

GENERAL THEORY OF FIELDS AND IT'S APPLICATION TO ASTROPHYSICS

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Abstract: In part-I, Space is proved to be Euclidian and the gravitational theory of Newton is proved to be only an approximation valid at small scale astronomical distances. Laboratory experimental method is suggested to verify that the space and the field are different. As per the new theory presented here, the standard model of cosmology is modified, origin of cosmic rays is explained and Hubble's law and the laws of acceleration of the universe are proved to be directional dependent. In part-II, first forces acting on a matter particle are examined and expressions for new fields acting on the mass are derived. Similarly in the second section, forces acting on an energy particle are examined and expressions for new fields acting on the energy particle are derived. In the final section, relationship between the theories of relativity is examined and a simple analytical expression for all fields radiated by all known and unknown particles is derived. Application of the general theory to the field of astrophysics and astronomy is also explained.

Key words: Space, time and field concepts and relations as per the Newton and Einstein's theories, General expression for fields.

I. INTRODUCTION

Inadequate experimental evidences, logical inconsistencies and contradictions, unrealistic assumptions made and alternate theories of gravitation demands the modification of general theory of relativity. Therefore, in part-I, Space is proved to be Euclidian and the gravitational theory of Newton is proved to be only an approximation valid at small scale astronomical distances. From the assumptions, predictions and verifications of general theory of relativity, Newton's gravitational field formulae are corrected and therefore, complicated calculations and derivations of general theory of relativity are proved to be not required for the determination of gravitational field generated by mass distribution of any size and for any distance. In short, this section proves that gravitational theories of Newton and Einstein are same from physics point of view and are different from the mathematical point of view. Laboratory experimental method is suggested to verify that the space and the field are different. As per the new theory presented here, the standard model of cosmology is modified, origin of cosmic rays is explained and Hubble's law and the laws of acceleration of the universe are proved to be directional dependent.

In the part-I, space is proved to be Euclidian and the gravitational theory of Newton is proved to be only an approximation valid at small scale astronomical distances. From the assumptions, predictions and verifications of general theory of relativity, Newton's gravitational field formulae are corrected. In the paper [10], an expression for the gravitational force acting on a photon radiated by an isotropic electromagnetic radiator (Fifth Force of the Nature?) is derived by means of mass energy equivalence of the particles as defined by the special theory of relativity. The speed of electromagnetic wave is proved to be much greater than 3×10^8 m/s in the regions close to the source of an isotropic radiator. In the paper [11], Gravitational force acting on an Einstein's particle and the validity of the equations derived are discussed. In the paper [10], mass and the charge are shown to be equivalent. Newton and Coulomb's laws are corrected to include near field components. Complete form of Field laws of Newton and Coulomb are derived from a better model of the particle.

In the paper [12], 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. But the universal field formula obtained is a highly complicated function of time and space and the simpler formulae obtained by radiation theory of fields are steady state radiation fields and does not include the transient radiation components which are very significant in the regions close to the source of radiation.

Therefore, in this part, first forces acting on a matter particle are examined and expressions for new fields acting on the mass are derived. Similarly, in the next section, forces acting on an energy particle are examined and expressions for new fields acting on the matter particle are derived. In the next section, relationship between the theories of relativity is examined and a general expression for field radiated by the particle is derived. This simple analytical expression derived is valid for all fields radiated by all known and unknown particles.

II. PART-I: MODIFICATION OF GENERAL THEORY OF RELATIVITY AND COSMOLOGY

2.1 Need for modifying the general theory of relativity

Einstein's general theory of relativity was accepted by the scientific community fundamentally based on three predictions. They are bending of star light by gravitational pull, prediction of Mercury's precession of the long axis of elliptical orbit and prediction of slowing down of rate of physical process by the influence of gravity [1]. But the experimental evidences and alternate theories are proves that the general theory of relativity may not be new [2]. Special theory of relativity has got no competitive theory and is validated by many experimental evidences. But the same is not true with the general theory of relativity [2]. Modern cosmology could be explained by avoiding general theory of relativity altogether [3]. Relativistic Cosmology in general and standard model in particular has the curious and unsatisfactory feature of space time singularity. The appearance of infinities is considered disastrous in any physical theory [4].

Fermat's last theorem of number theory could be proved using Euclidian geometry [5]. But as per general theory of relativity, space is curved and Fermat's last theorem of number theory could not be proved. So, is number theory invalid in the curved space structure? Or the assumption of curved space wrong? Number theory is formed by human mind. It originated from human mind. Therefore, beyond any doubt human mind exists in a linear Euclidian space.

As per special theory of relativity, time is just 4th coordinate of 3-D space [6]. Therefore, exactly at time $t=0$, the universe began. At time $t=0$, the time coordinate disappear. Only 3-D space coordinates exists. Under these conditions energy must have originated from nothingness or absolute space. In electromagnetism including the special theory of relativity, only linear coordinates are used. Therefore, space of electromagnetism is not curved and linear. Just almost at $t=0$, energy originated. Till this almost zero time, universal space was linear (Euclid). Then from energy matter particles originated. As per the standard model big bang theory, in the early universe, there was a period called "radiation and matter dominated universe" just after the radiation dominated Universe [3]. Albert Einstein's general theory of relativity is applicable only from here. Here is the contradiction, how can the linear space from the beginning to this stage, became curved as per general theory of relativity?

In the book written by P.A.M. Dirac on general relativity, he says Albert Einstein made assumption that space and field are one and the same [7]. Once this assumption is made he can easily apply Riemann's geometry. Gravitational field theory is not yet developed like the electromagnetic field theory. Therefore, this assumption is essential to apply the well developed Riemann's geometry to develop general theory of relativity. So, his assumption is mathematically correct and physically incorrect. The physical reality is that space and fields are different. Mathematically to simplify the complexity of mathematics one can assume that space and field are one and the same. Albert Einstein believed that both physical and mathematical realities are the same. This assumption is incorrect.

2.2. Modification of the General Theory of Relativity

The field produced by a mass m at a point could be described in the 4 dimensional space by the points (x, y, z, \mathbf{a}) where x, y, z are points of Cartesian coordinate system and the vector \mathbf{a} is the acceleration or gravitational field produced by m acting upon another particle at x, y, z . A 4 dimensional space time structure could be described by the points (x, y, z, jt) where the time coordinate t is represented as an imaginary axis. This 4 dimensional space is useful representation for special theory of relativity and the 4 dimensional space (x, y, z, \mathbf{a}) is a useful representation for general theory of relativity. In this 4-d space, x, y, z are space points and \mathbf{a} is acceleration or field vector. Therefore, this vector is represented by both space and time coordinates since $\mathbf{a} = d^2\mathbf{r}/dt^2 = \mathbf{a}$ where \mathbf{r} is radial vector defined by $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ where $\mathbf{i}, \mathbf{j}, \mathbf{k}$ are unit vectors in x, y, z directions respectively. These statements are true as per the Newton's laws of force.

This assumption, separate the force acting upon the second particle from the particle which produces the force and the space itself becomes the generator of the force acting upon the second particle. Therefore, action of force from the first particle on the second particle is removed. Albert Einstein never believed in the action at a distance as assumed by Sir Isaac Newton while formulating his gravitational theory. Since space generates the field by this assumption, the mass of the first particle is assumed to disturb the space to produce the gravitational field. Therefore, in the general theory of relativity, space is assumed to be a transducer which converts the energy supplied by the mass into gravitational field energy. Already Riemann had developed the geometry in the curved space. Mathematics need not be related the physical world. But if the mathematical space and the physical space are assumed be one and the same, the mathematical and the physical realities become one and the same. Albert Einstein had assumed that mathematical and the physical spaces are one and the same in addition to assuming that space and the field is one and the same. Therefore, by these assumptions he made use of the Riemann's geometry and developed the general theory of relativity. Therefore, general theory of relativity is mathematically a correct theory and physically need not be a correct theory.

In formulating the general theory of relativity, space and the field are assumed to be one and the same like the derived fact that space and the time are similar dimensions. There were no prior physical evidences existed for making such assumptions. But if such assumption is made to transform the physical problem into a mathematical problem to find solution to the physical problem, the assumption is very well valid. After finding the solution to the physical problem, the solution has to be interpreted in terms of the physical world and not in terms of the mathematical world. Therefore, after finding the solution to a physical problem by applying the general theory of relativity, space and the field should be treated as separate physical entities. In quantum physics such a procedure is followed and the same has to be followed in the general theory of relativity.

If we assume that the space and the field are one and the same, $\mathbf{a} = \mathbf{r}$ and therefore, $d^2\mathbf{r}/dt^2 = \mathbf{a} = \mathbf{r}$. Therefore, $x = d^2x/dt^2$, $y = d^2y/dt^2$ and $z = d^2z/dt^2$. The solutions of these equations are well known solutions and they are $x, y, z = e^t$ or e^{-t} .

Therefore, $\mathbf{A}e^t + \mathbf{B}e^{-t}$ (1)

where \mathbf{A} and \mathbf{B} are constant vectors. Therefore, the assumption that the space and field are one and the same leads to the establishing relationship between space and the time. Since the field grows up exponentially with the time as per e^t , space generates exponentially growing field. This is not true from the physical point of view.

Therefore, from the physical point of view $\mathbf{r} = \mathbf{a} = \mathbf{B}e^{-t}$ (2)

Therefore, space generates an impulse gravitational field vector in the time domain.

As per the Newton's law, $\mathbf{a} = G.M/r^2 \mathbf{a}_r$, where \mathbf{a}_r is the unit vector in the radial direction. (3)

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 [6] with the Coulomb's Law of electricity [8]. 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.

Therefore, as per the Newton's law the mass M generates the gravitational field and propagates into the space. By comparing equations (1), (2) and (3),

$$\mathbf{a} = G.M/(A^2.e^{2t}) \mathbf{a}_r \quad (4)$$

Equation (3) also clearly proves that mass M generates gravitational field. In other words, Newton's gravitational field is derived from the assumptions made in the general theory of relativity. But, if we compare the equations (2) and (4), Field in the general theory of relativity varies with the times as a function of e^{-t} and field in Newton's theory varies as a function of e^{-2t} . This means the field produced by the space is greater than the field produced by the mass. Therefore, this contradiction violates the first law of thermodynamics. Since experimental and observational evidences prove that the general theory of relativity is more accurate than the Newton's theory, Newton's gravitational theory is only approximately correct. Newton's theory could be equated with the general theory of relativity, if the Newton's field is modified to

$$\mathbf{a} = G.M/A.e^t \mathbf{a}_r \quad (5)$$

Therefore, Newton's formula is not valid at large scale astronomical distances where $1/r$ dominates over $1/r^2$ and the corrected formula (5) has to be used. In the smaller scale distances, the difference between the $1/r^2$ term and the term $1/r$ are reduced. Therefore, physical space is proved to be Euclid's space and not Riemann's space. Therefore, gravitational field of any mass distribution of any scale could be determined by the simpler corrected Newton's formulas and the complicated general theory of relativity is not required. However, corrections to the Newton's formulae are made here based on the assumptions, predictions and verifications of general theory of relativity.

2.3. Laboratory Experimental Demonstration of Nature of Space and Fields

The equivalence of charge & mass relationship was derived in the previous section. Therefore, from this relationship the interaction between electromagnetic and gravitational fields could be studied and the bending of light by gravitational field and the red shift of light frequency due to gravitation could be explained by charging a spherical metallic surface or passing electric current and passing a monochromatic laser beam close to the charged metallic surface, bending of light by electric field could be demonstrated. By passing a white light close to the charged sphere, red shift by electric field can be demonstrated.

2.4. Modification of the theory of Cosmos

As explained in the previous section, Universe originated from high density and high temperature radiations. Therefore, this initial fire ball existed in Euclid's space. Universe did not originate from an initial singularity as assumed in the present standard Big Bang cosmology. Then this fire ball exploded due to high pressure and temperature and universe began to expand and cool down. Now, the matter particles originated from photons of high energy. Therefore, electromagnetic fields originated first in Euclid space and then matter originated after big bang. Matter generated gravitational field. This gravitational field ties up all matters and energy of the Universe. Now, the general theory of relativity could be applied by assuming that space and gravitational field are the same. As the Universe expanded, matter formed, stars and galaxies originated and speed of expansion at outermost layers of universe is higher than that of inner parts of the universe (acceleration). When the matter reached large distance of expansion, matter began to disintegrate and when it reaches the limit, matter is converted into energy once again. Since space and time is curved as per the general theory of relativity and space and field are proved to be different, this energy radiates back towards to center of the world. Therefore, matter is created, preserved and then destroyed back to energy continuously in the universe. Therefore, at the center of the universe, always there is a big fire ball made up of high density and temperature energy. Then the middle layers are made up of matter and outermost layers are made up of matter and energy. Therefore, energy and matter are conserved and universe works as a perpetual machine. This modified theory of cosmos complies with the first law of thermodynamics. The standard model of cosmos does not comply with the first law of thermodynamics. Over 67.5% of missing energy exists at the center of the universe (Big Fire Ball). Then Over 27.5% of missing mass and nearly 5% of the visible Universe exists as outer layers of the world.

The origin is cosmic ray is not yet understood [9] since the standard model big bang theory was developed based on the assumption that space is curved. In this article, the general theory of relativity was modified and space and fields are proved to be different by qualitative theoretical methods. Therefore, standard model of cosmology is modified as per the modified theory of gravity in the previous section. As per the modified theory of cosmos, the energy and particles radiated back towards the center of the Universe must be Cosmic rays and particles. Cosmic rays are dominated by nucleus since nucleus is not easily breakable by the forces of expansion of the Universe. Electrons of an atom could be stripped off by the forces of expansion. When the expanding matter and the energy reach sufficient radial distance from the center of the universe to reduce the speed of expansion to zero, gravitational pull of the universe bring back the matter particles and the energy as cosmic rays. Since the gravitational pull towards the center of the universe is much higher than the forces in curved line directions, most of the cosmic ray particles flow towards the center of the universe.

2.5. Observational verification of the proposed new theory of Cosmos

Expansion and contraction of the universe clearly indicates the existence of gravitational field in radial direction from the center of the universe. This force originates from the center of the universe through the radiation pressure on matter particles generated at the edge of the radiation dominated universe. Therefore, this fifth force of nature, gravitational force between matter particles in radial and angular directions of spherical coordinate system acts on all particles of the expanding universe. Therefore, Hubble's law and the laws of acceleration of the universe are directional dependent [8].

III. PART-II: GENERAL THEORY OF GRAVITATIONAL AND OTHER FIELDS AND IT'S APPLICATIONS TO ASTROPHYSICS

3.1. Field acting on a matter particle [13]

Let us assume that an isotropic radiator radiates electromagnetic waves from the origin of a spherical coordinate system. Close to the source of radiation, the speed of the electromagnetic wave $C(r)$ was proved [2] to be much greater than that of $C_0 = 3 \times 10^8$ m/s. The $C^2(r) = P_0/4\pi r^2 =$ Power density at r from the electromagnetic radiator or the speed of the photon radiated or the group velocity of the signal $= dE/dt$ and the phase velocity $dr/dt = C(r)$, where P_0 is the total average power radiated by the source. Therefore,

$$dE/dt = dE/dr. dr/dt = C(r). dE/dr = P_0/4\pi r^2 \text{ and } dE/dr = \pm (P_0/4\pi r^2)^{1/2} \quad (1)$$

Integration of the equation (1) leads to

$$e^{E/B} = r, \text{ where } B = \pm(P_0/4\pi)^{1/2} \quad (2)$$

$$\text{and } E = B.\ln r = \text{the energy of a photon} \quad (3)$$

$$\text{As per the Planck law of radiation, } E = h.f \text{ and therefore, } f(r) = (B/h).\ln r \quad (4)$$

Therefore, from the well known wave relation, $C(r) = f(r).\lambda(r)$, where f and λ are frequency and wavelength of the electromagnetic wave radiated, $\lambda(r)$ could be found by substituting equations (4) and the expression for $C(r)$.

$$\text{So, } \lambda(r) = C(r)/f(r) = h./(r.\ln r) \quad (5)$$

Now, suppose, if there is a mass m moving with a velocity in the direction of electromagnetic wave propagation, then the energy of the particle moving with the velocity V , as per the special theory of relativity is

$$E = mC^2(r), \text{ where } m = m_0/(1 - (V/C(r))^2)^{1/2} \text{ where } m_0 \text{ is the rest mass of the particle} \quad (6)$$

By equating expressions for E from the equations (4) and (6) and solving for V , we get the following expression for

$$V = C(r).(1 - (m_0 C^2(r)/(h.f(r)))^2)^{1/2} \quad (7)$$

From the equation (7), it is very obvious that the gravitational field acting upon the mass $m = dV/dt$ contains very higher order terms of r . As per the unified theory of fields [4], the field radiated by the mass has only $1/r$, $1/r^2$ and $1/r^3$ terms. Therefore, the field radiated by a particle must be generalized to include the higher order terms. This generalization is done in the last section of the article.

3.2. Fields acting on an energy particle [13]

Energy radiated E by a particle is directly proportional to the square of the field F radiated. Therefore, $E = K.F^2$ where K is the proportionality constant. From the equation (1) of the last section,

$$dE/dt = C^2(r) = P_0/4\pi r^2 = K.2.F.dF/dt \quad (1)$$

The factor dF/dt is the phase velocity of the signal which is $C(r)$. Therefore, as per the equation (1) the field radiated is directly proportional to $1/r$. Since the energy is directly proportional to F^2 , energy is directly proportional to $1/r^2$. The field acting on the photon d^2E/dt^2 is directly proportional to $1/r^4$. The field acting on the field d^2F/dt^2 to drive the field is also directly proportional to $1/r^2$. Therefore, the radiated field has three components which are proportional to $1/r$, $1/r^2$ and $1/r^4$ terms. Another near field component in the corrected Coulomb and Newton's laws [4] is directly proportional to $1/r^3$. Therefore, the field radiated could be generalized to $F = K_1/r + K_2/r^2 + K_3/r^3 + K_4/r^4$ where K_1 , K_2 , K_3 and K_4 are proportionality constants.

3.3. Relativity theories [1]

As per the classical electromagnetic theory, $dr/dt = C_0 = 3 \times 10^8$ m/s where r is the radial distance from the source of electromagnetic field radiated. Therefore, by integrating this expression, $r = C_0.t$. This expression relates the space with the time and the space is a linear function of time. As per the general theory of relativity, space and the field are one and the same. Therefore, the field acting on the field

$$d^2r/dt^2 = r \quad (1)$$

The solution to the equation (1) is

$$r = e^{\pm t} \quad (2)$$

From the equation (2), obviously the space-time relationship is a non linear relationship. Therefore, the space-time relationship of the classical electromagnetism and the special theory of relativity is in contradiction with the general theory of relativity. As per the Newton's law the field radiated is directly proportional to $1/r^2$ and as per the equation (2), the field is directly proportional to $1/r$. As per the corrected Coulomb and Newton's laws, the generalized radiated field like in the previous section is $F = K_1/r + K_2/r^2 + K_3/r^3$. As per the equation (2), the space or field is a non linear or exponential function of time. Therefore, the radiated field declines or grows up exponentially with time in the space. Therefore, field declines or grows up exponentially from the source with the radial distance in absolute space. Therefore, using the Taylor series, the exponential field could be expressed by $F = \sum K_n/r^n$ where n varies from 1 to infinity. This expression is valid for all fields radiated by all known and unknown particles as per the charge mass relationship explained in the next section.

3.4. Mass and the charge equivalence [6 8]

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 [8] with the Coulomb's law of electricity [9]. 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.

3.5. Application of the general theory of fields to astrophysics [2]

The general theory derived integrates the Newton's gravitational field with the gravitational field of general theory of relativity. Gravitational field of general theory is valid at larger scales of astronomical distances and Newton's law is valid at smaller scales of astronomy. However, in the intermediate scales, integration of both fields are required. General theory of relativity complicates the field calculations by assuming that field and space are one and the same and using Riemann's geometry. Therefore, the simple theory presented in this article can be used very easily to find the gravitational fields of all astronomical objects.

The higher order terms of general field theory assumes significance at atomic and nuclear scale distances. All matters are made up of atoms, nucleus and charges. The general theory presented clearly indicates that the gravitational field components originate from a large array of very small dipoles. This is true since all atoms are made up of electrons and positively charged nucleus. The nucleus has so many elementary charged and uncharged particles. Therefore, a large scale mass is made up of so many electric and magnetic dipoles. Therefore, general field theory is based on the simplified model of atoms and particles. That is why the theory leads to a singularity at points close to the origin of the field.

If the atoms are compressed by gravitational pressure of very large stars, they could become neutron stars as is well known in astrophysics. As the mass of the star is more, it could become a very high density matter under gravitational pressure as per the application of general theory of relativity and atomic physics. However, the structure of the nucleus which has so many elementary particles is not yet understood. The theory presented in this article proves that the structure of the nucleus could be modeled as an array of very large number of very small dipoles. Therefore, if the atoms are more and more compressed by the gravitational pressure, more and more heat will be generated by the electric sparks generated by the closer electric poles. This heat will possibly balance the gravitational pressure.

As per the standard model of cosmology, all matter particles and the charges originated from very high frequency electromagnetic radiations. Therefore, all particles of the universe are made up of high frequency electromagnetic wavelets. Therefore, the structure of the nucleus and all the elementary particles could be described by electromagnetic wavelets as basic units. Therefore, at scales smaller than the nucleus, all matter and charge particles must be described by electromagnetic field theory. The elementary particles are studied by quantum field theory. So, the theory presented in the article is validated by the quantum field theory and the standard model of the cosmology. Therefore, the theory developed in this article could be applied to study the very high density stars, black holes and beyond the black holes. However, the possibility of formation of black hole or very high density matter is highly speculative since there is no laboratory experiment is available to find the state of nucleus under very high pressures. One possibility is trigger of nuclear fission reaction at pressures beyond the scale of pressure in neutron stars and subsequent explosion of higher density neutron star. Therefore, black holes may not be formed in the physical world.

3.6. Conclusion

In part-I, Space is proved to be Euclidian and the gravitational theory of Newton is proved to be only an approximation valid at small scale astronomical distances. Laboratory experimental method is suggested to verify that the space and the field are different. As per the new theory presented here, the standard model of cosmology is modified, origin of cosmic rays is explained and Hubble's law and the laws of acceleration of the universe are proved to be directional dependent. In part-II, the force acting on a matter particle is shown to contain higher order terms of r . As per the unified theory of fields [10], the field radiated by the mass has only $1/r$, $1/r^2$ and $1/r^3$ terms. The field acting on an energy particle is also shown to have higher order terms of r . Therefore, the field radiated by a particle must be generalized to include the higher order terms. This generalization was done in the last section of the article. This general field expression is valid for all fields radiated by all known and unknown particles. Application of the theory to astronomy and astrophysics is also explained at the end.

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