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Maxwell's Original Equations

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Abstract:- Although Maxwell's most important equations had already appeared throughout his seminal paper entitled ***"On Physical Lines of Force"*** **[1]**, which was written in 1861 in Great Britain, it was not until 1864 that Maxwell created a distinct listing of ***eight*** equations in a section entitled *'General Equations of the Electromagnetic Field'* in his follow up paper entitled ***"A Dynamical Theory of the Electromagnetic Field"*** **[2]**. While Maxwell refers to ***twenty*** equations at the end of this section, there are in fact only eight equations as such. Maxwell arrives at the figure of twenty because he splits six of these equations into their three Cartesian components. Maxwell's eight original equations,

$\mathbf{J}_{total} = \mathbf{J}_{conduction} + \partial\mathbf{D}/\partial t$ **(A)**
$\nabla\times\mathbf{A} = \mu\mathbf{H}$ **(B)**
$\nabla\times\mathbf{H} = \mathbf{J}_{total}$ **(C)**
$\mathbf{E} = \mu\mathbf{v}\times\mathbf{H} - \partial\mathbf{A}/\partial t - \mathrm{grad}\psi$ **(D)**
$\mathbf{D} = \varepsilon\mathbf{E}$ **(E)**
$\mathbf{E} = R\mathbf{J}_{conduction}$ **(F)**
$\nabla\cdot\mathbf{D} = \rho$ **(G)**
$\nabla\cdot\mathbf{J} + \partial\rho/\partial t = 0$ **(H)**

will be discussed in depth in individual sections throughout this paper.

Displacement Current

I. The first in the list of eight equations appearing in Maxwell's 1865 paper **[2]** is,

$\mathbf{J}_{total} = \mathbf{J}_{conduction} + \partial\mathbf{D}/\partial t$ **(Total Electric Current)** **(A)**

It is a statement to the extent that the total electric current is the sum of the conduction current and the *'displacement current'*, and it immediately introduces confusion. Maxwell believed that the electromagnetic wave propagation mechanism involves a physical displacement, **D**, in an elastic solid, and he conceived of displacement current, $\partial\mathbf{D}/\partial t$, in relation to this displacement mechanism. Maxwell then added $\partial\mathbf{D}/\partial t$ to Ampère's circuital law as an extra term, as at equation (112) in his 1861 paper [1]. Maxwell seems to have misidentified the physical displacement mechanism in electromagnetic radiation with linear polarization in a dielectric, and this misidentification has resulted in the phenomenon being mis-associated with electric capacitor circuits. Electromagnetic waves however propagate sideways from an electric current, so we therefore require an alternative explanation for the displacement mechanism that is not confined to the space between the plates of a capacitor, and it is most unlikely that we would ever wish to sum such an alternative form of displacement current together with a conduction current in the same equation.

The situation became exacerbated in the twentieth century when the aether was dropped from physics altogether. An *'aether free'* impostor for displacement current was devised in which its divergence is the negative of the divergence of the conduction current. Summing this impostor with the conduction current in Ampère's Circuital Law is of course a corruption by virtue of the addition of an extra term to one side of an equation. It is highly illegal to add an extra term to one side of an equation, because in doing so, the equation will cease to be balanced, and will of course cease to be an equation. See section **VIII** for further discussion on this point.

The Fly-Wheel Equation

II. Maxwell's second equation appeared as equation (55) in Part II of the 1861 paper, and it exposes the fine-grained rotational nature of the magnetic field. Maxwell identified Faraday's *'electrotonic state'* with a vector **A** which he called the *'electromagnetic momentum'*. The vector **A** relates to the magnetic intensity, **H**, through the curl equation,

$$\nabla\times\mathbf{A} = \mu\mathbf{H} \qquad \textbf{(Magnetic Force)} \qquad \textbf{(B)}$$

The vector **A** is the momentum of free electricity per unit volume, and so in principle it is the same thing as the vector **J** that is used to denote electric current density. It's only the context that differs. The vector **A** is used in the context of the fine-grained circular flow within a magnetic field, and so it must correspond to Maxwell's displacement current. The coefficient of magnetic induction, μ, is closely related to mass density and it would appear to play the role of *'moment of inertia'* in the magnetic field. According to Maxwell in 1861, the electrotonic state corresponds to ***"the impulse which would act on the axle of a wheel in a machine if the actual velocity were suddenly given to the driving wheel, the machine being previously at rest."*** He expands upon this fly-wheel analogy in his 1865 paper, in sections (24) and (25).

Since the divergence of a curl is always zero, equation **(B)** can be used to derive the equation $\nabla\cdot\mathbf{H} = 0$, which is equation (56) in Maxwell's 1861 paper, and which appears as an alternative to equation **(B)** in modern listings of Maxwell's equations.

Ampère's Circuital Law

III. In Part I of his 1861 paper, Maxwell proposed the existence of a sea of molecular vortices which are composed of a fluid-like aether. Maxwell's third equation is derived hydrodynamically, and it appears as equation (9) in Part I,

$$\nabla\times\mathbf{H} = \mathbf{J} \qquad \textbf{(Electric Current)} \qquad \textbf{(C)}$$

In Part II of the same paper, Maxwell added electric particles to his aethereal vortices. These particles circled around the edge of the vortices and acted as idler wheels. If we apply equation **(C)** to a single vortex, the vector **J** becomes the electromagnetic momentum vector **A**. Equations **(B)** and **(C)** together point us to an aethereal sea in which closed solenoidal circuits of vortex axes (magnetic lines of force) are interlocked with fine-grained circulations of electric particles ‡. Vector **A** is therefore the displacement current in the sea of molecular vortices.

Part III of Maxwell's 1861 paper deals with the elasticity of the sea of vortices. At the beginning of Part III, Maxwell says,

"In the first part of this paper I have shown how the forces acting between magnets, electric currents, and matter capable of magnetic induction may be accounted for on the hypothesis of the magnetic field being occupied with innumerable vortices of revolving matter, their axes coinciding with the direction of the magnetic force at every point of the field. The <u>centrifugal force</u> of these vortices produces pressures distributed in such a way that the final effect is a force identical in direction and magnitude with that which we observe." James Clerk Maxwell, 1861

The magnetic intensity **H** therefore represents an angular momentum or a vorticity. Maxwell further says in the same part,

"I conceived the rotating matter to be the substance of certain cells, divided from each other by cell-walls composed of particles which are very small compared with the cells, and that it is by the motions of these particles, and their tangential action on the substance in the cells, that the rotation is communicated from one cell to another." James Clerk Maxwell, 1861

However, by 1864, Maxwell seems to have ignored this fine-grained rotational mechanism for electric displacement and focused instead on linear polarization in a dielectric. He seems to have made the serious mistake of blending together the two distinct phenomena of magnetization on the one hand, and linear polarization on the other hand.

(‡When equation ***(C)*** *is applied on the large scale, electric current is a solenoidal flow of aether in which a conducting wire acts like a pipe. The pressure of the flowing aether causes it to leak tangentially into the surrounding sea of tiny vortices, causing the vortices to angularly accelerate and to align solenoidally around the circuit, hence resulting in a magnetic field.)*

The Lorentz Force

IV. Maxwell's fourth equation originally appeared as equation (77) in Part II of his 1861 paper, and it takes the form,

$$\mathbf{E} = \mu\mathbf{v}\times\mathbf{H} - \partial\mathbf{A}/\partial t - \text{grad}\psi \qquad \textbf{(Electromotive Force)} \qquad \textbf{(D)}$$

Maxwell called the vector **E** *'electromotive force'*, but it actually corresponds more closely to the modern day *'electric field'*, and not to the modern-day electromotive force which is in fact a voltage. The first of the three terms on the right-hand side, $\mu\mathbf{v}\times\mathbf{H}$, is the *compound centrifugal force* (Coriolis force) that acts on an element moving with velocity **v** in a magnetic field, where **v** is measured relative to the sea of molecular vortices. The solenoidal alignment of the tiny vortices causes a differential centrifugal pressure to act on either side of the element when it is moving at right angles to the rotation axes of the vortices, and this causes a deflection in the path of motion. The second term involves the electromagnetic momentum **A**, nowadays referred to as the *magnetic vector potential*. This is the torque, $\mathbf{E} = -\partial\mathbf{A}/\partial t$, which appeared as equation (58) in the 1861 paper and which is tied up with time-varying electromagnetic induction and the displacement mechanism in electromagnetic radiation. Maxwell's famous displacement current first appears in the preamble to Part III in the 1861 paper and then again at equation (111) in the same part. It appears in the form $\mathbf{J} = -\varepsilon\partial\mathbf{E}/\partial t$. The negative sign indicates that the displacement is being driven by the applied EMF. In electromagnetic induction however, we are interested in the induced EMF which is in the opposite direction to the applied EMF and so we will remove the negative sign.

If we accept that **J** is equivalent to **A** in the context, then the second term on the right hand side of equation **(D)** leads us to the simple harmonic relationship $\mathbf{A} = -\varepsilon\partial^2\mathbf{A}/\partial t^2$ for the circumferential momentum in the tiny vortices. In Part VI of his 1865 paper, Maxwell used displacement current in conjunction with equations **(B)** and **(C)** in order to derive the electromagnetic wave equation **[2]**. Equation **(B)** introduces the density of the wave carrying medium, while equation **(C)** introduces the elasticity factor through the displacement current. Since displacement current, **A**, is transverse to the tiny vortices, then we are dealing with fine-grained rotational elasticity. We can therefore deduce that Maxwell's displacement current was ideally supposed to be connected with a fine-grained angular displacement in the tiny molecular vortices. In a steady state magnetic field, the displacement current is ubiquitous as a fine-grained localized circulation, but in the dynamic state where $\partial\mathbf{A}/\partial t$ is non-zero, the tiny vortices angularly accelerate and decelerate while pressurized aether overflows from vortex to vortex. This is electromagnetic radiation operating on the fly-wheel principle [3]. Finally, the third term in equation **(D)** is just the electrostatic term, where ψ refers to the electrostatic potential.

If we take the curl of equation **(D)** we end up with $\nabla\times\mathbf{E} = -d\mathbf{B}/dt$, which is unfamiliar because of the total time derivative. If however we ignore the $\mu\mathbf{v}\times\mathbf{H}$ term in equation **(D)**, since it is not used in the derivation of the electromagnetic wave equation, and then take the curl, we end up with the familiar partial time derivative form, $\nabla\times\mathbf{E} = -\partial\mathbf{B}/\partial t$. Heaviside referred to this partial time derivative curl equation as *'Faraday's Law'*. Strictly speaking, it is not exactly Faraday's law because it doesn't cover for the convective aspect of electromagnetic induction that is described by the $\mu\mathbf{v}\times\mathbf{H}$ force. The equation $\nabla\times\mathbf{E} = -\partial\mathbf{B}/\partial t$ appeared as equation (54) in Maxwell's 1861 paper, and it also appears in modern listings of Maxwell's equations. Interestingly, because they don't cover for the $\mu\mathbf{v}\times\mathbf{H}$ force, modern listings have to be supplemented by Maxwell's equation **(D)** from the original list. And even more interesting still is the fact that Maxwell's original equation **(D)** is introduced in modern textbooks, under the misnomer of ***'The Lorentz Force'***, as being something extra that is lacking in Maxwell's equations, and which is needed as an extra equation to compliment Maxwell's equations, in order to make the set complete, as if it had never been one of Maxwell's equations in the first place! Maxwell in fact derived the so-called Lorentz force when Lorentz was only eight years old.

Using the name *'The Lorentz Force'* in modern textbooks for equation **(D)** is somewhat regrettable, in that it gives the false impression that the $\mu\mathbf{v}\times\mathbf{H}$ expression is something that arises as a consequence of doing a *'Lorentz transformation'*. A Lorentz transformation is an unfortunate product of Hendrik Lorentz's misunderstandings regarding the subject of electromagnetism, and these misunderstandings led to even greater misunderstandings when Albert Einstein got involved. Neither Lorentz nor Einstein seemed to have been aware of the contents of Maxwell's original papers, while both of them seemed to be under the impression that they were fixing something that wasn't broken in the first place. In doing so, Einstein managed to drop the luminiferous aether out of physics altogether, claiming that he was basing his investigation on what he had read in the so-called *'Maxwell-Hertz equations for empty space'*! But whatever these Maxwell-Hertz equations might have been, they certainly can't have been Maxwell's original equations.

This is a tragic story of confusion heaped upon more confusion. The aether was a crucial aspect in the development of Maxwell's equations, yet in 1905, Albert Einstein sought to impose Galileo's *'Principle of Equivalence'* upon Maxwell's equations while ignoring the aether altogether. The result was the abominable product which is hailed by modern physicists and known as *'The Special Theory of Relativity'*. Einstein himself knowing that something wasn't right with his special theory of relativity, attempted to make amends in 1915 with his *'General Theory of Relativity'*, but he only made things worse by virtue of spiking Newton's law of gravity with his toxic special theory of relativity. In later years, judging from his Leyden speech in 1920, Einstein realized that the aether was indeed needed after all, but by this time it was too late, because he already had a following of fanatics.

Elasticity, Dielectric Constant, and Permittivity

V. Maxwell's fifth equation is the equation of electric elasticity, which first appeared in the preamble of Part III of his 1861 paper, and then again at equation (105) in the same part. In 1864, the negative sign was removed,

$$\mathbf{D} = \varepsilon\mathbf{E} \qquad \textbf{(Electric Elasticity Equation)} \qquad \textbf{(E)}$$

In Part II of the 1861 paper, Maxwell added electric particles to the tiny vortices that featured in Part I. These electric particles moved around the circumference of the vortices and acted as idler wheels. In Part III, the sea of molecular vortices along with the accompanying idler wheel electric particles morphed into an elastic dielectric solid. The electric permittivity, ε, is related to the elasticity of the dielectric solid although it should be noted that Maxwell actually used a dielectric constant which is inversely related to the permittivity. The elasticity constant is central to electromagnetic radiation, since through the 1855 Weber-Kohlrausch experiment **[4]**, it introduces the speed of light.

Knowing that Newton's equation for the speed of a wave in an elastic solid involves the ratio of transverse elasticity to density, Maxwell was able to equate this ratio to the ratio of the dielectric constant to the coefficient of magnetic induction. He then showed that the ratio of the dielectric constant to the coefficient of magnetic induction was equivalent to the ratio of electrostatic units of electricity to electromagnetic units of electricity, this ratio being closely related to the directly measured speed of light. In 1855 Weber and Kohlrausch, by discharging a Leyden jar, equivalent to a modern-day capacitor, had shown that the ratio of electrostatic units to electrodynamic units was numerically equal to $c\sqrt{2}$, and in 1861, Maxwell made the conversion from electrodynamic units to electromagnetic units. Maxwell was therefore able to insert a numerical result into Newton's equation and hence conclude that waves in the luminiferous medium travel at the speed of light, and that hence light must be a transverse undulation in the same medium that is the cause of electric and magnetic phenomena. In his own words he stated,

"we can scarcely avoid the inference that light consists in the transverse undulations of the same medium which is the cause of electric and magnetic phenomena" James Clerk Maxwell, 1861

In establishing this fact, Maxwell had inadvertently demonstrated at equation (132) in his 1861 paper, that Newton's equation for the speed of a wave in the luminiferous medium is equivalent to the famous equation $\mathbf{E} = mc^2$ that is normally attributed to Albert Einstein. This Newton-Maxwell equation, wrongly attributed to Einstein more that forty years later, can alternatively be written as the well-known equation $c^2 = 1/\mu\varepsilon$. It should always be remembered though that Maxwell in turn obtained the numerical values from the 1855 experiment of Weber and Kohlrausch. It is often wrongly assumed that the numerical value of the speed of light itself fell out of Maxwell's theoretical manipulations. This is not so. The genius of Maxwell's theoretical work was in exposing the physical significance of the 1855 Weber-Kohlrausch result using Newton's equation in relation to a dielectric solid.

Ohm's Law

VI. Maxwell's sixth equation is Ohm's law,

$$\mathbf{E} = R\mathbf{J}_{\text{conduction}} \qquad \textbf{(Ohm's Law)} \qquad \textbf{(F)}$$

where R is the specific resistance referred to unit volume. Ohm's law is an equation which is of interest in electric circuit theory, but it holds no interest value in terms of the connection between the electric current and the magnetic field.

Gauss's Law

VII. Maxwell's seventh equation appeared as equation (115) in his 1861 paper,

$$\nabla\cdot\mathbf{D} = \rho \qquad \textbf{(Gauss's Law)} \qquad \textbf{(G)}$$

Gauss's law is an equation of aether hydrodynamics and the quantity ρ is the density of *'free electricity'*. Free electricity can only mean *the aether*, alternatively known as the *electric fluid*. While the aether itself behaves like a fluid, the luminiferous medium in its totality is a solid that is comprised of densely packed aether vortices. The repulsive electromagnetic forces and the inertial forces are based on the centrifugal pressure that exists between neighbouring vortices as they press against each other while striving to dilate **[5]**, but Gauss's law deals with the flow of aether into and out of sources and sinks which we call positive and negative particles.

Maxwell knew that gravitational field lines must involve a lateral pressure as is the case between two repelling like magnetic poles, but he failed to realize that this pressure in the gravitational field is actually the inverse cube law centrifugal repulsive pressure as opposed to the inverse square law gravitational attractive tension.

The Equation of Continuity

VIII. Maxwell's eighth equation, number (113) in his 1861 paper,

$\nabla\cdot\mathbf{J} + \partial\rho/\partial t = 0$ **(Equation of Continuity)** **(H)**

is the equation of continuity, which like equation **(G)** *(Gauss's law)*, is another equation of hydrodynamics. This equation is used in modern textbooks in conjunction with one of the greatest scientific deceptions of the twentieth century. It is used in conjunction with Gauss's law for the purpose of deriving a term that has the outward mathematical form of Maxwell's displacement current, but which cannot connect with the curl equations that are used in the derivation of the electromagnetic wave equation. The actual displacement mechanism, as occurs in electromagnetic wave propagation, involves the rotational electromagnetic momentum **A**, and hence the **E** field associated with the displacement current should be $\mathbf{E} = -\partial\mathbf{A}/\partial t$, and not the electrostatic **E** as per $\mathbf{E} = -\text{grad}\psi$ and $\nabla\cdot\mathbf{E} = \rho/\varepsilon$. Electromagnetic radiation is a fine-grained fly-wheel mechanism. The modern textbooks, in deriving displacement current, have however been diverting attention to the irrelevant issue of *'conservation of charge'* and using Ampère's Circuital Law in conjunction with a broken electric circuit in which charge accumulates, such as a capacitor circuit, even though Ampère's Circuital Law applies strictly in connection with unbroken solenoidal currents where $\nabla\cdot\nabla\times\mathbf{H} = 0$. Displacement current's irrotational impostor, in a highly illegal move *(see section I above)*, is then inserted alongside the conduction current in Ampère's Circuital Law. This is then supposed to make everything right, on the grounds that the divergence of the combined result will now equal zero. Modern textbooks then force fit this irrotational displacement current impostor with the rotational curl equations in order to fraudulently derive the electromagnetic wave equation. It's quite amazing just how many top physicists and mathematicians fail to notice this deception and fail to realize that the curl equations require a displacement current which involves the rotational relationship $\mathbf{E} = -\partial\mathbf{A}/\partial t$. It seems that they are all quite content to use the irrotational relationship $\mathbf{E} = -\mathrm{grad}\psi$, and to derive the electromagnetic wave equation as if this irrotational electrostatic force were one and the same thing as the time varying electromagnetic force. This sleight of hand is in fact a mathematical conjuring trick that enables the modern textbooks to purport to derive the electromagnetic wave equation without involving Maxwell's sea of molecular vortices, hence furthering the cause of *'aether denial'*.

Linear Polarization, Charge, and Cable Telegraphy

IX. Maxwell's papers of 1861 and 1865 make no explicit mention of the concept of electric charge. Maxwell talks about *'free electricity'* and *'electrification'*. By free electricity, it would appear that he is talking about a fluid-like aethereal substance that corresponds to the vitreous fluid of Franklin, Watson, and DuFay, and it would appear that when Maxwell is talking about the density of free electricity that he is talking about a quantity which corresponds very closely to the modern concept of electric charge. Charge would therefore appear to be aether pressure and aether tension. Such a hydrodynamical approach to charge enables us to explain how net charge enters an electric circuit when it is switched on, as like water coming from a tap. An actual substance enters the circuit from the outside.

If Maxwell's aethereal vortices are dipolar, each comprised of an aether sink (electron) and an aether source (positron), magnetic charge can then be understood as electrostatic charge channelled along a double helix **[6]**. On knowing this, nobody is going to be asking questions like *'why can we not find magnetic monopoles?'* The magnetic equation $\nabla\cdot\mathbf{H} = 0$ describes the solenoidal nature of the lines traced out by the rotation axes of neighbouring vortices. This equation is simply Gauss's law for bi-directional aether flow, and magnetic charge is simply the electrostatic tension along the magnetic lines of force. There are no magnetic monopoles. We are dealing with cylindrical symmetry. There are only electric monopoles, and in a magnetic field, positive electric monopoles and negative electric monopoles exist in equal numbers, leading to overall electric neutrality. It is the double helix alignment of positive and negative electric monopoles that is the secret of magnetic charge in relation to magnetic attraction, and the magnitude of the magnetic attractive force will depend on the concentration of magnetic lines of force, and hence it will depend on the magnetic flux density, $\mathbf{B}$, which is equal to $\mu\mathbf{H}$.

Magnetization is something that is connected with wireless telegraphy. It is a rotational effect associated with the angular acceleration of the molecular vortices that fill all of space. Electromagnetic waves radiate from the side of an electric current. The tiny vortices in the magnetized state are acting like fly-wheels. Linear polarization on the other hand is slightly more complicated and it involves the dipolar nature of the molecular vortices [7]. It is more analogous to a mechanical spring. It is the subject that we are dealing with in connection with cable telegraphy. An electric current begins as pure pressurized aether flow. It may or may not involve the flow of particles as a secondary effect. Positive particles may be pushed along with the aether flow and negative particles may eat their way in the opposite direction towards the source, but the primary event is the flow of pure pressurized aether. Hence when we first switch an electric circuit on, there will be a net injection of pressurized aether into the circuit from the power source. The pressurized aether will cross the dielectric gap between the two conducting wires so as to flow in a closed circuit which will inflate and expand until it settles inside the conducting wires. Conducting wires act like arteries for aether flow. The situation is easiest to visualize in the case of two parallel wires as are used in a transmission line. As the current circulation is initially advancing through the dielectric space between the two wires, the aethereal current that crosses the dielectric laterally will form a step. Linear polarization of the luminiferous medium will be occurring at this step, and this will oppose the current. Hence the current will go wide of this impedance, causing the step to advance in a wave like fashion. This is the principle behind cable telegraphy [7].

When, in Part III of his 1861 paper, Maxwell first established the connection between the speed of light and the elasticity of the luminiferous medium, he did so on the basis of linear polarization in a dielectric solid. This elasticity was then later transferred into the electromagnetic wave equation that he derived in his 1865 paper [2]. Maxwell had now integrated the linear elasticity of a dielectric with a theory of magnetism that was based on the rotational elasticity of vortices and fly-wheels. It might be argued that this was a force-fit. Linear elasticity in a dielectric can however be reconciled with rotational elasticity if the constituent dipoles are rotating. This is because the polarizing electric field will cause a torque to act on the rotating dipoles. This would suggest that the electric permittivity of the luminiferous medium applies equally to the elasticity of linear polarization and to magnetization, as in both cases the elasticity is transverse and rotational.

Conclusion

X. The electromagnetic wave propagation mechanism depends upon the existence of a sea of tiny molecular vortices as advocated by James Clerk

Maxwell in 1861. Maxwell's equations were derived using hydrodynamics and elasticity based on the existence of such a physical medium, and these equations therefore cease to have any meaning in physics once this medium is removed. Weber and Kohlrausch first made the connection between electromagnetism and the speed of light in 1855 by discharging a Leyden jar (capacitor) and measuring the ratio of electrostatic to electrodynamic units of electricity **[4]**. The significance of Maxwell's original papers is that they connect light with an all-pervading elastic solid which enables the electromagnetic induction mechanism to operate throughout all of space. It is generally forgotten that the equation $c^2 = 1/\mu\varepsilon$ follows from the 1855 Weber-Kohlrausch experiment and not from Maxwell's equations. Maxwell connected this equation with Newton's equation for the speed of a wave in an elastic solid, hence inadvertently showing its equivalence to $\mathbf{E} = mc^2$, but unless we numerically establish the electric permittivity experimentally using a discharging capacitor, we can have no basis whatsoever to assume the existence of an equation of the form $c^2 = 1/\mu\varepsilon$.

Unfortunately, Maxwell didn't distinguish clearly enough between the rotational magnetization mechanism on the one hand, and the linear polarization mechanism on the other hand, in relation to the physical nature of the displacement that is involved in electromagnetic radiation. Had he done so, he would have realized that the magnetic vector potential, **A**, that he linked to Faraday's *electrotonic state*, is in fact his famous displacement current.

Nevertheless, Maxwell's original works are pioneering works of enormous value which pointed us in the right direction, and any shortcomings within these works pale into insignificance when compared with the errors that followed in Maxwell's wake. Lorentz, Poincaré, and Einstein had an obsession with finding a symmetry in Maxwell's equations where no symmetry exists, nor was ever meant to exist. Einstein couldn't see that convective EM induction must involve an interaction with a sea of aethereal vortices. The end result was that Einstein dropped the aether altogether and took us into a mad world of relativity where two clocks can both go slower than each other, and where electromagnetic waves can propagate in a pure vacuum without the need for any physical displacement mechanism.

Since 1983, the situation has degenerated even further still. The speed of light is now a defined quantity rather than a measured quantity, and the equation $c^2 = 1/\mu\varepsilon$ has become a meaningless conversion formula without enquiry as to its physical origins. Hence the physical elasticity *(electric permittivity ε)* that is connected with the electromagnetic wave propagation mechanism has been eaten up by one big mathematical tautology, and to make matters worse, those supporting Einstein's theories of relativity have the audacity to claim that these theories are a natural consequence of Maxwell's work, when in fact Maxwell and Einstein were not even remotely working along the same lines. Maxwell is quite clear about the fact that the $\mu\mathbf{v}\times\mathbf{H}$ force is a centrifugal force *(more precisely a compound centrifugal force (Coriolis force))*, and that the velocity,

v, is measured relative to the physical medium for the propagation of light. Modern physics is languishing in a totally misguided relativity-based paradigm in which physicists have been brainwashed into believing that neither centrifugal force nor the aether exist **[8]**. This nonsense needs to end. We need to go back to Maxwell and start again.

References

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http://vacuum-physics.com/Maxwell/maxwell_oplf.pdf

[2] Clerk-Maxwell, J., ***"A Dynamical Theory of the Electromagnetic Field"***, Philos. Trans. Roy. Soc. London **155**, pp 459-512 (1865). Abstract: Proceedings of the Royal Society of London 13, pp. 531--536 (1864). The original eight Maxwell's equations are found in the link below in Part III entitled *'General Equations of the Electromagnetic Field'* which begins on page 480,
http://www.zpenergy.com/downloads/Maxwell_1864_3.pdf
Maxwell's derivation of the electromagnetic wave equation is found in the link below in Part VI entitled *'Electromagnetic Theory of Light'* which begins on page 497,
http://www.zpenergy.com/downloads/Maxwell_1864_4.pdf

[3] The 1937 Encyclopaedia Britannica article on *'Ether in Physics'* discusses its structure in relation to the cause of the speed of light. It says, *"POSSIBLE STRUCTURE._The question arises as to what that velocity can be due to. 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 order of magnitude as the vortex or circulation speed - - - -"*

[4] Tombe, F.D., ***"The 1855 Weber-Kohlrausch Experiment"***, (2019)
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[5] Whittaker, E.T., ***"A History of the Theories of Aether and Electricity"***, Chapter 4, pages 100-102, (1910) *"All space, according to the younger Bernoulli, is permeated by a fluid aether, containing an immense number of excessively small whirlpools. The elasticity which the aether appears to possess, and in virtue of which it is able to transmit vibrations, is really due to the presence of these whirlpools; for, owing to centrifugal force, each whirlpool is continually striving to dilate, and so presses against the neighbouring whirlpools."*

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