Gravitation, Electrostatics, and the Electron-Positron Aether (Ether)

(Based on the 1982 paper by David Tombe, entitled Electrogravitomagnetism)

Frederick David Tombe

Northern Ireland, United Kingdom
E-mail: sirius184@hotmail.com
atlantis184@btopenworld.com

Abstract. **PART 1** A unified derivation of Newton's law of gravitation, and Coulomb's law of electrostatics, demonstrates charge to be a property associated with acceleration, and inertial mass to be a measure of the amount of matter in a body. It also demonstrates inertial mass to have an effect on acceleration in relation to electrostatic forces, but not in relation to gravitational forces. The derivation demonstrates from first principles that electrostatics and gravitation are mathematically parallel, despite this apparent difference between them. Einstein was aware that the acceleration of a body under gravity is independent of its inertial mass, but his interpretation of this fact, which led to his General Theory of Relativity, is called into question.

PART 2 Maxwell's displacement current is considered. Attention is drawn to the close association between Maxwell's displacement current and Coulomb's law of electrostatics. It is concluded that an electromagnetic force must ultimately be an electrostatic force in origin, when examined at the microscopic level, and that this can only be possible by introducing an elastic aether comprised of electrons and positrons. Electromagnetism is the manifestation of stresses and strains in the aether, whereas the forces acting between the particles of the aether are electrostatic. The force acting on a charged particle moving in a magnetic field, which we will refer to as 'The Lorentz Force', is then considered. The Lorentz Force is incorporated into Maxwell's equations, leading to a slight modification in the latter. This modification involves replacing the partial time derivatives with total time derivatives, and therefore removing any ambiguity about which frame of reference Maxwell's equations are valid in. They are valid in the geocentric aether rest frame. Maxwell's equations do not, as is customarily believed, give any credence whatsoever to Einstein's postulate of the constancy of the speed of light.

PART 1

One notable difference between electrostatics and gravitation is that in electrostatics, we have two types of charge, which are both mutually repulsive, whereas in gravitation, we only have one kind of charge, and it is mutually attractive. This difference is sufficient to give rise to a principle in gravitation, which is not paralleled in electrostatic theory. The principle, demonstrated notoriously by Galileo from the Leaning Tower of Pisa, is that under the force of gravity, bodies of different weights will fall at the same rate. Einstein observed this principle from a different angle. He considered it as a 'Principle of Equivalence' of inertial mass and gravitational mass. This 'Principle of Equivalence' became the cornerstone of his General Theory of Relativity, which allowed the theory of gravitation to appear more different than the theory of electrostatics, than it might otherwise have done.
A new combined derivation of Newton's law of gravitation and Coulomb's law of electrostatics will take place below, demonstrating that the two forces are absolutely mathematically parallel, and that inertial mass and gravitational mass are quite definitely not equivalent. These facts call into question the validity of Einstein's General Theory of Relativity (1915), never mind why this theory can only be applied to gravitation, and not to electrostatics. This is not withstanding the fact that the General Theory of Relativity hinges entirely on the validity of Einstein's Special Theory of Relativity (1905). The Special Theory of Relativity will be undermined in the second part of this paper.

(1) Electric charge Q, is a property associated with a body, which partly determines its acceleration, within the context of Coulomb's law of electrostatics.
Inertial mass m is another property associated with a body, which also partly determines acceleration in relation to electrostatic forces. Ernst Mach defined inertial mass in terms of the inverse ratio of the accelerations a, which two bodies induce on each other as a result of electrostatic interaction. (Most common interactions such as collisions, friction, air resistance etc., are electrostatic in origin). Mach's definition of inertial mass is summed up in the equation

$$\frac{m_1}{m_2} = \frac{a_2}{a_1} \tag{1}$$

On cross-multiplying equation (1), this definition exposes Newton's three laws of motion as being merely a definition of the two quantities (i) inertial mass, and (ii) force. Since a definition cannot be wrong, it follows that Newton's laws of motion cannot be wrong either, in any circumstances whatsoever.
Gravitational mass, which I prefer to call gravitational charge W, is to Newton's law of gravitation, what electric charge is to Coulomb's law of electrostatics. In classical mechanics we give both m and

W the same units since they are directly proportional to each other in magnitude, and this disguises the fact that they are quite different quantities.

A UNIFIED DERIVATION

(2) Consider the acceleration of an elementary particle (a particle that is not made up of other particles) in a frame of reference, which is fixed relative to the background stars. Let us postulate an acceleration law, which may lead us to existing classical theory, when summed over a system of particles. The postulate has to take into consideration the fact that neither force, nor inertial mass have as yet been defined, and as such cannot appear at this stage. Likewise, Newton's Law of gravitation, and Coulomb's law of electrostatics have not yet been discovered, hence forbidding any criticism of equation (2) in relation to any manner in which it might appear to be at variance with Newton or Coulomb. The Question is whether or not the postulate will lead us to Newton's and Coulomb's laws. Let us postulate that the acceleration law for an elementary particle is;

$$\ddot{\underline{r}} = \frac{\pm Q - W}{r^2}\hat{\underline{r}} \tag{2}$$

The left hand side represents the acceleration of a particle due to it being in the vicinity of another particle of charge $Q - W$. The only property of the particle, whose acceleration we are considering on the left hand side of the equation (2), which will actually effect its own acceleration, is the sign of its own electric charge. This will determine the sign beside the Q on the right hand side of equation (2).

(3) If it is desired to apply this law to situations concerning the acceleration of systems of particles, we must first of all clarify the meaning of such. Mass has not yet been defined, and so we cannot talk about the 'centre of mass'. We therefore consider the motion of a point defined with respect to the system, which will be called the 'centre of charge', and defined as follows

$$\underline{R} = \frac{\sum_{i=1}^{n}(|Q_i| - W_i)\underline{r}_i}{\sum_{i=1}^{n}(|Q_i| - W_i)} \tag{3}$$

and hence

$$\ddot{\underline{R}} = \frac{\sum_{i=1}^{n}(|Q_i| - W_i)\ddot{\underline{r}}_i}{\sum_{i=1}^{n}(|Q_i| - W_i)} \tag{4}$$

where

$$\ddot{\underline{r}}_i = \ddot{\underline{r}}_i\,(INT) + \ddot{\underline{r}}_i\,(EX) \tag{5}$$

i.e. the acceleration of each elementary particle in the system can be split up into the internal acceleration due to all other elementary particles in the system $\ddot{\underline{r}}_i(\mathrm{INT})$, and the external acceleration $\ddot{\underline{r}}_i(\mathrm{EX})$ due to an external source. Considering the internal component of equation (4), we have for the numerator,

$$\sum_{i=1}^{n}(|Q_i|-W_i)\ddot{\underline{r}}_i\,(INT)=\sum_{i=1}^{n}\left[(|Q_i|-W_i)\left(\sum_{\substack{j=1\\ j\neq i}}^{n}\frac{\pm Q_j-W_j}{r_{ij}^2}\hat{\underline{r}}\right)\right] \tag{6}$$

The right hand side of equation (6) will sum to pairs of quantities of equal magnitude and because all particles either attract or repel each other, members of each pair will have opposite sign. Hence

$$\sum_{i=1}^{n}(|Q_i|-W_i)\ddot{\underline{r}}_i\,(INT)=0 \tag{7}$$

If $\ddot{\underline{r}}_i(EX)$ is not caused by a collision with another system and is generated by a system far enough away, it would be reasonable to assume that $\ddot{\underline{r}}_i\,(EX)$ is the same for every elementary particle in the system whose acceleration we are considering. Hence

$$\ddot{\underline{R}}=\frac{\sum_{i=1}^{n}(|Q_i|-W_i)(\pm Q_{EX}-W_{EX})}{\sum_{i=1}^{n}(|Q_i|-W_i)r^2}\hat{\underline{r}} \tag{8}$$

therefore

$$\ddot{\underline{R}}=\frac{\sum_{i=1}^{n}(|Q_i|-W_i)(\pm Q_{EX})}{\sum_{i=1}^{n}(|Q_i|-W_i)r^2}\hat{\underline{r}}-\frac{W_{EX}}{r^2}\hat{\underline{r}} \tag{9}$$

Now care must be taken when considering the summation term of equation (9) because the sign in front of Q_{EX} will depend upon the sign of Q_i. The equation should look like this

$$\ddot{\underline{R}}=\frac{\pm(NETT\,(|Q|-W))Q_{\mathrm{EX}}}{\sum_{i=1}^{n}(|Q_i|-W_i)r^2}\hat{\underline{r}}-\frac{W_{EX}}{r^2}\hat{\underline{r}} \tag{10}$$

where $|Q|$ is the modulus of the cancelled down nett electric charge, and W is a cancelled down quantity of gravitational charge which depends on the difference between the number of negative electrically charged particles, and the number of positive electrically charged particles in the system. It is most likely that since the gravitational charge of a particle is negligible compared with its electric charge, that this quantity would also be negligible in the equation (10), which could then be written,

$$\ddot{\underline{R}}=\frac{Q_{NETT}\ Q_{EX}}{\sum_{i=1}^{n}(|Q_i|-W_i)r^2}\hat{\underline{r}}-\frac{W_{EX}}{r^2}\hat{\underline{r}} \tag{11}$$

multiplying across by m leads to

$$m\ddot{\underline{R}} = \frac{Q_1 Q_2}{r^2}\hat{\underline{r}} + m\underline{g} \qquad (12)$$

where

$$\underline{g} = -\frac{W_{EX}}{r^2}\hat{\underline{r}} \qquad (13)$$

and

$$m = \sum_{i=1}^{n}(|Q_i| - W_i) \qquad (14)$$

Equation (11) therefore incorporates Coulomb's law of electrostatics, Galileo's Leaning Tower of Pisa 'weight independent' acceleration law, Newton's law of gravitation, and Newton's first and second laws of motion with inertial mass m defined as $\sum_{i=1}^{n}(|Q_i| - W_i)$. The definition of inertial mass given at equation (14) clearly indicates that inertial mass is a measure of the amount of matter (number of elementary particles) in a system of particles.

Gravitational charge, which is only known to exist with one sign (and hence no levitation), must therefore be directly proportional to inertial mass. We can therefore assign the same units to both quantities, and this ensures that Newton's third law is general for electrostatics and gravitation.

The inverse square law of acceleration is the basis of classical physics, and since it assumes the presence of a background of apparently fixed celestial objects, it seems logical to suggest Coulomb's law of electrostatics and Newton's law of gravitation, are both intertwined with the background stars. This is known as the Mach hypothesis.

PART 2

Electromagnetic theory was rapidly approaching completion towards the end of the nineteenth century, although it lacked the discovery of the electron and the positron. Without these two elementary particles it would have been impossible for the great electromagnetic pioneers such as James Clerk-Maxwell, or Hermann von Helmholtz to have been able to ascertain the true nature of the aether.

Lorentz occupies an ironic position in electromagnetic history. He predicted the electron, and also the equation for the force on a charged particle moving in a magnetic field. These were the penultimate two ingredients necessary to put the picture together. Unfortunately Lorentz held the belief, that there was an aether wind blowing through the Earth, due to the Earth's orbital motion around the sun. As such he was in a dilemma over the results of the Michelson and Morley experiment of 1887, which detected no motion of the Earth through the aether. Lorentz tried to get around the problem by devising equations that would account for contraction of material objects due to the aether wind, in such a way as to totally cancel out any observation of the Earth's motion through the aether. These highly over optimistic equations were eventually to form the basis of Einstein's special theory of relativity, which is heavily flawed due to its inherent self-contradictions. The Clock Paradox, which points out the fact that two clocks can't both run slower than each other, is well documented in Professor Herbert Dingle's 'Science at the Crossroads'. Unfortunately Einstein's theories took hold amongst the scientific establishment, and this prevented electromagnetic theory from coming to a satisfactory conclusion.

MAXWELL'S EQUATIONS

(4) In the following considerations, knowledge of Maxwell's equations and Vector Field Theory will be assumed. All the constants in the equations will be left out, as they are not relevant to the purposes of the discussion.

Nobody disagrees that the equation,

curl $\underline{B}$ = d$\underline{E}$/dt (**Maxwell's Displacement Current**) (15) (where $\underline{B}$ is the magnetic induction vector, $\underline{E}$ is electric field, and t is time) holds true between the plates of a condenser. The disagreement arises over the derivation, and hence the interpretation.

(5) Let us look at the conventional derivation, which I consider to be heavily flawed. It begins with Ampère's circuital law,

$$\text{curl } \underline{B} = \underline{J} \qquad \textbf{(Ampère's Circuital Law)} \tag{16}$$

where $\underline{J}$ is the current density. The divergence of a curl is always zero therefore the divergence of $\underline{J}$ must also be zero. However the equation of continuity of charge,

$$\text{div } \underline{J} = -d\rho/dt \qquad \textbf{(Equation of Continuity of Charge)} \tag{17}$$

(where ρ is charge density) tells us that the divergence of $\underline{J}$ is only zero in static situations. In time varying situations, it may not necessarily be zero. Orthodox teaching tells us that we now have a dilemma.

We do not however have a dilemma, because Ampère's equation (16) was derived from a closed loop integral equation in which the divergence of $\underline{J}$ would necessarily be zero. Ampère's Equation (16) is not permitted to exist unless div $\underline{J}$ is equal to zero.

Orthodox physicists, who nevertheless erroneously believe that we do have a dilemma, tell us that we need to add an extra d$\underline{E}$/dt term to the right hand side of Ampère's equation (16) in order to cater for time varying $\underline{B}$ fields.

Their argument contains two flaws. First of all, we are not permitted to add an extra term to the right hand side of Ampère's equation (16). Ampère's equation (16), as it stands, is what was derived from first principles, using sound mathematical reasoning. We cannot change the derivation. Secondly, the curl operator only involves partial spatial derivatives. A time dependent $\underline{B}$ field would not alter the result.

Ignoring these two flaws for a moment, I will point out what their reasoning is for adding this extra d$\underline{E}$/dt term to the right hand side of Ampère's equation (16). It lies rooted in Coulomb's law of electrostatics, which in its differential form is,

$$\text{div } \underline{E} = \rho \qquad \textbf{(Coulomb's Law of Electrostatics)} \tag{18}$$

If we take the divergence of ($\underline{J}$ + d$\underline{E}$/dt) and compare with equations (17) and (18), we will produce a zero result. Orthodox physicists hence believe that they have solved their dilemma, which in my opinion doesn't exist anyway.

(6) James Clerk-Maxwell assumed the existence of a dielectric aether. He wrote an excellent paper on the subject in 1862 (see reference [1]).

Maxwell's belief in the existence of a dielectric aether became of great importance when he came to examine electrical current flowing in a condenser circuit. He believed that the current in a condenser circuit must form a closed loop, despite the gap between the condenser plates. In order to complete this closed loop, he introduced a polarization current in the dielectric aether between the condenser plates. Maxwell's choice of the term d$\underline{E}$/dt for this polarization current lies, on the one hand in the proportionality between the electric field vector $\underline{E}$, and the electric displacement vector $\underline{D}$, and on the other hand, he believed that adding this term to the circuit current term ensures that the divergence of the combination ($\underline{J}$ + d$\underline{E}$/dt), will always equal zero. At most points in the condenser circuit, the circuit current term and the polarization current term will not overlap and their divergences will be zero anyway. The region of major interest lies at the surface of the condenser plates, as this is where the electric charge is said to be building up. It is on these surfaces that Maxwell examined the divergence of the current. He treated the total current on these surfaces to be equal to the sum of the circuit current and the dielectric polarization current. Doing this may or may not be contrary to Ampère's equation (16). It depends whether one is viewing the polarization current as an additional term, or whether one is treating it as ultimately coming under the umbrella of the $\underline{J}$ term. Only the latter approach is legitimate.

(7) As charge builds up on the plates of a condenser, the term on the right hand side of equation (17) will be non-zero and hence so will div $\underline{J}$. Either Ampère's equation (16) doesn't apply in this situation, or there is no build up of charge on the surface of the condenser plates. It has to be one or the other. Lets assume for the time being that Ampère's equation (16) does apply. It must therefore follow that there is no nett build up of charge on the surface of the condenser plates. The polarization current in the dielectric between the plates must cancel out the charge that flows into the plates from the circuit current.

(8) Maxwell wanted his displacement current term to represent as near as possible a real current. He clearly envisaged it as the current associated with polarizing dipoles in the aether, without actually having much of an idea as to their physical nature. If the displacement current $d\underline{E}/dt$ is a real current, it has to satisfy the equation of continuity (17). This is only possible if,
(i) E satisfies Coulomb's law of electrostatics, and
(ii) if dE/dt has a minus sign in front of it.
The introduction of a minus sign in front of the $d\underline{E}/dt$ term is undesirable for other reasons, and this leaves us with a problem. The answer to the problem lies with Lenz's law. Between the plates of a charging condenser in an electrical circuit, $\underline{E}$ will be equal to $\underline{E}o – \underline{E}i$, where $\underline{E}o$ is the steady electric field driving the circuit current, and $\underline{E}i$ is the induced electric field that opposes the polarization process in the condenser dielectric. It therefore follows that $–d\underline{E}/dt$ will equal $+d\underline{E}i/dt$, and therefore we can now see that the $\underline{E}$ in the Maxwell's Displacement Current equation (15) refers to the induced $\underline{E}$ in the dielectric that opposes the displacement current. This is Lenz's Law extended to polarization in a dielectric. The induced $\underline{E}$ in Maxwell's Displacement Current equation (15) is now starting to show increasing similarities to the induced $\underline{E}$ in the theory of electromagnetic induction.

(9) If the induced $\underline{E}$ in Faraday's law of electromagnetic induction,

$$\text{curl } \underline{E} = –d\underline{B}/dt \quad \textbf{(Faraday's Law of Electromagnetic Induction)} \qquad (19)$$

is equated to the induced $\underline{E}$ in Maxwell's equation (15), we can then combine these two equations to produce a wave equation with a propagation speed equal to the speed of light. Unless this is a total coincidence, all the above considerations would prove that the $\underline{E}$ in Faraday's equation (19) is interchangeable with the $\underline{E}$ in Coulomb's law, because the $\underline{E}$ in Maxwell's equation (15) is interchangeable with the $\underline{E}$ in Coulomb's law.
Even though they are both represented by completely different mathematical formulae, there is clearly a link between the 'action-at-a-distance' electrostatic $\underline{E}$ on the one hand, and the electromagnetic $\underline{E}$ on the other hand.
The relationship is that of the microscopic to the macroscopic. We must introduce an electrically neutral plasma aether of electrons and positrons to properly explain the link. I imagine this aether to be an extremely dense solid structure, highly elastic and yet to which normal atomic matter is largely porous. The aether would pass through ordinary atomic matter, just as water would pass through a basket. Microscopically, the only forces at work in the aether are the electrostatic forces acting between the electrons and positrons. But macroscopically we have an elastic medium, which is subject to stresses and strains. Where we have a stressed aether, we have a magnetic field. Magnetic waves propagate at the speed of light, which is effectively the Mach number for the aether at normal temperature and pressure. Magnetic and optical phenomena must be considered as elastic effects in the aether. An electric current in a circuit will stress the surrounding aether giving rise to a magnetic field. The induced $\underline{E}$ in both Maxwell's Displacement Current equation (15), and in Faraday's law of electromagnetic induction equation (19), is caused by aether stress. Aether stress simultaneously results in both induced $\underline{E}$ fields, and induced $\underline{B}$ fields, since both $\underline{E}$ and $\underline{B}$ are mathematically intertwined.

(10) When electrons flow to the surface of a condenser plate from the circuit wire, positrons from the aether beyond the plate flow towards it from the opposite direction, hence negating the build up of charge inside the plate. The aether positrons flowing towards the condenser plate do so as part of the polarization process occurring in the aether beyond the plate. Hence the circuit current term and the displacement current term are both acting concurrently at the surface of the plate, and they are both flowing in the same direction. In fact I would go further and state that the current at the surface of the plates is a single current that could be viewed either as the circuit current or the displacement current. Its divergence will be zero no matter whether it is viewed as a single entity or as the sum of a circuit current and a polarization current. No nett charge builds up on the surface of condenser plates. Charge density ρ, and rate of change of charge density $–d\rho/dt$, will always be zero. If however there is no dielectric between the condenser plates, charge will either build up on the plates or it will flow straight across the vacuum. In either case, we would have a total breakdown of the theory of electromagnetism in the vicinity of the condenser plates.

(11) The Earth's gravity will carry a pocket of the aether with the Earth in its orbit around the sun, in the same manner as it carries the atmosphere. This will explain the result of the famous 1887 Michelson-Morley experiment, which led Einstein to postulate the constancy of the speed of light.
The rotation of the Earth about its axis will cause torsional stress in the aether around the Earth. This will result in the Earth's magnetic field. Vortices will form in the aether near to the poles. The precession and nutation of the Earth will cause these magnetic poles to wander and to be located away from the rotational poles. Rotational slippage of the aether at the surface of the Earth could account for the results of the famous Michelson-Gale experiment of 1924, when interference fringes were detected as a result of the Earth's rotation.

(12) If we take the curl of the Lorentz force,

$$\underline{E} = \underline{v} X \underline{B} \qquad \textbf{(Lorentz Force)} \tag{20}$$

(where $\underline{v}$ is the velocity of a charged particle moving in a magnetic field, and $\underline{E}$ is the force per unit charge acting upon it, as a result of its motion) we get,

$$\text{curl } \underline{E} = -\underline{v}.\text{grad } \underline{B} \qquad \textbf{(Differential Lorentz Force)} \tag{21}$$

(see reference [2]). The right hand side of the equation (21) is the convective part of the right hand side of Faraday's equation (19). (A total time derivative is made up of a convective component and a partial time derivative component). It is the Lorentz force which is the justification for using total time derivatives in Maxwell's equations.
Until now, it has been customary to use partial time derivatives in Maxwell's equations, and to keep equation (20) outside Maxwell's group, as a separate equation. The postulate of the constancy of the speed of light is the cornerstone of Einstein's theories of relativity. Partial time derivative Maxwell's equations have been used to bolster this postulate, on the basis that they hold in any frame of reference and still yield a wave equation in which the wave speed is equal to the speed of light.
With total time derivatives, this argument falls through. The situation becomes no different to that of the speed of sound in air. The velocity term $\underline{v}$ in the Lorentz Force equation (20) is measured relative to the aether. We no longer have any ambiguity. Maxwell's equations apply in the geocentric aether rest frame, and probably any aether rest frame.

CONCLUSIONS

(a) Inertial Mass and Gravitational Mass are not equivalent. Einstein's General Theory of Relativity should never have come about.

(b) An elastic electron-positron aether is absolutely necessary, not only as a medium for the propagation of light, but also to explain how Coulomb's law of electrostatics can legitimately be manipulated mathematically with Faraday's law of electromagnetic induction, bearing in mind that the $\underline{E}$ vectors in each case derive from different mathematical functions.

(c) The force on a charged particle moving in a magnetic field, which we call the Lorentz Force, can be absorbed into Maxwell's Equations, bringing them into a total time derivative format, and eliminating any arguments about which frames of reference they apply in.

(d) The parallel nature of electrostatics and gravitation suggests that there would almost certainly be a gravitational component to magnetism, parallel to the much more dominant electrostatic component. However, the enormous difference in strength between electrostatics and gravitation would almost certainly render the gravitomagnetic component negligible.

(e) The elastic aether in the vicinity of atoms and molecules would certainly have a perturbing effect on the electrons orbiting the atomic nuclei. Electrons being a constituent component of the aether itself would get mixed up with the orbital electrons. This disturbance in the aether around atomic nuclei would almost certainly manifest itself as standing waves in the aether. These standing waves would only be permitted to have certain wavelengths, depending on the charge of the atomic nuclei in question. This would explain the quantisation of electron orbits, and the fact that electromagnetic waves only get emitted and absorbed by atoms and molecules in discrete quanta. The electron-positron aether would also explain the close association between electromagnetic waves and beams of electrons.

R E F E R E N C E S

1. J. Clerk-Maxwell. On Physical Lines Of Force.1862
2. David Tombe. Maxwell's Equations And Galilean Relativity. Toth-Maatian Review, January 1984