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The Electrodynamics of Moving Material Fields and the Two Speeds Implied by the Expanding Earth

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Abstract

This work identifies the branch point, which was never explicit in EM treatises, from which came the choice of abandoning the Galilean transformations in favor of the Lorentz covariance, a path that originated the various relativistic theories. The need arising from the *expanding Earth* for a hydrodynamic mechanism for Newtonian and Coulomb fields is discussed. This hydrodynamic material mechanism is shown to constitute a completion of the Newton and Maxwell concepts of the fields, which were only a phenomenological description of physical reality. It is shown that the analogy between Maxwell's equations and hydrodynamics cannot become a perfect correspondence. The lack of coupling of the electromagnetic field to the underlying material "causing field"—which induces hydrodynamical forces and accelerations observed only phenomenologically—gives rise to inaccuracies in the formulation of its equations, which are incorrect for Galilean covariance. But the most serious flaw in the original formulation of electromagnetism is the erroneous identification of the flow velocity of the field (variable as $1/r^2$) with the speed of light c, with which it was demonstrated that the fields of charges in motion contract in the direction of motion (the Heaviside ellipsoid, 1888, 1889). From this error, historically due to the incomplete development of many hydrodynamics sectors (a situation that persists today), came Fitz Gerald's contractions and finally, the relativistic theories. Some future research lines are proposed for a return to realistic physics and a possible but still weak form of Galilean covariance.

Keywords

Expanding Earth, Aether Central Flow, Hydrodynamic Gravity, Material Fields, Electrodynamics, Galilean Covariance

1. Short Historical Introduction

In the history of the last four centuries of physics [1]-[3], there have been numerous attempts to explain gravitational attraction through physical processes: among the first, Nicolas Fatio de Duillier (1690) and George Le Sage (1750) proposed a ballistic mechanism [4], which was also judged reasonable by Newton and still today has many admirers [5]. Huygens and Euler, on the other hand, both had similar ideas on a gravity produced by "floating" towards regions of aether with lower pressure, the difficulties of which consisted in justifying an upward trend of the pressure and explaining the "magnetic" analogue part of the gravitational field. This idea has been developed up to the present day [6] [7].

However, the concept of Johann Bernoulli deserves more attention:

The gravitation of the planets toward the center of the sun, and the weight of bodies toward the center of the Earth, are not caused either by the attraction of Newton, or by the rotary force of the vortex medium of Descartes, but by the immediate impulsion of a substance which under the form of what I call a "central torrent", is continually thrown from the whole circumference of the vortex to its center, and consequently impresses on all bodies encountered by it in its path the same tendency toward the center of the vortex […]. And all that Newton has derived from his "attractions" are by my theory, derived from the impulsions of the central torrent (Bernoulli, 1735 [8]: quoted in [1]).

This conception, embryonic and at the time without a developed mathematical theory, can be defined as hydrodynamic. Although Bernoulli's idea of a *central stream* had a certain following (Laplace seems to have adopted it), in Peck's 1903 historical work [9] on corpuscular theories of gravity, it was misinterpreted as belonging to the class of ballistic theories of de Duillier and Le Sage, contributing to its oblivion.

The need for an energy-mass flow directed towards the interior of the planets was intertwined since the end of the 19th century with the concept of increase in size and mass of celestial bodies developed in the most basic aspects in [10]-[15] and others. It was completely replaced in the interest of geophysicists and cosmologists by the discussion of a possible terrestrial expansion caused by the decrease of the universal gravitational constant G [16]-[18], which would have given rise to a very modest size's growth and not in conflict with the *big bang* cosmology established after the discovery of the cosmic background radiation at a temperature of 2.7˚K. Equally non-conflicting with the *big bang*, the global geodynamic concept of *plate tectonics* quickly spread (which with grave blunder was adopted with revolutionary enthusiasm by the adherents of the socio-political movement of 1968) in which the constancy of the Earth's size was postulated.

Only recently, experiments aimed at quantifying the radiogenic heat of the Earth's deep interior [19] [20] have revealed the insufficiency of radiogenic heat in closing the balance of the total Earth's heat flow. As discussed in [21] [22], from the results, not only is the convective motion model of the mantle (an engine preferred by *plate tectonics*) not confirmed, but the sum of the contributions of primordial heat

and radiogenic heat remains well below 45 - 47 TW of total Earth's heat measured in wells, mines and tunnels. To close the balance, an additional source of heat or energy must be identified (already hypothesized in [23]).

Once discarded as insufficient (but also as improbable due to the unsolved problem of eliminating radioactive waste), the source hypothesized by some as coming from self-feeding nuclear reactors nestled in the vicinity of the geocenter or in the D" region at the core-mantle boundary, all that remains is to hypothesize an energy transported towards the Earth's interior by the gravity field, through an inflow of impalpable constituent matter, aether, which it would transform into ordinary matter in the deep interior of the Earth through still unknown exothermic processes [22].

2. Hydrodynamics, Fields, and the Paradoxical Special Relativity of Fluid Dynamics

Although the *central stream* concept is founded on material physical flows, the idea that prevailed with Newton and his successors did not model the actual hydrodynamic field—because this was not perceptible to the senses and incompatible with the traditional myth of the origins of the world—but quantities kept unrelated to the latter. What we call the gravity field, whose strength decreases as $1/r^2$, was defined as the force or acceleration experienced by a unit test mass m at one point, but that force does not exist at another point if we do not place a mass-test there. The field is therefore a point-by-point mapping of the phenomena, *i.e.* of what the unitary mass would experience if placed in each of the infinite points of the space surrounding the massive central body with $M \ggg m$. It is not visible—contemporary physicists are not interested in it—what really exists in all the infinite points where we could place m, and which exerts physical action on it. The Newtonian gravitational field is therefore an incomplete phenomenological description of physical reality (similar fate for the electromagnetic field).

However, its formulator Isaac Newton fully realized this and was aware of attempts to find the deeper cause of gravitation. Newton was a friend of Fatio de Duillier, and proposed similar ideas that he did not develop—the time was not yet ripe. The conjectures on the aether of de Duillier, Newton, Bernoulli, Le Sage, in all cases collided with the inability to admit that the Earth received matter from the outside and could absorb it and therefore increase in mass and volume, because this extravagant idea conflicted with religious dogmas (from an era still close to the stake of Bruno and the convictions of Galilei and others).

The concepts of gravitational and electromagnetic fields then developed in many aspects independently and only for the latter—in advantage for the possibility of carrying out laboratory experiments with less difficulty—did we arrive at an understanding of the dynamic links existing between the electric and magnetic fields (Maxwell, Treatise [24]; and then many others, among which Heaviside, stands out). For the gravitational field, the difficult testability of a counterpart analogous to the magnetic field did not allow the drafting of equations similar to those of

Maxwell before the end of the 19th century. The gravimagnetic equation were published Heaviside in 1893 [25] (Table 1, right).

Table 1. The equations of electromagnetism (EM) and gravimagnetism (GM).

Maxwell equations (EM)	Gravimagnetism equations (GM)
$\nabla \cdot \boldsymbol{E} = \frac{\rho}{\epsilon_0}$	$\nabla \cdot \boldsymbol{\aleph} = -4\pi G \rho_g$
$\nabla \cdot \boldsymbol{B} = 0$	$\nabla \cdot \boldsymbol{\wp} = 0$
$\nabla \times \boldsymbol{E} = -\frac{\partial \boldsymbol{B}}{\partial t}$	$\nabla \times \boldsymbol{\aleph} = -\frac{\partial \boldsymbol{\wp}}{\partial t}$
$\nabla \times \boldsymbol{B} = -\frac{1}{\epsilon_0 c^2}\boldsymbol{J} + \frac{1}{c^2}\frac{\partial \boldsymbol{E}}{\partial t}$	$\nabla \times \boldsymbol{\wp} = -\frac{4\pi G}{c^2}\boldsymbol{J} + \frac{1}{c^2}\frac{\partial \boldsymbol{\aleph}}{\partial t}$

In classical hydrodynamics two entities are dealt with: sinks and sources, which are however described in the textbooks quickly and almost with dismay due to their being singularities within which matter arises or disappears [22]. Today an analogy can be made between EM, GM and hydrodynamics, reflecting that the electric and gravitational fields that decrease as $1/r^2$ moving away from point charges and masses, can be put in correspondence with the material field of a fluid that flows from sources or flows into sinks, whose flow speed has a trend $1/r^2$ for perfect incompressible fluids. It is so possible to write equations analogous to those EM and GM for the material fields of hydrodynamics (Table 2).

Table 2. The equations of hydromagnetism (HM).

Hydromagnetic equations (HM)
$\nabla \cdot \boldsymbol{\upsilon} = \rho_Q$
$\nabla \cdot \boldsymbol{w} = 0$
$\nabla \times \boldsymbol{\upsilon} = -\frac{\partial \boldsymbol{w}}{\partial t}$
$\nabla \times \boldsymbol{w} = const_1 \boldsymbol{J} + const_2 \frac{\partial \boldsymbol{\upsilon}}{\partial t}$

The vector field $\boldsymbol{\upsilon}$ in Table 2 is that of the flow velocity to or from sinks and sources. The symbol $\boldsymbol{w}$ in Table 2 is a further vector field analogous to the magnetic field associated with actual existing point-by-point properties in space [26]-[30]. The $\boldsymbol{w}$ field—dimensionally it is an angle—is not intuitive or perceptible in our daily experience, because hydrodynamic "magnets" that deploy this field have not yet been built. We should however expect that $\boldsymbol{w}$ is perpendicular to the field $\boldsymbol{\upsilon}$, that an ideal wire along which travels a current $\boldsymbol{J}$ of sinks or sources produces a field $\boldsymbol{w}$ enveloping the wire, and that a long series of turns of this ideal wire produces a dipole of $\boldsymbol{w}$, analogous to the magnetic dipole generated by the coils of a conducting cable carrying an electric current or to that generated by a magnetized

bar.

This is a classical physics that is no longer perfectly Newtonian because in addition to normal rational mechanics, hydromagnetic effects which are absent today in the manuals of hydrodynamics should be considered. We remember the:

$$\nabla \times \boldsymbol{\upsilon}(x,t) = curl\boldsymbol{\upsilon}(x,t) = -\frac{\partial \boldsymbol{w}}{\partial t}, \tag{1}$$

the "Maxwell-type" equation which confirms that w is an angle of rotation, given that in rational mechanics the rotor of a speed is an angular speed (actually a vorticity, which is twice the angular speed).

Equation (1), never exposed in textbooks, tells us that if a sink moves with respect to a second sink, it feels not only the effect of the flow converging into the other sink but also the effect of the variation of its position and therefore of the angle with which the fluid invests it. In turn, the time-changing angular field $\boldsymbol{w}$, the vorticity, creates the field $\boldsymbol{\upsilon}$ and its effects, just as the change in $\boldsymbol{\upsilon}$ over time creates $\boldsymbol{w}$:

$$curl\boldsymbol{w}(x,t) = const_1 \boldsymbol{J}(x,t) + const_2 \frac{\partial \boldsymbol{\upsilon}}{\partial t}. \tag{2}$$

A good experimentation of the field $\boldsymbol{w}$ could be carried out without the disturbance of the Earth's gravitation—which causes the pressure to increase with depth—probably only in future space experiments in satellite orbits, for example in very large balloons filled with water at a much higher pressure than that induced by their self-gravity. We could make the intriguing hydrodynamic magnets there, but even a large naval tank perhaps would suffice.

All this take place within the sphere of classical rational mechanics, in which no one has ever hypothesized the effects of space-time contractions or dilations analogous to the relativistic ones. But the fathers of electrodynamics and their successors (from Maxwell's time to today) were not aware of these phenomena of hydrodynamics. Even today, sinks and sources currents $\boldsymbol{J}(x,t)$ are absolutely not covered in hydrodynamics textbooks. In electromagnetism the magnetic field was (and still is) considered a strange and singular property of nature, far from the normal physical events associated with the material world. Indeed, hydrodynamics stopped (and stops) in front of the entities of sinks and sources. Maxwell only went so far as to criticize Helmholtz's erroneous analogies, and to understand that the magnetic field was related to rotation phenomena [31]. But the concepts of sinks and sources and their associated phenomena remained alien to him.

The effect of this lack of development in hydrodynamics was the construction of an electrodynamics freed from a causing field (the flow of aether), which would have immediately recognized the hydrodynamic cause of the magnetic field, and avoided the mistake of not recognizing the distinction between the speed of propagation of the field (speed of the flow of aether) and the speed of light (analogous to the speed of sound) (see next Sections 3 and 4). The result was the creation of a theory based on absurd assumptions, which being erroneous could not satisfy Galilei's transformations, and is synthesized with the equations in **Table 1** (left).

But once written in analogy with those in Table 1, the corresponding equations in Table 2, a form of special relativity should be contained in the HM hydromagnetic equations as it is known to be in Maxwell's EM equations. The incompleteness of equation in Table 1 and Table 2 must be logically deduced from the fact that hydrodynamic phenomena, despite being within the scope of classical physics and covariant according to Galilean transformations, would satisfy equations analogous to those of Maxwell which are covariant according to Lorentz transformations. The paradox would be created by having to admit a theory of classical phenomena that take place in low-speed regimes, but which would require a limit speed that cannot be exceeded, with a maximum value equal to that of the speed of sound in the liquid. This paradox can be resolved by admitting that the true complete sets of equations of EM, GM and HM must be different from those written in Table 1 and Table 2, but should be analogous to the Navier-Stokes equations.

3. Conflicts with Non-Material Fields

However, the possibility of describing gravitation with flows of matter, is in conflict with the description that general relativity makes of it, where the gravitational effects would be due to deformations of space and time, in a mathematical-geometric tensor treatment. So, we would be interested in how to exclude general relativity, replacing it with a physics based on material entities. For a physicist, believing that space and time can be warped is equivalent to believing in something resembling magic.

The great diffusion that the West has wanted to give to relativistic theories [32]-[34] hides precise political and cultural interests. One of this is certainly the imposition in universities and research institutions from all over the world of a fundamental idealism that is difficult to eradicate and of an advantageous cultural hegemony of Western nationalities [35] considering the indissoluble link between relativistic theories and *big bang* theory, an evolutionary idea of the universe that has maintained the ancient continuity, traditional in Europe, between religion and cosmological theories [36].

For a desirable change, first aid comes from the demonstration published by Arbab [37] on the equivalence of GM gravimagnetism with general relativity. By applying the GM equations, it is possible to calculate the secular advances of the perihelia of planets and binary pulsar stars, obtaining values in agreement with those deduced from general relativity and with those observed [37]. General relativity can thus be set aside and replaced by a Maxwellian treatment of the gravity field, which in turn will be completed and treated as a material field of velocity of a perfect fluid [22] [38] [39].

But still, something calls for a further step, the foundations of relativistic theories being uncertain. We have to deal with the problem of the origin of non-covariance of Maxwell equations under Galilean transformations [40]. This non-Galilean covariance constitutes further sign of incompleteness of the equations of

electromagnetism, which would imply their malfunctioning which would manifest itself as unpleasant relativistic space-time distortions. Due to a series of historical-cultural contingencies, at the beginning of the 1900s, it was not understood that the crux of the problem was the continuing neglect of the aether: so, the Galilean transformations were abandoned and those of Lorentz were adopted [35] [39], based on an erroneous concept of Coulomb fields working without the link to actions of a material medium.

We should at least try to understand the formal origins of this incompleteness. A work program should start by recognizing that if it is true that the electric field for moving charges changes, the symmetric crushing of the field in the direction of the velocity vector obtained by Heaviside should no longer hold, as the aether would break this symmetry. The configuration of the field we expect would become analogous to that of the velocity field around a hydrodynamic sink moving in a stationary fluid. The same thing can be seen considering that in classical electromagnetism, passing from an inertial reference system (x,t) to another (x',t'), the phenomenological field of acceleration is transformed as:

$$\boldsymbol{E}'(x',t') = \boldsymbol{E}(x,t) + \boldsymbol{\upsilon}_0 \times \boldsymbol{B}(x,t), \tag{3}$$

that if we go down to the fundamental level of the fluid dynamics cause of those accelerations, it should be written for the "causing field", as in for the velocity field $\boldsymbol{\upsilon}(x,t)$ of the fluid absorbed or emitted by singularities of hydrodynamic sinks or sources, as:

$$\boldsymbol{\upsilon}'(x',t') = \boldsymbol{\upsilon}(x,t) + \boldsymbol{\upsilon}_0 \times \boldsymbol{w}(x,t). \tag{4}$$

It is immediately recognized that (4) is wrong, revealing the wrongness of (3). In fact, Equation (4) does not respect the Galilean transformation of the velocities $\boldsymbol{\upsilon}' = \boldsymbol{\upsilon} - \boldsymbol{\upsilon}_0$, according to which Equation (4) should be written:

$$\boldsymbol{\upsilon}'(x',t') = \boldsymbol{\upsilon}(x,t) - \boldsymbol{\upsilon}_0 + \boldsymbol{\upsilon}_0 \times \boldsymbol{w}(x,t). \tag{5}$$

Equations (3) and (4) can only be written as good approximations only in the case $\boldsymbol{\upsilon}(x,t) \ggg \boldsymbol{\upsilon}_0(x,t)$ which is a condition satisfied according to the results of the experiment by de Sangro *et al.* [41], and according to the considerations related to the *expanding Earth* and its links with gravitation [22]. The approximate forms (3) and (4) decay to incorrect forms in regions far from the center of the sinks and sources, where there always exists a distance at which $\boldsymbol{\upsilon}(x,t) = \boldsymbol{\upsilon}_0(x,t)$. In summary, by writing (3), classical electromagnetism imposes an incorrect, non-Galilean transformation on the electric field $\boldsymbol{E}(x,t)$, which is the cause (the only cause?) of the impossibility for Maxwell's equations to be covariant for Galilean transformations. This is an unpleasant vicious circle from which it will be necessary to get out by providing the right EM equations in the future.

4. Two Velocities, Speeds without Limit Values and a *Reductio ad Absurdum*

But another fundamental cause that contributed to the rejection of Galilean

covariance can be identified in the serious error of considering the value of the speed of propagation of light c (constant in the local reference) and the speed of propagation of the field (instead variable according to $1/r^2$) to be identical. Using this erroneous assumption—caused by the complete lack of treatment of the hydrodynamic phenomena characterizing moving sinks and sources—Heaviside's (1888, 1889) inferences led the scientists to believe in contractions of the field of moving charges, paving the way for relativistic theories.

The cardinal postulates of relativistic theories are the constancy, isotropy and insurmountability of the speed c of light. In addition to many other pieces of evidence that contradict this postulate (for example, the experiment of de Sangro *et al.* [41]), the one coming from the unification between gravity and the *expanding Earth* is the most significant [22]. The *central stream* not only increases the mass of celestial bodies but generates gravitation. Bearing in mind the results of the geoneutrino detection experiments concerning the internal energy balance of the Earth [19] [20], with the help of astrophysics (Hubble's law, classical gravitation around large masses, etc.) it is possible to calculate the density, range and speed of the flowing aether towards the center of the planets (details in [22]). For the fluid, the laws of hydrodynamics apply, for which a hydrodynamic friction force $f = \rho Q \upsilon$ (called the dissipative term) is exerted by the aether with density ρ on any sink or source with flow rate Q crossing it with speed υ—or *vice versa* exerted on stationary sinks and sources solicited by a flow of aether with speed υ [42]. It is from this force mutually exerted between pairs of wells or sources with flow rates Q_1 and Q_2 distant R, that we get a law of attractive force analogous to that of Newtonian gravity:

$$f = \frac{\rho}{4\pi} \cdot \frac{Q_1 Q_2}{R^2}.$$

With a little algebra [22], it is found that the density of the aether at the present epoch can be written $\rho = \frac{1}{4\pi}\frac{H_0^2}{G}$ whose tenuous value is $\rho = 0.647 \times 10^{-26}$ kg/m^3 (the accuracy depends on that of H_0, the Hubble constant and on the G one). To pass from the phenomenological world of masses to the real world of flow rates, it is found that the relation:

$$\frac{q}{m} = \ell \tag{6}$$

is valid [22], with the universal constant $\ell = 3.6 \times 10^8$ m^3/(kg·s).

The found density allows us to calculate the velocity field of the gravigenic aether (a field that exists at every point) which at zero altitude—the Earth's surface—has a superluminal value equal to $\upsilon = 0.42 \times 10^{19}$ m/s, ten orders of magnitude larger than c. This value has already been confirmed for the electric field in the experiment performed at the INFN of Frascati [41]. The authors have interpreted the results as a rigid behavior of the Coulomb field, but a velocity much higher than c would be a legitimate interpretation. Instead, in the texts on which we studied electrodynamics at the university, it was assumed, rather than demonstrated

(following Heaviside, 1888, 1889 [43] [44]), that the speed of propagation of the field was strictly equal to c, and the concept was always illustrated with figures.

The mistake of identifying field speed and light speed goes back at least to the end of 19th century. When discussing the electrodynamics of charged bodies in motion, Heaviside (1888, 1889) [43] [44] thinks that once the speed of light is reached, a charge reduces its field to a "plate" or a plane wave [45]. With this erroneous identification, he arrives at the demonstration that the field of a moving charge flattens as the speed increases, assuming the shape (its equipotential surfaces) of an ellipsoid. This belief was widespread among members of the scientific community of the time, and we find traces of it in Heaviside's 1888 work [43], which quotes a letter from Lord Kelvin (William Thomson):

I don't agree that velocity of propagation of electric potential is a merely metaphysical question. Consider an electrified globe, A, moved to and from, with simple harmonic motion, if you please, to fix the ideas. Consider very quickly-acting electroscopes B, B', at different distances from A. If the indications of B, B' were exactly in the same phase, however their places are changed, the velocity of propagation of electric potential would be infinite; but if they showed differences of phase, they would demonstrate a velocity of propagation of electric potential. Neither is velocity of propagation of "vector-potential" metaphysical. It is simply the velocity of propagation of electromagnetic force the velocity of electromagnetic waves', in fact (William Thomson: quoted in [43]).

So, Heaviside repeats this pure assumption several times during his papers of 1888 [43] and 1889 [44] in which the equation of the ellipsoid is obtained:

I am myself accustomed to mentally picture the electric and magnetic forces or fluxes, and their propagation, which takes place at the speed of light or thereabouts, because they give the most direct representation of the state of the medium, which, I think, must be agreed is the real physical subject of propagation (Heaviside, 1888 [43]).

And later (with u = speed of the charge; c = speed of light; p = permittance; q = charge; ν = direction-cosine; E and H = electric and magnetic fields respectively) when he arrives to the ellipsoid equation:

[...]

$$pE = \frac{q}{r^2} \cdot \frac{1-u^2/c^2}{\left(1-u^2\nu^2/c^2\right)^{3/2}}, \quad [....] \tag{29}$$

[...] *As the speed increases, the electromagnetic field concentrates itself more and more about the equatorial plane,* $\theta = (1/2)\pi$. *To give an idea of the accumulation, let* $u^2/c^2 = 0.99$. *Then,* pE *is 0.01 of the normal value* q/r^2 *at the pole, and 10 times the normal value at the equator. The latitude where the value is normal is given by:*

$$\nu = (c/u)\left[1-\left(1-u^2/c^2\right)^{2/3}\right]^{1/2} \tag{30}$$

When $u = c$ *, the solution (29) becomes a plane electromagnetic wave,* E *and* H *being zero everywhere except in the equatorial plane* (Heaviside, 1889 [44]).

As can be seen above, the speed of light c enters into the calculations performed by Heaviside to obtain the 3D structure of the electric field as the velocity u of the charge varies. In fact, the velocity c is also present in the final equation of the famous ellipsoid contracting as u increases. This is very incorrect judging by what we know today. It would be analogous to use the speed of sound c_s as a fundamental parameter to calculate the variation of the geometric structure of the velocity field of a hydrodynamic sink as its velocity u varies. The abovementioned incorrectness is not the only one in Heaviside's work [43], which is a pile of rather foggy concepts not based on experience. But we must not judge the author as a naive, but only as an extraordinary mind who laboriously tries to shed light using the scarce cultural means and experimental evidence available at his time for electromagnetism.

In other words, from the incorrect premise that $\upsilon_{field} = c$, a result emerges showing a singularity in $\upsilon = c$. The singularity was believed in good faith to be part of physical reality. A comparison with the properties and interactions of hydrodynamic sinks and sources would have been enough to notice the error. But considering the state of incomplete development in which entire sectors of hydrodynamics find themselves, no one could become aware of how disconnected from reality Maxwellian EM theory was.

Instead, it can be demonstrated with a *reductio ad absurdum* that, for example, the spherical surface of discontinuity of the velocity field of a fluid emitted by a stationary source singularity which is instantaneously moved to a position different from the initial one cannot propagate with a constant velocity $\upsilon = const$ because large discontinuities or overlaps would form in the fluid (depending on whether υ is greater or less than the velocity of the fluid at a given distance). It can only propagate with the velocity $\upsilon(x, y, z)$ that the fluid has at the point (x, y, z). The field's transient can so propagate in case at superluminal speeds around the sinks and sources, while its speed decreases as $1/r^2$ and assumes a zero value at infinity.

In the vicinity of sinks of adequate flow rate, we could imagine sending signals and communicating with other observers at speeds greater than c by exploiting the possible superluminal propagation of the flux. This could have a connexion with the apparent phenomena of the non-locality (also known as entanglement [46] [47]).

5. Disappearance of the Disappearance Paradox

In educational textbooks on electromagnetism, the main argument for highlighting the inadequacy of Galilei's transformations comes (coincidentally) from the electrodynamics of moving bodies (Eintein's article on the subject that introduced relativity is famous). Let's compare how it is exposed for the immaterial electric and magnetic fields and for the hydrodynamic material fields.

5.1. Modern "Didactic" Treatment

The treatment is different (row of positive charges, cable with neutral bifilar arrangement of the charges with motion of only one of the two rows, two charges in relative motion) in different textbooks, and here I report the simplest version. An observer O is attached to a neutral wire carrying a current $\boldsymbol{J}$. At a distance r from the wire, a charge q travels with speed $\boldsymbol{\upsilon}$ parallel to the wire. The observer O does not see the electric field of the wire but sees the magnetic field $\boldsymbol{B}$ generated by $\boldsymbol{J}$. This field acts on the moving charge with the force:

$$\boldsymbol{F} = q\boldsymbol{\upsilon} \times \boldsymbol{B},$$

directed towards the wire.

Instead, an observer O' connected with the moving charge q sees the velocity of the charge $\boldsymbol{\upsilon}' = 0$, but always sees the magnetic field $\boldsymbol{B}'$ produced by $\boldsymbol{J}'$. This field does not produce force on q since $\boldsymbol{\upsilon}' = 0$, and we have:

$$\boldsymbol{F}' = 0.$$

The force disappeared as if by magic! The two observers would see completely different forces and their effects, thus demonstrating the inadequacy of Galilean transformations. But, reasoning with the material fields, the unsustainability of this argument against the classical covariance appears clear.

5.2. Material Fields Treatment

The observer O attached to the neutral cable carrying current $\boldsymbol{J}$ sees the magnetic field $\boldsymbol{B}$ acting on the charge q distant r from the cable and moving with speed $\boldsymbol{\upsilon}$. The force is again:

$$\boldsymbol{F} = q\boldsymbol{\upsilon} \times \boldsymbol{B},$$

directed towards the wire.

The observer O' attached to the charge q will see that q continues to have the same speed $\boldsymbol{\upsilon}$ it had for O with respect to the row of charges moving in the neutral wire. It is the Galilean relative motion between q and the charges of the current $\boldsymbol{J}'$ that generates the "magnetic field" effect, this relative motion does not change passing from O to O', nor does the force generated by it on q change:

$$\boldsymbol{F}' = \boldsymbol{F} = q\boldsymbol{\upsilon} \times \boldsymbol{B}.$$

In hydrodynamic velocity fields, for example in those dependent on $1/r^2$, the $\boldsymbol{w}$ field is a physical field due to the change in direction of the fluid velocity vector of a first sink with respect to a second sink that crosses the field of the first. It is a vorticity which cannot change or possibly disappear if the state of motion of the observer changes. At the beginning of the 1900s there was no precise concept of what an $\boldsymbol{E}$ or $\boldsymbol{B}$ field could be, treated only phenomenologically. Due to a lack of development in hydrodynamics, the best minds of the time were mistaken about the electrodynamics of moving bodies, with the fallacious reasoning mentioned above, and the distorted results that have been handed down to us.

6. Clues for Michelson and Morley's Null Result

The Michelson-Morley experiment has been ever considered an enigma for physics and the history of science [48] [49]. It was certainly the experiment most discussed by the scientific community (not only that of Physics), and the one that most influenced contemporary scientific and philosophical thought, standing as a bulwark against all those intending to return to the concept of aether. But the nineteenth-century concept of aether was in favor of a static and rigid aether, and it is only against this kind of aether that the experiment could claim not to observe the expected aether wind. Indeed, a further important blunder was to elevate the phenomena of polarization of light as indisputable proof of the transverse nature of electromagnetic waves (a general review in [50]), which had the consequence of further distancing the idea that hydrodynamics could be involved, because shear waves propagate only in rigid materials, while fluids only transmit longitudinal vibrations. At the present stage of my research, I do not know if anyone has ever come across the idea that longitudinal sound vibrations also have a transverse component (the "hydromagnetic" one) that could be involved in polarization phenomena.

The most proper aether for the description of Newtonian and Coulomb fields is not static and rigid but fluid and flowing like Bernoulli's *central stream*, for which the MM experiment was not designed. The wrongly based inference of the squashing of the field of a uniformly moving charge in the direction of motion was credited to change the equipotential surfaces from spherical to ellipsoidal, and as a consequence, interatomic and intermolecular forces would shorten objects in the direction of motion. This has been advocated to explain the absence of the effects sought by Michelson & Morley with their interferometer.

Instead, it is possible to summarize the clues for a possible solution to the problem in the perspective of the material fields needed for the *expanding Earth*. To do this, we will have to discuss the possible ways of creating new matter within celestial bodies: creation at rest in a reference system comoving with the planet, or at rest with respect to a reference system linked to an absolute universal space. This is of interest with regard to the problem of the null result of the MM experiment as it is fundamental to understand on which aether substrate the light waves of the experimental apparatus propagate and what the state of motion of this substrate is. But the laws that regulate the transformation of the aether of the *central stream*—directed towards the interior of celestial bodies—into ordinary matter (or rather into further sinks or sources, gravitational and/or EM) are not known, and we have to try to understand whether the new mass is created having already a velocity equal to that of the mass of the planetary body. The process could be analogous (see [22]; sect. 9.5, pp. 1427-1428) to one of the two following experiments with which a heavy brick can be placed on a small light cart already loaded with an identical brick, and already traveling for inertia at a given nearly constant velocity with respect to the laboratory.

1) If you put down the brick, when it is stationary with respect to the laboratory,

making it fall onto the cart carrying the second brick, the speed of the cart is approximately halved.

2) But, if before dropping it the speed of the first brick is increased until it equals that of the second brick carried by the cart, the speed of the cart does not change when the brick is added.

In our case of hydrodynamic gravitation are we dealing with elastic or inelastic collisions? Or are they not collisions? As regards the aether of the *central stream*, at the moment we have no way of distinguishing, with a formal mathematical method, between the two modes of action, even if the invariance of the speed (the second mode) would be much more desirable, otherwise it would enter into game the galactic reference system (or even more general, an absolute universal system, if it exists), in which new matter should be formed at rest, with evidently effects of violent collision against the already existing moving planetary matter, with significant rise in temperature, strong slowing down of the celestial body and consequent progressive narrowing of the orbit of the planets. This narrowing and spiraling of the orbits would be added to the similar narrowing caused by the increase in mass of the central star.

It must be recalled the demonstration (given by Poincaré on 1913 [51]; on considerations already carried out by Maxwell [52] and Darwin [53]) that the possible inelastic collisions of the aether particles against the planets, necessary for gravitation in the mechanism by De Duillier and Le Sage, would cause such a high increase in the temperature of celestial bodies as to quickly lead them to complete fusion, a phenomenon that is not observed. So, one might think that the *central stream* does not collide with anything but that, arriving with a solid angle of 4π, it creates within its own flow those vibrations that constitute the different subparticles and particles of the quantum world. This process would not produce the enormous amounts of heat Poincaré predicted, because the energy would be stored as new mass added to the planets. Poincaré's argument against "gravitations" produced by material processes would thus be rejected. In his time only kinetic gravities deriving from mutual shielding from collisions (à la De Duillier and Le Sage; an orderly and convergent flow of aether like the *central stream* was not thought possible) were taken into consideration.

An argument that strengthens the previous evidence against collision-governed gravity comes from the history of the Earth's rotation in geological time. The length of the day (LOD) in the Triassic was only about an hour shorter than the modern duration [54] while the new mass acquired in 250 My was about 10 times that of the Triassic. If there had been elastic or inelastic collisions with the aether particles the difference in LOD would have been several hours. The previous confutation of the Poincaré's argument is evidence against kinetic gravities governed by collisions and in favor of hydrodynamic interactions, which even today—as in Bernoulli's time—are not well understood. Bernoulli claimed that it was the "push" of his *central stream* that reproduced all the results of Newton's gravitation. Today there is still poor understanding of the way sources interact: since the sources emit fluid on the total solid angle 4π, it is intuitive to think that two nearby sources, by

virtue of the opposing emissions, tend to repel each other. But, counterintuitively, the opposite is true and the two sources attract each other through a complex interaction between the two entire velocity fields. Then, we are not in presence of elastic or inelastic collisions. We should so trust, while waiting to discover and formulate the laws, that materiogenesis occurs at rest in the reference system comoving with the hydrodynamic sink of aether that forms the gravitational field of bodies.

If we therefore assume that the new particles, atoms and molecules are created at rest (neglecting thermal motions) in the reference system of the planet, and that the light radiation must propagate as a hydrodynamic phenomenon on some material substrate—in this case the EM field of matter in the laboratory—then it seems natural that an experiment like that of Michelson and Morley gives null results and that no aether wind is detectable. It would seem like a situation similar to the concept of *ballistic light* defended by some at the beginning of the last century [55] [56] (reminiscent of Newton's ballistic theory), with the light starting with speed c with respect to the light source and maintaining this speed throughout his journey. Here, however, we are talking about light supported, like a sound wave, by a field of material substance, and if the motion of this background field changes, the light must adapt its progress to the fields it then encounters during its trip. For example, if the light passes from the laboratory system, where it has speed c on the EM fields of the laboratory ordinary matter, to then propagate in space outside the planet Earth, it there will take on the speed c with respect to the EM field defined by the interplanetary matter. It is so a different concept from that of ballistic light and, to verify its complete validity, it should be compared with all the experiments carried out from the nineteenth century to the present day (Fizeau, Foucault, Michelson, Sagnac, astronomical aberration, etc.). However, the condition to be satisfied must be a speed of light equal to c (or modulated according to the refractive index of the medium crossed) in all material reference systems, a condition that recalls the one idealistically posed by relativistic theories (an historical review in [57]). All these experiments can be read as a confirmation in favor of the concept indicated by the *expanding Earth*. The only experiments and phenomena that require reinterpretation are those of the entrainment of light in moving fluids (Fizeau's experiments and similar), polarization and astronomical aberration with and without fluids in the telescope.

7. The CMB and Its Impossible Absolute Reference System in an Inhomogeneous Infinite Universe

The previous discussion of the Michelson & Morley experiment and the identification of the possible characteristics of light propagation locked to the existing *in situ* material EM fields, may have more general consequences. Many authors in the past, including myself, have expressed the hope that the reference system of the fixed stars, and, more recently, of the CMB (Cosmic Microwave Background), can be assumed to be at least an approximation of the much-sought reference

system in absolute rest, locked to an absolute space of Newtonian memory.

But in an inhomogeneous infinite universe the undefinability of an absolute reference system can be shown. Referring to Figure 1, a huge rectangular region of the cosmos is represented—non-containing our galactic system—which has several zones of higher density of ordinary matter (in dark grey). A spherical observable sector of the infinite universe (the solid line circle—but a 3D sphere—into which the non-human observer is in the center) is embedded into a high-density zone A of normal ordinary matter of mass approximately m. The high-density region A is attracted and accelerated by hydrodynamic gravitation with an average velocity υ towards a region B of high density, higher mass M ($M \ggg m$), and higher size.

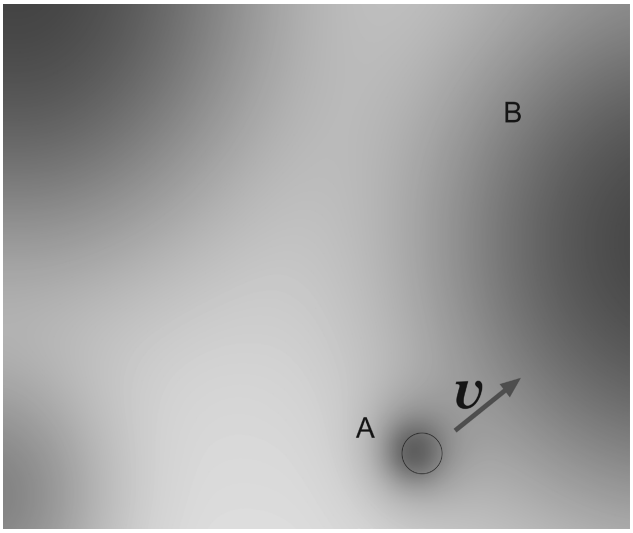

Figure 1. Our inhomogeneous infinite universe and the undefinability of an absolute reference system. Imagine an observable sector of the infinite universe (the solid line circle that indicates the sphere in which the observer is on the center) embedded in a high-density zone A of normal ordinary matter of mass about m. The observer's high-density region is attracted and accelerated by gravitation with an average velocity υ towards a near region B of high density, higher mass M ($M \ggg m$), and higher size. Region B is not observable from A and υ cannot be known. All the observer's observable universe, his high-density region A, and many surrounding lower density regions are accelerated towards the Huge-Attractor B. CMB radiation is a material wave process propagating on the EM fields of the matter in region A, so it will not show any effect due to the movement of the matter of the whole region A towards the B one.

Because region B is not observable by the observer's technologies, he cannot know the acceleration and υ. Furthermore, since the CMB radiation is a material wave process propagating on the EM fields of the matter in region A, CMB will not show any effect due to the movement of the whole ordinary matter of the region A towards region B with velocity υ. Thus, the Cosmic Microwave Background Radiation cannot be assumed as a privileged reference system.

All this can be generalized imagining a Super-Huge-Attractor located outside the rectangle of Figure 1, which attracts both regions A and B, and again generalized

to higher level situations. It follows that, at the moment, any of our position measurements must be downgraded to a mere measurement of distances, or distance and angle. A set of n points in a reference system is characterized by n triplets of Cartesian coordinates (distances from axes) or polar coordinates (distance from the pole and direction angles). We have no hope, by means of the "fixed stars" or even the CMBR, of being able to know the absolute positions of the points.

Similar reasoning, based not on electromagnetic radiation but on gravitational radiation, is premature due to the initial state of elaboration of the hydrodynamic gravitation theory, of the technologies aimed at detecting gravitational waves, and the limited amount of data collected.

8. Length Contractions and Time Dilations

The logical path followed so far has led us to conclude that relativistic theories arose from historically determined errors made by the scientific community that, using inadequate concepts, built an incomplete and flawed electrodynamic theory. Special relativity was derived by giving full confidence to the erroneous identity posed by Heaviside—between the speed of the material field and the speed of light—in deriving the equations of the contraction of the Coulomb field in the direction of its motion. All subsequent electromagnetism and relativistic theories that descend from it are permeated by this error that made these theories not Galilean.

Then, in this work, space-time contractions and dilations will not be discussed in detail since, not being existent phenomena, they are not part of physics. However, the fact that space and time are not modified by relativistic effects does not mean that the devices used to measure them are not affected by their movement. The motion of complex macro- and microscopic objects (clocks, muons and other charged particles) in this new physics that abandons the idealism of relativistic theories, cannot but be affected by the influence of its surrounding environment—now permeated by the constituent matter (aether) and its local action. Here, we will only mention that the existence of material causes affecting the duration of physical phenomena has already been considered several times in the past.

The lengthening of the decay time of charged particles (muons and other cosmic rays) has already received several times as an explanation the variation of the interaction between the particles and the electromagnetic fields of our atmosphere (Bell [58]; Selleri [59]; Jefimenko [60]; Hajra [61]). But all these authors continue to accept the erroneous demonstration of the Heaviside ellipsoid, and therefore their conclusions should be revised. For example, Bell [58] directly deduces from the Heaviside field contraction that the circular orbits of electrons orbiting nuclei must become ellipses with a shorter orbital travel time. This would be the origin of an apparent time dilation: the astronaut's journey would seem to last many more atomic cycles than that of the stationary twin. Instead it would be considered at least two different explanations: a) The internal cyclicities (which lead to decay) of the fast-moving particle could increase their period T_v with respect to the rest

period T_o due to the interaction of the moving particle with the stationary field of the atmosphere and thus increase the average decay time. b) Since the upper limit imposed by relativity on the velocities of objects no longer exists, decaying particles could succeed to reach the Earth's surface due to their possible superluminal velocities.

Hafele and Keating's [62] experiment has been criticized several times for its inconsistency [63] [64]. The apparatus was less than that necessary to reveal the effect sought. But the experiment has been repeated by others (e.g. [65]) with higher precision. There is still a lively discussion about the subject of the real conclusiveness of these kinds of experiments [66], and in general time dilation has had many criticisms [60] [67]-[70]. There is no doubt that it is necessary to make all the many corrections needed for the proper functioning of the GPS Global Positioning System described in several review papers [71]-[74], but as in the case of the advancement of the perihelia of the planets [37] without resorting to relativistic deformations of space-time, the same corrections could be obtained from the gravimagnetism equations in **Table 1** (on the right), and in the future from the more complete hydrodynamic equations that the Newtonian and Coulomb fields must satisfy. However, as suggested by EE (see Section 6), the most conspicuous part of the "corrections" must come from the more realistic behavior of light passing from one material reference system (e.g. the Earth and its atmosphere) to another different material reference system (e.g. artificial satellites orbiting the Earth). By taking into account a propagation of light related to the material fields present in its path (see Section 6), a more understandable theory of the functioning of the GPS system should be obtained.

Finally, length contractions have never been detected [60] [75] [76].

9. Conclusions

Starting from the Earth sciences—both from the evidence of expansion of our planet ([13] [21] [22] [77]-[98] and many others) and by large experiments for the detection of terrestrial neutrinos from radioactive decay [19] [20]—it is possible to reformulate the physics of Newtonian and Coulomb fields as due to a flow of constitutive matter, aether, directed towards the center of the bodies.

The hitherto unknown phenomena of the Earth sciences, often considered ancillary to other sciences, in particular those involved in the cause-effect chain of the *expanding Earth*, are proving to be indispensable *puzzle pieces* for the reconstruction of a realistic vision of many disciplines of the foundations of science and cosmology. The *horror vaqui*, which causes the aether to flow towards the areas of "aether vacuum" created by the transformation of tenuous constituent matter into normal matter within celestial bodies, should be considered the engine of the universe.

This rediscovered materiality of fields clashes with the concepts of immaterial and phenomenological fields handed down by Newton and Maxwell, which are present today in relativistic theories. The need to identify the cause of the renunciation

of the Galilean covariance in favor of the Lorentzian one has led to identifying a first inaccuracy in considering the field $\boldsymbol{E}(x,y,z)$ unrelated to the hydrodynamic "causing field" of velocity $\boldsymbol{\upsilon}(x,y,z)$, which is transformed among different reference systems using right Galilean equations other than those used for the unrealistic "empty" field $\boldsymbol{E}$ —as seen from Equations (3), (4) and (5).

This work does not pretend to solve any problem. It has only the certainty to have reached the heart, the nodal point, which was never clearly explained in EM treatises, from which the questionable choices that led to the various relativistic theories originated. Once the two-way correspondence between EM phenomena and hydrodynamic ones was ignored (due to historical contingencies), the uncritical acceptance of the equality between the propagation speed of EM fields and the speed of light became part of mathematical demonstrations that so were wrong (Heaviside's ellipsoid [43] [44]), and consequently were wrong the deductions by Fitz George [99] and Lorentz [100] of the bodies length contraction, and finally affecting the formulation of the relativistic ideas.

Although there is already literature on the history of the progress of field physics (e.g. [101] [102]) between the 19th and 20th centuries and its more or less unconscious association with fluid dynamics (e.g. [31]), much attention should be paid by the historical community to the intertwining of situations, to the accumulation of experimental results, to the lack of precise theoretical elaboration, in a context of general lack of interest in increasing the development of entire sectors of other disciplines that could have "shown the way" to sister disciplines. Nor should we neglect to deepen the investigation into the general problem of the "qui prodet", that is, who or which community or historical process has consciously or unconsciously allowed science to be gradually affected by serious deviations from the right path, while propagating the myth of the great progress and power of "modern science". It would be an interesting field of investigation into a certainly complex and very multifaceted reality.

If we put on the weighing plates on one side the Galilean covariance and on the other the polarization phenomena (which seem to require a rigid ether that transmits transverse vibrations) together with the erroneous identification of the speed of the field with that of light, it should be obvious that the choice of election should favor saving Galilei's transformations and look for other solutions for what is placed on the other plate. Instead, we see that with great superficiality (but also because of historical social, industrial, cultural hegemony, and political reasons [35] [39]), it was chosen to trash Galilei's transformations as false and to keep as true the indications of rigidity of the ether (which distanced him from hydrodynamics) and the false identifications of two different kinds of speeds. In practice, without knowing it, scientists involved in electrodynamics were building an incomplete, lopsided, flawed sketch of the hydrodynamics of sources and sinks moving like electron currents in conducting cables. Having themselves been firsthand protagonists of the exciting industrial revolution (telegraphy, wireless telegraphy, radio communications, electromagnetic hardware...), far from admitting possible errors, the scientists of the time defended their results (but let's grant them the fact that they

were in good faith) and proclaimed Lorentz's transformations to be true, condemning Galilei for the second time. Indeed, Galilean covariance is not false, but needs to be reformulated in a "weak" form.

In fact, it must be taken into account that the masses, which turn out to be aether flows, always suffer the decelerating term of hydrodynamic friction ($f = \rho Q \upsilon$, the dissipative term), preventing perfect uniform inertial motion. Constant speed reference frames become only ideal and not doable situations, asking for a reformulation of the Galilean covariance in an approximate form. It does not appear feasible to maintain, using propulsion systems, a constant velocity of a reference system and of all the objects contained in it, because each body would be subject to a different dissipative term. The progressive increase in mass of each of them would be a further problem. Also, the escape velocity concept should be reconsidered.

A future work program indicated by these first considerations—and reached awareness—should be to try to achieve a reformulation of field physics, finally adhering to the principles of fluid dynamics. One branch of this work program must aim to find the correct way to explain the result of the Michelson and Morley experiment. Much experimental work in favor of the most probable explanation indicated by the *expanding Earth* has already been carried out in the last century [57], but it is plausible that we need to reinterpret the results of the experiments on the entrainment of light radiation (like those of Fizeau and his followers). The velocity-dependent electromagnetic and gravitational dissipative terms are expected to play a role in the apparent increases in inertial mass in particle accelerator experiments. Investigations would be deserved on the possible cause-effect relationship between the decreasing velocity propagation of field transients and the generation of EM and GM waves. It should not be forgotten that the work program will meet great difficulties in dealing with phenomena such as birefringence, partial dragging of Fresnel and Fizeau, and polarization. However, the author of this work is convinced that it is preferable to clash again, but with new awareness and motivations, against these certainly serious problems, finally starting with considering as erroneous the transformations of Lorentz-Poincaré. We should be confident that by addressing old problems with proper and correct concepts different from the relativistic ones, the solutions should finally be found.

A more general completion of the research would be to assess the concomitant influence of the progressive storage of aether into the celestial bodies—and its consequent decreasing density in the "free space"—on the cosmic redshift. In any case, the complexity of the real world informs us that to give a more solid foundation to our knowledge, the bumpy path to be taken is still very long, if not infinite.

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