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The Unification of Electricity and Magnetism

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Annotation by author in red added 4th June 2019:- Reading over this article again twelve years later, it is clear that the whole point could have been explained in a greatly simplified manner. The origins of the article trace back to March 1982 when I learned that Scottish physicist James Clerk Maxwell had derived his displacement current idea on the basis of linear polarization in a dielectric. It wasn't until 2005 while in the Philippines that I began to study Parts I and II of Maxwell's 1861 paper [2], where to my surprise he treated the electromagnetic field, not in terms of a dielectric, but rather in terms of a sea of molecular vortices. In early 2006, I finally accepted that I couldn't explain the magnetic F = qv×B force in terms of a dielectric, and so I considered where in nature do we encounter a force with similar mathematical form. The Coriolis force immediately came to mind and I then took a closer look at the manner in which Maxwell had aligned his molecular vortices in order to construct a magnetic field. This led me to propose *"The Double Helix Theory of the Magnetic Field"* which is in essence a combination between a dielectric and Maxwell's sea of tiny aethereal vortices. It was only then that I clearly realized that magnetization cannot be physically explained in terms of linear polarization.

But it wasn't until I was on a bus travelling from Kota Kinabalu to Sandakan in Sabah, Malaysia, in late October 2006, that I started to have problems with Maxwell's displacement current in the context of the double helix alignment. This was because until then I had still been clinging to the idea that displacement current is a linear polarization effect, notwithstanding that I had further failed to realize by this stage that linear polarization of a rotating dipole would result in a torque and hence a precession. It was during this bus journey when it dawned on me that displacement current in wireless radiation is actually about

angular displacement, and that hence it is a magnetization effect and not a linear polarization effect. This realization was to some degree inspired by the fact that the displacement current which exists in wireless waves radiates sideways from a wire, perpendicularly to the direction of the current, whereas the linearly polarized region between the plates of a capacitor is parallel to the current and it never leaves the vicinity of the circuit.

On reading my own article below, although I still hold to all the final conclusions, I realize that the explanation for why magnetization and polarization are two different phenomena is over cumbersome and not entirely accurate. For example, the only magnetic field in a charged capacitor will be the background magnetic field which has got nothing to do with the capacitor circuit itself. It would have been sufficient to have pointed out that the linear polarization between the plates of a charged capacitor does not constitute a magnetic field, and that in an inductor circuit when the power is switched off, the stored magnetization, unlike the stored energy in a capacitor, discharges forwards, whereas in a capacitor the discharge is backwards. The argument has now been presented in a more concise manner in a new paper entitled *"Isotropy in the Electromagnetic Field"* which can be found in this link,
https://www.researchgate.net/publication/333599783_Isotropy_in_the_Electromagnetic_Field
The article draws attention to the fact that Maxwell begins Part III of his 1861 paper talking about a sea of molecular vortices whereas he finishes that same part talking about a perfect isotropic dielectric solid, an idea which he then carries forward into his later paper in 1865 entitled *"A Dynamical Theory of the Electromagnetic Field"* [1].

Abstract. It is widely believed that electricity and magnetism were united by James Clerk Maxwell in the nineteenth century. In his 1865 paper *'A Dynamical Theory of the Electromagnetic Field'* [1], Maxwell substituted the quantity 'Displacement Current' into Ampère's circuital law and he obtained the electromagnetic wave equation. Displacement current is generally believed to incorporate Gauss's law and so it would appear that Maxwell had successfully united electrostatics with electromagnetism.

Maxwell's physical explanation for displacement current began in terms of tangential stress on the electrical particles in his sea of molecular vortices and it later developed into dielectric linear polarization current. Maxwell was on the right tracks when he considered the tangential stress on the electrical particles in his vortex sea, but he went wrong when he later ignored his molecular vortices to concentrate on the dielectric aspect of the aether.

There exists a tangential quantity that might be accurately described as *'Angular Displacement Current'* which exists perpendicular to linear polarization current and which has an identical mathematical form. Maxwell mistakenly interpreted displacement current in electromagnetic radiation to refer to linear polarization current, when in fact it should more accurately refer to angular displacement current. Angular displacement current is a rotational phenomenon and it will be concluded that electromagnetic radiation is a gyroscopic phenomenon involving the coherent plane polarized propagation of rotations (including precessions) and also the longitudinal propagation of centrifugal pressure.

Polarization and Magnetization

I. The purpose of this article is to examine and to find the solution to certain problems that have arisen in the double helix theory of the magnetic field. These problems are connected with confusion surrounding the physical interpretation Maxwell's displacement current. Maxwell's displacement current has been traditionally associated with the phenomenon of linear polarization.

In ***'The Double Helix Theory of the Magnetic Field'***,

https://www.gsjournal.net/Science-Journals/Research%20Papers-Mathematical%20Physics/Download/6371

it was explained how a magnetic field line is comprised of rotating electron-positron dipoles aligned in their axial planes, electron above positron, such as to render a Coulomb tension in the axial direction, and such as to cause the magnetic force of attraction.

Under this theory an electron-positron dipole consists of an electron and a positron undergoing a mutual circular orbit. Linear polarization of a sea of such electron-positron dipoles would consist in the individual orbits of the electrons and positrons being displaced from each other in their equatorial planes under the radial action of an external Coulomb force. An electric current would be occurring while the polarization is in progress, and under existing electromagnetic theory we should expect this linear displacement current to be accompanied by a magnetic field. Our current textbooks contain a set of four equations that are commonly referred to as 'Maxwell's Equations'. One of these equations contains Maxwell's displacement current and if we interpret it in terms of linear polarization current, we are left with no choice but to conclude that polarization and magnetization must necessarily coexist in the dynamic state.

We will now look at some evidence that suggests that polarization and magnetization are actually two separate phenomena and that they can exist independently of each other even in the dynamic state.

In the static state of a fully charged electrical capacitor where linear polarization of the electric sea exists between the plates, it is an accepted fact that this situation is not accompanied by a magnetic field. This presents no problem from an establishment perspective, but in the double helix theory the polarized electron-positron dipoles between the capacitor plates must still nevertheless be arranged in a solenoidal fashion as a result of the gyroscopic aligning force which we will discuss in section **II** below. We would still expect the solenoidal form of a magnetic field to be present. This dilemma could be explained away by suggesting that the polarization process negates any tendency for the vorticity of the dipoles to increase. For a magnetic field to exist, we need to have an increase in the vorticity of the electron-positron dipoles above a standard minimum value.

Unfortunately, this explanation runs into trouble when we consider the electrical inductor (LR) circuit. In the LR circuit we know that when the current is changing, we will also have a changing magnetic field surrounding the wire. According to standard electromagnetic theory we should also have a displacement current while the dynamic state is in progress. From an establishment perspective this presents no problem because there exists no established physical model for displacement current. However, within the context of the double helix model, and based on what was said in the

previous paragraph regarding the static capacitor circuit, if the displacement current is a linear polarization current then we would expect that it should undermine the changing magnetic field. There is certainly no evidence that any undermining of the magnetic field occurs during the dynamic state of an LR circuit.

The double helix model would prefer the LR circuit to be explained entirely by virtue of circular electron-positron dipoles acting like fly-wheels and without the involvement of linear polarization at all. Unfortunately, Maxwell's displacement current is an integral part of the dynamic state and if it constitutes linear polarization current, it would follow that polarization and magnetization must coexist in the dynamic state.

The manner in which the electromagnetic wave equation is derived using Maxwell's displacement current makes it highly unlikely that displacement current is not involved in electromagnetic radiation. However, when we derive the electromagnetic wave equation, the formula for the electric field vector **E** is the rotational/non-conservative $\partial\mathbf{A}/\partial t$ term from the Lorentz force. This contradicts derivations of the displacement current that are based on the idea that **E** is given by the Coulomb force. We also know that the Coulomb force is a conservative force whereas electromagnetic waves involve the transfer of energy. Since it is therefore certain that displacement current involves the $\partial\mathbf{A}/\partial t$ force, we should get a better idea of the true nature of displacement current if we could find out more about the true physical nature of $\partial\mathbf{A}/\partial t$.

The Four Fundamental Forces

II. An equation of the basic form,

$$\mathbf{E} = -d\mathbf{A}/dt \qquad \textbf{(1)}$$

appears at equation (58) in Maxwell's 1861 paper ***'On Physical Lines of Force'*** [2], where **E** represents electric field. Maxwell's paper can be seen at this web link,

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

It does not appear that Maxwell was fully aware of the physical significance of equation (58). Equation **(1)** (or equation (58)) is the single equation that accounts for all the fundamental forces, and it makes no distinction between whether we are dealing with gravity or electricity. We can treat equation **(1)** as if it were a hydrodynamical equation for a dynamic aether of unknown substance where that substance is the stuff of space itself. Maxwell was working with the unified field theory without realizing it.

If **A** represents the field velocity for the aether, equation **(1)** can be expanded into four components. See ***'Gravitational Induction and the Gyroscopic Force'***,

https://www.gsjournal.net/Science-Journals/Research%20Papers-Astrophysics/Download/198

These four components can be divided into two radial components, and two tangential components. The radial components and the tangential components can each be divided into a local component and a convective (velocity dependent) component.

The four components are,

(1) The radial inflow component. This is an irrotational conservative force. It is a local force and it can be represented by the Coulomb force or by Newton's law of gravity. The radial (Coulomb) component provides the magnetic force of attraction in the axial direction of magnetic field lines.

(2) The radial centrifugal force is a mutually repulsive force that occurs between any two objects that possess mutual tangential speed. It is a convective force that is important in orbital theory, and it also causes repulsion pressure in matter. See ***'Archimedes' Principle in the Electric Sea'*** at,

https://www.gsjournal.net/Science-Journals/Research%20Papers-Mechanics%20/%20Electrodynamics/Download/205

and also see ***'Electric Centrifugal Force'*** by Prof. AKT Assis in Brazil at,

http://www.ifi.unicamp.br/%7Eassis/Commun-Theor-Phys-V18-p475-478(1992).pdf

The centrifugal force provides the force of repulsion between two ferromagnets or between two electromagnets by virtue of the spreading outwards of magnetic field lines in conjunction with an equatorial alignment of dipoles. A similar centrifugal repulsion can occur between the solenoidally aligned polarization lines that spread away from each other in the space between two negatively charged bodies.

(3) The tangential gyroscopic $\mathbf{E} = \mathbf{v}\times\mathbf{B}$ force. This is the Coriolis force. It is a convective force that causes gyroscopes to precess. It would have an aligning effect on rotating electron-positron dipoles. The aether which flows out of the dipole positrons and into the dipole electrons provides a rotating frame of reference that invokes the gyroscopic force in electromagnetic induction. The $\mathbf{E} = \mathbf{v}\times\mathbf{B}$ force is one of two forces involved in electromagnetic induction.

(4) The angular $\partial\mathbf{A}/\partial t$ force. This is a local and tangential term. Together with the other local radial inflow term (Coulomb force) it represents the local rate of vortex aether flow. The angular force is a rotational force and hence it is not conservative. The angular force is the only one of the four fundamental forces which allows for the transfer of energy, and along with the $\mathbf{E} = \mathbf{v}\times\mathbf{B}$ force it is one of the two forces involved in electromagnetic induction.

Polarization and the Coulomb Force

III. The Coulomb force is the force that causes linear polarization. If we consider a circular rotating electron-positron dipole in an applied electrostatic field, then the Coulomb force will act radially on the electron and positron in one direction and serve to displace the individual orbits of the electron and the positron from each other. We will have a linear displacement of two circular motions. Since the Coulomb force is a conservative force, energy will be stored in the system.

In a sea of electron-positron dipoles, the centrifugal pressure will curtail the elongation of the individual orbits during the polarization procedure, and so the stored energy will be predominantly kinetic energy and the polarized dipoles will appear approximately as two intersecting circles.

If two charged spheres are such that the polarization field lines between them are spreading outwards from each other, these field lines will have to be arranged both radially and solenoidally as best as is possible. The stored kinetic energy in the polarized dipoles will increase the centrifugal repulsion between adjacent field lines and the overall effect will be to cause a repulsive force to act between the charged spheres. This would be on top of the Coulomb force acting directly between the spheres. The issue of dominance is discussed in ***'Gravity Reversal and Atomic Bonding'*** at,

https://www.gsjournal.net/Science-Journals/Research%20Papers-Mechanics%20/%20Electrodynamics/Download/201

Magnetization and the $\partial\mathbf{A}/\partial t$ Force

IV. It was shown in section **II** that $\partial\mathbf{A}/\partial t$ is a rotational tangential angular force that acts at right angles to the Coulomb force. Let us now consider the rotating electron-positron dipole once again. If the angular $\partial\mathbf{A}/\partial t$ force acts tangentially on the dipole, it will serve to cause an angular acceleration. If the angular force acts in the equatorial plane, the vorticity of the dipole will increase. If it acts at an angle between the equatorial plane and the axial plane, it will cause the dipole to precess and change its orientation. Magnetization is the process of changing the vorticity in the electric sea.

Since the electric field term **E** in Maxwell's displacement current is represented by the angular $\partial\mathbf{A}/\partial t$ force, we can conclude that Maxwell's displacement current more accurately refers to angular displacement current.

In other words, electromagnetic radiation is a propagation of rotations of the electron-positron dipoles and it doesn't involve linear polarization at all. Likewise, linear polarization is not directly connected with changes in the magnitude of a magnetic field. Polarization and magnetization are two separate but closely related phenomena. The Coulomb force causes polarization by external action on the electric sea such as to separate the electron-positron dipoles into two separate orbits in a state of stored kinetic energy. The angular $\partial\mathbf{A}/\partial t$ force causes magnetization which is about changing the vorticity of the electron-positron dipoles. Magnetization can be induced by bar magnets, electric currents, and by spin sources.

Electromagnetic Waves

V. Electromagnetic waves involve the tangential angular force $\partial\mathbf{A}/\partial t$ and they therefore constitute the propagation of rotations. These propagated rotations could be in the equatorial plane of the dipoles as would be the case when the electric current source of a magnetic field is increasing. In this case, the effect of the propagated rotations would be to increase the vorticity and hence the magnetic field strength.

The propagated rotations could also be at some angle between the equatorial and the axial plane of the dipoles as would be caused when a magnet is rotating (other than on its magnetic axis). In this case, the effect of the propagated rotations would be that of a precessional re-alignment of the magnetic field.

Electromagnetic waves can therefore be magnitude changing waves associated with accelerated spin or they can be direction changing waves associated with propagated precession.

It was shown in ***'The Link between Electric Current and magnetic Field'*** at,

https://www.gsjournal.net/Science-Journals/Research%20Papers-Mechanics%20/%20Electrodynamics/Download/210

that it is the convective Coriolis and centrifugal compressions that are involved in transmitting the propagated angular acceleration. The angular acceleration is actually the effect whereas the convective forces are the cause. The entire electromagnetic radiation phenomenon is based on a vortex flow in which aether swings diagonally from vortex to vortex. The net aether flow accounts for radiation pressure and the famous mass energy equivalence formula $\mathbf{E}=mc^2$. See ***'The Connection between Gravity and Light'*** at,

https://www.gsjournal.net/Science-Journals/Research%20Papers-Mechanics%20/%20Electrodynamics/Download/208

The Coriolis/centrifugal compressions that account for radiation pressure are probably at an angle that is diagonally off longitudinal.

Conclusion

VI. James Clerk-Maxwell's two biggest mistakes were,

(1) Dropping his molecular vortex concept simply because he couldn't accurately visualize how the electrical particles interacted with the vortices.

(2) Interpreting displacement current in electromagnetic radiation as a linear polarization effect. This had the long-term effect of causing the scientific establishment to fail to realize that electromagnetic radiation is a rotational phenomenon. It should however have alerted them to the fact that electromagnetic radiation necessarily propagates in a dielectric medium.

Apart from these two mistakes, Maxwell was within grasp of obtaining the unified field theory. Equation (58) in part II of his 1861 paper 'On Physical Lines of Force' was in actual fact the unified field theory. Maxwell failed to detect it despite the fact that equation (5) in part I of the same paper was the expansion of equation (58) within the context of a sea of aether vortices.

Maxwell knew that the aether alone could not constitute the luminiferous medium. He knew that the luminiferous medium had to constitute a sea of aether vortices, and he knew that these aether vortices had to be stabilized by being linked to electrical particles.

Had he taken the electrical particles in his molecular vortices to be a single electron in orbit with a single positron, then he would have had a picture of an aethereal medium flowing out of the positron and into the electron, and hence providing a vortex.

The aether is the cause of all the fundamental forces, and it leads to the theory of electromagnetism when taken in conjunction with a sea of rotating electron positron dipoles. The rotating aether inside each electron positron dipole acts as the rotating frame of reference needed to induce the gyroscopic $\mathbf{E} = \mathbf{v}\times\mathbf{B}$ force.

Electromagnetic radiation is a gyroscopic phenomenon consisting of coherent propagations of rotational kinetic energy. It consists of propagating rotations, precessions, and centrifugal compressions.

References

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