The Need for Reformation in Modern Science Based on Universal Truth, Structuralism and Euclidean Geometry

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Euclid and the ancient Greeks were among the first to define Natural Philosophy and its dependence on geometry. They defined the Law of Cause and Effect requiring local contact forces, plus they invented the Axiomatic method to confirm and present universal truth. Later Isaac Newton and others defined the Empirical method of pursuing natural philosophy to discover new axioms, but the method ignored the question of truth and introduced idealizations. The empirical approach led to concepts like mass, non-local action-at-a-distance forces, point-particle idealizations, etc. which man's common sense knew were not true. The success of the empirical approach in mathematically describing nature led to the development of the existential philosophy under which the universe did not function according to logic and common sense. Under the reign of this philosophy Maxwellian electrodynamics, quantum mechanics and relativity theory were developed. Some natural philosophers rebelled against existentialism and introduced the philosophy of structuralism in which meaning is derived from the internal structure of systems. Scientists in the fields of biology, chemistry, and physics did not want to participate in the structural reformation, because they liked their existential theories. So they introduced the Postmodern Philosophy in which each field or discipline in science has its own definition of truth and reality. The university became the multiversity with no universal standards for truth. Work on a new version of the electrodynamic force under the philosophy of structuralism shows that the approach of structural philosophy leads to better theories of electrodynamics, elementary particles, atoms, nuclei, molecules, gravity, inertia, mass, and symmetry of nature based on Euclidean geometry.

1. Introduction

Lee Smolin in his book **The Trouble with Physics**[1] indicates that modern science is in trouble. It appears that science has taken a misstep. In order to correct the path that science is pursuing, it is necessary to understand some of the history of science and how it got to its present state.

1.1. The Axiomatic Method

The axiomatic method was invented by the ancient Greeks as the proper way to organize and demonstrate deductive 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 science or branch of mathematics) is generated in accordance with specified rules by logical deduction from certain basic propositions (axioms or postulates), which in turn are constructed from a few terms taken as primitives. These terms and axioms are defined and constructed according to some method by which some warrant for their truth is felt to exist. The oldest example of an axiomatic system is Euclidean geometry.

Euclid, in the process of developing geometry, defined the axiomatic method of proofs to be used in logically establishing theorems in geometry. To the extent that the postulates chosen were valid, the logically developed theorems would be valid with good certainty

The ancient Greeks, like Plato and Aristotle, were so impressed 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** [2] (**of Geometry**) has been published in more languages and editions than any other natural philosophy or scientific book in the history of the world.

Euclid's approach worked well in geometry where the propositions could be imagined or justified by simple geometrical constructions, 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 is a method of logical organization of proofs of propositions or theorems or theories, but not a method of axiom discovery.

1.2. Newton's Empirical Method of Axiom Discovery

When Isaac Newton published his **Principia**, 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 all the unique forces of nature and use them as axioms.

> And therefore our present work sets forth mathematical principles of natural philosophy. For the whole difficulty of philosophy seems to be to find the forces of nature from the phenomena of motions and then to demonstrate the other phenomena from these forces… For many things lead me to have a suspicion that all phenomena may depend on certain forces by which the particles of bodies, by causes yet un-

> known, either are impelled toward one another and cohere in regular figures, or are repelled from one another and recede. Since these forces are unknown, philosophers have hitherto made trial of nature in vain. But I hope that the principles set down here will shed some light on either this mode of philosophizing or some truer one [3].

Newton claims that in the past natural philosophers tried to understand nature in vain, because they did not use an empirical approach based on experimentation. The empirical approach is more effective in discovering the causes and effects of nature. As a result he argues that the empirical approach is 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 postulates or axioms for natural philosophy upon which to apply logic to derive the theorems or theories of natural philosophy outside of geometry and mathematics. These axioms need to be discovered by experiment.

This approach 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 Force of Inertia and the Force of Gravity as shown below.

Force of Inertia: $$\vec{\mathbf{F}}_I = m_I \vec{\mathbf{a}} \tag{1}$$

Force of Gravity: $$\vec{\mathbf{F}}_G = G\frac{m_{G1}m_{G2}}{{R_{12}}^2}\hat{\mathbf{R}} \tag{2}$$

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 experimental inertial and gravitational masses were found to be equal in magnitude for the same body, 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 took a very practical approach to forces. He assumed the total force on a body was due to the sum or linear superposition of the individual forces of the particles making up that body. Newton also recognized mathematics as a tool to enable an analysis of forces, to help identify the causes of forces and to argue more securely.

In the mechanical philosophy of Newton's time all forces had to be contact forces due to causality. According to Descartes [4] the mechanical philosophy could only allow contact forces between physical bodies, if there were some sort of medium or aether to convey the force between the bodies. Newton realized, however, that no hypothetical contact mechanism seems even imaginable to effect "attractive" forces among particles of matter generally. In the face of criticism from Huygens and others, Newton claimed that he is employing mathematically formulated theory in physics in a new way in which forces are treated abstractly, independently of physical cause or contact mechanism. In other words the two functions could be performed separately with progress being made on the one when no progress could be made on the other.

The first type of proposition in Newton's Principia is a mathematical proposition that links parameters in rules characterizing forces to parameters of motion. The second type of proposition in the **Principia** consists of combinations that contrast different conditions of force in terms of different conditions of motion.

By contrast, an examination of the mathematical theories of Galileo and Huygens shows that the propositions that they were pursuing were ones that made a distinctive empirical prediction that provided an answer to some practical question, or explained some known phenomena. Newton in the **Principia** was not so interested in conjecturing hypotheses and then testing the implications of those hypotheses, but rather to use mathematics to provide a basis for specifying experiments and observations by which the empirical world can provide answers to questions.

In Definition 8 for force at the beginning of the **Principia** Newton says "this concept is purely mathematical, for I am not considering the physical causes and sites of forces". Thus we could say that Newton differed from his predecessors in that he treated forces from a mathematical point of view instead of the physical.

In Book 3 of the **Principia** Newton considers gravitational forces and resistive forces arising from the inertia of the fluid from the physical point of view. Newton requires five conditions to be met for a component of a mathematically characterized force to be considered a physical force as follows:

1. The direction of the force must be determined by some material body other than the one it is acting on
2. All aspects of the force's magnitude must be given by a general law such that the action and reaction forces are always the same magnitude but in opposite direction
3. Some of the physical quantities in a force law must pertain to the other body in a way that determines the direction of the force
4. The force law must hold for some forces that are indisputably real
5. If the force acts on a macroscopic body, then it must be composed of forces acting on the microphysical parts of that body

Notably absent from this list is anything about the mechanism or process effecting the force. Adherents of the "mechanical philosophy" such as Descartes and Huygens would have required not only a mechanism causing the force, but also a contact mechanism for delivering the force. Newton believed that progress could be made in determining the properties of the force mathematically even though not all aspects of the force were known, such as its cause and the mechanism by which it was delivered. He believed that an investigation of the microstructural forces within bodies was key to understanding the macro forces between bodies.

Although Newton was somewhat vague in his writings about how to make the transition from mathematically characterized forces to physically characterized forces, he did realize the potential of the microscopic forces for this purpose. Of course, he did specify the use of predictions of new or additional phenomena as a way of checking force laws. Here the process is to address the complexity of real forces in a sequence of successive approximations. Each force approximation is based upon certain idealizations with systematic deviations from it being used to improve the next version of the force law. Before Newton, the small residual discrepancies between idealized theory and the real world were dismissed as being of no practical importance. After Newton every systematic deviation from current theory automatically has the status of a pressing unsolved problem or new force law.

Newton views these successive approximations for forces as exact. His fourth Rule for Natural Philosophy says:

> In experimental philosophy, propositions gathered from phenomena by induction should be considered either exact or very nearly true notwithstanding any contrary hypotheses, until yet other phenomena make such propositions either more exact or liable to exceptions. This rule should be followed so that arguments based on induction may not be nullified by hypotheses. [5]

Newton's first Rule for Natural Philosophy "no more causes should be admitted than are both true and sufficient to explain their phenomena", has the effect of confining the number and type of forces to no more than the experimental data clearly demands. Requiring the force laws to be deduced from phenomena is a way of meeting this Rule. This approach attempts to limit risk in developing force theories as much as possible to just "inductive generalization". For example, this restriction would preclude inventing unobservable forces due to 'dark matter' to explain spiral galaxies, or 'dark energy' to explain the expansion of the universe to 'rescue' Einstein's Theory of General Relativity.

1.3. Existentialism – Reaction to the Empirical Method

In 1687 Isaac Newton published his famous book **Mathematical Principles of Natural Philosophy** [6, 7]. In this work Newton described universal gravitation and the three laws of motion, laying the groundwork for classical mechanics, which dominated the scientific view of the physical universe for nearly three centuries. Newton's book is considered by many to be the most important contribution to science in the history of the world, because it was the first to show how to describe the physical world in terms of the precise language and equations of mathematics which would become the laws of science.

Toward the end of the nineteenth century a number of natural philosophers became dissatisfied with Newton's approach, because they felt that it did not describe the "real" world. For instance Newton postulated the existence of gravitational and inertial mass, but nobody knew what mass was or could explain it. Newton, himself, admitted that he did not know what mass was. Why were gravitational and inertial masses equal for the same body? Presumably they should be fundamentally different, since they were associated with fundamentally different forces. Newton's force of gravity was an action-at-a-distance type force with no known mechanism to produce spatial contact from the cause to the effect. Newton had invented the aether as a medium to transmit the force from the cause to the effect, but the aether was not fully satisfactory in explaining attractive and repulsive forces and the force of inertia.

The description of the universe in terms of fictitious quantities such as mass, the aether, and action-at-a-distance forces eventually led to the creation of existentialism to replace the Greek approach of natural philosophy. The existentialist philosophers expressed the sense of the purposelessness and absurdity of the world that Newton described with fictitious forces and masses that did not exist.

During the time that existentialism was a dominant force in philosophy, many major developments of modern science occurred. These included the invention of quantum mechanics, especially the Copenhagen version of quantum mechanics of Bohr and Heisenberg, in which the particles in nature are all idealized to be point-like. According to Heisenburg, "reality is in the observation process, not in the structure of the atom or electron". The universal wave function of quantum mechanics describes these ideal particles as governed 100% by random statistical processes. Thus in the quantum realm it is not possible to determine that action A caused result B.

Previously natural philosophers had believed, from experience with the real world that the universe is not totally random in nature, but has a certain degree of order, and the law of cause and effect is dominant. Also modern natural philosophers realized from scattering experiments that every particle in nature has a finite size and an internal charge structure as seen in Fig. 1 contrary to the assumptions of quantum mechanics.

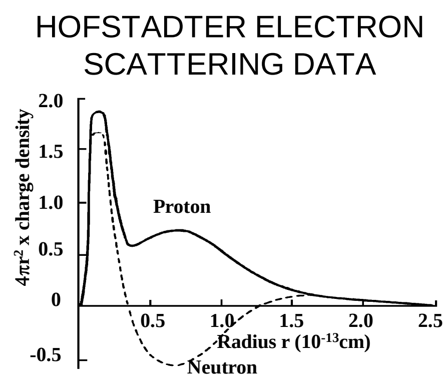

Fig. 1. Electron Scattering Data for Proton & Neutron [8]

Einstein's theory of relativity was also introduced during this time. It too was based on the point-particle idealization of quantum mechanics and the idealization that light was a particle called the photon. A second idealization was incorporated that the spatial universe was homogeneous and isotropic. The lumpiness of stars and galaxies in space seemed to deny the latter assumption. . Furthermore the idealization was incorporated that no particle or information can move faster than the speed of light. Many experiments now show phenomena that move faster than the speed of light. Also relativity theory introduced the notion of four-dimensional space, where time is the fourth dimension. In this view the velocity of light is independent of reference frame. However newer versions of the Michelson-Morley experiment have shown this notion is also an idealization. Finally General Relativity Theory has had problems explaining the high velocity of the spiraling arms of spiral galaxies. Dark matter was invented to explain this phenomenon. The universe is now composed of 95% dark matter and 5% regular matter. Dark matter cannot be observed in laboratories or accelerator experiments like real matter. Also dark energy was invented to explain the apparent expansion of the universe.

No wonder the existentialist philosophers found the universe confusing without purpose and meaning. Their scientific theories described the universe using nonsensical notions and idealizations that defied the reality of the ancient natural philosophers.

1.4. Structuralism – Reaction to Existentialism

In the 1930s a new philosophy called structuralism [9, 10, 11] was developed by the Bourbaki (a secret society of French mathematicians) using some new ideas from linguistics. According to this new philosophy

1. Every system has a structure
2. There are laws responsible for the structure of systems
3. There are unique elements that make up systems
4. Meaning is derived from the structure of systems which act as signs

The items making up any particular system exemplifying the structures are based on axioms which comprise the barest set of first principles. The theorems of mathematics or the theories of science are obtained by the rigorous application of logic to these axioms in a manner similar to the way proofs of theorems are done in Euclidean geometry. There are underlying structures in science and mathematics and the relationship of these structures is the source of meaning and reality that was missing in existential mathematics and science.

Structuralism is closely related to semiotics. Semiotics, also called semiotic studies or semiology, is the study of sign processes (semiosis), or signification and communication, signs and symbols, both individually and grouped into sign systems. It includes the study of how meaning is constructed and understood.

Structuralism appeared in academia in the second half of the 20th century. It was an approach to the human sciences that attempted to analyze a specific field (for instance, mythology) as a complex system of interrelated parts. It began in linguistics with the work of Ferdinand de Saussure. But many French intellectuals perceived it to have a wider application, and the model was soon modified and applied to other fields, such as anthropology, psychoanalysis, sociology, literary theory, mathematics, economics and architecture. This ushered in the dawn of structuralism as not just a method, but also an intellectual movement that came to take existentialism's pedestal in 1960s France [11].

The secret French mathematical society known as Bourbaki, in a series of 10 volumes, revolutionized most of mathematics by establishing an axiomatic basis for all of mathematics and showing its common structures. The Bourbaki believed that every fact in mathematics must have an explanation. Using set theory they attempted to show the unity and universality of mathematics in terms of axioms, logic, and structures. Structure was seen as the mathematically describable portion of reality that has meaning. This meaning can be expressed in terms of mathematical symbols and equations. Structuralism was perceived as the method of intellectual inquiry that provides a framework for organizing and understanding areas of natural philosophy that enables the discovery of meaning. Structuralism replaced existentialism which regarded human existence as unexplainable and without meaning, i.e. not in agreement with logic and common sense.

Members of the Bourbaki worked with researchers in many fields and applied structuralism to their studies. In the areas of linguistics [12], literary theory [13], psychology [14], anthropology [15,16], and economics [17] the Bourbaki were able to help researchers move their study from a descriptive phase to one based on mathematical symbols and mathematical equations with laws and theories derived by rigorous logic from a finite set of axioms. Many of these researchers won Nobel prizes for their work. One fundamental assumption of structuralism is that all of human behavior arises from the innate structures in the human brain. The ultimate goal in the social sciences is to discover and understand the cause and nature of the innate structures of the brain.

The success of structuralism in the social sciences was not matched in the hard sciences of physics, astronomy, geology, chemistry and biology. The scientists in these fields were content with the previously developed existentialist type theories in their fields. As a result of their failure to participate in structuralism, the grand goal of structuralism was slowly abandoned and replaced by postmodernism [18, 19, 20].

1.5. Post Modern Attempt to Maintain Existentialism

Postmodernists liked the existentialist theories of electrodynamics, relativity theory and quantum mechanics and did not want to participate in the structural philosophy reformation of science. So they hold that each field of study or body of knowledge has its own internally defined notion of truth or reality. As a consequence, the truth or validity of different fields of study cannot be compared. Each field is supervised by a group of experts in order to police the borders of that field with criteria for inclusion and exclusion. In the wake of Karl Popper's[21] influential work, falsifiability is often put forward as the criterion for distinguishing between the truly scientific and the pseudoscientific in each field. This is a much weaker criterion than what the axiomatic method offers.

Under postmodernism each field of human study now has experts that define their criteria for truth and meaning. Each field is now a somewhat independent silo of knowledge and truth. The university, which in the past tried to integrate all of man's knowledge into a unified whole, is now a multiversity with each discipline being a somewhat independent field of knowledge.

2. Need for Reformation

In the past most major reformations in science, i.e. the axiomatic, the empirical, and the structural appear to have moved science forward. Now it appears that Postmodernism is a backward direction for science to go. The major scientific theories introduced under the philosophy of existentialism have major problems.

Work on a new version of electrodynamics, that started during the time that the structural philosophy was in vogue, appears to point in a good direction. Unlike the relativistic covariant Maxwellian version of electrodynamics, this version does not use idealizations, fictitious displacement forces, fictitious quantities like gravitational and inertial mass, and fictitious non-local action-at-a-distance forces for electrodynamics and gravity. It appears to be based on a more complete union of the axiomatic and empirical scientific methods and Euclidean geometry.

3. New Version of Electrodynamic Force

A new version of the electrodynamic force [22] has been derived from a more perfect union of the axiomatic and empirical scientific methods than was previously obtained by Maxwell. This electrodynamic force was derived from the complete set of 6 empirical laws of electrodynamics plus Galilean invariance plus Euclidean combinatorial geometry. It does not incorporate the point particle idealization, the linear superposition principle for electromagnetic fields, or the fictitious displacement current in capacitors. It does not use the vector potential approach based on the assumption that magnetic monopoles do not exist. Magnetic monopoles have been discovered [23].

By using the complete set of empirical equations instead of the partial set that Maxwell used, this new version of electrodynamics does not need to be supplemented by quantum mechanics and relativity theory. The covariant relativistic results of Maxwellian electrodynamics are obtained without any reference to relativity theory. The explanation of the Michelson-Morley experiment of 1886, the photoelectric effect, blackbody radiation law of Planck, the bending of starlight by gravitational masses are all explained without relativity theory and the Copenhagen version of quantum mechanics. Quantum effects in this approach are due to standing charge waves in the finite-size structures of elementary particles.

2.1. Differences with Maxwellian Version

Although the constant velocity version of this new electrodynamic force law is the same as relativistic Maxwellian version, there are very significant differences as follows

1. No point particle idealization
2. No Heisenberg Uncertainty Principle to allow non-conservation of energy and momentum for short periods of time
3. No fictitious displacement currents inside capacitors
4. No use of the vector potential which is illegal now that magnetic monopoles have been discovered and the divergence of the magnetic field is no longer zero [23].
5. No need for relativity theory. Finite size feedback effects give the same results via Lenz's Law.

The new version of the electrodynamic force is not based on the vector potential approach, but on conservation of energy, momentum, and charge. It is based on the incorporation of Lenz's empirical electrodynamical law which describes non-linear effects, and conservation of energy and momentum for dynamic magnetic phenomena. Thus a true conservative potential can be defined and extended to include acceleration a and radiative reaction da/dt terms which are not legally derived in the relativistic quantum electrodynamic approach due to the constant velocity basis of relativity theory and the use of the flawed vector potential approach.

2.2. Implications for Elementary Particles

In the derivation of the empirically confirmed radiation reaction law of the new version of electrodynamics a boundary condition was obtained for all elementary particles that radiate. This boundary condition is that they must consist of closed charge loop structures.[24] This result is in conflict with the fundamental assumptions of the relativistic quantum electrodynamic Standard Model of elementary particles which is based on idealized point particles. Thus it is no surprise that this new version of electrodynamics has given rise to a more complete theory of elementary particles [25] that is able to explain by means of combinatorial geometry the complete set of observed elementary particles, their internal structure, their rest mass and excited states, and their decay modes. Whereas the Standard Model uses 25 adjustable constants based on unknown yet to be discovered physics, the new electrodynamic force law approach uses no adjustable constants and still explains more data.

2.3. Implications for Gravity and Inertia

Poincare [26], one of the founders of relativity theory with Einstein, pointed out from meta theory (the theory of theories) a logical criterion for scientific theories that "no two fundamental theories may use the same fundamental constant" such as c. Each fundamental theory needs to have its own unique fundamental constants. Electrodynamics uses c in the wave equation $\lambda f = c$. Special Relativity theory uses c in $E = mc^2$. The Copenhagen version of Quantum Mechanics uses c in the fundamental energy quantization formula $E = h\nu = h(2\pi/\lambda)c$. General Relativity Theory uses c in the Einstein field equations $R_{\mu\nu} - ½\, g_{\mu\nu} R + g_{\mu\nu}\Lambda = 8\pi G/c^4 T_{\mu\nu}$. Poincare predicted that all of the theories above are fundamentally electrodynamic in nature.

Based on the guidance from Poincare, the new version of electrodynamics was used to derive the force of gravity [27] and the force of inertia [28] following the method used by Assis [29,30] to derive the force of gravity for the Weber electrodynamic force law. In this approach the force of gravity is due to the force between vibrating neutral electric dipoles. The statistically averaged v/c, v^2/c^2, v^3/c^3 terms average to zero as expected, but the v^4/c^4 terms average to an always attractive force of the right magnitude for gravity. However, there were two terms obtained and some new unexpected properties of gravity.

The first term was a radial term equivalent to Newton's Universal Law of Gravitation as expected. From it one can define the gravitational mass in terms of the charge, frequency and amplitude of oscillation of the vibrating neutral electric dipoles.

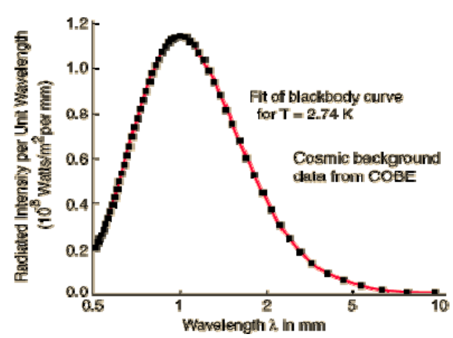

Fig. 2. Fit of Vibrating Neutral Electric Dipole Decay Radiation to Cosmic Microwave Background Radiation

Also this result implied that the force of gravity had to be decaying over time, because all vibrating neutral electric dipoles must decay by giving off radiation over time. The bigger the gravitational body the slower the decay over time due to reabsorption of the radiation on the other vibrating neutral electric dipoles. When the frequency spectrum of the radiation was calculated it was found to be identical to the cosmic microwave background radiation [31] with data from COBE shown in Fig. 2.

The second term was proportional to $\hat{\mathbf{r}}\times(\hat{\mathbf{r}}\times\vec{\mathbf{v}})$ causing a spiraling motion and requiring quantization for stability. This second term explained the origin of the modern version of Bode's quantization law[32] for the orbits of planets and moons in our solar system as shown in the Figure 3 below.

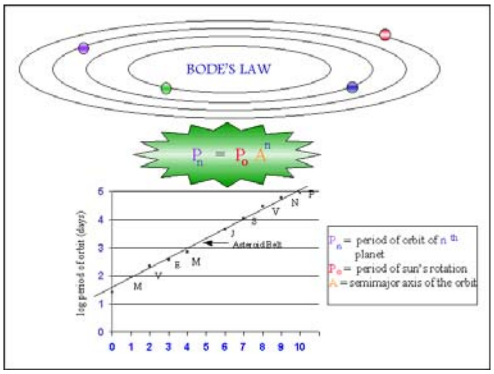

Fig. 3. Bode's Quantization Law for Planets

In a similar manner the inertial force was calculated as the force between a unit charge and a vibrating neutral electric dipole. Again two terms were obtained and some new unexpected properties of inertia.

The first term was the expected equivalence of Newton's universal force of inertia. From $F_I = m_I a$ the inertial mass definition could be obtained in terms of the charge, frequency of vibration, and amplitude of vibration of the vibrating neutral electric dipoles. The inertial and gravitational masses were found to be equal. No previous theory had been able to prove the equivalence of the gravitational and inertial masses.

The second term was proportional to $\vec{r}\times(\vec{r}\times\vec{v})$ giving rise to a force counteracting the first for extreme rotational velocities. This term was able to explain for the first time the unusual gyroscope experiments of Eric Laithwaite [33].

Also the decay of the force of gravity and the force of inertia was able to explain the higher than expected rotational velocities of the outer spiral arms of spiral galaxies without having to resort to the invention of dark matter. Relativity theory needs a universe of 95% dark matter to explain the motion of the spiral arms of spiral galaxies and the expansion of the universe.

2.4. Implications for the Symmetry of the Universe

The new electrodynamic force law including acceleration terms is

$$\mathbf{F}(\vec{\mathbf{r}},\vec{\mathbf{v}},\vec{\mathbf{a}}) = \frac{qq'}{r^2}\frac{(1-\beta^2)\hat{\mathbf{r}} + 2r\vec{\mathbf{a}}/c^2}{\left[1-\left\{\hat{\mathbf{r}}\times(\hat{\mathbf{r}}\times\vec{\boldsymbol{\beta}})\right\}^2\right]^{1/2}} - \frac{qq'(1-\beta^2)}{r^2}\frac{(\hat{\mathbf{r}}\bullet\vec{\boldsymbol{\beta}})\hat{\mathbf{r}}\times(\hat{\mathbf{r}}\times\vec{\boldsymbol{\beta}}) - \hat{\mathbf{r}}\times(\hat{\mathbf{r}}\times r\vec{\mathbf{a}}/c^2)}{\left[1-\left\{\hat{\mathbf{r}}\times(\hat{\mathbf{r}}\times\vec{\boldsymbol{\beta}})\right\}^2\right]^{3/2}} \tag{3}$$

The first term in the non-relativistic limit is spherical. The second term has chiral symmetry due to the triple cross product vector terms. A combination of spherical and chiral symmetry produces a combination of left and right hand mirror symmetry combined with a spiraling motion. It results in symmetry patterns based on the prime numbers 1, 3, 5, 7, 11, 13, … The word chiral comes from the Greek for "hand". The most commonly known example of chiral symmetry is the mirror symmetry shown in the left and right hand.

From the new electrodynamic force a new theory of elementary particles has been developed [25]. In this theory all elementary particles are formed from 1, 3, 5 or 7 primary charge fibers exhibiting chiral symmetry.

The new version of electrodynamic leads to a new physical model of the atom[35] in which the finite size electrons are in the shape of a ring. In this model the magnetic flux lines linking the finite size electrons to form physical electron shells define planes. The number of planes in the various atoms is 1, 3, 5 ... and has chiral symmetry.

The new version of electrodynamic leads to a new physical model of the atomic nucleus [35] in which the finite size electrons, and protons are in the shape of a ring. The neutrons in the nucleus polarize to form an electron and a proton. Each of these particles participates in forming physical electron and proton shells of opposite charge in the nucleus. For shells with the same number of protons or electrons in them, a particle from each shell aligns with a particle from the other shells with the same number of particles to form a group of particles in a line. The number of particles in these groups on a line is 1, 3, 5 … and has chiral symmetry.

The new model of the atom above based on finite-size ring shaped electrons gives rise to a new mechanism for the binding of atoms to form molecules. Instead of orbiting valence point electrons performing figure 8 orbits about two nuclei to bind them together, stationary ring electrons bind atoms together magnetically and electrically. Each electron acts as a small ring magnet. Combinatorial geometry can then be used to determine the complete set of possible configurations just as it was in the case of elementary particles and the atom.

An examination of organic carbon molecules shows that they have 1, 3, 5, … symmetry axes displaying chiral symmetry. Larger organic molecules are found to consist of long spiraling fibers consisting of a stack of carbon ring structures. There are 1, 3, 5, … spiraling fibers observed in these molecules showing their chiral symmetry.

Chiral symmetry can be seen in many types of crystals. One of the best demonstrations is in the photographs of snowflakes by the California Institute of Technology [36]. From the photographs of snowflakes it appears that they have 1 or 3 primary axes of symmetry and 1, 3, 5, … axes of secondary symmetry.

Chiral symmetry can be seen in the pattern of leaves on the stalk of a plant when observed from above. Spiraling patterns are seen as well as 1, 3, 5, … axes of symmetry. Chiral 1, 3, 5, 7, … symmetry can be seen in the lobe pattern of a leaf and in its vein structure. Chiral symmetry can be seen in the 1, 3, 5, 7 symmetry patterns of petals in a flower. Chiral symmetry with spiraling can also be seen in the structures of plant seed pods.

Chiral symmetry can be seen in the structure of the planets especially Saturn. The rings of various latitudes and the equator define planes in the same way as the magnetic flux loops of the atom.

Chiral symmetry can also be seen in the orbits of the planets and moons, such as the orbits of the moons of Jupiter [37]. The spiraling of the moon orbits around the orbit of Jupiter bears a remarkable similarity to the DNA molecule.

Chiral symmetry can be seen in the structure of spiral galaxies such as our own Milky Way galaxy[38] where there are 7 spiral arms. In general spiral galaxies have 1, 3, 5, 7 … spiral arms.

In addition to spiral galaxies there are ring galaxies. Ring galaxies such as Hoag's Object [39] exhibit chiral symmetry in the spiraling of 3 fibers composed of millions of stars. This structure is very similar to that of the electron.

4. Conclusions

Lee Smolin in his book **The Trouble with Physics** [1] indicates that modern science is in trouble. It appears that science has taken a misstep. An examination of the history of science in this paper appears to show that the misstep was the development of science under the existential philosophy that incorporated point particle idealizations, unrealistic action-at-a-distance forces, and false notions about the origin of quantum effects. We need a reformation in science to remove these things from science.

An examination of the new version of electrodynamics that attempted to do these things while being developed under the philosophy of structuralism appears to result in a better theory of electrodynamics, elementary particles, atoms, nuclei, gravity, inertia, and mass. The symmetry of the objects in the universe appears to be explained. The success of this approach further supports the direction needed for a reformation in science.

References

[1] Lee Smolin, **The Trouble with Physics** (Houghton Miflin, 2006).

[2] Euclid, **Elements** (about 300 BC).

[3] Isaac Newton, **The Principia, Mathematical Principles of Natural Philosophy: A New Translation**, trans. I Bernard Cohen and Anne Whitman, p. 382 (University of California Press, Berkeley, 1999).

[4] Rene Descartes, **Principles of Philosophy**, trans. Valentine Rodger Miller, Reese P. Miller (D. Reidel, Dordrecht, 1983)gravity in Propositions 20–27 and magnetism in Propositions 133-183 in Part 4.

[5] Curtis Wilson, "Predictive Astronomy in the Century after Kepler" in Rene Taton, Curtis Wilson Eds., **Planetary Astronomy from the Renaissance to the Rise of Astrophysics, Part A: Tycho Brahe to Newton**, pp. 172-185 (Cambridge University Press, 1989).

[6] I. Newton, **Philosophiae. Naturalis Principia Mathematica** (1687).

[7] Isaac Newton, **Mathematical Principles of Natural Philosophy** (1687), in Great Books of the Western World, Vol. 34 (Encyclopedia Britannica Inc., Chicago, 1952).

[8] Littauer, Schopper, and Wilson, "Structure of the Proton and Neutron", *Phys. Rev. Letters* **7**: 144-147 (1961).

[9] Amir D. Aczel, **The Artist and the Mathematician** (Thunder's Mouth Press, New York, 2006).

[10] Maurice Mashaal, **Bourbaki: A Secret Society of Mathematicians** (American Mathematical Society, 2006).

[11] John Sturrock, **Structuralism**, 2nd Ed. (Blackwell Publishing, 2003).

[12] Roman Jakobson, **Essays on General Linguistics**, (University of Indiana Press, Bloomington, 1952).

[13] Oulipo**, La littèrature potentielle** (Gallimard, Paris, 1973).

[14] Jacques Lacan, **The Seminar, Book IV "La relation d'objet"** (W.W. Norton & Co., New York, 1993).

[15] Claude Lévi-Strauss, **Elementary Structures of Kinship** (Les Structures Élémentaires del la Parenté). (Mouton, The Hague, 1947)

[16] Claude Lévi-Strauss, **Anthropologie structural** (Plon, Paris, 1958).

[17] Wassily Leontief, et al., **Studies in the Structure of the American Economy: Theoretical and Empirical Explorations in Input-Output Analysis** (Oxford University Press, New York, 1953).

[18] Jean-Francois Lyotard, extracts from **The Postmodern Condition: a Report on Knowledge** (University of Minnesota Press, 1979).

[19] Andrew Ross, Ed., **Science Wars** (Duck University Press, 1996).

[20] Richard Rorty, **Introduction, Objectivity, Relativism, and Truth**, (Cambridge University Press, 1991).

[21] Karl Popper, **The Logic of Scientific Discovery** (Basic Books, 1959)

[22] Charles W. Lucas, Jr., "Derivation of the Universal Force Law – Part 1, 2, 3, 4", *Foundations of Science* **9** (2): 1-10 (2006); **9** (3): 1-6 (2006); **9** (4): 1-13 (2006); **10** (1): 1-6 (2007).

[23] www.sciencedaily.com/releases/2009/09/090903163725.htm www.nature.com/news/2009/090903/full/news.2009.881.html

[24] Charles W. Lucas, Jr., "The Universal Electrodynamic Force", *Proceedings of the NPA* **8**: 387-396 (2011).

[25] Charles W. Lucas Jr., "A Classical Electromagnetic Theory of Elementary Particles," *Journal of New Energy* **6** (4): 81-109 (2002), Proceedings of "Physics as a Science" International Workshop, Arrecife, Lanzarote, Canary Islands, 1-5 July 2002).

[26] Henri Poincare, *Oeuvres* **9**: 497 (1954).

[27] Charles W. Lucas, Jr., "The Electrodynamic Origin of the Force of Gravity Part 1-3", *Foundations of Science* **11** (4): 1-10 (2008); **12** (1): 1-11 (2009); **12** (2): 1-12 (2009).

[28] Charles W. Lucas, Jr., "The Electrodynamic Origin of the Force of Inertia Part 1-3", *Foundations of Science* **10** (4): 1-9 (2007); **11** (1): 1-5 (2008); **11** (2): 1-6 (2008).

[29] A. K. T. Assis, "Deriving Gravitation from Electromagnetism", *Canadian Journal of Physics* **70**: 330-340 (1992).

[30] A. K. T. Assis, "Gravitation as a Fourth Order Electromagnetic Effect", in **Advanced Electromagnetism: Foundations, Theory and Applications**, pp. 314-331 (World Scientific, Singapore, 1995).

[31] J. C. Mather, et al, *Astronomy Journal* **354**: L37 (1990).

[32] www.astro.cornell.edu/academics/courses/astro2201/bodes_law.htm.

[33] www.gyroscopes.org/1974lecture.asp.

[34] www.en.wikipedia.org/wiki/Chiral_symmetry.

[35] Joseph Lucas & Charles W. Lucas, Jr., "A Physical Model for Atoms and Nuclei – Part 1, 2, 3, 4" *Foundations of Science* **5** (1): 1-7 (2002); **5** (2): 1-8 (2002); **6** (1): 1-10 (2003); **6** (3): 1-8 (2003).

[36] www.its.caltech.edu/~atomic/snowcrystals/photos/photos.htm.

[37] *Sky & Telescope*, September 2009

[38] University of Clifornia, San Diego Center for Astrophysics & Space Sciences, www.ucsd.edu/archive/public/tutorial/MW.html.

[39] www.en.wikipedia.org/wiki/Ring_galaxy.

What were scientists called during the Post-Reformation Era? Natural philosophers. 1. What is the heliocentric view of the universe? 2. Who discovered it? 1. The idea that the planets, including the earth, revolve around the sun, and that the earth is not a motionless body about which everything else in the universe moves 2. Nicolaus Copernicus. 1. Briefly describe the three laws of planetary motion.Â 1. Isaac Newton 2. a. The universal law of gravitation b. The three laws of motion. 1. Who is known as the "Father of Anatomy"? 2. The "Father of Modern Chemistry"? 3. The "Father of Microbiology"?Â 1. What was the first permanent scientific society of the Modern Age? 2. Name some of its early members. 3. What scientific society was founded in Paris in 1666? 4. What two groups supported it? Abstract: Many scientific fields study data with an underlying structure that is a non-Euclidean space. Some examples include social networks in computational social sciences, sensor networks in communications, functional networks in brain imaging, regulatory networks in genetics, and meshed surfaces in computer graphics.Â Geometric deep learning is an umbrella term for emerging techniques attempting to generalize (structured) deep neural models to non-Euclidean domains such as graphs and manifolds. The purpose of this paper is to overview different examples of geometric deep learning problems and present available solutions, key difficulties, applications, and future research directions in this nascent field. Subjects: Computer Vision and Pattern Recognition (cs.CV). Euclidean geometry is the kind of geometry you learned in high school, the geometry most of us use to visualize the physical universe. It comes from the text by the Greek mathematician Euclid, the Ele-ments, written around 300 B.C. Our picture of the physical universe based on this geometry was painted largely by Isaac Newton in the late seventeenth century. Geometries that differ from Euclid's own arose out of a deeper study ofparallelism.Â We will concentrate on Euclidean and hyperbolic geometries in this book. Hyperbolic geometry requires a change in only one of Euclid's axioms, and can be as easily grasped as high school geometry. Euclidean Geometry - Science topic. Explore the latest publications in Euclidean Geometry, and find Euclidean Geometry experts. Questions (76). Publications (3,733).Â In contrast to Euclidean geometry based on the continuity of geometric forms, frag Cite. Download full-text.Â Compared to those clustering methods based on Euclidean geometry, spectral clustering has no limitations on the shape of data and can detect linearly non-separable pattern. Due to the high computation complexity of spectral clustering, it i Cite.