Relativity Without Space-Time – Viraj Fernando

Independent Researcher on The History and Philosophy of Physics - virajfernando03@gmail.com

Introduction: The central thesis of "**Relativity" without Space-Time** is that **Physical Relativity** of phenomena in the real world derives its origin from the ratio pc/E, of the two terms E and pc in the energy-momentum equation, and not by some fictitious union of space and time. With this ratio pc/E as the rudimentary operational concept, **Non-linear Relational Physics,** valid for all velocities 0<v<c is developed (see Note 1). As a historical mishap, Maxwell's equations concerning electric and magnetic forces, that emerge in an interaction, were accidentally derived earlier than the concomitant 'relativistic phenomena', on the flip side of the coin. Upon these phenomena being discovered later, there was an earnest search by Lorentz and others to establish the necessary connection that exists between these and the two forces. Contrariwise, Einstein (following Mach's positivistic philosophy),has found it expedient to dispense with the search of this connection, in order to arbitrarily 'explain away' these phenomena **independently of Maxwell's equations,** as mere kinematic effects. Herein lies the crux of the problem of unintelligibility of the Relativity Theory. This paper revokes Einstein's positivistic manoeuvre to superficially interpret physics, by rejecting the **necessity of giving due recognition to implicit and underlying connections within physical processes**. This paper invokes this essential connection between Maxwell's equations and relativistic phenomena back into physics. A pictorial of view of this connection is shown below.

The amended law of Newton; $\Gamma F = ma$ of relativistic mechanics, is mathematically untenable (see.section 1.6). Physics has come into an impasse without being able to take account of **non-linearity arising in open systems** (except by isolated, *ad hoc* adaptations). There being no closed systems in Nature, and **all systems being open and conjoined to the field** in the real world, it **leaves Physics no option** but to make a relentless effort to discern a method capable of dealing with the inflow and outflow of energy from the field in open systems under **Weyl's principle of conservation of energy** – "The total energy as well as total momentum remains unchanged,: they merely stream from one part of the field to another, and become transformed from field energy and field momentum into kinetic energy and kinetic momentum of matter and *vice-versa*" (1, p. 168). It is only by **abandoning Space-Time Physics** that this goal can be achieved.

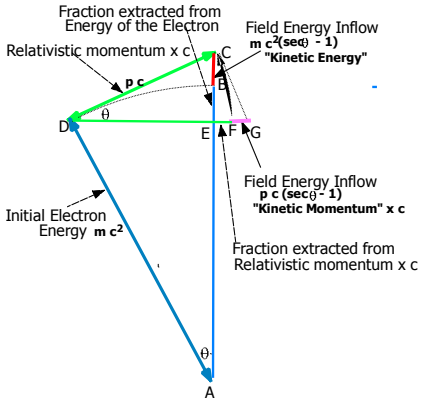


FIG. 1
ALGORITHM OF RELATIVITY OF ENERGY
(Geometric Representation of Energy-Momentum Equation)

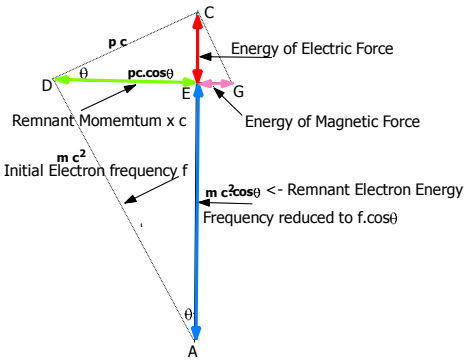


FIG. 2
INTERCONNECTION OF 2 FORCES AND 2 PHENOMENA
System in Motion Consisting of Four Energy Components

The **Algorithm of Relativity of Energy** (Fig 1) based on the ratio $pc/E = \tan\theta$ enables precise measurements of field energy inflow (shown in red Fig.1). Using these measurements, we derive the equations of electric and magnetic forces. And then it establishes the connection between Maxwell's equations and the two phenomena a) 'slowing of internal processes' of a particle and b) momentum reduction (from p to p/Γ), as the two counterpart effects, of generation of the electric and magnetic forces, which underlie Maxwell's equations. Energy represented by $EB = mc^2(1- \cos\theta)$ is transferred to the field, (under Weyl's conservation principle) from the particle's intrinsic energy $AB = mc^2$, to produce the electric force. This causes the particle's frequency to decrease from f to $f.\cos\theta$ (by Planck's law) manifesting as "slowing of internal processes". We establish this by correlating it to the 'time loss' of a GPS clock when in orbit. The above connection being thus established, the space-time approach taken by Special Relativity becomes superfluous. With reference to this Algorithm (Fig. 1), using only the expression for momentum $p = \Gamma mv$, discerned from experiments, (with no other assumptions whatsoever) we derive the **fundamental equation $E = mc^2$**. We also demonstrate how the expression for **'relativistic kinetic energy' $mc^2(\Gamma -1)$** comes to be, and then derive the **classical equation for kinetic energy $\frac{1}{2}mv^2$** from the relativistic formula for the limiting case $\Gamma \to 1$. Do all these mean whether we have stumbled upon a new epoch in Physics by some chance? The epoch of Relativity of Energy, without Space-Time?

1.0 Nonlinear Physics of Interactions of Energy vs. Special Relativity.

It is our view that some of the seemingly insoluble "Problems of Physics" that we confront today have their origins, partly in the errors in the Newtonian Foundation of Physics (see Note 2), and partly due to the disjointed and *ad hoc* approach that has been adopted since the beginning of the 20^{th} century, instead of adopting the **new paradigm** that Maxwell proposed -"**All phenomena depend on variations of energy**"(2, p.72), and following the path outlined by him in his book, 'Matter and Motion' (see the Appendix 1). Unfortunately we have just the outline of his program, since he could not develop the new physics based on this paradigm due to his untimely death within two years of writing this book. Had he lived another 25 years, we would have been spared of the unintelligible theory of relativity and consequently spared us of one whole century of groping in the dark. In its place there would have blossomed a theory, where **every single phenomenon is explained in terms of changes of states quantities of energy** in the course of their interactions, just the same way chemical changes are explained in terms of the interactions of chemical substances. This paper is an initial step in that direction.

1.1 Manifestation of Relativistic Phenomena connected to Motion of a Particle.

Hitherto, the so-called 'relativistic phenomena' have not been properly accounted for, in dynamical (i.e. mass, force, energy) terms, but have rather been 'explained away' by attributing unprovable kinematic propositions. The **particular 'relativistic phenomena'** that we deal with **in this paper** are those that were discerned (**prior** to the formulation of the special theory of relativity) with respect to fast moving (fermion) particles. These phenomena are (a) the requirement of **'relativistic momentum'** Γmv to set a particle in motion with momentum mv. (b) The **slowing down of internal processes** of a particle when set in motion, which is associated with 'time dilation' (c) 'Mass increase' of the particle –(See Note 3): this is not an actual observation, but a **fallacious** proposition made in an attempt to account for the slowing down of internal processes) (d) 'Lorentz transformation', $x' = (x-ut)/(1-u^2/c^2)^{1/2}$ - this is **real,** (see Section 5). And further this will be demonstrated more in full in Appendix 2, as **arising from a separate subsidiary interaction** of energy, whereas the others i.e (a) and (b) above, are the **by-products** of the energy-momentum interaction.

For the reason that when we consider the motion of a **charged** particle, the **connection** between 'relativistic phenomena' a) and b) that occur and the forces that emerge can be made without touching upon the errors in the Newtonian Foundation (see Note 2), we begin this quest with the motion of an electron. We would address the errors in the Newtonian Foundation in detail elsewhere, applying the same holistic approach to the motions of (uncharged) bodies, and thereby unify electromagnetism, mechanics and gravitation.

1.2 The HIdden Connection between Relativistic Phenomena and Forces related to Motion.

We show in this paper that if we consider an electron, 'relativistic phenomena' occur as 'by-products' or as a **consequence of generating the electric and the magnetic forces** when it is set in motion. Although no body casts any doubts about the fact that an electric force emerges when a free electron is set in motion, there has hitherto been no attempt **to account from where the energy is drawn to generate these forces**. Further although both the electric force and the 'slowing down of internal processes' occur side by side when the electron is set in motion, physicists have failed to realize that there is a **direct connection** between them (See Note 4). Similarly they have failed to make the connection between the magnetic force and the reduction of 'relativistic momentum'. In short they have failed to put 'these two forces' and 'those two phenomena' together and to look at all four within a single perspective. When the sources of energy underlying these forces are accounted for as we do in this paper, then how these relativistic phenomena occur becomes as clear as day light. Why this connection has not been recognised is because of obscurantism and diversion of attention that the space-time concepts create in our minds, making us to abort the search for such a connection, by considering it to be superfluous.

1.3 Einstein Dispenses with the Connection for Expediency.

There is a good historical reason for this blatant obscurantism that has come into being about the connection between the two forces and the two relativistic phenomena. In early 20th Century, (around the time the theory of relativity was formulated) it was at first thought that the relativistic phenomena were confined only to electromagnetism, and on the flip side, it was found that Maxwell's equations retained the same form in all inertial reference frames. And the essential feature of these equations is the emergence of the electric force E and the magnetic force H and their relationship H = E.v/c. The most urgent scientific task of the day was considered to be the establishment of **the connection** between the two phenomena and the two forces by the true pioneers like Lorentz. In this respect we find that Einstein, upon following Mach's positivist philosophy (see 3, p.53), had in a 'constructive approach', found a way to **dispense with the necessity of establishing this connection** under the guise of the 'philosophy of space-time'. Here is what Max Born writes: "What he (Poincare) missed was a simple physical – or should we say philosophical – point, which would make the **theory of relativity independent of its derivation from Maxwell's equations**,..... This important step was to come from Einstein. He noticed that **to overcome the difficulties** met in relativistic considerations one had to go back to the fundamental concepts of space and time" (4. p 224). That is, **Einstein's stratagem** had been a) to **abandon the dynamical approach** by cutting off the **umbilical cord** that exists between the two forces and the two relativistic phenomena, and then to deem them to be entirely unrelated matters, and thereby making the necessity of the **search for their connection to be redundant, a**nd then b) to concoct that the two phenomena as mere kinematic effects when observed from a different frame of reference.

1.4 Limited Applicability of Einstein's Relativity Postulate subject to the Lorentz Transformation Interaction.

Out of the two postulates of the special theory of relativity, the invocation of the "relativity postulate", or the "Principle of Relativity" has been necessitated to encapsulate the above two phenomena which arise from energy-momentum interaction into the theory. This postulate states that 'laws of physics' are independent of the (translational) motion of the system". This contention of SRT is correct to the extent that the terms involving 'motion of the system' that enter into the final result, in the form of the Lorentz transformation, manifests only by virtue of a **subsequent subsidiary interaction** which occurs in a later phase. (See Section 5 and Appendix 2 about the subsidiary Lorentz transformation interaction).

SRT does not view that when a particle is set in motion, that **two consecutive interactions occur**, with the preceding one (i.e., energy-momentum interaction) occurring **as if** it is independent of the motion of the system, and the second one (i.e. the Lorentz transformation interaction) coming into action on the heels of the first, to take account of the motion of the system. Since SRT takes only the energy-momentum interaction into account, it denies (through relativity postulate) that there is a dynamic connection between the motion of the system and the motion of the particle which occurs relative to the system.

But factually, (before Special Relativity was formulated) Lorentz found that on the basis of the empirical formulae deduced from data of experiments conducted by Kaufman and Bucherer, Rayleigh and Brace, Trouton and Noble, in relation to **discrete motion of a particle** relative to the system, undeniably manifesting terms indicating the translational motion of the system. Accordingly, Lorentz stated in the opening passage of his 1904 paper: "The problem of determining the influence exerted on electric and optical phenomena by a translation, such as **all systems have in virtue of Earth's annual motion** ....." (5, .p.11),

Since the above discovery of vital importance by Lorentz has been obscured and misinterpreted by the theory of relativity, as some mysterious "co-ordinate transformation" that occurs, we need to lay bare what it really is. The "system" consists of two parts, a) The laboratory where the experiment is carried out (i.e. the lab frame) and b) the particle. These two parts **taken together constitute the system**. The laboratory and the particle both together (i.e. the system) **participate** in the translational motion of the Earth in its orbit. And the **particle's discrete motion** relative to the laboratory frame occurs **over and above this common motion** with the Earth. This **conception of common motion** was the corner stone of physics,

ever since Galileo, until Poincare objected to it (in St Louis Speech in 1904): "The laws of physical phenomena must be the same for a fixed observer and for an observer in rectilinear and uniform motion *so that we have no possibility of perceiving whether or not we are dragged in such a motion".* (www.annales.org/archives/x/Relativity.doc,)6. p4. And Einstein jumped his bandwagon. The original concept was of utmost importance to the Galilean foundation of physics, that it is the concept that Galileo most painstakingly elaborated. Such was its importance to physics, that in the *Dialogue*, Galileo dedicated one whole section (the 'Second Day') consisting of 169 pages to explicate this concept (7, p.106-275). Yet this rich wealth of knowledge so important to physics has been wantonly sacrificed at the altar of positivist expediency for the following reason.

From the energy-momentum equation, it is deemed that when momentum p = Γmv is applied, the particle moves with momentum mv. Accordingly, it is expected ideally (i.e. theoretically) that in time t, the displacement x, of the particle **relative to the lab frame, due to its discrete motion alone,** will be given by x = vt. But in practise, when the actual displacement that occurs in time t is measured relative to the lab frame, it is found that the displacement is x' (which is less than x). When data of Kaufmann's experiments was iterated by Lorentz, he found that the actual displacement corresponds to the empirical formula $x' = (x-ut)/(1-u^2/c^2)^{1/2}$, where u = 30 km/sec (which obviously is the velocity of earth's orbit). This is the undeniable fact what Lorentz statement above points out, **on the basis of experimental evidence**. (This empirical formula has been confirmed by thousands of experiments performed ever since). Just because it had not struck anybody to conceive this **as a result of a second interaction** of energy which follows energy-momentum interaction immediately after, without patiently searching for this dynamic reason, Einstein once again has chosen the easy path to escape from the problem, by providing a kinematic postulate – "co-ordinate transformation" instead. In this way, SRT has shoved the wealth of the results of these experiments (of Kaufman *et al*) under the carpet without attempting to find a dynamic explanation. Instead of explaining how the Lorentz transformation occurs dynamically in terms of an interaction of energy, it pretends that this transformation occurs in the process of conversion of 'co-ordinates' from one inertial system to another (see Note 5).

If we are in search of a consistent **dynamic explanation** for the Lorentz transformation (as we must), then there can be one and only one answer. That is, it is a result of another interaction of energy which occurs on the heels of the energy-momentum interaction. (Yet surprisingly, no one has thought of formulating the **rational answer** to the problem in this manner). We must note that for all experiments conducted on earth (and where else have we human beings conducted experiments?) this second interaction changes the result x = vt to $x' = (x-ut)/(1- u^2/c^2)^{1/2}$ and that in all those results we find that uniquely u = 30 km/sec which is obviously the velocity of earth's orbit.

We shall discuss this second interaction in Section 5 and in detail in Appendix 2.

Let us therefore note that in the process of setting a particle in motion, that it is in the earlier phase that the energy-momentum interaction occurs. And it occurs **as if** it is independent of the motion of the system. Hence when we consider the two relativistic phenomena that we are presently interested in, which are results of the energy-momentum equation *per se*, we can consider these phenomena to be "independent of the motion of the system" and go along with Einstein's postulate in a provisional and a limited sense.

1.5 Failure of Space-Time Mechanics:

SRT draws a blank about how the 'relativistic momentum' Γmv gets reduced to mv in the interaction. Also, it does not address the problem how the **natural processes turn out to be non-linear**, when Newton's laws demand them to be linear (see Note 1). Therefore, in order to take account of the **non-linear relationship** between the applied force and the velocity imparted to a particle, Newton's second law (which is linear in classical physics) has **had to be amended** from F = ma to ΓF = ma to be in a cosmetic 'compliance' with the results of the energy-momentum equation. It is important to note that the very requirement of this amendment implies clearly that **Newton's second law is subordinate to, and derivative of, the**

energy momentum-equation. This would then require us to account for the two 'relativistic phenomena' involving the Γ factor i.e. a) the slowing down of processes ('time dilation'), and b) the reduction of 'relativistic momentum', in dynamic terms **from within the framework of the energy-momentum equation**. Theory of relativity fails to do this.

1.6 The Blunder of Blunders:

As we discussed just above, in order to accommodate the **non-linear character** of the natural processes, in "Relativistic Dynamics", the equation of Newton's second law has been adjusted to $\Gamma F = ma$. Since the force ΓF is defined as the "rate of change of momentum", this means that ΓF should represent

$dp/dt = d/dt[(mv/(1-v^2/c^2)^{1/2}]$ ----------(1) (since $p = \Gamma mv$ and $\Gamma = 1/(1-v^2/c^2)^{1/2}$).

Let us note that it is d/dt(mv) that is equal to ma. Therefore to obtain $\Gamma F = ma$, firstly $\Gamma = 1/(1 - v^2/c^2)^{1/2}$ **needs to be treated as a constant** and pulled **illegitimately** out of the differential operation and consider $dp/dt = \Gamma d/dt(mv)$. How it is possible to consider Γ as a constant, when v is the very variable that is differentiated with respect to time in equation (1) is **beyond any logic**. And further for the resulting equation to be balanced, Γ should be considered as tending to 1. These make the contention of relativistic mechanics that $\Gamma F = ma$ to be **mathematically untenable**. Under these circumstances, Force can no longer be defined as" the rate of change of momentum". This compels us to **search for an alternate method** that can account for motion, starting with intrinsic energy of a particle mc^2, and the applied momentum p.

2.0 The Search for an alternative – Algorithm and Weyl's Principle of Conservation of Energy.

Instead of explaining the two phenomena in relation to the energy-momentum equation, theory of relativity evades this by merely alluding them to be kinematic effects of the 'Principle of Relativity'. Whereas, these phenomena are the by-products of the energy-momentum interaction and therefore they have to be shown as such, and this is what we do in this paper.

The **literal meaning of the word 'Relativity'**, dynamically considered with respect to the energy-momentum equation $E^2 + (pc)^2 = (\Gamma E)^2$ ----------(2), ought therefore convey **the relational nexus that exists between the two interactants**, E and pc in bringing forth these phenomena. Accordingly, it should stand to reason that at its very core, **in a physical sense** 'Relativity' of the phenomena has to have their origin not in space-time but in the ratio of the two interactants, obtained by re-arranging the energy-momentum equation as follows.

$\Gamma^2 = 1 + (pc/E)^2$. ----------(3); If we put $pc/E = \tan\theta$, then we find this expression to be of the same form as

$\sec^2\theta = 1 + \tan^2\theta$ ----------(4) where $\Gamma \equiv \sec\theta$.

This gives us a clue that **Nature uses the Algorithm** as shown in Fig 1 above, **to compute** the component parts out of which the energy required for the generation of the two forces are determined **including the share of energy contribution from the field** towards each force. It is through this Algorithm that **Weyl's Principle of Conservation of Energy** is enforced - "The total energy as well as total momentum remains unchanged: they merely stream from one part of the field to another, and become transformed from field energy and field momentum into kinetic energy and kinetic momentum of matter and *vice-versa*" (1, p. 168).

(Note: This Algorithm is neither a vector diagram nor a pictorial of the actual configuration the way energy is aligned during the interaction. **It is merely a calculating device** employed by Nature. How this Algorithm is discerned through extracting hidden information from the energy-momentum equation is discussed in detail in Part 2 of this paper). See Note 6 for further details.

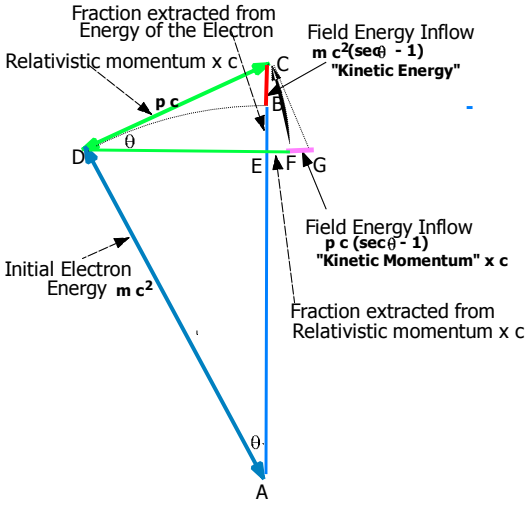


FIG. 1
ALGORITHM OF RELATIVITY OF ENERGY
(Geometric Representation of Energy-Momentum Equation)

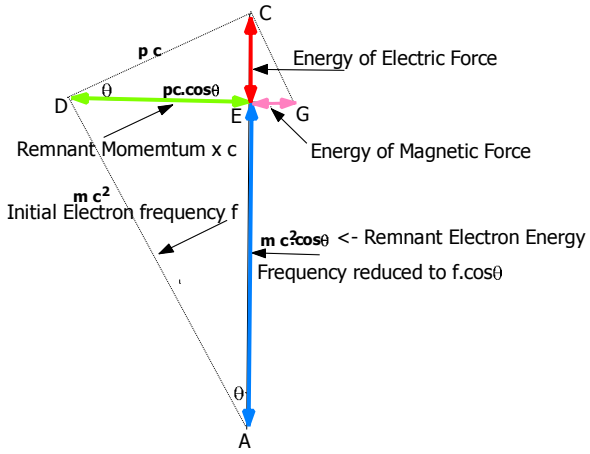


FIG. 2
INTERCONNECTION OF 2 FORCES AND 2 PHENOMENA
System in Motion Consisting of Four Energy Components

2.1 Algorithm and Trigonometric Ratios.

As discussed above, Nature employs a certain Algorithm (Fig. 1) for the execution of the above interaction which results in a) the motion of the electron, b) generation of an electric and a magnetic force and c) the two 'relativistic phenomena' as a consequence. We have discussed in the Part 2 of this paper, **how the energy-momentum equation innately carries the information possessed in this Algorithm**. In the Part 2, we have shown that $\Gamma = (1-v^2/c^2)^{1/2}$ that appears in relativistic expressions, comes to be equal to $\sec\theta$. Since $\Gamma = (1-v^2/c^2)^{1/2}$ is identified with $\sec\theta$ in the algorithm on the one hand and on the other hand since in general $\sec\theta = 1/(1- \sin^2\theta)^{1/2}$, we find that $\sin\theta = v/c$ etc, in the algorithm. **We have also derived the equation $E = mc^2$ from the information in the Algorithm which would confirm the validity of the Algorithm**. All these allow us to re-write the energy-momentum equation (1) in relation to the algorithm. We need to make it clear that the value c in the algorithm is the **'absolute velocity' of nature**, which has been superficially and vulgarly misconstrued as the 'velocity of light' (See Note 7) .

$E^2 + (pc)^2 = (\Gamma E)^2$ ----------(2) as

$(mc^2)^2 + (mvc.\sec\theta)^2 = (mc^2.\sec\theta)^2$ ----------(5)

2.2 Algorithm, Gradient Invariance and Relational Physics:

In the previous section we have presented equation (2) in three other forms as well. A familiarity with these different forms is required to apply this same algorithm to cases where energy represented by AB in the algorithm is not the intrinsic energy of the particle, but some other quantity of energy undergoing a subsidiary interaction, which is nevertheless **patterned after the main interaction**. This understanding of different forms is of particular importance for solving the problem of derivation of the Lorentz transformation equation (See Section 5) .

$(\Gamma E)^2 = E^2 + (pc)^2$ ----------(2) - Equation in the 'concrete- empirical' form.

$\Gamma^{-2} = 1 + (pc/E)^2$. ----------(3) - Equation in the particular – equivalent form.

In this form, the empirical equation (2) is expressed in terms of fractions of E. This makes E to become the 'EQUIVALENT' and pc to be expressed as a fraction of E, hence it becomes the 'RELATIVE'. E still retains its particular identity. As such it is the 'particular-equivalent'.

$\sec^2\theta = 1 + \tan^2\theta$ ----------(4) where $\Gamma \equiv \sec\theta$ - Equation in the abstract- equivalent form.
In this form the identity of E is lost. Hence it becomes a **general equation** applicable to a whole class of phenomena characterised by the ratio $\tan\theta$. That is, although a secondary interaction involves some quantities of energy other than E and pc, (say e_1 and e_2) there is a '**Gradient Invariance**' (not to be confused with V.A.Fok's concept) in this class of interactions. This means that the pattern of the main interaction in (2) is followed as the genetic signature of the secondary interactions such that $e_2/e_1 = \tan\theta$. Thus for the solution of a problem where a 'Gradient Invariance' is evident, (as in the case of the Lorentz Transformation) we can substitute the values, considering e_1 to be the equivalent ($e_1 = 1$) and $e_2 = e_1.\tan\theta$ as the relative, to obtain the solution.

$(e_1.\sec\theta)^2 = e_1^2 + (e_1.\tan\theta)^2$ ----------(5A)

2.3 Algorithm and the Flow of Energy from the Field.
In this part of the paper we shall use this algorithm to demonstrate how the interaction is executed by the Field by employment of relational physics inherent in it. Newton was the first to conceive the nebular notion of there being an implicit controlling mechanism beyond the immediate and explicit order of things. Newton wrote in the concluding paragraph of his General Scholium about there being a subtle spirit: "And now we might add something concerning a certain most **subtle spirit** which **pervades** and **lies hid** in **all gross bodies**; by the **force and action of which spirit** the **particles** of bodies attract one another at near distances, and cohere if contiguous; and electric bodies operate to greater distances, as well repelling as attracting the neighbouring **corpuscles**, and light is emitted, reflected, refracted, inflected, and heats bodies"(8, p.547). However, a considerable body of evidence Newton's 'subtle spirit' of the action of the field, came only with the experiments made with fast moving particles two hundred years later. But by then empiricism and positivism had come to dominate the minds of physicists, and taken their toll by obscuring the path of consistent attempts of realistic correlations beyond what is immediately evident. Beyond the immediate evidence, physics had become a hodgepodge of idealist and fictitious concepts and postulates. This was the playground of Einstein, Bohr and others. For further details about the Action of the Field in the Implicit Order, see Appendix 3.

Simply put, this is what happens. In the algorithm mc^2 represented by AD; and $pc = mvc.\sec\theta$ represented by DC are the elements of the explicit order that enter the interaction. And we find the intrinsic energy of the particle $AD = mc^2$ and the motive energy, $DC = pc = mvc.\sec\theta$ interact as if they are aligned *orthogonally. (For why we call pc as 'motive energy' see Note 8; and about orthogonal alignment of mc^2 and pc see note 6). From this point onwards **the Field takes over** in the implicit order (as we have discussed more in detail in Appendix 3). **Field energy flows in** and augments $AB = mc^2$ to $AC = mc^2.\sec\theta$, and at the same time it also augments $DF = mvc.\sec\theta$ to $DG = mvc.\sec^2\theta$. **The purpose of the field action** is to **alienate the requisite quantities of energy in order create to a force each** out of the above augmented quantities of energy represented by AC and DG. Therefore in this action of the field, $AC = mc^2.\sec\theta$ is transformed into **two parts** $AE = mc^2.\cos\theta$ and $EC = mc^2(\sec\theta - \cos\theta)$. It is this alienated energy EC that is used for the generation of the electric force. Thus the intrinsic energy left remaining in the electron comes to be only $AE = mc^2\cos\theta$. This remnant energy, by Planck's law, reflects as the reduction of the frequency of energy from f to $f.\cos\theta$. Hence this manifests as "slowing down of internal processes". And it is this frequency reduction that has been interpreted as 'time dilation'. Similarly, in this action of the field, $DG = pc.\sec\theta = mvc.\sec^2\theta$ too is transformed into two parts $DE = pc.\cos\theta = mvc$ and $EG = pc(\sec\theta - \cos\theta)$. It is this alienated energy EG that is used for the generation of the magnetic force. Hence the momentum that remains for the motion of the electron is $p.\cos\theta = (mv\sec\theta)\cos\theta = mv$. Thus this will explain that the **two relativistic phenomena** a) slowing down of internal processes b) the reduction of 'relativistic momentum' to 'classical momentum' are **mere consequences of the generation of the two forces** when a particle is in motion (and that they are not kinematic illusions of an observer located in a different frame of reference as it has been proclaimed in the theory of relativity).

3.0 Proof of Validity of the Algorithm:

In Fig. 2 we have already demonstrated the connection between, the energy underlying the electric and magnetic forces and the two relativistic phenomena with reference to the Algorithm. In addition we now further establish the validity of the Algorithm by the following derivations with reference to it.

3.1 Derivation of $E = mc^2$, from Information carried within the Algorithm.

We note that from the analysis of data of experiments, it has been discerned that the empirical formula for Γ is given by:
$\Gamma = 1/(1- v^2/c^2)^{1/2}$
Thus from the identity we made in equation (4) above that $\Gamma \equiv \sec\theta$; we have $\sec\theta = 1/(1- v^2/c^2)^{1/2}$.
And since $\sec\theta = 1/(1- \sin^2\theta)^{1/2}$ also, we identify $v/c = \sin\theta$.

We also know from experiments that for a particle of mass m to be set in motion with momentum mv, we need to apply momentum $p = \Gamma mv = mv.\sec\theta$ (i.e. 'relativistic momentum').
Reference Fig. 1, $DC = mvc.\sec\theta$ and $AC = \Gamma E = E.\sec\theta$.
We find that $DC = AC\sin\theta$
That is, $mvc.\sec\theta = E\sec\theta.\ \sin\theta$
$mvc = E.v/c$ (since $\sin\theta = v/c$)

Hence $E = mc^2$. QED.

3.2 Demonstration of the formula "Relativistic KE" = $mc^2(\Gamma-1)$ and Derivation of the Classical formula ½ mv^2 from the Algorithm

Another way we can prove the validity of the Algorithm is its precise representation of kinetic energy and the demonstration of the relationship between the relativistic and classical expressions of it. Presently 'relativistic kinetic energy' is represented by K.E. = $mc^2(\Gamma -1)$ and at low velocities when $\Gamma \to 1$, this expression changes to $\frac{1}{2}mv^2$. But the classical expression has not hitherto been obtained in relation to the 'relativistic' expression.

Firstly, with respect to the algorithm (Fig. 1), when $AC = \Gamma mc^2$ and $AB = mc^2$, kinetic energy is given by AC – AB = CB = $mc^2(\Gamma-1)$. So we can easily visualize the relationship that kinetic energy (i.e. the field energy that flows in during the interaction) has, to the intrinsic energy of the particle mc^2 and the motive energy pc, with respect to the equation (2)

$\Gamma^2 = 1 + (pc/E)^2$. ----------(2) re-arranging the equation, and substituting $E = mc^2$ and $p = \Gamma mv$, we have
$(\Gamma^2 -1)\, mc^2 = (\Gamma mvc)^2/mc^2$
$(\Gamma -1)(\Gamma +1)\, mc^2 = \Gamma mv^2$
$(\Gamma- 1)mc^2 = \Gamma mv^2 /(\Gamma+1)$

When $v << c$, since $\Gamma \to 1$, $\Gamma/(\Gamma + 1) \to ½$.
Therefore under this limiting case of $v << c$, we have that
$(\Gamma- 1)mc^2 \to ½\, mv^2$ QED.

3.3 Why a Fermion Particle Cannot Reach the Velocity c.

Ref. Fig. 1. for a fermion particle to reach the velocity c, its net motive energy DE will have to be equal to mcc (instead of mvc). This means that DE will be perpendicular to AB at A with E coinciding with A. Then AE = 0. That is the fermion particle has to part with all its intrinsic energy for the creation of the centrifugal force (electric force in the case of the electron), and as a consequence the particle has no intrinsic energy left for its own existence. Also the algorithm breaks down at this

point, since at this point the tangent DC becomes parallel to AB, which means an infinite quantity of 'relativistic momentum' will be required to set the particle in motion.

3.4 Derivation of the Electric and Magnetic Forces by the Application of the Algorithm

We derive here the exact equations for the electric force E and the magnetic force H in their relationship H = E.v/c, It is the energy of the two quanta (i.e., EC and EG) that generate the electric and the magnetic forces respectively, when the electron is in motion. **This will demonstrate beyond doubt** that these 'relativistic phenomena' are not mere kinematic illusions, but real occurrences due to changes of energy taking place in one part of the system, under Weyl's principle of conservation of energy, in the process of generating and equipping the system with forces to create the other part of the system, as shown in figure 2. Ref Fig 1, in order to produce the quantum of energy EC (for the electric force) the fraction indicated by EB = $mc^2(1-\cos\theta)$ is extracted from the electron's intrinsic energy mc^2 and the fraction indicated as EF = $pc(1-\cos\theta)$ extracted from the motive energy pc applied. These extractions and transfer of fractions of energy cause the two relativistic phenomena under investigation.

3.5 **Fractional Charges of Sub-Elementary Particles.**

In the process of deriving the equations for the electric and magnetic force it becomes evident that we find the need to **challenge the paradigm that charges can exist only as integral multiples of a unit charge**, by contending that aliquot parts of a unit charge (i.e. fractional charges) are possible under certain circumstances. It is true that when we consider elementary particles, we find that they can carry only unit charges. But when we consider sub-particles within these elementary particle such as quarks, they are found to consist of fractional charges, which the following extract (7, p. 1) will show. http://fqxi.org/data/essay-contest-files/Rowlands_PRfractionalcharge_1.pdf

> In order to explain the structures of the baryons and mesons then known, the originators of the quark theory, Murray Gell-Mann and George Zweig, assumed that the up quark had an electric charge of 2*e* / 3, where *e* is the fundamental electronic charge, while the down quark had a charge of –*e* / 3.1-4 Subsequent discoveries showed that this pattern was repeated in the two further generations for the charm / strange and top / bottom quarks. Antiquarks were assumed to have the same electric charges with reversed sign. The phenomenology of quantum electrodynamics (QED) has shown over many experiments that quarks do behave as though constituted in exactly this way, with interactions between charges with fractional values of *e*. The three quarks could also be considered to contribute equally to the unit *baryon number*, *B* = 1, which indicated the presence of a source of the strong interaction and which is assumed to be identical for all baryons, however constituted.

	Blue	**Green**	**Red**
Up	2*e*/3	2*e*/3	2*e*/3
	B/3	*B*/3	*B*/3
Down	–*e*/3	–*e*/3	–*e*/3
	B/3	*B*/3	*B*/3

In the case of the quarks, it appears that the fractional charges are produced in pairs such as +e/3 and –e/3. However, in the case of a moving electron, what is even more striking is that there is no pairing involved in the production of fractional charges. In the case of an electron we find that if we consider its charge when it is stationary as the unit charge q; when it is in motion, it loses a part of its charge q to become a fraction of it (q.cosθ), however at the same time two other parts also appear which are also of a fractional nature. And what is more the sum of these 3 fractions turns out to be greater than q as we see from the following. From the charge to mass ratio of an electron, let the charge of the stationary electron be q (unit charge) when its intrinsic energy is mc^2. It is on the basis of the above findings about a moving electron that we are able to derive the equations of the electric and magnetic forces. We contend that the same ratio of mass to charge holds for fractions of energy mc^2 as well. Thus in Fig. 1, when the charge that represents the energy AB = mc^2 is q (unit charge), the charge that is representative of the energy AE = $mc^2.\cos\theta$ is $q_1 = q.\cos\theta$. The charge that represents the energy of the quantum EC = $mc^2.\sin\theta.\tan\theta$ is $q_2 = q\ \sin\theta.\tan\theta$. And the charge that represents the energy of the quantum EG = $pc.\sin\theta\tan\theta$ is $q_3 = q\sin\theta.\tan^2\theta$, (since $pc = mc^2\tan\theta$).

3.6 The Proof that the Quantum of Energy represented by EC is instrumental in generating the Electric Force.

Ref. Fig 1, the electric force F_E is generated by the interaction of the charge q_1 of AE and the charge q_2 of EC.

$F_E = q_1.q_2/4\pi r^2 \varepsilon_0 = (q.\cos\theta).(q\sin\theta\tan\theta)/4\pi r^2\varepsilon_0$

$= q^2\sin^2\theta/4\pi r^2 \varepsilon_0 =$ **$(q^2v^2/c^2)/ 4\pi r^2 \varepsilon_0$** (since $\sin\theta = v/c$) QED

3.7 The Proof that the Quantum of Energy represented by EG is instrumental in generating the Magnetic Force.

Ref. Fig. 1, the magnetic force F_M is generated by the interaction of the charge q_1 of AE and the charge q_3 of EG.

$F_M = q_1.q_3/4\pi r^2 \varepsilon_0 = (q.\cos\theta).(q\sin\theta\tan^2\theta)/4\pi r^2\varepsilon_0$

$= q^2\sin^2\theta.\tan\theta /4\pi r^2 \varepsilon_0 = q^2\sin^3\theta.\sec\theta /4\pi r^2 \varepsilon_0$

$= (q^2 v^3/c^3).\sec\theta/4\pi r^2 \varepsilon_0$ and since $\varepsilon_0 = 1/\mu_0 c^2$

$F_M = (q^2 v^2) (v/c)).\sec\theta.\ \mu/4\pi r^2$

For low values of v , $\sec\theta \approx 1$

$F_M \approx (q^2 v^2) (v/c)).\mu/4\pi r^2$

Hence $F_M \approx F_E.v/c$ (or $H = E.v/c$) QED.

We invite the reader to compare the above derivations with the following derivation of the magnetic force http://physics.weber.edu/schroeder/mrr/MRRtalk.html , (10, p.1) attributed to the Nobel laureate Purcell, using "length contraction". The reader may note that in the latter approach both the electric force and the magnetic force cannot be derived 'under the same umbrella', nor can their interconnection demonstrated. This will establish the unique superiority of our method, over Purcell's method using 'length contraction'.

4. What GPS Clocks Tell Us About Relativity.

4.1 The Connection Between the Motive Energy and the Magnetic Force (and Spin).

We can best discuss this topic by considering how a Caesium Atomic Clock works (See Appendix 4). It also has the advantage because this information of the atomic clocks can then be used to discuss slowing down of processes when a particle is in motion. (Gravitational time change will be discussed in its proper place in Part 3 of this paper).

How a Caesium atomic clock works, is as follows. (See Appendix 4 for further details). The outermost electron orbital in an atom can have one of two states. The difference of the two frequencies of the two states in a Caesium atom correspond to waves of frequency of 9192631770 cycles per second. The actual clock is the quartz crystal oscillator. The oscillator is set to work at the same frequency 9192631770 cps as above. As long as it oscillates at this frequency the oscillator keeps accurate time, by giving out a pulse exactly every second whenever it has completed the above number of cycles. But the oscillator (if left to run spontaneously) unpredictably changes frequency and then the accuracy of time keeping drops.

A strategy is therefore required to find a way to constantly adjust the frequency of the oscillator back to the correct level to maintain the accuracy of the clock. So firstly, the oscillator is made to control a source of radio waves directed at the atoms, at whatever frequency the oscillator oscillates at any given moment. If the source emits waves of the frequency 9192631770 cps, then and only then will the lower state electrons jump to the higher state. Another important feature of the arrangement is that the higher state electrons are constantly removed by a magnetic detector to have more atoms with lower state electrons always available in abundance at one end of the beam tube. Then the radio waves are directed towards the electrons which are kept at the lower state. However, they will jump to the higher state only if the wave frequency is exactly 9192631770 cps. If the oscillator frequency drifts, then the radio waves are of a wrong frequency, and consequently, the rate of conversion from the lower to higher state drops. A counter at the other end of the beam tube detects the rate of conversion, by counting the number of electrons in the higher and lower states. If the rate of conversion from lower to higher state is found to have dropped, this means that the oscillator has drifted to a different frequency. Once this detection is made, an automatic control system kicks in to fine tune the frequency of the oscillator, until the

maximum number atoms with higher state electrons is reached (at the other end of the beam tube). This result becomes possible only if the oscillator frequency has been re-adjusted to 9192631770 cycles per second by the control system. This way the oscillator frequency is fine tuned incessantly and made to keep accurate time.

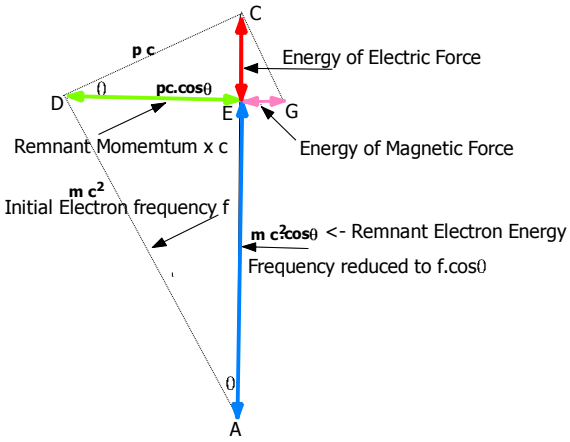


FIG. 3
INTERCONNECTION OF 2 FORCES AND 2 PHENOMENA
Electron Orbit at Higher Energy State

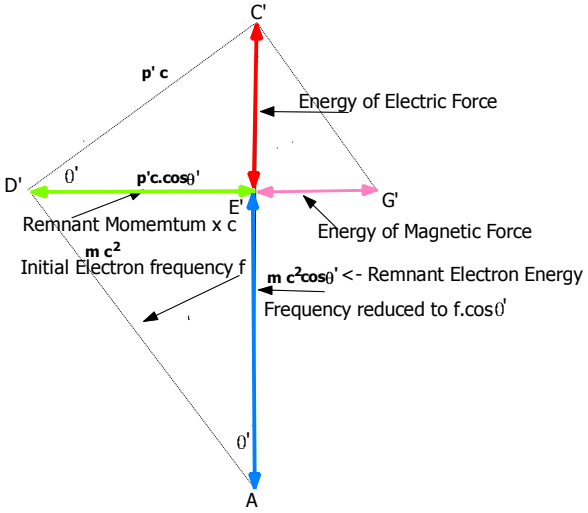


FIG. 4
INTERCONNECTION OF 2 FORCES AND 2 PHENOMENA
Electron Orbit at Lower Energy State

We can now explain some of the matters discussed above. One question is how can the magnetic detector distinguish between high state and low state electrons? This is where our algorithm becomes helpful. The higher state electrons orbit at a slightly outer position from the nucleus than the lower state ones. This means that the velocity of orbit of a higher state electron is slightly lower than that of a lower state one. Thus Fig.3 represents the algorithm for a higher state electron and Fig. 4 that for a lower state electron. The corresponding motive energy (i.e. momentum x c) is DE for the higher state, and D'E' is for the other, where D'E' > DE. The same is true for the energy of the magnetic force where E'G' > EG. Because of this difference in the magnetic forces, the magnetic detectors can detect the lower state electrons from the higher state electrons. (See Note 8 for why we refer to pc as 'Motive energy').

Next thing of interest is the spin of the electron. The electron acquires spin due to the magnetic force that is generated, which is the same as the Biot-Savart force H = E.v/c, which is a rotary force.

We can also see that the higher state electron has a greater quantity of intrinsic energy remaining represented by AE = $mc^2.\cos\theta$ than the lower state electron whose intrinsic energy level is by AE' = $mc^2.\cos\theta'$. We can now see that the radio waves of the frequency 9192631770 cps must consist of quanta of energy $h\nu$ such that, $h\nu = mc^2(\cos\theta - \cos\theta')$. When such a quantum impacts on an electron in the lower state it absorbs the quantum and jumps to the higher state, and then it acquires the appropriate motive energy (from the field) to orbit at that state. This also means that the frequency f_L of the electron at the lower state, which is orbiting faster, is less than frequency f_H at the higher state such that $f_H - f_L$ = 9192631770 cps. This also shows that the internal processes slow down when a particle is in motion, faster the orbital speed, slower the internal processes become. We can quantitatively substantiate our position concerning the slowing down of internal processes due to diminution of intrinsic energy in terms of our the algorithm, by considering the time delay due to motion of a GPS clock in orbit.

4.2 Time Delay of a GPS Atomic Clock Due to Orbital Motion.

(In the atomic clock technology the frequency change reflects directly as the time delay (11) -

Reference Fig. 1, we may consider that upon reaching the altitude of the orbit radius R = 26,561.75 km, at the instant just before acquiring the orbital motion, the intrinsic energy of an electron in a caesium atom in the GPS clock is AB = $h\nu$.

When it has acquired orbital motion at velocity V, the fraction EB = $h\nu(1-\cos\theta)$ of the intrinsic energy gets extracted to combine with the kinetic energy BC = $h\nu(\sec\theta-1)$ to provide the energy for the electric force.

Let $\Delta E = h\nu(1 -\cos\theta) = h.\ \Delta\nu$

Hence as a consequence of the extraction of the fraction EB (for the production of the electric force as we discussed above), there occurs a reduction $\Delta\nu = [\nu(1 - \cos\theta)]$ in the frequency in direct proportion to the lost energy ΔE.
$\Delta\nu = [\nu(1 - \cos\theta)]$
Hence $\Delta\nu/\nu = (1-\cos\theta)$

For this evaluation, in order that we can compare the results we obtain from our theory meaningfully with those which are observed and are in practical use in GPS technology, we use the same data as Parkinson (12, p.38) :
GM = 3.986004418 x10^{14}, R_O (semi-major axis) = 26561.75 km, c= 2.99792458 x10^8

From the above we get the velocity of orbit of the GPS satellite as V = 3.873887909 km/sec
And since $\sin\theta = V/c$ knowing the value of $\sin\theta$, we get the value of $\cos\theta$, hence,

$\Delta\nu/\nu = (1 – \cos\theta)$ **= 8.348521873813297** x 10^{-11} per second

Hence time delay per day = $\Delta\nu/\nu$ x 86400 = **7213.12289897** nanoseconds per day.

We may note that the relativistic formula for time dilation given by $\Delta t = t(\Gamma-1)$

whereby the fraction would be $\Delta t/t = (\Gamma -1) = [1/(1-V^2/c^2)^{1/2} -1)$. = 8.348521873813297 x 10^{-11}, which is the exact **numerical result** as we got from our method, though from an entirely different formula. However, we need to carefully note that this coincidence of values will not happen if the earth had a mass say 1000 times greater but with the same radius, or if the atomic clock is placed in a spaceship moving at a near light velocity (which we discuss in sec 4.1). Then the velocity being much greater and there would occur a deviation between the value obtained from relativistic formula and ours. Hence the two theories (i.e. our theory and relativity theory) **cannot be considered equivalent**. Ironically SRT gets the result correct in the case of a GPS clock, because $(\Gamma-1) \approx (1-\cos\theta)$ for the **limiting case v<<c, for which case SRT does not apply**. But for the **case v-> c, i.e near light velocities** for which SRT is custom made, $(\Gamma -1) >> (1-\cos\theta)$ and **SRT cannot deliver the results**. We shall demonstrate this discrepancy in results of SRT below in relation to a fast moving spaceship.

In order to decide between the two theories, one has to take into consideration what happens to the difference in the energy levels of the two electron orbits. By Planck's law the frequency of the electron at a given orbit (the higher state being slightly distant from the nucleus than the other) is determined by its energy level. Let the frequency at the higher state be f_H and that at the lower state be f_L. For an atomic clock in an observatory on earth, $f_H – f_L$ = 9192631770 cps. The electron's intrinsic energy at the higher energy level is E_H such that $E_H = hf_H$ and that at the lower energy level is E_L such that $E_L = hf_L$

According to our theory, when atomic clock is in orbit, the electron's intrinsic energy at both levels will get scaled down due to motion, by the same factor $\cos\theta$. So our prediction is that the frequency difference (between the two levels) when in orbit will decrease (due to motion) by the factor $(1-\cos\theta)$.

We have already calculated above; the value of (1- cosθ) = 8.348521873813297 X 10^{-11}. Hence the **difference in the frequency difference** between the two states (when in orbit) has to be =(f_H –f_L)(1- cosθ) = 9192631770 .(1-cosθ) = 0.76744905085 cps, (Note this reduction in the frequency difference is what causes the delay of 7213 ns per day).

Hence the frequency difference between the two states of the electron orbit becomes = 9192631769.23 cps when the clock is in orbit. However, we need to note that actually there **also** occurs an **increase of frequency** by the factor 5.2837803112 x 10^{-10} due to **the difference in the gravitational potentials due to altitude change.** Hence the differences of frequencies (f_H – f_L) at the two states also undergo proportionate increases due to gravitation under the principle of superposition given by:

(f_H –f_L) x 5.2837803112 x 10^{-10} =9192631770 x 5.2837803112 x 10^{-10} = 4.85718467544 cps.

(Note: In the above calculation we have left out two more very minute corrections, which are also categorised under 'relativistic corrections'. Ashby (13, p. 11) has included the two terms, 1.208 x10^{-12} and 3.764 x 10^{-13} which are due to "the quadrupole potential", and a "centripetal term due to the earth's rotation" respectively, in calculating the "effective potential" at the equator).

Hence the crystal oscillator frequency will have to be adjusted to (9192631770 - 0.76744905085 + 4.85718467544) = 9192631774 cps (approx) to read one second for the clock in orbit to keep the same time as a clock on Earth which reads one second in every 9192631770 cycles.

The above prediction from our theory can easily be verified by checking on current practice by the GPS engineers, whether or not they adjust the GPS clock oscillator to read 9192631774 cps to a second (for 'relativistic corrections'). Also whether or not the **radio waves** that are emitted by the source directed at the caesium atoms in the beam tube have to have the frequency 9192631774 cps, when in orbit, to keep the correct time (instead of 9192631770 for clocks on earth).

Although these are called "relativistic corrections" in GPS technology, this is a misnomer. This is because special relativity cannot account for the above frequency change due to motion by the application of Planck's law, since it has already given another 'explanation' – that is, that time dilation occurs by virtue of the "Principle of Relativity" which is not an explanation at all, but a mere declaration to stay clearly away from any application of the Planck's law (see Note 3). They do this because they have to circumvent the paradoxical situation they fall into, if time dilation is to be related with the 'total energy' ΓE of the electron. This is because SRT holds that when the electron is in motion, kinetic energy gets added to its rest energy and the 'total energy' increases to ΓE. Since it does not recognise that this 'total energy' AC splits up immediately into two parts AE + EC as we have discussed above, in accordance with SRT's position by Planck's law, the frequency must increase from f to Γf. Hence this increase of energy must cause the time unit to 'contract' from t to t/Γ (and not dilate from t to Γt) which is in direct contradiction with what is observed.

We note that SRT considers time to dilate due to motion. So let the amount by which time dilates be Δt. This dilation factor Δt = t' – t = t(Γ -1). Hence the rate of dilation is Δt/t = (Γ -1). In the case of the GPS clock, (Γ -1) x 86400 amounted to the time loss per day = 7213 ns, exactly the same as from Δt/t = (1-cosθ) in our theory. However, when we consider how the caesium atomic clock works, for SRT's contention of (Γ -1) to be correct, we find that the change of frequency difference Δf between the two states of electron orbits, that occurs (due to motion) when in orbit must be given by Δf = (Γ-1)f. So that the new frequency difference is given by 9192631770 [1 –(Γ-1)] = 9192631770(2 - Γ). This is how we can get the correct answer of 9192631769.23 cps as the frequency difference if we go by SRT's contentions. And indeed, SRT's formula

9192631770(2 - Γ) gives the correct numerical answer **in this particular case**. Thus if SRT is correct, this formula should be **applicable generally** so that the equation,

new frequency difference = original frequency difference (2 -Γ)

should work for all cases 0<v<c. And most of all, since SRT is claimed to be most accurate for cases where v - > c, it should work for a case of an atomic clock placed inside a spaceship moving at a near light velocity.

Note by our theory, the formula is: new frequency difference = (original frequency difference)/Γ (where $1/\Gamma = \cos\theta$)

4. 3 Atomic Clock inside a Spacecraft Moving at the same Velocity 0.9c as a Cosmic Ray.

Let the velocity of the spaceship be 0.9c. Then Γ = 2.294. We know that the original frequency difference between the two states of electron orbits in a caesium atom is 9192631770 cps (when atomic clock is on earth).

Hence when the atomic clock is on the spaceship new frequency difference = original frequency difference (2 -Γ)
= 9192631770 (2 – 2.294) = - 2702633740 cps We get a negative result which is impossible and absurd.

By our theory: new frequency difference = (original frequency difference)/Γ) = 9192631770 / 2.294 = 4007250118.

4.4 Atomic Clock Inside the Spacecraft and with a New Time Unit.

Let us now imagine that the time unit (instead of one second) is considered to be defined by the disintegration time of a muon on earth = 2.2 μs and the crystal oscillator is set to send out a pulse, in every 2.2 μs corresponding to the number of cycles given by: 9192631770 cycles x 2.2 x 10^{-6} μs = 20223.78 cycles per 2.2μs). Hence it sends out a pulse every 2.2 μs. When the clock is placed inside the moving spaceship, the frequency difference (between the two states of electron orbits) will become 8815.95 cycles per 2.2μs (given by 20223.78/Γ). And because the pulse signal has been set to be sent out once every 20223.78 cycles the time between pulse signals in the spaceship will be (20223.78/8815.95) x 2.2 μs = 5.047 μs of the earth's clock. This result will be confirmed below by the disintegration time of a muon in a cosmic ray.

4.5 Wilful Ignorance Required to Use SRT as a Calculation Tool.

When we try to apply SRT's position consistently for all cases 0 < v < c, (though we found our theory and SRT gives identical results for v << c) we find that SRT's result for v -> c to be paradoxical. This paradoxical situation requires SRT exponents to artfully dodge the issue by a mere statement that **an apparent time change** occurs due to the "Principle of Relativity". According to this principle, an observer is not supposed to know or find out "how fast he is moving" (i.e whether his frame of reference is moving or not) by direct observation or by comparing any changes in the physical processes happening on his own frame. In this regard Einstein wrote: "...Judged from the standpoint of such an observer, everything would have to happen according to the same laws as for an observer who, relative to the earth, was at rest. For how, otherwise, should the first observer know, i.e. be able to determine, that he is in a state of fast motion?" (3, p. 53). According to SRT, the only thing that happens is that the observer's time runs slowly, about which he is completely unaware of and this time slow down appears to the observer in the rest frame. It is only a kinematic illusion and **no physical changes are involved** – 'everything would have to happen according to the same laws'. Let us bear in mind that this is the basic position of SRT.

However, on the contrary we know from our previous experience with the GPS clock, that the correction to be made in the spaceship for the time delay is to adjust the crystal oscillator to the frequency of 8815.95 cycles per 2.2 μs and to set the pulse signal to be made at every 8815.95 cycles. We know this machinery. All this knowledge and the insights that come with it, **have to be completely ignored for the use of SRT** as a methodology, as we can see from below.

In this respect, for the sake of upholding theory of relativity for using it as a calculational tool , even leading physicists such as Feynman of stellar fame, have resorted to deliberate obscurantism, or befogging what is already known. For instance Feynman writes: “One of these clocks is taken into a spaceship, along with the first kind.

> (Note: In terms of our above example the two clocks are: one clock sending a pulse every 20223 cycles per 2.2μs just the same as the clock on earth, and the other clock is the one adjusted to send out a pulse every 8815 cycles. So let us imagine these are the clocks referred to in the following discussion by Feynman).

Feynman continues: “Perhaps ***this*** clock (i.e. the one adjusted to a pulse per 8815 cycles) will not run slower, but will continue to keep the same time as its stationary counterpart (on earth), thus disagree with the other moving clock. Ah no, if **that should happen**, the man in the ship could use this mismatch between his two clocks to determine the speed of the ship, **which we have been supposing is impossible**. ***We need not know anything about the machinery* of the new clock that might cause the effect –** we simply know that whatever the reason, **it will appear to run slow** (for an observer on earth), just like the first one. ..... Now if the moving clocks run slower, and if no way of measuring time gives anything but a slower rate, we shall just have to say, in a certain sense, ***time itself* appears to be slower in a spaceship”.** (14, 15-4)

Note that Feynman Published his “Lectures in Physics” in 1965 , atomic clocks were invented and adjustments for velocity and altitude in principle were known by then. Still he has resorted to spread the SRT mythology, to enable the use of SRT’s methodology as a calculation tool. And to use it one has to become **wilfully ignorant** of whatever physical changes that occur when the clock is in motion, and pretend that no physical changes have occurred.

What is Feynman’s message here? When it comes to application of special relativity as a calculation tool, brainwash yourself of what you know about the frequency changes and adjustments. Just condition your mind to blindly assume that it is impossible for an observer in the spaceship to get to know of any changes of the physical processes. **Just believe** that without any changes occurring in the physical processes in the spaceship, **the time itself appears to the observer on earth to be slower in the spaceship**.

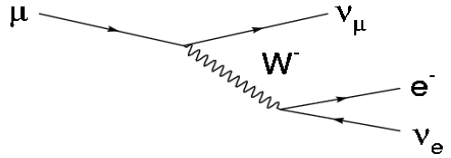
Thus despite having some understanding of the physical processes, Feynman deliberately suppresses this knowledge and keeps the enigma of the ‘Principle of relativity” going, for the sake of the use of SRT as a calculating tool – this will become clear from what Feynman has stated when discussing the time dilation of a fast moving muon.

> "We do not know why the meson disintegrates or what its machinery is, but we do know its behaviour satisfies the principle of relativity. That is the utility of principle of relativity - it permits us to make predictions, even about things that otherwise we do not know much about. For example, before we have any idea at all about what makes the meson disintegrate, we can still predict that when it is moving at nine-tenths of the speed of light, the **apparent length of time** that it last is (increased by the gamma-factor); and our prediction works -that is the good thing about it" (14, 15-4).

However, is this not the same Richard Feynman who tells us above "We do not know why the meson disintegrates or what its machinery is ... before we have any idea of what makes the meson disintegrate”, who is also the **author of the famous Feynman diagram of Muon decay**? Does not this diagram give us an idea of what makes the meson disintegrate? And what the “machinery” of disintegration of the muon is? So why cannot we attempt to explain the time delay of disintegration is, when the muon is in motion in terms of this diagram? When it comes to special relativity Feyman plays Mr. Hyde denying the connection between phenomena and underlying physical changes (they are only kinematic illusions), and when it comes to quantum mechanics he plays Dr Jekyll explaining phenomena in terms physical change. This is not to denigrate Feynman as such, but to highlight the pitiful schizophrenia that space-time physics is trapped in and finds itself

powerless to dispel presently. That being said, let us try to find the answer to the time delay in relation to this Feynman diagram.

4.5 Delay in the Disintegration Time of a Muon in a Cosmic Ray in terms of the Feynman Diagram.



It is our view that a muon has energy 105.7 MeV when it comes into existence, with an electron trapped within it. (Hence the negative charge in the μ^-). Due to the high mass to charge ratio of the muon, it is highly unstable, and seeks stability by attaining the configuration of an electron of energy 0.511Mev of the correct mass to charge ratio, by separating the electron from the rest of the energy . But for the electron to free itself from entrapment within the meson, it needs to create a repulsive force to overwhelm the attractive force that keeps it trapped within. Thus during its half life period, the muon **draws in energy from the field** to build up a reserve of energy to produce the necessary repulsive force. During this **period of build up**, the field energy drawn in is benign and passive. But when the build up has reached the level of 80 GeV, a qualitative change occurs and transforms itself into a W^- boson. Thus it is this 80 GeV quantum of energy in this unstable state (with a negative charge within it) is what we call a "W^- boson".

During the time the muon draws in energy from the field, it is in a relatively stable state, due to the fact that the field energy has not yet taken the form a repulsive force. However when the field energy drawn reaches the threshold of 80 GeV, it turns into a repulsive force. This repulsive force overwhelms the attraction which holds the electron within the muon. And consequently the new formation (i.e. W^- Boson) disintegrates, releasing the electron. In order to release the electron, the W^- boson has to burst asunder and it does burst asunder.

It seems obvious, that a Muon (when at rest on earth), by assimilating energy from the field, transforms itself into a muon neutrino and a W^- boson (say) in N cycles of its intrinsic energy E. The W^- boson then instantaneously disintegrates into an electron and an electron neutrino (and releases the balance energy back into the field). Thus when a muon is in a laboratory on Earth, its intrinsic energy being E and frequency being f, and it takes N cycles to accumulate the requisite quantity of field energy to reach the threshold of transformation into a W^- boson. When the frequency is f, it takes 2.2 μs to perform N cycles. When in motion in a cosmic ray moving at 0.9c, in order to reach the same threshold of N cycles it takes a longer time because its intrinsic energy has been cleaved, with one part EB = $E(1 - 1/\Gamma)$ being usurped for the formation of the electric force (that appears when a charged particle is in motion as we discussed in sections 3.4-6), and it is only the other part of intrinsic energy AE = E/Γ that remains functional. And frequency that corresponds to this functional part AE is $f' = f/\Gamma$. With this frequency f/Γ, it takes a time Γt to perform N cycles and to reach the threshold level of 80 GeV of accumulated field energy. Thus it takes a time $t' = \Gamma t$ to produce the W^- boson and disintegrate itself, when the muon is in motion.

$t' = \Gamma t$ where $\Gamma = 1/(1 - v^2/c^2)^{1/2}$, $t = 2.2 \times 10^6$ sec and $v = 0.9c$.
Hence $t' = 5.047 \times 10^{-6}$ sec.

The big question is why did not Feynman give us an answer on the above lines, when he easily could have, but choose to instruct us to train our minds not to think in terms of the machinery (i.e. how the internal process of a muon works as he has laid out in his diagram), but only blindly to accept the 'principle of relativity' as the gospel truth and hence to believe that 'time by itself' subjects itself to dilation?

The answer is for a positivist there is no underlying truth; reality is ascribed only to what is given in direct observation; the rest of the content of physical theories is treated as constructions linking up observation data rather than as presentation of reality (15, p. 106). So when it comes to linking up observation data, there are many techniques and fictitious constructions that can lead to the same result - Einstein (3, p. 393). You choose whatever technique that is convenient for a given case. Feynman was teaching in this lecture how to use one of those techniques based on a certain construction and not the other. In this approach Physics is a technology and not the science of seeking the Truth. (see Note 9).

5.0 Lorentz Transformation Interaction.

We have said in the foregoing that the Lorentz transformation interaction occurs immediately following the energy-momentum interaction that we discussed, and as demonstrated by Fig. 1 and Fig. 2. However in order to understand the Lorentz Transformation interaction, we have to take into consideration, the 'Galilean rest' interaction the electron **had undergone in its pre-history**.

5.1 Algorithm of Galilean Rest

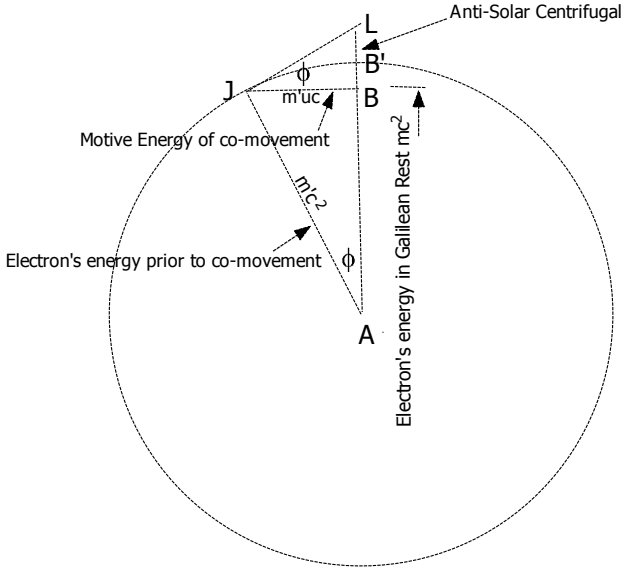


Fig. 5A - ALGORITHM OF GALILEAN REST
Concrete Form

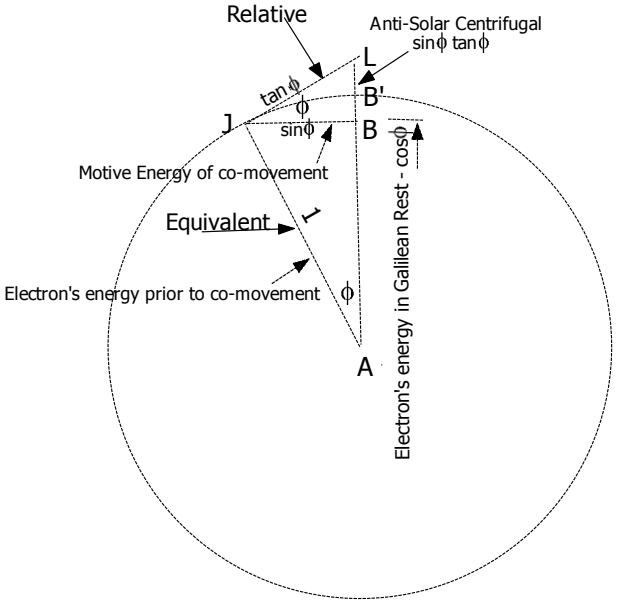


Fig. 5B - ALGORITHM OF GALILEAN REST
Abstract Form

The 'Galilean Rest' is that the electron (in our study) in its ionized state, is in co-movement with the earth (just as much as any other part or particle of the earth does). Consequently, the electron moves along with the earth in its annual translational motion round the sun. Since the electron and the earth are moving together, it appears that the electron is at rest to an observer on earth, who is also moving along with the earth. This conception comes straight from Galileo's book *Dialogos*. And we have evidence of this from experiments of Kaufmann and Bucherer, Rayleigh and Brace, and Trouton and Noble as recorded as early as in Lorentz' 1904 paper "The problem of determining the influence exerted on electric and optical phenomena by a translation, such as **all systems have in virtue of Earth's annual motion** .....". However, for the electron to move in this manner, (not to mention the observer too) it must have undergone a form of an energy-momentum interaction, as in Fig. 5A, where electron's initial intrinsic energy AB' = $m'c^2$ had interacted with a quantity of motive energy JL = $\Gamma_U m'uc = m'c^2.\tan\phi$, (where u = velocity of earth's orbit, $\Gamma_U = 1/(1-u^2/c^2)^{1/2}$. With that historical legacy etched indelibly in the background, presently AB = mc^2 (in Fig. 1)is the intrinsic energy level of the electron at 'rest', such that in Fig. 5A, m' = m.secϕ and sinϕ = u/c. Thus "Galilean rest" **is a state of motion** where a particle or a body **is in co-movement with the earth**, and by virtue of which it will **appear** to be at rest to an observer co-moving with the earth.

5.2 The Abstract Algorithm of Galilean Rest

In Fig. 5B (previous page) we have the Algorithm in the **abstract-equivalent form** where AB' = $m'c^2$ plays the role of **the "equivalent"** and by assuming its value to be 1, (that is $m'c^2$ has assigned itself the value 1). Then total motive energy JL= $\Gamma_U m'uc$ assumes the role of **the "relative"** and gets assigned $\tan\phi$ to be its value.

> Note: This notion of "equivalent and the relative" is familiar to us in the determination of 'equivalent weights' of chemical elements. If we assign the weight of a Hydrogen atom to be 1 as the equivalent, in relation to that a Chlorine atom has a weight of 35.22. In practice it has been turned around and Chlorine is assigned as the "equivalent" and has been assigned the value 35.5 and then relative to that, Hydrogen gets the "equivalent weight" of 1.008. Actually there is a misnomer here calling both Chlorine and Hydrogen as having 'equivalent weights'. When 35.5 is assigned as the equivalent weight of Chlorine, relative to it Hydrogen has weight of 1.008 (which is its **relative weight**).

All Galilean Rest Interactions (with respect to earth) are '**Gradient Invariant**' and they occur in the same mould of this Abstract-Equivalent form of the Algorithm (Fig. 5B). Thus this algorithm turns out to be a general program (like a computer program) where, when any given quantity of energy is assigned the **role of the equivalent**, its corresponding 'gross co-movement motive energy' comes to be given by **the relative** = $\tan\phi$. (Note when gross motive energy has assumed the relative value $\tan\phi$, net motive energy acquires the value $\sin\phi$)

5.3 The Anti-Solar Centrifugal Force

The conception of **co-movement** of particles of the earth**, with the earth** is nothing new. This conception is as old as Galileo. What is new is that we are here stating that for the co-movement to occur, each particle of the earth (inclusive of our electron) has undergone in its pre-history, a form of an energy-momentum interaction which we call the 'Galilean Rest Interaction'. However, due to this interaction, besides the co-movement of the parts of the earth, along with the earth itself, we insist that there is some other aspect in the Galilean Rest that has hitherto not received our attention.

For example if we take the case of the Moon, we find that it not only is in co-movement with the earth round the sun, and in doing so, it develops a **centrifugal force** to counter it being drawn **towards the sun**. Moon's orbit round the earth occurs over and above the co-movement with the earth round the sun. In its co-movement it develops an **anti-solar centrifugal force**, to prevent itself from being drawn into the sun by solar attraction, just as much as in its orbit round the earth it develops a centrifugal force to prevent it from falling into the earth due to its gravitational attraction. This development of the anti-solar centrifugal force by every particle on earth is the thing that has hitherto not drawn our attention. It is the key to the understanding of the **physical reason of why** the Lorentz Transformation occurs.

As Newton has said, "Nature does nothing in vain". That is, there has to be a purpose underlying any given phenomenon. Accordingly, we can say that the purpose of Galilean Rest of a body (with respect to earth), is to develop an anti-solar centrifugal force to prevent itself from being drawn into the sun, and to ensure that it continues to remain a part of the earth. Thus a body, in so far as it is a part of the earth, whether it is at 'rest' or in motion relative to earth, has to have a component of energy for co-movement with the earth, and also has to have another component of energy to produce the anti-solar centrifugal force. So for instance, when a meteor has hit the earth, its matter becomes a part of the earth. And to be a part of the earth it has to acquire the state of Galilean Rest, having the above two components of energy.

5.4 Aberration of Starlight

Even when a ray of starlight enters the earth, it must attain the state of Galilean Rest. This is what Aberration is all about. The photon must create by drawing energy from the field, a component of energy for its co-movement with the earth as well as another component to produce the anti-solar centrifugal force.

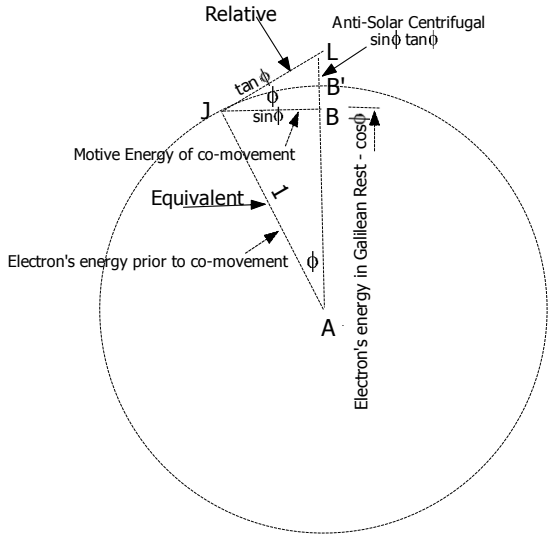


Fig. 5B - ALGORITHM OF GALILEAN REST
Abstract Form

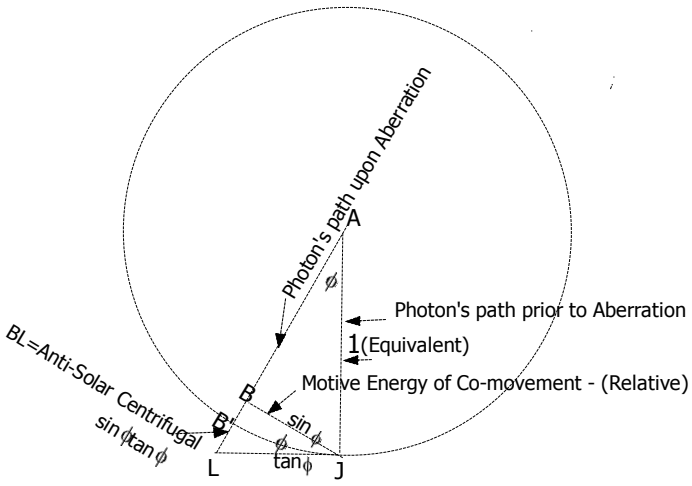


Fig. 5C - ALORITHM OF ABERRATION
Abstract Form

The ray originally coming along AJ,(Ref Fig 5c) has to deflect itself by ϕ to AB (where $\phi = \sin^{-1}u/c$). JB = muc is drawn from the field for co=movement. BB' = $mc^2(1-\cos\phi)$ is usurped from photon's intrinsic energy and this is combined with energy BL = $mc^2.(\sec\phi-1)$ drawn from the field, to form B'L, the **energy of the anti-solar centrifugal force**. This will make it clear, that all matter on earth, or upon entering the earth, has to be in harmony , as a consequence of all matter having undergone the Galilean Rest interaction, as dictated by Galilean Rest Algorithm as shown in Fig. 5B.

We must note that the very basic feature that is preserved from the fermion algorithm Fig. 5B to the photon algorithm Fig. 5C is the **gradient invariance**. Therein lies their basic similarity. But within this essential similarity, there are differences between the two algorithms. This is because a photon possesses different properties to that of a fermion. For a photon the field provides the motive energy for co-movement, whereas for a fermion, this has to be usurped from the motive energy mvc (Fig. 1)that is acting on the fermion, as we discuss in section 5.5. (How this usurpation of the fraction is done is discussed below). Also, in turn in the case of the algorithm for co-movement of motive energy mvc in Fig. 5C, while it has the general similarity in terms of **gradient invariance**, with Fig. 5A (fermion) and 5B (photon), there are specific differences, such as the motive energy mvc having to part with a fraction of itself to create its own co-movement component, while the field providing the energy for the anti-solar component in its entirety.

We need to bear the existence of these similarities and differences between fermions, photons and motive energy in our minds. While we may say that things happen in the 'same way' considering the general character of gradient invariance, we must also take into consideration the caveats that apply in regard to differences between fermions, photons and motive energy, which are three different kinds of energy defined by their different properties (See Note 8).

5.5 Lorentz Transformation Interaction.

Now we come to our main topic, that is, how the Lorentz Transformation of the displacement of the electron occurs.

The electron has already been in the state of Galilean Rest before it was set in motion, and then continues to be in that state even after being set in motion by the energy-momentum interaction as in Fig.1. Its discrete motion relative to the earth occurs over and above its co-movement with the earth. However, when the energy-momentum interaction occurred, (to set it in discrete motion relative to the earth), motive energy DE = mvc has got attached to the electron as **an**

'appendage' to it. This 'appendage' (motive energy) too has to be **harmonised** into the electron's state of Galilean Rest to incorporate it into a system acting in concert..

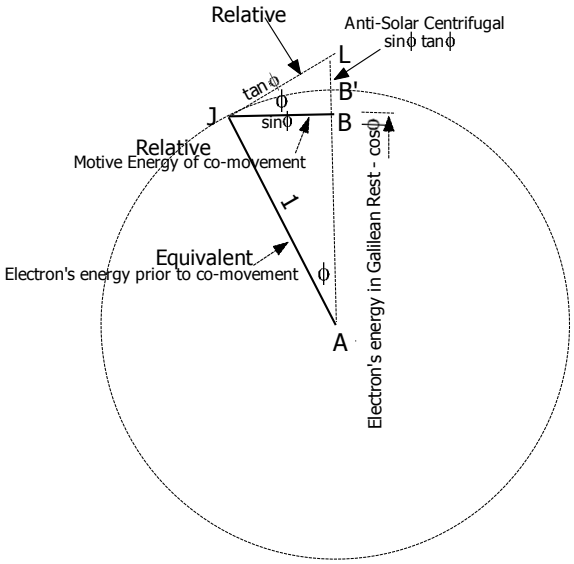


Fig. 5B - ALGORITHM OF GALILEAN REST
Abstract Form

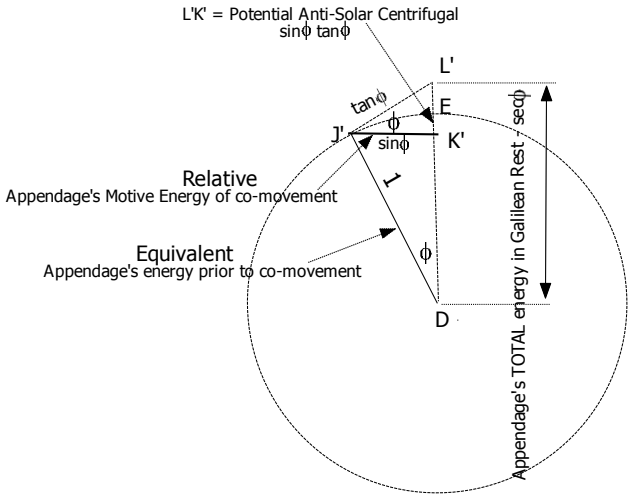


Fig. 5D - ALGORITHM OF APPENDAGE AT GALILEAN REST
Abstract Form

The harmonisation is done by '**gradient invariance**'. When the motive energy of co-movement of the electron is given by sinϕ, in the Abstract Algorithm of Galilean Rest, Fig. 5B, the energy of co-movement of its appendage mvc too has to be given by sinϕ in Fig. 5D. This harmonisation through gradient invariance is made by the appendage **assuming the role of the equivalent** in Fig. 5D, **parallel to** electron's intrinsic energy assuming the role of the equivalent in Fig 5B. In turn, parallel to electron's energy of co-movement(muc) playing the role of the relative in the form of sinϕ, in Fig.5B, the energy of co-movement of the appendage assumes the role of the relative as sinϕ in Fig. 5D - (ref. Sections 2.3 and 5.3). Hence in the mould of the Abstract Algorithm of Galilean Rest as shown in Fig. 5B, the appendage (mvc) forms its own abstract algorithm 5D, by substituting DE = mvc (of Fig 1) as the equivalent (equal to 1). And, relative to mvc =1, its own co-movement component has to take the form of J'K' = sinϕ and the anti-solar centrifugal component has to take the form L'K' = sin $\phi \tan^2\phi$ (since DE = DJ' = 1) in Fig. 5D. In short mvc - the appendage – aims to replicate, the **same pattern** *vis-a-vis* the electron for the formation of the component of energy for its co-movement.

However, there is a problem. Motive energy is a specific kind of energy with its own peculiar properties, and as such it is neither a fermion nor a boson. It has one property which makes it to be 'photon- like', in that it is exempt from the law of inertia. That is, it moves by its own intrinsic energy like a photon. But there is another property which makes it 'not-photon-like' in that it cannot draw energy **from the field to form the co-movement component** as in the case of aberration of a photon discussed above in section 5.4. It has to first contribute towards the formation of the co-movement component **out of its own energy**, in order to activate the field and contribute field energy to complete the interaction. (This, is like a bank requiring the entrepreneur to put down his part of the capital first, before the bank contributes its share to continue with the business). The detailed course that this interaction takes is discussed below in Appendix 2, leaving the reader to decide on these details separately. In the interim, we shall discuss how the Lorentz transformation occurs in a briefer version in section 5.6.

5.6 Lorentz Transformation Equation.

In order to derive the Lorentz transformation equation, let us assume that in Fig.5E (Algorithm in Abstract format), the motive energy DE =1 (the equivalent) demarcates the fraction EM as its contribution for the interaction.

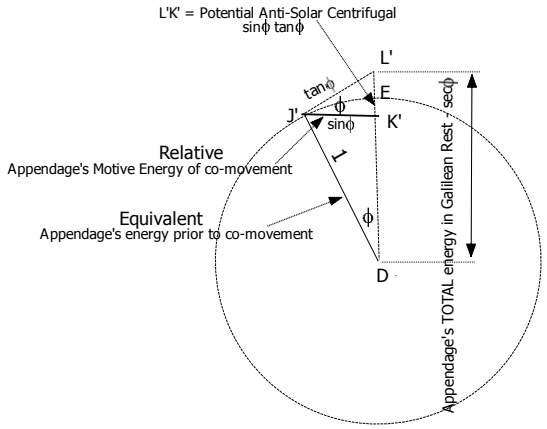


Fig. 5D - ALGORITHM OF APPENDAGE AT GALILEAN REST
Abstract Form

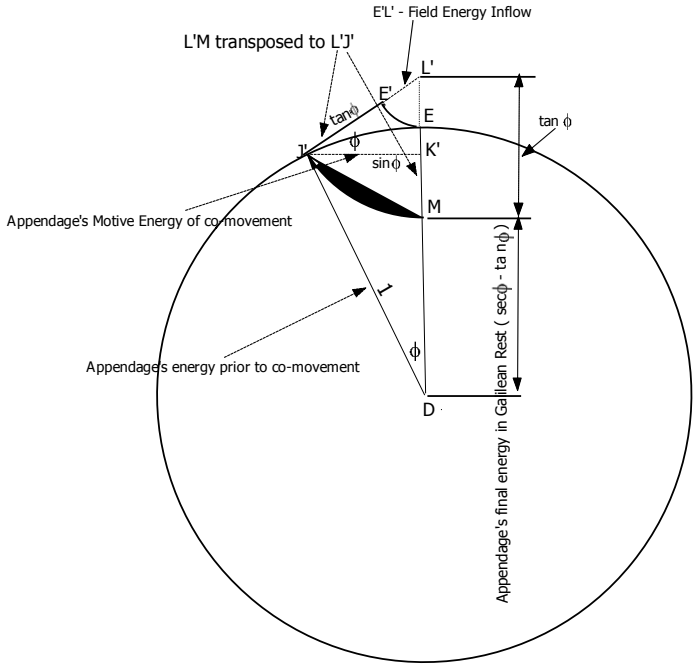


Fig. 5E - ALGORITHM OF APPENDAGE AT GALILEAN REST
Abstract Form

Then DE = 1, gets augmented to DL = secϕ (by the inflow of energy from the field). And thereafter from DL the fraction L'M = tanϕ is removed for the creation of the co-movement component. L'M is transposed to L'J'. Hence the motive energy remaining available for the motion of the electron relative to the earth is: DM = DL' – L'M

DM = secϕ - tanϕ ---------- (7)

Now we substitute the concrete values in place of the abstract values. In the **abstract form** we considered DE =1 when its concrete value is DE = mvc. We do this by multiplying the right hand side of (7) by mvc. Hence in the **concrete form,** the equation (7) becomes,

DM = mvc.secϕ - mvc.tanϕ = mvc.secϕ(1-sinϕ) ----------(8)

Let the velocity (of relative motion) of the electron be v'. Then from (8)

v' = v.secϕ(1-sinϕ).

Therefore the displacement of the electron: x' = v't = vt. secϕ(1-sinϕ).

$x' = vt(1 - u/c)/(1-u^2/c^2)^{1/2}$ (since sinϕ = u/c and secϕ =$1/(1-u^2/c^2)^{1/2}$)

Let x = ct, then,

$x' = (v/c).(x - ut)/(1-u^2/c^2)^{1/2}$ ----------(9)

Equation (9) is the **general equation of motion** of a particle **valid for any velocity 0<v<c**.

And for the special condition of near light velocities where v/c -> 1 we get the "Lorentz transformation".

$x' = (x - ut)/(1-u^2/c^2)^{1/2}$ ----------(10) QED.

5.7 Component of Co-movement with the Earth and the Anti-Solar Centrifugal Component.

As we said, in some ways motive energy is not-photon-like and therefore it has to contribute a fraction of its own energy to form the co-movement component (compared with aberration in Section 5.4). In compliance with this requirement of creating its co-movement component out of its own energy, we can consider the process schematically as follows. The first step is that EM (in Fig. 5F) is rotated about the remote centre L' through (90°-ϕ). In the process energy EL'= sinϕ(secϕ-1) flows in from the field so that, J'L' becomes a tangent at J' to the circle of radius DE. Then J'L' = tanϕ.

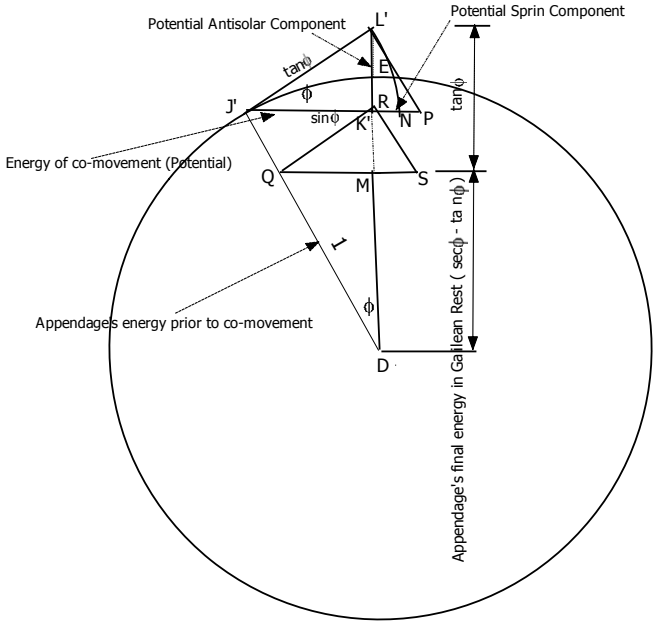


Fig. 5F - ALGORITHM OF FORMATION OF POTENTIALS
Abstract Form

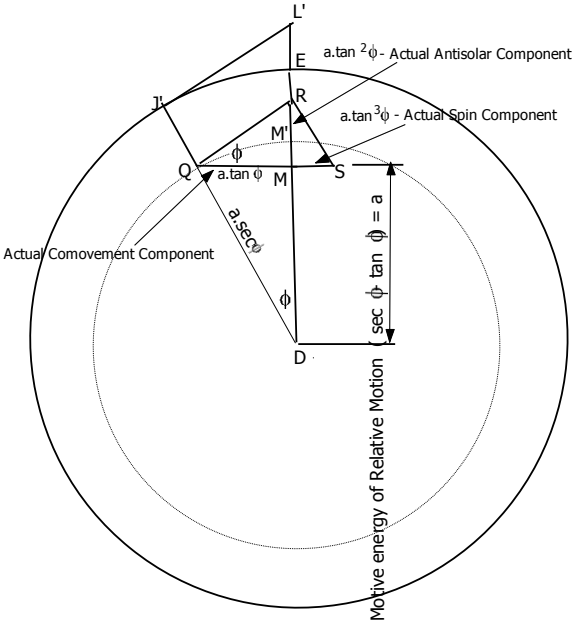


Fig. 5G - ALGORITHM OF REALISATION OF ACTUALS
Abstract Form

Then in the second step, to form the potentials J'L' rotates through ϕ, to J'N. Field energy NP = tanϕ(secϕ-1) flows in to augment J'N to J'P = tanϕsecϕ. And then in the third step J'N divides up into two parts J'K' = sinϕ (potential co-movement component) and K'P = sin ϕtan^{2}ϕ (potential spin component). Field energy also flows in to create the anti-solar component KL' in its entirety. These components are formed as **abstract potentials** in proportion to DE.

At the concrete level they are scaled down by the factor (secϕ-tanϕ) to represent the **actual components** that are proportionate to DM as shown in Fig. 5G. However these representations are still in the abstract form. We obtain the concrete values out of these when we substitute the **concrete value mvc** to DE = J'D, **in place of the abstract value** DE =1 which we assigned to it **to make it the equivalent**.

Accrodingly, a) QM = mvc(secϕ-tanϕ)tanϕ is the actual value of energy of co-movement, b) NR = mvc(secϕ-tanϕ)tan^{2}ϕ the actual value of the anti-solar component and c) MS = mvc(secϕ-tanϕ)tan^{3}ϕ is the actual value of the anti-solar spin component.

Conclusion:

We have proved that the electric force and the magnetic force emerge out of the interaction between the **fractional charges** of parts of the system. These fractional charges of these parts being determined precisely in proportion to the energy content of those parts. This fact establishes that the two **'relativistic phenomena'** that appear when a particle is in motion, **are consequences of creating the two quanta of energy to generate the above two forces**, (in the energy-momentum interaction), by extracting fractions of energy from the electron as well as from the motive energy and by augmenting these by adding field energy to them. This gives us an insight as to how a repulsive force is created in general.

However, in order get a deeper understanding of how a repulsive force is created we need to get an idea of how its opposite - an attractive force - is created. Consider an electron in the ionized state being pushed towards a nucleus, and attaining the ground state within a Hydrogen atom. We notice that a photon is **emitted** in this process. That is, a fraction of the electron's energy is removed, thereby it **creates a deficiency** of energy within itself. This deficiency drives the electron to seek to **share the energy of the nucleus**. Such a deficiency of energy driving a body to **share the energy of another through the field** is what "**attraction"** is. In the case of repulsion, it would be the opposite process, where the presence of an excess quantity of energy, tends to reduce the existing level of attraction and thereby this tending the body to distance away from the other. Upon distancing away, the body absorbs the excess energy, and increases its own intrinsic energy (that is, what happens here is the opposite of emitting energy, reducing intrinsic energy and getting closer). In the case of a free electron in motion (as discussed above), the electron set apart the fraction $mc^2(1-\cos\theta)$ and the motive energy (pc) set apart the fraction $pc(1-\cos\theta)$. This **alienation of the fractions** of energy causes deficiencies in the remnants $mc^2.\cos\theta$ and $pc.\cos\theta$ of the original interactancts (mc^2 and pc). The remnants are therefore mutually attracted towards one another to merge and form a system. Thereby their deficiencies become satiated. However, the above **alienated fractions** of energy are **not emitted**, but they are **retained within the system**. This retained fractions EB and EF (ref. Fig 1) upon being augmented by field energy BC and FG, turn into two quanta of energy EC and EG which generate the electric and the magnetic force respectively. Clearly this approach will open up a new vista towards the study of atomic physics.

When we consider the change of the electron orbits from one state to the other in GPS clocks, we get further insights into how all phenomena occur in concert with one another. In an atomic clock, in order to reduce the number of electrons in the higher state, a magnetic field is applied which tends to increase the magnetic force and spin of the higher state electrons, and this collaterally increases the motive energy- making it to orbit faster. This then makes the electron to give out a quantum off its intrinsic energy and jump to the lower state (having a lower intrinsic energy and frequency, and a higher electric force). At the other end of the beam tube, when a radio wave of the correct frequency strikes an electron in the lower state, the opposite processes occur. It jumps back to the higher state, with lower motive energy, lower magnetic force and spin, higher intrinsic energy and a higher frequency. This shows clearly that all these phenomena are interconnected and occur in concatenation; and also that causes and effects are interchangeable. We have demonstrated the physical basis of the Lorentz transformation as arising from a secondary interaction, in relation to Galileo's basic concept of co-movement of a particle with the earth. We have on the one hand removed the boundary between 'relativity' and classical physics and made it seamless, and on the other hand, in demonstrating the so-called 'relativistic effects' of GPS clocks in terms of energy transfers we have taken a step towards making atomic physics and classical theory also seamless. All these have been achieved by abandoning the space-time frameworks of both Newton and Einstein. We need to remember that the reason why Relativity Theory was created and was readily accepted is because the concatenation of the above phenomena could not yet be established at that time, and as such its existence was justified as a **provisional theory** presenting itself as a useful calculational tool to "shut up and calculate". But now after the concatenation of the phenomena has been clearly discerned and their mathematical relationships established, including Lorentz Transformation, the continued irrational and authoritarian imposition of SRT's methodology will only fetter the progress of science. Its place in the history of physics will have to be on the same shelf as where tomes of Ptolemaic astronomy now are. As a matter of historical curiosity about a useful theory that was once upon a time.

Appendix 1

The Maxwellian Approach to Comprehending of Relativistic Phenomena:

"All phenomena depend on variations of energy...." - James Clerk Maxwell (p. 72)

It goes without saying that the meaning of Maxwell's above statement is that in 'RWOT' , every conceivable event without exception occurs by virtue of **interactions of energy,** (and we may add) .... in **open systems** . In an open system, there is an ingress and egress of energy from the field. In this regard, Maxwell also had the following intuition towards the development of physics, "....when we have to deal with real bodies, we must define their state not only to the configuration and motion of their visible parts, but if we have reason to suspect that the configuration and motion of their **invisible** particles influence the visible phenomenon, **we must devise some method of estimating the energy** thence arising" (p. 71). This prompts the question whether anyone has taken this cue from Maxwell and attempted to develop a method that enables the measurement of inflow and outflow of energy from the field?

For Maxwell, development of such a method appears to have been of utmost importance to the extent that he has summarized his future program in the following statement. "In fact the **special work** which lies before the physical inquirer in the **present state of science** is the determination of **the quantity of energy which enters and leaves** a material system during the passage of the system from its standard state to any other definite state". (p. 74). Unfortunately, before he could devise the method for the above determination, he died soon after writing those words. Although, nearly 150 years have elapsed since then, his successors have disregarded the necessity of devising of such a **method based on interactions of energy** in open systems, but instead have been satisfied with the modification of space-time physics.

In this paper, it will be found that we have 'devised' this method that Maxwell called for. Further the simple philosophical outlook "All phenomena depend on variations of energy...." has been adapted as the working paradigm. In actual fact, as for the 'method' it is not that we have devised it as such or to use Einstein's word 'invented' a method based on a set of propositions along with a mathematical apparatus and then imposed it on nature. But rather, we have by diligent contemplation, **discerned** the **algorithms** that **nature uses** to govern the interactions of energy inclusive of egress and ingress of field energy. This has been achieved by way of deciphering the geometric structure that underlies the energy-momentum equation. Or in the sense of Galileo, we have discovered the very 'geometric characters' that the 'Book of Nature' of interactions of energy has been written in. Thereby we have been able to account for all the so-called 'relativistic phenomena' in terms of effects of interactions of energy, without recourse to the 'relativity principle', 'space time relationships' etc.

Appendix 2

Lorentz Transformation Interaction.

The Critique: How the Equation for Displacement has come to be Interpreted as 'Co-ordinate Conversion'.

The equation : $x' = (x - ut)/(1- u^2/c^2)^{1/2}$ ---------- (1); which is commonly referred to as the 'Lorentz transformation' is an empirical equation and not a derived one. The empirical equation was discerned by Lorentz in iterating the data of fast moving particles of experiments conducted by Kaufmann and others. The equation in the final form was put forward by Poincare, and he named this equation as the 'Lorentz transformation' giving credit to the Herculean work done by Lorentz.

We need to bear in mind that this is an empirical equation that was deduced by 'curve fitting' data of particles moving at near light velocities. And we note that at near light velocities v-> c and therefore v/c -> 1. So if there is a term v/c in the actual equation, there is still a chance in this curve fitting exercise, this v/c term being missed to be taken into consideration by oversight. And without this v/c term in the empirical equation, still the results of this equation will correspond to the observations correctly when tested (as long as the test is within the limited condition v-> c). We have good reasons to suspect that such an oversight has occurred by Lorentz, and by accident the term v/c has gone without being incorporated into the equation.

The reason is that the equation in the above form holds for particles moving at near light velocities and gives the correct displacement for a particle for these velocities. However as the velocity drops less and less than c, the observed result deviates more and more from the result predicted by the equation.

On the other hand Special relativity tells us that equation (1) gives the "co-ordinate", x' of a moving particle as measured in the observer's frame, upon the "co-ordinate" x in the moving frame being converted, (the question is conerted by whom? By nature we have to assume). So when the observer measures the displacement of the particle, he gets the value x' instead of x.

In equation (1) u is the velocity of the observer's frame. There is no reference to the velocity v of the particle (in SRT in relation to this equation). But the question is, if nature converts co-ordinates as alleged by SRT, why does it not do it correctly and consistently for all values of $0<v<c$? How can nature err on giving us this co-ordinate as the velocity of the particle becomes less and less than c? If this conversion of co-ordinates is the work of Nature as claimed, Nature will not do it that way. That's for sure.

We must bear in mind that the only experiments we know of are the experiments conducted on earth. For these experiment u = 30 km/sec. So before we generalize this equation (1) to be applicable to all moving observers located on Juipter, Venus, Sirius, or the Moon, we must first of all test this equation for results of experiments conducted on earth. For experiments conducted on earth, there are two problems involved with the equation when applied to particles moving even at moderate velocities less than c.

It is well known that the equation (1) works only for particles with very high velocities. But in nature there cannot be a schism where one kind of physics applies to a very fast moving particle and another kind of physics applies to the same particle when moving at a low velocity. In view of this we can logically deduce an equation which will be applicable for $0<v<c$. Our reasoning is as follows: If the equation (1) holds for particles moving at v-> c; then for a particle moving at any velocity v , $0<v< c$ the equation must have the form

$x'' = v/c\ (x - ut)/(1- u^2/c^2)^{1/2}$ ---------- (2)

Then we have x" = x'.v/c and when v/c -> 1 x" -> x'

If x in equation (1) is taken as equal to ct as defined in the relativity theory, then we find that according to (1) the value of x' (for all experiments conducted on earth) **will be the same** no matter whatever the velocity v, that the particle moves in the experiment. **This result is absurd**. Therefore, although SRT speaks nothing of velocity v in regard to this equation, and defines x = ct, particle physicists will (surreptitiously) substitute x = vt to make the equation to be workable, and then "shut up and calculate" to get fairly reasonable results for a range from v/c -> 1. For instance at v= .99c error will be $1.01x10^{-6}$; at v = 0.5c the error will be $8.3x10^{-5}$. So depending on the required degree of accuracy it works even at v = 0.5c.

But then there comes a point when they have to shut up and **stop calculating**. For instance at v =.001c (i.e. v =3000 km/sec) the error will be 9.999×10^{-2}. This error keeps on building up as the velocity declines such that at v= 30 km/per sec (i.e. when v =u) the equation will completely breakdown since the equation (1) will have the value zero. And for values of v< u, the equation (1) paradoxically gives negative values for x'.

It will be seen that we will not have the above problems with equation (2). In equation (2) x =ct stays true to the definition and we do not need to surreptitiously substitute x =vt to make the equation workable. Secondly even for values of v << u, x" always has positive values.

However, the above discussion alone does not prove our point. Therefore our real task will have to be to demonstrate that **Lorentz transformation is a result of an interaction of energy** that occurs when a particle is in motion, and in the process of this demonstration have to derive the equation (2).

The Lorentz Transformation Interaction and the Derivation of the Equation:

Newton wrote: "And to us it is enough that gravity does really exist, and act according to the laws which we have explained, and abundantly serves to account for all the motions of celestial bodies, and **of our sea**" **– *General Scholium* (13, p.547)**

Newton here points to not only the first order centralised effect of gravitation as whole, on a body (satellite) in its motion around its primary, but in pointing to "our sea" he indicates the second order, differential effects of gravitation of one body on the individual particles of another body. Thus, in solar and lunar tides we see the differential effects of gravitation of the sun and the moon on particles of the earth. We must not forget also the differential effect of the earth as a whole on each of its particles - this being the gravitation that we experience most commonly on earth.

However, in the conceptions of Newtonian mechanics of motions of bodies and of Special relativity, since space is considered free of gravitation, and our minds have been conditioned from the very beginning to have amnesia about the differential gravitational effect of the earth on its own particles when considering "inertial motion" of particles. So with this mindset, it would never occur to anybody to suspect whether differential effects of gravitation of the sun* will manifest in the motion of the particle on earth (in the form of the Lorentz transformation).

* We consider the effect of the sun only here, while ignoring that of the moon, because sun's force on a particle on earth is about a hundred times greater than that of the moon. However sun's force being hundred times greater and why still it is that lunar tides are greater than solar tides is something that has not been explained in dynamic terms. We shall explain this elsewhere.

This inertial space conception is applied to motions of particles, even though, quite in other contexts, as *ad hoc* considerations only, besides the ocean tides, they will readily recognise that there are atmospheric tides which involve individual gas molecules being displaced by the pull towards the sun and the moon.

The question is, if in atmospheric tides, we find a gas molecule in a mass of 'still air' being drawn hither and thither by the variation of the sun's gravity, why can not the same pull of sun's gravity affect the trajectory of the same molecule when it is set in motion. The reason why the connection between Lorentz transformation and the sun's pull on earth's particles has escaped our minds is because physics has no holistic approach. At most times gravitation is ignored and it is invoked only on an *ad hoc* basis. We forget that we have chosen to ignore gravitation for our convenience subjectively, but in objective reality gravitation acts indiscriminately and produce phenomena irrespective of our subjective schema. But the irony is that when such phenomena have appeared we tend to concoct explanations to fit to the subjective schema. This is why we have hitherto not been able to explain how Lorentz transformation occurs.

Common Motion of Galileo and Newton:

Galileo is credited for the enunciation of the "principle of relativity". According to Galileo effects of physical processes occurring in a moving ship are identical to those occurring in a ship at rest. He gave **the reason why** they are so: "**The cause of** all these correspondences of effects is the fact that the **ship's motion is common** to all the things contained in it" (p. 187).

We must note that Galileo here states **two things**, a) the appearance of correspondences effects of two or more particles in motion relative to the ship, irrespective of whether the ship is in motion or it is at rest. b) **The cause underlying** this effect is **the motion that the contents** of the ship (i.e. the moving particles included) has **in common with the ship** ('common motion').

Newton on his part separated the cause and the effect and mentioned these in two places in his *Principia*.

The cause – the common motion - has been expressed by Newton: "…that if a place is moved, whatever is placed therein moves along with it; and therefore a body, which is moved from a place in motion, **partakes also of the motion of the place**"(p. 9).

Then "the correspondences of effects": Newton wrote (in *Principia, Corollary* V), what has been termed as "the principle of relativity" as follows: "The motions of bodies included in a ***given space*** are the same among themselves, whether that space is at rest or moves uniformly forwards in a right line without any circular motion" (p. 20).

Einstein has in effect obliterated Galileo's principle of relativity beyond recognition. To explain this, let us consider Galileo's ship. When the ship is at rest its velocity is obviously zero, and when in motion let it be V_S. In the ship there is a fly and a butterfly that Galileo takes as examples. Let the velocity of the fly when the ship is at rest be V_F and that of the butterfly V_B. When viewed from the shore or the ship, the velocity of the butterfly relative to the fly is $V_B - V_F$. When the ship is in motion, according to Galileo, the **ship's motion gets added** to those of the discrete motions of its contents, not as a kinematic effect, but **as a dynamic effect**. But an observer in the ship will not feel this because the observer himself possesses this motion. So when the ship is in motion the velocity of the fly becomes $(V_F + V_S)$ and that of the butterfly $(V_B + V_S)$. But in this case too, although the velocities of the fly and the butterfly have changed in their absolute values, the velocity of the butterfly **relative** to the fly remains the same: $[(V_B + V_S) - (V_F + V_S)] = V_B - V_F$. This is what Galileo's position is. The 'correspondences of effects' i.e. the relative velocity between the fly and the butterfly remaining the same is due to the cause that both fly and the butterfly has ships motion V_S in common to them, as well as with the observer.

And this is what Newton has stated. "The motions of bodies included in a ***given space*** are the same **among themselves** (i.e. relative velocity **among** the fly and the butterfly remains the same), whether that space is at rest or

moves uniformly forwards ....." . Thus Galileo's principle is applicable for **relative motion** between **two moving parts** (or more) within a system. On the contrary, in Einstein's principle it concerns **one moving part**.

Einstein has **dropped the cause** (common motion) altogether from physics and run away with the "correspondences of effects". And that too **not** as the relative velocity 'among' the fly and the butterfly. Einstein's position is whether the ship is in motion or at rest, the absolute velocity of the fly will be V_F and the absolute velocity of the butterfly will be V_B. Hence in Einstein principle of relativity "laws of physics are independent of the motion of the system (ship)".

When Lorentz analysed the experimental results of Kaufmann and Bucherer, Rayleigh and Brace, and Trouton and Noble, terms involving common motion with the earth were detected. Thus for Lorentz, the existence of a term involving common motion was clear. For instance in the Lorentz transformation equation, $x' = (x-ut)/(1-u^2/c^2)^{1/2}$, it was evident that the ut term (term of the first order) could be directly connected to the common motion that a particle possesses with that of the earth round the sun. This was easy since in all experiments analysed u = 30 km/sec which is the orbital velocity of the earth round the sun. However, despite the fact that in experiments of these terms were revealed, it was rashly ignored by Einstein as due to a dynamic interaction.

One only needs to read the opening passage of Lorentz 1904 to get a grasp of where physics was heading at that time. Lorentz wrote: "The problem of determining the influence exerted on electric and optical phenomena by a translation, such as **all systems have in virtue of Earth's annual motion** admits of a comparatively simple solution, as long as these terms need to be taken into account, which are proportional to the first power of the ratio between the velocity of translation u and the velocity of light c". But for Lorentz the problem was how to account for the second order term u^2/c^2. "Cases in which quantities of the second order, i.e., of the order u^2/c^2 may be perceptible present more difficulties" (4, .p.11). This was the point where physics was stuck, when Einstein entered the stage, and diverted physics in an entirely different direction, - towards kinematic sophistry. Lorentz transformation was attributed to 'conversion of co-ordinates from one inertial system to another'!

However, this direction would have been quite different if Einstein thought of his 'falling lift' concept 10 years earlier in 1905 (and not in 1915) and incorporated that and the common motion to obtain a holistic solution . Here is how.

Consider a gas molecule in a mass of still air in the atmosphere. Although we consider the molecule to be 'still', it has a random motion about a mean position. It appears to us to be 'still' because (besides rotating with the earth), it is also engaged in the translational motion of the earth round the sun. And just like the earth avoids falling into the sun due to its gravitational pull, by virtue of the centrifugal force developed by it's orbital motion, the gas molecule also avoids being drawn in more and more towards the sun due the centrifugal force it develops through the common motion with the earth round the sun. It is because the gas molecule and the earth are 'falling together' (as the man in the falling lift), that we observe it to be still in the atmosphere.

Now if this gas molecule, having intrinsic energy AB = mc^2 is set in motion by application of motive energy DC = pc = mvc $\sec\theta$, (as in Fig 1) it will undergo the energy momentum interaction as we discussed in the Part 1 of this paper and as a by product, it will have a net motive energy of $pc.\cos\theta = mvc$.

The moving gas molecule (as a consequence of the above interaction) is now a system with two explicate parts, AE= $mc^2.\cos\theta$ and DE = mvc (besides the two implicate parts, which are the energy EC and EG of the two forces – see Fig. 1). The problem this moving gas molecule now faces is while the remnant of the original molecule AE has a common motion with the earth and a concomitant centrifugal force to counter act sun's gravity, the other part DE (net motive energy) is without this common motion and a concomitant centrifugal force to counteract sun's gravity. Therefore it, i.e, DE has to synthesize these two components of energy, **out of itself**, along with drawing energy from the field, to produce common motion for itself and the concomitant centrifugal force.

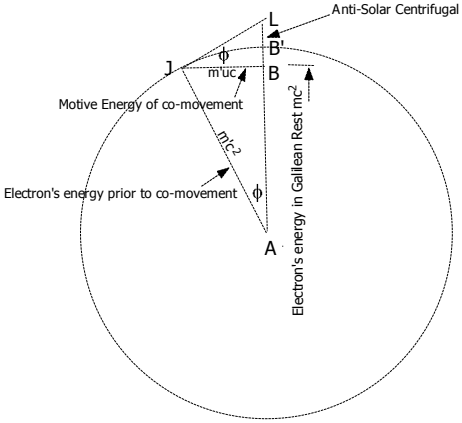


Fig. 5A - ALGORITHM OF GALILEAN REST
Concrete Form

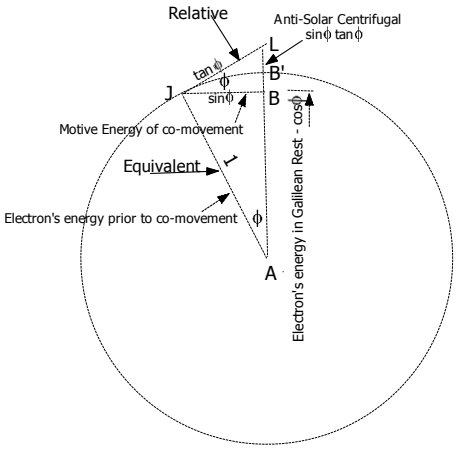


Fig. 5B - ALGORITHM OF GALILEAN REST
Abstract Form

(Note: We are using the same diagrams used in the section 5 for the electron for convenience. Hence the reader is requested to read the word 'electron' in the diagram as 'gas molecule').

Let us first consider how the gas molecule, when in the 'still' condition, possessed the two components of energy for the common motion and the centrifugal force. Ref. Fig 5A, AB' = $m'c^2$ (where m' = msecϕ) is the intrinsic energy (if there is no co-movement of the gas molecule with the earth). AB = mc^2 is the intrinsic energy when the molecule is a constituent of still air (while co-moving with the earth). JB = m'uc is the motive energy of the common motion and LB' = $m'c^2$.sinϕ.tanϕ is the energy of the concomitant (anti-solar) centrifugal force. (And to produce this anti-solar centrifugal force, energy BB' has been drawn from the gas molecule and combined with field energy LB' drawn from the field). Fig. 5B is the Genetic Blue Print of the co-movement ('Galilean Rest') interaction.

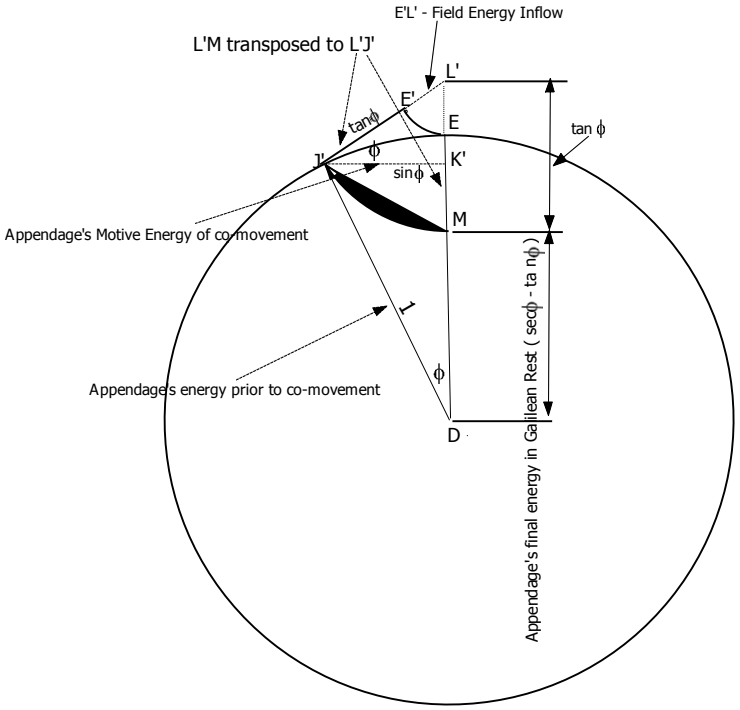


Fig. 5E - ALGORITHM OF APPENDAGE AT GALILEAN REST
Abstract Form

When the gas molecule has been set in motion, the motive energy DE = mvc gets attached to it as an appendage. This 'Appendage' should move in lock step with the gas molecule, in harmony with it, as regards the co-movement as well as having an anti-solar component to prevent itself from being drawn towards the sun by its attraction.

Now for the motive energy DE to produce a co-movement component and anti-solar centrifugal component it catches hold of the genetic blue print 5B and creates the Algorithm in Fig .5E with ED = J'D equal to one. Then J'L' = mvc.tanϕ. L'E = mvc.(secϕ -1) to be drawn in from the field. Once this field energy is drawn, the motive energy DE gets augmented to L'D = mvc.secϕ.

Now there comes a problem.

AB' = mc^2 represents the energy of a fermion particle. Fermion particles are affected by the law of inertia. That is for fermion particles to move they require motive energy to be applied externally. On the contrary, the motive energy (as represented by DL') is photon-like, since it moves by its own energy, and not by the application of external energy (like for a fermion). So in order to generate the common motion, DL' cannot draw further energy from the field or acquire energy from an outside source. To make the interaction possible, it has to draw the energy represented by J'L', out of DL' itself.

Therefore L'M' = J'L' mvc.tanϕ is cannibalised from DL'. Hence the motive energy that remains for the relative motion of the gas molecule is DM. (It is proposed that once the co-movement component J'K = mvc.sinϕ is supplied with the cannibalised energy J'L' only, that L'K' = mvc.tan ϕ flows in from the field for the production of the anti-solar centrifugal force).

DM = DL' – ML'

DM = secϕ - tanϕ = secϕ(1-sinϕ).

But we got the above relationship by substituting DE = mvc = 1, Hence to obtain the actual values we multiply the right hand side of the above equation by mvc.

DM = mvcsecϕ - mvctanϕ = secϕ(1-sinϕ).

Hence the velocity v' (of relative motion) of the gas molecule = v.secϕ(1-sinϕ).

Therefore the displacement of the gas molecule x' = v't = vt. secϕ(1-sinϕ).

$x' = vt(1 - u/c)/(1-u^2/c^2)^{1/2}$ (since sinϕ = u/c and secϕ =$1/(1-u^2/c^2)^{1/2}$)

Let x = ct, then,

$x' = (v/c).(x - ut)/(1-u^2/c^2)^{1/2}$ ----------(7)

Equation (7) is the **general equation of motion** of a particle valid for any velocity 0<v<c.

And for the special condition of near light velocities where v/c -> 1 we get the Lorentz transformation.

$x' = (x - ut)/(1-u^2/c^2)^{1/2}$ ----------(8)

QED.

Appendix 3

The Action of the Field and the Production of the Two Forces

Our position is that:

a) all systems are open, and are governed by the inflow and out flow of energy from the Field. And accordingly, in the "energy-momentum interaction" - $E^2 + (pc)^2 = (\Gamma E)^2$, energy flows in from the field and gets added to the intrinsic energy of the particle as well as to applied motive energy ('relativistic momentum' x c), increasing both quantities by the factor Γ; [where $\Gamma = (1 - v^2/c^2)^{1/2}$]. If we consider that this interaction occurs within a closed isolated system as those who accept the existence of the explicit order only would suggest (see Note3) , then there is no way to account for the kinetic energy and 'kinetic momentum' that get added. In this situation, the only conclusion one can come to is that the Field **injects energy** into to interaction. And then, in addition if we are to accept that the law of conservation of energy is real, we are compelled to consider it in the manner Weyl has stated it: "The total energy as well as total momentum remains unchanged: they merely stream from one part of the field to another, and become transformed from field energy and field momentum into kinetic energy and kinetic momentum of matter and *vice-versa*" (p. 168).

Accordingly, the "whole" is the Field and the explicate components (E and pc) taken together. And it is within this "whole" that the principle of conservation of energy holds. (We may note that Energy is the uncreatable and indestructible **primitive substance** – i.e. it is the 'Prima Materiae'- and that is why it is conserved. For this reason the kinetic energy that flows in from the Field is absolute and real; and it is not a relative kinematic illusion that appears with respect to an observer in a moving reference frame as it has been suggested.

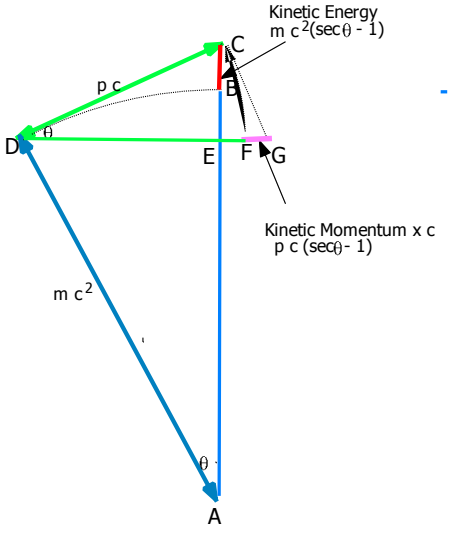


FIG. 1

Geometric Representation of Energy-Momentum Equation

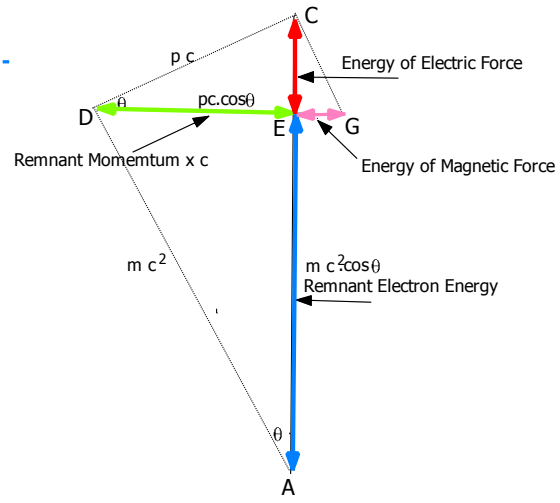


FIG. 2

System in Motion Consisting of Four Energy Components

b) **the purpose** for the flow of energy from the field, which is presently called 'kinetic energy' $E(\Gamma-1)$ represented by BC (ref. Fig. 1), is the **field energy contribution** towards the energy required to **produce the concomitant repulsive force** when the particle is in motion. The other part of the energy required towards producing this force is the energy $E(1-1/\Gamma)$ represented by EB so that EB + BC = EC. EC represents the energy that underlies the electric force. This fraction EB is **extracted from the particle's intrinsic energy** E for the above purpose, and therefore the intrinsic energy left remaining in the particle is only E/Γ represented by AE. Hence when the original frequency that corresponds to energy E is f, the

frequency that corresponds to energy E/Γ is f/Γ. It is this reduction in the frequency that manifests as the "slowing down of internal processes".

The above will indicate that when a particle is in motion, **"slowing down of internal processes" is directly connected** to the **emergence of a repulsive force**. Similarly, there is a force that emerges in connection with the phenomenon of reduction of relativistic momentum.

The Field and the Implicit Order.

In effect, in this short paper, we demonstrate how the so-called 'relativistic phenomena' (a) and (b) above that arise when a particle is in motion, find an easy, coherent, and a natural explanation when the appropriate **holistic approach** is taken. The most essential aspect of the holistic approach is the recognition of **implicit role that the Field plays** in all interactions of energy. In the energy-momentum interaction, $E^2 + (pc)^2 = (\Gamma E)^2$ that we are presently concerned with in this paper, the Field, the particle's intrinsic energy E, and the applied *'motive energy' pc (i.e momentum x c), all these three **together** form the **"Whole"**, in which the E and pc are in the **explicit order**, and **the Field governs the interaction** while it remains in the **Implicit order**. (*See Note 1, for what we mean by 'motive energy')

It is no fanciful idea of this author (along with Bohm, Vigier *et al*) to suggest the existence of this **implicit order** that subsumes and governs the explicit order. **This conception in fact goes back to Newton,** who felt that there is an essential underlying order in physics which has gone completely unattended, and that for the development of physics there has to be a method that should connect up the two orders. Newton was convinced that this conception of the implicit order (Newton's "**subtle spirit**" – see below) is of utmost importance for the progress of physics, that he made it a point to record it as the **concluding passage in his General Scholium.** He stated that his problem was that he could not figure out how to integrate this all important **implicit order** into his Mechanics, for the lack of experimental evidence.

> Newton wrote: "And now we might add something concerning a certain most **subtle spirit** which **pervades** and **lies hid** in **all gross bodies**; by the **force and action of which spirit** the **particles** of bodies attract one another at near distances, and cohere if contiguous; and electric bodies operate to greater distances, as well repelling as attracting the neighbouring **corpuscles**, and light is emitted, reflected, refracted, inflected, and heats bodies;. And all sensation is excited and the members of animal bodies move at the command of the will, namely, by the vibrations of this spirit, mutually propagated along the solid filaments of the nerves, from the outward organs of sense to the brain, and from the brain into the muscles. But these are things that cannot be explained in a few words, nor are we furnished with that **sufficiency of experiments** which is required to an accurate determination and demonstration of the **laws by which this (*) spirit operates**" (p. 547). Note: Rupert Hall has found out that the above is how Newton's original Latin manuscript reads, however that the translator has for some reason inserted the words *"elastic and electric" before the words 'spirit operates' in the last sentence.

It is our contention that **Newton's 'subtle spirit' is the Field that universally supplements energy and governs all interactions of energy**. It is also our view that there is no interaction of energy that occurs without an inflow of energy from the Field and/or an outflow of energy to the Field. This field has variously been called the 'aether', 'aetherial field', 'Unified Field', 'Cosmic Field' etc, etc., by various authors in their attempts to integrate it into physics. However, in order that this present work not to be confused with the particular interpretations of these authors as to how it operates, this author prefers to merely to refer to it as the 'Field', and limit the discussion to how the Field operates in the energy-momentum interaction.

Appendix 4

How atomic clocks work

The part of an atomic clock which is responsible for keeping time is actually a quartz crystal oscillator. In most quartz clocks, the oscillator is tuned accurately when the clock is made but its frequency is never checked again. Over time, its frequency changes slightly but unpredictably, making the clock fast or slow.

The purpose of the complicated apparatus in an atomic clock is to check the frequency of the quartz oscillator continually, giving the clock its great accuracy.

An atom can be thought of as a collection of electrons orbiting a nucleus like planets around the Sun. Calculations using quantum mechanics show that only certain orbits are allowed. To move from a high orbit to a lower one, an electron must emit energy in the form of electromagnetic radiation (light or radio waves) of a particular frequency. This frequency depends on the energy difference between the two orbits. If an electron in the lower orbit is supplied with radiation of exactly the right frequency, it will jump to the higher orbit.

Each caesium atom contains 55 electrons. The last of these normally occupies an orbit which is much further from the nucleus than the rest. In this orbit, its energy can have two slightly different values, depending on a property called the "spin" of the electron. The energy difference between the two states corresponds to radio waves with a frequency of 9192631770 Hz (cycles per second). Atoms in these two states have slightly different magnetic properties.

At one end of the caesium clock is an oven which evaporates atoms of caesium from the surface of a piece of the metal. These atoms will have their electrons in one of the two arrangements described above. A magnet is used to separate them and discard those with the higher energy.

The clock's quartz crystal oscillator is tuned as accurately as possible to 9192631770 Hz. It controls a source of radio waves aimed at the atoms with the lower energy. If the crystal's frequency is correct, many of the atoms have their states changed.

At the other end of the beam tube is another magnet which separates those atoms which have been changed from those which have not. The atoms in the changed state are counted by a detector. If the number which have been changed starts to fall, it is because the frequency of the quartz crystal has drifted. In that case, an automatic control system adjusts the crystal oscillator until the number of atoms being changed reaches a maximum again. Preventing the crystal's frequency from changing keeps the clock accurate. An electronic counter converts the oscillation frequency to pulses at intervals of exactly one second.

Explanatory Notes:

Note 1: All physical processes are non-linear at all velocities 0<v<c. Hence even at classical (slow) velocities, the interactions are non-linear. However due to the exponential character of the non-linear processes, they appear to be linear at low velocities. When Newton wrote the *Principia* he drew his conclusions on the basis of experiments with slow moving bodies. Therefore for simplicity, he has asserted that his second law is linear. In this regard, after stating the second law, he has written the following below it: "If any force generates a motion, a double force will generate double the motion, a triple force triple the motion". Which means that if with F the body acquires a velocity v, with 2F it will acquire 2v and with 3F it will acquire 3v. But when experiments were conducted with fast moving particles, it revealed that if F generates the velocity v, 2F generates less than 2v, and with 3F the efficiency is still less, and the velocity is much less than 3v. So to get 2v, the force had to be Γ(2F) where $\Gamma = 1/[1 - (2v/c)^2]^{1/2}$ and so on. In order to address this problem Newton's second law has been amended to ΓF = ma, in relativistic physics with the claim that the law in this form is valid for the condition v -> c.

Note 2 : The particular error in the Newtonian foundation that has afflicted SRT in this instance is the following. Although Newton's law of universal gravitation demands that there cannot be any space in the universe that is free of gravitation, the concept of inertial frames of reference has been borne out of the selective amnesia of this fact in Newtonian foundation with respect to absolute and relative spaces. Thus the 'equivalence of inertial reference frames' can be considered to be only **approximately true**, in so far as they are all located on the same gravitational potential in the space surrounding a given body. But this kind of 'approximate inertial reference frames' of real life will differ from the ideal frames considered in SRT. The difference being that in those frames of real life, **inertial forces** will inevitably appear as true forces, determined by the velocity relative to gravitational centre and the distance to it, whereas in the ideal frames of SRT there will be no such forces. Thus the question whether the centrifugal force exists as a real force or not, is a test that will falsify or validate SRT. But, let us leave this question for another day, because even most of those who otherwise cast doubts about the validity of SRT, firmly believe that the centrifugal force is a 'pseudo force'. However, since everybody accepts firmly without any dispute, the fact that when an electron is in motion, there appears an electric force E and a magnetic force H such that H = E.v/c, we choose to discuss the motion of an electron to avoid controversy.

Note 3: An attempt has been made to construe that when the energy gets increased to ΓE due to the addition of kinetic energy E(Γ-1) to the particle's energy, the particle's inertia increases from m to Γm and therefore the internal processes slow down due to 'sluggishness' engendered by increased inertia. This contention however, flies in the face of Planck's law. According to this law (i.e., E = hf), when the energy increases by the factor Γ, frequency also must increase by the same factor, and the internal processes must intensify accordingly and not slow down). This indicates to us that the inflow of **kinetic energy from the field must serve another purpose**, and in the process of achieving this purpose, the energy of the particle gets scaled down by the factor $1/\Gamma$, which then results in reducing the frequency of the energy from f to f/Γ.

Note 4: It is because empiricism and positivism inhibits our thinking to be limited only to what is immediately apparent, (that is to limit them only to the explicate order), that no further explorations have been made into deeper implications of this interaction. But the irony is that while prohibiting the possibility of there being an implicate order existing and working hand in glove with immediately apparent explicate order, they have allowed themselves to be gullible to accept fantastic propositions about kinematic illusions arising from the space-time order, (which is in no way empirically verifiable) and to dwell on these fantasies and fictions for over a century.

Note 5: Consider the following statement by Lorentz: :"The problem of determining the influence exerted on electric and optical phenomena by a translation, such as **all systems have in virtue of Earth's annual motion** ....." (4, p.11). And to understand this we need to grasp that in the terminology used by Lorentz and others: there is a)the laboratory (on Earth) and there is b) the particle, which moved (with velocity v)in an experiment, relative to the laboratory frame. Then a) the particle and the b) the laboratory taken together as a whole, consisted the 'system'. When the earth moved in its 'annual

motion' with velocity u = 30 km/sec, the system was carried along in this translational motion. While the particle was participating in this common motion in the system at velocity u, **its discrete motion** was relative to the system at velocity v. While for all experiments carried out on earth (where else have we humans carried out experiments) u = 30 km/sec is always invariable, the discrete velocity v of the particle is variable and could assume any value 0<v<c.

Accordingly, we must first of all note that **there are two Γ-factors** involved in relativistic phenomena. It is found that Γ_U = 1.0000005 is constant and Γ_V is variable. Consequently, there are two classes of 'relativistic phenomena. The Γ_V that appears in 'length contraction', 'time dilation', 'relativistic momentum', 'mass increase' etc., is 'accounted for' by the Principle of Relativity, as kinematic effects appearing to an observer located in a different frame of reference. But then the class of phenomena involving Γ_U cannot be included in this group. However, in Einstein's 1905 paper, he has made a futile 'apples and oranges' attempt in art 3 (4, p.43) to derive the Lorentz transformation which involves Γ_U (apples); by using time dilation and length contraction which involve Γ_V (oranges). Having realized this folly, that Lorentz transformation cannot be derived that way, he has resorted in his Autobiographical Notes (1949) to surreptitiously add Lorentz transformation **as the third postulate of his theory**. To conceal the effort still further, the two original postulates in the 1905 paper (4, p. 38), are referred to as 'assumptions' in (1949) and Lorentz transformation is raised to a 'postulate' (2, p. 57). So according to Einstein's final afterthought, special relativity has two "assumptions" and one "postulate".

Note 6: In the Algorithm (Fig 1) the intrinsic energy mc^2 is represented by the line segment AD and **at the same time** considers AD to be rotated through θ to AB (to be in line AC). The line segment DC represents pc and it is poised as if it is orthogonal to AD. A similar operation (to the above) comes into effect with the line segment DC, which is at the same time rotated through θ to DF. (The line CG is projected to make the triangle DCG similar to the triangle ADC). As we see in Fig 1. AB and DF intersect at E. The part EB is extracted from the parent quantity of energy mc^2 represented by AB, and merged with kinetic energy represented by BC supplied by the field. EB and BC merge to form EC. Thus as shown in Fig. 2, EC is the energy that underlies the electric force. Similarly EF represents the fraction of energy extracted from the parent quantity of energy pc represented by DF, and FG represents the energy flown in from the field. EF and FG merge to form the energy represented by EG that underlies the magnetic force as shown in Fig. 2. As a result of extracting fractions from the electron's intrinsic energy mc^2 and from the motive energy pc as shown in Fig 2, AE represents the intrinsic energy that remains in the electron. This reduction in intrinsic energy is the cause for the internal processes to slow down. And DE represents the reduced motive energy. It needs to be noted that what we have shown above (in Figs 1 & 2) are not vector diagrams, but the computational method that Nature employs using trigonometric ratios to divide up energy of the electron mc^2 and ***motive energy** pc, in the energy-momentum interaction, to extract fractions off each of them and add field energy to them to synthesize the two quanta of energy necessary to generate the electric and the magnetic forces. (Note: In this method quantities of energy are represented by line segments in proportion to the respective quantities. Accordingly, in this paper, we adopt the convention of equating a named line segment such as AD to the corresponding quantity of energy it represents such as mc^2 so that we write this representation as AD = mc^2. Further, when the angle between AD and AE is θ we find that AE = $mc^2.\cos\theta$. Since AD = AB = mc^2, the line EB = (AB – AE) = $mc^2(1-\cos\theta)$. *(see Note 8 for the reason why we call momentum x c as 'motive energy).

Further: It may seem rather strange for the reader to see trigonometric ratios being applied to scalar quantities like mc^2, in the expression for energy E'= $mc^2(1-\cos\theta)$. However, let us note that for a given situation (i.e. for a specific value of $pc/mc^2 = \tan\theta$), $\cos\theta$ always has a **precise numerical value** (between 0 and 1) with respect to the algorithm. And let us consider for example the case when $\cos\theta$ has the value 2/3. Then it will be clear that the expression E' = $mc^2(1-\cos\theta)$ merely states that E' = 1/3 mc^2. Would the reader have felt it strange and baffled to see an expression like E' = $1/3mc^2$? So he/she should not feel odd to see E' = $mc^2(1-\cos\theta)$. Once the rationale of why trigonometric ratios are used, is understood, it will be easier for the reader to get accustomed to the use of these ratios applied to scalar quantities, and the strangeness of this practice will disappear. It is also our contention that **Nature uses geometric**

algorithms involving trigonometry (not algebraic equations) because the former affords the highest level of precision. To allay the doubts the reader may have, we remind him/her that Newton in his *Preface to the Principia* wrote: "mechanics is so distinguished from geometry that what is perfectly accurate is called geometrical; and what is less so is called mechanical". This implies that he has opted for mechanics only as a desperate measure because he simply could not discern the correct geometric method underlying motions of bodies. Energy-momentum equation reveals these geometric relations to us. Hence what we have before us is perhaps Newton's wish for a purely geometrical method, having come true.

Note 7: In experiments beginning with Biot and Savart in 1824, a certain constant appeared in equations which had the dimensions of velocity. This constant was assigned the symbol c - the **absolute velocity of Nature**. In 1856 Weber and Kohlrausch found out that the velocity of light approximated to the value c to a very high degree of accuracy. In time this universal constant has acquired the name 'velocity of light' as a misnomer. We may note that the velocity of light is by no means a constant and it is only the schizophrenia of the theory of relativity that asserts it to be a constant in the case of special theory, while asserting it not to be so in the general theory. Shapiro experiment has demonstrated that the velocity of light varies at different gravitational potentials. It appears to be constant at a given gravitational potential. Thus at the gravitational potential of the Sun's gravitational field where the earth orbits, the fact that the velocity of light c' appears constant and it very nearly approximates to the absolute velocity c, we should not confuse velocity of light with the absolute velocity of Nature c itself. Therefore we should note that objectively, i**t is the absolute velocity c that appears in the 'relativistic' expressions such as $\Gamma = 1/(1- v^2/c^2)^{1/2}$** (and not the light velocity).

Note 8: it is not just for dimensional equality that the term pc appears as momentum p multiplied by the constant c, in the energy-momentum equation - $E^2 + (pc)^2 = (\Gamma E)^2$. It is necessary to recognize that 'momentum' is not an independent category of thing different to energy. It is but the intensive component of a particular type of energy – viz., motive energy. It is by virtue of the fact that motive energy is generically the same as particle's intrinsic energy and field energy, that they can mix and match in the 'energy-momentum' equation., as Aristotle has pointed out (*Nicomachean Ethics)* as follows. In order that two quantities of different kinds of things to commensurate,(such as 5 beds = 1 house) there has to be a common quality between them (i.e. for there to be quantitative commensurability between a number of things there must first of all be a qualitative equality between them). Thus in order that $(pc)^2 = E^2(\Gamma^2-1)$, both pc and E must be qualitatively equal at a higher level. That is they (i.e. particle's intrinsic energy E and motive energy pc) are commensurable because they are both two forms of the same generic energy. However if the reader is uncomfortable with this philosophical proposition, he/she may just ignore the Aristotlean "Commensurability Principle" and consider that the term pc has been obtained by multiplying p by c as a purely mathematical operation to achieve dimensional equality and follo w th rest of the arguments in this paper.

Note 9: Extract from http://fqxi.org/data/essay-contest-files/Kyriakos_Kyriakos__FQXi.pdf
In a series of lectures "The Character of Physical Law " (Feynman, 1964), he analyzed these issues in detail. The following are typical excerpts from his book: *"...there are two kinds of ways of looking at mathematics, which for the purpose of this lecture I will call the Babylonian tradition and the Euclidean or Greek tradition. In Babylonian schools in mathematics the student would learn by doing a large number of examples until establishing the general rule... Tables of numerical quantities were available so that they could solve elaborate equations. ..... But Euclid (under the Greek mathematical system) discovered that there was a way in which all of the theorems of geometry could be ordered from a set of axioms that were simple*". Further Feynman argued that, "*In physics, we need the Babylonian method, and not the Euclidian or Greek method*". The Babylonian tradition and the Euclidean or Greek tradition in the framework of physics and mathematics can also be named "algorithmic approach" and "axiomatic approach"; following Karl Popper (Popper, 1982), they can be called "instrumentalism" and "realism"; recalling the T. Kuhn analysis (Kuhn, 1962), we can also name these methods "Babylonian paradigm" and "Greek paradigm"; or "neo-positivistic approach" and "classical approach" (Mach, 1897; Holton, 1968)).

References:

1. Weyl, H.**"Space-Time-Matter**", (Dover 1952)
2. Maxwell, James C., "**Matter and Motion",** (Dover, 1991)
3. Schlipp, P.A. "**Albert Einstein Philosopher-Scientist**", (Library of Living Philosophers 1970)
4. Born, Max "Einstein's Theory of Relativity", (Dover 1962)
5. Perret, W and Jeffery, G.B, "The Principle of Relativity", (Dover 1952)
6. Marchal, C., www.annales.org/archives/x/Relativity.doc,
7. Galileo. Galeli,"**Dialogue Concerning Two Chief World Systems**", (U. of California Press, 1967).
8. Newton, Isaac, **Mathematical Principles** (U. of California Press, 1962).
9. Rowlands, P., . http://fqxi.org/data/essay-contest-files/Rowlands_PRfractionalcharge_1.pdf
10. Schroeder, D.V., http://physics.weber.edu/schroeder/mrr/MRRtalk.html
11. http://www.sciencemuseum.org.uk/onlinestuff/stories/atomic_clocks.aspx
12. **Global Positioning System: Theory and Applications, Volume 1** (edited by B. W. Parkinson, J. J. Spilker
13. Ashby, Neil, Relativity in the Global Positioning System,
http://relativity.livingreviews.org/Articles/lrr-2003-1/download/lrr-2003-1Color.pdf
14. Feynman, R., **"Lectures on Physics**" (Addison Wesley 1964).
15. Alexandrov, A.D., "**Einstein and Philosophical Problems of 20th Century Physics.**"(Progress Publishers 1970)