# The Lorentz Aether Theory

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Abstract. **The Lorentz transformations are best known for the relativistic Lorentz factor, $1/\sqrt{(1 - v^2/c^2)}$, which appears in the equations of special relativity. It is also known that the Lorentz transformations can be used to derive the Biot-Savart law in the form $B = \mu_0\varepsilon_0 v \times E$ and also the Maxwell-Lorentz force in the form $E = v \times B$.**

What is not well-known however is that the emergence of these two cross-product equations has got no bearing on the Lorentz factor itself. It is often argued that the magnetic force $E = v \times B$ is a relativistic effect, yet it clearly isn't. While the connection between the Lorentz transformations and the return-path Doppler effect in light is a matter of interest, this article will take a closer look at the classical origins of the two vector cross-product equations that emerge from the Lorentz transformations alongside the Lorentz factor, but independently of it.
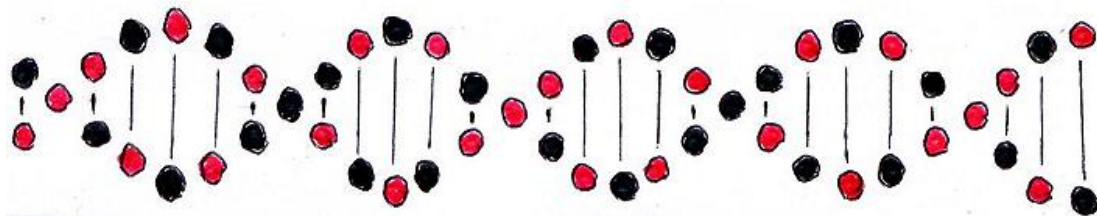
The Lorentz Force

I. The Lorentz force first appeared as an electromotive force term at equation (77) in Part II of Scottish physicist James Clerk Maxwell's 1861 seminal paper entitled ***"On Physical Lines of Force"*** [1]. It appeared in the basic form,

$$\mathbf{E} = \mu_0\mathbf{v}\times\mathbf{H} + \partial\mathbf{A}/\partial t - \nabla\psi \qquad\qquad (1)$$

and in 1864 he listed it as one of the original eight *"Maxwell's Equations"* in his paper entitled ***"A Dynamical Theory of the Electromagetic Field"*** [2]. The term, **E**, on the left-hand side is the force acting on *unity of the electric particles* within his proposed dielectric sea

of molecular vortices. Today, **E** is referred to as *"force per unit charge"* while the term electromotive force is generally used for voltage, which of course plays the exact same role in electric circuit theory. In modern textbooks, the charge term, q, is taken over to the right-hand side, hence making equation (**1**) appear as,

$$\mathbf{F} = q[\mathbf{v} \times \mathbf{B} + \partial \mathbf{A}/\partial t - \nabla \psi] \tag{2}$$

where,

$$\mathbf{B} = \mu_0 \mathbf{H} \tag{3}$$

The quantity, **B**, is the magnetic flux density which will be referred to as the *magnetic field*, while μ_0 is the magnetic permeability which is closely related to the density of the sea of aethereal vortices, and **H** is the magnetic intensity. The second and third terms on the right-hand side of equation (**1**) are the *electric field* terms. The second term, which arises from Faraday's Law, is the partial time derivative of the *electromagnetic momentum*, **A**, nowadays referred to as the *magnetic vector potential*. The second term arises due to a changing magnetic field, while the third term is the electrostatic field as per Coulomb's law. Collectively they are represented as,

$$\mathbf{E} = \partial \mathbf{A}/\partial t - \nabla \psi \tag{4}$$

It's common to have a negative sign in front of the $\partial \mathbf{A}/\partial t$ term in order to take account of Lenz's Law, but it will be left out here so as to maintain consistency with Maxwell's original convention. In modern textbooks, equation (**1**) is generally written in the familiar *Lorentz force* format,

$$\mathbf{F} = q[\mathbf{E} + \mathbf{v} \times \mathbf{B}] \tag{5}$$

As regards the convective term, **v**×**B**, which is often referred to as the Lorentz force on its own, it was derived by Maxwell in conjunction with his sea of molecular vortices long before Lorentz got involved in the topic, and so in this article it will be referred to as the *Maxwell-Lorentz Force*. The **v**×**B** force is like a kind of compound centrifugal force arising from the differential pressure acting on either side of an element of electric current as it flows through the sea of tiny aethereal vortices. This differential pressure causes a deflection in the path of motion.

Prior to introducing electric particles into his sea of aethereal vortices in Part II of his 1861 paper, Maxwell had relied exclusively on three-dimensional aether hydrodynamics, and he operated in terms of *force per unit volume*. Let us consider the two force terms which appear as parts 3 and 4 on the right-hand side of equation (5) in part I of his 1861 paper,

$$\mathbf{E} = \mu_0 \mathbf{v} \times (\nabla \times \mathbf{v}) \tag{6}$$

where $\mathbf{E}$ refers to force per unit volume. Since the velocity term, $\mathbf{v}$, is the fine-grained circumferential velocity of the tiny vortices, then the vorticity must be expressed as,

$$\nabla \times \mathbf{v} = 2\boldsymbol{\omega} \tag{7}$$

where $\boldsymbol{\omega}$ is the angular velocity at the edge of the vortices, and since the magnetic permeability, μ_0, is related to the density of the sea of vortices, this brings us to,

$$\mathbf{F} = 2m\mathbf{v} \times \boldsymbol{\omega} \qquad \textbf{(Coriolis Force)} \tag{8}$$

which is the familiar Coriolis force. Maxwell identified the circumferential velocity, $\mathbf{v}$, with the magnetic intensity, $\mathbf{H}$. Substituting equations **(3)** and **(7)** into equation **(6)** therefore leads to,

$$\mathbf{E} = \mathbf{B} \times (\nabla \times \mathbf{B}/\mu_0) \tag{9}$$

Comparing with Ampère's Circuital Law, and substituting $\mathbf{J} = \rho\mathbf{v}$, where ρ is the charge density, we obtain,

$$\mathbf{E} = \mathbf{B} \times \rho\mathbf{v} \tag{10}$$

which is the familiar Maxwell-Lorentz force. A subtle difference between the Coriolis force when observed in atmospheric cyclones on the one hand, and the Maxwell-Lorentz force when observed in a magnetic field on the other hand, is that in the atmospheric case, we are observing inertial motion in a vortex, whereas in the electromagnetic case, we are observing motion between vortices. See ***"The Coriolis Force in Maxwell's Equations"*** [3].

The Three-Dimensional Aether Hydrodynamical Analysis

II. In Maxwell's hydrodynamical analysis in Section **I** above, he bases the magnetic intensity, **H**, and the magnetic flux density, **B**, on the fine-grained circumferential aether circulation in his sea of tiny vortices. However, all papers relating to ***"The Double Helix Theory of the Magnetic field"***, [6], [7], instead apply **H** directly to the vorticity of the vortices, and hence Maxwell's electromagnetic momentum, **A**, becomes his displacement current, [4], [5]. It's upon this basis that we will operate in this article. The scalar potential, ψ, represents hydrostatic aether pressure, and together with the dynamic momentum/displacement current, **A**, they make up the two important ingredients of Bernoulli's Principle within the sea of fine-grained aethereal vortices. The Maxwell-Lorentz term, $\mathbf{E_C} = \mathbf{v} \times \mathbf{B}$, follows naturally from three-dimensional aether hydrodynamics as shown in Section **I** above, and also in **Appendix A** at the end.

Relativists claim that Einstein's Special theory of Relativity covers all these hydrodynamical relationships, hence rendering Maxwell's pioneering works redundant. This is despite the fact that relativity completely removes the aether from the entire picture, whereas it's very hard to comprehend how a force such as the Maxwell-Lorentz force, $\mathbf{E_C} = \mathbf{v} \times \mathbf{B}$, which follows from differential pressure within a sea of tiny aethereal vortices could still exist after we have removed the aether itself. Could an aeroplane fly if we removed the atmosphere?

It's true though that the Lorentz transformations can indeed produce the Maxwell-Lorentz force, $\mathbf{E_C} = \mathbf{v} \times \mathbf{B}$, from the combined electric field term, $\partial \mathbf{A}/\partial t - \nabla \psi$, on the right-hand side of equation **(4)**. But can they do it without the aether? And while Maxwell's approach introduces the speed of light into the equations of electromagnetism through the 1855 Weber-Kohlrausch experiment [8], the Lorentz transformations introduce it through optics and relative speeds. The commonality between the two methods will now be investigated.

The Lorentz Transformations

III. In a letter entitled ***"The Ether and the Earth's Atmosphere"*** written by the Anglo-Irish physicist George Francis Fitzgerald, dated 2nd May 1889 and published in the ***"Science"*** illustrated weekly journal [9], Professor Fitzgerald expressed great interest in the recent experiment carried out in 1887 by Messrs. Michelson and Morley at Cleveland, Ohio, in the USA. Michelson and Morley, using an interferometer in an attempt to measure the speed of the Earth relative to the luminiferous medium,

had obtained no significant fringe shifts. Professor Fitzgerald stated that the only hypothesis that could be reconciled with this negative observation is that the length of moving bodies changes due to electrical interaction with the aether.

In 1892 the Dutch physicist Hendrik Lorentz began working on a project aimed at reconciling Maxwell's equations with certain experiments involving optics and relative motion [10]. Initially attention was focused on stellar aberration and Fizeau's 1851 experiment involving the speed of light in a moving column of water, but Lorentz extended the investigation to include inter-molecular forces and length contraction in order to try and explain the null result of the 1887 Michelson-Morley experiment. In 1897 the Ulster physicist and mathematician Sir Joseph Larmor extended Lorentz's work further, paying particular attention to the electrical interaction between matter in motion and the luminiferous aether [11]. Lorentz on the other hand was largely working on an *ad hoc* mathematical basis. It was Larmor who first suggested that length contraction would have to also involve some kind of retardation of local time, a concept which he never clearly explained but which is understood by some to relate to the frequency of natural processes, and it was Larmor who is said to have been the first to have arrived at the Lorentz transformations as we know them today [12]. See **Appendix B**.

In 1905, French physicist Henri Poincaré formulated equivalent transformation equations and named them the *Lorentz transformations* as it seems that he was unaware of Larmor's contributions [13]. Shortly afterwards, Albert Einstein published an alternative derivation of the Lorentz transformation equations which gave them a brand-new interpretation not involving the aether at all, [14]. It was this act of mindless vandalism on Einstein's part which is central to a major controversy which rages to this day.

The Luminiferous Aether

IV. Maxwell never overtly mentioned electric charge in his 1861 paper. Instead, he talked about the density of *free electricity*, a concept which he never elaborated upon. This is highly significant since the term free electricity is likely to refer to the electric fluid, which is the primordial aether from which everything is made. This would equate electric charge to the state of compression of space itself, space being something that can be compressed or stretched, and which can also flow. Maxwell considered the luminiferous medium to be a sea of tiny aethereal vortices exhibiting 3-D cylindrical symmetry and obeying the classical laws of

hydrodynamics, and from the arguments in Sections **I** and **II** above, there would seem to be no compelling reason to see the matter any differently.

The idea however, that the luminiferous medium is actually a 4-D space-time continuum, originates in optics, and it can be argued from the equation,

$$s^2 = x^2 + y^2 + z^2 - c^2t^2 \tag{11}$$

where the quantity, *s*, is *Lorentz invariant*, meaning that it doesn't change under a Lorentz transformation. This equation is the cornerstone of Einstein's special theory of relativity, and the assertion that the speed of light, *c*, is a universal constant is what gives rise to the controversial concept of time dilation. We all know that when the Earth has performed a complete orbit of the Sun, relative to the background stars, that one year will have passed for everybody in the universe, and that therefore time dilation is a nonsense concept.

Equation **(11)** is closely related to the return-path longitudinal Doppler shift in the frequency of a ray of light, [15], but it would appear to have no obvious connection to the hydrodynamics of a sea of tiny vortices. If we could somehow connect this equation to the electric and magnetic fields that are involved in a ray of light, we might get to see the picture at a deeper level, hence enabling us to discard absurd ideas like time dilation. Throughout the 1890s, Sir Joseph Larmor was working directly on this problem in connection with a rotationally elastic aether and the manner in which the frequency of rotating dipoles is altered as they move through this aether, [11], [12]. Larmor's papers would be an ideal place to begin in order to investigate this matter further. Larmor talked about positive and negative electrons being singularities in the aether and he connected this idea with electromagnetic radiation. See page 211 in his 1897 paper [11], and Section 114, pages 179-180, in his 1900 paper [12]. This line of research would be relevant to the effect of motion through the aether on atomic clocks, such as in the case of atomic clocks in GPS satellites, where it can be shown how the ensuing frequency dilations relate to conservation of energy, and where the associated equations can be shown to approximate to the Lorentz transformation equations, [16],

We need to investigate the deeper origins of the electric and magnetic fields that are involved in the electromagnetic wave propagation mechanism, and to this end it is proposed that the wave carrying medium is in fact Maxwell's sea of molecular vortices, as modified by ***"The Double Helix Theory of the Magnetic Field"*** [6], [7], which replaces his molecular vortices with rotating electron-positron dipoles. These tiny vortices press against each other with centrifugal force while striving to dilate, [17], [18], [19]. The sea of tiny aether vortices may itself be

incompressible, but the pure aether of which these vortices are comprised will certainly be compressible and stretchable.

The Four-Dimensional Space-Time Continuum

V. In Einstein's 1905 paper [14], he derived the kinematical Lorentz transformations in his own way and then went on to apply them to Ampère's Circuital Law and Faraday's Law. On page 907, Einstein wrote out these two curl equations side by side in a perfectly dual format involving three rows and two columns. He split each equation into three, one for each of the three Cartesian components, and he used Gaussian units so that the speed of light was overtly displayed. Einstein applied the Lorentz transformations to the two curl equations and then wrote out the perfectly dual solutions, $\mathbf{E} = \gamma(1/c)\mathbf{v}\times\mathbf{B}$ and $\mathbf{B} = \gamma(1/c)\mathbf{v}\times\mathbf{E}$, that apply in the plane perpendicular to the motion. When he wrote out these solutions, he inserted gaps on each line. See **Appendix C**. In the same year, French mathematician and theoretical physicist Henri Poincaré devised an analytical tool known as *four-vectors* which showed how Einstein could have arrived at these solutions. This was written up in Poincaré's *"Palermo paper"*, [20], and the same idea was later developed further in 1908 by German mathematician Hermann Minkowski whose name is now associated with the 4-D space-time continuum. It's not clear how Einstein could have arrived at his solutions without using four-vectors.

The Lorentz transformation equations can be converted into four-vector format by treating time as a fourth dimension. We can then re-write equation **(11)** as,

$$s^2 = x_1{}^2 + x_2{}^2 + x_3{}^2 + x_4{}^2 \tag{12}$$

The term x_4 involves the imaginary number, $i^2 = -1$, such that,

$$x_4 = ict \tag{13}$$

The Lorentz transformations for motion exclusively along the *x*-axis then take on the form,

$$x_1' = \gamma(x_1 + iv_\mathrm{x}x_4/c) \tag{14}$$

$$x_2' = x_2 \tag{15}$$

$$x_3' = x_3 \tag{16}$$

$$x_4' = \gamma(x_4 - iv_x x_1/c) \tag{17}$$

To whatever extent these equations are rooted in the optical return-path longitudinal Doppler effect, we will treat x_1 as referring to wavelength and x_4 as referring to frequency. This will be in line with Larmor's and Lorentz's concept of local time, as understood in terms of the frequency of the system under investigation. Time dilation in the broader sense, as per Einstein's special theory of relativity, which follows from his disregarding of the luminiferous aether, will be ruled out on the basis that it is not a realistic option.

We will now apply these transformation equations directly to the tiny dipolar vortices (rotating electron-positron dipoles) that fill all of space and which form the basis of the electromagnetic wave propagation mechanism. While the return-path longitudinal Doppler effect is something that normally applies to waves, we will see if it can be extended into the context of a rotating dipole in a state of translational motion through a larger sea of such rotating dipoles.

The Biot-Savart Law

VI. The circumferential momentum density of a rotating electron-positron dipole is **A**, where $\nabla \times \mathbf{A} = \mathbf{B}$. Consider such a dipole, of random orientation, undergoing translational motion along the x-axis through a larger sea of such rotating dipoles (vortices). The physical interaction will distort **B**, and the component of **B'** along the z-axis will take the form,

$$B'_z = \partial A'_y/\partial x' - \partial A'_x/\partial y' \tag{18}$$

In four-vector notation this becomes,

$$B'_z = \partial A'_2/\partial x'_1 - \partial A'_1/\partial x'_2 \tag{19}$$

And now we will introduce the *Lorentz condition*, more accurately known as the *Lorenz gauge* after Danish physicist Ludvig Lorenz. It takes the form,

$$\nabla \cdot \mathbf{A} + 1/c^2 \partial \psi/\partial t = 0 \tag{20}$$

This is in effect the equation of continuity of the aether with the scalar potential, ψ, representing aether pressure. The speed of light has been introduced into the proceedings, with the benefit of hindsight. With the Lorentz condition satisfied, the four-vector for **A** and ψ takes the form $(A_1, A_2, A_3, i\psi/c)$. The z-component of the momentum, A_z, becomes A_3, while the scalar potential (pressure), ψ, becomes $i\psi/c$. The four-vector for ∇ and $\partial/\partial t$ becomes, $(\partial/\partial x, \partial/\partial y, \partial/\partial z, i/c.\partial/\partial t)$.

Using the Lorentz transformation equations **(14)** to **(17)**, *but deliberately omitting the gamma factor, $1/(\sqrt{1 - v^2/c^2})$* , equation **(19)** then expands to,

$$B'_z = (\partial/\partial x_1 + iv_x/c.\partial/\partial x_4)A_2) - \partial/\partial x_2(A_1 + iv_xA_4/c) \qquad \textbf{(21)}$$

Hence,

$$B'_z = (\partial A_2/\partial x_1 - \partial A_1/\partial x_2) + (iv_x/c)(\partial A_2/\partial x_4 - \partial A_4/\partial x_2) \qquad \textbf{(22)}$$

The first bracketed term on the right-hand side of equation **(22)** should already be recognizable as the z-component of $\nabla\times$**A**, which is B_z. As regards the second bracketed component on the right-hand side of equation **(22)**, we must remember that $\partial/\partial x_4$ is $(i/c)\partial/\partial t$ while A_4 is $i\psi/c$.

Hence,

$$B'_z = B_z - (v_x/c^2)(\partial A_y/\partial t - \partial\psi/\partial y) \qquad \textbf{(23)}$$

Hence,

$$B'_z = B_z - v_xE_y /c^2 \qquad \textbf{(24)}$$

A reciprocal result for B'_y leads us to,

$$\textbf{B}' = \textbf{B} - \mu_0\varepsilon_0\textbf{v}\times\textbf{E} \qquad \textbf{(25)}$$

where $\mu_0\varepsilon_0$**v**$\times$**E** is restricted to the yz-plane. This suggests that a rotating dipole, when in translational motion along the x-axis, precesses about that axis. The gamma factor, $1/(\sqrt{1 - v^2/c^2})$, was deliberately omitted from the analysis in order to explicitly demonstrate that it has no involvement in these classical electromagnetic relationships.

From the 1856 Weber-Kohlrausch experiment [8], we can write,

$$c^2 = 1/\mu_0 \varepsilon_0 \qquad \qquad (26)$$

where μ_0 is the magnetic permeability of space, ε_0 is the electric permittivity of space.

In order to establish the meaning of **E** in equation **(25)**, we will now perform another Lorentz transformation, this time on, $\mathbf{E} = \partial\mathbf{A}/\partial t - \nabla\psi$. The *z*-component of **E'** is,

$$E'_z = \partial A'_z/\partial t' - \partial\psi'/\partial z' \qquad \qquad (27)$$

Hence, we can write,

$$E'_z = ic[\ \partial A'_4 /\partial x'_3 - \partial A'_3/\partial x'_4] \qquad \qquad (28)$$

From equation **(17)**, *while still deliberately omitting the gamma factor, γ,* we can apply the Lorentz transformations,

$$A'_4 = (A_4 - iv_x A_1/c) \qquad \qquad (29)$$

and

$$\partial/\partial x'_4 = (\partial/\partial x_4 - iv_x/c.\partial/\partial x_1) \qquad \qquad (30)$$

Then trivially, since motion is only along the *x*-axis, it follows from equation **(16)** that $A'_3 = A_3$ and $\partial/\partial x'_3 = \partial/\partial x_3$. Applying these transformations to equation **(28)** leads to,

$$E'_z = ic[\partial/\partial x_3(A_4 - iv_x A_1/c) - (\partial/\partial x_4 - iv_x/c.\partial/\partial x_1)A_3] \qquad (31)$$

therefore,

$$E'_z = ic(\partial A_4/\partial x_3 - \partial A_3/\partial x_4) + v_x(\partial A_1/\partial x_3 - \partial A_3/\partial x_1) \qquad (32)$$

By comparing the first bracketed term on the right-hand side of equation **(32)** with the starting equation **(28)**, it simply becomes E_z. The second bracketed term on the right-hand side applies purely within 3-D space and it is readily identifiable as the *y*-component of the curl of **A**. It's of interest to note that curl is a purely spatial operation which exists only in three and seven dimensions. There can be no curl in four dimensions, [21], but curl can still operate in tandem with time in 4-D space-time. Hence,

$$E'_z = E_z + v_x B_y \qquad\qquad (33)$$

Repeating this exercise across all the Cartesian components, we end up with,

$$\mathbf{E'} = \mathbf{E} + \mathbf{v} \times \mathbf{B} \qquad\qquad (34)$$

where $\mathbf{v} \times \mathbf{B}$ is exclusively in the yz-plane, just like the additional component of the magnetic field in equation (25). The equation $\mathbf{B} = -\mu_0 \varepsilon_0 \mathbf{v} \times \mathbf{E}$ is the Biot-Savart Law in its most fundamental form, and we now know that the $\mathbf{E}$ field is due to the centrifugal force, $\mathbf{E_C} = \mathbf{v} \times \mathbf{B}$, that emanates from the equatorial plane of a rotating electron-positron dipole, [1], [8], [17]. See **Appendices D**, **E**, and **F**. We have established a clear bridge between Maxwell's sea of aethereal vortices and the Lorentz aether theory. Two specific points of interest are, *(1)* that this derivation could not have been done without invoking Hermann Minkowski's concept of 4-D space-time, and *(2)* that there was no need to invoke the gamma factor for this particular purpose. The magnetic field, $\mathbf{B} = -\mu_0 \varepsilon_0 \mathbf{v} \times \mathbf{E_C}$, and the magnetic force, $\mathbf{E_C} = \mathbf{v} \times \mathbf{B}$, contrary to popular opinion, are not relativistic effects.

The Physical Interpretation

VII. A Lorentz transformation should not be considered in the manner of a Galilean transformation whereby we are viewing the same event from a different frame of reference. A Lorentz transformation is intricately tied up with the elasticity of the luminiferous medium, which is the carrier of electric and magnetic fields, as well as electromagnetic waves, and so we are studying the physical effects of absolute motion, and not simply relative motion.

In the previous section, we saw how a Lorentz transformation appears to have the effect of applying a gyroscopic force to a rotating dipolar vortex, such as to cause it to precess. While it was assumed that the translational motion in question was relative to the larger sea of tiny vortices that fill all of space, it is now proposed that the same effect ensues when the motion is relative to the pure vortex fluid itself (the aether), when it is in a state of acceleration. Consider a charged sphere on the large scale and its surrounding radial electrostatic field. According to whether the charge is negative or positive, this large-scale electrostatic field will involve an inflow or an outflow of pure aether which will flow

through the tiny dipolar vortices in the vicinity. It is proposed that this is equivalent to a Lorentz transformation based on the aether velocity field, and so we should expect the tiny vortices to precess about the lines of force of the electrostatic field on the large scale, and when the sphere is at rest in the sea of tiny vortices, we will have a state of spherical symmetry. If, however, the charged sphere is then caused to move translationally, the tiny vortices will begin to re-align so that their rotation axes trace out concentric vortex rings around the path of motion, much in the likeness of smoke rings. In the vicinity of the tiny vortices (rotating electron-positron dipoles) themselves, an electrostatic field on the tiny scale exists in the axial direction while a fine-grained centrifugal repulsion field exists in their equatorial planes. Hence the re-orientation of these tiny vortices interferes with the electrostatic field on the large scale in a manner such as to undermine it in the direction parallel to the path of motion and to convert it into a magnetic field perpendicular to the path of motion. The Biot-Savart law, $\mathbf{B} = -\mu_0\varepsilon_0\mathbf{v}\times\mathbf{E_C}$, describes the magnetic field lines that form concentrically around the moving sphere, and we now know that this solenoidal magnetic field involves a radial centrifugal force field, $\mathbf{E_C} = \mathbf{v}\times\mathbf{B}$, pressing inwards on the moving source. Hence, due to the agency of the all-pervading sea of dipolar vortices, the electrostatic field that surrounds a charged sphere on the large-scale, is converted into a magnetic field as the body accelerates linearly. As the sphere approaches the speed of light, its radial electrostatic field will have been largely re-aligned into a disc-shaped magnetic field perpendicular to the path of motion. When we introduce the gamma factor, $1/\sqrt{(1 - v^2/c^2)}$, this will account for the tendency of the electrostatic field on the large-scale to diminish in the direction of motion while increasing the magnitude of the magnetic field perpendicular to the direction of motion, particularly as the charged body approaches the speed of light. This is the relativistic effect which is additional to the classical electromagnetic relationships.

The Maxwell-Lorentz force, $\mathbf{E_C} = \mathbf{v}\times\mathbf{B}$, is actually more familiar in the context in which it deflects a moving charged particle in an already existing background magnetic field, such as to cause it to undergo helical motion. In this context, it behaves more like a Coriolis force. This Coriolis-like aspect of the Maxwell-Lorentz centrifugal force will be due to the fact that when a charged particle moves through the background sea of tiny vortices, since these vortices are all spinning in nearly the same direction as their immediate neighbours, the moving charged particle will experience a differential centrifugal pressure at right angles to its direction of motion, hence causing it to deflect.

Lorentz-Fitzgerald Contraction in Electric Currents

VIII. American physicist Edward Mills Purcell wrote a book in 1963 entitled *"Electricity and Magnetism"* [22]. There is a belief that Purcell demonstrated that a magnetic field in one frame of reference is an electrostatic field in another frame of reference. Purcell involved the concept of Lorentz-Fitzgerald contraction in an electric circuit in order to provide a source charge for the electrostatic field, where only a magnetic field existed from the perspective of a stationary observer. The application of the Lorentz-Fitzgerald contraction to electric current, as a source of charge density, seems to have progressed into the myth that the Maxwell-Lorentz force, $\mathbf{E_C} = \mathbf{v} \times \mathbf{B}$, as viewed in a stationary frame of reference is equivalent to an electrostatic force, $\mathbf{E_S} = -\nabla \psi$, as viewed in a moving frame of reference. Purcell's theory is based on the relativistic gamma factor, truncated to first order binomial approximation, and the essence of the equality in Purcell's analysis is based on the beta squared (β^2) factor, v^2/c^2, within the gamma factor. The equality which Purcell then relies on has a superficial resemblance to the equality which Weber used when arguing that the speed of light is a reducing factor in his 1846 force law, [8]. Purcell has amazingly managed to transport a classical electromagnetic relationship into a relativistic context. The most important thing though is, that the Lorentz contraction is being applied selectively as between the positive particles and the negative particles in the conducting wire, hence creating the equivalent of the clock paradox. This context is hence unrealistic, and so Purcell's theory must be ruled out.

Conclusion

IX. The luminiferous medium of the Lorentz aether theory is specifically Maxwell's sea of tiny aether vortices and it is one and the same thing as Minkowski's 4-D space-time continuum. The four-dimensional aspect has been shown to be of crucial importance. The classical electromagnetic relationships which unfold from a Lorentz transformation, arise through aether hydrodynamics and are not due to the Lorentz factor, $\gamma = 1/(\sqrt{1 - v^2/c^2})$, itself. Magnetism, contrary to popular opinion, is not a relativistic effect. The Lorentz factor does however add to the classical elastic effects of the luminiferous aether by enhancing the fields perpendicular to the path of motion while diminishing them in the direction of this path, and these enhancements become noticeable as the

speed of light is approached. The relativistic effect on the electromagnetic fields is closely related to the Doppler effect.

The claim that Maxwell's equations have been subsumed by Einstein's theories of relativity is patently false. The connection between Maxwell and Lorentz is through the aether, and when we remove the aether, as Einstein did, we remove the linkage between Maxwell and Einstein, leaving Einstein with no physical basis whatsoever to justify his theories. With Einstein's interpretation, we have no rest frame upon which to base the Lorentz transformations and we end up in an absurd universe where waves propagate in empty space, and where two clocks can both tick slower than each other, [23]. Meanwhile, all experimental results which are claimed for Einstein are, at least to a reasonable approximation, a vindication of the Lorentz aether theory in connection with Maxwell's sea of molecular vortices.

As regards Lorentz himself, he need have had no worries about vortices forming high up at the interface of Stokes's entrained aether, [24], since vortices are actually the essence of the electromagnetic wave propagation mechanism in the first place, and they already exist everywhere.

Appendix A
(Three-Dimensional Aether Hydrodynamics)

The gradient of the scalar product of two vectors can be expanded by the standard vector identity,

$$\nabla(\mathbf{A}\cdot\mathbf{v}) = \mathbf{A}\times(\nabla\times\mathbf{v}) + \mathbf{v}\times(\nabla\times\mathbf{A}) + (\mathbf{A}\cdot\nabla)\mathbf{v} + (\mathbf{v}\cdot\nabla)\mathbf{A} \qquad (35)$$

Let us consider only the vector $\mathbf{A}$ to be a vector field. If $\mathbf{v}$ represents arbitrary particle motion, the first and the third terms on the right-hand side of equation (35) will vanish, and from the relationship $\nabla\times\mathbf{A} = \mathbf{B}$, we will obtain,

$$\nabla(\mathbf{A}\cdot\mathbf{v}) = \mathbf{v}\times\mathbf{B} + (\mathbf{v}\cdot\nabla)\mathbf{A} \qquad (36)$$

Hence,

$$(\mathbf{v}\cdot\nabla)\mathbf{A} = -\mathbf{v}\times\mathbf{B} + \nabla(\mathbf{A}\cdot\mathbf{v}) \qquad (37)$$

Since by the theorem of total derivatives,

$$dA/dt = \partial A/\partial t + (v{\cdot}\nabla)A \qquad\qquad (38)$$

it then follows that,

$$dA/dt = \partial A/\partial t - v{\times}B + \nabla(A{\cdot}v) \qquad\qquad (39)$$

Using the vector identity for the curl of a cross product in conjunction with the same reasoning as per the derivation of equation **(36)** above, we can safely conclude that,

$$\nabla{\times}(v{\times}B) = -(v{\cdot}\nabla)B \qquad\qquad (40)$$

Hence taking the curl of equation **(39)** leads to,

$$dB/dt = \partial B/\partial t + (v{\cdot}\nabla)B \qquad\qquad (41)$$

since the curl of a gradient is always zero, hence eliminating the $\nabla(A{\cdot}v)$ term. Then with reference to equation **(40)**, if we take the curl of Maxwell's equation **(1)** at the beginning of the article, which is broadly the same as equation **(39)**, we obtain,

$$\nabla{\times}E = \partial B/\partial t + (v{\cdot}\nabla)B \qquad\qquad (42)$$

This time it was the electrostatic term that was eliminated by the fact that the curl of a gradient is always zero. From equation **(41)** this is equivalent to,

$$\nabla{\times}E = dB/dt \qquad\qquad (43)$$

which when the negative sign is added to take account of Lenz's Law, is a complete total time derivative version of Faraday's Law covering for both convective and time-varying electromagnetic induction. Faraday's Law is therefore equivalent to Maxwell's electromotive force equation, known today as the Lorentz Force.

Appendix B
(The Lorentz Transformations)

In 1897, Ulster physicist Sir Joseph Larmor presented equations in a paper which was published in *Philosophical Transactions of the Royal*

Society [11]. On page 229, Larmor wrote $x_1 = x\epsilon^{\frac{1}{2}}$, where the more familiar gamma factor, γ, appears in the form $\epsilon^{\frac{1}{2}}$. He probably meant to write, $x_1 = x'\epsilon^{\frac{1}{2}}$, where $x' = (x - vt)$. He also wrote $\mathrm{d}t_1 = \mathrm{d}t'\epsilon^{-\frac{1}{2}}$, where $t' = t - vx/c^2$. These equations approximate to what we know today as the Lorentz transformations. Then in the year 1900, on page 174 in his article entitled ***"Aether and Matter"*** [12], Larmor transformed x_1, y_1, z_1, and t_1 into $\epsilon^{\frac{1}{2}}x'$, y', z', and $\epsilon^{-\frac{1}{2}}t' - (v/c^2)\,\epsilon^{\frac{1}{2}}x'$.

Whatever the finer details are, because they are not always very clear, Lorentz and Larmor were the two pioneers who first worked on the problem throughout the 1890s. They achieved what they believed to be justification for length contraction, but as regards their twin aim of finding a transformation that would make Maxwell's equations invariant, this wasn't possible until Henri Poincaré invented four-vectors in 1905. In that same year, Einstein re-derived the Lorentz transformations in the form below, which is unequivocally that which is used in modern textbooks,

$$\mathrm{x}' = \gamma(x - vt) \tag{44}$$

$$y' = y \tag{45}$$

$$z' = z \tag{46}$$

$$t' = \gamma(t - vx/c^2) \tag{47}$$

Appendix C
(The Advent of Four-Vectors)

On page 907 of his 1905 Bern paper [14], Einstein purported to subject Ampère's Circuital Law and Faraday's Law to Lorentz transformations. He wrote these two curl equations out in a perfectly dual format, using Gaussian units, which expose the speed of light, and he expanded them into their three Cartesian components, hence resulting in six equations in total. The primed versions were then displayed on pages 907-908 as seen below, with the solutions shown within the curved brackets. However, it should not have been possible for Einstein to have arrived at the solutions listed below, even though these solutions are correct. Einstein used the kinematical Lorentz transformations which he had derived on page 902. With these, he would not have been able to introduce the beta factor, v/c, so symmetrically. It's interesting that Einstein left spacings when he

wrote out the perfectly dual solutions. These deliberate spacings which Einstein left have been highlighted in yellow,

$$1/c.\partial E_x/\partial t' \underline{\qquad\qquad} = \partial/\partial y'[\gamma(B_z - v/c.E_y)] - \partial/\partial z'[\gamma(B_y + v/c.E_z)]$$

$$1/c.\partial/\partial t'[\gamma(E_y - v/c.B_z)] = \partial B_x/\partial z' \underline{\qquad\qquad} - \partial/\partial x'[\gamma(B_z - v/c.E_y)]$$

$$1/c.\partial/\partial t'[\gamma(E_z + v/c.B_y)] = \partial/\partial x'[\gamma(B_y + v/c.E_z)] - \partial B_x/\partial y' \underline{\qquad\qquad}$$

$$1/c.\partial B_x/\partial t' \underline{\qquad\qquad} = \partial/\partial z'[\gamma(E_y - v/c.B_z)] - \partial/\partial y'[\gamma(E_z + v/c.B_y)]$$

$$1/c.\partial/\partial t'[\gamma(B_y + v/c.E_z)] = \partial/\partial x'[\gamma(E_z + v/c.B_y)] - \partial E_x/\partial z' \underline{\qquad\qquad}$$

$$1/c.\partial/\partial t'[\gamma(B_z - v/c.E_y)] = \partial E_x/\partial y' \underline{\qquad\qquad} - \partial/\partial x'[\gamma(E_y - v/c.B_z)]$$

Appendix D
(The Biot-Savart Law in the Coulomb Gauge)

"*The Double Helix Theory of the Magnetic Field*" [6], is essentially Maxwell's sea of aethereal vortices but with the vortices replaced by rotating electron-positron dipoles. Within the context of a single rotating electron-positron dipole, the angular momentum can be written as $\mathbf{H} = \mathbf{D} \times \mathbf{v}$, where $\mathbf{D}$ is the displacement from the centre of the dipole and $\mathbf{v}$ is the circumferential velocity. When elastically bonded to other dipoles within the wider electron-positron sea, the displacement $\mathbf{D}$ will be related to the transverse elasticity through Maxwell's fifth equation, $\mathbf{D} = \varepsilon\mathbf{E}$. A full analysis can be seen in the articles **"*Radiation Pressure and E = mc²*"** [25], and **"*The 1855 Weber-Kohlrausch Experiment*"** [8]. If we substitute $\mathbf{D} = \varepsilon\mathbf{E}$ into the equation $\mathbf{H} = \mathbf{D} \times \mathbf{v}$, this leads to,

$$\mathbf{H} = -\varepsilon\mathbf{v} \times \mathbf{E}_C \tag{48}$$

See **Appendix E** regarding why the magnitude of $\mathbf{v}$ should necessarily be equal to the speed of light. Equation **(48)** would appear to be equivalent to the Biot-Savart Law if $\mathbf{E}_C$ were to correspond to the Coulomb electrostatic force. However, in the context, $\mathbf{E}_C$ will be the centrifugal force, $\mathbf{E}_C = \mu\mathbf{v} \times \mathbf{H}$, and not the Coulomb force. If we take the curl of equation **(48)** we get,

$$\nabla \times \mathbf{H} = -\varepsilon[\mathbf{v}(\nabla \cdot \mathbf{E}_C) - \mathbf{E}_C(\nabla \cdot \mathbf{v}) + (\mathbf{E}_C \cdot \nabla)\mathbf{v} - (\mathbf{v} \cdot \nabla)\mathbf{E}_C] \tag{49}$$

Since $\mathbf{v}$ is an arbitrary particle velocity and not a vector field, this reduces to,

$$\nabla\times\mathbf{H} = -\varepsilon[\mathbf{v}(\nabla\cdot\mathbf{E}_C) - (\mathbf{v}\cdot\nabla)\mathbf{E}_C] \tag{50}$$

Since $\mathbf{v}$ and $\mathbf{E}_C$ are perpendicular, the second term on the right-hand side of equation **(50)** vanishes. In a rotating dipole, the aethereal flow from positron to electron will be cut due to the vorticity, the separate flows surrounding the electron and the positron will be passing each other in opposite directions, and so the Coulomb force of attraction will be disengaged. Hence, the two particles will press against each other with centrifugal force while striving to dilate, since the aether can't pass laterally through itself, and meanwhile the two vortex flows will be diverted up and down into the axial direction of the double helix, [7]. Despite the absence of the Coulomb force in the equatorial plane, $\mathbf{E}_C$ is still nevertheless radial, and like the Coulomb force, as explained in **Appendix F**, it still satisfies Gauss's Law, this time with a negative sign in the form,

$$\nabla\cdot\mathbf{E}_C = -\rho/\varepsilon \tag{51}$$

Substituting into equation **(50)** leaves us with,

$$\nabla\times\mathbf{H} = \rho\mathbf{v} = \mathbf{J} = \mathbf{A} \tag{52}$$

and hence since $\mathbf{B} = \mu\mathbf{H}$ then,

$$\nabla\times\mathbf{B} = \mu\mathbf{J} = \mu\mathbf{A} \tag{53}$$

which is Ampère's Circuital Law in the Coulomb gauge.

Appendix E
(The Speed of Light)

Starting with the Biot-Savart law in the Coulomb gauge, $\mathbf{H} = -\varepsilon\mathbf{v}\times\mathbf{E}_C$, where $\mathbf{E}_C = \mu\mathbf{v}\times\mathbf{H}$, means that we can then write $\mathbf{H} = -\varepsilon\mu\mathbf{v}\times(\mathbf{v}\times\mathbf{H})$. It follows therefore that the modulus $|\mathbf{H}|$ is equal to $\varepsilon\mu v^2 H$ since $\mathbf{v}$, $\mathbf{E}_C$, and $\mathbf{H}$ are mutually perpendicular within a rotating electron-positron dipole. Hence, from the ratio $\varepsilon\mu = 1/c^2$, it follows that the circumferential speed v must be equal to c within such a rotating dipole. In other words, the ratio $\varepsilon\mu = 1/c^2$ hinges on the fact that the circumferential speed in Maxwell's molecular vortices is equal to the speed of light.

Appendix F
(Gauss's Law for Centrifugal Force)

Taking the divergence of the centrifugal force, $\mathbf{E}_C = \mu\mathbf{v}\times\mathbf{H}$, we expand as follows,

$$\nabla\cdot(\mu\mathbf{v}\times\mathbf{H}) = \mu[\mathbf{H}\cdot(\nabla\times\mathbf{v}) - \mathbf{v}\cdot(\nabla\times\mathbf{H})] \tag{54}$$

Since $\mathbf{v}$ refers to a point particle that is in arbitrary motion, and not to a vector field, then $\nabla\times\mathbf{v} = 0$, and since $\nabla\times\mathbf{H} = \mathbf{J} = \rho\mathbf{v}$, it follows that,

$$\nabla\cdot(\mu\mathbf{v}\times\mathbf{H}) = -\mu\rho\mathbf{v}\cdot\mathbf{v} \tag{55}$$

then substituting $v = c$ as per **Appendix E**,

$$\nabla\cdot(\mu\mathbf{v}\times\mathbf{H}) = -\mu\rho c^2 \tag{56}$$

and substituting $c^2 = 1/\mu\varepsilon$, this leaves us with,

$$\nabla\cdot(\mu\mathbf{v}\times\mathbf{H}) = -\rho/\varepsilon \tag{57}$$

which is a negative version of Gauss's law for centrifugal force.

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"Long ago he (mankind) recognized that all perceptible matter comes from a primary substance, of a tenuity beyond conception and filling all space - the Akasha or luminiferous ether - which is acted upon by the life-giving Prana or creative force, calling into existence, in never ending cycles, all things and phenomena. The primary substance, thrown into infinitesimal whirls of prodigious velocity, becomes gross matter; the force subsiding, the motion ceases and matter disappears, reverting to the primary substance".
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In relation to the speed of light, *"The most probable surmise or guess at present is that **the ether is a perfectly incompressible continuous fluid, in a state of fine-grained vortex motion,** circulating with that same enormous speed. For it has been partly, though as yet incompletely, shown that such a vortex fluid would transmit waves of the same general nature as light waves— i.e., periodic disturbances across the line of propagation—and would transmit them at a rate of the same order of magnitude as the vortex or circulation speed"*

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