The Theory of Self-variation

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Abstract
In this article we formulate the theory of Self-variation in N-dimensional Riemannian spacetime. We present main conclusions of the theory, such as the unified interaction, the generalized particle, and a justification of the cosmological data.
Keywords: self-variation, unified interaction, generalized particle, cosmology

1. INTRODUCTION

Every substantial, decisive expansion of our knowledge of theoretical physics is related to at least one unknown law, an unknown principle whose action in nature had not been integrated into the theoretical background of physics. This principle cannot be contained, not even implicitly, in current theories of physics. Theoretical investigation would eventually bring it to the light. One such principle is the law of the Theory of Special Relativity which states that the speed of electromagnetic waves is not affected, nor does it depend on the speed of their source, as is the case with all other waves. However, an implication emerging from Theory of Special Relativity is the relativity of simultaneity. Two events occurring simultaneously in one inertial reference system do not occur simultaneously in another. This conclusion contradicts our perception of time. The Theory of Special Relativity was published thanks to Planck's insight and intelligence, but it could have just as easily not been published due to the prediction it made of the relativity of simultaneity. Planck's interpretation of black-body heat radiation, that electromagnetic radiation consists of "quanta" or "bundles of energy", is absent from Maxwell's Electromagnetic Theory. In fact, it is completely incompatible with the entire theoretical background of nineteenth-century physics. Planck's hypothesis, although unexpected at the time of its integration to the theoretical background of physics, is essential for understanding the microcosm. The independence of the speed of electromagnetic waves from the speed of their source and the quanta hypothesis did not exist in the theoretical background of physics of the twentieth century. The difficulty in the advancement of theoretical physics concerns the identification of the principles that govern the natural world and the investigation of their consequences.

The principle that was absent from the current theories of physics and emerges from the Theory of Self-Variation is the principle of self-variation. It is a simple, though obviously a somewhat unexpected principle. Taking into account the energy-momentum conservation principle, the self-variation of the rest mass of the material particle can only take place with the simultaneous emission of energy-momentum into the surrounding spacetime of the particle. The combination of the principle of self-variation with the conservation of energy-momentum has as a consequence the presence of energy-momentum in the surrounding spacetime of the material particle. The introduction of the principle of the rest mass self-variation was made with the expectation that this energy-momentum in spacetime could provide a cause for the interaction of material particles. In retrospect, this expectation was confirmed. Being aware of the existence of the gravitational interaction we set as an axiom the self-variation of the rest mass. Similarly, due to the existence of the electromagnetic interaction we set as an axiom the self-variation of the electric charge: each interaction results from a "self-variating charge" Q .

In this article we present the Theory of Self-Variation based on three principles, the principle of self-variation, the principle of conservation of self-variating charge and the principle of conservation of energy-momentum. The theory is formulated in a N -dimensional Riemannian spacetime.

2. THE PRINCIPLES OF THE THEORY OF SELF-VARIATION

In curved N -dimensional spacetime the Theory of Self-variation is based on three principles:

A. The self-variation principle.

With the term "principle of self-variation" we mean an exactly determined increase of the rest mass of material particles and generally of the "self-variating charge" Q. The most direct consequence of the principle of self-variation is that energy, momentum, angular momentum and electric charge (when the material particle is electrically charged) of particles are distributed in the surrounding spacetime. To compensate for the increase, in absolute value, of the electric charge of the electron, the particle emits a corresponding positive electric charge into the surrounding spacetime. Otherwise, the conservation of the electric charge would be violated. Similarly, the increase of the rest mass of the material particle involves the "emission" of negative energy as well as momentum in the spacetime surrounding the material particle (spacetime energy-momentum) P .

The principle of self-variation quantitatively describes the interaction of the self-variating charge $Q = Q\left(x^0, x^1, x^2, ..., x^{N-1}\right) = Q\left(x^k\right)$, $N \in \mathbb{N}^* = \{1, 2, 3, ...\}$ of material particles with the energy-momentum P it emits in spacetime as a consequence of the self-variation of the charge Q:

$$\frac{\partial Q}{\partial x^k} = \frac{b}{\hbar} P_k Q \qquad (2.1)$$

$$k = 0, 1, 2, ..., N-1$$

in every system of reference $\mathrm{O}\left(x^0, x^1, x^2, ..., x^{N-1}\right) = \mathrm{O}\left(x^k\right)$ where $\frac{dx^0}{c}$ is the observer time, c is vacuum velocity of light, $\hbar = \frac{h}{2\pi}$ is the reduced Planck's and $b \in \mathbb{C}$ is a constant. If $Q = m_0$ equation (2.1) becomes

$$\frac{\partial m_0}{\partial x^k} = \frac{b}{\hbar} P_k m_0 \,. \qquad (2.2)$$

B. The principle of conservation of self-variating charge.

To compensate for the increase, in absolute value, a negative charge, the particle emits a corresponding positive charge into the surrounding spacetime. Similarly, to compensate for the increase a positive charge, the particle emits a corresponding negative charge into the surrounding spacetime. We accept that the principle of charge conservation applies to this procedure.

C. The principle of conservation of energy-momentum.

The material particle and the spacetime energy-momentum with which it interacts, comprise a dynamic system which we call "generalized particle". We consider the covariant [1, 2] momentum of the particle J and the total covariant momentum C of generalized particle,

$$C_n = J_n + P_n \,. \qquad (2.3)$$

For the generalized particle we accept that conservation of energy-momentum holds in each x^k-axis, $k = 0, 1, 2, ..., N-1$:

$$C_{n;a} = \frac{\partial C_n}{\partial x^a} - \Gamma^l_{na} C_l = 0 \,. \qquad (2.4)$$

We denote by $;a$ the covariant derivative with respect to x^a, s the length of the arc,

$$ds^2 = g_{ij} dx^i dx^j \qquad (2.5)$$

where g_{ij} is the metric tensor and Γ^k_{na} are the symbols of Christoffel. We follow Einstein's summation convention for terms where an index appears twice.

Via equation (2.4) the total energy-momentum C of the generalized particle is related to the symbols of Christoffel and finally to the metric tensor:

$$\Gamma^k_{an} = \frac{1}{2} g^{k\nu} \left(\frac{\partial g_{a\nu}}{\partial x^n} + \frac{\partial g_{\nu n}}{\partial x^a} - \frac{\partial g_{an}}{\partial x^\nu} \right). \qquad (2.6)$$

Corresponding equations also apply to the contravariant N -vectors $C^n = g^{nk}C_k$, $P^n = g^{nk}P_k$, $J^n = g^{nk}J_k$ where g^{ij} the contravariant form of the metric tensor. The contravariant form g^{ij} of the metric tensor is defined by the equation

$$g_{ik}g^{kj} = \delta_i^j \tag{2.7}$$

where

$$\delta_i^j = \begin{cases} 1, i = j \\ 0, i \neq j \end{cases} \tag{2.8}$$

is the Kronecker delta.

In the following sections we present the main conclusions of the theory of Self-variation.

3. THE CONSEQUENCES OF SELF-VARIATION ONTO THE CHARGE AND IN THE SURROUNDING SPACETIME.

From equation (2.1) we get

$$\left(\frac{\partial Q}{\partial x^k}\right)_{;a} = \frac{b}{\hbar}\left(P_k Q\right)_{;a}$$

$$\frac{\partial^2 Q}{\partial x^a \partial x^k} - \Gamma^l_{ka}\frac{\partial Q}{\partial x^l} = \frac{b^2}{\hbar^2}P_k P_a Q + \frac{b}{\hbar}Q\left(\frac{\partial P_k}{\partial x^a} - \Gamma^l_{ka}P_l\right)$$

$$\frac{\partial^2 Q}{\partial x^a \partial x^k} - \Gamma^l_{ka}\frac{\partial Q}{\partial x^l} = \frac{b^2}{\hbar^2}P_k P_a Q + \frac{b}{\hbar}Q\frac{\partial P_k}{\partial x^a} - \frac{b}{\hbar}Q\Gamma^l_{ka}P_l$$

and with equation (2.1) we get

$$\frac{\partial^2 Q}{\partial x^a \partial x^k} - \frac{b}{\hbar}Q\Gamma^l_{ka}P_l = \frac{b^2}{\hbar^2}P_k P_a Q + \frac{b}{\hbar}Q\frac{\partial P_k}{\partial x^a} - \frac{b}{\hbar}Q\Gamma^l_{ka}P_l$$

and finally we get

$$\frac{\partial^2 Q}{\partial x^a \partial x^k} - \frac{b^2}{\hbar^2}P_k P_a Q = \frac{b}{\hbar}Q\frac{\partial P_k}{\partial x^a}\,. \tag{3.1}$$

Similarly, from the equation

$$\frac{\partial Q}{\partial x^\alpha} = \frac{b}{\hbar}P_\alpha Q$$

we get

$$\frac{\partial^2 Q}{\partial x^k \partial x^\alpha} - \frac{b^2}{\hbar^2}P_\alpha P_k Q = \frac{b}{\hbar}Q\frac{\partial P_\alpha}{\partial x^k}\,. \tag{3.2}$$

From equations (3.1), (3.2) we get

$$\frac{\partial P_k}{\partial x^a} = \frac{\partial P_a}{\partial x^k}\,. \tag{3.3}$$

In addition we have

$$P_{k;a} - P_{a;k} = \frac{\partial P_k}{\partial x^a} - \Gamma^l_{ka}P_l - \left(\frac{\partial P_a}{\partial x^k} - \Gamma^l_{ka}P_l\right) = \frac{\partial P_k}{\partial x^a} - \frac{\partial P_a}{\partial x^k}$$

and with equation (3.3) we get

$$P_{k;a} - P_{a;k} = 0$$

$$P_{k;a} = P_{a;k}\,. \tag{3.4}$$

As a consequence of equations (3.3), (3.4) the inner product $P_k u^k$ satisfy Euler's equation:

$$\frac{d}{ds}\left(\frac{\partial\left(P_k u^k\right)}{\partial u^a}\right) - \frac{\partial\left(P_k u^k\right)}{\partial x^a} = 0 \tag{3.5}$$

where

$$u^k = \frac{dx^k}{ds} \tag{3.6}$$

and $x^k = x^k(s)$ the trajectory of the charge Q.

If $ds = 0$, the arc length s cannot be used as a particle trajectory parameter. In this case, a new parameter l, $dl \neq 0$ can be used, $x^k = x^k(l)$, for which:

$$g_{an} \frac{dx^a}{dl} \frac{dx^n}{dl} = 0. \tag{3.7}$$

Proof. In equation (2.1) it is $Q = Q(x^n)$ so for the momentum

$$P_k = \frac{\hbar}{b} \frac{\partial Q}{Q \partial x^k} = P_k(x^n)$$

we have

$$\frac{\partial P_k}{\partial u^a} = 0$$

and

$$\frac{d}{ds}\left(\frac{\partial(P_k u^k)}{\partial u^a}\right) - \frac{\partial(P_k u^k)}{\partial x^a} = \frac{d}{ds}(P_a) - \frac{\partial P_k}{\partial x^a} u^k = \frac{\partial P_a}{\partial x^k}\frac{dx^k}{ds} - \frac{\partial P_k}{\partial x^a} u^k = \frac{\partial P_a}{\partial x^k} u^k - \frac{\partial P_k}{\partial x^a} u^k$$

and with equation (3.3) we get

$$\frac{d}{ds}\left(\frac{\partial(P_k u^k)}{\partial u^a}\right) - \frac{\partial(P_k u^k)}{\partial x^a} = 0. \ \square$$

From equation (2.1) we get

$$\frac{dQ}{ds} = \frac{\partial Q}{\partial x^k}\frac{dx^k}{ds} = \frac{b}{\hbar} P_k u^k Q$$

and equivalently we obtain

$$\frac{dQ}{Q} = \frac{b}{\hbar} P_k u^k ds. \tag{3.8}$$

From equation (3.8) we get

$$\int_E^M \frac{dQ}{Q} = \ln\frac{Q(M)}{Q(E)} = \int_E^M \frac{b}{\hbar} P_k u^k ds \tag{3.9}$$

during the displacement of the charge Q from a point E to a point M through the trajectory $x^k = x^k(s)$. From equations (3.9) and (3.5) it follows that the particle moves in the trajectory $x^k = x^k(s)$ in which the quotient

$$\frac{Q(M)}{Q(E)}$$

takes either a minimum or a maximum value. If $ds = 0$ we use equation (3.7).

As a consequence of self-variation, when the charge is at position $M\left(x_M^0 = x^0, x_M^1, x_M^2, \dots, x_M^{N-1}\right)$, it acts on point $A\left(X^0, X^1, X^2, X^3\right)$ of spacetime with the value

$$Q_I = Q(E) \tag{3.10}$$

it had at previous / different position $E\left(x_E^0, x_E^1, x_E^2, \dots, x_E^{N-1}\right)$. From equations (3.9), (3.10) we get

$$
\begin{aligned}
&Q_I = Q(M)\exp(-I_1) \\
&I_1 = \int_E^M P_k u^k ds
\end{aligned}
. \qquad (3.11)
$$

Consider the trajectory $X^k = X^k(S)$, $X^k(0) = x^k(E)$ for which

$$
dQ_I = dQ(E) = \frac{\partial Q(E)}{\partial X^k} dX^k = 0 . \qquad (3.12)
$$

From equation (3.12) we get

$$
\frac{\partial Q(E)}{\partial x^a(E)} \frac{\partial x^a(E)}{\partial X^k} dX^k = 0
$$

and with equation (2.1) we get

$$
\frac{b}{\hbar} P_a(E) Q(E) \frac{\partial x^a(E)}{\partial X^k} dX^k = 0
$$

and equivalently we get

$$
P_a(E) \frac{\partial x^a(E)}{\partial X^k} dX^k = 0 . \qquad (3.13)
$$

Symbolizing

$$
\frac{\partial x^a(E)}{\partial X^k} P_a(E) = P_k(A) = P_k \qquad (3.14)
$$

equation (3.13) is written in the form

$$
P_k dX^k = 0 . \qquad (3.15)
$$

From equation (3.15) we get

$$
P_k \upsilon^k = 0 \qquad (3.16)
$$

where

$$
\upsilon^k = \frac{dX^k}{dS} . \qquad (3.17)
$$

For each direction defined at point E there is one point A. We symbolize by S the closed surface defined by the points A and by V the volume of the part of space-time that it encloses. As a consequence of the charge conservation principle, the equation

$$
\int_V D dV + Q(E) = Q(M) \qquad (3.18)
$$

applies, where D is the charge density in the volume V. From equations (3.10), (3.18) we get

$$
\begin{aligned}
&Q_I = Q(M) - I_2 \\
&I_2 = \int_V D dV
\end{aligned}
. \qquad (3.19)
$$

An observer at point M measures the value $Q(M)$ for the charge Q, while an observer at point A measures the value Q_I through the action of the charge Q on point A. Equations (3.11), (3.19) relate the charges Q_I, $Q(M)$ through two different integrals I_1, I_2.

In our study we have considered the Q as a point charge. However, at each point A the N-dimensional current density is defined. Therefore, in the surrounding spacetime of the charge Q, a “continuous medium” results, even if the Q is a point charge. The existence of this continuous medium, i.e. the energy-momentum-charge of spacetime is one of the main conclusions of the theory of Self-variation.

4. THE UNIFIED SELF-VARIATION INTERACTION

The study of interactions is equivalent to the study of the continuous medium predicted by the theory of Self-variation in spacetime. Via the energy-momentum-charge of surrounding spacetime, the charge Q can interact with other charges. We called this interaction “Unified Self-variation Interaction”. In four-dimensional spacetime, for studying this interaction we consider the charge-current tensor $T^{\mu\nu}$,

$$T^{\mu\nu} = D\upsilon^{\mu}\upsilon^{\nu} . \tag{4.1}$$

The conservation of charge-current is given by the equation

$$T^{\mu\nu}_{;\nu} = 0 . \tag{4.2}$$

In the four-dimensional flat spacetime of Special Relativity, from equations (4.1), (4.2) we get the continuity equation

$$\frac{\partial\left(D\upsilon^{0}\right)}{\partial x^{0}} + \nabla\cdot\left(D\boldsymbol{\upsilon}\right) = 0$$
$$\boldsymbol{\upsilon} = \left(\upsilon^{1},\upsilon^{2},\upsilon^{3}\right), \upsilon^{0} = constant \tag{4.3}$$

and

$$\upsilon^{0}\frac{\partial\upsilon^{k}}{\partial x^{0}} + \boldsymbol{\upsilon}\cdot\nabla\left(\upsilon^{k}\right) = 0 \ . \tag{4.4}$$
$$k = 1,2,3$$

Equations (4.3), (4.4) arise, in a different way, in the study of the electromagnetic field in the surrounding spacetime of an arbitrarily moving electric point charge [3]. The Liénard-Wiechert electromagnetic potentials are compatible with the Lorentz-Einstein transformations, but are not compatible with the self-variation principle. For this reason they are replaced by the self-variation potentials, although they correctly give the electromagnetic field of an arbitrarily moving electric point charge. The resulting electromagnetic field from the self-variation potentials is the same as that given by the Liénard-Wiechert potentials. However, there is a fundamental difference between the potentials Liénard-Wiechert and the Self-variation theory. Instead of the one couple of scalar-vector potentials as in the Liénard-Wiechert potentials, we have derived two independent couples. The first couple gives the electromagnetic field which accompanies the electric charge during its motion. This couple is inversely proportional to the distance from the electric charge. The other couple of scalar-vector potentials describe the electromagnetic radiation. This couple is independent from the distance from the electric charge. Also, in the surrounding spacetime of the point charge there is a charge density D given by the equation

$$\nabla\cdot\boldsymbol{\varepsilon} = \frac{b}{\hbar}\mathbf{P}\cdot\boldsymbol{\varepsilon} = \frac{D}{\varepsilon_{0}} \tag{4.5}$$

where $\boldsymbol{\varepsilon}$ is the strength of the electric field and ε_0 is the electric vacuum permeability.

Starting from equation (4.5) we can define the field

$$\alpha = \left(\alpha_{0},\alpha_{1},\alpha_{2},\alpha_{3}\right) \tag{4.7}$$

where the vector $\boldsymbol{\alpha} = \left(\alpha_{1},\alpha_{2},\alpha_{3}\right)$ corresponds to the electric field $\boldsymbol{\varepsilon}$. The general form of equation (4.5) in four-dimensional spacetime is

$$\frac{b}{\hbar}\left(P_{0}g^{0k}\alpha_{k} + P_{1}g^{1k}\alpha_{k} + P_{2}g^{2k}\alpha_{k} + P_{3}g^{3k}\alpha_{k}\right) = \frac{b}{\hbar}\left(g^{0k}P_{k}\alpha_{0} + g^{1k}P_{k}\alpha_{1} + g^{2k}P_{k}\alpha_{2} + g^{3k}P_{k}\alpha_{3}\right) = \sigma D \ . \tag{4.8}$$
$$\sigma = constant$$

When the field α is defined via the potential, it follows that $\alpha_0 = 0$.

Equations (4.8), (4.1), (4.2) and (3.16),

$$\frac{b}{\hbar}\left(g^{0k}P_k\alpha_0+g^{1k}P_k\alpha_1+g^{2k}P_k\alpha_2+g^{3k}P_k\alpha_3\right)=\sigma D$$
$$T^{\mu\nu}=D\upsilon^{\mu}\upsilon^{\nu} \tag{4.9}$$
$$T^{\mu\nu}_{;\nu}=0$$
$$P_k\upsilon^k=0$$

give the unified Self-variation interaction. The system of equations (4.9) includes the four-vectors P, υ, α and the density D. These physical quantities are related to each other through the metric tensor. Corresponding equations apply in N-dimensional spacetime.

5. THE GENERALIZED PARTICLE. A JUSTIFICATION OF THE COSMOLOGICAL DATA

One of the main predictions of the theory of Self-variation concerns the generalized particle: the dynamical system resulting from the particle carrying the charge Q with the energy-momentum-charge it emits into the surrounding spacetime.

The simplest generalized particle results as a consequence of equation (2.3), at a point in spacetime. In an isotropic spacetime we expect that the spontaneous emission of momentum P by the material particle cannot disturb its kinetic state. For a stationary particle, $J=0$, the total momentum P that radiates in all directions will also be zero, $P=0$. Hence, due to the isotropy of spacetime, the covariant N-vectors P and J are parallel in the case that they are different from zero,

$$P_n=\Phi J_n. \qquad \Phi\neq 0 \tag{5.1}$$

In the flat four-dimensional spacetime of special relativity, equation (5.1) arises as a consequence of the linearity of Lorentz-Einstein transformations.

In the frame of the theory of Self-variation, equation (5.1) predicts the simplest possible particle. From equations (2.3), (2.4) and (5.1) we get

$$\left(\left(\Phi+1\right)J_n\right)_{;a}=0$$

and equivalently we obtain

$$\frac{\partial}{\partial x^a}\left(\left(\Phi+1\right)J_n\right)-\Gamma^k_{na}\left(\Phi+1\right)J_k=0. \tag{5.2}$$

In the flat spacetime the symbols of Christoffel are zeroed and the equation (5.2) become

$$\frac{\partial}{\partial x^a}\left(\left(\Phi+1\right)J_n\right)=0$$

for every x^a, so we get

$$\left(\Phi+1\right)J_n=c_n=constant$$

and equivalently we obtain

$$J_n=\frac{c_n}{\Phi+1}. \qquad c_n=constant \tag{5.3}$$

From equations (5.1), (5.3) we obtain

$$P_n=\frac{\Phi c_n}{\Phi+1}. \tag{5.4}$$

In the four-dimensional flat spacetime of special relativity the equation holds:

$$J^n=J_n$$
$$J_0J^0+J_1J^1+J_2J^2+J_3J^3+m_0^2c^2=J_0^2+J_1^2+J_2^2+J_3^2+m_0^2c^2=0$$

and with equation (5.3) we get

$$\frac{c_0^2 + c_1^2 + c_2^2 + c_3^2}{(1+\Phi)^2} + m_0^2 c^2 = 0$$

$$m_0 = \pm \frac{M_0}{1+\Phi} \quad . \tag{5.5}$$

$$c_0^2 + c_1^2 + c_2^2 + c_3^2 = -M_0^2 c^2$$

From equation (5.5) we get

$$\frac{\partial m_0}{\partial x^n} = \mp \frac{M_0}{(1+\Phi)^2} \frac{\partial \Phi}{\partial x^n}$$

$$\frac{\partial m_0}{\partial x^n} = -\frac{m_0}{(1+\Phi)} \frac{\partial \Phi}{\partial x^n}$$

and with equation (2.2) we get

$$\frac{b}{\hbar} P_n m_0 = -\frac{m_0}{(1+\Phi)} \frac{\partial \Phi}{\partial x^n}$$

$$\frac{b}{\hbar} P_n = -\frac{1}{(1+\Phi)} \frac{\partial \Phi}{\partial x^n}$$

and with equation (5.4) we get

$$\frac{b}{\hbar} \frac{\Phi c_n}{1+\Phi} = -\frac{1}{(1+\Phi)} \frac{\partial \Phi}{\partial x^n}$$

$$\frac{\partial \Phi}{\partial x^n} = -\frac{b c_n}{\hbar} \Phi$$

and finally we obtain

$$\Phi = K \exp\left(-\frac{b}{\hbar} \left(c_0 x^0 + c_1 x^1 + c_2 x^2 + c_3 x^3 \right) \right). \tag{5.6}$$

$$K = constant$$

From equations (2.1), (5.4) we obtain

$$Q = \frac{Q_0}{\Phi + 1} \quad . \tag{5.7}$$

$$Q_0 = constant$$

Equations (5.3)-(5.7) give, in the flat spacetime, the simplest particle predicted by the theory of Self-variation. Equations (5.5), (5.6), (5.7) justify the cosmological data in a static flat universe [4].

The emission of energy-momentum-charge makes the surrounding spacetime of the charge Q non-isotropic. In this case the equations (3.11),

$$Q_I = Q(M) \exp(-I_1)$$

$$I_1 = \int_E^M P_k u^k ds$$

and (3.19),

$$Q_I = Q(M) - I_2$$

$$I_2 = \int_V D dV$$

apply. In these equations, $Q(M)$ is the value of the charge that is measured at point A, while Q_0 in equation (5.7) is a constant. Equations (3.11), (3.10) refer to a local frame of reference, while equation (5.7) applies in cosmological scale. The consequences of self-variation must be considered at all distance scales, from microcosm to cosmological scale observations.

On a macroscopic scale, spacetime contains particles-sources of charge Q moving with velocity u and the energy-momentum-charge they emit. Denoting with ρ the particle density, the energy-momentum-charge tensor $C^{\mu\nu}$ is given by the equation

$$C^{\mu\nu} = \rho Q u^{\mu} u^{\nu} + D\upsilon^{\mu}\upsilon^{\nu} . \tag{5.8}$$

The conservation of charge-current is given by the equation

$$C^{\mu\nu}_{;\nu} = \left(\rho Q u^{\mu} u^{\nu} + D\upsilon^{\mu}\upsilon^{\nu}\right)_{;\nu} = 0 . \tag{5.9}$$

Depending on the physical system we are studying, we can introduce additional terms in equation (5.8). These terms can arise from specific properties of the continuous medium we studied.

6. CONCLUSION

Self-variation leads to the revision of all physical structures-systems-models that have been studied, from the microcosm and the macrocosm to the cosmological scale. In this article we present the main conclusions and equations for this revision.

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