I. Introduction; recall (looking for the masses):

A lot of works (e.g. [02]) actually explore mechanisms which could explain how elementary particles of the physics "win" their mass; for memory one can recall the paper of Ibison "semi-classical electro-dynamic for mass less particles" (in which the author thinks about a kind of pre-electron) [26] and more recently the work of Rueda and Haisch [22] explaining a possible origin for inertia or of Majorana looking behind the standard model and explaining why one is today obliged to do it to discover a possible origin for the mass of neutrinos. Our approach fundamentally stays in the continuity of this stream that can be rooted in an initial intuition perceiving the matter as the observable foam of an energetic ocean. That is why we feel absolutely free to start the discussion in vacuum which is accordingly to the controversial prediction of the QFT (quantum field theory) theoretically containing an infinite energy per unit volume (thus representing an enormous natural reserve of energy) if all frequencies are taken in account [31] and at least about seventy per cent (73% in [31] and 71% ± 1 % in [17]) of all energy in the universe (the dark energy) if, as we think, this part of the energy is contained in the geometric structure of space-time.

II. Natural forces in vacuum:

1. Symmetries in vacuum and the Navier Stokes equation:

Consider the first part of our work as an introduction to the following paper. We insist on the fact that it is only an essay and that our argumentation could sometimes appears to be a little bit poor because at the beginning only based on a symmetry. We mainly hope to open a way leading to the right solutions, our purpose being to predict correct ratio for masses of elementary particles.

The symmetry concerning the expression of a force arising inside a region of a 3 (+ 1) space (-time) $\wp$ without electric current where an EM field exists faraway from any material source, charged or not, where the mathematical (E) question (see intuitive introduction) receives a trivial solution:

$$\partial(\varepsilon_0.\mu_0.\ \rho_0.\mathbf{V})/\partial t = \varepsilon_0.\ T_2(°)(\partial, \mathbf{E}).\ \mathbf{E} + \mu_0.\ T_2(°)(\partial, \mathbf{H}).\ \mathbf{H} - \mathbf{grad}\ \rho_0 + \varepsilon_0.\ \mu_0.\ \partial(\mathbf{rot\ X})/\partial t \qquad (1)$$

was from the very beginning of our work a sufficient argument to introduce the hypothesis of the existence of a "gravitational" component of this force with following formalism: $\chi_0.\ T_2(°)(\partial, \Gamma).\ \Gamma$; in a first totally intuitive and quasi- naive approach we had imagine a virtual situation related to the vacuum undergoing this triad action under the condition that each point in (or of) $\wp$ had to be at rest:

$$\mathbf{0} = \varepsilon_0.\ T_2(°)(\partial, \mathbf{E}).\ \mathbf{E} + \mu_0.\ T_2(°)(\partial, \mathbf{H}).\ \mathbf{H} + \chi_0.\ T_2(°)(\partial, \Gamma).\ \Gamma \qquad (2)$$

Why not? It is certainly a beautiful relation! But why would it be correct somewhere? In fact we have no proof of the existence of a basis where it could be true. What do we really know about this (until now) virtual basis? If it exists, it *must* be one in which the (E) question receives *simultaneously* a trivial answer for **E**, **H** and Γ; in fact for **rot E** ⌂ **E**, **rot H** ⌂ **H** and **rot** Γ ⌂ Γ. And it must be one where absolutely no mechanical motion occurs because of (2). This basis must be the image of a perfect rigid immaterial body (because there is no source in $\wp$), a kind of crystal at 0°Kelvin; in fact, a representation of the forbidden (by the RG) absolute frame. Because of the completeness of the vacuum and accordingly to the ideas developed in the first part § III. 2. we could now argue that a combination of (1) and (2) is an acceptable way of doing and we would obtain in this unknown basis:

$$\partial(\varepsilon_0.\ \mu_0.\ \rho_0.\mathbf{V})/\partial t = -\ \chi_0.\ T_2(°)(\partial, \Gamma).\ \Gamma - \mathbf{grad}\ \rho_0 + \varepsilon_0.\ \mu_0.\ \partial(\mathbf{rot\ X})/\partial t \qquad (3)$$

But a priori with:

$$\mathbf{grad}\ \rho_0 = \varepsilon_0.\ T^{t}_2(°)(\partial, \mathbf{E}).\ \mathbf{E} + \mu_0.\ T^{t}_2(°)(\partial, \mathbf{H}).\ \mathbf{H} \qquad (4)$$

only, suggesting that a term $\chi_0.\ T^{t}_2(°)(\partial, \Gamma).\ \Gamma$ could have been forgotten in the discussion starting with the Maxwell's Laws.

Because the Poynting's vector **K** exists, at least for a while, we are authorized to think that short time motions (streams) of EM energy occur in vacuum even if for any observer staying at the origin of an inertial frame (IF) in vacuum one must have $\langle\mathbf{K}\rangle = \mathbf{0}$. Since any energy is associated to an equivalent mass because of the equivalence-relation between mass and energy obtained in the Special Theory of Relativity (SRT), eventually in its "translation" per unit of volume:

$$\rho_0 = \rho.\ c^2 \qquad (5)$$

where ρ is the volumetric density of "equivalent matter" (in the sense of the STR) or of "potential matter in vacuum" for us and with the well known relation valid in vacuum:

$$\varepsilon_0.\ \mu_0.\ c^2 = 1 \qquad (6)$$

where ρ_0 is the volumetric density of EM energy (see first part), we rapidly get from (3):

$$\partial(\rho.\mathbf{V})/\partial t = -\ \chi_0.\ T_2(°)(\partial, \Gamma).\ \Gamma - \mathbf{grad}\ \rho_0 + (1/c^2).\ \partial(\mathbf{rot\ X})/\partial t \qquad (7)$$

Let us recall the general rules of partial derivations:

$$d(\rho.\mathbf{V})/dt = \Sigma_\alpha\ [\partial(\rho.\mathbf{V})/\partial y^\alpha].(dy^\alpha/dt) + 0(2) \qquad (8)$$

with $dy^0 = dt$ (9). This leads to:

$$\partial(\rho.\mathbf{V})/\partial t = d(\rho.\mathbf{V})/dt - \Sigma_k\ [\partial(\rho.\mathbf{V})/\partial y^k].(dy^k/dt) \qquad (10)$$

for k = 1, 2 and 3. And from (7) follows:

$$d(\rho.\mathbf{V})/dt + \mathbf{grad}\ \rho_0 = -\ \chi_0.\ T_2(°)(\partial, \Gamma).\ \Gamma + \Sigma_k\ [\partial(\rho.\mathbf{V})/\partial y^k].(dy^k/dt) + (1/c^2).\ \partial(\mathbf{rot\ X})/\partial t \qquad (11)$$

Remember that within the SRT the formalism $d\mathbf{p}/dt$ [34; page 1; relation (1)] is a relativistic force. In the present approach the term $d(\rho.\mathbf{V})/dt$ is a relativistic force per unit of volume $d(\partial\mathbf{p}/\partial\tau)/dt$ applied to any point M at any time t in vacuum because of the intrinsic nature of vacuum, that is – *we suppose* – because of the spontaneous random fluctuations of the triad field (**E** , **H**, Γ) on itself. Than our relation (3) is now:

$$-\ \chi_0.\ T_2(°)(\partial, \Gamma).\ \Gamma + \Sigma_k\ [\partial(\rho.\mathbf{V})/\partial y^k].(dy^k/dt) + (1/c^2).\ \partial(\mathbf{rot\ X})/\partial t = \mathbf{grad}\ \rho_0 + d(\partial\mathbf{p}/\partial\tau)/dt \qquad (12)$$

where the coordinates $(dy^k/dt) = v^k$ have to be related to an unknown speed vector **v** that we have in a first time no reason to equate with the speed vector **V**. That is we are encouraged, once more time (see beginning of this section), to consider the vacuum as a crystal in which energetic flows (moving with **V**) do not automatically follow the path of the mechanical events (moving with **v**).

Let us now recall a special formulation of the Navier – Stokes equations where only η is invariant :

$$\rho.\ [\partial\mathbf{u}/\partial t + T_2(°)(\partial, \mathbf{u}).\ \mathbf{u}] + (d\rho/dt).\ \mathbf{u} - \eta.\ \Delta\mathbf{u} + \mathbf{grad}\ p = \rho.\ \gamma \qquad (13)$$

This is an extension of the so called momentum equation (for which ρ and η are invariant). In (13) γ represents an external acceleration acting on the fluid (it could be the gravity), **u** is the velocity of the fluid, η is its viscosity, p the pressure and Δ the Laplace's operator applied to each coordinate of the vector positioned behind it (here **u**). This operator is related to the friction. One other NSE is:

$$\mathrm{div}\ \mathbf{u} = 0 \qquad (14)$$

Suppose that the "rigid" region $\wp$, defined as vacuum, can be seen as a region filled with an energetic immaterial fluid with velocity **u = V** satisfying the following equation of state:

$$\rho° + p = 0 \qquad (15)$$

which is, as everyone knows one solution of the equations resulting from the GR. The Navier Stokes equation is transformed into:

$$\rho.\ [\partial\mathbf{V}/\partial t + T_2(°)(\partial,\mathbf{V}).\mathbf{V}] + (d\rho/dt).\ \mathbf{V} - \eta.\ \Delta\mathbf{V} = \mathbf{grad}\ \rho_0 + \rho.\ \gamma \qquad (16)$$

We can logically consider that $\partial(\varepsilon_0.\ \mu_0.\ \rho_0.\ \mathbf{V})/\partial t$ in (1) is a part of a more complete expression $d(\varepsilon_0.\mu_0.\ \rho_0.\mathbf{V})/dt = d(\partial\mathbf{p}/\partial\tau)/dt$ (17) which is acting like a force per unit of volume on each event occurring inside the region $\wp$. It is an applied force due to the fluctuations of vacuum on itself, a kind of self induction. In this sense the term $d(\partial\mathbf{p}/\partial\tau)/dt$ can be compared to the term $\rho.\ \gamma$ in (16). The formalism of (16) is strongly suggesting that our equation (12) could be a special formulation of the NSE for the vacuum. Indeed, *if and only if* we can compare:

$\rho.\ [\partial\mathbf{V}/\partial t + T_2(°)(\partial, \mathbf{V}).\ \mathbf{V}] + (d\rho/dt).\ \mathbf{V} - \eta.\ \Delta\mathbf{V}$ (18)

and:

$- \chi_0.\ T_2(°)(\partial, \mathbf{\Gamma}).\ \mathbf{\Gamma} + \Sigma_k\ [\partial(\rho.\mathbf{V})/\partial y^k].\ v^k + (1/c^2).\ \partial(\mathbf{rot\ X})/\partial t$ (19)

Our proposition (2) gives the absolutely insurance of the equivalence between:

i) a consequence (1) of the Maxwell's Laws in vacuum obtained when the (E) question admits a triad of trivial solutions and
ii) the Navier Stokes equation (NSE) in the region $\wp$ (defined as vacuum) when the equation of state (15) is valid.

So that we are in front of a very interesting situation because if we can connect (12) and (16), independently of our interpretation of (2) concerning the vacuum, this would lead to a correct mathematical connection between the NSE and a peculiar consequence, (1), of the Maxwell's Laws in vacuum. It is an evidence that we must make the comparison on the same basis.

2. GR, vacuum and pre-Newtonian state:

We remark the importance of this equation of state (15) in a connection between our equation and the NSE. Let us think further about this representation of vacuum. A Law of conservation concerning the EM energy in vacuum would result in [First part § II. 1. relation (12)]:

$\partial\rho_0/\partial t = - \mathrm{div}\ (\rho_0.\mathbf{V})$

Because of rules concerning the divergence of any vector $\mathbf{K}$ [21 ; page 101 ; (10)] even in a 4-D curved space-time:

$\mathrm{div}(^{(4)}\mathbf{K}) = (1/|g|^{1/2}).\ \Sigma_\alpha\ \partial(|g|^{1/2}.\ ^{(4)}K^\alpha)/\partial y^\alpha$

we can easily demonstrate that:

$\mathrm{div}(^{(4)}\mathbf{K}) = \Sigma_\alpha\ \partial^{(4)}K^\alpha/\partial y^\alpha + (1/|g|^{1/2}).\ \Sigma_\alpha\ (\partial|g|^{1/2}/\partial y^\alpha).\ ^{(4)}K^\alpha$ (20)

So that if we have in particularly [see first part § II.1. extension of the relation (13)]:

$\mathbf{K} = \rho_0.\ ^{(4)}\mathbf{V}$ (21)

Following calculation can be done:

$\Sigma_\alpha\ \partial^{(4)}K^\alpha/\partial y^\alpha$
$= \Sigma_\alpha\ \partial(\rho_0.\ ^{(4)}V^\alpha)/\partial y^\alpha$
$= \Sigma_k\ \partial(\rho_0.\ ^{(3)}V^k)/\partial y^k + (\partial\rho_0/\partial t).\ V^0 + \rho_0.\ (\partial V^0/\partial t)$
$= \Sigma_k\ \partial(\rho_0.\ ^{(3)}V^k)/\partial y^k + (\partial\rho_0/\partial t).\ (1 + V^0 - 1) + \rho_0.\ (\partial V^0/\partial t)$
$= \Sigma_k\ \partial(\rho_0.\ ^{(3)}V^k)/\partial y^k + (\partial\rho_0/\partial t) + (\partial\rho_0/\partial t).\ (V^0 - 1)$
$+ \rho_0.\ (\partial V^0/\partial t)$

From the Law of conservation in a 3-D space [First part § II. 1. relation (12)] follows:

$= (\partial\rho_0/\partial t).\ (V^0 - 1) + \rho_0.\ (\partial V^0/\partial t)$ (22)

We must insist on the fact that $\mathbf{V}$ is not always necessary equal to $\mathbf{v}$ and consequently that V^0 is not always necessary equal to $1 = v^0$ [consequence of (9)]. The Law of conservation in a 3-D space concerning the EM energy induces a 4-D formalism under the following relation:

$\mathrm{div}\ (\rho_0.\ ^{(4)}\mathbf{V}) = (\rho_0/|g|^{1/2}).\ \Sigma_\alpha\ (\partial|g|^{1/2}/\partial y^\alpha).\ ^{(4)}V^\alpha$
$+ (\partial\rho_0/\partial t).\ (V^0 - 1) + \rho_0.\ (\partial V^0/\partial t)$ (23)

As one can see, the right hand term of (23) is not necessary zero.

We now admit that (15) is valid in the region $\wp$ where the EM energy is preserved. A combination between (15) and (23) yields:

$\mathrm{div}\ (p.\ ^{(4)}\mathbf{V}) = - (\rho_0/|g|^{1/2}).\ \Sigma_\alpha\ (\partial|g|^{1/2}/\partial y^\alpha).\ ^{(4)}V^\alpha$
$+ (\partial\rho_0/\partial t).\ (1 - V^0) - \rho_0.\ (\partial V^0/\partial t)$ (24)

This leads to:

$p.\ \mathrm{div}\ (^{(4)}\mathbf{V}) + \Sigma_\beta\ V^\beta.\ [\partial p/\partial y^\beta] = - (\rho_0/|g|^{1/2}).\ \Sigma_\alpha\ (\partial|g|^{1/2}/\partial y^\alpha).\ ^{(4)}V^\alpha + (\partial\rho_0/\partial t).\ (1 - V^0) - \rho_0.\ (\partial V^0/\partial t)$ (25)

The respect of an extension of (14) to the 4-D space:

$\mathrm{div}\ (^{(4)}\mathbf{V}) = 0$ (26)

would give:

$\Sigma_\beta\ V^\beta.\ [\partial p/\partial y^\beta] = - (\rho_0/|g|^{1/2}).\ \Sigma_\alpha\ (\partial|g|^{1/2}/\partial y^\alpha).\ ^{(4)}V^\alpha$
$+ (\partial\rho_0/\partial t).\ (1 - V^0) - \rho_0.\ (\partial V^0/\partial t)$ (27)

Note:

i) that the respect of (26) is a strongest condition than (14) and that (26) is not need to "solve" the NSE (13) which was here written in a 3-D space.
ii) that for an observer following the energetic flow ($\mathbf{v} = \mathbf{V}$) in a 4-D space with an invariant metric $[(\partial|g|^{1/2}/\partial y^\alpha) = 0$ for all $\alpha = 0, 1, 2$ and $3]$, (23) becomes $\mathrm{div}\ (\rho_0.\ ^{(4)}\mathbf{V}) = 0$ which is a relation expressing a kind of law of preservation for the EM energy in this 4-D space and (27) becomes $\Sigma_\beta\ V^\beta.\ [\partial p/\partial y^\beta] = 0$.
iii) that results ii) can be also obtained "by approximation" for an observer following the energetic flow ($\mathbf{v} = \mathbf{V}$) in a 4-D space with a smoothly and not too strongly changing metric $[(\partial|g|^{1/2}/\partial y^\alpha) \ll |g|^{1/2}$ for all $\alpha = 0, 1, 2$ and $3]$.

Accordingly to physical units, a pressure is a force per unit of area or a force per unit of volume time a distance. This gives us the possibility to study the pressure due to the force per unit of volume, $\partial(\varepsilon_0.\ \mu_0.\ \rho_0.\ \mathbf{V})/\partial t$ or equivalently $d(\rho.\mathbf{V})/dt$ $- \Sigma_k\ [\partial(\rho.\mathbf{V})/\partial y^k].(dy^k/dt)$, appearing in (1). Both expressions are equivalent if the observer is at rest in the laboratory where this force per unit of volume is expressed. Nevertheless we can write it $\partial\mathbf{F}/\partial\tau$ and, independently of the relative motion of the observer in his laboratory, $\mathbf{v}$, calculate:

$dp = (\partial\mathbf{F}/\partial\tau).\ \mathbf{dr}$ (28)

Following paragraphs will explore a special situation like a pioneer would do it; i. e. we will study what "happens" if:

i) this $(\partial\mathbf{F}/\partial\tau)$ has the $\chi_0.\ T_2(°)(\partial, \mathbf{\Gamma}).\ \mathbf{\Gamma}$ formalism:
$(\partial\mathbf{F}/\partial\tau)^\alpha = \chi_0.\ \Sigma_\beta\ (\partial\Gamma^\alpha/\partial y^\beta).\ \Gamma^\beta$ (29.α for $\alpha = 0, 1, 2, 3$)

ii) $\mathbf{\Gamma}$ has a pseudo-Newtonian formalism:
$\mathbf{\Gamma} = s.\ \nabla U + \mathbf{\Gamma}_0$ (30)
where U is a potential of acceleration (we obviously not say of gravitation), s is an invariant scalar and $\mathbf{\Gamma}_0$ and invariant vector.

From (28) and in supposing that $(\partial\mathbf{F}/\partial\tau)$ can deform the 4-D space, we first get:

$dp = \Sigma_\alpha\ \Sigma_\beta\ g_{\alpha\beta}.\ (\partial\mathbf{F}/\partial\tau)^\alpha.\ (\mathbf{dr})^\beta$ (31)

Recalling some rules concerning the divergence, we note that:

$\mathrm{div}(\Gamma^\alpha.\ \mathbf{\Gamma}) = (1/g^{1/2}).\ \Sigma_\beta\ \partial(g^{1/2}.\ \Gamma^\alpha.\ \Gamma^\beta)/\partial y^\beta$
$\mathrm{div}(\Gamma^\alpha.\ \mathbf{\Gamma}) = (1/g^{1/2}).\ \Sigma_\beta\ (g^{1/2}.\ \Gamma^\beta).\ [\partial\Gamma^\alpha/\partial y^\beta]$
$+ (1/g^{1/2}).\ \Sigma_\beta\ [\partial(g^{1/2}.\ \Gamma^\beta)/\partial y^\beta].\ \Gamma^\alpha$
$\mathrm{div}(\Gamma^\alpha.\ \mathbf{\Gamma}) = \Gamma^\alpha.\ \mathrm{div}(\mathbf{\Gamma}) + \Sigma_\beta\ \Gamma^\beta.\ [\partial\Gamma^\alpha/\partial y^\beta]$ (32)

Considering (29), this leads to:

$(\partial\mathbf{F}/\partial\tau)^\alpha = \chi_0.\ [\mathrm{div}(\Gamma^\alpha.\ \mathbf{\Gamma}) - \Gamma^\alpha.\ \mathrm{div}(\mathbf{\Gamma})]$ (33)

As long as we can say that either we "stay" outside of a local particle which would virtually be in (M, t) or there is no particle in (M, t), than $\mathrm{div}(\mathbf{\Gamma}) = 0$ (34) and (33) is reduced to:

$(\partial \mathbf{F}/\partial \tau)^\alpha = \chi_0.\ \mathrm{div}(\Gamma^\alpha.\ \mathbf{\Gamma})$ (35)

Consequently:

$dp = \chi_0.\ \Sigma_\alpha \Sigma_\beta\ g_{\alpha\beta}.\ \mathrm{div}(\Gamma^\alpha.\ \mathbf{\Gamma}).\ (\mathbf{dr})^\beta$ (36)

If we do no more want to reduce the discussion we must consider (33) entirely and inject (30) in:

$dp = \chi_0.\ \Sigma_\alpha \Sigma_\beta\ g_{\alpha\beta}.\ \{\mathrm{div}[\Gamma^\alpha.\ (s.\ \nabla U + \mathbf{\Gamma_0})]$
$-\ \Gamma^\alpha.\ \mathrm{div}[s.\ \nabla U + \mathbf{\Gamma_0}]\}.\ (\mathbf{dr})^\beta$ (37)

Recall that [21 ; page 101 ; (10)]:

$\mathrm{div}(\mathbf{v_1} + \mathbf{v_2}) = (1/|g|^{1/2}).\ \Sigma_\alpha\ \partial[|g|^{1/2}.\ (v_1{}^\alpha + v_2{}^\alpha)]/\partial y^\alpha$
$\mathrm{div}(\mathbf{v_1} + \mathbf{v_2}) = (1/|g|^{1/2}).\ \Sigma_\alpha\ \partial(|g|^{1/2}.\ v_1{}^\alpha)/\partial y^\alpha$
$+\ (1/|g|^{1/2}).\ \Sigma_\alpha\ \partial(|g|^{1/2}.\ v_2{}^\alpha)/\partial y^\alpha$
$\mathrm{div}(\mathbf{v_1} + \mathbf{v_2}) = \mathrm{div}(\mathbf{v_1}) + \mathrm{div}(\mathbf{v_2})$ (38)

gives the possibility to decompose (37) in:

$\delta p = \chi_0.\ s.\ \Sigma_\alpha \Sigma_\beta\ g_{\alpha\beta}.\ \{\mathrm{div}[\Gamma^\alpha.\ \nabla U] - \Gamma^\alpha\ \mathrm{div}[\nabla U]\}.\ (\delta \mathbf{r})^\beta$
$+\ \chi_0.\ \Sigma_\alpha \Sigma_\beta\ g_{\alpha\beta}.\ \{\mathrm{div}[\Gamma^\alpha.\ \mathbf{\Gamma_0}] - \Gamma^\alpha.\ \mathrm{div}[\mathbf{\Gamma_0}]\}.\ (\delta \mathbf{r})^\beta$
(39)

Recall that [21 ; page 101 ; (10)] the divergence of any invariant vector is not necessary zero but depending on how the metric is changing:

$\mathrm{div}(\mathbf{\Gamma_0}) = (1/|g|^{1/2}).\ \Sigma_\alpha\ \partial|g|^{1/2}/\partial y^\alpha.\ \Gamma_0{}^\alpha$ (40)

Taking care of (32) for the invariant vector $\mathbf{\Gamma_0}$:

$\mathrm{div}(\Gamma^\alpha.\mathbf{\Gamma_0}) = \Gamma^\alpha.\ \mathrm{div}(\mathbf{\Gamma_0}) + \Sigma_\beta\ \Gamma_0{}^\beta.\ [\partial \Gamma_0{}^\alpha/\partial y^\beta]$

We get finally because of its invariance:

$\mathrm{div}(\Gamma^\alpha.\mathbf{\Gamma_0}) - \Gamma^\alpha.\ \mathrm{div}(\mathbf{\Gamma_0}) = 0$ (41)

and:

$dp = \chi_0.\ s.\ \Sigma_\alpha \Sigma_\beta\ g_{\alpha\beta}.\ \{\mathrm{div}[\Gamma^\alpha.\nabla U] - \Gamma^\alpha\ \mathrm{div}[\nabla U]\}.\ (\mathbf{dr})^\beta$
(42)

Consider the definition of the 4-gradient vector

$\nabla U = \Sigma_\gamma\ (\partial U/\partial y^\gamma).\ \mathbf{e}_\gamma$ (43)

And calculate its divergence:

$\mathrm{div}(\nabla U) = \mathrm{div}(\Sigma_\gamma\ (\partial U/\partial y^\gamma).\ \mathbf{e}_\gamma)$
$\mathrm{div}(\nabla U) = (1/|g|^{1/2}).\ \Sigma_\gamma\ \partial[|g|^{1/2}.\ (\partial U/\partial y^\gamma)]/\partial y^\gamma$ (44)

On the same way we get:

$\mathrm{div}(\Gamma^\alpha.\nabla U) = (1/|g|^{1/2}).\ \Sigma_\gamma\ (\partial|g|^{1/2}.\ \Gamma^\alpha/\partial y^\gamma).\ (\partial U/\partial y^\gamma)$
$+\ \Gamma^\alpha.\ \Sigma_\gamma\ (\partial^2 U/\partial^2 y^\gamma)$ (45)

With (44) and (45) we get from (42):

$dp = \chi_0.\ s.\ \Sigma_\alpha \Sigma_\beta\ g_{\alpha\beta}.\ \{\Sigma_\gamma\ (\partial \Gamma^\alpha/\partial y^\gamma).\ (\partial U/\partial y^\gamma)\}.\ (\mathbf{dr})^\beta$
(46)

Recalling the definition (30) of a pseudo-Newtonian field:

$\Gamma^\alpha = s.\ (\partial U/\partial y^\alpha) + \Gamma_0{}^\alpha$ (30.α)

This yields because of the invariance of $\mathbf{\Gamma_0}$:

$(\partial \Gamma^\alpha/\partial y^\gamma) = s.\ (\partial^2 U/\partial y^\gamma \partial y^\alpha)$ (47)

And at the end:

$dp = \chi_0.\ s^2.\ \Sigma_\alpha \Sigma_\beta\ g_{\alpha\beta}.\ \{\Sigma_\gamma\ (\partial^2 U/\partial y^\gamma \partial y^\alpha).\ (\partial U/\partial y^\gamma)\}.\ (\mathbf{dr})^\beta$
(48)

This is the infinitesimal pressure corresponding to an infinitesimal excursion (**dr**) in a 4-D curved space where a pseudo-Newtonian field **Γ** is defined (with 30) and generates a field of force having the $\chi_0.\ T_2(°)(\partial, \Gamma).\ \Gamma$ formalism.

It should be clear for the reader that we are exploring in which way the Law of conservation concerning the EM energy in vacuum and the implicit hypothesis of the completeness of our universe (the relation 2) could induce the existence, in vacuum, of pre-Newtonian states.

In all modern theories, forces always are related to particles. Spontaneous forces, call it Maxwell's forces to avoid misunderstanding, even under the special formalism (1) in basis where the (E) question have trivial solutions, should be too.

From (48) we can obtain the partial derivates of p(M, t):

$\partial p/\partial y^\beta = \chi_0.\ s^2.\ \Sigma_\alpha\ g_{\alpha\beta}.\ \{\Sigma_\gamma\ (\partial^2 U/\partial y^\gamma \partial y^\alpha).\ (\partial U/\partial y^\gamma)\}$
(49)

That is the coordinates of the 4-gradient of the pressure. Coming back to (25) we always have:

$\Sigma_\beta\ V^\beta.\ [\partial p/\partial y^\beta] = -\ p.\ \mathrm{div}\ ({}^{(4)}\mathbf{V}) - (\rho_0/|g|^{1/2}).\ \Sigma_\alpha\ (\partial|g|^{1/2}/\partial y^\alpha).$
${}^{(4)}V^\alpha + (\partial \rho_0/\partial t).\ (1 - V^0) - \rho_0.\ (\partial V^0/\partial t)$ (50)

and, with (49):

$\chi_0.\ s^2.\ \Sigma_\alpha \Sigma_\beta.\ g_{\alpha\beta}.\ \{\Sigma_\gamma\ (\partial^2 U/\partial y^\gamma \partial y^\alpha).\ (\partial U/\partial y^\gamma)\}.\ V^\beta$
$= -\ p.\ \mathrm{div}\ ({}^{(4)}\mathbf{V}) - (\rho_0/|g|^{1/2}).\ \Sigma_\alpha\ (\partial|g|^{1/2}/\partial y^\alpha).\ {}^{(4)}V^\alpha$
$+\ (\partial \rho_0/\partial t).\ (1 - V^0) - \rho_0.\ (\partial V^0/\partial t)$ (51)

and with (15):

$\chi_0.\ s^2.\ \Sigma_\alpha \Sigma_\beta.\ g_{\alpha\beta}.\ \{\Sigma_\gamma\ (\partial^2 U/\partial y^\gamma \partial y^\alpha).\ (\partial U/\partial y^\gamma)\}.\ V^\beta$
$= \rho_0.\ \mathrm{div}\ ({}^{(4)}\mathbf{V}) - (\rho_0/|g|^{1/2}).\ \Sigma_\alpha\ (\partial|g|^{1/2}/\partial y^\alpha).\ {}^{(4)}V^\alpha$
$+\ (\partial \rho_0/\partial t).\ (1 - V^0) - \rho_0.\ (\partial V^0/\partial t)$ (52)

Let us consider a part of the region ℘ where the metric is changing very smoothly and not too strongly $[(\partial|g|^{1/2}/\partial y^\alpha) \ll |g|^{1/2}$ for all $\alpha = 0, 1, 2$ and $3]$:

$\chi_0.\ s^2.\ \Sigma_\alpha \Sigma_\beta.\ g_{\alpha\beta}.\ \{\Sigma_\gamma\ (\partial^2 U/\partial y^\gamma \partial y^\alpha).\ (\partial U/\partial y^\gamma)\}.\ V^\beta$
$\approx \rho_0.\ \mathrm{div}\ ({}^{(4)}\mathbf{V}) + (\partial \rho_0/\partial t).\ (1 - V^0) - \rho_0.\ (\partial V^0/\partial t)$
(53)

Consider the definition of the divergence again, but related to this part of ℘ where the metric doesn't change rapidly:

$\mathrm{div}({}^{(4)}\mathbf{K}) \approx \Sigma_\alpha\ \partial^{(4)}K^\alpha/\partial y^\alpha$ (20. ≈)

From (53) with (20. ≈) we get :

$\chi_0.\ s^2.\ \Sigma_\alpha \Sigma_\beta.\ g_{\alpha\beta}.\ \{\Sigma_\gamma\ (\partial^2 U/\partial y^\gamma \partial y^\alpha).\ (\partial U/\partial y^\gamma)\}.\ V^\beta$
$\approx \rho_0.\ \Sigma_\alpha\ \partial^{(4)}V^\alpha/\partial y^\alpha + (\partial \rho_0/\partial t).\ (1 - V^0) - \rho_0.\ (\partial V^0/\partial t)$
(54)

$\chi_0.\ s^2.\ \Sigma_\alpha \Sigma_\beta.\ g_{\alpha\beta}.\ \{\Sigma_\gamma\ (\partial^2 U/\partial y^\gamma \partial y^\alpha).\ (\partial U/\partial y^\gamma)\}.\ V^\beta$
$\approx \rho_0.\ \Sigma_\alpha\ \partial^{(3)}V^\alpha/\partial y^\alpha + (\partial \rho_0/\partial t).\ (1 - V^0)$ (55)

$\chi_0.\ s^2.\ \Sigma_\alpha \Sigma_\beta.\ g_{\alpha\beta}.\ \{\Sigma_\gamma\ (\partial^2 U/\partial y^\gamma \partial y^\alpha).\ (\partial U/\partial y^\gamma)\}.\ V^\beta$
$\approx \rho_0.\ \mathrm{div}({}^{(3)}\mathbf{V}) + (\partial \rho_0/\partial t).\ (1 - V^0)$ (56)

And with (14) – complementary NSE :

$\chi_0.\ s^2.\ \Sigma_\alpha \Sigma_\beta.\ g_{\alpha\beta}.\ \{\Sigma_\gamma\ (\partial^2 U/\partial y^\gamma \partial y^\alpha).\ (\partial U/\partial y^\gamma)\}.\ V^\beta$
$\approx (\partial \rho_0/\partial t).\ (1 - V^0)$ (57)

And at the end:

$\chi_0.\ s^2.\ \Sigma_\alpha \Sigma_k.\ g_{\alpha k}.\ \{\Sigma_\gamma\ (\partial^2 U/\partial y^\gamma \partial y^\alpha).\ (\partial U/\partial y^\gamma)\}.\ V^k$
$+\ [(\partial \rho_0/\partial t) + \chi_0.\ s^2.\ \Sigma_\alpha\ g_{\alpha 0}.\ \{\Sigma_\gamma\ (\partial^2 U/\partial y^\gamma \partial y^\alpha).\ (\partial U/\partial y^\gamma)\}].\ V^0$
$\approx (\partial \rho_0/\partial t)$ (58)

It is well known that the volumetric density of matter of any nucleus of an atom is a constant [05; §1.2.2 Page 26] and that most part of these atoms do exist a certain time, so that we can consider the volumetric density of matter of any nucleus as invariant during its lifetime. Because of the "matter – energy" equivalence resulting from the SR [relation (5) above], we can do the same remark for the volumetric density of energy associated with these nuclei. It is also well known that nuclei are surrounded with vacuum and have so small dimensions that they can be compared with a point.

Let us make here a mental jump. Even if we don't actually know what kind of particle is associated with this Maxwell's force in vacuum, we can easily admit that it acts locally and generates a pressure p(M, t). We can also imagine to associate a particle with a current of pressure. Furthermore, accordingly to preceding considerations concerning the nuclei and:

i) Since we know that nuclei are composed of elementary particles (quarks, …),
ii) Since we know that the Laws of the GR must be valid everywhere, including vacuum,

we propose to say that every elementary particle is a quasi – invariant concentration of EM energy ρ_0 satisfying in any part of ℘ with a smoothly changing metric:

$\chi_0.\ s^2.\ \Sigma_\alpha \Sigma_\beta.\ g_{\alpha\beta}.\ \{\Sigma_\gamma\ (\partial^2 U/\partial y^\gamma \partial y^\alpha).\ (\partial U/\partial y^\gamma)\}.\ V^\beta \approx 0$ (59)

and we consequently interpret (59) as the obligatory condition satisfied by any solution of:

$\rho. (D\mathbf{V}/dt) \sim \rho. (d\mathbf{V}/dt) = (\partial \mathbf{F}/\partial \tau)$ (60)

That is we write: The potential of acceleration U determinates the field vector of speed of the energetic flow **V** associated with the particle in such way that we could write (59) under the standardized form:

$\Sigma_\alpha \Sigma_\beta. g_{\alpha\beta}. V^\alpha. V^\beta \approx 0$ (61)

yielding :

$V^\alpha = \chi_0. s^2. \{\Sigma_\gamma (\partial^2 U/\partial y^\gamma \partial y^\alpha). (\partial U/\partial y^\gamma)\}$ (62.α)

3. Mathematical coherence and Quantization :

This section will only develop our way of thinking in special conditions but this will particularly good illustrate our ideas. Preceding reasoning applied to a pseudo – Newtonian potential of acceleration leading to a field of acceleration without divergence (34) leads to:

$V^\alpha = \chi_0. \mathrm{div}(\Gamma^\alpha. \mathbf{\Gamma})$ (63.α)

Remark that we were until now absolutely not obliged to make the common hypothesis that this field of acceleration derivates of the field of speed. Let us now do this hypothesis:

$\mathbf{\Gamma} = d\mathbf{V}/dt$ (64)

This can be also written in the language of the coordinates:

$\Gamma^\alpha = dV^\alpha/dt$ (64.α)

$\Gamma^\alpha = \Sigma_\beta (\partial V^\alpha/\partial y^\beta). v^\beta$ (65.α)

and this leads to:

$\partial\Gamma^\alpha/\partial y^\gamma = \Sigma_\beta (\partial^2 V^\alpha/\partial y^\gamma \partial y^\beta). v^\beta + \Sigma_\beta (\partial V^\alpha/\partial y^\beta). (\partial v^\beta/\partial y^\gamma)$ (66.α)

But from (63.α), (32) and (34) we get:

$V^\alpha = \chi_0. \Sigma_\gamma \Gamma^\gamma. [\partial\Gamma^\alpha/\partial y^\gamma]$

And with (65.α) and (66.α):

$V^\alpha = \chi_0. \Sigma_\gamma \{\Sigma_\beta (\partial V^\gamma/\partial y^\beta). v^\beta\}. \{\Sigma_\delta (\partial^2 V^\alpha/\partial y^\gamma \partial y^\delta). v^\delta + \Sigma_\delta (\partial V^\alpha/\partial y^\delta). (\partial v^\delta/\partial y^\gamma)\}$ (67.α)

Which is a strategic differential equation connecting the 4-speed vector of the energetic flow and the 4-speed vector of the observer. [Note and don't forget that $v^0 = 1 \neq 0$; that is even if the spatial speed of the observer is zero, we have:

$V^\alpha = \chi_0. \Sigma_\gamma \{\partial V^\gamma/\partial y^0\}. \{(\partial^2 V^\alpha/\partial y^\gamma \partial y^0) + \Sigma_\delta (\partial V^\alpha/\partial y^\delta). (\partial v^\delta/\partial y^\gamma)\}$ (67.α.0)].

Let us now make an astonishing hypothesis to illustrate the idea that we want to expose and develop:

$V^\alpha = c. \sin(k_\alpha. y^\alpha)$ (68)

without summation on α and with an invariant k_α.

Its easy to get:

$(\partial V^m/\partial y^n) = \delta^m{}_n. c. k_m. \mathrm{cosinus}\ (k_m. y^m)$ (69)

$(\partial^2 V^m/\partial y^p \partial y^k) = \partial[\delta^m{}_p. c. k_m. \mathrm{cosinus}\ (k_m. y^m)]/\partial y^k$
$= \delta^m{}_p. c. k_m. \partial[\mathrm{cosinus}\ (k_m. y^m)]/\partial y^k + \partial[\delta^m{}_p. c. k_m]/\partial y^k\ \mathrm{cosinus}\ (k_m. y^m)$

$(\partial^2 V^m/\partial y^p \partial y^k) = - \delta^m{}_p. \delta^m{}_k. c. (k_m)^2. \mathrm{sinus}\ (k_m. y^m)$ (70)

The differential equation (67.α) yields:

$V^k = \Sigma_m (\partial V^m/\partial y^m). v^m. [\partial^2 V^m/\partial^2 y^k. v^k + (\partial V^m/\partial y^m). \partial v^m/\partial y^k]$

$V^k = \Sigma_m (\partial V^m/\partial y^m). v^m. \partial^2 V^m/\partial^2 y^k. v^k + \Sigma_m (\partial V^m/\partial y^m). v^m. (\partial V^m/\partial y^m). \partial v^m/\partial y^k$

$V^k = (\partial V^k/\partial y^k). v^k. \partial^2 V^k/\partial^2 y^k. v^k + \Sigma_m (\partial V^m/\partial y^m). v^m. (\partial V^m/\partial y^m). (\partial v^m/\partial y^k)$

$V^k = (\partial V^k/\partial y^k). (\partial^2 V^k/\partial^2 y^k). (v^k)^2 + \Sigma_m (\partial V^m/\partial y^m)^2. v^m. (\partial v^m/\partial y^k)$ (71)

If we now consider an observer moving with the energetic flow ($\mathbf{v} = \mathbf{V}$):

$0 = (\partial V^k/\partial y^k). (\partial^2 V^k/\partial^2 y^k). (V^k)^2 + [(\partial V^k/\partial y^k)^3 - 1]. V^k$ (72)

becoming:

$c. \mathrm{sinus}\ (k_m. y^m) = c. k_k. \cos (k_k. y^k) - c. (k_k)^2. \sin (k_k. y^k). c^2. \mathrm{sinus}^2 (k_k. y^k) + c^3. (k_k)^3. \cos (k_k. y^k). c. \mathrm{sinus}\ (k_k. y^k)$

that can be simplified:

$1 = c^3. (k_k)^3. \cos (k_k. y^k). [1 - \mathrm{sinus}^2 (k_k. y^k)]$

and:

$1 = c^3. (k_k)^3. \mathrm{cosinus}^3 (k_k. y^k)$

Or, supposing that all values are real values:

$1 = c. (k_k). \cos(k_k. y^k)$ (73)

This special example demonstrates that our representation automatically leads to a quantization of the4-D vector **k** (k^0, k^1, k^2, k^3), or of the 4-D position vector **y** (y^0, y^1, y^2, y^3). Note that (68) and (73) have a consequence:

$(1/k_\alpha)^2 = c^2. \cos^2 (k_\alpha. y^\alpha) = c^2 - (V^\alpha)^2$

The relation (34) illustrates the condition that an observer would encounter in a standardized gravitational field outside of the source of this field. The hypothesis (68) results of acknowledges concerning the SR. Since we know that particles like photons in vacuum moves at c speed, or that any information moves with a speed not exceeding c speed, we can imagine an energetic information of which each component can oscillate between – c and + c. We should add the condition $|^{(3)}\mathbf{V}| = c$ to perfect our example; this complementary condition is still included in (61) and consequently in (63.α). This would be specially here:

$\Sigma_\alpha \Sigma_\beta. g_{\alpha\beta}. V^\alpha. V^\beta \approx 0$

$\Sigma_\alpha \Sigma_\beta. g_{\alpha\beta}. \sin(k_\alpha. y^\alpha). \sin(k_\beta. y^\beta) \approx 0$ (74)

leading (as said in the first part) to an oscillating metric.

4. Masses:

Coming back to (18) and (19), we have the challenge to compare:

$d(\rho. \mathbf{V})/dt - \eta. \Delta\mathbf{V}$ (18)

and:

$- \chi_0. T_2(°)(\partial, \mathbf{\Gamma}). \mathbf{\Gamma} + \Sigma_k [\partial(\rho.\mathbf{V})/\partial y^k]. v^k + (1/c^2). \partial(\mathbf{rot\ X})/\partial t$ (19)

or, concerning the lines of invariant density of matter:

$\rho. d\mathbf{V}/dt - \eta. \Delta\mathbf{V}$ (18 =)

and:

$- \chi_0. T_2(°)(\partial, \mathbf{\Gamma}). \mathbf{\Gamma} + \Sigma_k [\partial(\rho.\mathbf{V})/\partial y^k]. v^k + (1/c^2). \partial(\mathbf{rot\ X})/\partial t$ (19)

In the special conditions:

$- \eta. \Delta\mathbf{V} = \Sigma_k [\partial(\rho.\mathbf{V})/\partial y^k]. v^k + (1/c^2). \partial(\mathbf{rot\ X})/\partial t$ (75)

This results in the comparison:

$\rho. d\mathbf{V}/dt = - \chi_0. T_2(°)(\partial, \mathbf{\Gamma}). \mathbf{\Gamma}$ (76)

Which is possible if we make the *common* but *not trivial* hypothesis (64) that the field of acceleration **Γ** derivates from the field of speed of the EM energetic flow. Relation (76) is the relation that we proposed last year in our first attempt to be published at the fourth Vigier's symposium in Paris. Unfortunately our acknowledges was insufficient at this time to precise correctly the context of the validity (for example 75 and all the discussion contained in this paper) of our theory.

4.1. Intrinsic equation :

The intrinsic equation is the following:

$|\rho. I_3 + (\chi_0). T(°)(\partial, \mathbf{\Gamma})| = 0$ (76.bis)

In accordance with the formalism of my equations established for a 3-dimensional space, we have to calculate the determinant of:

$$\begin{matrix} \rho + (\chi_0). \partial\Gamma^1/\partial x^1 & (\chi_0). \partial\Gamma^1/\partial x^2 & (\chi_0). \partial\Gamma^1/\partial x^3 \\ (\chi_0). \partial\Gamma^2/\partial x^1 & \rho + (\chi_0). \partial\Gamma^2/\partial x^2 & (\chi_0). \partial\Gamma^2/\partial x^3 \\ (\chi_0). \partial\Gamma^3/\partial x^1 & (\chi_0). \partial\Gamma^3/\partial x^2 & \rho + (\chi_0). \partial\Gamma^3/\partial x^3 \end{matrix}$$

and it follows :

$\rho^3 + (\chi_0).\ \rho^2.\ (\partial\Gamma^1/\partial x^1 + \partial\Gamma^2/\partial x^2 + \partial\Gamma^3/\partial x^3) + (\chi_0)^2.\ \rho.\ [(\partial\Gamma^1/\partial x^1\ \partial\Gamma^2/\partial x^2 + \partial\Gamma^1/\partial x^1\ \partial\Gamma^3/\partial x^3 + \partial\Gamma^3/\partial x^3\ \partial\Gamma^2/\partial x^2) - (\partial\Gamma^2/\partial x^1.\partial\Gamma^1/\partial x^2 + \partial\Gamma^3/\partial x^1.\partial\Gamma^1/\partial x^3 + \partial\Gamma^3/\partial x^2.\partial\Gamma^2/\partial x^3)] + (\chi_0).\ ^3[\partial\Gamma^1/\partial x^1.\partial\Gamma^2/\partial x^2.\partial\Gamma^3/\partial x^3 - \partial\Gamma^1/\partial x^1.\partial\Gamma^3/\partial x^2.\partial\Gamma^2/\partial x^3 + \ldots] = 0$ (77)

To cut short, in identifying [(1°) et 3°)] and creating [2°)]:

1°) $\mathrm{div}\ \boldsymbol{\Gamma} = (\partial\Gamma^1/\partial x^1 + \partial\Gamma^2/\partial x^2 + \partial\Gamma^3/\partial x^3)$ (78)

2°) $\pounds = (\partial\Gamma^1/\partial x^1\ \partial\Gamma^2/\partial x^2 + \partial\Gamma^1/\partial x^1\ \partial\Gamma^3/\partial x^3 + \partial\Gamma^3/\partial x^3\ .\partial\Gamma^2/\partial x^2) - (\partial\Gamma^2/\partial x^1.\partial\Gamma^1/\partial x^2 + \partial\Gamma^3/\partial x^1.\partial\Gamma^1/\partial x^3 + \partial\Gamma^3/\partial x^2.\partial\Gamma^2/\partial x^3)]$ (79)

3°) $|T_2\ (°)(\partial,\ \boldsymbol{\Gamma})| = [\partial\Gamma^1/\partial x^1.\partial\Gamma^2/\partial x^2.\partial\Gamma^3/\partial x^3 - \partial\Gamma^1/\partial x^1.\partial\Gamma^3/\partial x^2.\partial\Gamma^2/\partial x^3 + \ldots]$ (80)

We obtain :

$\rho^3 + (\chi_0).\ \mathrm{div}\boldsymbol{\Gamma}.\ \rho^2 + (\chi_0)^2.\ \pounds.\ \rho + (\chi_0)^3.\ |\ T_2\ (°)(\partial, \boldsymbol{\Gamma})\ | = 0$ (81)

4.2. Resolution of the intrinsic equation :

4.2.1. Preliminary remarks:

The equation (81) owns very interesting properties :

i) It produces a kind of symmetry between the volumetric density of matter, ρ, and the coefficient (χ_0) attached to the physical environment of the discussion (here the vacuum). It seems to induce, if we can later generalize this equation for other environments, that the knowing of the exact value of ρ will be sufficient to determinate the nature of the environment.

ii). The term in ρ^2 is the divergence of the acceleration field itself.

iii) **In the case of a coincidence between the field of acceleration and a Newtonian gravitational field**, so that we could write:

$\mathrm{div}\ \boldsymbol{\Gamma} = -\ (\rho/\chi_0)$ (82)

than consequently **the equation (81) falls into two parts** and gives us two new equations:

$\pounds.\ \rho + (\chi_0).\ |T_2\ (°)(\partial, \boldsymbol{\Gamma})| = 0$ (83)

$-\ \mathrm{div}\boldsymbol{\Gamma}.\ \pounds + |T_2\ (°)(\partial, \boldsymbol{\Gamma})| = 0$ (84)

iv) Distinctions made in this theory between field of acceleration and of gravitation allow zero-divergence for the field of acceleration with a non zero volumetric density of matter. The immense advantage of my method seems to be the possibility to separate the behaviour of the fields and of the potential sources.

v) Complete resolution of this equation needs mathematical results found by Tartaglia and Cardan in the century 16th. [06].

4.2.2 Principles :

Following the method proposed by Tartaglia-Cardan, we introduce:

$z = \rho + 1/3\ (\chi_0\ \mathrm{div}\ \boldsymbol{\Gamma})$ (85)

and we get:

$z^3 + [-\ 1/3\ (\chi_0.\ \mathrm{div}\boldsymbol{\Gamma})^2 + (\chi_0^2\ \pounds)].\ z + [2/27\ (\chi_0\ \mathrm{div}\boldsymbol{\Gamma})^3 - 1/3\ (\chi_0^3\ \pounds.\ \mathrm{div}\boldsymbol{\Gamma}) + |\ (\chi_0).\ T_2(°)(\partial, \boldsymbol{\Gamma})\ |\ ] = 0$ (86)

Therefore we write:

$z = z_1 + z_2$ (87)

$p = [-\ 1/3\ (\chi_0\ \mathrm{div}\boldsymbol{\Gamma})^2 + (\chi_0^2\ \pounds)]$ (88)

$q = [2/27\ (\chi_0.\ \mathrm{div}\boldsymbol{\Gamma})^3 - 1/3\ (\chi_0^3\ \pounds.\ \mathrm{div}\boldsymbol{\Gamma}) + |\chi_0.\ T_2\ (°)(\partial, \boldsymbol{\Gamma})|]$ (89)

$\Delta = q^2 + (4/27).\ p^3$ (90)

4.2.3. Classification :

When coordinates of the acceleration field $\boldsymbol{\Gamma}$ are taking all different possible real values, we obtain several types of situations classified in:

a) $\Delta > 0$ results one real value given by:

$z = \sqrt[3]{-q/2 - (\sqrt{\Delta})/2} + \sqrt[3]{-q/2 + (\sqrt{\Delta})/2}$ (91)

b) $\Delta = 0$ results one real value given by:

$z = 2\ \sqrt[3]{-q/2}$ (92)

c) $\Delta < 0$ results three real values. (93, 94, 95)

To our surprise, when Δ is describing all real numbers, **we find out only 5 types of solutions**. I classify this result of my theory as a strange hazard and I ask if it is reasonable to try a comparison with one of the proposed theories for unification of the world of the particles: SU (5) (quark down right red, green and blue; e^+ right; ν right) [07].

4.2.4. Symmetries; some remarks for a graphical resolution of the equations:

The system of the two equations is mathematically equivalent to:

$2x.\ (x^2 - 3y^2) = A$ (96)

$2y.\ (3x^2 - y^2) = B$ (97)

This system offers some interesting symmetries :

1°) If we inverse x and y then we get a similar system of equations but with other coefficients; what I could call the mirror-symmetry (**right hand - left hand; or matter and anti-matter?**). We are in front of a unique family of curves defined by: $x.\ (x^2 - 3y^2) = f\ (A/2)$. To find out the solutions of the system is equivalent to the study of the intersection between $f\ (A/2)$ and $f^{-1}(-B/2)$ under two conditions: $B > 0$ and $A \in\ ]\ -2.\ |z|^3, +2.\ |z|^3\ [$.

2°) If (x, y) is a solution of this system, then couples obtained after a rotation of $2\pi/3$ et $4\pi/3$ are solutions too, my so called triangle-symmetry (**the trinity of the quarks, of the neutrinos?**)

4.3. Divergence-free fields of acceleration:

Preceding paragraph gives general indications concerning the resolution of (76). To give consistence to our theory we want to study a more pragmatic example. We must insist on our main idea pretending that elementary particles are in someway the eigen-values of EM energetic flows. We take our example of § 3 again for a divergence free field of acceleration [$\mathrm{div}\boldsymbol{\Gamma} = 0$ (34)] and we calculate the coefficients of the intrinsic equation.

$z = \rho$ (85.0)

and we get:

$z^3 + (\chi_0^2\ \pounds).\ z + |\ (\chi_0).\ T_2(°)(\partial, \boldsymbol{\Gamma})\ | = 0$ (86.0)

Therefore we write:

$z = z_1 + z_2$ (87)

$p = (\chi_0^2.\ \pounds)$ (88.0)

$q = |\chi_0.\ T_2\ (°)(\partial, \boldsymbol{\Gamma})|$ (89.0)

$\Delta = q^2 + (4/27).\ p^3$ (90)

In our approach the field of acceleration $\boldsymbol{\Gamma}$ is the field resulting from the variations of the field **V** of the speed of the energetic flow but the natural connection respecting the Laws of the GR is given by (63). The introduction of the mathematical usual connection (64) yields a possible quantization of these phenomenons and the identification (76) an indirect possible comparison with the formalism of the Newtonian fields.

The logical consequence of our approach is to scrutinize the cases of fields of acceleration induced by the variations of the field of the EM flow of energy that can be reasonably compared with Newtonian fields. We must note that the introduction of the formalism (82) reduces the number of the solutions. For example if we suppose that both, (34) and (82) are simultaneously valid, this results automatically only in:

$|T_2 (°)(\partial, \Gamma)| = 0 = \rho \ \forall £$ (91)

This is obviously reducing the generality of (86.0) which would have led alone to others solutions even with a determinant equal to zero:

$|T_2 (°)(\partial, \Gamma)| = 0 \rightarrow z^3 + (\chi_0^2 £). z = 0 \rightarrow \rho = \{0, \pm \chi_0. £^{1/2}\}$ (92)

Except if real circumstances in the nature are leading to £ = 0.

At the end it is telling an important question: does every elementary particle automatically generate a Newtonian field of acceleration, usually called a gravitational field? Or, with other words: are all gravitational fields Newtonian one? The equivalence enounced by the GR tells that each field of acceleration is a field of gravitation but this principle doesn't explain if all fields of gravitation must have the Newtonian formalism even if for historical reasons the answer seemed to be evidently yes.

Let us consider for any divergence-free field of acceleration the case of a determinant not equal to zero and let us try to calculate the ratio between (91) and (92). This is:

$\vartheta = \rho(\Delta > 0)/\rho(\Delta = 0)$

$\vartheta = {}^3\sqrt{[-q/2 - ({}^2\sqrt{\Delta})/2]} + {}^3\sqrt{[-q/2 + ({}^2\sqrt{\Delta})/2]}/ 2\ {}^3\sqrt{(-q/2)}$ (93)

Let us first try with the definition (90):

$({}^2\sqrt{\Delta})/2 = ({}^2\sqrt{q^2 + (4/27). p^3})/2 = (q/2). [{}^2\sqrt{1 + (4 p^3/27 q^2)}]$ (94)

Another ratio, $r = (4 p^3/27 q^2)$ (95), that cannot be calculated if $q = |T_2 (°)(\partial, \Gamma)| = 0$, is playing an important role in our possibility to approximate ϑ. Let us consider the easiest configuration:

$r = (4 p^3/27 q^2) << 1$ (96)

We get:

$({}^2\sqrt{\Delta})/2 \approx (q/2). (1 + ½. r)$ (97)

and consequently :

$\vartheta \approx {}^3\sqrt{[-q. (1 + ¼. r)]} + {}^3\sqrt{[¼. q. r]}/ 2\ {}^3\sqrt{(-q/2)}$

$\vartheta \approx {}^3\sqrt{[-q. {}^3\sqrt{(1 + ¼. r)}]} + {}^3\sqrt{q}. {}^3\sqrt{[¼. r]}/ 2\ {}^3\sqrt{(-q/2)}$

$\vartheta \approx {}^3\sqrt{(1 + ¼. r)]} - {}^3\sqrt{[¼. r]}/ 2\ {}^3\sqrt{(1/2)}$ (98)

From this relation we can guess what happens if the ratio r is approximating zero :

$\lim_{r \to 0} \vartheta = {}^3\sqrt{-q} / 2\ {}^3\sqrt{(-q/2)} = {}^3\sqrt{2}/2 \approx 0.63$ (99)

The ratio ϑ is a measurement of the "volumetric density difference" between the solution with positive Δ and the solution with $\Delta = 0$ accordingly to the implicit hypothesis that each type of solution could appear with the same probability. Remember that £ = 0 is the condition that would lead to a coincidence between the general results predicted with (86.0) and a reduction of these predictions to the Newtonian formalism of the divergence of the field of acceleration when $|T_2 (°)(\partial, \Gamma) | = 0$ (see above in this §). But we will see that the Newtonian case is not corresponding to this equality $|T_2 (°)(\partial, \Gamma) | = 0$; even if always very small the quantity $|T_2 (°)(\partial, \Gamma) |$ is never exactly zero.

4.4. If we could write Γ = G (Newton):

What would happen if the field of acceleration field could be locally exactly compared with the field induced by a Newtonian source in some region of space-time faraway from its source (*weak gravitation field*)?

Spatial coordinates of a Newtonian field (the well-known gravitation field) are given by [01]:

$\Gamma^i = G. M. (x^i /R^3)$ (100)

M being the source, G the gravitational constant, R > 0 the distance between the source and the place of the measure. So that we get:

$\partial\Gamma^i/\partial x^j = (G.M/R^3).[\delta^i{}_j - 3x^i. x^j /R^2]$ (101)

followed by:

1°) div $\Gamma = 0$ (102)

The divergence of a Newtonian field is always zero if measured outside from this source.

2°) $£ = - 3. (G.M/R^3)^2$ (103)

3°) $|T_2 (°)(\partial, \Gamma)| = 2. (G. M/R^3)^3$ (104)

As said in § 4.3.this quantity *is not exactly equal to zero* in the case of a Newtonian field. But we must remark that at the surface of the first orbital of an atom of hydrogen, that is if we consider this model for an electron surrounding a proton in the lowest energetic configuration, supposing that $R \sim 10^{-10}$ is a big distance in comparison with the dimensions of the proton itself, with $G \sim 10^{-11}$ and $M \sim 10^{-27}$, we rapidly win the sensation that $|T_2 (°)(\partial, \Gamma)| \sim 10^{-24} \sim 0$ is a very good approximation. Remember that the equation to be resolved is given by (86.0) and use results (85.0), (103) and (104):

$\rho^3 - 3. (\chi_0)^2. (G.M/R^3)^2. \rho + 2. (\chi_0)^3. (G.M/R^3)^3 = 0$ (105)

Written in a simpler form:

$[\rho - (\chi_0). G. M/R^3)]^2. [\rho + 2. (\chi_0). G. M/R^3)] = 0$ (106)

Newtonian vacuum weak acceleration fields always have two types of intrinsic-values:

1°) a double one given by: $(\chi_0. G. M/R^3)$ (107)

2°) a simple one given by: $-2. (\chi_0. G. M/R^3)$ (108)

Studying the intrinsic-vectors associated to these intrinsic-values will give us later the acceptable physical values for potential volumetric density of mass in such a vacuum, depending on the sign of the yet unknown constant χ_0.

But as we said at the beginning of this paragraph, there is no matter in the region situated at a big distance R of the source M; that's why we carefully introduce the expression of: "potential volumetric density of matter" in this discussion.

In fact solutions of (106) are basis independent allowed values for volumetric densities of matter far away from a classical gravitational source M which would have the same effect than the local residual EM field if relation (2) and conditions (75) are valid.

Let us imagine a source M uniformly dispersed in vacuum over the distance R around a central point. We would have everywhere in this vacuum a volumetric density of matter "ρ" given by: $M = (4\pi R^3). ("\rho"/3)$ (109). Consider the solution (108) and get: ρ (solution of 86.0) $= - (8. \chi_0. G. \pi. "\rho")/3$ (110). The energetic part of the dynamic equation obtained from the GR in an isotropic and homogeneous model with the Robertson-Walker metric is: $(8.G.\pi"\rho")/3$ [08]. To realize the coherence of the present model with the latter, we should absolutely introduce the relation: ρ (solution of 86.0) = "ρ" (111) which could give the value of the constant χ_0:

$\chi_0 = - 3/8. \pi. G$ (112)

It is a negative universal constant and consequently the double solution given by (107) is difficult to interpret because apparently corresponding to a negative volumetric density of matter.

Note that:
$q = |\chi_0 . T_2 (°)(\partial, \Gamma)| = q = (\chi_0)^3 . 2. (G. M/R^3)^3$
$q^2 = 4. (\chi_0 . G. M/R^3)^6$
$p = (\chi_0^2 . £) = - 3. (\chi_0 . G. M/R^3)^2$
$(4/27). p^3 = - 4. (\chi_0 . G. M/R^3)^6$
This yields for the Newtonian case:
$\Delta = 0$
The ratio r is becoming:
$r = (4 p^3/27 q^2) = -1 < 1$
This leads to:
$\vartheta \approx \sqrt[3]{(1 + ¼. r)} - \sqrt[3]{[¼. r]} / 2 \sqrt[3]{(1/2)}$
$\vartheta \approx [\sqrt[3]{¾} + \sqrt[3]{¼}] / 2 \sqrt[3]{(1/2)}$
$\vartheta \approx \sqrt[3]{¼}. [\sqrt[3]{¾} + \sqrt[3]{¼}]$
$\vartheta = \rho(\Delta > 0)/\rho(\Delta = 0) \approx 0.63. [0.91 + 0.63] = 0.63. 1.54 =$
$\vartheta = \rho(\Delta > 0)/\rho(\Delta = 0) \approx 0.9702…$
We are actually not in a mental position to interpret the preceding calculation.
We have now to analyze precisely our way of thinking to find the correct interpretation of the solutions induced by (76). Solutions of (76) are basis-independent (they are eigenvalues) but obviously (p, q) dependant. Our model tells that all turbulences and whirls in the nature should only generate 5 families of situations. That is, if we want to prove that each possible situation (91, 92, 93, 94 and 95) obtained when the partial derivations of the coordinates of the field of acceleration Γ are taken all real values really generates each a family of solutions, then we have to define families of transformations acting on the parameters p and q and leaving the formulation of these solutions invariant.
As one see, the way is long until we reach the purpose….

Bibliography:

[01] Mécanique des particules-champs ; R.Lennuier, P.-Y. Gal, D. Perrin ; Librairie Armand Colin ; chapitre 10 : relativité restreinte : dynamique des particules ; pages 256-260.
[02] Connectivity and Origin of Inertia; L.J. Nickisch; Jules Mollere; May 2003
[03] BERKELEY cours de physique ; électricité et magnétisme volume 2 ; Armand Colin ; 1978
[04] = [01] §4.9 Page 133
[05] F.W.Bopp Kerne, Hadronen und Elementarteilchen; Teubner Stuttgart 1989.
[06] Bordas Encyclopédie; 50/51 mathématiques ; page 81 ; 1972
[07] Les particules élémentaires ; Une théorie unifiée des particules élémentaires ; Howard Georgi ; pages 162-179 ; 1983.
[08] "Dernières nouvelles du cosmos" (Hubert Reeves; Edition du Seuil; science ouverte), page 98 et suivantes.
[09] Sciences et Avenir ; La théorie du tout ; hors-série Mai-Juin 1999.
[10] Pour la Science; N°250 août 1998 ; La mesure du champ gravitationnel local ; encart page 96.
[11] Pour la Science ; N° 253 Novembre 1998 ; accélération anormale des sondes spatiales.
[12] Klassische Feldtheorie ; Landau et Lifschitz ; 1992
[13] Quantenmechanik ; 1999 ; Prof. Dr. rer. Nat. Udo Scherz; B. G. Teubner Stuttgart.
[14] BERKELEY cours de physique ; Mécanique volume 1 ; Armand Colin ; 1972
[15] Un courant neutre de spins ; Pour la Science ; perspectives scientifiques ; page 21 ; janvier 2004
[16] Théories relativistes de la gravitation et de l'électromagnétisme ; A. Lichnerowicz ; 1955.
[17] ART ;Torsten Fließbach ; 4. Auflage; Spektrum der Wissenschaft; 2003
[18] BERKELEY cours de physique ; Mécanique ; volume 1 ; Armand Colin ; 1978
[19] Zero-point fields, Gravitation and new physics; A report by Professor Paul S. Wesson, F.R.A.S. for the C.I.P.A.
[20] Misner, Thorne et Wheeler : Gravitation ; 1973.
[21] « Que sais-je ? » n° 1336 Le calcul tensoriel ; André DELACHET ; 1974.
[22] Inertia as reaction of the vacuum to accelerated motion ; A. Rueda, B. Haisch; 1998
[23] Que sais-je n° 1104, la géométrie différentielle ; André DELACHET ; 1970.
[24] Maxwell's Laws and the Newton's second Laws (Inertial motions in vacuum?) Th. Periat; proposed for the 4th Vigier symposium in Paris; September 2003.
[25] Pour la Science; N° 320 ; Juin 2004 ; page 28 : Les constantes ..le sont.
[26] Ibison ; massless classical electrodynamics
[27] Geometrical Formulation of Quantum Mechanics; A. Ashtekar and T. A. Schilling; arXiv:gr-qc/9706069 v1 23 Jun 1997.
[28] Mécanique quantique I; Cohen-Tanoudji, B. Diu et Fr. Laloë ; complément BVI moments cinétiques et rotations ; pages 697 et suivantes ; 1977.
[29] Closed formula for Wilson loops for SU(N) Quantum Yang-Mills Theory in two dimensions; A. Ashtekar, J. Lewandowski, D. Marolf, J. Mourao; T. Thiemann; arXiv:hep-th/9605128 v1 17 May 1996.
[31] Beck and Mackey; has dark energy been measured in lab? arXiv: astro-ph/0406504v1 23 June 2004
[34] An analytical treatment of the Clock paradox in the framework of the Special and General Theories of Relativity; arXiv: physics / 0405038 v1 / 8 May 2004; Lorenzo Ioro.
[35] Existence and smoothness of the Navier Stokes equation; Charles F. Feffermann; May 1, 2000. Princeton University, Department of Mathematics, Princeton, NJ 08544-1000 (official Problem Description).

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