v^2] = [\tfrac{1}{2}M_1 0^2] + [\tfrac{1}{2}(M_2+m)(v'')^2] + Q_2$$

$$\Longrightarrow 0 + \frac{1}{2}M_2 v^2 = 0 + \frac{M_2.M_2}{2(M_2+m)}v^2 + Q_2$$

$$\Longrightarrow Q_2 = \frac{1}{2}M_2 v^2 - \frac{M_2.M_2}{2(M_2+m)}v^2 = \frac{1}{2}M_2 v^2\{1-\frac{M_2}{(M_2+m)}\} \tag{6.4}$$

This is the amount of heat (or heat radiation) Q_2 released during collision. The results can also be put values as given in Table 2 for heat released in the collision.

Now we can consider the reverse cases when metal-ball is through back from train T_2 towards train T_1.

Table 2 I Calculation of velocity, Kinetic Energy & Heat Q_2 Released for observer 'A' of the collision of metal ball with Train T_2 in respect to inertial frame F_1 (rest frame of train T_1)

Train m=1kg (ball)	**Velocity**		**Kinetic energy**		**Heat Released In collision**
	Initial	Final	Initial	Final	
T_1 (Rest) M_1=1000 kg m=1kg (ball)	0 (Rest)	0	$\frac{1}{2}(M_1+m)(0)^2$ = 0 Joule	$\frac{1}{2}(M_2)(0^2)$ =0 Joule	-------
T_2 M_2=1000 kg	v =100 m/s	v'' =99.9 m/s	$\frac{1}{2}(M_2)v^2$ =5000000 Joule	$\frac{1}{2}(M_2+m)v''^2$ =4995005 Joule	$Q_2=\frac{1}{2}M_2\,v^2\{1-\frac{M_2}{(M_2+m)}\}$ = 4995 Joule

5.2 Case-2: When metal-ball of mass (m) thrown back from train T_2 towards Train T_1

The similar mathematical analysis can be obtained except the *initial relative velocity* be v''=99.9 m/s in this case. When calculated in reference to both frames F_1 and F_2, Heat energy released and total energy will be nearly 0.1% decreased from previous obtained results. Velocity of train T_1 decreased by 0.1% and final relative speed comes to approximately 99.8 m/s. In this way after every exchange of mass (m), the released heat energy and relative velocity between trains go on decreasing. Suppose heat energy released in each collision is in radiation form which comes in the category of *'non-inertial energy'* type and which being *invariant* between reference frames so the part of this energy can be send to other frame 'invariantly'. In this way little addition of energy to the trains by its own frames (rest) can makes the relative velocity to be of previous value i.e. v=100 m/s and in this way all process repeats again and again without losing their relative velocity of 100 m/s and heat released per collision remains constant.

5.3 Outcome of above thought experiment

Observer B on train T_2 conclude that since he is in rest, metal ball of mass m=1 kg collide the rest train T_2 with velocity of v=100 m/s and in this perfectly inelastic collision, 4995 joule of total kinetic energy of the metal ball ($\frac{1}{2}m\,v^2$=5000 joule) is converted into heat Q_1 and 5 Joule out of kinetic energy is used to give little velocity to train T_2 (combined with metal ball) of v'=0.1 m/s. In this way 'conservation of energy' perfectly obeys for observer B and he conclude that the heat energy Q_1 released come from kinetic energy of metal ball kept on train T_1.

Observer A on train T_1 conclude that since he is in rest, he through the metal ball of mass of m=1 kg towards train T_2 which collide with train which is moving with velocity of v=100 m/s relative to train T_1. And in this perfectly inelastic collision, 4995 joule of total kinetic energy of the Train T_2 ($\frac{1}{2}M_2\,v^2$=5000000 joule) is converted into heat and the velocity of Train T_2 reduced slightly to 99.9 m/s and kinetic energy remaining =4995005 Joule. In this way 'conservation of energy' perfectly obeys for observer B also and he conclude that the heat energy released come from losing some of kinetic energy of T_2. So both the observer found the energy conservation law follows perfectly from their respective reference frames. Both observer concluded one thing same that after the collision, velocity of train T_2 decreased by v'=0.1 m/s.

VI. ENERGY PARADOX

Each observer find that heat energy released have come from other reference frame (Train). Observer A in train T_1 calculate that this heat energy of 4995 joule come from kinetic energy of moving train T_2 and he is quite right. On the other hand observer B in train T_2 calculate that the heat energy of 4995 joule come from kinetic energy of train T_1 (with metal ball) since he is at rest and having no kinetic energy, this observer is also right. Actually both the observers are right at the same time but common sense will tell that both can't be right at the same time because their (both) statements are contradictory to each other. This phenomenon is impossible to explain using current physics and its understanding will go beyond our common sense.

It is the nature of spacetime field causes things to be relative to each other. Here the condition produces an 'Energy Paradox'. We can use this paradox to design the Perpetual Motion Machine of 1st kind and the feasibility of perpetual motion machines can be explained as per the new physics laws in variable spacetime field through GI theory.

Both observer concluded that velocity of train T_2 is reduced by v'=0.1 m/s. Suppose these 'two parallel trains thought experiment' is enclosed in a isolated system and let observer B give energy equal to

$=\frac{1}{2}(M_2+m)v'^2$ =0.5 x (1000+1) x $(0.1)^2$= **5 Joule** to the train T_2 so that it gains its rest position again. In this way adding mere energy of 5 joule make the relative velocity between the trains again **v**=100 m/s. We can have the same condition again and repeating the exchange of metal ball of mass(m) produce output energy of 4995 joule whereas it takes input energy of only 5 joule per cycle giving **efficiency** of **999 times**.

6.1 Explanation of 'Energy paradox' by Quantum mechanics and Theory of Relativity

We have Noether's theorem for conservation laws and let's see the condition when the energy did not get conserved. Many fundamental physical laws are mathematical consequences of various 'symmetries' of space, time or other aspects of nature. Specially, "Noether's theorem" connects some conservation laws to certain symmetries. For example, conservation of energy is a consequence of the shift symmetry of time (no moment of time is different from any other), while conservation of momentum is a consequence of the symmetry (homogeneity) of space (no place in space is special, or different than any other) [19-22]. So as per Noether's theorem Energy conservation can only be violated if the symmetry of time could be broken anyhow.

The law of Energy conservation is most fundamental and hardly anyone find any phenomena/system where it gets violated. In quantum mechanics at atomic scale, energy conservation gets violated but for an extremely small time interval. It is not conserved for such tiny interval of time but having no use in classical world. Important fact is that energy gets un-conserved which could be proved a clue to make it violated in classic world. The phenomena are explained by *uncertainty principle*. Consider the phenomenon by using Noether's theorem. In plank scale 'energy' and 'time' be in form of 'quanta' or discrete i.e. it is not in continuous form. As we know if time did not remain continuous, time-symmetry will no longer holds. Thus quantum nature of time leads to break up its symmetry which further leads to violation of energy conservation in plank scale only. In this way if we could make time discrete in classical world then we could observe non conservation of energy.

Now making time discrete is next to impossible. Here the general theory of relativity helps to make time discrete. In general as well as special theory of relativity, time is continuous. The special and general theory of relativity tells the rate of time relativistically varies from one reference frame to another. The observer of either frame can feel the time at constant rate and continuous since it always in rest with his own reference frame. But the observer of one reference frame feels the time-rate of another frame to at another constant rate (dilates) and continuous. Now focus the moment when observer left his time ($rate_1$) and suddenly look at another frame's time rate ($rate_2$), here the discontinuity in time arises as shown in fig-13. In this way if we succeed in connecting 'two inertial frame forever' and continue toggling times of both the reference frames, then this would be a system in which time becomes discrete and un-symmetric which finally leads non-conservation of energy. According to the Noether's theorem, in this system either we could create energy out of nothing or destroy the energy completely what is supplied to it. Remember when measured the energy separately in either frame comes out to be completely conserved. This is the situation which creates '**Energy paradox**' similar as twin paradox. The Energy being complex conjugate of time in Noether's theorem so a similar (Energy) paradox also observed when involves (connected) two reference frames.

VII. CONCLUSION

The four laws of inertia proposed in front of the scientific community are most basic and fundamental even than the laws of momentum and energy conservation. The theory of conservation of Energy and momentum in fact are one-third part of the proposed GI theory. Current laws of energy and momentum holds only in a fixed (non-variable) spacetime field whether these proposed four laws are derived in fixed as well as variable spacetime field. The proposed GI theory tries to explain laws of physics in random variable spacetime field. In general, the laws of nature can be explained in three parts:-

a) The first part deals with the laws of nature in a fixed spacetime field for any observer which includes all our current theory of physics in which energy and momentum remains conserved.

b) The second part deals with the increasing field intensity of spacetime for any observer where energy get originated from nothing and the object situated in the field get accelerated its own.

c) The third part deals with the decreasing field intensity of spacetime for any observer where energy get destroyed to nothing and object situated in the field get accelerated its own in opposite direction.

This Paper Explains Several Fundamental Concepts Which Summarize in the Followings Points-

1) The most fundamental constituent of the universe is 'spacetime' field' and it is flexible. The intensity of spacetime gets varied (distorted) by acceleration of any 'masses'. Fundamental laws of physics changes as the intensity of spacetime changes. All the physics law deals only in fixed (non-variable) spacetime field. The current physics does not have any concrete and complete theory (except relativity) which could deals with variable field of spacetime.

2) There are only two fundamental field and forces are in nature, first is **inertia (gravity)** in 'spacetime' field and second is electromagnetic force in 'electromagnetic' field.

3) Relativity is an intrinsic property of spacetime field and probabilistic nature of sub-atomic particle is due to quantum nature of spacetime field at Planck's scale of spacetime.

4) Concept of 'energy' is explains as originated quantity from spacetime field. Three new types of energies are proposed based on relativity.

5) First law and third of inertia explains the origin of inertia as a resistance offered by spacetime field to the mass and origin of gravity as the pressure exerted by gradient spacetime field upon the mass. Spacetime field being the reason behind both inertia and gravity also explains the principle of equivalence (reason behind inertial mass and gravitational mass to be equivalent).

6) Second law of inertia tells how energy can be generated, destroyed or remains conserved in spacetime field. A mechanical experimental setup is proposed for the destruction of energy.

7) Fourth law presents an inverse of first law of inertia which predicted for artificial gravitation.

8) The thought experiment of two parallel trains analytically shows the violation of conservation of Energy inspite its mathematical analysis is done by using only the laws of conservation of energy and momentum. The magic of GI theory is that it explains the concept 'Energy paradox' which generates Energy from nothing even without violating energy conservation law for each observer.

References

[1]. Raman, P. Introduction to Quantum filed theory (Wiley, 1969).
[2]. Peskin, M.E., Schroeder, D.V. An Introduction to Quantum Filed theory (Addison Wesley, 1995).
[3]. Lorentz, H.A., Weyl, Minkowski, H. H. The Principal of relativity (Dover, 1952).
[4]. Higgs, P. "Broken symmetries, massless particles and gauge fields". Physics Letters. **12** (2), 132–133 (1964).
[5]. Duff, M. J. and Liu, J. T. A Spacetime Odyssey: Proceedings of the Inaugural Conference of the Michigan Center for Theoretical Physics. World Scientific Publishing. 86–88 (2003).
[6]. Bergmann, P.G., Introduction to the theory of relativity, preface by Albert Einstein, Englewood cliffs, (Prentice-Hal, 1942).
[7]. Schilip, P. A. Albert Einstein: Philosopher-Scientist. Library of living philosophers, Evanston II. 65-67 (1949).
[8]. Moller, C. On the localization of the energy of a physical system in the general theory of relativity. Annals of physics, 4(1958), PP. 347-371.
[9]. Anderson, J. L. Principles of relativity physics (New York: Academic Press, 1967).
[10]. Chandrashekhar, S. Derivations of Einstein's field Equations. American Journal of physics. 40, 224-234 (1972).
[11]. Pais, A. "Subtle in the Lord ……" .The Science and the life of Albert Einstein (oxford: Clarendon Press, 1982).
[12]. Howard, D., Stachel, J. Einstein and the History of General relativity (Birkhouse, Boston, 1989).
[13]. Clifford, M. Was Einstein right? Putting General Relativity to the Test, (Basic Books/Perseus Group, New York, 1993).
[14]. Thorne, K.S. Black holes & time warps: Einstein's Outrageous Legacy (W.W. Norton, New York, 1994).
[15]. Kox, A. J., Martin, J.K., Schulmann, R. The collected paper of Albert Einstein, (Princeton University Press, 1997).
[16]. Swerdlow, N.M., Levere, T.H. Essays on Galileo and the history and philosophy of science (Toronto: University of Toronto Press. 1999).
[17]. Bevilacqua, F., Matthews, M. "Galileo's Rhetoric of Relativity" Science and Education, Enrico Gianetto. 8(2), 111–120 (2001).
[18]. Dirac, P.A.M. Does conservation of energy held in atomic process?. Nature. 137, 288-289 (1936).
[19]. Dass, T. Conservation laws and symmetries. Physical Review. 150, 1251-1255(1966).
[20]. Trautman, A. Noether equations and conservation laws. Communication in mathematical physics. 6,248-261 (1967).
[21]. Rosen, J. Noether`s theorem in classical field theory. Annals of physics, 69, 349-369 (1972).
[22]. Dan, A. Noether's Theorem in generalized mechanics. Journal of Physic A. 6, 299-305 (1973).