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Unification of Newton and Relativistic Energy conservation and Gravitational Equations

توحيد معادلات حفظ الطاقة النيوتينية والنسبية والتثاقلية

A thesis Submitted for fulfillment for the requirements of the degree of Doctor Philosophy in Physics

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Sept 2016

الايـة

قَالَ تَعَالَىٰ:

﴿ وَٱلشَّمۡسُ تَجۡرِي لِمُسۡتَقَرّٖ لَّهَاۚ ذَٰلِكَ تَقۡدِيرُ ٱلۡعَزِيزِ ٱلۡعَلِيمِ ٣٨ وَٱلۡقَمَرَ قَدَّرۡنَٰهُ مَنَازِلَ
حَتَّىٰ عَادَ كَٱلۡعُرۡجُونِ ٱلۡقَدِيمِ ٣٩ لَا ٱلشَّمۡسُ يَنۢبَغِي لَهَآ أَن تُدۡرِكَ ٱلۡقَمَرَ وَلَا ٱلَّيۡلُ سَابِقُ ٱلنَّهَارِۚ
وَكُلّٞ فِي فَلَكٖ يَسۡبَحُونَ ٤٠ ﴾

صدق الله العظيم

يس: ٣٨ ـ ٤٠

Dedication

I dedicate my dissertation work to my family and my friends special feeling of gratitude to my loving parents, whose words of encouragement and push for tenacity ring in my ears . To my brothers, sisters and my husband he is never left my side.

Acknowledgments

I would like to express my special thanks to my supervisor, my teacher professor Mubarak Dirar Abd Allah , for his ideas and his support during my work with this thesis which also helped me in doing a lot of research and I came to know about so many new things I am really thankful to him . I specially thank college of graduate studies college of science , department of physics , library of college of science , my teacher Dr Ibrahim Hassan Hassan and university of Al-Butana teaching staff members for their efforts and assistance .

Also I would like to thank my husband , friends and my big family for their encouragement and support to do this thesis within the limited time frame .

المستخلص

يتضح من هذا البحث ان بقاء الطاقة النيوتونية والنسبية الخاصة المعممة متكافئتان. كما يتضح انه عندما ابقاء الطاقة فان تعريف القوة في مصطلحات القوة الدافعة يؤدي إلى تعريفه في مصطلحات الاحتمالية في كل من نظرية نيوتن والنظرية النسبية المعممة. تلعب القوة المركزية دوراً مهماً في الفيزياء حيث يمكن ان توضح حركة الكواكب بجانب معظم الحركة الدائرية المجهرية . تعطي معادلة الحركة في محور دائري تعبيراً نسبياً لسرعة الجرم التي تعطي قيم مختلفة لمراقبين مختلفين هذا التعارض يزول باستنتاج تحويل يتطلب وجود معامل كوني وفراغ . هذه المجالات المطلوبة تسبب تمدداً وتضخماً بسبب الطاقة النيوتونية.

Abstract

In this work it was shown that the energy conservation in Newtonian and generalized special relativity are equivalent. It also shown that when the energy is conserved the definition of force in terms of momentum Leads to its definition in terms of potential in both Newton and generalized special relativistic mechanics. Centrifugal force plays an important role in physic. It can explain motion of planets beside most macroscopic circular motion. The equation of motion in a circular orbit gives a relativistic expression for velocity which gives different values for different observers. This discrepancy is removed by a doping certain transformation which requires the existence of repulsive cosmic and vacuum field. This requirement fields cause expansion and inflation.

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Chapter Five: Maxwell Equation Gravitation Force and Generalized Special Relativity	

Chapter One

Introduction

1.1Fund amental force:

The dream of physics is to unify all found a metal forces that generates field [1] there now four fund a mental forces All the forces in the universe and are responsible for the interactions between sub atomic particles including nucleons and compound nuclei [2].The electromagnetic force acts between electric charges and the gravitational force acts between masses all other forces are based on the existence of the four fundamental interactions [3].

For example friction is a manifestation the electromagnetic force acting between atoms of two surfaces, the development of fundamental theories for pro ceded lines of unification of disparate ideas [4] for example Isaac Newton unified the force responsible for objects falling at the surface of the Earth with the force responsible for the orbits of celestial mechanics in the universal theory of gravitation Michael Faraday and James clerk Maxwell demonstrated that electric and magnetic forces were unified through one consistent theory of electromagnet son in the twentieth century, the development of quantum mechanics led to a modern understanding that the first three fundamental forces (all except gravity) are manifestations of matter(fermions) interacting by exchanging virtual particles called gaug ebosens[5]

Newtonian mechanics is one of the basic mechanical Laws which describes macroscopic objects with Law velocity [1]. High speed microscopic objects can be described by special relativity (SR)[2]. However SR energy relation dose not redact to the Newtonian one for Law speed. This is since it does not have a term representing potential energy [3, 4]. This motivates some anthers to generalize SR by the so-called generalizedSR (GSR). This GSR energy equation successfully reduced to Newtonian one in the Law speed limit [5, 6].

In also explains gravitational redshirt and gravity time diction [6, 7]. These successes need searching for energy conservation requires mentis which is done in section (2). It also requires redefinition of force which is done in section (3). Sections (4) and (5) are concerned with discussion and conclusions.

Gravity force is one of the older forces discovered by Newton [1]. It is an attractive force that affects mainly astronomical objects. It is one of the weakest physical forces known till now. Using the force of gravity Newton succeed in describing the motion of particles under the gravity effects [2,3]. He also succeeded in describing the motion of planets around the sun. Newton suggested that the stability of the planets in their orbits is due to the balance between gravity and centrifugal force [4,5]. This balance is also suggested in deriving classical atomic relations which was used by Boher to construct his old quantum theory [6, 7]. This role of centrifugal force in physic remarkably succeeded in explaining many physical phenomena at macroscopic and microscopic levels [8, 9]. However the equation of motion which relates centrifugal force to other physical force does not conform to the principle of relativity as shown in section2. The model is suggested to remove this conflict is constructed in section sections and are devoted for discussion and conclusion.

1.2Research Problem:

Newton’s contributions to gravitational theory was to unify the motions of heavenly bodies, which Aristotle had assumed were in antural stat of constant motion, realized that the acceleration due to gravity is proportional to the mass of the attracting body. Physicists are still attempting to develop self. Consistent unification models that would combine all four fundamental interactions in to a theory of everything [6].

1.3Literature Review:

Newton noted that the ratio of the centripetal acceleration of the moon in its orbit around the Earth to the acceleration of an apple falling to the surface of the Earth was inversely as the squares of the distances of moon and apple from the centre of the Earth. Every particle in the universe attracts every other to the product of their masses and inversely proportional to the square of the distance between them [7].

1.4Aim of the Work:

The aim of this work is to unify gravity with electromagnetic theory by geometrizing the electromagnetic field variables or by introducing extra dimension [8]. Alagragian describing electromagnetic field and gravity field is selected to be reduced to Maxwell equations and generalized gravitational field equation [9].

1.5Presentation of the thesis:

This thesis composed of fire chapters chapter one is an introduction, chapter two contains a derivation of electromagnetic field and Maxwell’s equation by using causs’s law for gravity and derive poisson’s equation, chapter three is calculation of gravitational fields and potentials chapter four is concerned for the Literature review, which the contribution is given in chapter five

Chapter Two

Elector magnetic and Maxwell's Equation

2.1 Introduction:

The basic electrodynamics equations are usually deriven from laws of a general course of electricity and magnetism [20]. These laws can describe the behavior of electromagnetic field inside matter as well as free space. In this chapter Maxwell Equations (M.E) are derived by utilizing the basic laws of electricity and magnetism [21]. The origin of electric and magnetic field would not be fully explained until 1864 when James clerk Maxwell unified a number of earlier theories into succinct set of four equations these Maxwell equation" fully described the sources of the fields [10]. This led Maxwell to discover that electric and magnetic field could be (self generating) [11]. Through a wave that traveled at a speed which calculated to be the speed of light.

2.2 Electric and Magnetic Field Intensity:

It is well know that, the electromagnetic field in a medium is described by four vectors quantities the electromagnetic field, the electric induction, the magnetic field and the magnetic induction. The force acting on unit electric charge at a given point in space is called the electric field intensity [22].

In future, instead of the field intensity one can simply speak of the field at a given point in space. The magnetic field intensity or, for short the magnetic field is defined analogously, separate magnetic charge, unlike electric charades, don't exists in nature, however if we make a long permanent magnet in the from of a needle, then the magnetic force acting at it's ends will be the same as if there existed point charges at the end[23].

A rigorous definition of the electric and magnetic induction vectors where the field equations in a medium will be derived from the equations for point charges in free space. It need only be recalled that in free space.

There is no need to use four vectors for a description of the electromagnetic field, only two vectors being sufficient. The electric and magnetic fields [24].

2.3 Electromotive Force:

One can recall the definition for electromotive force in circuit this is the work performed by the forces of the electric field when unit charge is taken along the given closed circuit [23]. It is absolutely immaterial what the given circuit represents. Whether it is field with a conductor or whether it is merely a closed line drown in space$(e.m.f)$. The force acting on unit charge at a given point is the electric field$E$. The work done by this force on an element of path dI is the scalar product$E.di$. Then the work done on the whole closed circuit. Or the $e.m.f$ is equal to the integral [25].

$$V = e.m.f = \int EdI \qquad (2.3.1)$$

Where V is the induction potential

2.4 Magnetic Field Flux across a Surface:

Let us that suppose that some surface is bounded by the given circuit. We shall denote the magnetic field by the letter$H$. The magnetic field flux through an element of the chosen dS is given by [26].

$$\int d\Phi = \int Hds$$

The magnetic field flux through the whole surface, bounded by the B is the magnetic field density.

One can consider a section of the surface through which unit flux $\Delta\Phi = 1$ passes. If one draws through this section of the surface a line tangential to the direction of the field at some point on the surface. A line which is tangential to the direction of the field at its point is called a magnetic line of force. For this reason the total flux Φ is equal, by definition, to number of magnetic line of force crossing the surface [27].

Magnetic line force are either closed or extended to infinity. Indeed a magnetic line force may begin or end only at a single charge, but separate magnetic charges do not exist in nature. In a permanent magnet the lines of force are completed inside the magnet. From this it follows that a magnet flux through any surface, bounded by circuit, is the same at a given instant. Other wise, a number of the magnetic lines of force would have to begin or end in the space between the surfaces through which different fluxes pass.

Consequently, at a given instant a constant a number of magnetic lines force. I.e. a constant magnetic field flux passes across any surface bounded by the circuit. Therefore the flux can be a scribed to the circuit it self, irrespective of the surface for which it is calculated [28].

2.5 Faraday's Induction Law:

Faraday's induction law is written in the form the following equation

$$V = e.m.f = \frac{1}{c}\frac{\partial \Phi}{\partial t} \qquad (2.5.1)$$

The constant of proportionality c is a universal constant with the dimensions of velocity equals to $3 \times 10^{8} ms^{-1}$usually, faraday's law is applied to circuits of conductors, however, $e.m.f$ is simply the quantity of work performed by unit charge in moving a long the circuit, and for a given field value through circuit, cannot depend upon the form of the circuit. The $e.m.f$ is simply equal to the integral$\int Edl$.

In a conducting circuit, this work can be dissipated in the generation of joule heat (an ohmic load). However it is completely justifiable to consider the circuit in a vacuum also. In this case, the work performed on the charge is spent in increasing the kinetic energy of the charged particles, as for instance in the case in an induction accelerator, the Betterton [29].

2.6 Maxwell's Equations:

Equation (2.5.1) refers to any arbitrary closed circuit. We substitute the definitions (2.3.1) and (2.4.1) in to this equation we get [30].

$$\int Edl = \frac{1}{c}\frac{\partial}{\partial t}\int BdS \qquad (2.6.1)$$

The left hand side of the equation can be transformed by the stokes theorem: which state that; the line integral of the tangential component of a vector a taken around a simple closed curve C is equal to the surface integral of the normal component of the curl of a taken over any surface S having C as it's boundary [31] i.e.

$$\int Adl = \int (\nabla \times A)dS \qquad (2.6.2)$$

When one takes$A = E$, then

$$\int_l Edl = \int_s (\nabla \times A)dS \qquad (2.6.3)$$

Thus equation (2.6.1) becomes

$$\int (\nabla \times E)dS = -\frac{1}{c}\frac{\partial}{\partial t}\int BdS = -\frac{1}{c}\int \frac{\partial B}{\partial t}dS \qquad (2.6.4)$$

Where on the right hand side, the order of time differentiation and surface integration is interchanged. Thus taking this integral over to the left hand side, one obtains.

$$\int\left((\nabla\times E)+\frac{1}{c}\frac{\partial B}{\partial t}\right)=0 \qquad (2.6.5)$$

But initial is completely arbitrary. I.e. it can have arbitrary magnitude and shape. Let us assume that integrand, in parentheses, of equation (2.6.5) is not equal to zero. Then one can choose the surface and the circuit that bounds it so that the integral (2.6.5) dose not becomes zero. Thus in all cases the following equation must be satisfied.

$$\nabla\times E+\frac{1}{c}\frac{\partial B}{\partial t}=0 \qquad (2.6.6)$$

This is one of the Maxwell's equations relating electric and magnetic fields in differential form. In many applications the differential form is more convenient than the integral form. Magnetic field lines of force are either closed or go off to infinity. Hence, in any closed surface, the same number of magnetic field lines enters as leave. The magnetic field flux, in free space, across any closed surface [32], is equal to:

$$\Phi=\int BdS \qquad (2.6.7)$$

Transforming this integral to a volume integral according to the Gauss-Ostrogradsky theorem [33].

$$\int_s AdS=\int(\nabla.A))\,dv=\int\left(\frac{\partial A_x}{\partial x}+\frac{\partial A_y}{\partial y}+\frac{\partial A_z}{\partial z}\right)dv \qquad (2.6.8)$$

One obtains

$$= \int BdS = \int (\nabla . B))\, dv = 0 \qquad (2.6.9)$$

Due to the fact that the surface bonding the volume is completely arbitrary, we can always choose this volume to be so small that the integral is taken over the region in witch $\nabla . B$ has constant sign if it is equal to zero. But then in spite of (2.6.7) and (2.6.9) $\int (\nabla \times B) dS$ will not be equal to zero.

For this reason, the divergence of B must become zero. Thus

$$\nabla . B = 0 \qquad (2.6.10)$$

This is the differential form of (2.6.7) for an infinitely small volume. Since the divergence of a vector is the density of source of a vector field. The sources of the field are free charges from which the vector (force) magnetic field lines originate. Thus (2.6.10) indicates the absences of free magnetic charges.

The equation (2.6.6) and (2.6.10) are together called the first pair of Maxwell's equations. The electric field flux through a closed surface is not equal to zero. But to total electric charge q in side the surface multiplied by 4π[34].

$$\int D . dS = 4\pi q \qquad (2.6.11)$$

Where D is the electric flux density, the field due to a point charge q is expressed by the following equation.

$$E = \frac{q}{r^2} \qquad (2.6.12)$$

Then the field is inversely proportional to r^2 if one surrounds the charge by a spherical surface for the sphere ds is $r^2 d\Omega$ where $d\Omega$ an elementary solid angle.

The flux of the field across the surface element is given by [35]

$$D.dS = \frac{q}{r^2}.r^2 d\Omega = \mathrm{q}d\Omega \qquad (2.6.13)$$

The flux across the whole surface of the sphere is thus given by

$$\int q.d\Omega = q\int d\Omega = 4\pi q \qquad (2.6.14)$$

But since lines of force begin only at a charge the flux will be the some through the sphere as through any closed surface around the charge. Therefore if there is an arbitrary charge, distribution q inside a closed surface, then equation (2.6.11) holds. In order to rewrite this equation, in differential form, we introduce the concept of charge density. The charge density ρ is the charge contained in unit volume, so that the total charge in the volume is relation to the density by the following equation.

$$q = \int \rho dv \qquad (2.6.15)$$

Introducing the charge density in (2.6.11), and utilizing the relation

$$\int DdS = \int \nabla.Ddv$$

$$\int (\nabla.D - 4\pi\rho)dv = 0 \qquad (2.6.16)$$

Repeating the same argument for this integral as used (2.6.9) one have

$$\nabla . D = 4\pi\rho \qquad (2.6.17)$$

According to (2.6.9) one can say that density of sources of an electric field is equal to the electric charge density multiplied by 4π[36].

2.7 Electromagnetic Potentials:

One can introduce new unknown quantities such that each equation will contain only one unknown. In this way overall number of equations is reduced. These new quantities are called electromagnetic potential. Thus for magnetic field one can define by $B = \nabla \times A$ where A is a vector the potential and for the electric potential is to satisfy

$$E = -\frac{1}{c}\frac{\partial A}{\partial t} - \nabla\phi$$

Where ϕ is also called the scalar potential.

2.8 Magnetomotive Force:

By analogy with electromotive Force $\int Edl$ one can define the magnetomotive force$\int Hdl$, where the integration is performed over a closed circuit. Using Ampere's law, it may be shown that the integration of H in a closed circuit is equal to the summation of the Electric current I surrounded by the magnetic loop. In other word [37].

$$\int Hdl = \sum I$$

$$\sum JdS = \int JdS \qquad (2.8.1)$$

But according to vector algebra

$$\int Hdl = \int (\nabla \times H) dS$$

Hence

$$\int (\nabla \times H) dS = \int JdS$$

$$\int (\nabla \times H - J) dS = 0$$

This relation can be satisfied if

$$(\nabla \times H - J) = 0$$

$$\nabla \times H = J \qquad (2.8.2)$$

This relation holds for static magnetic field and constant current which doesn't vary with time. But it is no larger hold for time dependant, current and field. To verify this take divergence of both sides of equation (2.8.2) one gets

$$\nabla . (\nabla \times H) = \nabla . J \qquad (2.8.3)$$

But for vector algebra

$$\nabla . (\nabla \times H) = |\nabla||\nabla \times H| cos 90 = 0 \qquad (2.8.4)$$

Hence

$$\nabla . J = 0 \qquad (2.8.5)$$

Where J is the current density in infinitesimal area mean while, if the electric field E is not stable, i.e. varying with respect to time, and the variation frequency is enough and extends into the radar frequency, there will another current in the medium known as the displacement current and is proportional to the variation of the electric field$E$, and the proportional force is the dielectric permittivityε. Thus there will be another contributor,$\frac{\partial D}{\partial t}$, to induce the magnetic field H. The displacement current works exactly the same way as the conductive current J, so that the total current works is $J + \frac{\partial D}{\partial t}$; put both contributors into the above equation ends up with other Maxwell's equation.

$$\nabla \times H = J + \frac{\partial D}{\partial r} \qquad (2.8.6)$$

2.9 Gauss's Law for Gravity:-

Newton's Law of gravity give the force F between tow point mass's $M$and$m$, separated by distance r

$$F = \frac{GMm}{r^2} \qquad (2.9.1)$$

Where G is the universal gravitational constant$6.674 \times 10^{-11} m^3 kg^{-1} s^{-2}$, by Newton's second Law force is related to acceleration by

$$F = ma \qquad (2.9.2)$$

Or given by

$$\vec{g} = -G\frac{m}{r^2}\hat{e}_r \qquad (2.9.3)$$

Where $\hat{e}_r$ the unit vector to the direction.

We can solve for the acceleration a due to the gravity of point charge

$$a = g = \frac{Gm}{r^2} \qquad (2.9.4)$$

In general we can say that for every field dependent as the inverse of the square of the distance the flux through a close surface, is proportional to the flux through the surface for the theorem divergence we can also express

$$\oint_s \overline{g}.dA = \int_V gdV = -4\pi G \qquad (2.9.5)$$

Now every where on the spheres,

$$g.\hat{n} = -g$$

The equation (2.9.5) become

$$-g\oint_s dA = -4\pi G_m \qquad (2.9.6)$$

Thus

$$g = \frac{Gm}{r^2} \qquad (2.9.7)$$

2.10 Poisson's equation:

If we combine this very general theorem with Gauss's theorem which applies to an inverse square field, which is that surface integral of the field over a closed volume in equal to the field over a closed equal to $4\pi G$.

$$div g = \nabla . g = -4\pi G_\rho \qquad (2.10.1)$$

This may help to give a bit more physical meaning to the divergence. At a point in space where the local density is zero

$$-4\pi G\rho = \nabla.(-\nabla\psi) = -\nabla.(\nabla\psi) \qquad (2.10.2)$$

$$\nabla^2\psi = \frac{\partial\psi^2}{\partial x^2} + \frac{\partial\psi^2}{\partial y^2} + \frac{\partial\psi^2}{\partial z^2} = 4\pi G_\rho \qquad (2.10.3)$$

From Maxwell

$$E = -\nabla\psi$$

$$\nabla. D = \rho$$

$$\varepsilon\nabla. E = \rho$$

$$\varepsilon\nabla.\nabla\phi = \rho$$

$$\varepsilon\nabla.\nabla\varphi = \rho \qquad (2.10.4)$$

This is Poisson equation, at any point in space where the local density is zero becomes

$$\nabla^2\varphi = 0 \qquad (2.10.5)$$

Chapter Three

Gravitational Field and Potential

3.1 Introduction:

This chapter deals with the calculation of gravitational fields and potentials in the vicinity of various shapes and sizes of massive bodies. The reader who has studied electrostatics will recognize that this is all just electrostatic laws and gravitational laws are similar.

3.2 Gravitational Law:

The attractive force between two masses M_1 and M_2 a distance r a part is given by [38].

$$F = \frac{GM_1M_2}{r^2}$$

Where $G$is the gravitational constant, or phrased another way, the repulsive force is given by

$$F = -\frac{GM_1M_2}{r^2}$$

Thus all the equations for the fields and potentials in gravitational problems are the same as the corresponding equations in electrostatics problems, provided that the charges are replaced by masses and $4\pi\varepsilon_0$ are replaced by$-1/G$.

One can, however, think of two differences. In the electrostatics case, we have the possibility of both positive and negative charges. As far as l knows, only positive masses exist. This means, among other things, that we do not have “gravitational dipoles” and all the phenomena associated with polarization that we have in electrostatics.

The second difference is this. If a particle of mass m and charge q is placed in an electric field$E$, it will experience a forceqE, and it will accelerate at a rate and in a direction given byqE/m. If the same particle is placed in a gravitational field$g$, it will experience a force mg and acceleration$\frac{mg}{m} = g$, irrespective of its mass or of charge. All masses and all charge s in the same gravitational field accelerate at the same rate. This is not so in the case of an electric field.

I have some sympathy for the idea of introducing “a rationalized” gravitational constant Γ, given by $\Gamma = 1/(4\pi G)$, in which case the gravitational formulas would look even more like the SI(rationalized $MKSA$) electrostatics formulas, with 4π appearing problems with spherical symmetry, 2π in problems with cylindrical symmetry, and no π in problems involving uniform fields. This is unlikely to happen, so I do not pursue the idea further here.

3.3 Gravitational Field:

The region around a gravitating body (by which I merely mean a mass, which will attract other masses in its vicinity) is a gravitational field. Although I have used the words “around” and “in its vicinity”, the field in fact extents to infinity. All massive bodies (and by “massive” I mean any body having the property of mass, however little) are surrounded by a gravitational field, and all of us are immersed in a gravitational field.

If a test particle of mass m is placed in a gravitational field, it will experience a force (and, if released and subjected to on additional forces, it will accelerate). This enables us to define quantitatively what we mean by the strength of a gravitational field, which is merely the force experience by unit mass placed in the field. I shall use the symbol g for the gravitational field, so that the force F on a mass m situated in a gravitational field g is[39].

$$F = mg \qquad (3.3.1)$$

It can be expressed in Newton's per Kilogram, Nkg^{-1}. If you work out the dimensions of$g$, you will see that it has dimensionsLT^{-2}, so that can be expressed equivalently in ms^{-2}. Indeed, as pointed out in section5.1, the mass m (or indeed any other mass) will accelerate at a rate g in the field, and the strength of a gravitational field is simply equal to the rate at which bodies placed in it will accelerate.

Very often, instead of using the expression "strength of the gravitational field" I shall use just "the gravitational field" or perhaps the "field strength" or even just the "field" strictly speaking, the gravitational mass rather then the field strength, but I hope that, when I am not speaking strictly, the context will make it clear.

3.4 Newton's Law of Gravitation:

Newton noted that the ratio of the centripetal acceleration of the Moon in its orbit around the Earth to the acceleration of on apple falling to the surface of the Earth was inversely as the squares of the distances of Moon and apple from the centre of the Erath. Together with other lines of evidence, this led Newton to propose his universal law of gravitation.

Every particle in the universe attracts every other particle with a force that is proportional to the product of their masses and inversely proportional to the square of the distance between them. In symbols:[40].

$$F = \frac{GM_1M_2}{r^2} \qquad (3.4.1)$$

Here, G is the universal gravitational constant. The word "universal" implies an assumption that its value is the same anywhere in the universe, and the word "constant" implies that it dose not vary with time. We shall here accept and adopt these assumptions, while noting that it is a legitimate cosmological equation to consider what implications there may be if either of them is not so.

Of all the fundamental physical constants, G is among those whose numerical value has been determined with least precision. Its currently accepted value is$6.6726 \times 10^{-11} Nm^2kg^{-2}$. It is worth noting that, while the product MG for the sun is known with very great precision, the mass of the sun is not known to any higher degree of precision than that of the gravitational constant.

Exercise. Determine the dimensions in terms of $(M, L\ and\ T)$ of the gravitational constant. Assume that the period of pulsation of a variable star depends on its mass. Its average radius and on the value of the gravitational constant, and show that the period of pulsation must be inversely proportional to the square root of its average density.

The gravitational field is often held to be the weakest of the four forces of nature, but to aver this is to compare incomparable. While it is true that the electrostatic force between two electrons is far, far greater than the gravitational force between them, it is equally true that the gravitational force between sun and Earth is far, far greater than the electrostatic force between them, this example shows that it makes no sense merely to state that electrical forces are stronger than gravitational forces. Thus any statement about the relative strengths of the four forces of nature has to be phrased with care and precision.

3.5 The Gravitational Fields of various Bodies:

In this section we calculate the fields near various shapes and size of bodies, much as one does in an introductory electricity course. Some of this will not have much direct application to celestial mechanics, but it will serve as good introductory practice in calculating fields and later potentials [41].

3.6 Field of a Point Mass:

Equation (3.3.1), together with the definition of as the force experienced by unit mass, means that the field at a distance r from a point mass M is

$$g = \frac{GM}{r^2} \qquad Nkg^{-1} or\ ms^{-2} \qquad (3.6.1)$$

In vector form, this can be written as

$$g = \frac{GM}{r^2}\hat{r} \quad Nkg^{-1} or\ ms^{-2} \qquad (3.6.2)$$

Here $\hat{r}$ is a dimensionless unit vector in the radial direction it can also be written as

$$g = \frac{GM}{r^2}r \quad Nkg^{-1} or\ ms^{-2} \qquad (3.6.2)$$

Here r is a vector of magnitude r $-$hence the r^3 in the denominator.

3.7 field on the Axis of a Ring:

Before starting, one can obtain a qualitative idea of how the field on the axis of a ring varies with distance from the center of the ring. Thus the field at the centre of the ring will be zero, by symmetry. It will also be zero at an infinite distance along the axis. At other places it will not be zero; in other words, the filed will first increase, then decrease, as we move along the axis. There will be some distance along the axis at which the field is greatest. We'll want to know this is, and what is its maximum value.

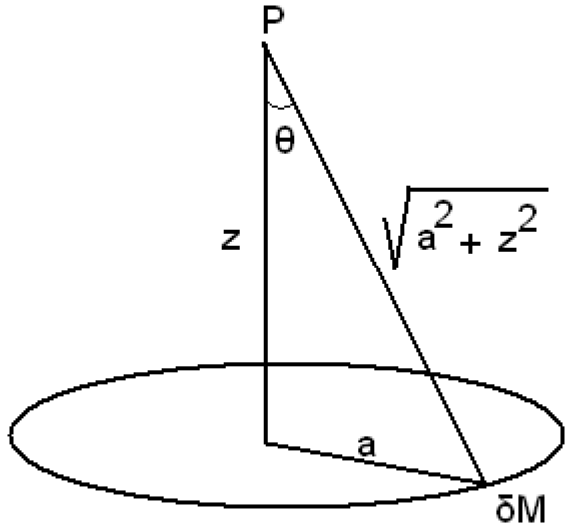

Figure:3.1

Figure:(3.1) shows a ring of mass$M$, radius$a$. The problem is to calculate the strength of the gravitational field at$P$. We start by considering a small element of the ring of massδM. The contribution of this element to the field is

$$\frac{G\delta M}{a^2+z^2} \qquad (3.7.1)$$

Directed from P towardsδM. This can be resolved into a component along the axis (directed to be centre of the ring) and a component at right angles to this. When the contributions to all elements around the circumference of the ring are added, the latter component will, by symmetry be zero. The component along the axis of the ring is

$$\frac{G\delta M}{a^2+z^2}cos\theta = \frac{G\delta M}{a^2+z^2}.\frac{z}{\sqrt{a^2+z^2}} = \frac{G\delta Mz}{(a^2+z^2)^{\frac{3}{2}}} \qquad (3.7.2)$$

On adding up the contributions of all elements around the circumference of the ring, we find for the gravitational field at P

$$g = \frac{GMz}{(a^2 + z^2)^{\frac{3}{2}}} \qquad (3.7.3)$$

Directed towards the centre of the ring. This has the property as expected of being zero at the centre of the ring and at an infinite distance along the axis. If we express $z$in units of$a$, and g in units ofGM/a^2, this becomes

$$g = \frac{z}{(1 + z^2)^{\frac{3}{2}}} \qquad (3.7.4)$$

3.8 Gauss's theorem:

Much of the above may have been good integration practice, but we shall now see that many of the results are immediately obvious from Gauss's theorem-itself a trivially obvious law. (Or shall we say that, like many things, it is trivially obvious in hindsight, though it needed Carl Friedrich Gauss to point it out).

First let us define gravitational flux Φ as an extensive quantity, being the product of gravitational field and area:

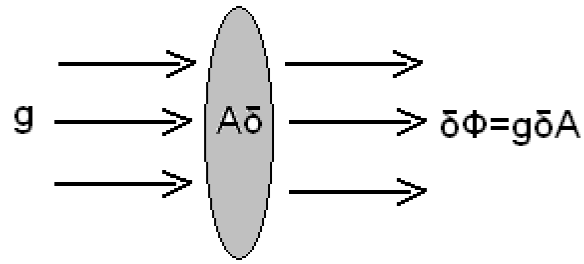

Figure:3.2

If g *and* δA are not parallel, the flux is a scalar quantity, being the scalar or dot product of g *and* δA:

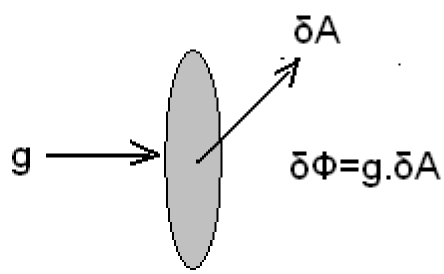

Figure:3.3

If the gravitational field is threading a large finite area. We have to calculate $g.\delta A$ for each element of area of the surface, the magnitude and direction of g possibly varying from point to point over the surface, and then we have to integrate this all over the surface. In other words, we have to calculate a surface integral. We'll give some examples as we proceed, but first let's move toward Gauss's theorem.

In figure: (3.4). I have drawn a mass M and several of the gravitational field lines converging on it. I have also drawn a sphere of radius r around the mass. At a distance r from the mass, the field is $\frac{GM}{r^2}$. The surface area of the sphere is $4\pi r^2$. Therefore the total in ward flux, the product of these two terms, is $4\pi GM$, and is independent of the size of the sphere. (It is independent of the size of the sphere because the field falls off inversely as the square of the distance. Thus Gauss's theorem is a theorem that applies to inverse square fields). Nothing changes if the mass is not at the centre of the sphere. Nor dose it changes if surface is not a sphere. If there were several masses inside the surface, each would contribute $4\pi G$ times to the total normal inwards flux. Thus the total normal inward flux trough any closed surface is equal to $4\pi G$ times the total mass enclosed by the surface. Or expressed another way:

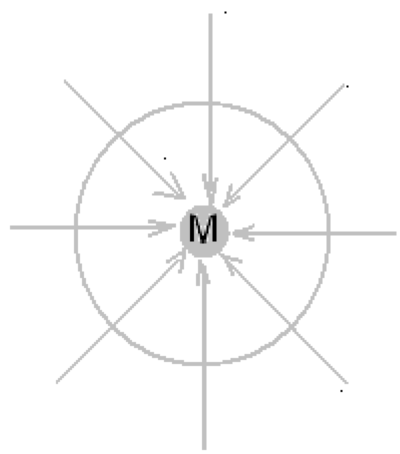

Figure:3.4

The total normal outward gravitational flux through a closed surface is equal to $-4\pi G$ times the total mass enclosed by the surface.

This is Gauss's theorem.

Mathematically, the flux through the surface is expressed by the surface integral

$$\iint g.dA$$

If there is a continuous distribution of matter inside the surface, of density ρ which varies from point to point and is a function of the coordinates, the total mass inside the surface is expressed by $\iint \rho dV$. Thus Gauss's theorem is expressed mathematically by

$$\iint g.dA = -4\pi G \iiint \rho dV$$

3.9 The Gravitational Potentials near Various Bodies:

Because potential is a scalar rather than a vector. Potentials are usually easier to calculate than field strengths. Indeed in order to calculate the potential and then to calculate the gradient of the potential.

3.9.1 Potential Near a point Mass:

We shall define the potential to be zero at infinity. If we are in the vicinity of a point mass, we shall always have to do work in moving a test particle away from the mass. We shan't reach zero potential until we are an infinite distance away. It follows that the potential at any finite distance from a point mass is negative. The potential at a point is the work required to move unit mass from infinity to the point; i.e., it is negative.

Figure:3.5

The magnitude of the field at a distance x from a point mass M isGM/x^2, and the force on a mass m placed there would be m/x^2 . The work required to move m from x to $x + \delta x$ is$GMm\delta x/x^2$. The work required to move it from r to infinity is$GMm \int_r^\infty \frac{dx}{x^2} = \frac{GMm}{r}$. The work required to move unit mass from∞ to r, which is the potential $r$is

$$\psi = -\frac{GM}{R} \qquad (3.9.1)$$

The mutual potential energy of two point masses a distance r apart, which is the work required to bring them to a distance $r$from an infinite initial separation. Is

$$V = -\frac{GM}{r} \qquad (3.9.2)$$

I here summarize a number of similar-looking formulas, although there is, course, not the slightest possibility of confusing them. Here goes:

Force between two masses:

$$F = \frac{GMm}{r^2} \qquad N \qquad (3.9.3)$$

Field near a point mass:

$$g = \frac{GM}{r^2} \qquad Nkg^{-1} or\ ms^{-1} \qquad (3.9.4)$$

$$g = -\frac{GM}{r^2}\hat{r} \qquad Nkg^{-1} or\ ms^{-1} \qquad (3.9.5)$$

Or as:

$$g = -\frac{GM}{r^3}r \qquad Nkg^{-1} or\ ms^{-1} \qquad (3.9.6)$$

Mutual potential energy of two masses:

$$V = -\frac{GM}{r} \qquad J \qquad (3.9.7)$$

Potential near a point mass:

$$\psi = -\frac{GM}{R} \qquad Jkg^{-1} \qquad (3.9.8)$$

I hope that's crystal clear.

3.9.2 Potential on the Axis of a Ring:

We can refer to figure V.I. the potential at from the element$\delta M$is$-\frac{\delta GM}{(a^2+z^2)^{1/2}}$. This is the same for all such elements around the circumference of the ring, and the total potential is just the scalar sum of the contributions from all the elements. Therefore the total potential on the axis of the ring is:

$$\psi = -\frac{GM}{(a^2 + z^2)^{\frac{1}{2}}} \qquad (3.9.9)$$

The $z - component$ of the field (its only component) is $-\frac{d}{dz}$ of this, which results in

$$g = \frac{\delta GMz}{(a^2 + z^2)^{3/2}}$$

The is the same as equation $(3.6.1)$ except for sign. When we derived equation $(3.6.1)$ we were concerned only with the magnitude of the field. Here $-\frac{d\psi}{dz}$ give the $z - component$ of the field. And the minus sign correctly indicates that the field is directed in the negative$z - direction$. Indeed, since potential, being a scalar quantity, is easier to work out than field, the easiest way to calculate a field is first to calculate the potential and then differentiate it. On the other hand, sometimes it is easy to calculate a field from Gauss's theorem, and then calculate the potential by integration. It is nice to.

Those three fundamental reasons enable us to conclude quite definitely that guidance force is in way centripetal.

Quod erat demonstrandum

- **Conclusion:**

One must face the facts: when it comes to cars, there are no such things as centrifugal or centripetal force.

1. In this relation, mass is expressed in kilograms (symbol Kg), speed in meters per second $m.s^{-1}$and radius of the trajectory in meters (m). Dimension obtained is kilograms-meters per square second $Kg.m.s^{-2}$ which characterizes the force unit, Newton (N).
2. Beware of instruction manuals. This law can only be aoolied to real force, never to fictional ones. This means that in an imaginary description, there is no reaction. Isaac Newton did not need to specify this fictional force were unknown at the time.
3. Mass of the sun (s):$2 \times 10^{30} kg$; mass of Earth (E):$6 \times 10^{24} kg$; ratio $\frac{S}{E} = \frac{1}{3} \times 10^{6}$.
4. This truncated description is said to be "static" as opposed to the actual description, said to be "dynamic". About hazards in applying too loosely this way of thinking (here this would imply there were no more seasons), see ADILCA file "cessac& Treherne".

(3.9.3)The Centripetal Force:

A frequent mistake is to associate guidance force to centripetal force although they vary in nature and thus have nothing in common. Therefore they should not be confused.

What then defines a centripetal force?

- **Definition**

Centripetal means “that brings closer to a centre”. A force is said to be centripetal when its action brings amass closer to a centre. Where should this centre be located. In physics, this term may have two different meanings.

(3.9.4) Finding the centre:

When a mass describes a circular trajectory, the centre is obviously the one of the circle this mass describes.

In the case of a bend taken by a car, the action of a centripetal force should lead to a steady decrease of the radius length unit it reaches zero. The car would then describe a spiral-shaped trajectory ending in the centre in question. Obviously this is never the case.

In the second definition, which goes beyond circular movement, the centre in question is a centre of mass, which in physics means a virtual point useful in describing certain phenomena.

For instance, the phenomenon of gravitation can be described as an attraction between two centers of mass. This definition supposes the existence of a force operating at a distance.

Amongst the four fundamental physical forces that guide the universe, only two meet this criterion, namely electromagnetic force and gravitational force. So their actions can be qualified as being centripetal-but they are only ones.

(3.9.5) Only two kinds of Centripetal Force:

An electromagnetic force operates at a distance a chemical. It allows a heavy atom to capture one or several lighter atoms to form a molecule. Its action can therefore be described as centripetal.

For instance, when oxygen atoms come into contact with hydrogen atoms, each oxygen atom attracts and captures two hydrogen atoms to form a molecule of water.

Gravitational force is the other force that operates a distance. Its action is also centripetal hence its name.

This can be verified by dropping an object on the ground. In its fall, the object gets closer to the centre of mass of Earth which attracts it.

The same sort of attraction maintains in orbit around the sun: the mass of the sun gives off a force that diverts Earth's trajectory. If this force did not exist, Earth would leave the Solar system. And if Earth's speed was zero, it would immediately head off to the Sun.

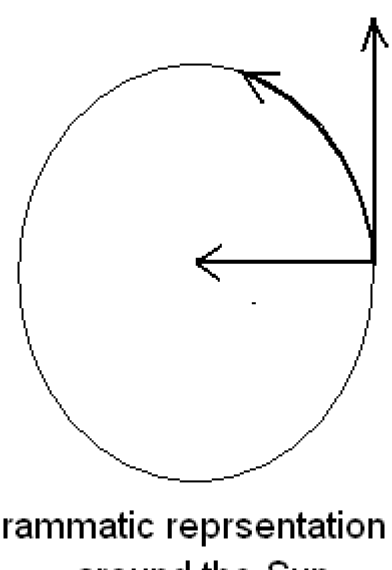

Fig:(3.6) Diagrammatic reprsentation of the Earth's rotation around the Sun

Earth describes a circular trajectory (blue arrow) because of the force generated by the sun's mass (red arrow). This is centripetal force. If it did not exist Earth's trajectory would be a straight line (green arrow).

(3.9.6)Expressing Centripetal Force:

How to express centripetal force?

Centripetal force is expressed thanks to the relation discovered by Isaac Newton to explain the Moon's rotation around Earth, then that of Earth around Sun:

$$F = \frac{mv^2}{R}$$

Let us note that this relation can express only two forces: centripetal force, or reasoning by analogy, guidance force (see ADILCA file "guidance force").

(3.9.7)Centrifugal Force and Centripetal Force:

Centripetal and centripetal force are often presented as inseparable. This simplistic reasoning rests on the two following confusions.

The first confusion stems form a poor understanding of Isaac Newton's third law which goes: "to every action there is always an equal and opposite reaction". Indeed this reaction exists, but how and where dose it manifest itself.

Consider again the description of movement within the Solar system and the relation between the Sun and Earth: the Sun generates a

force that acts from a distance and keeps Earth on a circular orbit. This is centripetal force.
The Law of reciprocity as set out by Newton allows us to deduce that Earth attracts the Sun with a force of equal intensity as the one keeping it on orbit, but in opposite direction. This very real force exerts on the Sun's gravity centre, but has nothing to do with centrifugal force, which indeed shouldn't even be brought up in this description.
Why is it that only Earth changes its trajectory, leaving the Sun entirely insensitive to this force. The explanation lies in the Sun's mass being over 300,000 times greater than Earth's. Taking advantage of this imbalance, the Sun lays down the law which Earth can only comply with.

The second confusion stems from poor understanding of the concept of centrifugal force. Centrifugal force being an imaginary force, it only appears in partial descriptions that leave out any mention of real movement. What is it all about.
In this description, entirely different from the former, one must assume that Earth ceases to orbit around the Sun and remains motionless in space. Subject to gravitational force, Earth would immediately head off to the Sun unit it reaches it, unless an imaginary force equal in magnitude and opposite in direction came to prevent it. That imaginary force is centrifugal force. But this

description is truncated because it implies that Earth stops orbiting around the Sun.

In a word, it is essential to dissociate the two descriptions, and thus the two forces: one is very real whereas the other is fictitious and appears only in the case of an imaginary description (see ADILCA file “centrifugal force”).

(3.9.8)Three Fundamental Differences:

Let us get back to Earth: is the guidance force (that is requested by a car driver to negotiate a bend) a centripetal force?

Let us examine step by step the characteristics of guidance force:

1. This force dose not act at a distance, it is a contact force.
2. This force dose not impacts the centre of mass of the car but acts at the circumference of the tires the steering wheels.
3. The car never gets closer to the centre of its trajectory: it is only diverted from a straight line trajectory.

Chapter Four

Literature Review

4.1 Introduction:

Energy concept is very important in physics. It is the cornerstones of all physical theories [41, 42, 43, and 44]. This meaner that new physical theories should satisfy this principle [45, 46, 47]. This chapter is concept with energy concept in special relativity and generalized special relativity be side some applications.

4.2 The Effect of Speed and Potential on Time Mass and Energy on the Basis Newton and Relativity Prediction:

The concept of space, time and mass. Plays an important role in physic. According to Newton laws of motion these concepts are absolute in the sense that these quantities have the same value in all frames of references [1, 2]. Newton’s laws of motion succeeded in explaining the motion of macro particles free in space and fields [48].

However the experiment done by Michelson and Morley shows that the speed of light in vacuum is constant and independent of the motion of the motion of the source or the observer. This result is in direct conflict with Newton’s concept of the absoluteness of space and time. This motivates Einstein to propose his relative motion between the system and the observer.

Special relativity theory SR is concerned with relations between time length and masses in reference frames that moves relative to each others with constant velocity.

According to SR time length and mass are functions of the velocity with which physical events move with respect to the observer [3].

The SR succeed in explaining a great number of observations, for instance it can explain the meson decay, pair production and nuclear binding energy.

Despite these remarkable successes SR suffers from noticeable setbacks. The theory of SR suffers from noticeable setbacks. First of all its expression for energy dose not satisfy Newtonian limit, for its expression at law speed gives matter energy beside kinetic energy only. The reduced SR energy does not contain an expression for the potential energy which is direct conflict with Newtonian one which consists of a term representing the potential energy beside the kinetic energy [4].

The theory of SR is also in direct conflict with the empirical relation for the red shift phenomena. The red shift phenomena states that the photon frequency change as it travels from free space to the gravitational field of the earth. The frequency change means that the mass and periodic time is effected as well. The observed effective mass in crystals show that the effect of crystal field on electron mass. The mass expression in SR has no room for the effect of the potential on mass [5, 6].

Different attempts were mode to modify SR [18]. In Savakis mode the energy and length are found in a curved space [19]. But the expression are not linked with theSR. moreover these expression are restricted to gravity field only.

In generalized special relativity theory (GSR), time, space mass and energy are found [20]. The energy expression is found to satisfy Newtonian limit and to explain the gravitational red shift. But unfortunately these expression are restricted to a weak field only [7, 8, 9].

- **Mechanical Experiments:-**

The verification of the laws of mechanics was made by some experiments which show clearly the viability of these laws.

For the comparison between Newton's lows(NL), Einstein special relativity (ESR) and generalized Einstein special relativity(GESR), the following experiment can clearly enable performing this task.

1. Potential energy experiments

a. Macroscopic particle motion can be described by using the Newton expression of energy E

$$E = E_0$$

$$T + V = T_0 + V_0$$

$$\frac{1}{2}mv^2 + V = \frac{1}{2}mv_0^2 \qquad (4.2.1)$$

But knowing the initial velocity v_0 and the initial potentialV_0, one can the velocity of the rocket V at any time$t$, when the potential V at this time t is known. This experiment shows clearly the importance of the potential energy in describing the motion of particles in any field. Any viable mechanical theory must include potential energy in its energy expression otherwise it predicts its own break down.

2. Time dilatation experiments

It was observed experimentally that the time is affected by speed as well as by potential of fields.

Two famous experiments were made:

a. Effect of velocity (speed):

The mesons which are at rest have life time

$$t_0 = 2 \times 10^{-2} S \qquad (4.2.2)$$

But μmesons which are produced in the atmosphere by fast cosmic-ray particles arrive at the earth from space, in profusion travelling a distance of more than$6km$. If no time dilatation exists, the speed $2.994 \times 10^8 m/s$ is given by

$$L_0 = vt_0 = 2.994 \times 10^8 \times 2 \times 10^{-6} = 600m \qquad (4.2.3)$$

This distance travelled is much less than the actual distance travelled which is more that$6km$. One of the possible ways to expprematnis this to use time dilation relation of SR, where the life time t of μ Meson travelling with speed

$v = 2.994 \times 10^{8} m/s$

Is given by

$$t = \frac{t_0}{\left(\sqrt{1-\frac{v^2}{c^2}}\right)} = 31.7 \times 10^{-6} s \qquad (4.2.4)$$

In this case the meson travels distance

$$L = vt = 9.5 km \qquad (4.2.5)$$

Which agrees with the fact that μ meson reaches the Earth after travelling more than $6km$ before decaying.

b. The effect of potential:

The effect gravity field on periodic time of light was verified by pound and Rebka in 1960 they allowed x – ray emitted $14.4ev, 0.1\mu s$ transition in $Fe^{57}$to fall$22.6m$, and observed its resonant absorption by a Fe^{57}target. The difference is the gravitational potential per unit mass for $22.6m$ is

$$\Delta\Phi = -2.46 \times 10^{-15} \qquad (4.2.6)$$

The observed relative frequency shift was found to be

$$\frac{\Delta f}{f} = (2.57 \pm 0.06) \times 10^{-15} \qquad (4.2.7)$$

This result indicates a change of the periodic time t which is related to F a according to the relation

$$T = \frac{1}{f} \qquad (4.2.8)$$

This result was expired by general relativity (G) according to the relation

$$T_2 = T_0\left(-g_{00}(x_2)\right)^{-1/2} = T_0\left(1 + \frac{2\varphi_2}{c^2}\right)^{-1/2}$$

$$T_1 = T_0\left(-g_{00}(x_1)\right)^{-1/2} = T_0\left(1 + \frac{2\varphi_1}{c^2}\right)^{-1/2}$$

$$\Delta T = T_2 - T_1$$

$$\Delta f = f_2 - f_1 \qquad (4.2.9)$$

Where

$$f_1 = \frac{1}{T_1} \quad f_2 = \frac{1}{T_2}$$

Thus

$$\Delta f = f_2 - f_1$$

$$f = f_1$$

$$\frac{f_2}{f_1} = \left(\frac{g_{00}(x_2)}{g_{00}(x_1)}\right)^{\frac{1}{2}} \qquad (4.2.10)$$

The predicted time by GR

$$g_{00} = -\left(1 + \frac{2\varphi}{c^2}\right) \qquad (4.2.11)$$

$$\frac{\Delta f}{f} = 2.46 \times 10^{-15} \qquad (4.2.12)$$

Which in is excellent agreement with the experimental one.

1. **Mass Energy Experiments**

The Max Plank quantum theory explants' a wide variety of physical phenomena. One of these phenomenons is the so called pair parction. In pair production a highly energy ethic photon of energy hf produce pair of particles and anti-particles adjkding to the relation

$$hf = 2m_0c^2 + k_1 + k_2 \qquad (4.2.13)$$

Some of the hoten energy is frozen in the form of rest mass energy with

$m_0 = rest\ mass$

$k_1 = kinetic\ energy\ of\ the\ partical$

$k_1 = kinetic\ energy\ of\ the\ anti - partical$

This phenomenon as the phenomenon, also confirms the concept of mass energy.

This phenomenon is concerned with the difference of mass between the total mass of protons and neutrons constituting a certa nucleus and the mass energy.

This the difference of mass between the total mass of portend and neutrons constituting a certain nucleus and the mass the nucleus it self. This difference is called mass defect or binding energy B where:

$$B = [n_p m_p + n_n m_n]c^2 - Mc^2 \qquad (4.2.14)$$

With

$n_p = number\ of\ proteins$

$n_n = number\ of\ neutrons$

$m_n = mass\ of\ a\ neutron$

$M = mass\ of\ the\ nucleus$

The energy liberates of nuclear power stations and unclear bomb confirms this relation.

The change of energy the potential of the gravitational was observed in the gravitational red shift phenol men on. In this phenomenon energy of the photon entering gravitation's field is given by:

$$h\acute{f} = hf + V$$

$$\acute{E} = E + V \qquad (4.2.15)$$

Where:

$\acute{f}$
$= newphoton\ frequency\ after\ entering\ the\ gravitational\ field$

$f = photon\ frequency\ in\ free\ space$

$V = potential\ energy$

If one believes in the Einstein SR one has energy relation for photon in the form

$$hf = mc^2 \qquad (4.2.16)$$

Therefore

$$m^{\backslash}c^2 = mc^2 \ + V \qquad (4.2.17)$$

Thus the is affected by the potential energy.

Another merriment indicates that mass of electrons are affected by the crystal field to the relations

$$m = m_0 \frac{F_e}{(F_e + F_L)} \qquad (4.2.18)$$

- Theoretical Models:-

For particle of mass velocity v moving in a field potential$V$. The time mass and energy in frames $S$and S_0 moving with resp each other with-speed v is given in Newtonian mechanics by:

$$t = t_0 \qquad (4.2.19)$$

$$m = m_0 \qquad (4.2.20)$$

$$E = E_0 \qquad (4.2.21)$$

$$\frac{1}{2}mv^2 + V = \frac{1}{2}mv_0^2 + V_0 \qquad (4.2.22)$$

When the particle is at rest inS_0:

$$v_0 = 0 \qquad (4.2.23)$$

According to SR Einstein theory [11] these relations are:

$$t = \frac{t_0}{\sqrt{1 - \frac{v^2}{c^2}}} \qquad (4.2.24)$$

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \quad (4.2.25)$$

$$E = E_0 + T \quad (4.2.26)$$

$$E_0 = m_0 c^2 \quad (4.2.27)$$

$$E = mc^2 = \frac{m_0 c^2}{\sqrt{1 - \frac{v^2}{c^2}}} \quad (4.2.28)$$

In the Newtonian limit for low speed

$$E = mc^2 = mc^2 + T \quad (4.2.29)$$

According to mass energy relation in SR the mass can be converted to energy according to equation (4.2.13) and (4.2.14).

This is since NM equation (4.2.22) has no term recognizing rest mass energy.

The NM energy equation (4.2.22) cannot explain the effect of lattice crystal force F_r an mass shown by equation (4.2.18).

However, Einstein equation explains a wide variety of physical phenomena, but not all of them. While it cannot explain the motion particle in fields [compare (4.2.1) with (4.2.28)], but it can explain the effect of velocity on life time [see equation (4.2.4) and (4.2.24)]. However as by shown by equation (4.2.9) cannot explained by SR equation (4.2.24).

Consider first Newton laws. It is clear from equation (4.2.1) and (4.2.23) that NM can explain the motion of macro particles in any frame the comparison of equations (4.2.4) with (4.2.19) shows the failure of NM in explaining time dilation experiment this is since according to equation (4.2.4) the life time is affected by velocity. It cannot also recognize the effect of potential on mass. Newton laws cannot also explain pair production and mass defect in which energy can be converted to mass, or the mass can be converted to energy according to equation (4.2.13) and (4.2.14).

The is since NM energy, relation (4.2.22) has no term recognizing rest mass energy.

However, Einstein SR can explain a wide variety of physical phenomena, but not all them. While it cannot explain the motion particle in field [compare (4.2.1) with (4.2.31)], but it can explain the effect of velocity on life time [see equation (4.2.4) and (4.2.24)]. However the effect on potential on time as shown by equation (4.2.9) cannot explain by RS equation (4.2.24).

Fortunately can explain all these phenomena. This is straight forward from the comparison of all equation in sections, with the GSR equation. The effect of velocity and on time shown experimentally to obey equations (4.2.4) and (4.2.9) can be explained by equation (4.2.31) by setting $\varphi = 0$ and $v = 0$ for the expression of t respectively. Equation (4.2.31) and (4.2.14) which states that rest mass is a energy can be easily explained by equation (4.2.32), hen the potential ter anishes.

Form GSR one explain all these phenomena. This is straight forward from obey equations (4.2.4) and (4.2.9) which can be deduced from equation (4.2.30) by setting $\varphi = 0$and $v = 0$ for the expressions of t respectively, where

$$t = \frac{t_0}{\sqrt{1 - \frac{v^2}{c^2} + \frac{2\varphi}{c^2}}} \qquad (4.2.30)$$

$$m = \frac{m_0}{\sqrt{1 + \frac{v^2}{c^2} + \frac{2\varphi}{c^2}}} \qquad (4.2.31)$$

$$E = mc^2 = \frac{m_0 c^2}{\sqrt{1 + \frac{2\varphi}{c^2} - \frac{v^2}{c^2}}} \qquad (4.2.32)$$

$$E = mc^2 = m_0 c^2 \left(1 + \frac{\varphi}{c^2} - \frac{v^2}{2c^2}\right)$$

$$= m_0 c^2 + m_0 \varphi + \frac{m_0 v^2}{c^2} \approx E_0 + V$$

Moreover the expressions for energy and mass in equation (4.2.15) and (4.2.18) which explains the photon frequency red be easily explained on the basis of relation (4.2.32) by considering the case of weak field where.

$$m = m_0 \left(1 - \frac{2\varphi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{1}{2}}$$

$$m = m_0 \left(1 + \frac{\varphi}{c^2} + \frac{1}{2}\frac{v^2}{c^2}\right) \qquad (4.2.33)$$

4.3Matter and Antimatter Generation and Repulsive Gravity Force:-

it is well known now that the universe consists of matter as well as antimatter.

The existence of anti matter was first proposed by Dirac, when solving his Dirac relativistic equation. The solution of his equation given an energy term with negative mass. He suggests that this negative mass term indicates the existence of anti matter [1]. Later on Anderson found anti electron (positron) in cosmic rays that confirmed piracy hypothesis [2]. This important discovery opens a new are in the physics of elementary particles.

It was experimentally observed that a particle and its anti particle can be produced by photons. This pair production was explained easily on the bases of Max Plank quantum hypothesis and Einstein mass energy relation []. It was also observed that when a particle and its anti particle meats they annihilate and produce a photon.

Repulsive gravity force was proposed by many scientists, and some of them claim that they result from interaction of particles and anti particle []. This repulsive force between matter and anti matter can help in explaining the particle and anti particle asymmetry and the abundance of particles in our universe. It can also explain the stream of anti particles that leaves galaxies and escape [].

The particle and anti particle production can be explained on the basis of GSR.

The energy relation according to Einstein generalized relation is given by

$$E = \frac{m_0 c^2 \left(1 + \frac{2\Phi}{c^2}\right)}{\sqrt{1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}}} \qquad (4.3.1)$$

When m_0, Φ, v stands for rest of mass, potential and velocity respectively.

Thus

$$E = m_0 c^2 \left(1 + \frac{2\Phi}{c^2}\right)\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{1}{2}} \qquad (4.3.2)$$

To find vacuum minimum energy, the energy one minimizes E to get

$$\frac{dE}{d\Phi} = m_0 c^2 \left[\left(1 + \frac{2\Phi}{c^2}\right) \times \frac{-1}{2}\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{3}{2}} \times \frac{2}{c^2} + \left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{1}{2}} \times \frac{2}{c^2}\right]$$

Thus

$$\frac{dE}{d\Phi} = \frac{2m_0c^2}{c^2} \frac{\left(\frac{1}{2} + \frac{\Phi}{c^2} - \frac{v^2}{c^2}\right)}{\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{\frac{3}{2}}} \qquad (4.3.3)$$

$$\frac{2m_0c^2}{c^2} \frac{\left(\frac{1}{2} + \frac{\Phi}{c^2} - \frac{v^2}{c^2}\right)}{\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{\frac{3}{2}}} = 0 \qquad (4.3.4)$$

Hence

$$\frac{1}{2} + \frac{\Phi}{c^2} - \frac{v^2}{c^2} = 0$$

Therefore

$$\Phi = v^2\left(\frac{v^2}{c^2} - \frac{1}{2}\right)$$

Thus the value Φ which make E minimum is given by

$$\Phi = v^2 - \frac{c^2}{2} \qquad (4.3.5)$$

Due to the wave nature of light

$$c_e = \frac{c_m}{\sqrt{2}}$$

$$c_m = \sqrt{2}c_e \qquad (4.3.6)$$

Let

$$c = c_m = \sqrt{2}c_e \qquad (4.3.7)$$

$$v^2 = c_e^2 \qquad (4.3.8)$$

When $v = 0$

$$\Phi = -c_e^2 \qquad (4.3.9)$$

Thus this potential is given by

$$V = m_0 \Phi = -m_0 c_e^2 \qquad (4.3.10)$$

In this case the vacuum constituents are rest$(v = 0)$.

But when a photon, which constitute vacuum move with speed$c$, thus

$$v = c \qquad (4.3.11)$$

Substitute in (4.3.5) to get

$$\Phi = c^2 - \frac{c^2}{2} = \frac{c^2}{2} \qquad (4.3.12)$$

When inserting equation (4.3.7), one gets

$$\Phi = c_e^2 \qquad (4.3.13)$$

But the potential energy given by

$$V = \Phi m_0$$

Thus from (4.3.13) and (4.3.1) the potential is given by

$$V = m_0 c_e^2$$

The vacuum energy can be found by inserting (4.3.11) and (4.3.12) in (4.3.1) to get

$$E = m_0 c^2 (1 + 1) = 2 m_0 c^2 \qquad (4.3.14)$$

Thus one can imagine vacuum energy levels as shown below

$$E_+ = m_m c^2 = m_0 c_e^2 \quad \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_$$

$$E = 0 \qquad \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_$$

$$E_- = -m_0 c^2 = m_a c_e^2 \quad \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_$$

Figuar (1) vacuum states as consisting of photons producing and destructing particles and anti particles with rest masses m_0

The production of pair particles can be regarded as due to electron transfer from state the lower to the upper after absorbing a photon.

Where

$$m_m = matter\ mass = m_0$$

$$m_a = anti\ matter\ mass = -m_0 \qquad (4.3.15)$$

The energy diagram is shown in figure (4.1)

According to Newton's laws the potential is given by

$$\Phi = -\frac{Gm}{r} \qquad (4.3.16)$$

For matter

$$m_m = m_0$$

Thus

$$\Phi_m = matter\ potential = -\frac{Gm_m}{r} = -\frac{Gm_0}{r} \qquad (4.3.17)$$

This is an attractive force.

For anti matter

$$m_a = -m_0$$

$$\Phi_a = anti\ matter \ = -\frac{Gm_a}{r} = +\frac{Gm_0}{r} \qquad (4.3.18)$$

This is a repulsive force

When matter and anti matter interact with each other the potential is given by

$$V = -\frac{GmM}{r} \qquad (4.3.19)$$

Where the force is given by

$$F = -\nabla V$$

$$= -\frac{\partial V}{\partial r} = GmM\frac{\partial r^{-1}}{\partial r}$$

Hence the force is given by

$$F = -\frac{GmM}{r^2} \qquad (4.3.20)$$

For matter and anti matter reaction

$$m = m_m = m_0$$

$$M = m_a = -m_0 \qquad (4.3.21)$$

Thus the force between matter and anti matter is given by

$$F = -\frac{G(m_0)(-m_0)}{r^2} = \frac{Gm_0^2}{r^2} \qquad (4.3.22)$$

Thus there is repulsive force between matter and anti matter

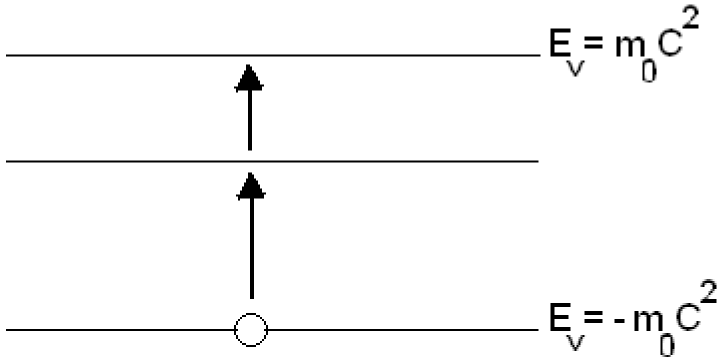

Fig:(4.3) vacuum energy levels

Generation of particle on the basis of conservation law:-

In this work it is shown that; the energy conservation requires

$$E = mc^2 + 2m\Phi \qquad (4.3.23)$$

The GSR mass was proposed by some authors to be

$$E = \frac{m_0c^2}{\sqrt{\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)}} + \frac{2m_0c^2}{\sqrt{\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)}}$$

$$E = m_0c^2\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{1}{2}} + 2m_0c^2\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{1}{2}}$$

To find vacuum state, the energy E needs to be minimized $w.r.t$ toΦ, to get

$$\frac{dE}{d\Phi} = -\frac{1}{2} m_0 c^2 \left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{3}{2}} \times \frac{2}{c^2}$$
$$+ 2m_0 \left[\Phi \times \frac{-1}{2} \left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{3}{2}}\right.$$
$$\left. \times \frac{2}{c^2} + \left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{1}{2}}\right]$$

Thus

$$\frac{dE}{d\Phi} = \frac{m_0}{\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{\frac{3}{2}}} - \frac{\frac{2m_0\Phi}{c^2}}{\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{\frac{3}{2}}} + \frac{2m_0}{\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{\frac{1}{2}}}$$

$$= \frac{\frac{-m_0 - 2m_0\Phi}{c^2} + 2m_0\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)}{\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{\frac{3}{2}}} \qquad (4.3.24)$$

This equation can be satisfied, when

$$2m_0\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right) = \frac{2m_0\Phi}{c^2} + m_0$$

$$1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2} = \frac{\Phi}{c^2} + \frac{1}{2}$$

$$\frac{\Phi}{c^2} = \frac{v^2}{c^2} - \frac{1}{2}$$

$$\Phi = v^2 - \frac{c^2}{2} \qquad (4.3.25)$$

If vacuum particles are at rest $v = 0$, thus equation (4.3.25) become

$$\Phi = -\frac{c^2}{2} \qquad (4.3.26)$$

Substituting this value (4.3.23) and (4.3.24) yield

$$m = \frac{m_0}{0} = \infty \qquad (4.3.27)$$

Thus from (4.3.23)

$$E = \infty \qquad (4.3.28)$$

Thus condition (4.3.24) is the condition maximum E.

Now one can use equation (4.3.23)

$$E = mc^2 + 2m\Phi$$

But the mass term is in the form

$$= \frac{\left(1 + \frac{2\Phi}{c^2}\right) m_0}{\sqrt{1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}}} \qquad (4.3.29)$$

Inserting (4.3.29) in (4.3.23) yields

$$E = \frac{\left(1 + \frac{2\Phi}{c^2}\right) m_0 c^2}{\sqrt{1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}}} + \frac{2m_0\Phi\left(1 + \frac{2\Phi}{c^2}\right)}{\sqrt{1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}}}$$

$$E = m_0 c^2\left(1 + \frac{2\Phi}{c^2}\right)\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{1}{2}} + 2m_0\left(\Phi + \frac{2\Phi^2}{c^2}\right)\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{1}{2}}$$

The differentiation of E $w.r.t$ to Φ requires

$$\frac{dE}{d\Phi} = m_0 c^2\left[\left(1 + \frac{2\Phi}{c^2}\right) \times -\frac{1}{2}\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{3}{2}} \times \frac{2}{c^2} + \left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{1}{2}} \times \frac{2}{c^2}\right] + 2m_0\left[\left(\Phi + \frac{2\Phi^2}{c^2}\right) \times -\frac{1}{2}\left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{3}{2}} \times \frac{2}{c^2} + \left(1 + \frac{2\Phi}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{1}{2}} \times \left(1 + \frac{4\Phi}{c^2}\right)\right]$$

$$= \frac{-m_0\left(1+\frac{2\Phi}{c^2}\right)}{\left(1+\frac{2\Phi}{c^2}-\frac{v^2}{c^2}\right)^{\frac{3}{2}}} + \frac{2m_0}{\left(1+\frac{2\Phi}{c^2}-\frac{v^2}{c^2}\right)^{+\frac{1}{2}}} - \frac{\frac{2m_0}{c^2}\frac{\left(\Phi+\frac{2\Phi^2}{c^2}\right)}{c^2}}{\left(1+\frac{2\Phi}{c^2}-\frac{v^2}{c^2}\right)^{\frac{3}{2}}}$$
$$+ \frac{2m_0\left(1+\frac{4\Phi}{c^2}\right)}{\left(1+\frac{2\Phi}{c^2}-\frac{v^2}{c^2}\right)^{\frac{1}{2}}} \qquad (4.3.30)$$

Where for minimum energy one has

$$\frac{dE}{d\Phi} = 0 \qquad (4.3.31)$$

$$\frac{-m_0\left(1+\frac{2\Phi}{c^2}\right) + 2m_0\left(1+\frac{2\Phi}{c^2}-\frac{v^2}{c^2}\right) - \frac{2m_0}{c^2}\left(\Phi+\frac{2\Phi^2}{c^2}\right) + 2m_0\left(1+\frac{4\Phi}{c^2}\right)\left(1+\frac{2\Phi}{c^2}-\frac{v^2}{c^2}\right)}{\left(1+\frac{2\Phi}{c^2}-\frac{v^2}{c^2}\right)}$$
$$= 0$$

$$\left(1+\frac{2\Phi}{c^2}\right) + 2\left(1+\frac{2\Phi}{c^2}\right) - \frac{v^2}{c^2} - \frac{2\Phi}{c^2} - \frac{4\Phi^2}{c^4} + 2\left(1+\frac{4\Phi}{c^2}\right)\left(1+\frac{2\Phi}{c^2}-\frac{v^2}{c^2}\right)$$
$$= 0 \qquad (4.3.32)$$

$$\left(1+\frac{2\Phi}{c^2}\right) - \frac{2\Phi}{c^2} - \frac{2v^2}{c^2} - \frac{4\Phi^2}{c^4} + 2\left(1+\frac{2\Phi}{c^2}\right) - \frac{2v^2}{c^2} + 4\Phi\left(1+\frac{2\Phi}{c^2}-\frac{v^2}{c^2}\right) = 0$$

$$3\left(1+\frac{2\Phi}{c^2}\right) - \frac{2\Phi}{c^2} - \frac{4v^2}{c^2} - \frac{4\Phi^2}{c^4} + \frac{4\Phi}{c^2} - \frac{8\Phi^2}{c^4} - \frac{4v^2\Phi}{c^4} = 0$$

$$3 + \frac{8\Phi}{c^2} - \frac{4v^2}{c^2} + \frac{4\Phi^2}{c^4} - \frac{4v^2\Phi}{c^4} = 0 \qquad (4.3.33)$$

Foe stationary vacuum constituents

$$v = 0 \qquad (4.3.34)$$

Equation (4.3.33) reads

$$\frac{4\Phi^2}{c^4} + \frac{8\Phi}{c^2} + 4 = 0$$

$$4\Phi^2 + 8\Phi + 3c^4 = 0$$

Solving for Φ

$$\Phi = \frac{-\mathrm{b} \pm \sqrt{\mathrm{b}^2 - 4\mathrm{ac}}}{2\mathrm{a}} \qquad (4.3.35)$$

$$\Phi = \frac{-8c^2 \pm \sqrt{16\mathrm{c}^4 - 48\mathrm{c}^4}}{8} \qquad (4.3.36)$$

Substituting (4.3.36) in the energy E relation (4.3.23) given

$$E = \pm\sqrt{-2m}c^2 \qquad (4.3.27)$$

Consider now a vacuum is full of photon. This means that

$$\frac{4\Phi^2}{c^4} + \frac{8\Phi}{c^2} - 1 = 0 \qquad (4.3.38)$$

Using (4.3.35)

$$\Phi = \frac{-4c^2 \pm \sqrt{16\mathrm{c}^4 - 16\mathrm{c}^4}}{8}$$

$$\Phi = \frac{-4c^2 \pm \sqrt{2}c^2}{8} = -\frac{1}{2} \pm \frac{1}{\sqrt{2}}c^2 \qquad (4.3.39)$$

Inserting equation (4.3.39) in equation (4.3.23) the energy is given by

$$E = mc^2 + 2m\left(-\frac{c^2}{2} \pm \frac{1}{\sqrt{2}}c^2\right)$$

$$E = \pm\sqrt{2m}c^2 \qquad (4.3.40)$$

The vacuum energy is found by minimizing GGR energy relation (4.3.1), together with the velocity and potential given by (4.3.11) and (4.3.12). One here assumes the vacuum consisting of photons, where we assume v to be equal to c in (4.3.11). In this case vacuum energy given by equation (4.3.14) to be

$$E_v = 2m_0c^2 \qquad (4.3.41)$$

According to figure (4.1), one can assume vacuum as consisting of photon of energy

$$E_p = hf = 2m_0c^2 \qquad (4.3.42)$$

Beside matter and anti matter particle with energies

$$E_m = m_0c^2 \qquad E_a = -m_0c^2$$

Thus the total vacuum energy is

$$E_v = E_p + E_m + E_a = 2m_0c^2 \qquad (4.3.43)$$

Where the particle exists in the energy state= m_0c^2.

This is equivalent to the existence of the particle and anti particle representing this lower state, together with non interacting photon. When the photon is incident on this particle in the lower state $(-m_0c^2)$ it gives it in energy $(2m_0c^2)$. This particle transfer itself to the state of energy (m_0c^2) appearing as a particle and leaving a vacancy in the state $(-m_0c^2)$ which appears as an anti particle, with numerical masses (m_0c^2). The photon of energy $2m_0c^2$ disappear production a particle and anti particle pair of total numerical mass$2m_0c^2$.

Using also Mubarak energy conservation expression (4.3.23), vacuum energy is again obtained by minimizing E and assuming vacuum to constitute stationary particles to get relation (4.3.27).

$$E = \sqrt{2}m_0c^2i = \hbar w = i\hbar w_0$$

$$w = iw_0$$

$$w_0 = \sqrt{2}m_0c^2 \qquad (4.3.44)$$

The wave function of vacuum particles takes the form

$$\psi = Ae^{\frac{iE}{\hbar}t} = Ae^{iwt} = Ae^{-w_0t} \qquad (4.3.45)$$

Thus the number of vacuum particles is given by

$$n \sim |\psi|^2 \sim A^2 e^{-2w_0 t} \qquad (4.3.46)$$

This means that vacuum particles decay and transforms to other forms like elementary particles. This result conforms to what proposed by cosmology physics at the early universe.

4.4 The generalized Newton's law of gravitation:-

Arbab suggested amid in which he assume that gravity and electromagnetic fields are nearly identical.

In electromagnetism, the force on a moving charge is given by Lorentz force. Analogously, the force on a moving mass is given by a Lorentz-like force. Such a force requires a priori the presence of the gravitomagnetic field produced by a central body. Hence the gravitimagnetic force acting on any orbiting object of mass m about a central M, in the presence of a gravitomagentic filed, is given by

$$\vec{F}_m = m\vec{v} \times \vec{B}_g \quad F_m = \frac{mv^4}{c^2 r} \Rightarrow F_m = \frac{mv^2}{r}\left(\frac{v}{c}\right)^2 \qquad (4.4.1)$$

Upon using the relation (Arbab 2000c)

$$\vec{B}_g = \frac{\vec{v}}{c^2} \times \vec{E}_g \Rightarrow B_g = \frac{v^3}{c^2 r} \quad \vec{E}_g = \vec{a} \qquad (4.4.2)$$

For the circular motion. This is nothing but the generalized Newton's law of gravitation. Using (4.4.1) one can calculate the ratio between the centripetal force of an orbiting body to the gravitomagnetic force. This is given by

$$\left(\frac{F_m}{F_g}\right) = \left(\frac{v}{c}\right)^2 \qquad (4.4.3)$$

This clearly shows that this gravitomagnetic force. Equation(4.4.1) reveals that the gravitomgnetic force represents a relativistic correction of Newton's law of gravitation. Notices that the gravitomagnetic field is not a real magnetic field as we know it (arising form the motion of currents). It is an analogue of the ordinary magnetic field. This gravitomgentic field has a unit of frequency. It is produced by the motion (neutral mass current) of a gravitation object. In 1961 oppenheim and Laplace in 1805 considered a modification of Newton's equation by adding a velocity dependent term, but that couldn't give the correct Mercury precession (Gine 2008). The gravitation Lorentz force takes the general form (Arbab 2009b).

$$\vec{F}_m = m\left(\vec{a} + \vec{v} \times \vec{B}_g\right) = \vec{F}_g + \vec{F}_m \qquad (4.4.4)$$

Where $\vec{E}_g = \vec{a}$ is the gravitation field. Using the vector identity, $\vec{A} \times \left(\vec{B} \times \vec{C}\right) = \vec{B}\left(\vec{A}.\vec{C}\right) - \vec{C}(\vec{A}.\vec{B})$, (4.4.2) and the fact that $(\vec{a}.\vec{v}) = 0$, (4.4.4) can be written as

$$F_{gm} = \frac{GmM}{r^2} - \frac{mv^4}{c^2 r} \qquad (4.4.5)$$

This shows that the force is not central, but depends on the object velocity as well. This is the modified Newton's low of gravitating. It must be applied when we study the motion of all gravitating objects. For circular motion one has

$$\frac{mv^2}{r} = \frac{GmM}{r^2} - \frac{mv^4}{c^2 r} \qquad (4.4.6)$$

Which can be solved to find the velocity of the object in terms of its orbital distance. To this end, one has

$$v^2 = \frac{c^2}{2}\left(-1 + \sqrt{1 + \frac{4GM}{rc^2}}\right) \qquad (4.4.7)$$

Substituting (4.4.7) in (4.4.5) yields the generalized gravitational force on the mass, viz.

$$F_{gm} = -\frac{mc^2}{2}\left(\frac{1}{r} - \frac{1}{r} + \sqrt{1 + \frac{4GM}{rc^2}}\right) \qquad (4.4.8)$$

This is the generalized Newton's law of gravitation that should be used in studying any gravitational interaction of gravitating bodies. This force can be associated with a central potential energy U_{gm} of the form

$$\vec{F}_{gm} = -\vec{\nabla} U_{gm} \qquad (4.4.9)$$

Which suggests that (see the Appendix)

$$U_{gm} = -\frac{mc^2}{2}\left(\ln r + 2\sqrt{1 + \frac{4GM}{rc^2}} + \ln \frac{\sqrt{1 + \frac{4GM}{rc^2}} - 1}{\sqrt{1 + \frac{4GM}{rc^2}} + 1}\right) (4.4.10)$$

This is can effective potential describing the motion of the gravitating object. This support the assertion made by wild (1996) that a central gravitational field can equally well be described by a modified Newtonian theory as by general relativity theory. Such a modification will satisfy the critical tests of general relativity. The curvature of space is a consequence of the force field and the Newton's equation determines this field. Hence the two approaches are compliment to each other.

Employing (4.4.6) and (4.4.7) the gravitomgnetic force is given by

$$F_m = -\frac{mc^2}{2r}\left(1 + \frac{2GM}{rc^2} - \sqrt{1 + \frac{4GM}{rc^2}}\right) \qquad (4.4.11)$$

The gravitomagnetic force vanishes for first and second order terms in $\frac{1}{r}$. We remark here that this potential energy is not a correction to the Newtonian potential energy but reduces to it in some particular case. It is evident from (4.4.6) that the gravitomagentic force is opposite (repulsive force) to gravitational force. This equation is found to give the correct advance of perihelion of planets and binary pulsars (Arbab 2009a). the equation of the orbit of the gravitating object can be found by solving (4.4.8) with

$$m\ddot{r} - mr\dot{\varphi}^2 = F_{gm} \qquad (4.4.12)$$

In the polar coordinates(r, φ). Such an orbit should give rise to an advance of the perihelion. It was shown by that there is a possible relation between galactic flat rotational curves and the Pioneers anomalous acceleration (Minguzzi 2006). According to the generalized Newton's law, the gravitomagnetic acceleration for the planets in our solar system ranges from$10^{-9}ms^{-1}to10^{-15}ms^{-1}$.

It was shown in this work that the generalized Newton's law of gravitation is of same form as Lorentz force in electromagnetism. The existence of the gravitomagetic term accounts very well for the precession of planetary orbits and pulsars. The generalized law gives an acceptable interpretation of the flat rotation curve exhibited by galaxies. The new law, rules out the existence of dark matter to interpret the flat rotation curve. Therefore static gravity is not the sole force that governs the dynamics of gravitating objects. The existence of a very minute acceleration could be liked to the gravitomagnetic force of the planets.

4.5 The Generalized Newton's Law of Gravitation versus the General Theory of Relativity:

Arbab also agreed with Einstein by assuming the gravitational phenomena, now known to the effect curvature of space-time induced by the presence of a massive object [2]. The effective gravitational potential of the object of mass m moving around a massive object of mass N takes the form [6].

$$U(r) = -\frac{GMm}{r} + \frac{L^2}{2mr^2} - \frac{GML^2}{c^2mr^3} \qquad (4.5.1)$$

And the force

$$F = -\frac{\partial U}{\partial r}$$

Can be written as

$$F(r) = \frac{GMm}{r^2} + \frac{L^2}{mr^3} - \frac{3GML^2}{mc^2r^4} \qquad (4.5.2)$$

Where L is the orbital angular momentum of the mass m this inverse-cubic energy term in equation (4.5.1) causes elliptical orbits to process gradually by an angle $\delta\varphi$ per revolution [2].

$$\delta\varphi = \frac{6\pi GM}{c^2 a(1-e^2)} \qquad (4.5.3)$$

Where e and a are eccentricity and semi-major axis of the elliptical orbit, respectively. This is known as the anomalous precession of the planet Mercury.

Anther prediction famously used as evidence for GTR is the bending of light in a gravitational field. The deflection angle is given by [2].

$$\delta\theta = \frac{4GM}{c^2 b} \qquad (4.5.4)$$

Where b is the distance of closest approach of light ray to the massive object. Therefore the gravitomagnetic force is equal to $\frac{\pi}{3}$of the GTR force. Whether the gravitomanetic model or with GTR is a subject of the present and future observations. At any rate, we are lucky it have two complementary paradigms explaining the same effect in different ways. Can we deduce that space and not the sun mass or can we say that it is the curvature that produces the gravitomagnetism.

The Generalized Newton Law of Gravitation:

We have shown recently that Newton law of gravitation can be written, as a Lorentz-like law as [7].

$$F(r) = mE_g + mv \times B_g \, , E_g = a = \frac{v^2}{r} \qquad (4.5.5)$$

Where

$$B_g = \frac{v \times E_g}{c^2} \qquad (4.5..6)$$

Thomas introduced a force ½ to account for the spin-orbit interaction in hydrogen atom [8]. Here B_g is measured ins^{-1}. To convert it to rad/sce, we multiply it by2π. Hence the gravitomagnetic force becomes

$$F_m(r) = -\frac{\pi m v^4}{c^2 r} \quad a = \frac{v^2}{r} \quad v^2 = \frac{GM}{r} \qquad (4.5.7)$$

The gravitomagnetic field is divergence less, since

$$\nabla . B_g = \frac{1}{c^2} \nabla . (v \times E_g)$$

$$\nabla . B_g = \frac{1}{c^2} E_g . (\nabla \times v) - \frac{1}{c^2} v . \left(\nabla \times E_g\right)$$

$$\nabla . B_g = \frac{1}{c^2} v . \frac{\partial B_g}{\partial t} = -\frac{1}{c^2} \frac{\partial}{\partial t} \left(v . B_g\right) = 0$$

This implies that the gravitomagnetic lines curl around the moving mass (gravitational current) creating it. This may also rule out the existence of negative mss. Therefore, as no magnetic monopole exits, no gravitomagnetic monopole (antigravity) exits. Thus the search for magnetic monopole is tantamount to that of antigravity.

The angular momentum is defined by$L = mvr$, so that equation (4.5.7) becomes

$$F_m(r) = -\frac{\pi G M L^2}{m c^2 r^4} \qquad (4.5.8)$$

The second term in equation (4.5.2) is due to the centrifugal term arising from a central force field. In polar coordinates the force is written as

$$ma = \left(\ddot{r} - r\dot{\theta}^2\right)\hat{e}_r + m\left(r\ddot{\theta} + 2\dot{r}\dot{\theta}\right)\hat{e}_\theta \qquad (4.5.9)$$

For a central force the second term vanishes. It yields

$$\dot{\theta} = \frac{L}{mr^2}$$

So that the first term becomes

$$ma_r = m\ddot{r} = \frac{L^2}{mr^3} \qquad (4.5.10)$$

Substituting equation (4.5.10) in equation (4.5.5) yields the full effective central force. Owing to gravitomagnetism, as

$$F(r) = -\frac{GMm}{r} + \frac{L^2}{mr^2} - \frac{\pi GML^2}{mc^2r^4} \qquad (4.5.11)$$

The corresponding potential will be

$$U(r) = -\frac{GMm}{r} + \frac{L^2}{2mr^3} - \frac{\pi GML^2}{3mc^2r^4}$$

Comparison of equation (4.5.2) and (4.5.11) reveals that the graitomagnetic force is equal to $\frac{\pi}{3}$ of the curvature force. Consequently the generalized Newton law of gravitation and the general theory of relativity produce the same gravitational phenomena.

The gravitomagnetic force term, the last in equation (4.5.11), can be written as

$$\frac{\pi GML^2}{mc^2r^4} = \frac{G^2M^2m}{c^2r^3} \quad where \ \ c^2 = \frac{GM}{r} \qquad (4.5.12)$$

Finally equation (4.5.11) can be written as

$$F(r) = -\frac{GMm}{r} + \frac{J_{eff}^2}{mr^3} \qquad (4.5.13)$$

Where

$$J_{eff}^2 = L^2 - \left[\frac{\sqrt{\pi}GMm}{c}\right]^2 \qquad (4.5.14)$$

Precession of Planets and Binary Pulsars:

Owing to the above equivalence between gravitomagnetism and GTR, we interpret the precesion of the perihelion of planets and binary pulsars as a larmor-like precession, and not due to the GTR interpretation as due to the curvature of space-time. We may attribute this precession as due to the precession of gravitational moment (mass) in gravitomagnetic field induced by the massive objects (Sun). In electromagnetism, the Larmor precession is defined by [4].

$$\omega = \frac{e}{2m}B \qquad (4.5.15)$$

While in gravitation ($since\ B_g\ is\ in\ s^{-1}\ and\ e \Leftrightarrow m$) it is defined as [1].

$$\omega_g = 2\pi\left(\frac{B_g}{2}\right) = \frac{\pi v^3}{rc^2} \quad B_g = \frac{va}{c^2} = \frac{v^3}{rc^2} \qquad (4.5.16)$$

Where (ω_g in is rad/seec) and

$$a = \frac{v^2}{r} \qquad (4.5.17)$$

The precession rate in equation (4.5.16) can be written as

$$\omega_g = \pi\left(\frac{2\pi GM}{Tc^2 r}\right) = \frac{\delta\phi_g}{T} \qquad (4.5.18)$$

Where $T = \frac{2\pi r}{v}$ is the period of revolution. This corresponds to precession angle of

$$\delta\varphi_g = \frac{\pi\left(\frac{2\pi GM}{c^2 r}\right) rad}{s} \qquad (4.5.19)$$

That is equal to $\frac{\pi}{3}$ of the curvature effect, and for elliptical orbit $r = a(1 - e^2)$.

- **Deflection of $\alpha - Particles$ by the Nucleus:**

We would like here to interpret the deflection of light by the Sun gravity in an analogous way to the deflection of $\alpha - Particles$ by the nucleus, without resorting to the GTR calculation. The deflection angle of $\alpha - Particles$ by a nucleus is given by [5].

$$\Delta\theta_e = \frac{4keQ}{mbv^2} \qquad (4.5.20)$$

Where Q is the nucleus charge, the $\alpha - Particles$ speed k coulomb constant, and b the impact factor. The corresponding gravitational analog for the deflection of light will be, $v \to c \quad e \to m \quad Q \to M \quad K \to G$[9].

$$\Delta\theta_g = \frac{4GM}{bC^2} \qquad (4.5.21)$$

Without resorting to GTR calculation. Recall that according to equivalence Principles in gravity accelerate without reference to their mass (whether massive or mass less). Therefore it doesn't matter whether light has a mass or not. The relation in equation (4.5.21) is the same as the relation obtained by GTR as in equation(4.5.4) the minimum distance α particles can approach the nucleus is given by equation the kinetic energy and the coulomb potential energy that yields the relation

$$b_e = \frac{2kq_1q_2}{mv^2} \qquad (4.5.22)$$

In gravitational and for light scattered by the Sun gravity the above relation gives ($q_1 \rightarrow m \quad q_2 \rightarrow M \ and \ k \rightarrow G$)

$$b_e = \frac{2GM}{C^2} \qquad (4.5.23)$$

This is nothing but the Schwarzschild distance that no particle can exceed. Therefore the complete analogy between gravitation and electricity is thus realized. In this context, we have shown recently that the Larmor dipole radiation has a gravitational analogue [10]. Similarly the same analogy exists between hydrodynamics and electromagnetism [11].

- **The spin of Planets:**

The discovery of the spin of the electron by Goudsmit and Uhlenbeck in 1926 was crucial in understanding many physical phenomena that wouldn’t have been explained without [12]. This spin is theoretically formulated by Dirac confirming the experimental finding. However the spin of planets had been known since long time (1851) that was demonstrated by Foucault’s pendulum. In a recent paper we have introduced the gravitomagnetism produced by moving planets as the magnetic field produced by moving charge [1]. We then obtained the gravitational Ampere’s and Faraday’s law’s of gravitomagnetism. The gravitomagnetic moment of a planet due to its orbital motion is given by [1].

$$\mu_L = \frac{v^3 r^2}{2G} \qquad (4.5.24)$$

For circular orbit, equation (4.5.24) yields

$$\mu_L = \left(\frac{M}{2m}\right) L \qquad (4.5.25)$$

In a similar manner the gravitomagnetic moment due to spin will be twice the above value (analogous to electromagnetism).

$$\mu_s = g_s \left(\frac{M}{2m}\right) S \qquad (4.5.26)$$

Where g_s defines some gyro-gravitomagnetic ratio that is independent of the planet’s mass. If we assume the precession of planet’s is a spin-orbit interaction, then we can equate $-\mu_s B_g$(assuming the angle to be zero the potential term arising from the gravitomagnetic force in equation (4.5.11). this yields for circular orbit

$$S = \left(\frac{4\pi}{3g_s}\frac{m}{M}\right)L \qquad S = \left(\frac{4\pi}{3g_s}\frac{Gm^2}{v}\right) \qquad (4.5.27)$$

This is very interesting equation, since it determines the spin of planets from their orbital angular momentum. With the help of the above equation. The moment of inertia of planets can be precisely determined. It then follows that the spin and the geometrical form of planets is a consequence of its dynamics. Consequently the spin,

Table1. the predicated values for spin and moment of inertia owing to equation (4.5.27) with $g_s = 57$. Any deviation from known values that may appear could be attributed to the uncertainty in determining the radii of planets. Alternatively, the angle between $L\ and\ S$ will be of importance.1

Planet	Spin(J_s)	Moment of inertia ($kg.m^2$
Mercury	1.12E+32	8.98E+36
Venus	3.31E+33	1.10E+37
Earth	5.84E+33	8.02E+36
Mars	8.35E+31	1.17E+36
Jupiter	1.35E+39	7.69E+42
Saturn	1.64E+38	1.00E+42
Uranus	5.44E+36	5.43E+40
Neptune	9.45E+36	8.12E+40

angular momentum is no longer an intrinsic property of the planet. The energy corresponding to this interaction may be converted into internal energy (heat) inside the planet.

Owing to equation (4.5.27) we are entitled to say that any orbiting planet must spin. Thus any gravitating object in curvilinear motion must spin. For consistency of the spin of the Earth with the present value with take $g_s = 57$ from this law the moment of inertia of all gravitation objects can be precisely determined. Table1 shows the anticipated values for the spin and the corresponding moment of inertia of the planetary system. Equation (4.5.27) can be used to estimate the hidden central mass around which anther mass orbits. It can be generally useful in many astrophysical applications.

This work shows that the gravitomagnetism and the general theory of relativity are two theories of the same phenomenon. This entitles us to fully accept the analogy existing between electromagnetism and gravity are unified phenomena. The precession of the perihelion of planets and binary pulsars may be interpreted as a spin-orbit interaction of gravitating objects. The spin of a planet is directly proportional to its orbital angular momentum and mass weighted by the Sun's mass. Alternatively the spin is directly proportional to the square of the orbiting planets mass and inversely proportional to its velocity.

4.6 Energy Conservation in Special and generalized special Relativity:

According to the laws of mechanics, the force can be defined using potential energy V and Kinetic energy$T$, one dimension as:

$$F = -\frac{\partial V}{\partial x} = -\frac{dV}{dx} = \frac{dmv}{dt} \qquad (4.6.1)$$

$$T = \int \frac{dmv}{dt} dx = \int F.dx = -\int \frac{dV}{dx} dx$$

$$\int \frac{dmv}{dt} dx + c_3 = -\int \frac{dV}{dx} dx + c_4 = -V + c_4 \quad (4.6.2)$$

$$T + c_3 = \int dmv \frac{dx}{dt} + c_3 = -V + c_4 \qquad (4.6.3)$$

$$T + V = c_4 - c_3 = c_5$$

$$\int v \, dmv = -V + c_5$$

$$\int d(mv^2) - \int mvdv = -V + c_5 \qquad (4.6.4)$$

Since:

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \qquad (4.6.5)$$

And by defining

$$\cos\theta = {}^{v}/_{c} \qquad d\sin\theta = \cos\theta \, d\theta$$

Equation (4.6.4) reads

$$mv^2 + m_o c \int \frac{[\cos\theta][c\sin\theta \, d\theta]}{\sin\theta} = -V + c_5$$

$$mv^2 + m_o c^2 \int d \sin\theta = -V + c_5$$

$$mv^2 + m_o c^2 \sin\theta = -V + c_5 \qquad (4.6.6)$$

Utilizing equation (4.6.5) again

$$\sin\theta = (1 - \cos^2\theta)^{1/2} = (1 - v^2/c^2)^{1/2} \qquad (4.6.7)$$

Therefore

$$mv^2 + m_o c^2 (1 - v^2/c^2)^{1/2} = -V + c_5$$

$$mv^2 + \frac{m_o c^2 (1 - v^2/c^2)}{\sqrt{(1 - v^2/c^2)}} = -V + c_5$$

$$mv^2 + mc^2 - mv^2 = -V + c_5$$

$$mc^2 + V = c_5 \qquad (4.6.8)$$

Thus in view of equation (4.6.3)

$$T + V = c_5 \qquad (4.2.9)$$

Thus the kinetic energy with in the frame work of SR is given by:

$$T = mc^2 \qquad (4.6.10)$$

$$\csc\theta = \frac{v^2}{{C_2}^2} \qquad (4.6.11)$$

Equation (4.6.4) reads:

$$mv^2 + \frac{m_0 {C_2}^2}{\sqrt{C_1}} \int d \sin\theta = -V + C_s$$

$$mv^2 + \frac{m_0 {C_2}^2}{\sqrt{C_1}} \sin\theta = -V + C_s$$

$$mv^2 + \frac{m_0 {C_2}^2}{\sqrt{C_1}} \sqrt{1 - \cos^2\theta} = -V + C_s$$

$$mv^2 + \frac{m_0 {C_2}^2}{\sqrt{C_1}} \sqrt{1 - \frac{v^2}{C_1 c^2}} = -V + C_s$$

$$mv^2 + \frac{m_0 {C_2}^2}{\sqrt{C_1}} \sqrt{C_1 - \frac{v^2}{c^2}} = -V + C_s$$

$$mv^2 + m_0 {C_2}^2 \sqrt{1 + \frac{2\emptyset}{c^2} - \frac{v^2}{c^2}} = -V + C_s$$

$$mv^2 + mc^2 \left(1 + \frac{2\emptyset}{c^2} - \frac{v^2}{c^2}\right) = -V + C_s$$

$$mv^2 + mc^2 + 2m\emptyset - mv^2 = -V + c_5$$

$$mc^2 + 2m\emptyset + V = c_5 \qquad (4.6.12)$$

According to equation (4.6.11)

$$T + V = c_5 \qquad (4.6.13)$$

By defining V to be

$$V = -m\emptyset \qquad (4.3.14)$$

$$mc^2 - V = c_5 \qquad (4.6.15)$$

This equation is inconsistent with equation (4.6.13) even if one define the kinetic energy to be

$$T = mc^2 \qquad (4.6.16)$$

However one can redefine the relation between the force and kinetic energy to be

$$F = \frac{d\left(\frac{1}{2}mv^2\right)}{dx} = \frac{dT}{dx} \qquad (4.6.17)$$

For particles having constant mass:

$$F = \frac{1}{2}m\frac{dv^2}{dx} = mv\frac{dv}{dx} = mv\frac{dv}{dt}\frac{dt}{dx} = m\frac{v}{v}\frac{dv}{dt} = m\frac{dv}{dt} \qquad (4.6.18)$$

Hence the definition of kinetic energy in terms of the force is consistent with the formal definition of force for particles having constant mass.

Thus according to this definition (4.6.17) together with definition (4.6.1):

$$F = \frac{d(T)}{dx} = -\frac{dV}{dx} \qquad (4.6.19)$$

There force:

$$\frac{d(T+V)}{dx} = 0$$

Let:

$$E = T + V = \frac{1}{2}mv^2 + V \qquad (4.6.20)$$

$$\frac{dE}{dx} = 0 \qquad (4.6.21)$$

$$E = T + V = \ constant \qquad (4.6.22)$$

However for T based on relation (4.6.10) and (4.6.17) requires:

$$F = -\frac{d\left(\frac{1}{2}mv^2 - \frac{1}{2}mc^2\right)}{dx} = \frac{dT}{dx} = -\frac{dV}{dx} = -\frac{\mathrm{d}V}{\mathrm{d}x}$$
$$= -\frac{\mathrm{d}m\emptyset}{\mathrm{d}x} \quad (4.6.23)$$

Since:

$$c > v$$

Thus for positive , One can define:

$$T = \frac{1}{2}mc^2 - \frac{1}{2}mv^2 \qquad (4.6.24)$$

Where

$$T > 0 \quad as\,far\,as \quad c > v$$

Thus:

$$\frac{d\left(m\emptyset + \frac{1}{2}mc^2 - \frac{1}{2}mv^2\right)}{dx} = 0$$

This requires:

$$T + V = m\emptyset + \frac{1}{2}mc^2 - \frac{1}{2}mv^2 = C_0 = constant \qquad (4.6.25)$$

$$\frac{\frac{c^2}{2}m_0\left(\frac{2\emptyset}{c^2} + 1 - \frac{v^2}{c^2}\right)}{\sqrt{1 + \frac{2\emptyset}{c^2} - \frac{v^2}{c^2}}} = C_0$$

$$\frac{c^2}{2}m_0\left(1 + \frac{2\emptyset}{c^2} - \frac{v^2}{c^2}\right)^{\frac{1}{2}} = C_0$$

$$\frac{c^2}{2} m_0 \left(1 + \frac{2\emptyset}{c^2} - \frac{v^2}{c^2}\right)^{\frac{1}{2}} = C_0$$

$$\frac{m_0^{\frac{1}{2}}}{\sqrt{2}} \left(\frac{1}{2} m_0 c^2 + m_0 \emptyset - \frac{1}{2} m_0 v^2\right) \qquad (4.6.26)$$

Squiring both sides:

$$\frac{1}{2} m_0 c^2 + m_0 \emptyset - \frac{1}{2} m_0 v^2 = \frac{2{C_0}^2}{m_0 c^2}$$

$$\frac{1}{2} m_0 c^2 - \frac{1}{2} m_0 v^2 + m_0 \emptyset = \frac{2{C_0}^2}{m_0 c^2} = constant \qquad (4.6.27)$$

To make this consistent with the fact that rest mass energy should exit in any relativistic expression, one can suppose that:

$$\frac{2{C_0}^2}{m_0 c^2} = C_1 \qquad (4.6.28)$$

To get:

$$\frac{1}{2} m_0 c^2 - \frac{1}{2} m_0 v^2 + m_0 \emptyset = C_1 \qquad (4.6.29\ )$$

Thus according to relation (4.6.23):

$$T_0 + V_0 = C_1 \qquad (4.6.30)$$

With the aid of equations (4.6.24), (4.6.25) and (4.630) requires:

$$T + V = C_0 = C_1 = \frac{2{C_0}^2}{m_0 c^2} = T_0 + V_0 \qquad (4.6.31)$$

Thus the energy conservation requires:

$$2C_0 = m_0 c^2 C_0 = \frac{1}{2} m_0 c^2 \qquad (4.6.32)$$

$$T = \int \frac{d(mv)}{dt} dx = \int dmv \frac{dx}{dt} = \int vdmv = \int Fdx$$

$$= \int d(mv^2) - \int mvdv = mv^2 - \int \frac{1}{2} mdv^2 \tag{4.6.33}$$

$$- \int Fdx = V = \int dV = \int md\emptyset \tag{4.6.34}$$

$$\int Fdx = -\int md\emptyset = mv^2 - \frac{1}{2}\int mdv^2 = C_0$$

$$T + V = C_0 = \text{constant} \tag{4.6.35}$$

$$mv^2 + \int md\left[\emptyset - \frac{v^2}{2}\right] = C_0$$

$$mv^2 - \frac{c^2}{2}\int md\left[\frac{v^2}{c^2} - \frac{2\emptyset}{c^2}\right] = C_0$$

Defining:

$$\cos^2\theta = z^2 = \frac{v^2}{c^2} - \frac{2\emptyset}{c^2} \tag{4.6.36}$$

One gets:

$$m = \frac{m_0}{\sqrt{1 - \cos^2\theta}} = \frac{m_0}{\sin\theta} \tag{4.6.37}$$

$$mv^2 - \frac{c^2}{2}\int \frac{m_0 dz^2}{\sin\theta} = mv^2 - \frac{c^2 m_0}{2}\int \frac{2zdz}{\sin\theta} = C_0$$

$$mv^2 + m_0c^2 \int \frac{\cos\theta \sin\theta \, d\theta}{\sin\theta} = C_0$$

$$mv^2 + m_0c^2 \sin\theta = C_0$$

$$mv^2 + m_0c^2\sqrt{1 - \cos^2\theta} = C_0$$

$$mv^2 + m_0c^2\sqrt{1-z^2} = C_0$$

$$mv^2 + \frac{m_0c^2(1-z^2)}{\sqrt{1-z^2}} = C_0$$

$$mv^2 + mc^2\left(1 + \frac{2\emptyset}{c^2} - \frac{v^2}{c^2}\right) = C_0$$

$$mv^2 + mc^2 + 2\mathrm{m}\emptyset - \mathrm{m}v^2 = C_0$$

$$mc^2 + 2\mathrm{m}\emptyset = C_0 \qquad (4.6.38)$$

Thus the energy conservation requires:

$$E = T + V = mc^2 + 2\mathrm{m}\emptyset \qquad (4.6.39)$$

In the classical limit, when:

$v \ll V$

$$E = m_0\left(1 + \frac{2\emptyset}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{1}{2}} c^2 + 2m_0\emptyset\left(1 - \frac{2\emptyset}{c^2} - \frac{v^2}{c^2}\right)^{-\frac{1}{2}}$$

$$= m_0\left(1 - \frac{\emptyset}{c^2} + \frac{1}{2}\frac{v^2}{c^2}\right)c^2 + 2m_0\emptyset\left(1 - \frac{\emptyset}{c^2} + \frac{1}{2}\frac{v^2}{c^2}\right)$$

$$E = m_0c^2 - m_0\emptyset + \frac{1}{2}m_0v^2 + 2m_0\emptyset$$

$$= m_0c^2 + \frac{1}{2}m_0v^2 + m_0\emptyset$$

$$E = m_0c^2 + T + V \qquad (4.6.40)$$

Which is the conventional ordinary Newton energy relation with additional term standing for rest mass energy

- **Discussion:**

Many relativistic expressions for energy that satisfies energy conservation were discussed. In the first one the ordinary SR expression for mass in equation (4.6.4), beside the ordinary definition of force in equation (4.6.1) were used to find expression E- the kinetic energy T be equal to mc^2. T is not like Newtonian one, but for small v

$$T = m_0c^2 + \frac{1}{2}m_0v^2$$

Thus it resembles Newtonian one with additional rest mass energy term. The SR energy reduces to Newtonian one in equation (4.6.12) and is conserved. It is more is more advance than SR one since it is conserved and consists of potential term .Another E is based on GSR beside expression for (m) in equation (4.6.15).

The energy is conserved according to equation (4.6.15) but V becomes with a minus sign.

Anew definition of force in equation (4.6.17) with ordinary expression for T is also used to define conservative E. the potential is related to F in a conventional way. Conservation was satisfied in equation (4.6.23) but T is defined in different way, i.e.

$$T = \frac{1}{2}mc^2 - \frac{1}{2}\ mv^2$$

$$T > 0 \qquad since \qquad c > v$$

4.7 Summary and Critique:

In the presented attempts and in most of the work done in explaining the energy conservation and planets motion [ ], the work dose not connect Newtonian Mechanics with GSR.

Most of the work try to explain the relation of GSR energy and force with potential or kinetic energy.

Some anthers proposes gravitomgnetic field. But non of them tries to study GSR conservation and centrifugal velocity conflict.

Chapter Five

Maxwell Equation

Gravitation Force and Generalized Special Relativity

5.1 Introduction:

These chapter elso with gravitational theory analogous to Maxwell equations. It also deals with gravity centrifugal force and conservation Laws, beside definition of force.

Gauss's theorem which applies to an inverse square field, which is that, the surface integral of the field over a closed volume in equal to $-4\pi G$time the in closed mass.

5.2 plane of mass:

In addition to spherical and cylindrical symmetry this technique may also be applied to plaice technique symmetry. Imagine that you have an infinite plane of mass having area densityσ.

Gauss's law to this situation

$$\oint_s g\,.ndA = -4\pi G_m \qquad (5.2.1)$$

g Is a it parallel to n so $g.n = -g$

Thus

$$-g\oint_s dA = 4\pi G_m$$

The integral in this case is just the area of two end of the slender $2A$this given

$$-g(2A) = -4\pi G_m(\sigma A) \qquad (5.2.2)$$

Cancelling $-2A$ on both sides we get

$$g = 2\pi G\sigma \qquad (5.2.3)$$

5.3 Gauss's Law for Electrostatics:

Techniques describe electricity and magnetism classical electricity by four equations called Maxwell's equation one of these is Gauss's Law describes the electric field E produced by an electric charge$q$.

$$\oint_s E\,.ndA = \frac{q}{\varepsilon_0} \qquad (5.3.1)$$

ε_0 The constant is called permittivity of free space and has a value of $8.85418 \times 10^{-12} F/m$

$$F_g = mE_g = \frac{GM_m}{r^2} \qquad (5.3.2)$$

Thus

$$E_g = \frac{F_g}{m} = \frac{GM}{r^2} \qquad (5.3.3)$$

$$D_g = \epsilon_g\, E_g$$

$$\int D_g\, dA = M \; Gauss's Law$$

The integrals is

$\epsilon_g \int E_g dA = \int \rho dv$ (5.3.4)

Thus

$$\epsilon_g \int_0^{\theta=\pi} \int_0^{\theta=2\pi} \frac{GM}{r^2}(rd\theta)(rsin\theta d\phi) = M \qquad (5.3.5)$$

It follows that equation (5.3.5)

$$\epsilon_g GM \int_0^{\pi} sin\theta d\theta \int_0^{2\pi} d\phi = M$$

Thus

$$\epsilon_g G[-cos\theta]_0^{\pi} \; [\phi]_0^{2\pi} = 1$$

$$\epsilon_g G[-cos180 + cos0][2\pi - 0] = 1$$

$$\epsilon_g GM[2][2\pi] = 1$$

$$4\pi\epsilon_g G = 1$$

$$\epsilon_g = \frac{1}{4\pi G} \qquad (5.3.6)$$

One can deduce Poisson equation from the definition of potential per unit mass ϕ to be

$$E_g = -\nabla\phi_g \qquad (5.3.7)$$

But

$$\int D_g dA = M \qquad (5.3.8)$$

$$\epsilon_g \int E_g dA = \int \rho dv \qquad (5.3.9)$$

But from algebra

$$\int D_g dA = \int \nabla . D_g dv \qquad (5.3.10)$$

From (5.3.9) and (5.3.10)

$$\int \nabla . D_g dv = \int \rho dv$$

Thus

$$\nabla . D_g = \rho \qquad (5.3.11)$$

From (5.3.11) and (5.3.7)

$$\epsilon_g \nabla . E_g = \rho$$

$$\epsilon_g (\nabla . \nabla \phi_g) = \rho$$

$$\nabla^2 \phi = \frac{\rho}{\epsilon_g}$$

$$\nabla^2 \phi = \frac{1}{\epsilon_g} \rho$$

Thus

$$\nabla^2 \phi = 4\pi G \rho$$

In spherical coordinate for

$$\phi = \phi(r)$$

Poisson equation becomes

$$\frac{1}{r^2} \frac{\partial^2}{\partial r^2} (r^2 \phi) = \rho$$

Out side the source

$$\rho = 0$$

$$\frac{\partial^2}{\partial r^2}(r^2\phi) = 0$$

$$\frac{d}{dr}(r^2\phi) = 0$$

$$\int d\,(r^2\phi) = c\int dr$$

$$r^2\phi = c_1 r + c_2$$

$$\phi = \frac{c_1}{r} + \frac{c_2}{r_2}$$

5.4 Newton's Law of Gravitation:

Newton noted that the ratio of centripetal acceleration of the moon is its orbit around the Earth to acceleration of an apple falling to the surface of the Earth was inversely as the squares of the distances of moon and apple from the centre of the Earth.

Other particle with a force that is proportional to the product of their masses in symbols.

$$\underline{F} = \frac{G_1 G_2}{r^2} \qquad (5.4.1)$$

This equation means that the field at distance r from a point mass $M$is

$$g = \frac{GM}{r^2}\ Nkg^{-1} or\ ms^{-1}$$

Or

$$g = \frac{GM}{r^2} r^n\ Nkg^{-1} or\ ms^{-2}$$

r^n is a dimensionless unit vector also

$$E_g = \frac{F_g}{m} = \frac{Gm}{r^2} \qquad (5.4.2)$$

5.5 The Quantum Cosmological Gravitation Equation:

The description of quantum needs to find the Hamiltonian of the gravitational field according to $GGFE$ the Hamiltonian is given by

$$H = -T_0^0$$

$$H = \alpha^2 R^2 + 2\alpha g^{00} R_0 = \alpha^2 R^2 - 6\alpha \frac{\dot{a}^{-2}}{a} \qquad (5.5.1)$$

Where α is constant, a is cosmological factor.

The angular momentum radial component is given by:

$$P_r = -T_r^r = \alpha^2 R^2 + 2\alpha g^{rr} R,r$$

In view of $Roberton - Walker$ metric in equation (5.5.1) one gets:

$$P_r = T_r^r = +\alpha^2 R^2 - 2\alpha \left[\frac{\ddot{a}}{a} + 2\frac{\dot{a}^2}{a^2} + 2\frac{k}{a^2}\right] \qquad (5.5.2)$$

Thus the radial part is given by:

$$P_r = +\alpha^2 R^2 - 2\alpha \left[\frac{\ddot{a}}{a} + 2\frac{\dot{a}^2}{a^2} + 2\frac{k}{a^2}\right]$$

5.6 Velocity Tran's formation of two Attracted Body Mooing In a Gravity orbit:-

Consider an observer on the earth of mass m observing the sun moving with speed v in a circular orbit of radius r. The sun in his frame is stable due to the balance between centrifugal force on the and gravity farce on the sun

$$F_c = F_g$$

$$\frac{Mv^2}{r} = \frac{GmM}{r^2} \qquad (5.6.1)$$

Thus the sun velocity for him is given by

$$v = \left(\frac{Gm}{r}\right)^{1/2} \qquad (5.6.2)$$

If on other hand we have an observer on the sun, he sees that the earth is stable due to the fact that centrifugal force counters balance the gravity force, i.e.

$$F_c = F_g$$

$$\frac{Mv^2}{r} = \frac{GmM}{r^2} \qquad (5.6.3)$$

$$v = \sqrt{\frac{Gm}{r}} \qquad (5.6.4)$$

According to the relativity principle the velocities in equations (5.6.2) and (5.6.4) showldbe equal but really this does not happen since.

$$m \neq M \qquad (5.6.5)$$

Motivated by special relativity consider the transformation of the form [see equation (5.6.1) and (5.6.2)]

$$\frac{Mv^2}{r} = \gamma \frac{GmM}{r^2} \qquad (5.6.6)$$

$$\frac{mv^2}{r} = \frac{GmM}{r^2} \qquad (5.6.7)$$

From (5.6.6) and (5.6.7) by dividing the former by M and the later by m one gets

$$\frac{v^2}{r} = \frac{\gamma Gm}{r^2} = \frac{\gamma GM}{r^2} \qquad (5.6.8)$$

This Trans forma tine is misleading since $\gamma$is can cell act.

According to general relativity (GR) the hole universe is permeated by comic field Now try existence of comic (vacuum) field of potential V_c and force F_c that is altercative. (In the direction of gravity make particles closer). In this case the equation of motion for both observers reads.

$$\frac{mv^2}{r} = \frac{GmM}{r^2} + F_c \qquad (5.6.9)$$

$$\frac{Mv^2}{r} = \frac{GmM}{r^2} + F_c \qquad (5.6.10)$$

Multiply both sides by to get

$$mv^2 = \frac{GmM}{r} + F_c r \qquad (5.6.11)$$

Since the cosmic potential isV_c, there fore multiplying (5.6.10) and (5.6.11) by r gives

$$mv^2 = \frac{GmM}{r} + V_c \qquad (5.6.12)$$

$$Mv^2 = \frac{GmM}{r} + V_c \qquad (5.6.13)$$

$$mv^2 = \gamma\left(\frac{GmM}{r} + V_c\right) \qquad (5.6.14)$$

$$Mv^2 = \gamma\left(\frac{GmM}{r} + V_c\right) \qquad (5.6.15)$$

$$v^2 = \gamma\left(\frac{GM}{r} + \frac{V_c}{m}\right) = \gamma\left(\frac{GM}{r} + \frac{V_c}{M}\right) \qquad (5.6.16)$$

$$\frac{mv^2}{r} + F_c = \frac{GmM}{r^2} \qquad (5.6.17)$$

$$\frac{Mv^2}{r} + F_c = \frac{GmM}{r^2} \qquad (5.6.18)$$

For repulsive cosmic field particles tend to increase distance between them with time. Thus F_c is in the direction of F_L

$$mv^2 + V_c = \frac{GmM}{r^2} \qquad (5.6.19)$$

$$Mv^2 + V_c = \frac{GmM}{r^2} \qquad (5.6.20)$$

$$mv^2 + V_c = \frac{\gamma GmM}{r^2} \qquad (5.6.21)$$

$$Mv^2 + V_c = \frac{\gamma GmM}{r^2} \qquad (5.6.22)$$

$$v^2 + \frac{V_c}{m} = \gamma\frac{GM}{r} \qquad (5.6.23)$$

$$v^2 + \frac{V_c}{M} = \gamma\frac{Gm}{r} \qquad (5.6.24)$$

$$v^2 = \gamma\frac{GM}{r} - \frac{V_c}{m} = \gamma\frac{Gm}{r} - \frac{V_c}{M}$$

$$\frac{\gamma G}{r}(M-m) = V_c\left(\frac{1}{m}-\frac{1}{M}\right) = \frac{V_c(m-M)}{mM}$$

$$\gamma = \frac{rV_c}{mMG} \qquad (5.6.25)$$

Cassimere experiments indicate the existence of vacuum.

One can also consider the existence of vacuum energy having potential V_v such that equations (5.6.19) and (5.6.20) read

$$mv^2 + V_v = \frac{GmM}{r} \qquad (5.6.26)$$

$$Mv^2 + V_v = \frac{GmM}{r} \qquad (5.6.27)$$

Using the same procedures as in equations (5.6.21), (5.6.22) and (5.6.25) to get

$$mv^2 + V_v = \frac{\gamma GmM}{r} \qquad (5.6.28)$$

$$Mv^2 + V_v = \frac{\gamma GmM}{r} \qquad (5.6.29)$$

To get

$$\gamma = \frac{rV_v}{mMG} \qquad (5.6.30)$$

However in the real world both cosmic field and vacuum exists. The cosmic field causes the universe to expand [ ]

Thus it is repulsive, which con forms with equations (5.6.19) and (5.6.20). Also vacuum causes inflation in the early universe [ ] thus it is a repulsive force. There fore equations (5.6.19) and (5.6.20) becomes

$$mv^2 + V_c + V_v = \frac{\gamma GmM}{r} \qquad (5.6.31)$$

$$Mv^2 + V_c + V_v = \frac{\gamma GmM}{r} \qquad (5.6.32)$$

To get [see equation (5.6.25)]

$$\gamma = \frac{r(V_v + V_c)}{mMG} \qquad (5.6.33)$$

5.7 Energy conservation forGSR:

The principle of relativity suggested that the relative velocity between the sun and earth should be the same for an observer at the sun and at the earth. But ordinary Newton second Law Lead to two un equal values for v as shown by equations (5.6.2) and (5.6.4).

This forces to construct new transformation similar to that of Lorentz.

But instead of transformation coordinates, the transformation is made at the energy scale. By suggesting the existence of only centrifugal and gravity force the transformation in equation (5.6.6) and (5.6.7) fails since it leads to cancelation of the transformation coefficientγ.

If one assumes attractive cosmic field or vacuum energy as shown in equation (5.6.9) and (5.6.10), the coefficientγ is cancelled again as equation (5.6.16) reads.

However if the cosmic field and vacuum field are repulsive as shown by equation (5.6.17), (5.6.18), (5.6.26) and (5.6.27) respectively, the transformation coefficient γ given a useful expressions in equations (5.6.25), (5.6.30)and (5.6.33) for cosmic field, vacuum field together respectively. These expressions show the dependence of γ on the cosmic and vacuum field as well as on the masses of the two objects beside the distance between them.

The fact that the assumption of repulsive cosmic and vacuum field conforms with the fact that cosmic field causes universe expansion, where as it causes inflation in the early universe. Thus they have both repulsive natures. The cosmic field is suitable for astronomical objects while the vacuum field is suitable for atomic world as well as the universe.

To see how energy is conserved consider the generalized special relativistic (GSR) energy equation

$$E = \frac{m_0 c^2}{\sqrt{1 - 2\varphi - \frac{v^2}{c^2}}} \qquad (5.7.1)$$

Rearranging and multiplying by m

$$E = \frac{m_0 c^2}{\sqrt{\frac{mc^2 - 2\left(m\varphi + \frac{1}{2}mv^2\right)}{mc^2}}} \qquad (5.7.2)$$

$$E = \frac{m_0 c^2}{\sqrt{\frac{mc^2 - 2(V + T)}{E}}} \qquad (5.7.3)$$

Multiply both sides by the square root and squarely yields

$$E^2\left(\frac{E-2(T+V)}{E}\right)=m_0c^2 \qquad (5.7.4)$$

$$E^2-2(T+V)E=m_0^2c^4 \qquad (5.7.5)$$

If the sum of kinetic and potential energy is constant, i.e.

$$T+V=C_0=constant$$

In this case equation (5.7.5) becomes

$$E^2-c_0E=m_0^2c^4 \qquad (5.7.6)$$

Using the relation

$$ax^2+bx+C_0=0 \qquad (5.7.7)$$

$$a=1 \qquad b=-c_0 \qquad c=-m_0^2c^4$$

$$E=-\frac{b\pm\sqrt{b^2-4ac}}{2a}$$

$$E=+\frac{c_0\pm\sqrt{b^2-4ac}}{2} \qquad (5.7.8)$$

Thus E is constant when the sum of T and V is constant

If on contrary E is contestant, i.e.

$$E=E_0=constant \qquad (5.7.9)$$

Thus from (5.7.5)

$$E_0^2-2(T+V)E_0=m_0^2c^4$$

$$T+V=\frac{E_0^2-m_0^2c^4}{2E_0}=c_0=constant \qquad (5.7.10)$$

Thus when E is constant the sum of T and V is constant.

Thus when Newtonian energy

$$E_N = T + V \qquad (5.7.11)$$

Is conserved GSR energy is also conserve.

5.8 Definition of Force In Terms of Potential:

A Newton energy equation is takes the form

$$E = \frac{P^2}{2m} + V = constant \qquad (5.8.1)$$

Where the total energy is constant differencing the equation (5.8.1) w.r.t time given

$$\frac{dE}{dt} = \frac{2p}{2m}\ \frac{dp}{dt} + \frac{dV}{dt} = 0 \qquad (5.8.2)$$

Where the momentum is given by

$$P = mv \qquad (5.8.3)$$

Using relation (5.8.3) and substituting in equation (5.8. 2)

$$v\frac{dp}{dt} = -\frac{dV}{dt} \qquad (5.8.4)$$

And the force is

$$F = \frac{dp}{dt} \qquad (5.8.5)$$

Using relation in (5.8.4)

$$F = -\frac{1}{v}\frac{dV}{dt} = -\frac{dt}{dx}\frac{dV}{dt} \qquad (5.8.6)$$

Thus equation (5.8.6) becomes

$$F = -\frac{dV}{dx} \qquad (5.8.7)$$

This is the formal definition of F in terms of V for special relativity one has:

$$E^2 = C^2 P^2 + m_0^2 C^4 \qquad (5.8.8)$$

By differenting equation (5.8.8) w. r. t time gives

$$2E \frac{dE}{dt} = 2 C^2 P \frac{dP}{dt} + 0 \qquad (5.8.9)$$

The force is defined as

$$\mathrm{F} = \frac{dP}{dt} \qquad (5.8.10)$$

Substituting in (5.8.9) and dividing by $(2c^2p)$ yields

$$\frac{2E}{2C^2P} \frac{dE}{dt} = \mathrm{F} \qquad (5.8.11)$$

Thus

$$\frac{E}{C^2P} \frac{dE}{dt} = F \qquad (5.8.12)$$

But

$$P = mv \qquad E = mC^2 \qquad (5.8.13)$$

Substituting in (5.8.12) gives

$$\frac{mC^2}{C^2(mv)} \frac{dE}{dt} = \frac{1}{v} \frac{dE}{dt}$$

$$\frac{dt}{dx} \frac{dE}{dt} = \frac{dE}{dx} = F \qquad (5.8.14)$$

Which relates force to energy but according to GSR the energy satisfies

$$E = \frac{m_0 C^2}{\sqrt{g_{00} - \frac{v^2}{c^2}}} \qquad (5.8.15)$$

$$E^2 = \frac{m_0^2 c^4 E^2}{g_{00} E^2 - C^2 P^2} \qquad (5.8.16)$$

Divides by E^2

$$1 = \frac{m_0^2 c^4}{g_{00} E^2 - C^2 P^2} \qquad (5.8.17)$$

$$g_{00} E^2 - C^2 P^2 = m_0^2 c^4 \qquad (5.8.18)$$

Thus

$$g_{00} E^2 = C^2 P^2 + m_0^2 c^4 \qquad (5.8.19)$$

Differentiating $w.r.t\ t$ given

$$E^2 \frac{d g_{00}}{dt} + g_{00} 2E \frac{dE}{dt} = 2 c^2 P \frac{dp}{dt} \qquad (5.8.20)$$

Rearranging and using the formal definition of force

$$\frac{dP}{dt} = F \qquad (5.8.21)$$

Rearranging again by dividing by$2C^2P$, yields

$$\frac{E^2}{2 C^2 P} \frac{d g_{00}}{dt} + \frac{2E g_{00}}{2 c^2 P} \frac{dE}{dt} = F \qquad (5.8.22)$$

From energy equation $E = mc^2$ substituting in (5.8.22) gives

$$\frac{m^2 c^4}{2 c^2 m v} \frac{d g_{00}}{dt} + \frac{2 mc^2}{2 c^2 m v} g_{00} \frac{dE}{dt} = F$$

Thus

$$\frac{mc^2 dt}{2\,dx} \quad \frac{dg_{00}}{dt} + \frac{dt}{dx} \; g_{00} \frac{dE}{dt} = F \qquad (5.8.23)$$

Thus

$$F = \frac{dP}{dt} = \frac{E}{2} \quad \frac{dg_{00}}{dx} + \quad g_{00} \frac{dE}{dx} \qquad (5.8.24)$$

$$g_{00} = 1 + \frac{2\emptyset}{c^2} \qquad (5.8.25)$$

Divides by m

$$g_{00} = 1 + \frac{2m\emptyset}{mc^2} = \left(1 + \frac{2V}{E}\right) \qquad (5.8.26)$$

Substituting

$$g_{00} = \left(1 + \frac{2V}{E}\right) \qquad (5.8.27)$$

Inserting (5.8.27) in (5.8.24) yields

$$F = \frac{dP}{dt} = \frac{E}{2} \quad \frac{2d(VE^{-1})}{dx} + \quad \left(1 + \frac{2V}{E}\right)\frac{dE}{dx}$$

Thus

$$F = \frac{E}{2}(2)\,(E)^{-1}\,\frac{dV}{dx} - VEE^{-2}\,\frac{dE}{dx} + \frac{dE}{dx} + \frac{2V}{E}\,\frac{dE}{dx} \qquad (5.8.28)$$

Cancelling similar terms in equation (5.8.28) yields

$$F = \frac{dV}{dx} - \frac{V}{E}\,\frac{dE}{dx} + \frac{dE}{dx} + \frac{2V}{E}\,\frac{dE}{dx} \qquad (5.8.29)$$

Thus

$$F = \frac{dV}{dx} + \frac{V}{E}\,\frac{dE}{dx} + \frac{dE}{dx} \qquad (5.8.30)$$

When E is conserved

$$\frac{dE}{dx} = 0 \qquad (5.8.31)$$

When the potential is positive, i.e. repulsive

$$V \to - V \qquad (5.8.32)$$

This is since g_{00} is derived by assuming negative attractive potential. Thus using (5.8.31) and (5.8.33) in equation (5.8.30) yields

$$F = \frac{\partial V}{\partial x} \qquad (5.8.33)$$

This is the ordinary definition of energy.

5.9 Discussion:-

Section (5) shows very interesting results. It shows that the conservation of GSR energy takes place when Newtonian one is conserved as shown by equation (5.7.7) and (5.7.12). If GSR is assumed to be conserved as equation (5.6.10) reads this Leads to Newtonian energy conservation as equation (5.6.12) shows.

The conservation of Newton and GSR energy indicates that the definition of force in terms of momentum time change Leads to the formal definition of force in terms of spatial change of potential. The Newtonian energy conservation in equation (5.10.1) beside force definition in terms of P in equation (5.10.5) Leads to definition F in terms of V as equation (5.10.7) indicates.

For SR the definition of F in terms P in (5.8.18) Leads to definition of F in terms of$E$, with E replacing $(-V)$ as equation (5.8.30) shows.

However for GSR the definition of F in terms of P in (5.10.21), with the constraint of energy conservation in (5.10.31) Leads to the formal definition of F in terms of V as equation (5.10.33).

5.10 Conclusion:-

The principle of relativity and second Newton Low can be made not in conflict with each other by assuming new transformation which repulsive existence of repulsive cosmic and vacuum field.

In also explains gravitational redshirt and gravity time diction [6, 7]. These successes need searching for energy conservation requires mentis which is done in section (2). It also requires redefinition of force which is done in section (3). Sections (4) and (5) are concerned with discussion and conclusions. The conservation of Newtonian energy and GSR one are equivalent. This conservation explains when the formal of momentum time change and in terms of potential spatial change coincide.

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