

# The Universal Force – Derived From a More Perfect Union of Axiomatic and Empirical Scientific Methods

Charles W. (Bill) Lucas, Jr.  
29045 Livingston Drive  
Mechanicsville, MD 20659-3271  
Bill.lucas001@gmail.com

## Summary:

In the last half of the 19<sup>th</sup> century many scientists believed that the universe would turn out to be electromagnetic in origin. Maxwell had just succeeded in uniting the electric force and the magnetic force in electrodynamics which became the foundation for the theory of light and optics. The form of Newton's universal gravitation force proportional to  $1/R^2$  was identical to the form of the electrostatic force implying a common origin as proved by Poincare using meta-theory or the theory of theories. The purpose of this paper is to derive a universal electrodynamic force law by means of a more perfect union of the axiomatic method used in Euclidean geometry for deriving theorems from postulates and Newton's empirical scientific method.

Maxwell's work in developing his wave equations for electrodynamics consisted of using 4 of the 6 known empirical equations of electrodynamics as axioms to develop electrodynamics, i.e. Faraday's Law, Ampere's Law, and Gauss's magnetostatic and electrostatic laws. From the symmetry of the wave equation Maxwell realized that something was missing and added the displacement current to Ampere's Law. In order to simplify the mathematics Maxwell made the point particle approximation to avoid considering finite size effects and charge particle deformation. As a result he could also assume linear interactions. The equations that he used for his axioms did not conserve magnetic energy nor satisfy Newton's 3<sup>rd</sup> Law. Only Lenz's Law did that, but it was not included as an axiom for Maxwell's equations. Maxwell only considered the case of constant forces, so his equations cannot handle radiative energy loss and radiation reaction. Finally Maxwell assumed a non-local force, not a contact force, and ignored the need to satisfy Mach's Principle.

In this work a more perfect union of the axiomatic and empirical methods is made by using a complete set of the empirical laws of electrodynamics which includes Lenz's Law and Lorentz's Force Law, instead of a partial set. Also the point particle approximation is not made allowing finite-size effects, particle deformation, and non-linear effects to be taken into account. This also allowed conservation of magnetic energy and Newton's 3<sup>rd</sup> Law to be satisfied. Although the initial derivation is for constant velocity and constant force, conservation of energy and charge allows higher order time derivatives to be obtained from the continuity equation assuming that all finite-size charged particles consist of closed charge loops. Maxwell's followers also use the Continuity Equation, but they do not realize that it is not legal if a point particle approximation is used, magnetic energy is not conserved, nonlinear effects are ignored, and forces are not local. This work satisfies Mach's Principle by assuming that the electric and magnetic fields of a moving charge remain attached to all distances

based on the experiments of Hooper showing that the fields of the electron remain attached as it moves.

The basic procedure for the derivation is to solve the equations simultaneously using the Galilean transformation to handle time. There are 7 equations and 6 unknowns, i.e. the static and induced electric fields, the static and induced magnetic fields, the proportionality constant for Lenz's Law, and time  $t'$  in the inertial frame of reference. The solution is straight forward. The extra axiom that is not used or needed is the Lorentz Force Law. It is derived as a consequence of the Galilean transformation and the other empirical laws. Thus it is a duplicate of them and not a fundamental empirical law to be considered as an axiom. The resulting electrodynamic fields and force law is

$$\vec{E}(\vec{r}, \vec{v}) = \frac{q(1 - \frac{v^2}{c^2})\vec{r}}{r^3 \left(1 - \frac{v^2}{c^2} \sin^2 \theta\right)^{3/2}} = \frac{q \left(1 - \frac{v^2}{c^2}\right) \vec{r}}{\left[ \vec{r}^2 - \frac{\left\{ \vec{r} \times \left( \vec{r} \times \frac{\vec{v}}{c} \right) \right\}^2}{\vec{r}^2} \right]^{3/2}}$$

$$\vec{B}_i(\vec{r}, \vec{v}) = \frac{\vec{v}}{c} \times \vec{E}(\vec{r}, \vec{v}) = \frac{q \left(1 - \frac{v^2}{c^2}\right) \frac{\vec{v}}{c} \times \vec{r}}{\left[ \vec{r}^2 - \frac{\left\{ \vec{r} \times \left( \vec{r} \times \frac{\vec{v}}{c} \right) \right\}^2}{\vec{r}^2} \right]^{3/2}}$$

$$\vec{F}(\vec{r}, \vec{v}) = q' \left[ \vec{E}(\vec{r}, \vec{v}) + \frac{\vec{v}}{c} \times \vec{B}_i(\vec{r}, \vec{v}) \right] = \frac{qq'}{\vec{r}^2} \frac{\left(1 - \frac{v^2}{c^2}\right) \vec{r}}{\left[ \vec{r}^2 - \frac{\left\{ \vec{r} \times \left( \vec{r} \times \frac{\vec{v}}{c} \right) \right\}^2}{\vec{r}^2} \right]^{1/2}} - \frac{qq'}{\vec{r}^2} \frac{\left(\frac{\vec{v}}{c} \cdot \vec{r}\right) \vec{r} \times \left(\vec{r} \times \frac{\vec{v}}{c}\right)}{\left[ \vec{r}^2 - \frac{\left\{ \vec{r} \times \left( \vec{r} \times \frac{\vec{v}}{c} \right) \right\}^2}{\vec{r}^2} \right]^{2.3/2}}$$

Note that the  $\beta^2 \sin^2 \theta$  term in the denominators above are written as the triple vector product  $r \times (r \times v/c)$  instead of  $r \times v/c$  for consistency with the triple vector product of the Lorentz Force Law. The results above are identical to the covariant relativistic electrodynamic force, except that the relativistic effects are due to taking into account Lenz's Law, finite-size particle effects, and Galilean invariance.

The electromagnetic potential  $U$  corresponding to the Lorentz force above is

$$U(\vec{r}, \vec{v}) = \frac{qq'}{r} \frac{\left(1 - \frac{v^2}{c^2}\right)}{\left(1 - \frac{v^2}{c^2} \sin^2 \theta\right)^{1/2}} = \frac{qq' \left(1 - \frac{v^2}{c^2}\right)}{\left[ \vec{r}^2 - \frac{\left\{ \vec{r} \times \left( \vec{r} \times \frac{\vec{v}}{c} \right) \right\}^2}{\vec{r}^2} \right]^{1/2}}$$

From the Continuity Equation expressing conservation of energy one has the general relationship for the electromagnetic potential  $U(r, v)$

$$\frac{dU(\vec{r}, \vec{v})}{dt} = -\vec{F}(\vec{r}, \vec{v}, \vec{a}) \cdot \vec{v}$$

where  $v$  is the relative velocity between the moving charges and  $r$  is the relative separation. Assuming that the electromagnetic potential is a regular function and well-behaved, one can obtain the acceleration terms of the force by allowing the velocity to be a function of time.

$$\vec{v} \cdot \vec{F}(\vec{r}, \vec{v}, \vec{a}) = -\frac{dU(\vec{r}, \vec{v})}{dt} = -\frac{d}{dt} \frac{qq' \left(1 - \frac{v^2}{c^2}\right)}{\left[\vec{r}^2 - \frac{\left\{\vec{r} \times \left(\vec{r} \times \frac{\vec{v}}{c}\right)\right\}^2}{\vec{r}^2}\right]^{\frac{1}{2}}}$$

$$\vec{v} \cdot \vec{F}(\vec{r}, \vec{v}, \vec{a}) = qq' \frac{\frac{2\vec{r}^2(\vec{v} \cdot \vec{a})}{c^2} + \left(1 - \frac{v^2}{c^2}\right)(\vec{r} \cdot \vec{v})}{\vec{r}^2 \left[\vec{r}^2 - \frac{\left\{\vec{r} \times \left(\vec{r} \times \frac{\vec{v}}{c}\right)\right\}^2}{\vec{r}^2}\right]^{\frac{1}{2}}} - \frac{qq' \left(1 - \frac{v^2}{c^2}\right) \left\{(\vec{r} \cdot \frac{\vec{v}}{c}) \vec{v} \cdot \vec{r} \times \left(\vec{r} \times \frac{\vec{v}}{c}\right) - (\vec{r} \cdot \vec{r}) \frac{\vec{v}}{c} \cdot \vec{r} \times \left(\vec{r} \times \frac{\vec{a}}{c}\right)\right\}}{\vec{r}^2 \left[\vec{r}^2 - \frac{\left\{\vec{r} \times \left(\vec{r} \times \frac{\vec{v}}{c}\right)\right\}^2}{\vec{r}^2}\right]^{\frac{3}{2}}}$$

This gives the more general electrodynamic force law which is capable of describing the force of inertia, gravity, radiation, etc directly.

$$\vec{F}(\vec{r}, \vec{v}, \vec{a}) = \frac{qq'}{\vec{r}^2} \frac{\left(1 - \frac{v^2}{c^2}\right) \vec{r} + \frac{2\vec{r}^2 \vec{a}}{c^2}}{\left[\vec{r}^2 - \frac{\left\{\vec{r} \times \left(\vec{r} \times \frac{\vec{v}}{c}\right)\right\}^2}{\vec{r}^2}\right]^{\frac{1}{2}}} - \frac{qq' \left(1 - \frac{v^2}{c^2}\right) \left\{(\vec{r} \cdot \frac{\vec{v}}{c}) \vec{r} \times \left(\vec{r} \times \frac{\vec{v}}{c}\right) - (\vec{r} \cdot \vec{r}) \vec{r} \times \left(\vec{r} \times \frac{\vec{a}}{c^2}\right)\right\}}{\vec{r}^2 \left[\vec{r}^2 - \frac{\left\{\vec{r} \times \left(\vec{r} \times \frac{\vec{v}}{c}\right)\right\}^2}{\vec{r}^2}\right]^{\frac{3}{2}}}$$

This approach appears to succeed in completing the goal of 19<sup>th</sup> century science. In addition the derivation of the quantized force of gravity as an electrodynamic force between vibrating neutral electric dipoles is presented.

$$R_{1+2+} = R_{2+} - R_{1+} \quad A_1 f_1 = v_1$$

$$R_{1-2+} = R_{2+} - R_{1-} - A_1 \cos(\omega_1 t + \varphi_1)$$

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$$\downarrow \qquad \qquad \omega_1 = 2\pi f_1 \qquad \qquad \downarrow$$

$$\bullet \leftarrow \bullet \rightarrow \vec{A}_1 \qquad \qquad \bullet \leftarrow \bullet \rightarrow \vec{A}_2$$

$$q_{1+} \quad q_{1-} \qquad \qquad q_{2+} \quad q_{2-}$$

$$\vec{F}_G = \vec{F}_{2+,1+} + \vec{F}_{2+,1-} + \vec{F}_{2-,1+} + \vec{F}_{2-,1-}$$

$$\begin{aligned}\vec{F}_G &= -\frac{2}{5\pi} \frac{e^2}{|R_2 - R_1|^2} \frac{N_2 Z_2 A_2^2 \omega_2^2}{c^2} \frac{N_1 Z_1 A_1^2 \omega_1^2}{c^2} \hat{R}_{12} \\ &\quad - \frac{9}{4\pi} \frac{e^2}{|R_2 - R_1|^2} \frac{N_2 Z_2 A_2^2 \omega_2^2}{c^2} \frac{N_1 Z_1 A_1^2 \omega_1^2}{c^2} (\hat{R}_{12} \cdot \vec{\beta}) \hat{R}_{12} x(\hat{R}_{12} x \vec{\beta}) \\ &\approx -G \frac{m_1 m_2}{|R_2 - R_1|^2} \hat{R}_{12} - \frac{45}{8} G \frac{m_1 m_2}{|R_2 - R_1|^2} (\hat{R}_{12} \cdot \vec{\beta}) \hat{R}_{12} x(\hat{R}_{12} x \vec{\beta})\end{aligned}$$

Also the derivation of the force of inertia as an electrodynamic force between a charge  $e$  and a vibrating neutral electric dipoles is presented.

$$\vec{F}_I = \left( \frac{4e^2}{3\pi c^2} \right) \frac{A_1^2 \omega_1^2}{c^2} \left[ \vec{A} - \frac{27}{32} \frac{A_1^2 \omega_1^2}{Rc^4} \vec{R} x(\vec{R} x \vec{A}) \right] = m_I \vec{A} - \frac{27}{32} \frac{A_1^2 \omega_1^2}{Rc^4} m_I \vec{R} x(\vec{R} x \vec{A})$$

The derived electrodynamic forces of gravity and inertia have a second term not found in previous theories. The second term for  $F_G$  allows gravity to be quantized and to satisfy the modern version of Bode's Law. The second term for  $F_I$  allows an explanation of some puzzling gyroscope experiments of Eric Laithwaite that appear to defy Newton's 2<sup>nd</sup> Law. Also these forces are undergoing decay, because in electrodynamics vibrating neutral electric dipoles are required to radiate continuously. The decay of gravity allows an explanation of the earth's expansion for which there is abundant data. The decay of the force of inertia combined with conservation of energy allows an explanation of the higher than expected speeds of the material in the outer arms of spiral galaxies for which dark matter and dark energy were invented to explain in the past.

Thus the newly derived universal electrodynamic force law has a legitimate claim to replace previous force laws based on simplicity (one universal force law), superior axioms (based on empirical laws, conservation of energy, Newton's 3<sup>rd</sup> Law, nonlinear interactions, local contact forces), superior logic (no point particle approximation and notions not based on forces), and agreement with more experimental phenomenon (Bode's Law for quantization of gravity, Eric Laithwaite's gyroscope experiments, expansion of the earth and other astronomical bodies, and the high speed of matter in the outer arms of spiral galaxies).

The identification of the electrodynamic force as the universal force is very significant for creation science, because the Bible indicates that God exerts his divine force via electromagnetic means (Habakkuk 3:4) and electromagnetic light is intimately involved as part of the nature or essence of God. This is seen in the shekinah glory indicating God's presence above the Ark of the Covenant in the Tabernacle and the Temple. In the New Testament it is seen in the cloven tongues of fire on the Day of Pentecost when Christians received the Holy Spirit, when the Samaritans received the Holy Spirit and when the Gentiles in the house of Cornelius the Centurion received the Holy Spirit. Thus the derivation and proof that the universal force is electromagnetic has the potential to bring the Bible and science into complete harmony with God in full control via the electromagnetic force of the universe that He created.