

# THEORY OF FIELDS AND ENERGY

*John Daniel*

*D.Sc.degree researcher,*

*Mumbai University.*

**Abstract:** In part-I, An expression for the gravitational force acting on a photon radiated by an isotropic electromagnetic radiator is derived. The speed of electromagnetic wave is proved to be much greater than  $3 \times 10^8$  m/s. Static gravitational fields and electric fields are proved to exist at discrete levels. The static field radiating systems also proved to be an automatic second order feedback control system. Quantum field radiation of the atoms is explained. Origin and the dynamics of the material universe and the radiation and the energy conservation of isotropic point radiators are proved to be governed by the same set of principles. Finally, a method of analyzing nuclear fields and structure and elementary particles is proposed. In part-II, Mass and the charge are shown to be equivalent. Newton and Coulomb's laws are corrected to include near field components. Complete form Field laws of Newton and Coulomb are derived from a better model of the particle. Based on the energy considerations the entire universe and it's all sub systems are described by the second order feedback control system theory. The missing mass or dark mass of the universe may be found if the energy calculations of the universe are made based on the findings of the article. In part-III, the structure of the nucleus and the particles are explained. The relationship between the space and the fields and the structure of the fields also explained. A deterministic and universal mathematical formula for fields is derived. The universe and all it's sub systems are proved to be an automatic second order feedback control system once again.

**Key Words:** Speed of light, Fields, particles, Energy, general field theory, automatic feedback control system.

## I. INTRODUCTION

As per the Newton's law of gravitational forces, matter particles radiate gravitational fields. As per the Coulomb's law, electric charges radiate electric fields. As per Bio-Sevart's law, electric currents produce magnetic fields. As per the classical theory of electromagnetic radiation, an accelerated electric charge radiates electromagnetic field. As per the quantum theory of radiation, electrons in the atomic orbits radiate photons if they are sufficiently energized. Recently many quantum mechanical principles were derived from the classical electromagnetism [1 2 3 4] and applied to develop new theories of cosmology [5 6 7 8]. Therefore, in this article, by applying all the new insights gained in the earlier papers, radiations of mass, charge and atoms are analyzed and new facts are found. In the first section, an expression for the gravitational force acting on a photon radiated by an isotropic electromagnetic radiator is derived by means of mass energy equivalence of the particles as defined by the special theory of relativity. In the second section, Static gravitational fields and electric fields produced by masses and electric charges are analyzed and are proved to exist at discrete levels. In the third section, quantum field radiation of the atoms is explained by the classical theory of radiation. Finally, a method of analyzing nuclear fields and structure and elementary particles by applying charge-mass equivalence is proposed as concluding remark.

In part-II, first the mass and charge equivalence principle is explained by comparing the field laws of Newton and Coulomb [13]. By comparing the Gauss [15] and Coulomb's laws of the fields, these laws are proved to fail in the regions close to the point charge and therefore, these laws are corrected. By applying mass and charge equivalence principle the corrected near field component is proved to be nuclear dipole field component radiated by the masses and charges of an atomic particle. In the next section, complete form of Newton and Coulomb laws which includes near field and far field radiated fields of mass and charge particles are derived by a better model of a Newton and Coulomb particles [9]. The far field gravitational field components includes both field components of Newton and Einstein [16 5]. By the energy theoretical analysis of the universe [8], the structure and dynamics of the entire universe and all it's sub systems like galaxies, stars, planetary systems, earth, plants, animals, humanity, society, economy, environment, wars, knowledge, information, etc. are proved to be described by the second order automatic feedback control system theory [7 8 14]. The present models of particles are proved to be crude and therefore, energy calculations based on the crude models of particles and universe may not be correct. Therefore, the concluding statement of the article is the missing mass or dark mass of the universe may be found if the energy calculations of the universe are made based on the new model and the theory of the cosmos, fields and the particles developed in this article [17].

In the previous sections, Newton's gravitational field law [13], Einstein's gravitational field law [16 5] and nuclear field laws [11] were integrated into one law by applying mass and charge equivalence principle derived from the laws of Newton and Coulomb [11] and the radiation theory of the continuum electromagnetism [9]. The field laws applicable in the near field regions of the particles also were derived from the electrostatic field laws of the Gauss [15]. This analytical formula derived is a deterministic formula and does not rely on statistical theory like the statistical interpretation of quantum mechanics. However, the limitations and the validity of the unified field theory also mentioned. As we all know well nucleus is filled with so many elementary particles and there are two forces namely strong and weak nuclear forces acting in the nucleus. Structure of the nucleus is also not yet understood well. A theory to understand the nuclear structure fully is not yet developed [11]. The highly successful quantum field theory applicable only to the quantum particles domain is also not yet understood like the quantum mechanical laws and theories. Since these theories were developed based on hypothesis and the experimental evidences and verifications of hypothesis, many of the laws, formulas and equations are not related to the classical world of physics. These theories mainly rely on the mathematical physics. Therefore, interpretation and relating them to the physics of the classical world has become so complicated. The classical physics was developed by deriving advanced theories, laws, formulas and equations from the well known and experimentally confirmed laws, theories, equations and formulas. Recently by following the traditions of the classical physics, a deterministic quantum theory [1 2 3 4 18 4 6 7 8] was developed. Based on these theoretical foundations,

the structure of the nucleus and the particles are explained. The relationship between the space and the fields and the structure of the fields also explained. Finally, by applying the qualitative and conceptual theories, a deterministic mathematical formula which includes all fields radiated by all the particles known and unknown to us is derived. This universal field formula is shown to be applicable to the smallest particle of the world to the biggest universe. Recently the universe and all its sub systems are proved to be an automatic second order feedback control system [14]. These theories are once again confirmed by this generalized field theoretical formula.

## II. PART-I: RADIATION THEORY OF THE FIELDS

### 2.1. Radiation of Electromagnetic and Gravitational Fields [9]

As per the special theory of relativity, energy  $E$  of a mass =  $E = mC^2$  where  $C$  is the maximum velocity of light. Therefore, all particle dynamics could be analyzed in terms of energy dynamics. Therefore, the speed of an energy or a matter particle =  $dE/dt = dx/dt$ , where  $x$  is the distance travelled by the particle at time  $t$ . As per Newton's law, force acting on a mass  $m = m.d^2x/dt^2$ .

Therefore, gravitational field acting on the mass  $m = d^2x/dt^2 =$  the acceleration of the mass =  $d^2E/dt^2$  (1)

$dE/dt = P_0/4\pi r^2 =$  Speed of photon energy radiated at the radial distance point  $r$  from the source, where  $P_0$  is the total radiated power (2)

By differentiating the equation (2), we get,  $\partial^2E/\partial t^2 + (P_0/2\pi r)\partial E/\partial t = 0$  (3)

By solving the equation (3), we get  $V(r) = V(r_0) - (P_0/2\pi r)\ln(r/r_0) = dE/dt$  (4)

From equation (3), we get,  $\partial^2E/\partial t^2 = - (P_0/2\pi r)\partial E/\partial t = - (P_0/2\pi r) V(r) = - (P_0/2\pi r).C^2(r)$ , where  $V(r) = C^2(r) =$  the velocity of a photon or energy or group velocity (5)

Both the phase velocity  $C(r)$  and group velocity  $V(r)$  of the photon are functions of  $r$  due to the divergence of electromagnetic wave and energy. Under far field conditions  $C(r) \approx 3 \times 10^8$  m/s. Equation (5) is also the equation for acceleration of the photon ( $\partial^2E/\partial t^2$ ) and therefore, it is also equal to the gravitational field acting upon the photon from the source. From the equation (2),  $C^2(r) = P_0/4\pi r^2$ .

Therefore, gravitational field acting upon the photon =  $-(P_0/\pi)^2.(1/8r^3)$  (6)

The force acting upon a photon = acceleration of the photon X mass =  $-(P_0/\pi)^2.(1/8r^3) \times m$ , where  $m$  is the mass of the photon given by  $m = m_0/(1 - (C(r)/C(0))^2)^{1/2}$  where  $m_0$  is the rest mass of the photon. The rest mass of the photon =  $h.f/C^2$  where  $h$  is Planck's constant and  $f$  is the frequency of the electromagnetic wave.

### 2.2. Radiations of Static Fields [9 10 11 12 13 14]

An isotropic radiator or a Hertzian dipole radiator or a capacitor [9] stops radiating electromagnetic waves if power supply is switches off. But the static field radiation (Gravitational field) of a mass and an electric charge (electric field) radiates energy continuously. This radiated field has stored energy. Both Newton and Coulomb's laws produces singularities in the radiated fields at the source point of radiation. Singularities are produced in physical theories due to unrealistic assumptions made while formulating the theories. Therefore, first law of the thermodynamics is not satisfied by these systems of radiation of fields. The energy radiated is directly proportional to the square of the radiated field. Therefore, the field radiated has both positive and negative values. Therefore, to satisfy the first law of thermodynamics, one has to assume that the radiated energy is circulated between the points of charge and mass and points at infinite distances (very large distances). In the case of magnetic charges, positive and negative magnetic charges can't be separated and therefore, the dipole field energy is circulated between the poles. A current loop is a magnetic dipole and therefore, the energy is conserved.

Therefore, in the case of static electric field radiations, the radiated energy is reflected back towards the source and the cycle continues for eternity. This multiple periodic reflections or circulation of energy produces stationary fields. Therefore, as per Fourier theorem, the field or energy radiated by a charge or a mass could be expressed as a sum of sine and cosine wave functions of fundamental period equal to the maximum radius of the sphere of radiation. Therefore, the field and the energy radiated exist at discrete levels in the space. The fundamental frequency of the circulation of energy is  $C/R$ , where  $R$  is the maximum radius of the sphere of radiation and  $C$  is  $3 \times 10^8$  m/s. As per the latest report on the nature of the space found [8], space is in a discrete form and interacts with mass, charge and energy. Therefore, fields could exist in discrete form only.

If an isotropic electromagnetic radiator is switched on the radiation goes from zero to a finite value within a short period of initial time. Therefore, speed of radiation must be greater than  $3 \times 10^8$  m/s at the initial phases of radiations and reaches a steady state value within a short time. This steady state velocity of electromagnetic radiation is  $3 \times 10^8$  m/s. This speculation is proved in the earlier section. Similarly, in the cases of static radiations by masses and charges, during the transient period of radiation, the speed of the radiation must have been much greater than the steady state speed of the radiation. To conserve the energy, radiated field/energy must have been reflected back with very high speed. This cycle of radiation and reflection must have been repeated at very high speed and frequency in the transient period till the radiation reached steady state condition. Therefore, static field radiating system could be described as a second order feedback control system since electromagnetic wave equation is a second order equation.[14].

Therefore, in the early universe, sudden rise of a charge of very high density radiated the required amount of electromagnetic energy to make the material universe and then stopped the radiation when the universe reached the steady state condition to produce matter particles. Then the universe become cyclical just like a point charge or mass conserves the energy in it's static radiations. The speed of radiation was very high and greater than the speed of  $3 \times 10^8$  m/s in the regions close to the point of origin of the universe. The gravitational force acting on the photons originates from the charged center of the universe. Static charges radiate and conserve the electromagnetic energy. Therefore, static charges are always in the vibrating mode with very high frequency of oscillation. This vibration is understandable since there is always a potential difference between a charges point of the space and in the neighboring region. Charges are made up of highly concentrated fields as per coulomb, Newton and De Broglie's laws and the theory of early universe just like matter particles. Space exists in the discrete form. Therefore, just like the matter particles, charges also can exist only at discrete states. Therefore, there will always be a potential difference between the point of charged space and it's neighboring space. Therefore, charges will always be in vibrating mode and these vibrations create gravitational force on the photons, radiation and the reflection of fields to conserve the energy. Therefore, the origin dynamics of the material universe and the radiation and the energy conservation of isotropic point radiators are governed by the same set of principles.

### 2.3. Radiations of Quantum Fields [1 2 3 4 9]

Discrete nature of the space makes the charged particles (electrons) of the atoms to radiate quantum pockets of electromagnetic waves/energy like a capacitor radiates while charging and discharging in a RC circuit when the power supply is switched on and off periodically [11]. In an atom, the electrons jump to higher energy levels if they are energized and radiates while going down to the ground level. Therefore, this upward jump and downward fall of electron constitutes a small electric current element between the orbits of jump. This impulse current element is comparable to an isotropic radiator whose steady state fields are given by [9]

$$E_{\theta} = (Idl \cdot \sin\theta / (4\pi\epsilon)) \cdot (-\omega \sin(\omega t') / rC^2 + \cos(\omega t') / r^2C + \sin(\omega t') / \omega r^3) \quad (1)$$

$$E_r = (2Idl \cdot \cos\theta / 4\pi\epsilon) \cdot (\cos(\omega t') / r^2C + \sin(\omega t') / \omega r^3) \quad (2)$$

$$H_{\phi} = (Idl \sin\theta / 4\pi) \cdot (-\omega \sin(\omega t') / rC + \cos(\omega t') / r^2) \quad (3)$$

$$\text{Where } t' = t - r/C \quad (4)$$

The  $1/r^2$  terms are induction field components dominates only in the region close to the current element and  $1/r$  term dominates at larger distances. Therefore, field at larger distances are actually the radiated fields. The  $1/r^3$  components are static field components originates due to the dipole nature of the radiating current element. The atomic radiator radiates over a band of frequency since frequency spectrum of the pulse function has a finite bandwidth. Therefore, by including the transient radiations, the actual radiation could be expressed in the form of a Fourier series with  $\omega$  as fundamental frequency. This is how atoms radiate quantum fields and energy. Note that the amplitude of the radiation depends on the distance between the orbits of the atom. Therefore, energy of radiated field is directly proportional to the square of the current element length. Therefore, photon energy and frequency is directly proportional to the square of the current element's length. The same is expressed as difference between orbital energies in the literature of quantum mechanics. The current loop generated by the electronic motion in the orbits could be compared with a magnetic dipole radiator whose frequency depends on the length of the orbit and the speed of the electron. The length of the magnetic dipole is directly proportional to the length of current loop or circumference of the electronic orbit and therefore, the radiated fields become independent of the orbital radius. That is why radiation of the accelerated electrons does not make the electrons to fall into nucleus. This phenomenon could be better understood in a different way. The electrons moving in the atomic orbits produce periodic impulse currents. An impulse current and charge radiates static field at all frequencies. This means radiation is constant and independent of frequency. Therefore, electrons orbiting in a loop around the nucleus do not lose any energy and do not fall into the nucleus.

If the current is constant,  $\omega = 0$  and therefore, there is no radiated field and produces only  $1/r^2$  and  $1/r^3$  static field components. The current becomes equal to the electron charge and formulae for electric fields reduces to Coulomb's law and formulae of magnetic fields reduced to Bio- Savart's laws of static fields. By comparing Newton's law and Coulomb's law relationship between the charge and the mass could be established and therefore, Newton's law is derived from the Coulomb's law. In both the static electric and magnetic field formulae,  $1/r^3$  terms are there. These components are due to the electric dipole of the current element.

## III. PART-II: A DETERMINISTIC UNIFIED THEORY OF THE FIELDS AND ENERGIES

### 3.1. Mass and the charge Equivalence [13 11]

In electromagnetic field theory, Euclid or linear space is used to formulate all problems. Only in gravitational field theory space is assumed to be curved. But Newton's law of gravitational field is comparable to Coulomb's electric field laws. Therefore, if the space is really curved, the space of electromagnetic fields should be proved to be curved. But no such evidences are available in the literature. Mass and Charges are proved to be equivalent sources of fields, if we compare the Newton's Law of gravitation [13] with the Coulomb's law of electricity [11]. Electric Charge is equal to  $\sqrt{G4\pi\epsilon}$  X Mass. This relationship establishes the link between fundamental units of electric and gravitational fields. This is another evidence to prove that space is not curved.

### 3.2. Near Field radiation of Masses and Charges [15]

As per the Gauss's law of electrostatics closed  $\int \mathbf{D} \cdot d\mathbf{s} = Q$  where  $\mathbf{D}$  is electric flux density of the field  $\mathbf{E}$ ,  $Q$  is the charge enclosed by the closed Gaussian surface  $\mathbf{s}$ . If the point charge  $Q$  is assumed to be placed at the center of closed spherical surface,  $\int \mathbf{D} \cdot d\mathbf{s} = \int D \cdot ds$  since  $\mathbf{D}$  and  $\mathbf{s}$  are in the same direction. Therefore, at the points very close to the point charge  $D \cdot ds \approx Q$ .

Therefore,  $D \approx Q/ds = \rho_s =$  the surface charge density (1)

Since  $D = \epsilon \cdot E$  where  $\epsilon$  is the permittivity of the medium,  $E = \rho_s/\epsilon$  (2)

From the equation (1), surface charge density of a point charge could be defined as electric flux density  $D$ .

Therefore,  $E = Q/(4\pi\epsilon r^2)$  as  $r \rightarrow 0$  (3)

Therefore, as per the Coulomb's law, a point charge could be defined as a highly concentrated field. Therefore, surface charge density can't correctly define the field at points close to the point charge. Only volume charge density can correctly define the electric field intensity at points close to the point charge.

Therefore, equation (3) is modified to  $E = 3Q/(4\pi\epsilon r^3)$  as  $r \rightarrow 0$  (4)

Therefore, the generalized or corrected or modified Coulomb's law is  $E = Q/(4\pi\epsilon r^2) + 3 \cdot Q/(4\pi\epsilon r^3) = (Q/(4\pi\epsilon))(1/r^2 + 3/r^3)$  (5)

By applying the mass – charge equivalence principle of the first section, the corrected Coulomb's law could be modified to correct the Newton's law of Gravitation. These corrected Coulomb and Newton's laws very well explain the strong and weak nuclear forces since nucleus is made up of matter particles and charges. Therefore, nuclear forces are just the near field radiations of charges and mass particles.

### 3.3. Force Laws of Newton, Coulomb and Lorenz [15 9 16]

As per the Coulomb's law, electric charge radiates electric field. As per the definition of electric current and Biot-Savart's law  $dQ/dt$  radiates magnetic field. As per the classical theory of radiation,  $d^2Q/dt^2$  radiates electromagnetic field. Similarly, if  $x$  is the distance travelled by the mass  $m$  at time  $t$ ,  $dx/dt$  is the velocity of the particle and  $d^2x/dt^2$  is the field acting on the mass. Therefore,  $d^2x/dt^2$  could be produced by another mass  $M$  at the distance  $r$ .

As per the Newton's law, the gravitational field produced by the mass  $M$  at the distance  $r = G \cdot M/r^2 = d^2x/dt^2$  where  $G$  is the gravitational field constant (1)

Therefore, as per the charge mass equivalence principle, the field term which produces  $dx/dt$  (velocity) equivalent to magnetic field component produced by  $dQ/dt$  is not included in the Newton's formula.

As per Lorenz's force formula the force acting on a charged particle of mass  $m$  and charge  $Q$  with the velocity  $\mathbf{v}$  in the magnetic flux density  $\mathbf{B}$  and electric field  $\mathbf{E} = m \cdot d^2x/dt^2 = Q \cdot (\mathbf{v} \times \mathbf{B} + \mathbf{E})$  (2)

Therefore, if we compare the equations (1) and (2), Newton's gravitational field formula has to be corrected to include the field corresponding to the term  $\mathbf{v} \times \mathbf{B}$ . In the days of Sir Isaac Newton, knowledge of atoms, electricity and magnetism were not available. Therefore, Newton's particle included only the total mass of the particle. Now, we all know that all matters are made up of atoms. Atoms are made up of relatively stationary nucleus and orbiting electrons. Therefore, Newton's particle includes only the mass of the atomic particle and the charges of nucleus. That is why Newton's law is comparable to Coulomb's law. Newton's model of a particle does not include the charge of the electron and the current produced by the orbiting electron. Therefore, the simplified model of an atom like Newton's particle is sum of one magnetic dipole corresponds to the loop currents produced by the orbiting electrons, an electric dipole corresponding to charges of electrons and protons and the total mass of the atom. As per the charge mass equivalence principle, mass could be split into equal parts and added with the dipoles. Therefore, the better and simple model of a mass particle is a Hertzian dipole radiator of electromagnetic field. The mass particle radiates dynamic field since electronic currents are periodic currents with a frequency. The electric field radiated by a Hertzian dipole radiator has  $1/r$ ,  $1/r^2$  and  $1/r$ .

Therefore, the formula for complete gravitational field =  $M \cdot (K_1/r + K_2/r^2 + K_3/r^3)$  where  $K_1$ ,  $K_2$ ,  $K_3$  are proportionality constants (3).

As was proved in another paper [5],  $1/r$  term is the far field component of the gravitational field radiated as per the general theory of relativity.  $1/r^2$  term is Newton's gravitational field component and  $1/r^2$  and  $1/r^3$  components nuclear field components. However, since the model of atom is simplified model, application of  $1/r^2$  and  $1/r^3$  terms have only a limited validity to study the nuclear forces and particles. For detailed study of the nuclear structure, particles and fields, the following accurate theory has to be applied.

### 3.4. Particles and the Energy [7 8 14]

If one considers the entire history and the evolution of the world, the world could very well be defined as a History made up of histories within histories in the 4 dimensional space – time structure. Therefore, the entire world could be described by a multiple periodic function. In other words, the world could be described by multidimensional Fourier series. Since all particles

could be described by mode functions of Fourier series and the entire world had evolved from elementary particles, in principle the entire world could be described by a multi dimensional Fourier series.

The entire world could be described by energy functions and the dynamics of the energies since all originated from energy and are different forms of energy. Since the universe is proved to be a second order feedback control system and made up of histories within histories, all sub system's (like atoms, molecules, Galaxies, stars, planets, earth, plants, animals, humanity, man, economics, human history, science, technology, environmental systems, etc.) structure and dynamics and the future could be described the second order feedback control system theory. Some small time scale histories could be repeated in the laboratories and other places and other histories are not repeatable. For example, human history is partly repeated and partly not.

#### IV. PART-III: GENERAL DETERMINISTIC THEORY OF FIELDS

##### 4.1. Mass and the charge Equivalence [13 11]

In electromagnetic field theory, Euclid or linear space is used to formulate all problems. Only in gravitational field theory space is assumed to be curved. But Newton's law of gravitational field is comparable to Coulomb's electric field laws. Therefore, if the space is really curved, the space of electromagnetic fields should be proved to be curved. But no such evidences are available in the literature. Mass and Charges are proved to be equivalent sources of fields, if we compare the Newton's Law of gravitation [13] with the Coulomb's law of electricity [11]. Electric Charge is equal to  $\sqrt{G4\pi\epsilon}$  X Mass. This relationship establishes the link between fundamental units of electric and gravitational fields. This is another evidence to prove that space is not curved.

##### 4.2. Structure of the Nucleus and the Particles [ 1 2 3 4 18 4 6 7 8 14 ]

There are three types of particles existing in the universe. They are energy, matter and charge particles. As per the standard model of cosmology, matter and charge particles originated from the highly energetic photons. Recently the particles are found to be made up of waves. Therefore, waves are more fundamental units than the particles. As is well known, waves are made up of fields. Therefore, fields are the most fundamental units of all the particles and the nature. Fields contain energy and energy is in the discrete form. Energy is directly proportional to the square of the field and therefore, fields also exist in discrete form. Therefore, Faraday's lines of forces are proved to be real physical lines. The rays of the ray theory of fields and the waves are also proved to be real physical lines. Electromagnetic waves are made up of positive and negative fields. Since all the particles are made up of electromagnetic waves, a cycle or half a cycle of the electromagnetic wave is the fundamental unit of all the particles. Therefore, positive charges are made up of positive half cycles of electromagnetic waves and negative charges are made up of negative half cycles of the electromagnetic waves. Matter particles are made up of full cycles of electromagnetic waves. As per the Newton and Coulomb's laws, charges and the masses could be defined as highly concentrated fields. Therefore, fields, masses and charges are proved to be one and the same physical entities. Therefore, the laws of Newton and Coulomb also confirm the theory explained here in this section. Therefore, electrons are made up of full cycles and negative half cycles of electromagnetic waves and the protons are made by full and half positive cycles of the waves and the neutrons by full cycles of the waves. All the other elementary particles also described by half and full cycles of electromagnetic waves depending on the mass and charge of the particles. Since positive field (or charge) attracts the negative field, a bond is built and becomes a full cycle of a wave. Since the like charges or fields repel each other, there is a half cycle gap between like charges or fields. In other words charges are in the form of half rectified waves. As per the Fourier theorem, half rectified waves could be expressed by sum of sine and cosine waves. Therefore, all particles are made up of Fourier wave cycles. This means each particle of the universe is made up of particles within particles or waves within waves. As per the Parseval's theorem, energy of each Fourier mode exists in discrete form. Therefore, charges could be expressed in mode form like matter and energy particles are expressed in mode forms. Therefore, charges, matter and energy particles could be described by the Schrodinger wave mechanics. Therefore, all particles of the nature could be described by waves within waves of sub harmonic frequencies. However, a particle is made up of finite number of sub particles since Fourier series converges to zero after a finite number of modes. Therefore, all particles of the nature could be described by electric and magnetic dipoles. Therefore, all fields of the nature could be described by electric and magnetic dipole radiations. An atom could be described by magnetic and electric dipoles. Similarly a nucleus could be described by full cycles of waves (neutrons) and half and full cycles of waves (protons). Since neutrons and particles without charges are made up of full cycles of electromagnetic waves, all dipoles are very tightly bonded in closed loop form. Protons are made up of positive half cycles and full cycles of wave. Therefore, internal bonds in the protons are weak as compared with the neutrons. Therefore, the internal fields of neutrons are much stronger than the internal field of the protons.

##### 4.3. Space and the Fields [16 5 7 8]

Space was proved to be in discrete form in the recently published theory of cosmos and modified theory of relativity. In the modified theory of relativity, space and the field are proved to be relative to each other. In the Newton's theory space was assumed to be stationary and field is assumed to be in the dynamic state. In the general theory of relativity by assuming that space and the field are one and the same, space was made as a dynamic entity, if disturbed by the mass. Therefore, Newton's theory and general theory were proved to be one and the same. Since the space is in three dimensional discrete matrix form, fields and quantum particles also exists in the discrete states of the space (Energy is directly proportional to the square of the field). Since the elements or cells of the discrete space matrix are very close to each other, space and the fields could be treated as continuous entities. But particles are larger in size as compared with the discrete fields and waves. Therefore, particles exist in the much greater discrete states of energy and space. Therefore, quantum mechanical theories are applicable only to larger sized particles and quantum field theory is applicable at very smallest scales of particle physics. Since the space itself is in the discrete form, classical continuum field theory is only an approximation to the quantum field theory. Therefore, quantum field theory is the most fundamental to all the theories of the physics.

#### 4.4. Fields Radiated by the (Nuclear) Particles [13 16 5 9 15]

When a point charge is placed at a particular point, due to the potential difference between the initial point of location of the particle and the points close to the point charge, there will be an oscillation of the point charge between the initial point and the point close to the initial location. Such an oscillation and potential difference originates due to the discrete nature of the space. As per the charge mass equivalence principle, a matter particle also will vibrate in this way. Such oscillations produce discrete electromagnetic fields or equivalently matter particles produce gravitational fields. The particles can exist only in discrete states as per the quantum mechanical theory also. As per the Newton and Coulomb laws particles continuously radiates fields. This continuous radiation is possible only if there is an expansion and contraction of the radiation in diametrically opposite directions. In order to create such a field which conserve the energy, oscillation or vibration of the source of radiation is required. Since negative/positive charges are made up of negative/positive half cycles of electromagnetic waves, they always vibrate between initial state and the next empty state. The matter particles are made up of full cycles of electromagnetic waves and therefore, vibration between dipoles is at very high frequencies. In the nucleus, such very high frequency radiations are responsible for strong fields and the radiations due to charged particle vibrations are responsible for weak field radiations.

All particles originated from electromagnetic energy of the early universe. Therefore, all particles could be described by Fourier series modes. The entire universe is made up of particles within the particles and therefore all particles evolved from smaller particles over a period of time in the history of the universe. Therefore, the entire universe can be described by a multiple periodic function or a multi dimensional Fourier series. Therefore, the smallest particle of the universe could be described by the Fourier series modes. Such modes are generated by the periodic vibrations of charge or matter particles. This vibration is comparable to the transfer of complete charge from one plate of a parallel plate capacitor to the other plate and back to the first plate cyclically at all times. Therefore, the capacitor or particle always radiates discrete/ quantum fields and energy at all times. The transient and the steady state of the oscillation are equally important since the particle oscillates between the states very fast with complete charging and discharging of the capacitor plates or positions in the space. The eternal vibration of the particles in deterministic way disproves the uncertainty principle of quantum mechanics. The radiated fields are given by [6] the following equations.

$$A_z = (\mu \cdot I \cdot dl / (4\pi r)) \cdot \cos \omega t' = \text{Magnetic vector potential, where } \mu \text{ is the permeability of the medium, } I \cdot dl \text{ is the current element at the origin of spherical coordinate system in the } z \text{ direction, } t' = t - r/v, I = I_0 \cdot (1 - e^{-at}), I_0 = \pm I_s \text{ and } v, a, I_0, I_s \text{ are constants} \quad (1)$$

$$H_\phi = (dl \sin \theta / 4\pi r) \cdot (- (\omega/v) \cdot I \cdot \sin(\omega t') + I \cdot \cos(\omega t') / r + (a/v) \cdot I_0 e^{-at'} \cdot \cos(\omega t')) \quad (2)$$

$$E_\theta = (dl \cdot \sin \theta / (4\pi \epsilon r)) \cdot ((\omega/v)^2 \cdot (I_0/\omega) \sin(\omega t') - (I_0/rv) \cdot \cos(\omega t') - I_0 \cdot \sin(\omega t') / \omega r^2) + (dl \cdot \sin \theta / (4\pi \epsilon r)) \cdot e^{-at'} \cdot (\cos(\omega t' + u) \cdot ((a/v)^2 - (\omega/v)^2 - 1 - (a/rv)) + \sin(\omega t' + u) \cdot (\omega/rv)), \tan(u) = \omega/a \quad (3)$$

$$E_r = (dl \cdot \cos \theta / 2\pi \epsilon r^2) \cdot ((I_0/v) \cos(\omega t') + (I_0/r\omega) \sin(\omega t') + (\omega I_0/v) \cdot e^{-at'} \cdot \sin(\omega t' + u) + ((aI_0/v) - (I_0/r)) \cdot e^{-at'} \cdot \cos(\omega t' + u)) \quad (4)$$

and other field components are zero, where  $\epsilon$  is the permittivity of the medium,  $\omega$  is the frequency of oscillation and  $v = 3 \times 10^8$  m/s.  $\theta$  is the spherical coordinate variable and therefore  $I \cdot dl \cdot \sin \theta$  or  $I \cdot dl \cdot \cos \theta$  are horizontal and vertical components of the current element. The transient periodic current values are given by  $I_0$  is positive over the period  $T_0/2$  and negative over the next  $T_0/2$ . Therefore,  $I_0$  is one full cycle of the pulse current of cycle width  $T_0$ . The complete radiated field by the vibration of a point charge or mass particle includes both steady state and transient components. For longer radial distances, the transient components can be neglected since field radiated out by the transient components reaches steady state within a very short period of time whereas the field radiated takes more time to reach longer distances. At very small scale distances like nuclear particle scales, the transient components of radiation is significant and therefore, can't be neglected and the far field steady state components are negligibly small and therefore, they can be neglected. Therefore, at nuclear scale distances, the near field steady state components ( $1/r^2$  and  $1/r^3$  terms) and transient components are significant. The far field components include  $1/r$  (Einstein's field component) and  $1/r^2$  (Coulomb/Newton's Field Component) terms. The near field nuclear particle's field includes  $1/r^3$  terms and transient field components. Therefore, equations (2), (3) and (4) includes all nuclear particle fields, Coulomb, Newton and Einstein field components. Therefore, these equations represent the generalized fields radiated by a charge or matter particle. Since the radiated fields are periodic functions of period  $T_0$  all field components could be expressed in Fourier series form. Therefore, all fields of the nature exists only indiscrete mode forms. Therefore, both the fields and energies of the fields exist only in discrete mode forms. The eternal vibration of the particles creates expansion and contraction of the fields radiated and therefore, energy is conserved. These equations are applicable to radiations at smallest scales of nuclear particles to the largest scale radiation of the universe. Therefore, these equations integrate the particle physics with the cosmology. The entire universe is made up of particles within the particles. Therefore, the fields radiated by any particle of any size could be described by a multi periodic Fourier series. The equations clearly prove that all systems of the universe and the universe itself could be described by second order feedback control system theory and by Fourier series modes.

#### V. CONCLUSION

In part-I, by charge mass equivalence principle as per Newton and Coulomb's laws, nuclear fields could be equivalently described by the field due to an array of electric dipoles. The array size and the dipole charges depend on the number, masses and charges of protons and neutrons. In this way, the nuclear fields and potential functions could be derived and by applying Schrodinger's wave equation, the structure of the nucleus could be studied. The theory developed here could be applied to study the other elementary particles also.

In part-II, four known fields of the nature namely gravitational, electromagnetic and nuclear fields are integrated by the corrected Coulomb's and Newton's field law and are proved to be equivalent to electromagnetic field by the continuum field theory. All particles of the universe namely matter, charge and energy particles are proved to be made up of Fourier electromagnetic waves. Fields are proved to be in discrete form and deterministic discrete field theory developed here in this article is proved to be the most fundamental theory of all the theories of the physics. All sub system's (like atoms, molecules, Galaxies, stars, planets, earth, plants, animals, humanity, man, economics, human history, science, technology, environmental systems, etc.) structure and dynamics and the future are proved to be described by the second order feedback control system theory [7 8 14]. The entire world is proved to be described by a multiple dimension Fourier series. The present calculation on the total matter of the universe are based on the  $E = m.C^2$  relationship where  $m$  is the mass and  $C$  is  $3 \times 10^8$  m/s. As is shown in this article, the field and energy calculations really depend on our detailed knowledge of structure and dynamics of all particles and the fields and the origin and the evolution of the world. Equating all the particles to matter particles is proved to be a very crude approximation and the Universe is proved to be a hybrid model of big bang and steady state cyclical theories [7 8]. Therefore, the missing matter or dark matter problem [17] of astrophysics and cosmology may be solved based on the new deterministic theories of particles and cosmos.

In part-III, atomic structures were studied and understood based on the classical quantum theory developed in the early stages of atomic physics. Then the quantum mechanical theories were developed based on the highly speculative laws and theories whose interpretations and relating them to classical physics was highly complicated. These theories were developed based on the experimental verifications and confirmations. Therefore, in this article, by following the traditions of classical physics, a generalized and deterministic field theory which includes all fields of nature known and unknown to us is derived. The generalized field formula derived is shown to be applicable to the field radiated by the smallest particle of the world and the point of origin of the material universe.

## REFERENCES

- [1]. John Daniel.2019. Deterministic Quantum Theory. JETIR
- [2]. John Daniel.2019. Velocity and Energy of Particles. JETIR.
- [3]. John Daniel.2019. Fundamentals of Deterministic Quantum Mechanical Theory. Submitted to JETIR
- [4]. John Daniel. 2019. Particles and Fields. Submitted to JETIR.
- [5]. John Daniel, "Modified Theory of Gravitation and Cosmology" Submitted to Astrophysical Reports, Springer publications, Russia.
- [6]. John Daniel.2019. Modified Theory of the Early Universe. JETIR,
- [7]. John Daniel, "A Field Theoretical Analysis of the Material Universe" Submitted to the Chinese Physics Letters, China.
- [8]. John Daniel, "An Energy Theoretical Analysis of the Material Universe" Submitted to Astronomy letters, Springer publications, Russia.
- [9] E. Jordan and K. Balmain.2009. Electromagnetic Waves and Radiating Systems. Prentice Hall of India Pvt. Ltd., pp. 317-322.
- [10]. J. V. Narlikar.2002. An Introduction to Cosmology", Cambridge University Press.pp.125-159.
- [11]. Halliday, Resnick and Krane.,2000. Physics. John Wiley & Sons, Singapore, Vol.2, 4<sup>th</sup> Edition, pp. 596-599, 725-728, 1141-1158, 1201-1213.
- [12]. Robert Eisberg and Robert Resnick.2003. Quantum Physics. John Wiley & Sons, Singapore, pp.1-175.
- [13]. Halliday, Resnick and Krane.2000 *Physics*. John Wiley & Sons, Vol.1, 4<sup>th</sup> Edition, Singapore. . pages 343-366, 467-487, 179-198.
- [14]. B.C.Kuo.2005. Automatic Control Systems. Prentice Hall of India Pvt. Ltd., New Delhi.
- [15]. W.H. Hayt, Jr. 1999. Engineering Electromagnetics. Tata McGraw Hill editions, New Delhi, pp. 52-76, 217, 266.
- [16]. Albert Einstein. 1954. Ideas and Opinions. Rupa and Co., , P. 217-377.
- [17]. Andrew Liddle.1999. An Introduction to Modern Cosmology", John Wiley & Sons. pp. 61-71.
- [18]. John Daniel. 2009. General theory of fields. JETIR.