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Relativity: The Real Meaning

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Abstract: **Relativistic setting up is nothing more than a mathematical game between definitions and identities turned into principles or physical laws; in this sense, relationship of physical quantities from distinct moving systems is reduced to a fixed system regarding a moving one, so that the time or mass estimated from such a system are given by definition and they can only acquire physical meaning when are considered from the fixed frame.**

Lorentz's transformation is only valid for electromagnetic phenomena and for subatomic particles, such as electron, which by virtue of the wave-corpuscle duality, can manifest its wavelike nature; its extension to classical particles is non-viable.

The only mass to consider is the relativistic one, variable (it depends on velocity), but must be "virtual". However, that virtualitiy confers to the same a great operative capacity under which it is possible to determine the energy levels working in weak, strong and electromagnetic interactions, as well as those produced in the nuclear reactions.

The confusión comes of having mixed two spaces conceptually different: a) ordinary or common one, in which we can use space and time to obtain the velocity as a kinematic characteristic of any particle; b) fields (functions), whose arguments (phases), contain the dynamic variables (energy and momentum) through frequency and wavenumber as essential parameters, which relationship results in the propagation of light's speed, as an universal constant, quite independent of any velocity.

Keywords: **Relativity, Relationship of Physical Quantities, Principles or Physical Laws.**

1. INTRODUCTION

At the end of 19th Century, G.H.Wells published "Time Machine", which has always been a bestseller. No wonder that Relativity Theory built somewhat later, has become a true bestseller of Modern Physics; its attraction lies in the illusion of "handling" time, so that it can be dilated as much as you want, as prescribed by the so-called twin paradox.

It is curious that when Physics at the beginning of 20th century was introduced in the quantum theory by means of the interpretation of the black body radiation, carried out by Planck, in which the continuitiy of the wave theory of light and mechanical phenomena was broken down, a new theory (Relativity) was presented, completely deterministic and with pretentious universality, whithout paying attention to that fact.

Fortunately, most of physicists were working during three decades in order to establish the foundations of Quantum Theory and about the middle of the century establishing the atomic structure and paving the path for the knowledge of subatomic particles and their interactions.

Relativity is incorporated to the quantum world through the well known energy equation, $E = mc^2$, that requires a more precise interpretation. The acceptance of a four-dimensional space (spacetime), mainly at General Theory, makes very difficult to "imagine" the evolution of the dynamic system, so it does not makes easy the understanding that an experimental science requires in its advance.

The theory is based upon two postulates, that just one is unquestionable: the constancy of the speed of light, c, in the free space or vacuum, while the invariance of "all" physical laws respect to moving systems, it is something we intend to examine in this paper.

Those systems are attributed to newtonian mechanic in conformity with the gravitation's law, so that a frame with uniform movement doesn't affect at all to the fundamental law, F = ma, neither to the force of gravitational attraction; the concept of inertial mass correspond to the characteristic of a particle to oppose to its velocity's change.

Extending this demand to electromagnetism, so that it were compatible with the very precise laws of the same one, it is the aim of Special Theory, that later on was completed with Gravitation in the General Theory.

Everything seems to be correct, since its application to the so-called "strong" and "weak" interactions appears to agree with Special Theory; but the almost unanimous of this theory in the development of the experimental physics is strange, since the results presented as demonstrative, produce more than reasonable doubts.

2. CONSTANCY OF THE LIGHT SPEED

The Michelson-Morley's experiment put an end to the existence of a material medium called "ether", that was considered necessary in supporting the matter vibrations for electromagnetic waves being transmitted.

Through this experiment, it was to get different times it takes light to travel the same distance (parallel and perpendicular to the ether linked to Earth), whose velocity would be, v. To obtain the formulas are used c+v and c-v, but being no interference detected, the times should be the same, so that light travels in the vacuum with a constant speed, independent of the velocity of any frame, that it would represent the movement of the ether; therefore, there is **no ether** at all or in other words, the moving system has no influence in the speed of light, in the same way that c-v or c+v have no physical meaning.

The most rational thing, i.e. the simplest in the sense of Ockam razor's rule, it would have been to obviate the propagation of light respect to moving frames. But the perplexity among the Physicists at the end of 19th Century, made them to try to explain the disparity somehow in the calculated "times". In this way, Lorentz and Fitzgerald estimated instead "time dilation", the "lenght's contraction" that experiences an electron in the moving direction, using a classical model.

Einstein's very well-known contribution, it seems to be resisting to any minimal adverse critic. Nevertheless, there are two aspects that appear to be contradictory: 1) the same author explained the photoelectric effect, where the light is considered as a particle (energy quanta) and not as a wave in its interaction with electrons, in his approach to one of the phenomena that inaugurated the quantum theory; 2) to establish a totally classical theory (not quantum), although, based on the propagation of light is inherent continuity and determinism.

3. THE AMBIGUITY OF THE RELATIVE TIME

Beginning with the introduction carried out by H.Goldstein in his work Classic Mechanics, it is observed that the extension of the so called Galilean's transformation (the speed of an inertial system doesn't influence in the acceleration of a particle) to the speed of light as if it were a material particle, then you arrives to an incorrect equation:

v' (veloc.relative to moving system) = c - v (veloc. moving system), since to obtain the acceleration the right-hand term would be null, so Mechanic's law are not valid, but not (as indicated by the author) because the wave cease being spherical, but, for c cannot be compared with the "humble" speed of a material body, for being absolute and the equation turns out impossible.

However, if we do not want to dismiss c, it is necessary modify the classical mechanical's laws and to accomodate it to those that govern electromagnetic phenomena, that are erected like the cornerstone on which should pivot "all" physical phenomena.

As already indicated, the easiest thing would had been to obviate the demand of inertial systems for electromagnetism or in any case that the so-called Lorentz's transformation only was fulfilled in the Maxwell's equations. In others words, the fact that entails the liquidation of the ether in the propagation of light, dosn't imply the necessity to modify mechanic's laws; this is only an "idea" that have been implanted as a paradigm of the Modern Physics: **Unification.**

To obtain the kinematics equations leading to the relationship of "times", Panofski (Classical Electromagnetism) proposes three "thought experiments" (incredible in an experimental science!), but he also goes to something more serious: the theory of transformations that connects with conservation laws. To this end, we have two coordinates systems with relative movement, coincident at the starting point, t = 0, and the fixed one emits a light signal and the equation of wave front will be

$(ct)^2 – (x^2+y^2+z^2) = 0$. (1).

For an observer placed in the moving system, that equation becomes

$(ct')^2 – (x'^2+y'^2+z'^2) = 0$ (2),

where we write down the time (t') and space (x',y',z') differents from the other one. The conservation law we are looking for is as follow:

$(ct)^2 – (x^2+y^2+z^2) = (ct')^2 – (x'^2+y'^2+z'^2) = \text{constant}.$

Considering the relationship between both frames, the significant formulas may be obtained through differential analysis. In this way, the transformation equation will be

$c^2dt^2 – (dx^2+dy^2+dz^2) = c^2dt'^2 – (dx'^2+dy'^2+dz'^2) = \text{const.}$ (3)

If $dx^2 + dy^2 + dz^2 = v^2dt^2$, where v is the velocity of the moving system (O') with respect to the fixed (O) and dx' = dy' = dz' = 0; dt' = $d\tau$, it follows:

$c^2dt^2 – v^2dt^2 = c^2d\tau^2 \equiv ds^2 = \text{const.}$ (4) ,

from which is obtained the **times** formula: $d\tau = [\sqrt{(1-v^2/c^2)}]dt$

Under this relationship, we can see that $d\tau$, called proper time**,** linked to the moving system (O'), will always be smaller than dt, corresponding to the fixed one (O).

Choosing another speed, v' > v, we see that the proper time should decrease, ie, $d\tau' < d\tau$, but considering the constancy of the **Interval,** ds, it would $d\tau' = d\tau$ and naturally, dt' > dt.

For this reason, the above expression is usually converted into the equivalent:

$dt = d\tau/\sqrt{(1-v^2/c^2)} = \gamma d\tau$ (5),

where $\gamma = 1/\sqrt{(1-v^2/c^2}$, is the so-called stretching or dilation factor.

The admission of the existence of two times can be summarized in the so-called **twin's paradox**, according to which, a clock in the fixed system (O) dilate its time respect the moving one (O').

This has caused numerous science fiction stories, movies, etc; it is as the propagation of light, i.e. the constancy of its velocity, c, it would had been provided, as a Chrono god, with the "power" of distributing different times over the whole universe.

How to admit any event can be subjected to "different times"?

Actually, the relationship between the times is reduced to that of "distances" traveled, that fit the Pythagorean theorem right triangle that obeys the formula (4), where it is noted that vdt must be kept perpendicular to $cd\tau$.

To compare two speed, v', v is not correct, as it always may be considered v'-v, ie, which would be the new velocity relative to the fixed system (O); for this reason, the composition of velocities (v', v) and simultaneity preceding this approach are "redundant".

Furthermore, by imposing the condition $cd\tau = \text{const} \Longrightarrow d\tau = \text{const.}$, this time would be a data of the problem, in the same way as it is the velocity, v, so the "dilation", γ, is not more than a factor from which can be obtained directly, dt, that would be be the only observable, that is, the variable capable of being measured from the fixed system (O).

Consequently, it is not possible the existence of an **observer** in the **moving** system (O') and it is solved the **twin's paradox;** likewise, the concept of **proper time**, $d\tau$, is "inappropriate", since this quantity is constant by definition.

Finally, it is possible to consider the transformation only concerning to the extent of space (where the time is not involved), that is, the so-called **Lorentz's contraction**; according to this, from (3)

$c^2dt^2 – dx^2 = -dx'^2 \Longrightarrow c^2dx^2/v^2 – dx^2 = dx'^2 \Longrightarrow dx^2/(v^2/c^2-1) = -dx'^2 \Longrightarrow dx^2 = (1-v^2/c^2)dx'^2 \Longrightarrow dx = \sqrt{(1-v^2/c^2)}dx'^2.$

How could be empirically tested the expression (5)?.

Given the above, the physical quantities involved can only be investigated by the propagation of electromagnetic **wave**. This is defined by a function that depends on a phase (wt – kx), whose propagation velocity, also called phase velocity is given by

c = w/k, (7),

where k is the wavenumber, k = $2\pi/\lambda$, being λ the wavelength corresponding to dx, while the frequency,

w = $2\pi/T$, where T is the period equivalent to dt.

These are the parameters that define the propagation of light and under of just been indicated, the equation of times result in the frequencies: $w_t = \sqrt{(1-v^2/c^2)}w_\tau$ ie, the so-called Doppler effect.

On the other hand, **Lorentz's contraction** may be applied upon wave number, k, that will be increasing according to $k = k_o/\sqrt{1-v^2/c^2}$.

Electron could assume the last relation from the **quantum point of view** (duality wave-particle) through De Broglie equation, based upon the equivalence between wave number and momentum:

p = (h/2π)k ==> λ = h/p (8)

The effect of the "contraction" will be corresponding with an increment of momentum that an electron should experiences.

Finally, we could use what it have been said above to explain the so-called **Compton effect**, if the interaction between electromagnetic and a free electron was equivalent with the "integration" of both entities in the new interpretation of relativistic analysis. So, while the wave experiences a decrease of its frequency (quantum energy), due to Doppler effect, the electron increment its momentum for Lorentz's contraction.

The particle nature of radiation appears with Quantum Theory by the Planck's action constant, h, and the concept of energy's packet (photon) on the radiation in the relation between energy and frequency,

E = hν = (h/2π)w (9);

likewise, Compton's wave lenght by λ_c = h/p = h/mc is taken into account when the electron adquires the wave character.

4. SPACETIME VECTOR

The contribution of Minkowsky to the theory has the advantage of getting a more compact and easier mathematical language, but it obscures the comprehension of the physical reality.

The first trouble comes up with the concepts of position and displacement vectors in the tetradimensional space (ct, **r**); we start designating r as a sort of "position vector", defined by r = (ct, **r)**, where **r** is the true position vector (three-dimensional).

The trajectory of an event will be represented in a spacetime graph

(ct, x) according to the well-known **Minkowski Diagram**, in which the diagonals (light cone) separates absolutely two regions: timelike and spacelike.

To obtain it analytically, we must consider a variation (infinitesimal) of the position vector or "displacement", dr = (cdt , d**r)**, whose module o numerical value is the **Interval** :

$ds^2 \equiv c^2d\tau^2 = dr^2 = c^2dt^2 - d\mathbf{r}^2$ (10);

this may admit three values:

a) null that coincides with the light cone (propagation of light)

b) positive ($ds^2>0$) or timelike (causal).

c) negative ($ds^2<0$) or spacelike, (non-causal).

***Actually, what does it mean this Interval*?**

As it is commonly used, the constant, c = 1, so the interval coincides with the proper time, dτ, which should be the time "to be measured" at the moving frame, and assigned to the particle placed in its own evolution as stated by Einstein (Meaning of Relativity): "...this time would be measured by a clock that indicates second-lights..".

But, this corresponds to the frequency wave, w, which can only assume the quanta particles, as mentioned above.

Respect to Minkowski diagram, we can see that some hyperbolic curves appears above the diagonal of lightcone: the timelike condition. Each curve correspond to an invariant time, $d\tau$, and is possible the existence of numerous times-interval, dt, that it will increase whithout limit with the velocity, v, as have said before. Anyway, it is easy to show geometrically time's dilation and Lorentz's contraction on the diagram.

Let's see how it works the Kinematic problem; first, to obtain the vector velocity, we must derive the "displacement vector", dr = (cdt, d**r),** respect to dτ, obtaining the **four-velocity** vector:

V = dr/dτ = (cdt/dτ, d**r**/dτ) = {cdt/dτ, (d**r**/dt)(dt/dτ)} = ($\gamma c, \gamma$**v).**

Where it may be noted that the four-vector, V, does not make much sense, since the time component is a contradiction in itself, because c can not increase.

But the surprises do not end here, since if we calculate the value or module of V, ie, apply the quadratic condition:

$V^2 = \gamma^2 c^2 - \gamma^2 \mathbf{v}^2 = \gamma^2(c^2 - \mathbf{v}^2) = [c^2/(c^2-\mathbf{v}^2)](c^2-\mathbf{v}^2) = c^2$ (11).

The four-velocity quantity is the same of light's speed, c, while the velocity, v, disappears; it is a proof that the only phenomenon or event that occurs in **Relativistic Kinematics** is the propagation of electromagnetic wave, since v is only a mere parameter independent of the time, dτ, as we have shown earlier.

On the other hand, we can hardly accept a vector in which the time component was a escalar (no direction). So, the easier is to turn to complex numbers at first, r = ct + i**r**, where the quadratic condition is fulfilled inmediately.

But instead we have a powerful mathematical tool with the covariant and contravariant components of tensors or manifolds. So, we may write down the **Interval**, $ds^2 = g_{\mu\nu}dx^\mu dx^\nu$, where the indices are running (0,1,2,3) and $g_{\mu\nu}$ is the **metric tensor** with signature (1,-1,-1,-1), constant, in Special's Relativity and variables in the General one.

Using the contravariant vector, dx^μ = (cdt, dx, dy, dz), and the covariant,

dx_μ = (cdt, -dx, -dy, -dz), we may have a simpler expression for the Interval:

$ds^2 = dx_\mu dx^\nu$.

The metric tensor is the basis on which the **transformation** of **Lorentz** is established, that may also be called "proper" Lorentz Group, as only include rotations; an extension of the same is Poincaré Group, which include displacements, a mathematical complication that hides the true meaning of Relativity.

In fact, the effectiveness of this transformation occurs when it is applied to wave functions and thanks to Noether' Theorem it appears as a physical quantity the Four-current, J^μ, in the equation $\partial_\mu J^\mu = 0$, which becomes in the continuity expression, dq/dt - $\nabla j = 0$, that finally it leads to charge conservation, q.

The effort carried out by some autors (Hestenes and others), to provide the modern physics of a more useful mathematical approach , enters fully in the appropiate formulation of the minkowskian space. So, the "Geometric Algebra", based on that of Clifford and Grassman, contemplates the possibility of a multivector, an algorithm consisting of a scalar, a vector and other resulting terms of multiplied vectors (bivectors, trivectors, etc.) that opens possibilities to deepen in many parts of Physics that classic vector doesn't have. Its extension to projective and conformal geometry are being applied to computer's software, where geometric operations of all kinds are carried out, as rotation, translation, inversion, dilation, etc. From this "virtual" world it could be possible to draw some simpler method to understand the "real" one.

5. THE TRUTH ABOUT ENERGY AND MOMENTUM

We arrive to the importante point of the Theory, accepted by the whole scientific community as a true discovery, the equation of the energy, $E = mc^2$; to get that formula, we follow the Einstein's proceeding: "the action of the an

electromagnetic field on a massive thing or its charges, it will produce changes on momentum and energy, considered as components of a four-momentum".

The dynamic problem arises when it is introduced the mass, m_o, in which case from the Four-velocity, V, we may have the corresponding physical quantity, ie, Four-Momentum:

$P = m_oV = (\gamma\ m_oc, \gamma\ m_o\mathbf{v}) = (mc, m\mathbf{v}) = (mc, \mathbf{p})$ where we have defined the **Relativistic mass:**

$m = \gamma m_o = m_o/\sqrt{(1-v^2/c^2)}$ (12).

But, looking for a more suitable physical meaning, it turns out to define Four-momentum:

$p = cP = (mc^2, cm\mathbf{v}) = \{m_oc^2/\sqrt{(1-v^2/c^2)}, cm_o\mathbf{v}/\sqrt{(1-v^2/c^2)}\}$,

wherein the timelike constitutes the well-known formula of

Energy: $E = mc^2 = m_oc^2/\sqrt{(1-v^2/c^2)}$ (13),

while the spacelike, cm**v** contains the **Momentum:**

$\mathbf{p} = m\mathbf{v} = m_o\mathbf{v}/\sqrt{(1-v^2/c^2)}$ (14) .

To demostrate the first term, $m_oc^2/\sqrt{(1-v^2/c^2)} = E$ represents energy, it is usually derived respect time: $dE/dt = \mathbf{F}.\mathbf{v}$, that is, work per unit of time; so, energy and work the same thing?. Some authors (Panofsky) refers of "work content", although others refers as "energy content", both concepts physically uninteligible; in any case, one can save all that, since the expresión is an energy from a dimensional point of view, since c is a velocity.

In any case, the important fact happens when *p* is defined as **Interval,** so on applying the relativistic (quadratic) condiction:

$p^2 = \gamma^2(m_oc^2)^2 - \gamma^2c^2(m_o\mathbf{v}^2)^2 = (m_oc^2)^2/(1-v^2/c^2) - c^2m_o^2v^2/(1-v^2/c^2) = (m_oc^2)^2$,

where we see that the numerical value of Four-momentum, m_oc^2 is obtained under algebraic operations and its coincidence with $cm_oV = m_oc^2$, makes the

Energy "equation": $E^2 - c^2\mathbf{p}^2 = (m_oc^2)^2$ (15)

an **identity!.**

***How can we admit that an identity may be an equation*?**

First, It turns out strange having been considered valid the "equation" according the same argument from Einstein: "the four-momentum" being a "tetravector", must fulfilled the conditions of the metric, in which case:

$E^2 - c^2\mathbf{p}^2 = E'^2 - c^2\mathbf{p}'^2$ (16) .

Where it is easy to check the prime variables are redundant, since the constant $(m_oc^2)^2$ is obtained again by simple algebraic operation, that is, the above expresion reduces to (15), which highlights the inconsistency of the same as an "equation".

However, the persistence in adhering to Energy formula,

$E = \sqrt{[(c^2\mathbf{p}^2 + (m_oc^2)^2]}$ is that with it you may "justify" the so-called **rest** or **proper mass,** m_o, since for $\mathbf{p} = 0 \Longrightarrow E = m_oc^2$; but as we have seen, the latter expression can be obtained at any speed, because of being an "identity".

Besides, one can reach to that conclusión as it follows: in the same way that an identity is like the two sides of a coin which cannot be used at the same time,

$E^2 - c^2\mathbf{p}^2$ must be used independentely of m_oc^2, as we have proved in the last two paragraph. so, the **energy "equation",** $E = \sqrt{(c^2\mathbf{p}^2+(m_oc^2)^2}$, **is not consistent.**

Actually, if we consider the expression $m = m_o/\sqrt{(1-v^2/c^2}$, we can see the relationship is the same that the times, dt and $d\tau$, so we may apply the same reasoning: m_o is a data of the problem and the only variable becoming "observable", will be the relativistic mass, m, from the fixed system (O); so, the event does not allow the existence of an "observer" in the moving system (O') and $\mathbf{m_o}$ should **not** be the **rest** or **proper mass.**

Furthermore**,** although the formula seems to say otherwise, the true interpretation of it is that m_o is contained in m, so it does not be figure separated one from the other, as it happens between $d\tau$ and dt, according to (5); it turns out a "**definition**" or a **identity",** not an "equation", which in fact should come expressed, $m \equiv m_o/\sqrt{(1-v^2/c^2)}$, so that instead of m_o is manifested **m**, which is the true "observable"; this is the cause of all the "confusion".

Finally, there is another aspect of the "formula" that makes sense: E^2(energy) - $c^2\mathbf{p}^2$(energy due momentum) = $(m_oc^2)^2$(**minimun energy)**; but that minimun can be achieved at any velocity; besides, from the independence of m_o respect v it cannot be inferred that it was null. Therefore, **rest** does **not** exist and electrons cannot assume the energy, m_oc^2, but the corresponding to **relativistic mass**, mc^2, in consonance with the fact of its measurement.

In this sense, the electron's mass is obtained experimentally (Thompson) in function of its charge an others electromagnetic variables, it will be attributed to the relativistic mass, $m = 9{,}1x10^{-31}$ kg and not to m_o. But it doesn't matter, because the dynamic evolution is expressed by the change of the mass, Δmc^2 and this can be determined (particles's accelerators), by $e\Delta V$, where e is the electron's charge and ΔV is the differential of potential. This equivalence permits the introduction of unit system for energy (mass) of electron and others subatomic particles, electron-volt (eV):

$E = mc^2 \equiv eV$ (17).

Therefore, the **electromagnetic nature** of the electron's **mass** and its derivation from the **charge,** e, appears as something logical and plausible.

Finally**,** we must admit that the valid equations are: $E = mc^2$ and $\mathbf{p} = m\mathbf{v}$ and their true relationship can be carried out in the context of Quantum Theory, where thanks to the constant action of Planck, $\hbar = h/2\pi$, the energy corresponds to frequency $mc^2 = \hbar w$ and momentum with the wave number, $m\mathbf{v} = \hbar\mathbf{k}$.

6. INERTIA AND ENERGY

The so-called "mass-energy equivalence" is in line with the questions:

1) "Mass is rest-energy": $m_o = E_o/c^2$. There is an obvious contradiction en that statement: if c act as a speed, then how can we state that m_o was an inertial mass?, and if their function is speed, but the body is at rest, E shoud be potential energy corresponding to electromagnetic interaction, so that the referred **mass** must be **electromagnetic.**

2) Einstein himself wrote (1905) an article: "Does the inertia of a body depend upon its energy content?". According to this, "the mass of body is a measure of its energy "content"; so, if energy changes by ΔE, the mass will be $\Delta m = \Delta E/c^2$; then tries to show that this mass is losing a body when it emits light, according to a mathematical analysis, based on the serie expansion of the formula, $E - E_o = (m-m_o)c^2 = m_oc^2[(1-v^2/c^2)^{-1/2} - 1] \approx m_ov^2/2$; taking into account that this result is corresponding to the classical kinetic energy was "inferred" the mass in question, m_o should be Inertial.

But, the true relation between m and m_o occurs in the same way as the times, dt and $d\tau$ do respect the paths; thus, from the definition of relativistic mass: $m = m_o/\sqrt{(1-v^2/c^2)}$ ===> $(mc)^2 - (m_oc)^2 = (mv)^2$ ===>

==> $(m+m_o)(m-m_o)c^2 = (mv)^2$, which should be the only relationship between the masses, consistent with the above definition, so the serie expansion is not appropiate and it proves nothing.

Finally, if we add that m_o is the minimun mass, but not at rest, **moving systems** are **not Inertial.**

***What is the meaning of Interval, m_oc^2 = constant*?.**

As we previously said, that constant value must be maintained when is increased the velocity, v and therefore the values of $E = mc^2$ and $\mathbf{p} = m\mathbf{v}$, but it is impossible to reach v = c, because in that case those should be infinite; to consider that in this case, $m_o = 0$ and at the same time E = cp is completely "arbitrary". Therefore, the **Interval** can not be **null** and the so-called "light cone" is nothing more than a "limit line".

However, it is possible the negative Interval, which occurs when v>c; this would require a reformulation of the theory, as we have done in our work: "*Tachyon and Modern Physics*" (International Journal of Scientific&Technology Research. Volum 4, Issue 12. December 2015).

In short, everything seems in line with a **virtual** and **electromagnetic mass**, as it have been suggested.

Such kind of mass may be assumed by elementary particles and radiation, with which may be satisfied the Einstein' s desire: "I feel it is a delusion to think of the electrons and the fields as two physically different, independent entities. Since neither can exist without the other, there is only one reality to be described, which happens to have two differents aspects, en the theory ought to recognize this from the start instead of doing things twice"

It is important to indicate that a "mass" of such feature (derived from "charge"), may be associated with any particle, either directly as in the case of electrons or indirectly as of photons, as it is evidenced by the double relationship $eV = mc^2 = h\nu$, where m is like "currency exchange" between charge (particle) and frequency (radiation).

In any case, the energy formula, $E = mc^2$ is the true contribution of the theory, since with it may be explained the high energies that come into play in nuclear reactions.

The **real mass** is obtained from the so-called *baryons or nucleons*, ie, protons and neutrons, which are the only composite particles (*hadrons)* that acquires stability by forming atomic nuclei; this is due to the intervention of three kinds of forces or interactions: **strong**, **weak** and **electromagnetic.**

So, constant mass and "inner" structure is achieved, essential requirements for the existence of **inertia**.

As a result of all the above arguments, it is not possible to establish a **Relativistic Dynamic** as a generalization of the Newtonian one and therefore, "Special Relativity" turns out to be a **failed theory**; but at the same time it can be considered **succesful**, because with it quantum phenomena may be more affordable by "Quantum Field Theory".

7. CONCLUSION

The analysis undertaken provides that both the equations of times and the masses are only valid within electromagnetic waves; they may be assumed by subatomnic particles, thanks to its quantum condition (wave-corpuscule duality), but not by particles involved in Classical Mechanics.

Therefore, Unification is not possible and "relativistic mass" should be electromagnetic and virtual; "true" mass, constant, is obtained by "strong", "weak" and "electromagnetic" interactions, after forming atoms, which constitute the basic material of the bodies in ordinary space.

A detailed exam about the incongruous concepts being detected, it might be due to the acceptance of the metric without reserve, which it leads to the definition of the two basic magnitudes of the theory: a) proper time, $d\tau$, b) proper energy, $m_o c^{2,}$.

But, we have shown that both the usual time, dt and relativistic mass, m, are the "true observables" in common for electromagnétic phenomena and particles having quantum properties (wave-particle duality), while $d\tau$ and m_o are mere problem data, given a priori as the velocity, v, of the moving system.

The consequences of this critical analysis may affect to the General Theory, as we have done in our paper: "*Matter in the Universe*" (International Journal of Mathematics and Physical Sciences Research. Vol. 4, Issue 1, pp.(46-55), Month April-September 2016. Available at: www.researchpublish.com).

The General theory is based on the acceptance of accelerated moving frames as the cause or origin of the Universe in its dynamic evolution. It has a great appeal, because the mathematical displayed, consistent, in the tensor or manifolds analysis, with which physicists have the feeling of being able to solve "any problem", and elevates their imagination towards the enormous sidereal world, with the illusion of dominating it, thanks to the physical (mathematics) equations.

This is legitimate, but the prudence is a virtue that cannot be out of mind. The unifying paradigm expressed in the postulate "all" physical laws it was premature and inadecuate, as we have shown. On the other hand, there is clear separation between the quantum world (atomic and subatomic particles) that we cannot approaching in a direct form, and the classic one, where you may accede in a direct way, because they are at a level to the "measure of human being", paraphrasing the Greek aphorism.

The insertion of the metric in the study of an enormous Universe, transforming it into the law that governs it, is something that impresses anyone. The known proofs are very poor, since the experiments cannot be repeated at will and consequently to control it; the existence of "black holes", "dark matter" and "dark energy", besides the impossibility of quantifying the gravitation doesn't invites us to a very clear optimism.

Electromagnetic theory connects perfectly with quanta phenomena, among others things, because some crucial experiment requests that, but to make it couple with Classical Mechanic was a simple exercise of exaggerated optimism.

The sources of Electromagnetic interaction are the charges, from which the virtual mass is originated. The Noether's theorem have stressed that fact, allowing the introduction of new "charges", in the study of strong and weak interactions. Besides, those charges are quantified, as demands Quantum Theory.

The sources of Gravitation interaction are the true masses, which origin stand up in the compound particles, as proton; this mass is not quantified, hence the electromagnetic and quantum models can't be put together with gravitation.

The charge and the true (inertial) mass are the pillars upon the whole material world is buiding-up and they are completely independents, suggesting that the true paradigm is that of Dualism, as we have tried to show in our previous work: "*The Adventure of Science*" (International Journal of Mathematics and Physical Research. Vol 3, Issue 2, pp.(22-32), Month: October 2015-March 2016, Available at www.researchpublish.com).

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