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By David Zareski

Israel Aerospace Industries, Israel

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UNIFICATIONOFPHYSICSTHEORIESBYTHEETHERELASTICITYTHEORY

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Unification of Physics Theories by the Ether Elasticity Theory

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Abstract- Our previous publications lead to the fact that the ether elasticity theory in which the ether is shown to be an elastic medium governed by a Navier-Stokes-Durand equation (NSDE), unifies physics theories. The great lines of this unification are the following. Electromagnetism, is the case where the ether is submitted to only densities C of couples of forces associated to the electric charges that creates the field ξ of the displacements of the points of the ether from which one deduces the Maxwell equations and the electromagnetic forces. Electromagnetism is generalized to the case where ξ is also associated to $Par(m,e)s$ (particles of mass m and electric charge e) submitted to incident fields, by the fact that the Lagrange-Einstein function L_G of a such a $Par(m,e)$ yields not only the motion equation, but also ϕ, defined by $\hbar\, d\phi/dt = L_G$, which is the phase of a wave ξ associated to $Par(m,e)s$. This ξ is a solution of a generalized NSDE. A specific sum $\hat{\xi}$ of waves ξ forms a globule that moves like the $\mathrm{Par}(m,e)$ and contains all its parameters; reciprocally, a wave ξ is a sum of globules $\hat{\xi}$, i.e., of $Par(m,e)s$. These sums are Fourier transforms, and we call this property, "wave-particle reciprocity". It appears that the fields are also elastic changes in the ether. In the Newton-Maxwell theory, the electrical repulsion between two massive electrically charged particles of same sign are always greater than their Newtonian attraction. But, by taking into account the General Relativity and the ether theory, we show that their mutual gravitational attraction surpasses their electrical repulsion when they are sufficiently close one to the other. This phenomena plays the role of the "strong nuclear interaction". The Schrödinger equation ensues from axioms inspired from the de Broglie plane wave, therefore this equation is axiomatic, even though it yields very important results. Therefore one may think that the quantum mechanics may be generalized by a theory based on physical parameters and on general relativity, and not only on axioms. Indeed, we show in particular, that Schrodinger's equation is a particular case of the ether elasticity theory compatible with the general relativity, in particular the quantum states are shown to be due to interferences of waves ξ that compose a $\hat{\xi}$ in an atom, i.e. where $\hat{\xi}$ describes a closed trajectory. Now in a linear motion, a $Par(m,e)$, i.e., a $\hat{\xi}(m,e)$, creates a Lienard-Wiechert covariant potential tensor that yields the magnetic field H which, in the *ether elasticity theory, is the velocity* $\partial_t\xi$ *of the ether points*. It appears that at a fixed observatory point near, at a given instant, to the moving electron, i.e., to the moving $\hat{\xi}(m,e)$, the velocity of the ether is of the same form as the velocity of a point of a rotating solid.

This phenomenon is the electron spin which, as we show, in a quantum state of an atom, can take only quantized values. Einstein's tensor $g_{\mu\nu}$ is usually considered as representing only the gravitational field . But the Einstein equations that defines $g_{\mu\nu}$ are pure mathematical reasoning related only to covariant derivatives. Therefore one can suppose that this tensor is more general than defining only the gravitational field and can define also other fields as, e.g., the EM field. We show that it is really the case, indeed, the fact that the electrostatic potential of force $A_{4,S}$, (S=static), created by an immobile electric charge q_0, is of the same form as the Newton potential of force $G_{4,S}$ created by an immobile $Par(m_0,0)$ implies that $A_{4,S}$ is a particular $G_{4,S}$. This is generalized by the fact, that the EM Lienard-Wiechert potential tensor A_μ created at a point by a moving e is of the same form as the Newton approximation, (NA), G_μ of $g_{\mu\nu}$ created by a moving m_0.

Résumé- Nos publications antérieures conduisent a ce que la théorie de l'éther montré être un milieu élastique régis par l'équation de Navier-Stokes-Durand, (NSDE), unifie des théories de la physique. Les grandes lignes de cette unification sont les suivantes. L'électromagnétisme est le cas ou l'éther est soumis seulement a des densités C de couples de force associées aux charges électriques qui créent le champ ξ des déplacements des points de l'éther desquelles on déduit les équations de Maxwell et les forces électrodynamiques. L'électromagnétisme est ensuite généralisée au cas ou ξ est aussi associé aux $Par(m,e)s$ (particules de masse m et de charge électrique e) soumises a des champs incidents, par le fait que la fonction the Lagrange-Einstein L_G d'une telle $Par(m,e)$ produit non seulement l'équation du mouvement, mais aussi ϕ, défini par $\hbar\, d\phi/dt = L_G$, qui est la phase d'une onde ξ associée a des $\mathrm{Par}(m,e)$. Cette ξ est solution d'une NSDE généralisée. Une somme spécifique $\hat{\xi}$ d'ondes ξ forme un globule qui se déplace comme la $Par(m,e)$ et contient tous ses paramètres; réciproquement, une onde ξ est une somme de

Author: "I.A.I, Israel Aerospace Industries" Yehud Israel, University Paul Sabatier of Toulouse, France. e-mail: zareski@inter.net.il

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globules $\hat{\xi}$, i.e., de $Par(m,e)s$. Ces sommes sont des transformations de Fourier, et nous appelons cette propriété, “onde-particule réciprocité”. Il apparaît que les champs sont aussi des changements élastiques de l’éther. Dans la théorie de Newton-Maxwell, la répulsion électrique entre deux particules massives et électriquement chargées de même signe est toujours plus grande que leur attraction Newtonienne. Mais, prenant en ligne de compte la Relativité Générale et la théorie de l’éther, nous montrons que leur attraction mutuelle gravitationnelle surpasse leur répulsion électrique lorsqu’ils sont suffisamment proche l’une de l’autre. Ce phénomène est la cause de “ l’interaction nucléaire forte”. L’équation de Schrödinger est basée sur des axiomes inspirés de l’onde plane de de Broglie, par conséquent cette équation est axiomatique, même si elle donne des résultats très importants. On peut donc penser que la mécanique quantique peut être généralisée par une théorie basée sur des paramètres physiques et sur la relativité générale, et non sur seulement sur des axiomes. En effet, nous montrons en particulier que l’équation de Schrödinger est un cas particulier de la théorie de l’élasticité de l’éther compatible avec la relativité générale, en particulier, les états quantiques sont montrés être dus a de interférences d’ondes ξ qui composent le globule $\hat{\xi}$ dans un atome, i.e. $\hat{\xi}$ décrit une trajectoire fermée. Or dans son mouvement linéaire, une $Par(m,e)$, i.e., un $\hat{\xi}(m,e)$, crée un potentiel tenseur de Lienard-Wiechert d’ou on déduit le champ magnétique H qui, dans *la théorie de élasticité de l’éther, est la vitesse* $\partial_t\xi$ *des points de l’éther*. Il apparait qu’a un point fixe d’observation proche, a l’instant donné, de l’électron mobile, i.e., du globule $\hat{\xi}(m,e)$ mobile, la vitesse de l’éther est de la même forme que la vitesse d’un point d’un solide en rotation. Ce phénomène est le spin de l’électron qui, comme nous le montrons, dans un état quantique d’un atome, ne peut prendre que des valeurs quantiques. Le tenseur $g_{\mu\nu}$ d’Einstein est généralement considéré comme représentant seulement le champ gravitationnel. Mais les équations d’Einstein qui définissent les $g_{\mu\nu}$ sont de purs raisonnement mathématiques n’ayant rapports qu’avec seulement des dérivées covariantes. Par conséquent, on peut supposer que ce tenseur est plus général que de définir seulement le champ gravitationnel et peut donc définir aussi d’autres champs comme, e.g., le champ électromagnétique. Nous montrons qu’il en est ainsi réellement, en effet, le potentiel électrostatique $A_{4,S}$, (S=statique), crée par une charge électrique q_0, immobile est de la même forme que le potentiel de force de Newton $G_{4,S}$ crée une $Par(m_0,0)$ immobile, implique que $A_{4,S}$ est un $G_{4,S}$ particulier. Ceci est généralisé par le fait que le tenseur de potentiel électromagnétique A_μ de Lienard-Wiechert créé a un point par une e mobile est de la même forme que l’approximation de Newton,(NA), G_μ de $g_{\mu\nu}$ crée par une m_0 mobile.

Keywords: ether theory as unifying; moving particle as a globule in the ether; Newton approximation; Lorentz transformation of static potential; globule motion creating a Lienard-Wiechert tensor; interactive forces as interactions of ether deformations.

I. Introduction

- *Einstein wrote in Ref. 1:*

"The introduction of the field as an elementary concept gave rise to an inconsistency of the theory as a whole. Maxwell's theory, although adequately describing the behavior of electrically charged particles in their interaction with one another, does not explain the behavior of electrical densities, that is, it does not provide a theory of the particles themselves. They must therefore be treated as mass points on the basis of the old theory. The combination of the idea of a continuous field with the conception of material points discontinuous in space appears inconsistent. A consistent field theory requires continuity of all elements of the theory not only in time but also in space and in all points of space. Hence, the material particle has no place as a fundamental concept in a field theory The particle can only appear as a limited region in space in which the field strength of the energy density is particularly high. Thus, even apart from the fact that gravitation is not included, Maxwell's electrodynamics cannot be considered a complete theory."

- *Maxwell and Einstein presumed the existence of an ether, in particular Maxwell wrote in Art. 866 of Ref. 2:*

  "Hence all these theories lead to the conception of a medium in which the propagation takes place, and if we admit this medium as an hypothesis, I think it ought to occupy a prominent place in our investigations.".

- *and Einstein in Ref. 3:*

“Recapitulating, we may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense.“.

Physicists and in particular Einstein tried to unify physics without success. In my opinion this is due to the fact that that they did not remarked any relation between: electromagnetism, particles, fields, spin, strong nuclear interaction, quantum mechanics, and in particular the relation between general relativity and electromagnetism.

But as we show here, these physics theories are particular cases of the ether elasticity theory. As we show, the ether is an elastic medium governed by the Navier-Stokes-Durand equation (NSDE) of elasticity. In the absence of gravitation the NSDE is given in Eq. (6) here below. As we show, this equation yields the Maxwell electromagnetic (EM) equations and the expression for the EM interactive forces. In the wave form, and in a region devoid of electric charges that create the field, Eq. (6) becomes Eq. (9). In presence of gravitational and/or EM fields, Eq. (9) is generalized by Eq. (25) in which V_P that appears now instead of c, is the phase velocity of a wave defined in the following. The general expression for V_P is, Cf. Eq. (31) of Ref. 4,

$$V_p = \frac{cE_T g_{44}}{eA_j \tilde{x}^j g_{44} + (E_T + eA_4)(\tilde{G}B - g_{j4}\tilde{x}^j)} \qquad (1)$$

where $\tilde{x}^\mu$, $\tilde{G}$, B, and E_T that appears in this expression are defined in Sec. IV of **Ref. 4**.

As shown here below, it appears: that the generalized NSDE yields the waves ξ associated to massive and electrically charged particle; that a specific sum $\hat{\xi}$ of these waves ξ forms a globule that moves like the particle and contains all its parameters; and that reciprocally, a specific sum of these globules $\hat{\xi}$ forms a wave ξ, these two sums are in fact are Fourier transforms that we call the "wave-particle reciprocity property". Then we show: that the fields are specific deformations of the ether; that the electron spin is the velocity of the points of the ether near the particle in its motion; that the strong nuclear interaction is due to the effects of the NSD theory and of the general relativity on massive and electrically charged particles even of same sign when they are sufficiently close one to the other; that the Schrodinger equation ensues from the NSDE, and that electromagnetism is the Newton approximation of Einstein's general relativity, this last fact is well in accord with the here above cited Einstein's opinion, namely: "*..Maxwell's electrodynamics cannot be considered a complete theory*".

Therefore the ether elasticity theory developed in our previous manuscripts and recalled here below is shown to unify the physics theories cited here above.

II. Notations and Generalities

x^μ, ($\mu = 1,2,3,4$), denote the four-coordinates, the Greek indices take the values 1,2,3,4, and the Latin, the values 1,2,3, these last refer to spatial quantities, the index 4 refers to temporal quantities. c denoting the light velocity in "vacuum", one always can impose $x^4 \equiv ct$. The Einstein summation will be used also with the Latin indices. As usual, $g_{\mu\nu}$ is the co-covariant Einstein's fundamental tensor, ds the Einstein infinitesimal element, A_μ the electromagnetic potential tensor, and $\dot{f}$ the quantity defined by $\dot{f} \equiv df/dt$, the expression for $\dot{s}$ is then

$$\dot{s} \equiv \sqrt{g_{\mu\nu}\dot{x}^\mu \dot{x}^\nu} \equiv \sqrt{\dot{x}^\mu \dot{x}_\mu} \ . \qquad (1a)$$

A particle of inertial rest mass m and of electric charge e will be denoted $Par(m,e)$, and its velocity by V, we remind that its energy E_T is constant when it is submitted to static incident fields, that then $A_j = 0$, and we can chose the coordinates to be such that $g_{4j} = 0$. The Lagrange-Einstein function of a $Par(m,e)$ submitted to the fields $g_{\mu\nu}$ and A_μ is denoted $L_G(g, A_\mu, m, e)$, for which the expression is

$$L_G(g, A_\mu, m, e) = -mc\dot{s} + eA_\mu \dot{x}^\mu/c \ , \qquad (2)$$

When there is no ambiguity $L_G(g, A_\mu, m, e)$ will be also denoted simply L_G. We denote by $d\ell$ the infinitesimal element of the trajectory of a $Par(m,e)$, by u^μ the quantity defined by $u^\mu \equiv dx^\mu/d\ell$, by **u** is the unitary vector along this trajectory of components $u^j \equiv dx^j/d\ell$, by $\Re(g, A_\mu)$ the spatial region in which are present the incident fields $g_{\mu\nu}$, and A_μ, but not any sources of these fields. We denote by p_μ the covariant momentum tensor, and by ∂_μ the derivatives $\partial/\partial x^\mu$. Since $p_\mu \equiv \partial L_G/\partial \dot{x}^\mu$, it follows that

$$p_\mu = -mc\,dx_\mu/ds + eA_\mu/c \ , \qquad (3)$$

therefore $L_G dt$ can be written also in the form

$$L_G dt = p_\mu dx^\mu \equiv p_4 dx^4 + p_j dx^j \, . \qquad (4)$$

A $Par(m_0, q_0)$, immobile at the origin **O**, (i.e., $m_0 >> m$), creates a Schwarzschild field indicated by g_{Sc} and an electrostatic field A_4. Since these fields are static, E_T is constant, and in spherical coordinates the sole modified components $g_{\mu\nu}$, are $g_{44} = \gamma^2 \equiv 1 - \alpha/r$, and $g_{11} = 1/\gamma^2$, with $\alpha \equiv 2m_0 k/c^2$, and, Cf. **Ref. 4**,

$$L_G(g_{Sc}, A_4, m, e) = -mc\sqrt{c^2\gamma^2 - V^2\gamma_a{}^2} + eA_4 \, . \qquad (5)$$

A spatial region in which are present these incident fields will be denoted $\Re(g_{Sc}, A_4)$.

III. The Elastic Interpretation of Electrodynamics

In Ref. 5 we have developed the "elastic interpretation of electrodynamics". In this interpretation, the ether Œ is shown to be an elastic medium of which the field ξ of the displacements of its points is governed by the Navier-Stokes-Durand equation

$$\mathbf{curl}(\mathbf{C}/2-\eta\mathbf{curl}\xi)=\rho\partial_{tt}\xi\,, \qquad (6)$$

where C denotes the volumetric density of couples applied to Œ, η, the elastic restoring rotation coefficient of Œ, and ρ, the volumetric density of Œ. By using the following variable changes:

$$\mathbf{E}\equiv\eta\mathbf{curl}\xi-\mathbf{C}/2\,,\quad \mathbf{H}\equiv\partial_t\xi\,,\quad \mathbf{B}\equiv\rho\partial_t\xi\,, \qquad (7a)(7b)(7c)$$

$$\mathbf{J}_e\equiv\partial_t\mathbf{C}/(2\eta)\,,\qquad \rho_e\equiv-\mathrm{div}[\mathbf{C}/(2\eta)]\,, \qquad (7d)(7e)$$

Eq. (6) yields the four following equations:

$$\mathrm{curl}\mathbf{E}+\partial_t\mathbf{B}=0\,,\quad \mathrm{curl}\mathbf{H}-\partial_t\mathbf{E}/\eta=\mathbf{J}_e\,, \qquad (8a)(8b)$$

$$\mathrm{div}\mathbf{B}=0\,,\quad \mathrm{div}\mathbf{E}=\eta\rho_e\,, \qquad (8c)(8d)$$

That are the Maxwell equations. It ensues that: Eqs. (7a), (7b), and (7c) represent respectively the elastic interpretation of: the electric field $\mathbf{E}$, the magnetic field H , and the magnetic induction B ; ρ and η that, in the elastic interpretation, are respectively: the volumetric density and the elastic restoring rotation coefficient of the ether are respectively the coefficient of magnetic induction and the inverse of the electric induction coefficient ε_0, i.e., $\eta\equiv 1/\varepsilon_0$; $\partial_t\mathbf{C}/(2\eta)$ and $-div[\mathbf{C}/(2\eta)]$ are the elastic interpretation of respectively the volumetric density of electric currents $\mathbf{J}_e$ and of electric charges ρ_e .

Furthermore, from (7d) and (7e) one deduces that $\mathbf{J}_e$ and ρ_e verify the continuity equation

$$\mathrm{div}\mathbf{J}_e+\partial_t\rho_e=0\,, \qquad (8e)$$

that expresses the charge conservation. One sees that, like presumed by Maxwell and by Einstein, the ether elasticity theory leads to Maxwell's electromagnetism.

Note: Eq. (6) is generalized in the following here below, it appears also that in the free ether then, $\eta=\eta_0=1/\varepsilon_0$, ρ_0 is a constant, and $\eta_0/\rho_0=c^2$.

In $\Re(0,A_\mu)$.and for C=0, (6) is a wave equation which takes the form

$$\mathrm{curl}\left(c^2\mathrm{curl}\xi\right)=\omega^2\xi\,, \qquad (9)$$

Where $\omega\equiv 2\pi\nu$. The solution ξ of (9), denoted also by ξ_{EM} , are of the form

$$\xi\ =\xi_0\exp[i\omega(-t+x/c)]\,,$$

Where ξ_0 is a constant vector perpendicular to the trajectory. As shown in Ref. 5, and in Sec. 8.3 here below, the electromagnetic forces are the interactions of the displacements ξ due to the electric charges. It appears that *electromagnetism is the particular case of elasticity.*

IV. Generalization of the Electromagnetic Waves to Waves Associated to Massive and Electrical Particles

The electromagnetic waves ξ associated to free photons, i.e., to $Par(0,0)s$ in $\Re(0,0)$ defined by Eq. (9), were generalized, Cf. Ref. 7, to waves ξ associated to $Par(m,e)s$ in $\Re(g,A_\mu)$ of the form

$$\xi=\xi_0\exp(i\phi) \qquad (10)$$

defined as following. As shown in Sec. II of Ref. 4, the Einstein four-motion equation of a $Par(m,e)$ in $\Re(g,A_\mu)$ can be formulated in the following Lagrange form

$$\frac{d}{dt}\left(\frac{\partial L_G}{\partial\dot{x}^\mu}\right)-\partial_\mu L_G=0\,, \qquad (11)$$

As shown, $-cp_4$ is the particle energy denoted E_T, which, in static fields, is constant and can be written

$$E_T=mc^2+h\nu\,, \qquad (12)$$

where ν is a frequency and h the Planck constant, for the photon $E_T=h\nu$. Now, $d\phi$ is defined by

$$d\phi\equiv L_G dt/\hbar\,, \qquad (13)$$

Then considering (4), and Sec. III of Ref.4,

$$\phi\equiv\frac{1}{\hbar}\left(-\int E_T dt+\int p_j dx^j\right), \qquad (14)$$

that is equivalent to

$$\phi\equiv\frac{1}{\hbar}\left(-\int E_T dt+\int\frac{E_T}{V_P}d\ell\right), \qquad (15)$$

where V_P is the phase velocity of the wave ξ of phase ϕ, and the spatial curvilinear integral is taken along trajectories defined here below. The general expression for V_P is given in Eq. (1), and that for the particle velocity V is given in Sec. IV of **Ref. 4**. Here are these expressions for a $Par(m,e)$ in $\Re(g_{Sc}, A_4)$, they are,

$$V_p = \frac{c\gamma}{\gamma_a}\frac{1}{\sqrt{1-b^{-2}\gamma^2}} . \tag{16}$$

$$V = c(\gamma/\gamma_a)\sqrt{1-b^{-2}\gamma^2} , \tag{17}$$

Cf. Sec. V, (ibid), where b is defined by

$$b \equiv (E_T + eA_4)/(mc^2). \tag{18}$$

We remind also that V is related to V_P by the relation, Cf. **Ref. 7**, and as one can verify here,

$$\frac{\partial}{\partial E_T}\left(\frac{E_T}{V_P}\right) = \frac{1}{V} , \tag{19}$$

therefore, if on denotes $\phi' \equiv \hbar\,\partial\phi/\partial E_T$, then, on account of (15) and (19), one has

$$\phi' \equiv -t + \int d\ell/V . \tag{20}$$

Furthermore, denoting $\omega \equiv E_T/\hbar$ and considering the case where E_T is constant , (15) becomes

$$\phi \equiv \omega\left(-t + \int d\ell/V_P\right) . \tag{21}$$

Now in order to determine completely the phase ϕ one has to determine the trajectory equation of the $Par(m,e)$. This was done in **Ref. 7**, it appeared that the particle trajectory equation is the same as the optical differential equation of light rays, Cf. Sec. 3.2 of **Ref. 8**. The great lines of this demonstration are: from Eqs. (13) and (15), here above, it follows that L_G can be written also in the following form

$$L_G = E_T\left(-1 + \dot{\ell}/V_P\right), \tag{22}$$

where $\dot{\ell}$ denotes the path length covered par unit of time, on the wave ray, i.e., on the particle trajectory. Let us now consider the case where the particle is in static fields, since then E_T is constant, (22) and (11) yield

$$\frac{d}{dt}\frac{\partial}{\partial \dot{x}^j}\left(\frac{\dot{\ell}}{V_P}\right) = \partial_j\left(\frac{\dot{\ell}}{V_P}\right). \tag{23}$$

As shown in Sec. IV.A of Ref. 7, this equation yields the following one

$$\frac{d}{d\ell}\left[\frac{1}{V_P(\ell)}u^j(\ell)\right] = \frac{\partial^{\cdot}}{\partial x^j(\ell)}\left[\frac{1}{V_P(\ell)}\right], \tag{24}$$

which is the same as the optical differential equation of light rays, the phase ϕ is therefore determined. We have demonstrated that the waves ξ defined in (10) are the solution of the equation

$$\mathrm{curl}\left(V_P^{\,2}\,\mathrm{curl}\xi\right) = \omega^2\xi , \tag{25}$$

where ξ_0 depends only upon the spatial coordinates and is perpendicular to the trajectory. Equation (25) generalizes Eq. (9), and as shown in **Ref. 7**, the density of ether remains constant, furthermore one has the relation

$$\eta = \eta_0\, V_P^{\,2}/c^2 . \tag{26}$$

V. The Elastic Interpretation of the Fields

Considering (22) and (2), it follows that

$$mc\dot{s} = E_T\left(1 - \dot{\ell}/V_P\right) + eA_\mu \dot{x}^\mu/c . \tag{27}$$

Denoting by $F_{\mu\nu}$ the tensor defined by

$$F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu , \tag{28}$$

One can verify considering the expressions for E and B given in (7), that

$$\dot{x}^i F_{ij} \equiv -(\mathbf{V}\wedge \mathrm{curl}\mathbf{A})_j = (\mathbf{V}\wedge\mathbf{B})_j = (\mathbf{V}\wedge\rho_0\partial\xi)_j , \tag{29}$$

$$F_{4j} = E_j = \eta\ (\mathrm{curl}\xi)_j . \tag{30}$$

It follows that $F_{\mu\nu}$, i.e., A_μ are functions of ξ, therefore as shown by (27), Einstein's element ds is also a function of ξ, this is the elastic interpretation of ds. From (22), one sees that L_G, i.e., V_P, defines the fields. That is to say, Cf. (26), that the fields are finally simply changes of the ether restoring rotation coefficient η. In $\Re(g,A)$, in presence of $Par(m,e)$, (16) of **Ref. 7**, and (22) here above, show that one cannot separate the gravitational field, the EM field, and the inertial mass m. In order to show the elastic side of the gravitational field, one considers the $Par(0,0)$ in $\Re(g,0)$, in this case (26) becomes Eq. (57a) of **Ref. 7**, which shows the change of the ether restoring rotation coefficient η. due to the gravitation field alone. For a $Par(m,0)$ in a $\Re(g_{Sc}, A_4)$, m_0 together with m, change η_0 into η defined by

$$\eta = \eta_0\frac{\gamma^2}{\gamma_a^{\,2}}\frac{E_T^{\,2}}{\left[E_T^{\,2} - \gamma^2\left(mc^2\right)^2\right]} . \tag{31}$$

which, for the photon, i.e., for .m=0 becomes

$$\eta = \eta_0\,\gamma^2/\gamma_a^{\,2} . \tag{32}$$

This shows the changes of the restoring rotation coefficient η due to the gravitation field and to the inertial mass m of the massive particle submitted to this field. In the general case, η is given by (26). Therefore:

the fields are simply changes of the coefficient η of the ether restoring elastic rotation.

VI. The Particle Wave Reciprocity

For simplicity we consider a $Par(m,0)$ submitted that a static gravitation, (or free), and will use the following notations: if ω is fixed, and ξ, ϕ, and ϕ' are functions of $\omega+\Delta\omega$, then they will be denoted $\xi(\Delta\omega)$, $\phi(\Delta\omega)$, and $\phi'(\Delta\omega)$, and if $\Delta\omega=0$, then they will be denoted simply ξ, ϕ, and ϕ'. Using the finite increment theorem we have shown in **Ref. 7**, that

$$\phi(\Delta\omega)=\phi+\Delta\omega\phi', \tag{33}$$

because the term in $(\Delta\omega)^2$ of this finite increment, is very small compared to the term in $\Delta\omega$, it follows that

$$\xi(\Delta\omega)=\xi\exp(i\Delta\omega\phi'). \tag{34}$$

Now, we have shown, (ibid), that the sum $\hat{\xi}(\Delta\omega)$ of waves $\xi(\vartheta)$ defined in Sec. VII of **Ref. 7**, is

$$\hat{\xi}(\Delta\omega)=\xi_0\exp\left[i\omega\left(-t+\int\frac{d\ell}{V_P}\right)\right]SINC\left[\frac{\Delta\omega}{2}\left(-t+\int\frac{d\ell}{V}\right)\right] \tag{35}$$

where $SINC(x)\equiv\sin x/x$. $\hat{\xi}(\Delta\omega)$ represents a wave $\xi=\xi_0\exp(i\phi)$ of which the amplitude is non zero only in the volume defined by $SINC(\pi\Delta\nu\phi')$ of length $2V_{mean}/(\sigma\Delta\nu)$, Cf. Sec. VII. B of **Ref. 4**, that moves with the particle velocity V. Thus, $\hat{\xi}(\Delta\nu)$ describes the properties of the particle, namely: its trajectory, velocity, energy, undulatory nature and its size. Therefore, $\hat{\xi}(\Delta\nu)$ is called "single-particle wave". For a free particle (35) becomes

$$\hat{\xi}(\Delta\nu)=\xi_0\exp\left[i\omega\left(-t+\frac{x}{V_{PF}}\right)\right]\bullet SINC\left[\pi\Delta\nu\left(-t+\frac{x}{V_F}\right)\right] \tag{36}$$

where "F" refers to free particle, obtained ,e.g., by setting $\gamma=\gamma_a=1$ and $A_4=0$, in (16) & (17). For m=0, i.e., for free photons, (36) is a single-photon wave. Reciprocally, we have shown in Sec. VIII of **Ref. 7**, that

$$\int_{-\infty}^{\infty}\hat{\xi}(\Delta\omega,\tau)d\tau\equiv\xi\int_{-\infty}^{\infty}SINC(\pi\Delta\nu\tau)d\tau=\frac{\xi}{\Delta\nu}. \tag{37}$$

Note that in (37) and (35) are Fourier transforms. Since the magnitude of ξ is arbitrary, one can say that ξ is constituted by single particle waves $\hat{\xi}(\Delta\nu)$, i.e., by particles, in particular, an EM wave is constituted by single-photon waves, i.e., by photons. Therefore, *the single-particle wave $\hat{\xi}(\Delta\nu)$ describes physical properties of the particle, i.e., denotes the particle, while the particle wave ξ is a sum of single particle waves i.e. ,of particles, this is the "wave-particle reciprocity"*. The wave-particle reciprocity permits to understand the physical signification of the probabilistic aspect of quantum mechanics as recalled in Sec. 9 here below.

VII. The Elasto-Gravitational Interpretation of the "Strong Interaction"

In a $\Re(g_{Sc},A_4)$, the expression for the component A_4 of the electromagnetic potential tensor is

$$A_4=-q_0/(4\pi\varepsilon r). \tag{38}$$

But A_4 is not only created by q_0 but is also influenced by the Schwarzschild gravitational field. Indeed, η defined by $\eta\equiv 1/\varepsilon$ is the elastic restoring rotation coefficient of the elastic medium Œ. Now η is related to the phase velocity V_P of the wave ξ associated to the $Par(m,e)$ in these fields by the relations (26) and (16). Now, contrarily to the gravitational force, the electrostatic force to which is submitted this particle do not depend upon its proper mass m, furthermore, in absence of gravitation η has to be η_0. From these two reasons it follows that in (38), the expression for η is given by (32), with a=0, therefore,

$$A_4=-q_0\gamma^4/(4\pi\varepsilon_0 r). \tag{39}$$

Let us consider again that e is such that $eq_0>0$, and $m_0>>m$, i.e., that the $Par(m_0,q_0)$ remains immobile even in the presence of the $Par(m,e)$. If the general relativity were not be taken into account, then the Coulomb repulsion due to e and q_0 would be greater than the Newton attraction due to m and m_0, i.e., these two particle could not be bound. However, when the general relativity and the elastic properties of the ether are taken into account, the gravitational attraction of these two particles can surpass their electrical repulsion. Indeed, inserting the expression (17) for the velocity V into (5), one obtains

$$L_G(g_{Sc},A_4,m,e)=-\frac{(mc^2\gamma)^2}{E_T+qA_4}+qA_4. \tag{40}$$

This expression (40) shows that the sole coordinate upon which $L_G(g_{Sc},A_4,m,e)$ depends, is r, it follows that the force F to which the $Par(m,e)$ is submitted is radial. In **Ref. 9**, we demonstrated that: "The general relativistic gravitation and the elastic properties of the ether implies that there is a distance r_0 between the $Par(m,e)$ and the $Par(m_0,q_0)$ such that, for $r<r_0$ their attractive gravitational force is, even for $eq_0>0$, greater than their electric repulsion". This phenomena plays the role of the "strong interaction.". This demonstration is based on the fact that the $Par(m,e)$ is submitted to the radial force $F(r)\equiv\partial_r L_G(g_{Sc},A_4,m,e)$. As shown there the value r_0 of r at which $F(r_0)=0$ and $V(r_0)=0$, is the solution of the equation

$$\frac{4\pi\varepsilon_0 mm_0 k}{qq_0}=\left(1-\frac{\alpha}{r_0}\right)^{3/2}\left(1-\frac{3\alpha}{r_0}\right). \tag{41}$$

Since the left member of (41) is positive and smaller than 1, it follows that $r_0>3\alpha$, the exact value of r_0 is obtainable by numerical calculation methods. It appears that for $r\in[\alpha,r_0[$, $F(r)$ is attractive, this is the so called "strong interaction".

Therefore, an external particle that collides with the $Par(m,e)$ and causes $r>r_0$, causes its ejection acting as an emission. Reciprocally, when a charged particle approaches a $Par(m_0,q_0)$ at a distance r smaller than r_0, they remain bound. *These phenomena may be associated to fission and fusion processes*.

VIII. The Quantum Mechanics as a Particular Case of the Ether Elasticity Theory

The particle waves ξ associated to a $Par(m,e)$ are the solutions of the "ether elasticity wave equation" (25). One considers that the fields to which is submitted a $Par(m,e)$ are static. In this case, the waves ξ are of the form (10) where ϕ is defined by (21) or (14), with E_T constant and $\omega=E_T/\hbar$.

When a $Par(m,e)$ is submitted to a Schwarzschild field and to a Coulomb field created by the $Par(m_0,q_0)$, i.e., a particle of mass m_0 and electric charge q_0, immobile at the origin O, the expression for V_P is given by (16). In the "non-relativistic approximation", i.e., when α/r is neglected in front of 1, and $h\nu+eA_4$ in front of mc^2, but where $mc^2\alpha/r$ is not neglected, $V_P{}^2$ becomes, Cf. Eq. (11) of Ref. 10,

$$V_P{}^2\cong\frac{E_T{}^2}{2m(h\nu+\hat{a}/r)}, \tag{42}$$

where $\hat{a}$ is defined by $\hat{a}\equiv|eq_0|/(4\pi\varepsilon)+mm_0k$. Now, denoting by $\boldsymbol{\psi}_0$ the vector defined by

$$\boldsymbol{\psi}_0\equiv\boldsymbol{\xi}_0\exp\left(i\omega\int d\ell/V_P\right), \tag{43}$$

Eq. (10) can be written

$$\boldsymbol{\xi}=\boldsymbol{\psi}_0\exp(-i\omega t) \tag{44}$$

inserting (44) in (25), one obtains

$$\mathbf{curl}\left(V_P{}^2\mathbf{curl}\,\boldsymbol{\psi}_0\right)=\omega^2\boldsymbol{\psi}_0. \tag{45}$$

As shown in Ref. 10, Eq. (45) can be written

$$-\nabla^2\boldsymbol{\psi}_0+\boldsymbol{\Xi}=\left(\omega^2/V_P{}^2\right)\boldsymbol{\psi}_0, \tag{46}$$

where, $\boldsymbol{\Xi}$ is defined by

$$\boldsymbol{\Xi}\equiv\left[\mathbf{grad}\left(\log V_P{}^2\right)\right]\wedge\mathbf{curl}\,\boldsymbol{\psi}_0. \tag{47}$$

Considering (42), this Eq. (46) becomes in the non-relativistic approximation

$$-\nabla^2\boldsymbol{\psi}_0+\boldsymbol{\Xi}\cong\left(2m/\hbar^2\right)(h\nu+\hat{a}/r)\boldsymbol{\psi}_0, \tag{48}$$

but as shown, (ibid),

$$|\boldsymbol{\Xi}|\cong\left|\frac{\sqrt{2m}}{\hbar}\frac{\hat{a}}{r^3}(\mathbf{u}\cdot\mathbf{r})\boldsymbol{\psi}_0\right|<<\left|\frac{2m}{\hbar^2}\left(h\nu+\frac{\hat{a}}{r}\right)\boldsymbol{\psi}_0\right|, \tag{49}$$

and moreover, that in a circular bound state, **u** and **r** are orthogonal, i.e., $\mathbf{u}\cdot\mathbf{r}=0$, i.e., $\boldsymbol{\Xi}=0$. It follows that (48) can be written with a good approximation, considering that $\hat{a}/r\cong eA_4$

$$-\left(\hbar^2/2m\right)\nabla^2\psi_0\cong eA_4\psi_0+h\nu\psi_0 \tag{50}$$

Now, multiplying the tow members of (50) by $\exp(-i2\pi\nu t)$ and denoting

$$\psi\equiv\boldsymbol{\psi}_0\exp(-i2\pi\nu t), \tag{51}$$

Eq. (50) becomes

$$-\left(\hbar^2/2m\right)\nabla^2\psi\cong eA_4\psi+h\nu\psi \tag{52}$$

that can be written as following

$$-\left(\hbar^2/2m\right)\nabla^2\psi\cong eA_4\psi+i\hbar\partial_t\psi. \tag{53}$$

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Equation (53) is Schrodinger's equation. We have therefore demonstrated that this equation is a particular form of the ether elasticity equation (25), i.e., that: the ether elasticity theory generalizes the quantum mechanics. We have therefore demonstrated that this equation is a particular form of the ether elasticity equation (25), i.e., that: the ether elasticity theory generalizes the quantum mechanics.

Let us furthermore remark, that the univocal motion of the classical massive particle occurs when there is a full superposition of waves that forms the single-particle wave. But such a full superposition cannot exist in a bound state of atomic size, as for example the electron in a atom. Indeed, in such a bound state, the waves that constitute the globule interfere with themselves, and only the resonant ones remain non destructed by these interferences and are even amplified Cf. Sec. 7 of Ref. 11, and Sec. 4 of Ref. 10. These resonant waves are quantum states. Since following the "wave-particle reciprocity property", such a resonant wave is also constituted by a multitude of globules, i.e., of particles, the results of measurement are not univocal, i.e., follow probabilistic laws. This explains the probabilistic properties of the massive bound particle. These resonant waves can be directly determined even in presence of gravitation. When m=0, the particle is a photon and, as shown here above, it is a sum of EM waves that behaves as a hard small projectile. The fact that, reciprocally, an EM wave is constituted by photons is the cause of the projectile effect that accompanies EM waves as, e.g., in the photo-electric effect.

IX. The Electron Spin as Resulting from the Ether Elasticity

A moving $Par(m,e)$, i.e., $\hat{\xi}(m,e)$ creates a Lienard-Wiechert covariant potential tensor from which one deduces the electromagnetic field and in particular the magnetic field H. Now, in the ether elasticity theory, H *is the velocity* $\partial_t\xi$ *of the ether points,* Cf. Eq. (7b). The fundamental fact that we demonstrate, is that on a fixed observatory point $\mathbf{r}_{ob}$ near at a given instant to the moving electron, i.e., to the moving $\hat{\xi}(m,e)$, the velocity of the ether denoted there by $\partial_t\xi_{ob}$ is of the same form as the velocity of a point of a rotating solid. This phenomenon is the electron spin which, as we show, in a quantum state of an atom, can take only quantized values.

At the observatory point $\mathbf{R}_{ob}$, let consider the electromagnetic field created by a moving electric charge e of velocity V. This field derives from the Lienard-Wiechert covariant potential tensor A_μ for which the expression is

$$A_\mu = -\frac{e}{4\pi\varepsilon_0}\frac{V_\mu}{(Rc-\mathbf{R}\cdot\mathbf{V})}, \tag{54}$$

where V_μ is such that $V_4 = c$, and V_j denotes the covariant spatial components of V, and where $\mathbf{R}$ denotes the radius vector going from the center of the charge to the point of observation $\mathbf{R}_{ob}$ at the retarded time. If A denotes the vector of covariant spatial components A_j, then the expression for the magnetic field H created by e is

$$\mathbf{H} \equiv (\mathbf{curl\ A})/\rho . \tag{55}$$

On account of Eq. (54), (55), here above, and of Eqs. (63.8) and (63.9) of Ref. 12 expressed in MKSA units, the explicit expression for H at $\mathbf{R}_{ob}$, is

$$\mathbf{H} \equiv \partial_t\xi = \frac{e\mathbf{R}}{4\pi c\rho\varepsilon_0 R(R-\mathbf{R}\cdot\mathbf{V}/c)^3}\wedge \left\{\frac{(\mathbf{R}-\mathbf{V}R/c)}{\beta^2}+\frac{\mathbf{R}\wedge[(\mathbf{R}-\mathbf{V}R/c)\wedge\dot{\mathbf{V}}]}{c^2}\right\}, \tag{56}$$

where $\beta^2 \equiv 1/(1-V^2/c^2)$, and $\dot{\mathbf{V}} \equiv d\mathbf{V}/dt$ denotes the acceleration of e.

Let us consider now the case where $\mathbf{R}_{ob}$ is very close to e and then denoted then by $\mathbf{r}_{ob}$, i.e., where R, denoted then by **r**, is very small. In this case, in Eq. (56), $\mathbf{r}\wedge[(\mathbf{r}-\mathbf{V}r/c)\wedge\dot{\mathbf{V}}]/c^2$ is negligible in front of $(\mathbf{r}-\mathbf{V}r/c)/\beta^2$, and $\mathbf{r}\cdot\mathbf{V}/c$ in front of r. Therefore, at $\mathbf{r}_{ob}$, the expression for H denoted then $\mathbf{H}_{ob}$ is the following

$$\mathbf{H}_{ob} = \rho_e\mathbf{V}\wedge\mathbf{r}, \tag{57}$$

where ρ_e is the density of electrical charge defined by $e/(4\pi r^3)$. Yet, as shown in Eq. (3), $\mathbf{H}$ is the velocity $\partial_t\xi$ of a point of the ether. Therefore, at $\mathbf{r}_{ob}$, the expression for $\partial_t\xi$ denoted more specifically by $\partial_t\xi_{ob}$, is

$$\partial_t\xi_{ob} = \mathbf{H}_{ob}, \tag{58}$$

where $\mathbf{H}_{ob}$ id defined in (57). It appears therefore, that the velocity $\partial_t\xi_{ob}$ of a point of the ether at $\mathbf{r}_{ob}$, defined by (57) and (58), is of the same form as the velocity $\mathbf{V}_\Omega$ of a point on a rotating solid of rotation vector $\mathbf{\Omega}$ and of radius r, since $\mathbf{V}_\Omega$ is of the form

$$\mathbf{V}_\Omega = \mathbf{\Omega}\wedge\mathbf{r}. \tag{59}$$

One sees, by considering (57) and (59), that all happens as if

$$\mathbf{\Omega} = \rho_e \mathbf{V} . \quad (60)$$

Remark. $\rho_e \mathbf{V}$ has the dimension [1/T] like $[\Omega]$, in deed in Ref. 4, we have shown that in the ether elasticity theory, then $[\rho_e] = [1/L]$.

Now let us take $r = r_e$, where r_e is the radius of e, in this case $\mathbf{\Omega}$ is the spin of the electron, and will be denoted $\mathbf{\Omega}_e$. In a quantum state, e.g., of an hydrogenous atom, one has, Cf. Eqs. (10), (43) & (47) of Ref. 13,

$$V = \frac{eq}{4\pi\varepsilon_0} \frac{1}{n\hbar} , \quad (61)$$

here q is the positive electric charge of the immobile nucleus around which the electron gravitate. Therefore

$$\Omega_e = \pm \rho_e \frac{eq}{4\pi\varepsilon_0} \frac{1}{n\hbar} , \quad (62)$$

that shows the quantum states of the electron spin in an hydrogenous atom. It appears that the $\Pr(m,e)$, is a globule $\hat{\xi}(m,e)$, i.e., a deformation of the ether that moves with the velocity of the particle. If this particle is an electron, then, in its motion the globule associated to this electron creates, out of it, a field ξ_{ob} of the displacements of the points of the ether such that near to this globule, the velocities $\partial_t \xi_{ob}$ of the points of the ether are of the same form as the velocities of the points of a rotating solid. In a quantum state of an atom, this spin can take only quantized values. These results regarding the elastic interpretation of the electron spin and the results described in Refs. 4, 5, 7, and 13 ensue from the "Ether Elasticity Theory" that takes into account Einstein's "General Relativity", Ref. 14.

X. The Elastic Ether Theory as Implying that EM is the NA of the General Relativity

a) *The field created by an electric charge as of the same form as the NA of the field created by a* $\mathrm{Par}(m,0)$

Considering Eq. (2) here above, Eq. (9) of Ref. 16, and the notation $\delta g_{\mu\mu} = g_{\mu\mu} - g_{0,\mu\mu}$, where $g_{0,\mu\mu}$ is the free value of $g_{\mu\mu}$, one has

$$L_G(g,0,m,0) = -mc\dot{s} = -mc\sqrt{c^2 - V^2} - mc\frac{\left(\delta g_{\mu\mu}\dot{x}^{\mu}\dot{x}^{\mu} + 2g_{4j}\dot{x}^4\dot{x}^j + 2\Delta_{i\neq j}\right)}{2\sqrt{\left(c^2 - V^2\right)}} + \ldots . \quad (63)$$

Let $L_{GNA}(g,0,m,0)$ denote the NA of $L_G(g,0,m,0)$, one has, Cf. Eq. (13) of Ref. 16,

$$L_{GNA}(g,0,m,0) = -mc\sqrt{c^2 - V^2} + mG_{\mu}\dot{x}^{\mu}/c \quad (63a)$$

where G_μ is the tensor defined by

$$G_4 \equiv -c^2 \delta g_{44}/2 , \qquad G_j \equiv -c^2 g_{4j} . \quad (64)$$

On the other hand one has

$$L_G(0, A_\mu, m, e) = -mc\sqrt{c^2 - V^2} + eA_\mu \dot{x}^\mu/c , \quad (65)$$

Comparing (63a) and (65), one sees that: *the tensor eA_μ play the same role as the tensor mG_μ*; this is reinforced by the fact that, in the NA of the Schwarzschild field, $G_j = 0$, and the expression for G_4, denoted then $G_{4,S}$, is

$$G_{4,S} = m_0 k/r . \quad (66)$$

On sees that $G_{4,S}$ is of the same form are the Coulomb potential. Let us now compare the field created by a moving electric charge q_0 and the NA of the field created by a moving a particle of mass M. The "single-particle wave" $\hat{\xi}(\Delta\omega)$ defined in (35), represents a wave $\xi = \xi_0 \exp(i\phi)$ of which the amplitude of vibration is non zero only in the volume defined by $SINC(\pi\Delta\nu\phi')$ of length $2V_{mean}/(\sigma\Delta\nu)$, Cf. Ref. 4. This volume moves with the particle velocity V. But even though it is of small volume, the globule $\hat{\xi}(\Delta\nu)$ perturbs also all the ether. This ether perturbation outside of the globule is denoted $P\left[\hat{\xi}(\Delta\omega)\right]$, it is propagated in the ether (supposed free before the apparition of this perturbation), with the velocity c much greater than V supposed constant in order to not involve other parameters. That is to say that, after its emission, $P\left[\hat{\xi}(\Delta\omega)\right]$ is no more influenced by $\hat{\xi}(\Delta\omega)$. We now determine $P\left[\hat{\xi}(\Delta\omega)\right]$ at a fixed observation point $\mathbf{R}_{ob}$. To this purpose we will use the fact that the NA of $P\left[\hat{\xi}(\Delta\omega)_{V=0}\right]$, i.e., the NA of the ether perturbation due to the immobile M is $G_{4,S}$ defined in (66), and the fact that

"the fields created by a particle moving at the velocity $-\mathbf{V}$ seen at fixed point, is the same as the field created by an immobile particle seen by a mobile particle of moving at the velocity $\mathbf{V}$"

Therefore the NA of $P\left[\hat{\xi}(\Delta\omega)\right]$ is the tensor G_μ obtained by applying the Lorentz transform,

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involving $\mathbf{V}$ and $G_{4,S}$. By using this transform, we demonstrated in Sec. V of **Ref. 16**, that

$$G_\mu = Mk\,V_\mu/(Rc - \mathbf{R}\cdot\mathbf{V}). \qquad (67)$$

Here, V_j denote the covariant component "j" of $\mathbf{V}$, $V_4 = c$. Equation (67) shows that G_μ is a Lienard-Wiechert potential tensor, i.e., is the gravitational potential field seen at an observation point R_{ob} due to the particle of mass M that moves with the velocity $\mathbf{V}$, and R is the distance between the position of M at the time t' where the signal was emitted and reaches the point R_{ob} at the time t such that $(t-t')c = R$. Now, the EM field created by a moving electric charge q_0 of velocity $\mathbf{V}$ that reaches R_{ob} is the Lienard-Wiechert potentials A_μ defined by

$$A_\mu = -\frac{q_0}{4\pi\varepsilon_0}\frac{V_\mu}{(Rc - \mathbf{R}\cdot\mathbf{V})}. \qquad (68)$$

Therefore the explicit expression for $L_G(0, A_\mu, m, e)$ is obtained by inserting (68) in (65), and that of $L_{GNA}(g,0,m,0)$ by inserting (67) in (63a). One see again the similarity of there two Lagrange-Einstein functions. In particular , when $\mathbf{V}=0$, then in (68), only A_4 is not null for which the expression is given in (38), and in (67), only G_4 is not null which is then denoted $G_{4,S}$ for which the expression is given in (66). This is also valid when $V << c$. It appears that: *The EM field due to an electric charge is similar to the NA of the gravitational field due to a massive particle.*

b) Behavior of the ether globule associated to the immobile massive particle

Let us consider Eq. (36) associated to a $Par(M,0)$, when V_F tends toward 0, then, Cf. Sec. 6 here above, V_{PF} tends toward ∞, E_T tends toward Mc^2, and $\hat{\xi}(\Delta\omega)_F$ tends toward $\hat{\xi}(\Delta\omega)_{V=0}$ defined by

$$\hat{\xi}(\Delta\omega)_{v=0} = \xi_0 \exp\left(-i\frac{2\pi}{h}Mc^2 t\right)\bullet$$
$$SINC\left[\frac{\Delta\omega}{2}\left(-t+\frac{x}{0}\right)\right] \qquad (69)$$

Since $SINC(\pm\infty)=0$, it follows that $\hat{\xi}(\Delta\omega)_F$ disappears when V_F tends toward 0. The question is then: what becomes this immobile globule that disappears? The response is: *it becomes a Schwarzschild gravitational field.*

c) The EM forces and the gravitational forces as interactions of ether deformations

In a flat spatial region, the electrostatic field $\mathbf{E}_{q_0}$ due to q_0 at O is related to the displacements ξ_{q_0} of the points of the ether defined by the relation

$$\mathbf{curl}\xi_{q_0} = \varepsilon_0 \mathbf{E}_{q_0}, \qquad (70)$$

Cf. Eq. (7a). From this relation, Cf. **Ref. 16**, one obtains the expression for the angle Φ_{q_0} described by a point of the ether on a small circle around the radius vector r:

$$\mathbf{E}_{q_0} = 2\mathbf{\Phi}_{q_0}/\varepsilon_0 = q_0\mathbf{r}/(4\pi r^3), \qquad (71)$$

Let $\mathbf{F}_{q_0,q}$ be the interactive force between q_0 and another electric charge e that can be mobile. As demonstrated, in **Ref. 5**, the expression for the potential $U_{q_0,q}$ such that $\mathbf{F}_{q_0,q} = -\nabla U_{q_0,e}$, is, Cf. Eq. (26), (ibid) and (71) here,

$$U_{q_0,q} = q_0 q/(4\pi\varepsilon_0 r) = \varepsilon_0 \iiint_{B(\mathbf{O},r)} \mathbf{E}_{q_0}\cdot\mathbf{E}_q dv$$
$$\equiv \frac{4}{\varepsilon_0}\iiint_{B(\mathbf{O},r)} \mathbf{\Phi}_{q_0}\cdot\mathbf{\Phi}_q dv \qquad (72)$$

where $B(\mathbf{O},r)$ denotes the sphere of radius r centered at O.

We show now that the NA of the field $E_{m_0,NA,S}$ due to an immobile neutral massive particle of mass m_0 is

$$E_{m_0,NA,S} = -m_0 k\,\mathbf{r}/r^3. \qquad (73)$$

Indeed, in the NA, the force $\mathbf{F}_{m_0,m,NA}$ acting between m_0 and another particle of mass m is

$$\mathbf{F}_{m_0,m,NA} = -mm_0 k\,\mathbf{r}/r^3 = m\mathbf{E}_{m_0,NA,S}. \qquad (74)$$

This force derives from the potential of force $U_{m_0,m}$, defined by

$$U_{m_0,m} = -m_0 mk/r. \qquad (75)$$

By the same calculation as in Sec. 4.2 of Ref. 5, and comparing the result with (75), one has

$$U_{m_0,m} = -\frac{1}{k}\iiint_{B(\mathbf{O},r)} \mathbf{E}_{m_0}\cdot\mathbf{E}_m dv. \qquad (76)$$

Now

$$\text{curl}\,\xi_{m_0} = m_0\,\mathbf{r}/r^3 = 2\mathbf{\Phi}_{m_0}, \qquad (77)$$

therefore

$$E_{m_0,NA,S} = -2k\mathbf{\Phi}_{m_0}, \qquad (78)$$

It follows, by comparison with (72), that

$$U_{m_0,m} = -m_0 m k \frac{1}{r} = -4k \iiint_{B(O,r)} \mathbf{\Phi}_{m_0} \cdot \mathbf{\Phi}_m dv \quad (79)$$

This shows that: *the electrostatic field* $\mathbf{E}_{q_0}$ *and the gravitostatic field* $\mathbf{E}_{m_0,NA,S}$ *are densities of couple of forces applied to the ether, and the inductions* $\varepsilon_0 \mathbf{E}_{q_0}$ *and* $-\mathbf{E}_{m_0,NA,S}/k$ *are twice the angle of rotation of the ether around the radius vector* **r** *issued from the electric charge* q_0*, Resp. from the massive particle* m_0*, at O.*

XI. Conclusion

This Navier-Stokes-Durand equation of the ether elasticity unifies the following particular cases:

- The Maxwell equations of electromagnetism.
- The constitution of particles and fields as changes in ether.
- The nuclear strong interaction,
- The quantum mechanics,
- The electron spin, and,
- Electrodynamics as the NA of the general relativity.

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