Explaining the Nature of the Mass $m$ of Submicroparticles and the Phenomenon of Mass Variation with Velocity $V$ in Ether

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ABSTRACT

A brief history of mass nature is presented, including formulas for mass variation with velocity $V$. A new mass hypothesis (MH), on the nature of mass $m$ is presented. Accordingly, the mass $m$ of submicroparticle (SMP), is given by the kinetic energy accumulated inside the SMP, by the vortices/vibrations of groups of ether (ETH) cells, constituting the submicroparticles (SSMP). These SSMPs will also create the inertial force ($F_{I}$) of the SMP, due to the opposition manifested by ETH, toward any accelerated movement of SMP. A new explanation of mass $m$ increase, with $V$ is proposed, admitting the existence of ether in the form of our model, HM16. The entrainment of the surrounding ETH of SMP, takes place, with speed $V_{ETH}$, which stores the $E_{ETH}$ energy. The spatial variation of $V_{ETH}$ around the SMP, was analysed using the method of potential motions, for a cylinder, moving in water-like fluid, or in ETH, resulting a spectrum of the lines of current $\psi$, indicating the size of $V_{ETH}$, rapidly decreasing with distance $r$. So resulted the kinetic energy $E_{ETH}$ stored by the movement of the outer ETH, which provides the supplementary mass $m_{s}$. The case of SMP which acquires velocity $V$, approaching $c$, was analysed. Then, a phase change (PC) will take place, through which the SMP, transforms into photons (PHs), when movements of the ETH from the outside including energy $E_{ETH}$ is transferred into PH photons, having velocity $c_{e}$ representing ETH’s property.

Keywords: General Physics adapted to Ether; Mass intrinsic nature and inertia; Mass variation of submicroparticles with velocity; SRT and GR substitution by Ether; Submicroparticles aproaching $c$ speed in Ether becoming photons.

I. BRIEF HISTORY OF APPROACHING AND TREATING THE PROBLEM OF BODY MASS

A. The Historical Aspect of the Problem of the Nature of Mass

The problem of composition and the intrinsic, inner, nature of the mass of material bodies (MB), which interests us here, has not been approached with a particular interest or with real success in the natural sciences, anywhere in the world and in earlier research.

In ancient times, researchers limited themselves to studying only the external manifestation and interaction of MBs, observable by humans, at the level of knowledge and with the means of investigation available at the time.

Back then, observations on MBs were made only on a human scale, so the practical purpose of weighing goods, when the units of measurement were also natural (in Romans, for example, the weight of a carob bean was used as a measure of weight).

But among the ancient Greeks, there was an intense study of mathematics, and deep, philosophical thinking, so they argued philosophically, that MBs were made up of very small particles, considered as being indivisible atoms, as in Democritus, but the mass concept of a MB body and its nature were unrecognised.

In Europe and the Mediterranean area, starting in the 17th century, a new interest was beginning to emerge to emerge in the circles of scholars, scholastics, and academics, for the laws of manifestation of the behaviour and interactions between various MBs, particularly for understanding their use for things such as the tools, carts, buildings, ships, and at that time, reaching even the planetary system.

These concerns about the external behaviour, of a mechanical nature of MBs, expanded and multiplied, becoming a research discipline initiated by Galileo and continued by Newton and many others in the following 18th and 19th centuries. Even then, however, the problem of the internal composition of MBs was not addressed, nor was the intrinsic nature of the matter that makes up these MBs. Newton nonetheless introduced the mechanical concept of the mass $m$ of MBs, which was later developed in new
European mechanics, but without specifying the intimate nature of mass.

The concept of ether was also developed during this period, representing a special medium/body, with a supporting role in many phenomena in physics and in nature, including light and gravity. This environment was introduced and discussed by important researchers such as Laplace, Stokes, Fresnel, Maxwell, etc.

Starting in the 18th century and the last part of the 19th century, research on the behaviour of MBs deepened, and an interest in the internal composition of MBs was beginning to show. Now, there were some new concerns regarding the laws of manifestation and external interaction of MBs, but also to know how to produce the behaviour of the internal components in MBs without addressing the intimate nature of the components that make up the mass $m$.

Now new scientific disciplines are emerging, which are concerned with the properties related to the interior of MBs, such as thermodynamics, optics, electricity, magnetism, chemistry, biology, etc. Mechanics have also developed strongly, through new branches and new theories of analysis and calculations (analytical mechanics, celestial mechanics, kinetic theory of gases), including new branches as hydrodynamics, acoustics, elasticity, etc.

All these developments have been made possible by the strong development of mathematics, which also diversified with new and unique methods and branches (differential/integral calculus, analytical geometry, non-Euclidean geometries...). However, these activities have not been concerned with the intimate nature of the components that constitute the mass $m$.

At this stage, some new approaches to Newton's mass $m$ have appeared, a notion that has been vehemently criticised by some researchers, such as Mach. However, the solution proposed by Mach, to explain the gravity of mass concentrations in the universe, was not taken over by later workers. Mach did not reach special concerns and results on the internal, intimate nature of the mass of MBs either.

We consider that this tendency to avoid the orientation of studies towards the intrinsic nature of the mass $m$, outlined at the beginning of the 20th century, was due to the appearance then, of the SRT and then of GR.

Following these new theories, the ETH ether was eliminated from physics and from the study of nature. And gravity as a real physical and mechanical force, created through mutual interaction with masses in MBs, and transmitted mechanically by percussion forces $p$, through the ether was replaced by an immaterial gravity, created within GR, by the so-called intrinsic curvature properties of space.

During this period and in this context, an ample and complex development of human knowledge on nature sparked the appearance and development of a new interest in the composition of the internal components of MBs, but without addressing the internal, intimate composition of the mass $m$.

A series of new MPs and SMPs have been identified, forming the so-called Standard System, but again without treating the internal, intimate composition of the mass $m$.

A trend similar to that of neglecting the nature of the mass $m$, was outlined at the beginning of the 20th century, also to the intrinsic nature of electric charges $+ - q$, a nature which was to be closely connected with the nature of the mass $m$.

The manifestations and physical effects of the electric charges $+ - q$ are constituted by the electric forces $F_{E}$ and the magnetic forces $F_{M}$, which are also transmitted mechanically by percussion forces $p$, through the ether, as we have previously demonstrated [1]-[3].

However, these mechanical forces have been replaced in SRT and GR by abstract notions, such as electric fields $E$ and magnetic fields $H$, etc., which have also replaced the role of ether.

Finally, at the beginning of the 20th century appeared the concept of quantum mechanics, which in its undulating variant is based on the so-called wave functions $\psi$, which being similar to the $E$ and $H$ fields, but treated probabilistically, it also contributed to the removal of the research interest, in the intimate nature of the mass $m$ of SMPs, and in the intimate nature of electrical charges $+ - q$, and also in the role of the ether.

B. The Historical Aspect of the Problem of Mass Variation with Speed

Over time, the problem/phenomenon of the variation of the mass $m$ of an SMP with the change of its velocity $V$, has become better known, with the introduction in physics of the special relativity theory (SRT) by Einstein, starting with 1905 [4].

We mention that this theory was introduced in physics in 1905, without developing also the problem of the mass-energy relationship in the form $E = mc^2$. This form became known only later, due to the interpretation given to Einstein's SRT by other physicists who were followers of the Einstein (Plank, Stark, Tolman, Lorenz, von Laue...). However, the first contributions to solving the problem of the variation of the mass $m$ with velocity $V$, appeared earlier 1905 through the works of Thomson (1881), and later those of Heaviside, Lorentz, Hasenhorl, Abraham, etc.

They considered and analysed this phenomenon, starting from experimental observations in laboratories (also from some theoretical considerations) which indicated variations of mass with velocity, so they admitted the existence of a phenomenon of mass $m$ variation with velocity $V$, as a natural property of a moving mass, independent of SRT.

An impetus for the study of the problem of mass variation with velocity came after Michelson's experiments in 1881/87, when some of the abovementioned physicists made several theoretical attempts at explaining the classical result considered "negative" in these experiments.

In the SRT in 1905, Einstein calculated that a material point of initial mass $m_{o}$, but having an electric charge $e$, (e.g., electron), located in an electric field of component $X$ in the longitudinal direction of motion of the particle, and component $Y$ in the transverse direction of motion, undergoes a change in its initial mass $m_{o}$.

He admitted that the change is different, depending on the longitudinal or transverse orientations, with respect to the $x$-direction of the motion of the particle with velocity $V / v$, (we will further adopt, noting in text with $V$ and in formulas with $v$, the velocities in ether), according to relations [4]:

\[
E = mc^2
\]
In obtaining and justifying Eq. (1), (2), Einstein relied on considerations resulting from the admission of the two principles of the SRT proposed by him as being true (without being proved), and as a justification for the creation of the SRT, he mentioned (indirectly) Michelson’s 1881/87 experiments.

We have previously shown repeatedly [5]-[10] that this experiment was misinterpreted slipping an error in transversal light path, by Michelson, so that the experiment can no longer be a means of supporting the maintenance of the SRT in its current form, which without other valid justifications, must be re-analysed and possibly corrected (including Eq. (1), (2)), or that the SRT should be replaced.

We mention that in the periods 1893/1904, Lorenz, trying to explain the negative result of Michelson’s experiments, performed calculations of the variation with speed \(v/V\), of the mass \(m\) of the electron, admitting the real appearance of the contraction of lengths, called Lorenz-Fitzgerald contraction.

Lorenz also applied this contraction to the spherical electron, which became a flattened ellipsoid in the direction of motion, a shape that influenced the result of calculating the mode of mass variation, both with velocity \(v\) and with direction \(x\) of motion, initially reaching the relation:

\[
m_L = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{3}
\]

\[
m_T = \frac{m_0}{1 - \frac{v^2}{c^2}} \tag{4}
\]

However, there is a clear difference between Eq. (4) and Eq. (2), with both being valid for the \(m_T\) transverse mass variation formula, so there is at least one error in the two theories.

For the differences that appear between the expressions of \(m_L\) and those of \(m_T\) from Eq. (1) and (2), and respectively between Eq. (3) and (4), no valid physical or logical justification has been given so far, so that the above expressions result only from calculations, based on their own hypotheses, differently from the works of various authors.

However, the experiments carried out in the years 1900-1910 by Kaufmann, Bucherer, Neuman, and others, proved that the mass of electrons does increase with their velocity \(v\), referring in these experiments, most often to \(m_T\).

For the theoretical explanation of these experimental results, in 1903, Max Abraham developed his own theory, in which the electron was considered a rigid, non-deformable sphere, having a uniformly distributed charge (on the surface or in its volume). According to Abraham’s calculations, due to the displacement of the electron with velocity \(v\), having the resting mass \(m_0\), a transverse electromagnetic mass \(m_T\) developed, varying with velocity \(v\) of the electron (when the active force was oriented perpendicular to the direction of electron motion), given by the formula:

\[
m_T = m_0 \frac{1}{\beta^2} \left( \frac{1 + \beta^2}{1 - \beta^2} \right) \ln \left[ \frac{1 + \beta}{1 - \beta} \right] - 1 \tag{5a}
\]

Eq. (5a) can also be written, after the development of the term with \(\ln \) [11] as:

\[
m_T = \frac{2e}{3a c^2} \left( 1 + \frac{1}{2} \beta^2 + \frac{2}{8} \beta^4 + \frac{5}{16} \beta^6 + \cdots \right) \tag{5b}
\]

However, it is assumed that a different longitudinal electromagnetic mass \(m_L\) also appears (when the active force is oriented in the direction of the movement of the electron), given by the formula:

\[
m_L = m_0 \frac{1}{\beta^2} \left( - \frac{1}{\beta} \ln \left[ \frac{1 + \beta}{1 - \beta} \right] + \frac{2}{1 - \beta^2} \right) \tag{5c}
\]

In Eq. (5b), \(a\) is the radius and \(e\) is the charge of the electron, and \(\beta = v/c\), where the well-known quantities \(v\) and \(c\) appear.

So, to explain the phenomenon of growth of the mass \(m_0\) of the electron due to the velocity \(v\) in ETH, two main theories were proposed in 1905: Lorenz’s electronic theory, according to Eq. (3), (4), and Abraham’s theory of electromagnetic mass, according to Eq. (5a), (5b) whose two authors, supported after 1905, among many others, the validity of the SRT.

We mention that in fact, Lorenz is the one who initiated the SRT bases, beginning in 1890-1900, with his proposal of the contraction of lengths, produced due to velocity \(v\), to explain the "negative" result of Michelson’s experiments in 1881/87.

It should also be noted that in 1905, also based on the theory of variation of the mass \(m\) with velocity \(v\) (Abraham), Kaufmann performed his own experiments, on which he relied his own conception, as Kaufmann did not support SRT, but he remaining in the minority.

But all this dispute arose because of the error that had crept into Michelson’s analysis of his experiments in 1881/87, as we have previously shown [5]-[10].

Under these conditions of error, Einstein’s SRT [4] appeared in 1905, which was based on Michelson's experiments and on the 2 principles of his theory. Einstein then explained in his own way, among other subjects, the phenomenon of increasing the mass of the electron, with speed \(V\) in vacuum, according to Eq. (1), (2) for \(m_L\) and \(m_T\), respectively, as defined by Einstein there.

We notice that since 1890-1905, the mode of variation of the mass \(m\) with velocity \(V\), has been treated in different ways, according to Eq. (1), (2), (3), and (4).

Paradoxically, in the SRT, the treatment of the variation of the mass \(m\) according to Eq. (1) and (2) of Einstein, no longer corresponds to the current interpretation of the SRT, in which a unique relationship is used today, of the type of Lorenz’s Eq. (4). This latter equation is completely different from Eq. (1) and (2), but without appearing today in the SRT, nor the distinction between \(m_L\) and \(m_T\), initially introduced by Einstein.
II. A NEW EXPLANATION OF THE INTIMATE NATURE OF THE MASS OF SMP SUBMICROPARTICLES

Prior to the analysis of the variation with velocity $V$ of the mass $m$ of an SMP, the analysis of the intimate nature of the mass $m$ of the SMP must be approached, in the context of admitting the existence of the ETH ether, even in the form of the HM16 model.

Based on the properties of ETH, and on the modes of interaction between SMPs exclusively by the $p_i$ percussions of ETH admitted by us in the model HM16 of ether [11]-[13], here we will admit a new hypothesis of mass, MH (Mass Hypothesis), on the nature of the mass $m$ of any SMPs.

According to this MH, the mass $m_0$ of an SMP is given by the kinetic energy accumulated in its own internal ether, here referring to the kinetic energy $E_{\text{SMP}}$ accumulated in the existing ether inside an SMP.

This $E_{\text{SMP}}$ energy consists of vortices with their own speeds $\omega_i$, or with their own vibrations with the frequency $f$ of groups of EC cells of the ether, located inside the SMP, here called generically subsubmicroparticle SSMP (Fig. 1).

When an SMP is at rest with respect to ETH, i.e., $V_{\text{SMP}}=0$ (relative to an Oxzy referential), and being isolated from other SMPs, no interaction force or inertial force is exerted on it, and it will have the resting mass $m_0$.

We consider the case when an interaction force begins to act on an SMP, such as the sum of percussions forces $p_i$, having the size $F_p$ [11]-[13], which comes from the outer ETH ether. This force $F_p$ will be applied in a proper action point $A_i$, on the surface of the SMP (Fig. 1).

The force $F_p$, will act, from a direction $-x$, at the point $A_i$, having $x = -r_0$, and consequently, the SMP will move in the direction $+x$ (Fig. 1), with a very small initial velocity $V$, starting from $V = 0$. The velocity $V$ will have the size depending on the size of $F_p$, but will increase with the length of time $t_1$ of the action of $F_p$. This dependence will not be analysed quantitatively here.

Even in this case, however, Newton's 3rd Law will be valid, so that it will appear, almost instantly with the appearance of $F_p$ (after an infinitesimal time, $\Delta t$), a reaction force $-F_p$, which will be created/constituted even by the inertia force $F_1 = -F_p$ of SMP1 (Fig. 1).

According to Newton's 3rd Law, there must be equality between $F_p = -F_i$, but the two forces will not appear perfectly simultaneously in time; instead, they will be separated by a short time lag, $\Delta t$, due to the fact that $F_p$ is the cause that appears first, and $F_1$ is the effect which will appear later. Additionally, because $\Delta t \neq 0$, the displacement of point $A_i$ will occur, in the sense of the first force $F_p$ with speed $V$.

This inertia force $F_1$ of the SMP, will be created physically/mechanically by the reaction of the ubiquitous ETH ether (including inside the SMP), but it will act as a resultant force on the opposite side of $F_p$, at point $A_i$, having $x = + r_0$ (actually, at the point of action of the resultant percussion forces $p_i$, on the semi-surface of the SMP) (Fig 1).

This phenomenon occurs because ETH acts on all SSMPs of inside SMP, and these SSMPs will experience the effect of percussions $p_i$ (or $F_P$) and exhibit the tendency of moving in the direction of $F_p$, +x direction. The ECs cells of ETH, however, adjacent/in contact with SSMPs, will oppose the tendency of SSMPs to move, so that the ECs of ETH, will create reaction percussion forces $-p_e$, which will form the so-called inertia force $F_1 = -F_p$.

It should be noted that the active force $F_p$ will be able to appear only if the inertial reaction force $F_1 = -F_p$ is formed almost simultaneously (after an infinitesimal $\Delta t$) (Fig. 1).

Otherwise, without the presence of $-F_p=F_i$, SMP would move with uncontrolled speed, under the tendency of the active action of ETH ether percussions $p_e$, a force materialised by percussion forces $p_e$ from $-x$ direction, resulting in total force $F_p$.

This is because the displacement that accompanies a force $F$ acting on a body, which would not have a reaction force $-F$ (including that of inertia), will be uncontrolled, so theoretically there would be an infinite amount of displacement of its point $A_i$, of application. However, this limit phenomenon does not happen because ETH is ubiquitous.

This is also the case of the collision of two balls, because in the presence of a single isolated ball, no collision can take place, and the only ball moves continuously with $V = ct$.

The case where the reaction force $-F$ would appear perfectly simultaneously with $F$, could also be analysed, and would occur with an infinitesimal fraction of force $-F$ smaller than $F$, but we believe that this effect would be the same as in the case of $\Delta t \neq 0$.

It follows that without the inertial opposition of $F_1 = -F_p$, there would be no active $F_p$.

It should be noted that for the displacement with distance $l_1$ of the point $A_i$ of action/impact of $F_p$ on the SMP, to produce the mechanical work $L_1$ by the active force $F_p$, it is necessary for them to appear simultaneously, also with the reactive force $F_1 = -F_p$, resulting in:

$$L_1 = F_pl_1$$

(6)

We now admit, according to Newton's Second Law, that the inertial force $F_1$ of the SMP, of mass $m_0$, and
acceleration \( a \), will be:

\[
F_t = m_oa = m_o \frac{\Delta V}{\Delta t}
\]  

(7)

We mention that at present in physics, the relation of transformation of the mass \( m \) into energy \( E \) is admitted in the well-known form [11]:

\[
m = \frac{E}{c^2}
\]  

(8)

In this case, we can apply Eq. (8) for obtaining the proper mass \( m_0 \), from the internal energy \( E_{SMP} \) of the SMP, resulting in:

\[
m_0 = \frac{E_{SMP}}{c^2}
\]  

(9)

Therefore, the inertia force \( F_t \) of an SMP, which develops through its mass \( m_0 \) (consisting of the internal volume \( C_i \) of ETH), is given by the magnitude of its internal \( E_{SMP} \) kinetic energy, created by vortex-type motions with speeds \( \omega \), or vibrations with frequency \( f \), of the SSMPs inside the SMP (Fig. 1). These vibrational movements are in fact movements of these SSMP particles and are also made up of ether EC cells, organised in the form of SSMPs inside the SMPs.

If the initial speed of SMP is very low (\( \Delta V = V-V_0 \approx 0 \), or for noting, \( v = V \)), then the supplementary mass \( m_s \) of the SSMPs will be negligible, so it will result in \( m_s \approx 0 \) from Eq. (4), and in fact will count in the calculations as active mass, only the mass \( m_0 \) from (9) of the SMP.

This expression in (8), of the transformation of mass into energy is logical and physically correct, because the equivalence of mass \( m \) with the energy of the SMP has been physically and experimentally proven.

Through the process described by Eq. (9), the transfer of the internal energy of the SMP \( E_{SMP} \) takes place, in an external energy \( E_{ex} \) also located within ETH and usable in physical processes of nuclear reactor type, etc.

In this process, of transformation \( m_0 \) to \( E_{SMP} \), the vortices/vibrations of all SSMPs will cease inside the SMP (Fig. 1), and the volume \( C_i \) previously occupied by SMP in ETH, will return to its initial state of free ether ETH. Obviously, the \( E_{SMP} \) energy contained by the swirls/vibrations of the SSMP (which are kinetic movements that have now ceased) will be found instantly in the areas of new SMPs, where the same energy \( E_{SMP} \) will be found. Alternatively, the \( E_{SMP} \) energy will be found in new PH photons (cf. Sec. IV).

III. A NEW EXPLANATION OF THE PHENOMENON OF INCREASING THE MASS OF SMPs WITH INCREASING SPEED \( V \) IN ETH

A. The General Framework of the Phenomenon of Mass Growth

We will rely in this approach on the results obtained by us on the mechanical properties of ether, according to the model HM16 [11]-[3], [12]-[14], to advance a new physical explanation having a mechanical nature, of the phenomenon of mass increase of any SMP, including the electron, due to velocities \( V \) in ETH.

We admit that any immobile SMP is surrounded by the ETH ether, which is in absolute rest in the surrounding area.

According to our HM16 model, we consider ETH as a perfectly elastic crystalline body without internal friction, nor at contact with another SMP.

As a result, in the case of a displacement with speed \( V \) in ETH of an SMP in a certain direction Ox, this movement of the SMP will produce replacement/ displacement, and in fact a continuous relocation in a proper time \( t_s \), of a certain volume/quantity \( C_i \) of ETH, corresponding to the proper volume of the SMP submicroparticle, denoted by \( C_i \) (Fig. 2, Fig. 3).

The situation in ETH is similar to that of a fluid, including an ideal liquid or gas, in which a sphere of radius \( a \), or any other solid body moves.

But due to the continuity of the crystalline body of ETH, through this relocation of ETH from a minimum \( C_i \) volume of the SMP, there will be a wider movement, of a volume of ETH, which will extend far beyond its own close area, of total \( C_i \) volume, around the SMP.

The influence will take place, in a here so-called Zone of Significant Influence (ZSI) with its own \( C_i \) volume, which will permanently accompany a SMP, at any given time \( t \), in its movement with speed \( V \) (Fig. 2).

In the area of influence of the ZSI, there will be mainly local displacements of length \( s \) \((x_s, y_s, z_s)\) of the EC cells of ETH, which will be accompanied by \( u \) linear and \( \nu \) angular deformations of the crystalline network of ETH.

Theoretically, the area of influence SZI, should extend to infinity, obviously appearing displacements \( s \) and deformations \( (u, \nu) \) of negligible sizes, beyond a certain distance \( r \), depending on the size/diameter \( 2r = 2a \) of the SMP, and of the speed \( V \).

This phenomenon of displacement of ETH, can be considered in a simplified way only as the displacement from the median plane Oxz of the sphere of volume \( C_i \) of the SMP. Thus, the phenomenon of displacement of ETH, can be treated as a problem of plane motion from hydraulics, of a circle/cylinder in water.
In this simplified case, the phenomenon of ETH displacement by an SMP, can be well described by the simpler case of the transverse displacement of a cylinder of radius \( a = r_0 \), along the axis Ox, through an ideal fluid (Fig. 2). This phenomenon can be analysed with the theory of the potential motions of a perfect fluid.

The complex potential \( f(z) \) of the cylinder problem (practically equivalent to our sphere of volume \( C_0 \)) which moves with velocity \( V \) in ETH, results from the summation/overlap of the complex potentials related to the case. Thus, we will superimpose the complex potentials of two parallel currents, having their initial velocities \( +V_\infty = V \) and \( -V_\infty = -V \) (to obtain the immobile ether), with the complex potential of a dipole/doublet of fluid, with radius \( a = r_0 \), moving with a speed \( V = \text{const.} \), resulting in the final potential function [15]:

\[
f(z) = V_\infty a^2 \frac{x - iy}{x^2 + y^2} \tag{10a}
\]

And the current function \( \psi \) of the above motion, results in:

\[
\psi = -V_\infty a^2 \frac{y}{x^2 + y^2} \tag{10b}
\]

With the complex potential of Eq. (10a), the results of the spectrum of motion are shown in Fig. 2. For our purpose, they are useful to analyse Fig. 2.

The lines of current \( \psi = \text{const.} \), are given by Eq. (10b), according to which the ample movement of ETH takes place around the SMP, produced by the displacement of SMP, of spherical shape, with radius \( r_0 = a \), and of volume \( C_0 \).

It is observed that the ETH motion will theoretically extend at an infinite distance \( (r = \infty) \), but with values of the velocity \( V_\infty \) of the ETH motion, which decrease rapidly (Fig. 2) with increasing distance \( r \).

It should also be noted that the allure of the lines of current \( \psi = \text{const.} \), from Eq. (10b), at a certain point in space M (Fig. 2), will be increasing with the increase of the speed \( V = V_\infty \) of the SMP.

It should also be noted that the allure of the lines of current \( \psi = \text{const.} \) is symmetrical to both the Oy axis and the Ox axis (Fig. 2). This situation indicates that the ETH ether displaced by the SMP front, will return to its initial position, but will be located behind the SMP, and displaced by a diameter \( 2a \) (Fig. 3) after the SMP has passed.

The pressures percussion forces \( p \), which act on the spherical surface \( S_p \) of the SMP, will also be symmetrical, both with respect to the Oy axis and to the Ox axis (Fig. 4). So, the resultant \( P_r \) of the pressure forces in the Ox direction, as well as \( P_x \) in the Oy direction on \( C_0 \), will both be zero. There will therefore be no driving force upon SMP, and in fact there will be no resistance force to the advancement of the SMP through ETH. This is the case with the ideal ETH type HM16, without friction.

However, it is known that in the case of a real fluid, manifesting friction during the deformation/displacement of a body SMP in its volume, will significantly change the pressure distribution \( p \) on the surface of the SMP, (Fig. 4, green curve), compared to the case of the ideal fluid (red curve).

Thus, a force resulting from the asymmetric pressure forces \( p \) with respect to Oy axe will appear in the direction Ox (Fig.4): a non-zero, \( P_x \neq 0 \), force that will constitute a braking/driving force on the SMP, along the direction Ox, as its speed \( V \).

As mentioned, in the presence of an ideal fluid such as ETH ether, such a non-zero driving force \( P_x \) will not exist (Bemoulli-Euler paradox).

We find that in the case of SMP moving through ETH with speed \( V \), there is the phenomenon of ether driving, resulting the movement/entrainment of ETH around the SMP with variable \( V_\text{Eth} \) speeds, decreasing with distance \( r \) from SMP, or according to the density of the lines of current...
ψ (proportional to speeds V) in Fig. 2 and Fig. 3.

This entrainment of ETH leads to the accumulation in the area around the moving ETH, of a quantity of \( E_E \) energy, which will be proportional even to the square of the speed of the ether \( V_E \), and to the quantity/volume \( C_E \) of ETH, subjected to the movement.

If for a short given time \( \Delta t \), the velocity \( V_{SMP} \) remains constant and the spectrum of the velocities of the ether \( V_E \) around the SMP also remains constant (\( V = V_E = ct \)), the corresponding kinetic energy \( E_k \) of the ether ETH moving around the SMP will also be kept constant (\( E_k = ct \)).

This \( E_k \) energy will move together with the SMP, with the speed \( V_{SMP} \), and thus \( E_k \) will be intimately attached to the SMP, giving to SMP the equivalent of the supplementary mass \( m_s \) (compared to the rest mass \( m_0 \)) according to the formula of equivalence (8), in modern physics:

\[
m_s = \frac{E_k}{c^2} \tag{11}
\]

This mass \( m_s \) will acquire increasing values, with the increase of \( E_k \) due to \( V_{SMP} \), according to the experiments from the 1900s, mentioned in Sec. 1, and accordingly, will increase the effect of force \( F_i \) due to the inertia \( I_m \), \( F_i = f \) (\( I_m \)), corresponding to this mass \( m_s \).

B. Approximate Calculation of the Kinetic Energy \( E_E \) Accumulated in the Ether Moving around an SMP, which Moves Slowly through the Ether

We admit according to HM16, that a certain volume/mass of ETH \( C_i \), moving with SMP having the final velocity \( V_{SMP} \), starting from zero, will store a quantity of kinetic energy \( E_i \) whose size, according to the principles of classical mechanics will be [8]:

\[
E_i = \frac{C_i V_E^2}{2}. \tag{12a}
\]

But if for short periods of time \( \Delta t \), the velocity \( V_E \) does not vary but is considered constant (\( V_E = ct \)), then the driving force \( F \) of ETH (conf. Sec. III A) which produces the mechanical work (or energy \( E_{kin} \)), will be constant, and then the factor \( \frac{1}{2} \) no longer appears in Eq. (12a).

Then from Eq. (12a), the total energy \( E_E \) as a function of the weighted/average velocity \( V_m \) and of the total mass/total volume (significant around SMP), of entrained ether \( C_i \), will be:

\[
E_E = \Sigma C_i V_E^2 = C_i V_m^2 \tag{12b}
\]

To evaluate as accurately as possible the quantities/volumes of mobile ETH \( C_i \) around an SMP to which the \( V_E \) velocities correspond, from Eq. (12b), we will replace conveniently, the theoretical surfaces between two consecutive lines of current \( \psi/\psi_{i+1} \) shown in Fig. 5., having the irregular aspect of two strips, symmetrical about the Ox axis, but having variable width \( \Delta r_i \) (starting and ending with zero), and in the form of crescents (green lines in Fig. 5).

To simplify the calculations, we will replace a crescent strip with a strip in the shape of a half-crown of a circle (in red in Fig. 5), but with a constant width \( \Delta r_i \), which is easier to calculate. The new strips will have the same surface area as the crescent strips (Fig. 5). Thus, the volume corresponding to such a complete circular crown, composed of two strips of width \( \Delta r_i = r_{i+1} - r_i \), considering the spherical crown between the radii \( r_i/r_{i+1} \), will be:

\[
C_i = \frac{4\pi}{3} (r_{i+1}^3 - r_i^3) \tag{13}
\]

For the practical case, with \( p=3 \) and \( m=10 \), a number of 30 calculation steps (\( n=3x10=30 \)) results from Eq. (14b).

The successive steps \( i \) of the calculation with \( n=30 \) in number, will be:

\[
r_{i+1} = r_i + \Delta r \tag{15}
\]

That is:

\[
\begin{align*}
r_1 &= r_0 + \Delta r \tag{15a} \\
r_2 &= r_0 + 2\Delta r \tag{15b} \\
r_3 &= r_0 + 3\Delta r \ldots \ldots \tag{15c} \\
r_n &= r_0 + n\Delta r \ldots \ldots \tag{15d}
\end{align*}
\]
The volumes of either $C_1$, $C_2$, $C_3$, ..., in the form of equidistant spherical crowns (Fig. 5) with equidistance $\Delta r$, will be:

$$C_1 = \frac{4\pi r_0^3}{3} - \frac{4\pi r_1^3}{3} = \frac{4\pi}{3} (r_1^3 - r_0^3)$$  \hspace{1cm} (16a)

$$C_2 = \frac{4\pi r_0^3}{3} - \frac{4\pi r_2^3}{3} = \frac{4\pi}{3} (r_2^3 - r_1^3)$$  \hspace{1cm} (16b)

$$C_3 = \ldots = \frac{4\pi}{3} (r_3^3 - r_2^3)$$  \hspace{1cm} (16c)

$$C_n = \ldots = \frac{4\pi}{3} (r_n^3 - r_{n-1}^3)$$  \hspace{1cm} (16d)

We now determine the differences between the volumes/adjacent crowns of either $\Delta C_i$, in the form of equidistant spherical crowns: $C_1$, $C_2$, $C_3$, ..., which, from Eq. (16a-d) and an algebraic calculation, will finally result in:

$$\Delta C_1 = C_2 - C_1 = \frac{4\pi}{3} (r_2^3 - 2r_1^3 + r_0^3)$$  \hspace{1cm} (17a)

$$\Delta C_2 = C_3 - C_2 = \frac{4\pi}{3} (r_3^3 - 2r_2^3 + r_1^3)$$  \hspace{1cm} (17b)

$$\Delta C_3 = \ldots = \frac{4\pi}{3} (r_3^3 - 2r_2^3 + r_1^3)$$  \hspace{1cm} (17c)

$$\Delta C_n = \ldots = \frac{4\pi}{3} (r_n^3 - 2r_{n-1}^3 + r_{n-2}^3)$$  \hspace{1cm} (17d)

We will now calculate the successive ratios of the volume differences $\Delta C_i$ from Eq. (17a-d), after simplifying by $4\pi/3$ and using Eq. (15a-d) and performing the algebraic calculation from the numerator and denominator, after simplified $\Delta r = \Delta$, was denoted. Finally simplifying with $\Delta^2$, passing to the limit of decreasing steps for $\Delta$, and applying the Hospital’s rule, our calculations finally result in:

$$\frac{\Delta C_2}{C_2 - C_1} = \frac{r_2^2 - 2r_1^2 + r_0^2}{r_2^3 - r_1^3}$$  \hspace{1cm} (18a)

$$\frac{\Delta C_3}{C_3 - C_2} = \frac{r_3^2 - 2r_2^2 + r_1^2}{r_3^3 - r_2^3}$$  \hspace{1cm} (18b)

$$\frac{\Delta C_4}{C_4 - C_3} = \frac{r_4^2 - 2r_3^2 + r_2^2}{r_4^3 - r_3^3}$$  \hspace{1cm} (18c)

$$\frac{\Delta C_5}{C_5 - C_4} = \frac{r_5^2 - 2r_4^2 + r_3^2}{r_5^3 - r_4^3}$$  \hspace{1cm} (18d)

$$\frac{\Delta C_n}{C_n - C_{n-1}} = \frac{r_n^2 - 2r_{n-1}^2 + r_{n-2}^2}{r_n^3 - r_{n-1}^3}$$  \hspace{1cm} (18e)

It can be easily seen in Eq. (18a-e), the forming rule for final terms from the numerator and the denominator, which are obtained by increasing them simultaneously with the value 6.0.

It is found that for $\Delta r = ct$, the magnitudes of increase $\Delta C_i$ of the volumes of ETH $C_i$ are initially larger, starting from double, 2.0 in the first step, before gradually decreasing to 1.50, 1.33... 1.00.

In this situation, the volumes of either $C_1$, $C_2$, $C_3$, ... from Eq. (13) will initially have for $i = 1, 2, 3, ...$, a relatively large increase $\Delta C_i$, starting from the ratio 2.0, according to Eq. (18a), but then the relative increase $\Delta C_i/\Delta C_i$ is cushioned, continuing with the ratios of approx. 1.50, 1.33, 1.25... and tending to 1.00, at large numbers of steps $\Delta r$, according to Eq. (18e).

So, at long $r$ distances, and a constancy of the increase $\Delta C_i$ of the volumes $C_i$ from Eq. (13) respectively (Eq. 16x) is obviously due to the increase of the radii $r_i$ but in radii $r$ of finite size, volumes $C_i$ will also have finite sizes.

In the same case, the velocities $V_i$ associated with the volumes $C_i$ will also acquire an accelerated decrease, with the increase of the distance $r_i$, according to the spectrum of motion from Fig. 2, starting from the value $V_1 \approx V_{SMP}$ in front of the SMP, and tending towards the value $V \approx 0.00$, at long distances $r$.

If the volumes of other $C_1$, $C_2$, $C_3$, ... are capped at finite values depending on the finite radii $r_i$, and the velocities $V_i$ tend to 0.0 with increasing distance $r$, the successive energy increases for the new steps $i$, and $E_{SMP}$ given by Eq. (12b) and will tend to 0.00. This way, the series of $E_i$ values in Eq. (12b) will form a convergent one.

In this way, the value of the total energy in ETH around the SMP, $E_T$, given by the sums of all the terms in Eq. (12b) for a certain speed $V_{SMP}$, will tend towards a precise value, which could be obtained by the well-known expression given by:

$$E_T = m_sc^2$$  \hspace{1cm} (19)

In Eq. (19), the supplementary mass $m_s$ of the SMP, will represent the equivalent of the energy accumulated in the ETH ether around the SMP, which moves with the speed $V_{SMP}$ (Fig. 2, Fig. 5... ) according to Eq. (11).

By introducing Eq. (19) into Eq. (11) with the weighted average velocity $V_m$ of Eq. (12b) denoted as the average velocity $V_m = V_E$ of the ether around the SMP, and denoting by $C_i$ the volume of the total significant ETH moving with velocity $V_m$, we obtain the significance of the supplementary mass $m_s$:

$$m_s = Ct \frac{V_E^2}{c^2}$$  \hspace{1cm} (20)

So, due to the $V_{SMP}$ velocity of the SMP particle, the supplementary mass $m_s$ will be proportional to the total significant volume/mass $C_i$ of ETH ether, driven in motion by the SMP, with the average velocity $V_{SMP}$ = $V_E$, and the ratio of the squares of these average velocities and of speed $c$.

A more detailed version of the formula for calculating the supplementary mass $m_s$ in Eq. (20), can be performed (in the future, by a special detailed approach) by determining the magnitude of the velocities $V_i^2$, at any point of the volume $C_i$ (Fig. 5), based on the formula of current lines $\psi$, and the movement of ETH around the SMP in Eq. (10). Here,
however, we set out to establish only the principle of the formula for calculating the supplementary mass \( m_s \), given by Eq. (20).

From Eq. (20) it also follows that for the case \( V_E = c \) we obtain:

\[
m_s = C_t \tag{21}
\]

From Eq. (21), we notice that to the additional mass \( m \) of the SMP, moving in the limit case \( V_E = c \), will correspond to the volume/quantity of the total ether \( C_t \) entrained together with the SMP.

However, it is not obligatory for the law of variation of mass \( m \), to be even the Lorenz’s law from Eq. (4), which was different from that of Einstein from Eq. (2) in 1905, but is identical to that of the current SRT, introduced later by relativistic physicists.

It is possible that the real law of mass variation, is more complex than the law from Eq. (4). In fact, it is often said in the field of physics, that the match with formula (4) of the experimental results is only “satisfactory, good, satisfactory”, so formula from Eq. (4) is not accurate.

Henceforth, we can admit that Eq. from (20), which will give a result in the form of an infinite but convergent series of terms (considering its origin from Eq. (12b)), can be considered possible, being even the real one.

Moreover, the phenomenon described above, of the appearance of the force \( F \) (conf. Sec. III A) of training/resistance of the ETH to the movement of an SMP, is a very complex spatial phenomenon.

It is more likely that the law of variation of mass \( m \) with velocity \( V \geq c \) of Abraham type from Eq. (5), in the form of a series of terms \([14]\) is closer to reality, but in fact, is closer to the results from experiments.

And so, Eq. from (20) give the most correct result for the mode of variation of the mass \( m \) of an SMP, being due to the velocity \( V \).

We mention here that the way described above in this Sec. III., concerning the constitution of the supplementary mass \( m_s \), of an SMP moving with velocity \( V \) in space, in fact in ETH, according to equation from (20), provides the first strong evidence of the presence and existence of ETH ether.

This is true, because this surrounding ETH accumulates the kinetic energy \( E_k \) received by the SMP as it attained by acceleration the velocity \( V \) in space, when in fact it advances through the ETH.

So, the ETH will provide supplementary opposition to any increase (acceleration) in speed with \( \Delta V \) of SMP, by driving ETH at increased speed with \( \Delta V_E \) of the surrounding ether of SMP, and on increased \( r \) thicknesses. So, will be stored in the surrounding ether of SMP the related additional energy \( \Delta E_t \). This energy \( \Delta E_t \) will lead to the mass increase with \( \Delta m_t \) of the SMP mass \( m_0 \), and the complete effect of the velocity \( V \) of the SMP will provide its supplementary mass \( m_t \) to its rest mass \( m_0 \).

At the same time, the real presence of ETH eliminates the justification of GR's invention, as well as the validity of its operation, which implies, after Einstein, the existence of an empty space, which is deformable in the presence of a mass \( m_0 \), a situation/phenomenon that is impossible in the presence of ETH ether.

IV. THE CASE OF AN SMP THAT MOVES RAPIDLY THROUGH THE ETHER BECOMING PHOTONS

To analyse what happens when the speed \( V_{SMP} \) of SMP, and implicitly the \( V_E \) of displaced ETH, approaches the speed of light \( c \), the case \( V_E = c \) is presented in Fig. 6.

We observe in Sec. III B above, that when \( V_E < c \), the energy \( E \) transmitted to the SMP by the percussions forces \( p \), of the ether ETH \([12]-[14]\) is converted into the kinetic energy \( E_{KS} \) of ETH around the SMP. This phenomenon can occur only if \( V_E < c \). However, due to the continuous energy inputs \( \Delta E \) on the SMP, the critical threshold of the velocity \( V_E = c \) is reached, and we conclude from experiments, that a phase change (PC-phase change) of the ETH/SMP situation must occur.

Fig. 6. Representation of an SMP (blue in section) in the form of a sphere of radius \( a \), moving through ETH with a speed \( V \), increasing to speed \( c \), producing the movement of surrounding ETH, along the equivalent lines of current \( \psi \) (in red). When velocity \( c \) is reached, the phase change FC takes place, when the external motion of the surrounding ETH is transferred in vortices inside the SMP, which becomes the photon PH with velocity \( c \), in the Oxzy referential.
Here, we admit that the correct transformation relation $m_0 \rightarrow \ldots \rightarrow m$ (Eq. 5b), does not contain terms that cancel out when $v=c$, so excluding infinite terms.

After the phase change PC, when in ETH reaches $v=E/c$, there will be a transformation of the ordinary SMP, of mass $m_0$ and equivalent energy $E_{SMP}$, into photons PH which will move with the speed of light $c$ in ETH (Fig. 6).

Through this PC phenomenon, the kinetic motion with the $V_e$ velocity of the ether around the SMP ceases, and the outer ETH motion and corresponding energy will be fully transferred as the internal kinetic motion of the SMP, constituting the $E_{SMP}$ energy located right inside the SMP. The SMP then in turn, will transform into one or more PH photons, which will accumulate inside them both the $E_k$ energy from the ETH and the $E_{SMP}$ own energy initially contained by the SMP.

$$E_{PH} = E_{SMP} + E_k \tag{22}$$

It also results, that the internal structure of the SMP, consisting of its own vortices/vibrations of frequency $\omega/\epsilon$ of the internal SSMPs, which initially constituted the $E_{SMP}$ energy itself (cf. Sec. III), will be transformed. For in fact, the rapidly moving SMP particle itself will be transformed, and the PH photons will appear in its place (Fig. 6), which will be equivalent in total $E_{PH}$ energy, to the SMP total energy, according to Eq. (22) so that energy $E$ is always conserved, including the conservation of mass $m_0$ by energy $E$.

V. CONCLUSIONS AND CONSEQUENCES

Initially, the intimate nature of the mass $m_0$ of the SMPs was analysed, establishing that it was represented by the energy $E_0$ stored in the vortices of SSMPs, the constituents of SMPs.

In Sec. III B, some new explanations were presented for the phenomenon of increasing the mass $m_0$ of SMPs with a supplementary mass $m_s$ due to the increase of the SMP velocity $V$ in ETH. This was done by assigning/identifying the mass $m_s$ with the kinetic energy $E_k$ accumulated in the ether moving around the SMP, which moves slowly through the ether.

The evaluation of $E_k$ was done here with an approximate calculation, based on the simplified equivalence of the $C_1$ volumes of variable shapes, by circular crowns of ETH. This ETH around the SMP, was brought into motion with variable velocities $V_e$ with distances $r$, precisely by the movement of the SMP trough ETH.

Thus, the variable volumes $C_1$ were equated by spherical crowns of ETH, so that their volumes would be easier to calculate. A direct correspondence was thus established between the supplementary mass $m_s$ and the volumes/masses $C_1$ of external ETH ether, set in motion by the passage of an SMP.

In the future, it will be possible to proceed to a more accurate approach for the problem of $E_0$ calculation, with the aim of obtaining a more accurate expression for the volumes/masses $C_1$ and for the velocities $V_e$ related to them.

As new consequences, the impact of this Article is strong and felt in all areas of Physics.

Thus, changes are made to the way of understanding and considering the mass in calculations, starting from the nature of SMP as vibrations of the internal cells of the ether type, whose kinetic energy constitutes the rest mass.

SMP constantly interacts with the cells of the external ether, and in the case of SMP motion with speed $v$, the additional mass increase is created. And this phenomenon of SMP/ETH interaction is produced exclusively by mechanical percussion and is based on the presence of ETH ether.

And the existence of ETH can no longer be disputed on the basis of the Michelson MMX Experiment of 1881/87, in which we have identified since 2000 [16], an error of analysis, a result which reverses Michelson’s initial conclusions.

In this case, SRT no longer has as its justification basis, MMX In this case SRT no longer has its base MMX, and therefore must be removed/delimitated from Physics, and GR is replaced even by ETH. For with regard to gravity, we have shown that gravity is in fact an interaction by percussion forces between pairs of electric dipoles, of which the whole matter is constituted, but based on a corrected Coulomb’s law.

Finally, a New Physics based on ETH (NPE) is formed, everything that is now new, started from the discovery of the error in MMX’s analysis.

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