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The Need for Reformation in Modern Physics Based on Logic and Metatheory

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Abstract. Modern physics has many problems with infinities, dark matter, dark energy, black holes, and logical inconsistencies. Since modern science poses as an authority more sure than the world's major religions, it seems appropriate to evaluate the truth of science from the perspective of logic and metatheory. Logic reveals that the assumptions or axioms of modern physics are based on idealizations known by experiment to be false. These idealizations lead to conclusions that are in disagreement with common sense. Metatheory (the theory of theories based on logic) indicates that the current theories of modern physics are conflicting, incomplete, and incompatible with each other. From logic the simplest solution that removes the conflicts and incompatibilities in modern science is to properly complete electrodynamics such that the theories of Maxwell's electrodynamics, the Copenhagen version of quantum mechanics, Einstein's special and general relativity theories and the standard model of elementary particles are replaced by a single more comprehensive theory. Improving modern science in this manner appears to result in science fully supporting the Judeo-Christian scriptural views of the physical universe and its creator.

Introduction. The development of science from ancient times was based on some intuitively obvious assumptions about the universe. These are as follows:

1. **Determinism** – There are natural causes for everything that happens in the universe.
2. **Objective Truth** – Observations of the universe can be made independent of the observer.
3. **Consistency** – The same causes produce the same effects everywhere in the universe.

These assumptions have been challenged by the theories of modern science. For instance the Copenhagen version of quantum mechanics claims that the universe is governed 100% by random statistical processes and that there is no Law of Cause and Effect thereby denying Determinism and Consistency. Also this version of quantum mechanics, according to Heisenberg, claims that reality is in the "observation process" and so is not independent of the observer, and there is no Objective Truth.

The purpose of this paper is to uncover the fallacies of the main pillars of modern science, i.e. Maxwell's electrodynamics, Einstein's special and general relativity theories, the Copenhagen version of quantum mechanics, and the standard model of elementary particles, and then to show from logic and metatheory the path back to true science.

The Axiomatic Method. The axiomatic method was invented by the ancient Greeks as the proper way to organize and demonstrate inductive and deductive logical reasoning in the pursuit of natural philosophy. The axiomatic method is a logical procedure by which an entire system of natural philosophy (e.g. a branch of science or mathematics) is generated in accordance with specified rules of logical deduction

from certain basic propositions (axioms or postulates), which in turn are constructed from a few terms (charge, mass, length, velocity, acceleration, etc.) taken as primitives. These axioms are to be defined and constructed by inductive logic from observed patterns in nature or intuition by which some warrant for their truth is felt to exist. One of the oldest examples of an axiomatic system is the ancient Greek Euclidean geometry.

Euclid, in the process of developing geometry, defined the axiomatic method of proof to be used in logically establishing theorems in geometry. To the extent that the axioms or postulates he chose were valid, his logically developed theorems would be valid. All theorems or theories could be falsified by the falsification of any of their axioms or postulates.

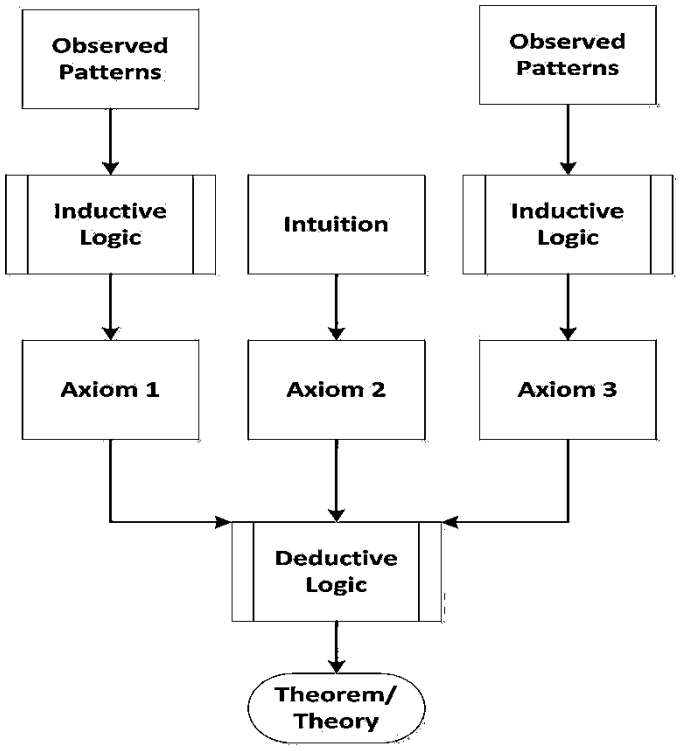

Figure 1 Axiomatic Scientific Method

The ancient Greeks were so impressed by the work of Euclid that they put the slogan "Let No One Ignorant of Geometry Enter Here" over the door of their academies of natural philosophy. The modern world has also been impressed by Euclid to the extent that his book Elements (of Geometry) [1] has been published in more languages and editions than any other natural philosophy or scientific book in the history of the world. [2]

Euclid's approach worked well in geometry where the propositions could be imagined or justified by simple geometrical constructions using a straight edge and compass, but in physics and other areas of Natural Philosophy, the ancient Greek natural philosophers were not able to discover the appropriate axioms or postulates so easily. This is due to the fact that the axiomatic method was primarily a method of logical organization of abstract proofs of theorems or theories, but not a general method for postulate or axiom discovery of objective reality.

Newton's Empirical Method of Axiom Discovery. When Isaac Newton published his **Principia** [3] or **Mathematical Principles of Natural Philosophy**, he stated that he intended to illustrate a new way of doing natural philosophy that overcomes some of the limitations of the axiomatic method. This method is now called the empirical scientific method. The goal of Newton's method was to find empirically the axioms and appropriate terms from which the forces of nature could be derived by logic.

Newton claimed that in the past natural philosophers tried to understand nature in vain, because they did not use an empirical approach to find the axioms leading to the fundamental forces of nature based on experimentation. The empirical approach is more effective and efficient in discovering the causes and effects of nature. As a result he argued that the empirical approach combined with the logic of the axiomatic method was a more secure path toward truth in natural philosophy. The problem faced by the ancient Greek philosophers was that they could not guess or discover the relevant axioms and appropriate primitive terms for natural philosophy upon which to apply logic to derive the theorems or theories of natural philosophy outside of geometry and mathematics. These needed to be discovered by experiment.

Before Newton, Kepler discovered three empirical laws for the motions of the planets about the sun.

1. The planets orbit the Sun in ellipses with the Sun at one focus.
2. The line joining the Sun and a planet sweeps through equal areas in an equal amount of time.

3. The square of the period of a planet's orbit (P) is directly proportional to the cube of the semi-major axis (A) of its elliptical path, i.e. $P^2 = kA^3$.

Although these empirical laws were practical and useful, the fundamental cause of the motions of the planets was not revealed by them. Newton's emphasis on more general derived forces turned out to be much more useful than Kepler's Laws and to give a better and simpler understanding of the mechanics of the solar system that could be applied even to processes on the Earth. From his derived force laws of equations (1) and (2) below Newton was able to deduce Kepler's Laws. After Newton's death in 1727, Titius Bode revealed his new empirical law in 1766 showing the quantum periodicity of the orbits of the planets. This indicated that Newton's derived force laws were incomplete, because there was another empirical law he had not taken into account.

Newton's approach emphasizing more general derived forces does not lead to all truth at once, as Newton himself recognized with regard to his study of inertia and gravity. He never claimed to understand the causes and nature of inertia and gravity, even though he could define the derived force of inertia and the derived force of gravity as shown below.

$$Force\ of\ Inertia\ \ \vec{F}_I = m_I \vec{A} \qquad (1)$$

$$Force\ of\ Gravity\ \ \vec{F}_G = G\frac{m_{G1}m_{G2}}{{R_{12}}^2}\hat{R}_{12} \quad (2)$$

When Newton was asked what inertial mass m_I was, he replied that inertial mass was a measure of some characteristic of matter that caused the force of inertia and that increased as the amount of matter increased. When Newton was asked what gravitational mass m_G was, he replied that gravitational mass was a measure of some characteristic of matter that caused the force of gravity between bodies of matter and increased as the amount of matter increased. When the ratio of the experimentally measured inertial and gravitational masses were found to be equal in magnitude for the same two bodies, Newton realized that instead of the force of inertia and the force of gravity being different fundamental forces, they might have a common cause. Newton believed that scientists needed to continue doing additional experiments to discover more of the fundamental axioms of nature until one day, following his scientific method of deriving more complete force laws using more complete sets of empirically discovered axioms, the universal force law would be discovered.

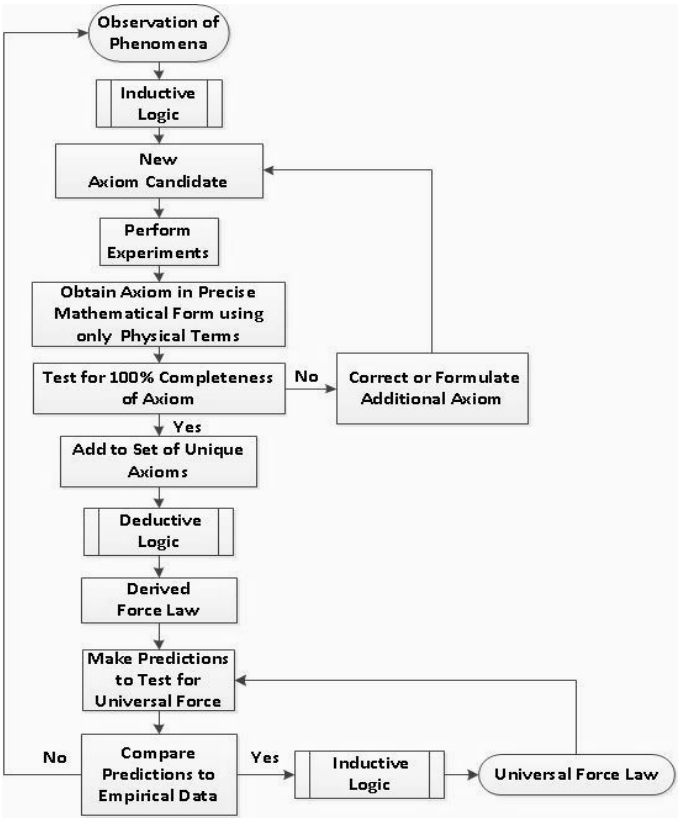

Figure 2 Newton's Empirical Scientific Method

The Existential and Post-Modern Scientific Method. The scientific community was greatly impressed with the progress that Newton had made in science. He had expressed scientific laws in precise mathematical terms and equations that described many things not previously understood. Even though they knew that Newton claimed his work was incomplete, they established a new approach to science based on his experimental empirical approach and his use of precise mathematical equations to express scientific theories.

They modified the scientific method to de-emphasize the role of logic as shown in their diagram of the scientific method in Figure 3 and substituted the much weaker criterion of falsifiability of hypotheses. The reason that they de-emphasized the strict role of deductive logic and truth in science is that they did not believe in ultimate truth and purpose in the universe, but they were greatly impressed with what Newton had accomplished in science describing nature in precise mathematical terms without

knowing (1) what inertial and gravitational mass was, (2) what was the cause of the inertial and gravitational forces, and (3) how the gravitational and inertial forces were transmitted between bodies.

This weaker version of the scientific method became known as the existential scientific method. It allowed idealizations to be freely used in scientific theories just as Newton had temporarily used the concepts of inertial and gravitational mass and action-at-a-distance forces. As modern science was developed the Maxwellian version of electrodynamics, the Copenhagen version of quantum mechanics, Einstein's special and general relativity theory, and the standard model of elementary particles were based on many similar idealizations including the point particle idealization. In 1957 Robert Hofstadter received the Nobel Prize for his scattering experiments that measured the finite size and three interior substructures of the proton and neutron. Since logic was no longer the criterion for falsification, the theories above, which are the pillars of modern science, were not falsified for the incorporation of the false point particle idealization or axiom.

Logical Arguments from Metatheory. Metatheory, the theory of theories, is a branch of metamathematics. It is the study of principles, conceptual elements, consistency and other aspects of logical systems. From the days of the earliest natural philosophers science or natural philosophy has been developed as a logical system derived from postulates or axioms. Such scientific theories are subject to various logical principles based upon inductive and deductive logic and consistency.

Henri Poincarè is generally credited as founding the field of metatheory or metamathematics. Being one of the last of the true natural philosophers, he was concerned about the logical structure of scientific theories and the logical basis of truth. Poincarè was the co-discoverer of relativity theory with Einstein, and he actually published one year before Einstein. However neither he nor Einstein ever received the Nobel Prize for this work, because of Poincarè's own arguments from metatheory below discrediting relativity theory.

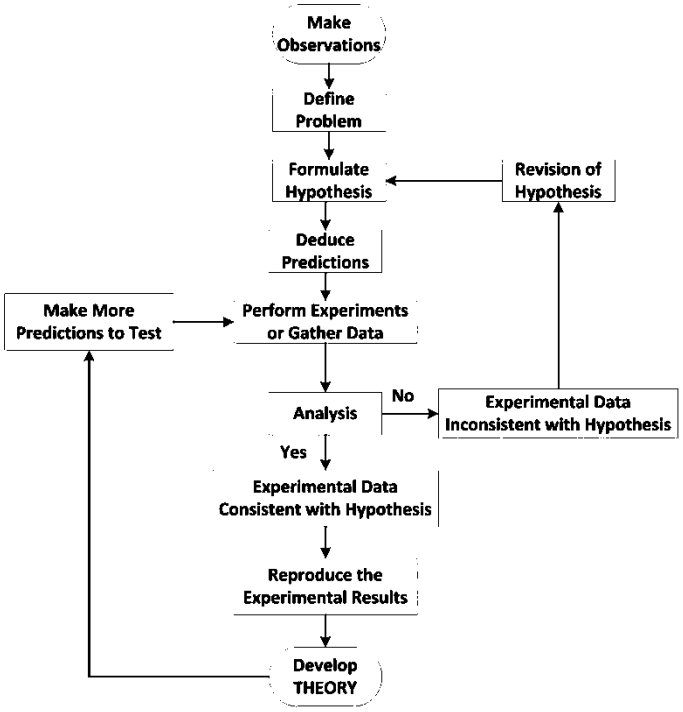

Figure 3 Existential and Post-Modern Scientific Method

Poincarè made logical arguments from metatheory [4] that no two fundamental theories in nature could employ the same fundamental constants, such as c the velocity of light.

- **Electrodynamics uses c in wave equation**

$$\nabla^2\Phi - \frac{1}{c^2}\frac{\partial^2\Phi}{\partial t^2} = -\frac{\rho}{\epsilon_0} \quad (1)$$

$$\nabla^2 A - \frac{1}{c^2}\frac{\partial^2 A}{\partial t^2} = -\mu_0 J$$

- **Special Relativity uses c in space-time interval**

$$ds^2 = dx^2 + dy2 + dz^2 - c^2dt^2 \quad (2)$$

- **Quantum Mechanics uses c in energy quantum**

$$E=hv=h(2Bc/8) \quad (3)$$

- **General Relativity uses c in Einstein's field equation**

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu} \quad (4)$$

This was then combined with another logical argument that only fundamental theories could be true theories.

Poincare noticed that four "so-called" fundamental theories of modern science used the same fundamental constant c for the velocity of light, i.e. electrodynamics, special relativity, quantum mechanics, and general relativity. According to his logical criterion only one of these four theories could be fundamental or true. Poincare suggested that the fundamental theory was electrodynamics and that eventually it would explain all of the data explained by these other theories.

Poincarè also published another interesting logical argument from metatheory. [5] In this logical argument he showed that no two fundamental force laws could have the same mathematical form such as $1/R^2$. From equation (5) Coulomb's electrostatic force law and the force of gravity both have a $1/R^2$ form. Also since Einstein's General Theory of Relativity involves the fundamental constant c, Poincarè reasoned that gravity must also be of electrodynamic origin.

$$F_G = -G\frac{m_1 m_2}{R^2} \qquad F_{EM} = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{R^2} \quad (5)$$

The Superposition Principle [6] of metatheory describes the properties of linear systems needed for coherence and stability. Systems may be a collection of moving charges in electrodynamics and a combination of theories to describe these charges such as electrodynamics, relativity theory, and quantum mechanics. A linear system is one that satisfies the homogeneity and additivity properties required by the Superposition Principle for coherence and stability shown below.

$$F(x_1+x_2+\ldots) = F(x_1) + F(x_2) + \ldots$$
Additivity (6)

$$F(ax) = a\,F(x) \text{ for scalar } a$$
Homogeneity (7)

If one wants to describe matter in the form of an elementary particle, an atom or a molecule by combining electrodynamics, relativity theory, quantum mechanics and the standard model of elementary particles, each of these theories must satisfy the Superposition Principle.

$$F(x_1+x_2+x_{3+}x_4) = F_{EM}(x_1) + F_{SR}(x_2) + F_{QM}(x_3) + F_{SM}(x_4) \quad (8)$$

Maxwellian electrodynamics cannot be combined with Special Relativity, because the electrodynamic field and force is nonlinear in r.

$$\vec{E}(\vec{r}) = \frac{q\hat{r}}{4\pi\epsilon_0 r^2} \quad (9)$$

Special Relativity is not a proper theory to add to electrodynamics either, since it modifies electrodynamics further making it more nonlinear by giving rise to the expression for the electric field that is nonlinear in v due to the $\beta^2 = (v/c)^2$ terms.

$$\vec{E}(\vec{r},\vec{v}) = \frac{q}{4\pi\epsilon_0 r^2}\frac{\left(1-\frac{v^2}{c^2}\right)\hat{r}}{\left[1-\left(\frac{v}{c}\right)^2 sin^2\,\varphi\right]^{3/2}} \quad (10)$$

$$\text{where } \sin\varphi = \hat{r} \times \hat{v} \quad (11)$$

In quantum mechanics the principal task is to compute how a certain type of wave propagates. The wave is called a wave function. The equation governing the behavior of the wave is the Schrödinger wave equation. The primary approach to computing the behavior of a wave function is to write the wave function as a quantum superposition of special wave functions known as stationary states. Since the non-relativistic time-dependent Schrödinger wave equation and the relativistic Dirac wave equation are linear in the wave function ψ where ψ is a linear superposition of the probability states of the system, the non-relativistic and relativistic wave equations of quantum mechanics are linear.

Schrödinger Equation

$$i\hbar\frac{\partial}{\partial t}\Psi(\mathbf{r},t) = \left[\frac{-\hbar^2}{2m}\nabla^2 + V(\mathbf{r},t)\right]\Psi(\mathbf{r},t) \quad (12)$$

Dirac Equation

$$i\hbar\frac{\partial}{\partial t}\Psi(r,t) = \left[\beta mc^2 + c\left(\sum_{n=1}^{3}\alpha_n p_n\right)\right]\Psi(\mathbf{r},t) \quad (13)$$

The standard model of elementary particles based on the short range strong interaction and the short range weak interaction proportional to $1/R^3$ to $1/R^5$ is also a highly nonlinear theory.

Another argument from metatheory is that any theory in modern physics that references c is incomplete if it does not include terms that are a function of r, v, a, and da/dt. This argument is based on the empirical evidence from accelerator experiments and astronomy that all charged particles in nature that are accelerated continuously emit radiation and undergo radiation recoil proportional to da/dt. Since all matter on the earth is accelerated due to the rotational acceleration of the earth on its axis, the acceleration of the earth in its orbit around the sun, the acceleration of the sun in its orbit about the center of the Milky Way galaxy, and the acceleration of the Milky Way galaxy about the center of the universe, any theory of modern physics involving c is incomplete if it does not contain terms proportional to r, v, a and da/dt.

An examination of the fundamental theories of modern physics shows that Maxwell's relativistic electrodynamics is a function of r and v. Quantum mechanics is a function of r and v. Einstein's special relativity is a function of r and v. Einstein's general relativity is a function of r, v, and a, but it does not take into account radiation and radiation reaction. One result is that Einstein's Equivalence Principle that causes the gravitational bending of star light is falsified. Finally the standard model of elementary particles does not properly take into account radiation reaction. Thus these fundamental theories of modern physics are all incomplete.

Conclusions from Metatheory. From the perspective of metatheory we see that electrodynamics is a nonlinear theory, Special Relativity is a nonlinear theory, quantum mechanics is a linear theory, and the standard model of elementary particles is a nonlinear theory. According to the Superposition Principle no two of these theories may be combined to describe matter in the form of an elementary particle, atom or molecule, because a nonlinear theory cannot be combined with another nonlinear or linear theory. Only linear theories can be combined. ***Only one nonlinear theory is possible.*** If a nonlinear theory is valid, it has to be the one and only theory, i.e. the universal theory. Of the five pillars of modern science, i.e. electrodynamics, quantum mechanics, special relativity, general relativity and the standard model of elementary particles, the only one capable of becoming the universal force according to metatheory is electrodynamics.

The newly published book **The Universal Force volume 1 – Derived from a More Perfect Union of the Axiomatic and Empirical Scientific Methods version 6** [7] confirms all of these arguments from metatheory.

$$\boldsymbol{U(r,v) = \frac{qq'}{r}\frac{(1-\beta^2)}{(1-\beta^2 sin^2\theta)^{1/2}}} \quad \boldsymbol{(14)}$$

$$\vec{F}\left(\vec{r},\vec{v},\vec{a},\frac{d\vec{a}}{dt}\right) = \frac{qq'}{r^2}\frac{(1-\vec{\beta}^2)\hat{r}+\frac{2r^2}{c^2}\vec{a}}{(1-\beta^2 sin^2\theta)^{\frac{1}{2}}} + \frac{\frac{2r^2}{3c^3}\frac{d\vec{a}}{dt}}{(1-\beta^2 sin^2\theta)}$$

$$-\frac{qq'}{r^2}(1-\vec{\beta}^2)\frac{(\vec{\beta}\cdot\vec{r})\vec{r}\times(\vec{r}\times\vec{\beta}) + r^2\vec{r}\times\left(\vec{r}\times\frac{\vec{a}}{c^2}\right)}{(1-\beta^2 sin^2\theta)^{\frac{3}{2}}}$$

Equation (14) gives the results for the improved version of the electrodynamic force based on the complete set of the empirical equations of electrodynamics and conservation of energy using the energy potential U. Note the acceleration a and radiation reaction da/dt terms. Equation (15) below gives Maxwell's relativistic electrodynamic force based on the covariant equations for the vector potential A and the scalar potential N. Note that equations (14) and (15) are identical in the terms proportional to r and v.

$$\nabla^2\vec{A} - \frac{1}{c^2}\frac{\partial^2\vec{A}}{\partial t^2} = -\frac{4\pi}{c}\vec{J}_t \quad \nabla^2\emptyset - \frac{1}{c^2}\frac{\partial^2\emptyset}{\partial t^2} = -4\pi\rho$$

$$\vec{F}(\vec{r},\vec{v}) = \frac{qq'}{r^2}\frac{(1-\beta^2)\hat{r}}{(1-\beta^2 sin^2\theta)^{\frac{1}{2}}}$$

$$-\frac{qq'}{r^2}(1-\beta^2)\frac{(\vec{\beta}\cdot\hat{r})\hat{r}\times(\hat{r}\times\vec{\beta})}{(1-\beta^2 sin^2\theta)^{\frac{3}{2}}} \quad (15)$$

The improved version of electrodynamics explains radiation and radiation reaction, conserves energy and satisfies Newton's 3rd law which the relativistic Maxwell's equations do not. From the

improved version of electrodynamics an improved version of the force of gravity equation (16) and the force of inertia equation (17) can be derived obtaining a new second term for each.

$$\vec{F}_G(\vec{r}) = -\frac{e^2\hat{r}_{21}}{|\vec{r}_2-\vec{r}_1|^2}\frac{{A_1}^2{\omega_1}^2}{c^2}\frac{{A_2}^2{\omega_2}^2}{c^2}\left(\frac{2}{5\pi}\right) - \frac{e^2(\hat{r}\cdot\vec{\beta})\hat{r}\times(\hat{r}\times\vec{\beta})}{|\vec{r}_2-\vec{r}_1|^2}\frac{{A_1}^2{\omega_1}^2}{c^2}\frac{{A_2}^2{\omega_2}^2}{c^2}\left(\frac{9}{4\pi}\right)$$

$$\vec{F}_G(\vec{r}) = -G\frac{m_{g1}m_{g2}}{|\vec{r}_2-\vec{r}_1|^2}\left[\hat{r}_{21}+\frac{45}{8}(\hat{r}_{21}\cdot\vec{\beta})\hat{r}_{21}\times(\hat{r}_{21}\times\vec{\beta})\right] \quad (16)$$

$$\vec{F}_I = \left(\frac{2e^2}{3\pi}\right)\left(\frac{{A_1}^2{\omega_1}^2}{|\vec{r}_2-\vec{r}_1|c^2}\right)\vec{a} + \frac{9e^2}{16\pi|\vec{r}_2-\vec{r}_1|c^2}\left(\frac{{A_1}^4{\omega_1}^4}{c^4}\right)\hat{r}\times\left(\hat{r}\times\frac{\vec{a}}{c^2}\right)$$

$$\vec{F}_I = m_i\vec{a}+\frac{27}{32}\frac{A^2\omega^2}{c^2}m_i\hat{r}\times\left(\hat{r}\times\frac{\vec{a}}{c^2}\right) \quad (17)$$

These new terms explain the quantization of gravity as discovered by Bode and improved upon by Stanley Dermitt plus the unusual gyroscope experiments of Eric Laithwaite. It also explains all the galaxy data for which dark matter, dark energy, and black holes were invented to explain. The book shows how to derive the universal gravitation constant G from electrodynamics. It also shows how to derive the value of Planck's constant h from electrodynamics. Subsequent volumes in the series present improved electrodynamics models of elementary particles, atoms, nuclei, and molecules. Furthermore they explain the electrodynamic basis of life and the operation of the living cell. However the most significant contribution of this book is in showing how to correct the scientific method to properly include logic and to make progress in the direction of truth as originally proposed by Isaac Newton.

The results of this book have been incorporated in another new book **Fingerprints of the Creator – the Source of All Beauty in Nature**. [8] This book confirms what the Bible has to say about the nature of the physical universe and its creation by God from an improved version of science. From the bible it defines the symmetry of the fingerprint of God and identifies it in the structure of all elementary particles, atoms, nuclei, molecules, crystals, flowers, leaves, seed pods, animal body structures, orbits of the planets in our solar system, shape of the Milky Way galaxy, and the overall structure of the universe. According to the dictionary this symmetry of form and color is the source of all beauty in nature.

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