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GRAND UNIFIED FIELD THEORY-A PREDATOR PREY APPROACH: CORROBORATION- DISSIPATION MODELS:PART ONE

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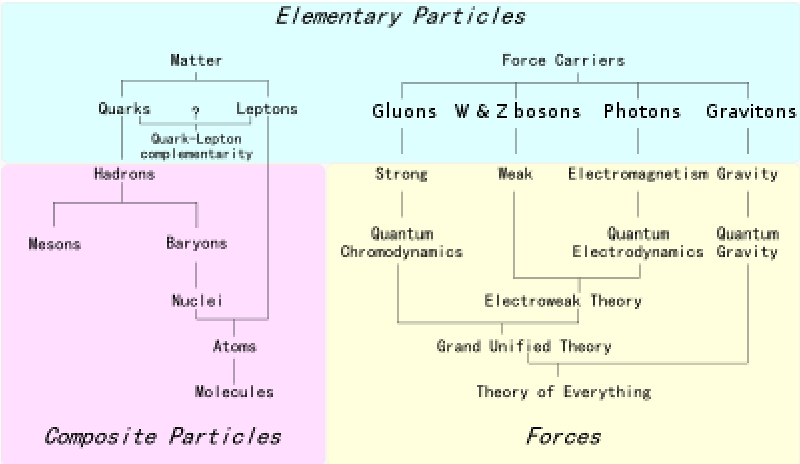
ABSTRACT: *A system of EMF (ELECTROMAGNETIC FOR FIELD) decelerating the dissipation coefficient of GF (GRAVITATIONAL FIELD) and parallel system of GF that contribute to the dissipation of the velocity of production of EMF in an accelerated sense is investigated. It is shown that the time independence of the contributions portrays another system by itself and constitutes the equilibrium solution of the original time independent system. With the methodology reinforced with the explanations, we write, parri passu the governing equations with the nomenclature for the systems in the foregoing, including those of SNF AND WNF system. Further papers extensively draw inferences upon such concatenation process, ipso facto fait accompli. A final Grand Unified Theory is proposed and the equations are given in the annexure, Which can be solved by the same methodology of the present paper mutatis mutandis. Gravitation is considered the weakest, but at Planck's length it becomes extremely powerful, so powerful as to punch the holes, We discuss all the aspects of Cosmology and Quantum Mechanics and arrive at a reconciliatory solution after a lengthy discussion which seemed inevitable and necessary to put the theory on terra firma.. The forces of gravity and electromagnetism are familiar in everyday life. Two new forces are introduced when discussing nuclear phenomena: the strong and weak interactions. When two protons encounter each other, they experience all four of the fundamental forces of nature simultaneously. The weak force governs beta decay and neutrino interactions with nuclei. The strong force, which we generally call the nuclear force, is actually the force that binds quarks together to form baryons (3 quarks) and mesons (a quark and an anti-quark). The nucleons of everyday matter, neutrons and protons, consist of the quark combinations uud and udd, respectively. The symbol u represents a single up quark, while the symbol d represents a single down quark. The force that holds nucleons together to form an atomic nucleus can be thought to be a residual interaction between quarks inside each individual nucleon. This is analogous to what happens in a molecule. The electrons in an atom are bound to its nucleus by electromagnetism: when two atoms are relatively near, there is a residual interaction between the electron clouds that can form a covalent bond. The nucleus can thus be thought of as a "strong force molecule."*

Keywords: Quantum physics, Quarks, Leptons, Protons, Photons, Gravity, Gravitons, Gravity Waves, Electro-Magnetic Waves, Plank Length, Black Holes, Quasars, Cosmos, Hydrogen, Basic forces

INTRODUCTION

FUNDAMENTAL INTERACTIONS:

In particle physics, **fundamental interactions** (sometimes called **interactive forces** or **fundamental forces**) are the ways that elementary particles interact with one another. An interaction is fundamental when it cannot be described in terms of other interactions. The four known fundamental interactions, are electromagnetism, strong interaction ("strong nuclear force"), weak interaction ("weak nuclear force") and gravitation. All are non-contact forces. With the possible exception of gravitation, these interactions can usually be described in a set of calculation approximation methods known as perturbation theory, as **being mediated** by the exchange of gauge bosons between particles. However, there are situations where perturbation theory does not adequately describe the observed phenomena, such as states and solitons



An overview of the various families of elementary and composite particles, and the theories describing their interactions. Fermions are on the left, and Bosons are on the right.

In the conceptual model of fundamental interactions, matter **consists of** fermions, which carry properties called chargesand spin $\pm\frac{1}{2}$ (intrinsic angular momentum $\pm\frac{\hbar}{2}$, where ħ is the reduced Planck constant). They **attract or repel** each other by exchanging bosons.

The **interaction** of any pair of fermions in perturbation theory can then be modeled thus:

Two fermions go in → ***interaction*** by boson exchange → Two changed fermions go out.

The exchange of bosons always carries energy and momentum between the fermions, thereby changing their speed and direction. The exchange may also transport a charge between the fermions, changing the charges of the fermions in the process (e.g., turn them from one type of fermion to another). Since bosons carry one unit of angular momentum, the fermion's spin direction will flip from $+\frac{1}{2}$ to $-\frac{1}{2}$ (or vice versa) during such an exchange (in units of the reduced Planck's constant).

Because an interaction results in fermions attracting and repelling each other, an older term for "interaction" isforce.According to the present understanding, there are four fundamental interactions or forces: gravitation, electromagnetism, the weak interaction, and the strong interaction. Their magnitude and behavior vary greatly, as described in the table below. Modern physics attempts to explain every observed physical phenomenon by these fundamental interactions. Moreover, reducing the number of different interaction types is seen as desirable. Two cases in point are the unification of:

Electric and magnetic force into electromagnetism;

The electromagnetic interaction and the weak interaction into the electroweak interaction; see below.

Both magnitude ("relative strength") and "range", as given in the table, are meaningful only within a rather complex theoretical framework. It should also be noted that the table below lists properties of a conceptual scheme that is still the subject of ongoing research.

Interaction	**Current theory**	**Mediators**	**Relative strength**[1]	**Long-distance behavior**	**Range (m)**
Strong	Quantum Chromodynamics (QCD)	gluons	10^{38}	1 (see discussion below)	10^{-15}
Electromagnetic	Quantum electrodynamics (QED)	photons	10^{36}	$\frac{1}{r^2}$	∞
Weak	Electroweak Theory	W and Z bosons	10^{25}	$\frac{1}{r} e^{-m_{W,Z} r}$	10^{-18}
Gravitation	General Relativity (GR)	gravitons (hypothetical)	1	$\frac{1}{r^2}$	∞

The modern (perturbative) quantum mechanical view of the fundamental forces other than gravity is that particles of matter (fermions) do not directly interact with each other, but rather carry a charge, and exchange virtual particles (gauge bosons), which are the interaction carriers or force mediators. For example, photons mediate the interaction of electric charges, and gluons mediate the interaction of color charges.

GRAVITATION

Hence it is always ignored when doing particle physics. Yet gravitation is very important for macroscopic objects and over macroscopic distances for the following reasons. Gravitation: is the only interaction that acts on all particles having mass; has an infinite range, like electromagnetism but unlike strong and weak interaction; cannot be absorbed, transformed, or shielded against; always attracts and never repels

Even though electromagnetism is far stronger than gravitation, electrostatic attraction is not relevant for large celestial bodies, such as planets, stars, and galaxies, simply because such bodies contain equal numbers of protons and electrons and so have a net electric charge of zero. Nothing "cancels" gravity, since it is only attractive, unlike electric forces which can be attractive or repulsive. On the other hand, all objects having mass are **subject** to the gravitational force, which only attracts. Therefore, only gravitation matters on the large scale structure of the universe.

The long range of gravitation makes it responsible for such large-scale phenomena as the structure of galaxies, black holes, and the expansion of the universe. Gravitation also explains astronomical phenomena on more modest scales, such as planetary orbits, as well as everyday experience: objects fall; heavy objects act as if they were glued to the ground; and animals can only jump so high.

Galileo determined that this was not the case — neglecting the friction due to air resistance, all objects accelerate toward the Earth at the same rate. Isaac's law of Universal Gravitation (1687) was a good approximation of the behaviour of gravitation. Our present-day understanding of gravitation stems from Albert Einstein'sGeneral Theory of Relativity of 1915, a more accurate (especially for cosmological masses and distances) description of gravitation in terms of the geometry of space-time.

Merging general relativity and quantum mechanics (or quantum field theory) into a more general theory of quantum gravity is an area of active research. It is hypothesized that gravitation is mediated by a massless spin-2 particle called the graviton.

Although general relativity has been experimentally confirmed (at least, in the weak field or Post-Newtonian case) on all but the smallest scales, there are rival theories of gravitation. Those taken seriously by the physics community all reduce to general relativity in some limit, and the focus of observational work is to establish limitations on what deviations from general relativity are possible.

Electroweak interaction

Electromagnetism and weak interaction appear to be very different at everyday low energies. They can be modeled using two different theories. However, above unification energy, on the order of 100 GeV, they would merge into a single electroweak force.

Electroweak theory is very important for modern cosmology, particularly on how the universe evolved. This is because shortly after the Big Bang, the temperature was approximately above 10^{15} K. Electromagnetic force and weak force were merged into a combined electroweak force.

For contributions to the **unification of the weak and electromagnetic interaction between elementary particles, Abdus Salam, Sheldon Glashow and Steven Weinberg were awarded theNobel Prize in Physics** in 1979.

Electromagnetism

Electromagnetism is the force that acts between electrically charged particles. This phenomenon includes the electrostatic force **acting between** charged particles at rest, and the **combined effect** of electric and magnetic forces acting between charge particles moving relative to each other.

Electromagnetism is infinite-ranged like gravity, but vastly stronger, and therefore describes a number of macroscopic phenomena of everyday experience such as friction, rainbows,lightning, and all human-made devices using electric current, such as television, lasers, and computers. Electromagnetism fundamentally determines all macroscopic, and many atomic level, properties of the chemical elements, including all chemical bonding.

This is larger than what the planet Earth would weigh if weighed on another Earth. The nuclei in one jug **also repel** those in the other with the same force. However, **these repulsive forces** are **cancelled** by **the attraction** of the electrons in jug A with the nuclei in jug B and the attraction of the nuclei in jug A with the electrons in jug B, resulting in no net force. Electromagnetic forces are tremendously stronger than gravity but cancel out so that for large bodies gravity dominates.

Electrical and magnetic phenomena have been observed since ancient times, but it was only in the 19th century that it was discovered that electricity and magnetism are two aspects of the same fundamental interaction. By 1864, Maxwell's equations had rigorously quantified this unified interaction. Maxwell's theory, restated using vector calculus, is the classical theory of electromagnetism, suitable for most technological purposes.

The constant speed of light in a vacuum (customarily described with the letter "c") can be derived from Maxwell's equations, which are consistent with the theory of special relativity. Einstein's 1905 theory of special relativity, however, which flows from the observation that the speed of light is constant no matter how fast the observer is moving, showed that the theoretical result implied by Maxwell's equations has profound implications far beyond electro-magnetism on the very nature of time and space.

In other work that departed from classical electro-magnetism, Einstein also explained the photoelectric **effect** by hypothesizing that light **was transmitted** in quanta, which we now call photons. Starting around 1927, Paul

Dirac **combined** quantum mechanics with the relativistic theory of electromagnetism. Further work in the 1940s, by Richard Feynman, Freeman Dyson, Julian Schwinger, and Sin-Itiro Tomonaga, completed this theory, which is now called quantum electrodynamics, the revised theory of electromagnetism. **Quantum electrodynamics and quantum mechanics provide a theoretical basis for electromagnetic behavior such as quantum tunneling, in which a certain percentage of electrically charged particles move in ways that would be impossible under classical electromagnetic theory, that is necessary for everyday electronic devices such as transistors to function.**

WEAK INTERACTION

The *weak interaction* or *weak nuclear force* is responsible for some nuclear phenomena such **as beta decay**. Electromagnetism and the weak force are now understood to be two aspects of a unified electroweak interaction — this discovery was the first step toward the unified theory known as the Standard Model. In the theory of the electroweak interaction, the carriers of the weak force are the massive gauge bosons called the W and Z bosons. The weak interaction is the only known interaction which does not conserve parity; it is left-right asymmetric. The weak interaction even violates CP symmetry but does conserve CPT.

Strong interaction

The *strong interaction*, or *strong nuclear force*, is the most complicated interaction, mainly because of the way it varies with distance. At distances greater than 10 femtometers, the strong force is practically unobservable. Moreover, it holds only inside the atomic nucleus.

After the nucleus was discovered in 1908, it was clear that a new force was needed to overcome the electrostatic repulsion, a manifestation of electromagnetism, of the positively charged protons. Otherwise the nucleus could not exist. Moreover, the force had to be strong enough to **squeeze** the protons into a volume that is 10^{-15} of that of the entire atom. From the short range of this force, Hideki Yukawa predicted that it was **associated w**ith a massive particle, whose mass is approximately 100 MeV.

The 1947 discovery of the pion ushered in the modern era of particle physics. Hundreds of hadrons were discovered from the 1940s to 1960s, and an extremely complicated theory of hadrons as strongly interacting particles was developed. Most notably:

The pions were understood to be oscillations of vacuum condensates;

Jun John Sakurai proposed the rho and omega vector bosons to be force carrying particles for approximate symmetries of isospin and hypercharge;

Geoffrey Chew, Edward K. Burdett and Steven Frautschi grouped the heavier hadrons into families that could be understood as vibrational and rotational excitations of strings.

While each of these approaches offered deep insights, no approach led directly to a fundamental theory.

Murray Gell-Mann along with George Zweig first proposed fractionally charged quarks in 1961. Throughout the 1960s, different authors considered theories similar to the modern fundamental theory of quantum chromodynamics (QCD) as simple models for the interactions of quarks. The first to hypothesize the gluons of QCD were Moo-Young Han and Yoichiro Nambu, who introduced the quark color charge and hypothesized that it might be **associated** with a force-carrying field. At that time, however, it was difficult to see how such a model could permanently confine quarks. Han and Nambu also assigned each quark color an integer electrical charge, so that the quarks were fractionally charged only on average, and they did not expect the quarks in their model to be permanently confined.

In 1971, Murray Gell-Mann and Harald Fritzsch proposed that the Han/Nambu color gauge field was the correct theory of the short-distance interactions of fractionally charged quarks. A little later, David Gross, Frank Wilczek, and David Politzer discovered that this theory had the property of asymptotic freedom, allowing them to make contact with experimental evidence. They concluded that QCD was the complete theory of the strong i**nteractions**, correct at all distance scales. The discovery of **asymptotic freedom led most physicists to accept QCD**, since it became clear that even the long-distance properties of the strong interactions could be consistent with experiment, if the quarks are permanently confined.

Assuming that quarks are confined, Mikhail Shifman, Arkady Vainshtein, and Valentine Zakharov were able to compute the properties of many low-lying hadrons directly from QCD, with only a few extra parameters to describe the vacuum. In 1980, Kenneth G. Wilson published computer calculations based on the first principles of QCD, establishing, to a level of confidence tantamount to certainty, that QCD will confine quarks. Since then, QCD has been the established theory of the strong interactions.

QCD is a theory of fractionally charged quarks interacting by means of 8 photon-like particles called gluons. The **gluons interact** with each other, not just with the quarks, and at long distances the lines of force **collimate** into strings. In this way, the mathematical theory of QCD not only explains how **quarks interact** over short distances, but also the string-like behavior, discovered by Chew and Frautschi, which they manifest over longer distances.

Transcending the Standard Model Numerous theoretical efforts have been made to systematize the existing four fundamental interactions on the model **of electro-weak unification.**

Grand Unified Theories (GUTs) are proposals to show that all of the fundamental interactions, other than gravity, arise from a single i**nteraction** with symmetries that **break down** at low energy levels. GUTs predict relationships among constants of nature that are **unrelated** in the SM. GUTs also predict **gauge coupling unification** for the relative **strengths of the electromagnetic, weak, and strong forces, a prediction verified at the LEP in 1991 for supersymmetric theories.**

Theories of everything, which integrate GUTs with a quantum gravity theory, face a greater barrier, because no quantum gravity theories, which **include string theory, loop quantum gravity, and twistor theory** have secured wide acceptance. **Some theories look for a graviton to complete the Standard Model list of force carrying particles, while others, like loop quantum gravity, emphasize the possibility that time-space itself may have a quantum aspect to it.**

Some theories beyond the Standard Model include a hypothetical fifth force, and the search for such a force is an ongoing line of experimental research in physics. In supersymmetrictheories, there are particles that acquire their masses only through super symmetry breaking effects and these particles, known as moduli can mediate new forces. Another reason to look for new forces is the recent discovery that **the expansion** of the universe is accelerating (also known as dark energy), giving rise to a need to explain **a nonzero cosmological constant**, and possibly to other modifications of general relativity. Fifth forces have also been suggested to explain phenomena such as CP violations, dark matter, and dark flow. In our theory, bereft of any assumptions and prognostications that had been made in the Standard Model, we concatenate,consummate,consolidate and consubstantiate all the four forces when once ,step by step the relationship between the forces are established under various conditions and circumstances.

Gravitation is extremely weak, it always wins over cosmological distances and therefore is the most important force for the understanding of the large scale structure and evolution of the Universe. Gravitational force in a local representation or referential frame is a electrostatic push in effect effects which encompass Electro Magnetic Force. Gravitational force is fundamentally of electromagnetic origin. Both follow inverse square laws EMF are present on a basic level across the universe, and its theory is similar to the theory of gravitation.

UNIFICATION OF THE FORCES OF NATURE

Although the fundamental forces in our present Universe are distinct and have very different characteristics, the current thinking in theoretical physics is that this was not always so. There is a rather strong belief (although it is yet to be confirmed experimentally) that in the very early Universe when temperatures were very high compared with today, the weak, electromagnetic, and strong forces were unified into a single force. Only when the temperature dropped did these forces separate from each other, with the strong force separating first and then at a still lower temperature the electromagnetic and weak forces separating to leave us with the 4 distinct forces that we see in our present Universe. The process of the forces separating from each other is called *spontaneous symmetry breaking*.

There is further speculation, which is even less firm than that above, that at even higher temperatures (the Planck Scale) all four forces were unified into a single force. Then, as the temperature dropped, gravitation separated first and then the other 3 forces separated as described above. The time and temperature scales for this proposed sequential loss of unification are illustrated in the following table.

Characterization	Forces Unified	Time Since Beginning	Temperature (GeV)*
All 4 forces unified	Gravity, Strong, Electromagnetic, Weak	~0	~infinite
Gravity separates (Planck Scale)	Strong, Electromagnetic, Weak	10^{-43} s	10^{19}
Strong force separates (GUTs Scale)	Electromagnetic, Weak	10^{-35} s	10^{14}
Split of weak and electromagnetic forces	None	10^{-11} s	100
Present Universe	None	10^{10} y	10^{-12}

Theories that postulate the unification of the strong, weak, and electromagnetic forces are called *Grand Unified Theories* (often known by the acronym GUTs). Theories that add gravity to the mix and try to unify all four fundamental forces into a single force are called *SupeR unified Theories*. The theory that describes the unified electromagnetic and weak interactions is called the *Standard Electroweak Theory*, or sometimes just the *Standard Model*.

Grand Unified and Super unified Theories remain theoretical speculations that are as yet unproven, but there is strong experimental evidence for the unification of the electromagnetic and weak interactions in the Standard Electroweak Theory. Furthermore, although GUTs are not proven experimentally, there is strong circumstantial evidence to suggest that a theory at least like a Grand Unified Theory is required to make sense of the Universe.(GOOGLE DOWNLOAD) . In general relativity, space time is assumed to be smooth and continuous and such an assumption is done in the mathematical sense. In the theory of quantum mechanics

There is an inherent discreteness incorporated in physics, in an attempt towards the reconciliation of these two theories. It is proposed that space time should be quantized at the very smallest scales. Current interest is on the locus and focus of nature of space time at the Planck scale, Causal sets, Loop quantum gravity, string theory, and black hole thermodynamics all predict a quantized space time at the Planck scale

There are two kinds of dimensions spatial and temporal. Former is bidirectional and second is unidirectional If we assume that and the temporal dimension be Setting aside and marginalization of the compactified directions invoked by String theory, physical ramifications of such an assumption can be expatiated in no uncertain terms, the justificatory argument being anthropic in thematic and discursive form.. Barrow, in fact attributed the manifestation of inverse square law in nature to the three dimensionality in space and time Law of gravitation follows from the concept of flux and the proportional nature of flux density and the strength of the field. Ehrenfest showed that if N is even then the different part of a wave impulse travel at different speeds. For N=3, there shall be detrimental and pernicious implications of distortion. Weyl confirmed that Maxwell"s Theory worked for N=3 and T=1. In the due course instability of electron orbits are proved for N greater than 3. They either collapse in to the nucleus or disperse Following map is taken from Google display which bears ample testimony and infallible observatory to the facts delineated and disseminated in the foregoing.. Behaviour of the physical systems remain unpredicted if t is greater than 1Protons and electrons would be unstable and could decay in to particles having .greater mass themselves.

Magnetism is the invisible, projective, electrically active ("electro-motive") force of thel oadstone, so gravity is the invisible, projective, dimensionally active ("inertio-motive") force of the ordinary rock. In the case of magnetism, we trace the force back to the moving (And aligned) electrical charges of electrons in the loadstone; in the case of gravity, wetrace the force back to the moving (and one-way) temporal charges of matter in the rock. Amoving electric charge creates a magnetic field; a moving temporal charge creates a Gravitational field. In both cases the field is produced at right angles to the current. Bothrelations are reciprocal: moving magnetic and spatial (gravitational) fields create electricand temporal currents. Magnetism and time are both "local gauge symmetry currents", Variable magnetic current protecting the invariance of electric charge in relative motion,the variable temporal current protecting the invariance of causality and velocity c("Lorentz Invariance"). Finally, time and gravity induce each other endlessly, as do the Electric and magnetic components of an electromagnetic field. This is the analogy betweenelectromagnetism and gravitation which so intrigued Einstein. (See: "The Conversion of Space to Time".)(Reproduced from John Gowan's article on Entropy and symmetry)

THE FUNDAMENTAL FORCES OF NATURE ARE:

The four forces of nature are considered to be the gravitational force, the electromagnetic force, which has residual effects, the weak nuclear force, and the strong nuclear force, which also has residual effects. Each of these forces reacts only on certain particles, and has its own range and force carrier, the particles that transmit the force, by traveling between the affected particles.

The range of any force is directly related to its force carrier. This is because force carriers must be emitted from one particle and reaches another to create a force. However, the emitting particle can be considered at rest in its own reference frame. Emitting a force carrying particle violates conservation of mass-energy, since the force carrier contains some energy. However, this can be allowed by the uncertainty principle. If the force of electromagnetism was greater the atoms would not share electrons with other atoms. On the other hand, of the force of electromagnetism was weaker atoms would not hold on to electrons at all. Strong nuclear force is the degree to which protons and neutrons stick together. Besides, weak nuclear force governs radioactive decay. In the eventuality of the fact that weak nuclear force was stronger, matter would be converted in to heavy metals. If the weak nuclear force was much weaker, matter would remain in the form of the lightest element. Gravitational force determines how hot the stars burn. If the number of electrons and protons had not been equal, galaxies stars planets would never have formed. In other words electromagnetic force is far more than the gravitational force and the ratio must be less than 1. Strong nuclear force ,on the other hand, is greater than the gravitational force and electromagnetic force and the ratio must be greater than 1.These are very important points that are used in building of the models and concatenation of the representative equations given at the end of the paper.

In fact, gravitational force is a residual force of force. At the quantum levels, gluons exhibit its effect beyond just a single proton and this is the reason as to why nuclear fusion can occur. Goradia in his essay “Microscopic Implications Of General Theory Of Relativity” says that mass tells space how to curve and space tells how to move. It must also be noted that Newtonian gravity analysis describes the relationship between mass and space by having mass effect assists numerator and space effect as its denominator. It is also a fact that Einstein tried to explain nuclear forces in terms of gravity. Gravitational force is a effect of color force Modified Newtonian gravity can explain residual strong nuclear interaction. Stephen Hawking in his “A Brief History of Time” says that in the eventuality of the fact that light is made of particles, then they must be effected in the same manner as gravitational force affects cannon balls, stars,or galaxies. In this connection, it must be noted that quantum mechanics can explain wave like characteristics and observations of light in terms of photons.

Weak nuclear force is responsible for beta decay. EMF (Electro Magnetic Force)and WNF(Weak Nuclear Force) are two aspects of electro weak interaction. Gauge Bosons carry weak force. It is left-right asymmetric ,violates CP symmetry but conserves CPT.In respect of Strong nuclear force Yukawa predicted that it was associated with a massive particle whose mass is 100 MeV. It may also be mentioned in the passing that merger of General Theory Of Relativity and Quantum Mechanics or Quantum Field Theory, has given rise to expectations that gravitation is mediated by a mass less spin particle(spin=2) called gravitons. Friction, rainbows, lightning,are explained by EMF. It has been documented that the changes in gravitational force and EMF fields propagate at the speed of light. Matter, energy, electric charges move at the speed of light Gravitations force is very much related to the mass.

The amount of energy borrowed multiplied by the time it is borrowed of, cannot exceed Planck's constant. Since the amount of energy in the borrowed particle is equal to mass (*m*) times speed of light (*c*) squared, the time of existence cannot exceed Planck's constant (*h*) divided by *m* times *c* squared. The maximum distance the force carrier can travel in time *t* is *ct*. This must be equal to *h/mc*. Since this is the maximum distance the force carrier can travel without violating the uncertainty principle, this range is the maximum range of the given force, based on two constants, h and *c*, and *m*, the mass of the force carrier.

THE ELECTROMAGNETIC FORCE

The electromagnetic force operates between particles which contain electric charge. The force carrier for the electromagnetic force is the photon. Photons, which are commonly called light waves, and referred to as gamma rays, X-rays, visible light, radio waves, and other names depending on their energy. Photons have no mass, which means that, according to the previous calculation, there is no limit on the distance of effect of the electromagnetic force. Photons also have no electric charge, no color, no strangeness, charm, topness, or bottomness, but do possess a spin of 1. EMF can be regarded as smooth, continuous field propogated in the form of a wave and follows Planck 's law.

The electromagnetic force has a strength proportional to the product of the electric charges of the particles, and inversely proportional to the square of the distance between the particles' centers of mass. The electromagnetic force is the second strongest force, behind the strong force by two orders of magnitude at the distances in a nucleus, but can be either attractive or repulsive. Like charges attract and unlike charges repel. Over large scale measurements, the overall charge of an area is most often neutral, and the electromagnetic force has no overall effect. It does have residual attractive forces between electrically neutral atoms that constrain the atoms into molecules. These interactions between atoms are referred to by *chemists* as chemical bonds, dipole-dipole interactions, or other such terms.

THE GRAVITATIONAL FORCE

The gravitational force is an interaction between mass-energy, and is thus experienced by all particles to some degree. The gravitational force is proportional to the product of the total energies of the interacting particles, and inversely proportional to the square of the separation between the particles. However, this implies that the gravitational force has no distance limit. By the previously determined relationship, the force carrier of the gravitational force must have no mass for gravity to have no limit to its distance. This particle, known as the graviton, had not been discovered, and is only hypothesized. However, it must exist for the current understanding of forces to be correct.

An interesting fact about gravity is that, although the weakest force, 42 factors of magnitude weaker than the strong nuclear force, it has the greatest effect in large scales. This is because total energies can only be positive, and gravity can therefore only be attractive. Over large areas, the qualities that the other charges act on tend to cancel out, but the effect of gravity merely increases as more mass-energy is involved.

THE WEAK NUCLEAR FORCE

It has been speculated that the Bell device was designed to use high-speed counter-rotating components filled with specialized materials and energized by electromagnetic energy to induce "torsion" effects and thus control gravity and other significant effects. John Dering, a physicist specializing advanced directed energy, nonlinear electrodynamics and new energy sources has further reported on a "Rhine Valley" facility and device. While the Bell experiment was focused on developing a radical new propulsion technology, the little-known Rhine Valley experiment may have been a last-ditch attempt to weaponries the Bell's dangerous side effect for use against Allied forces. Dering speculates that the German WW-II research was intended to create a powerful propulsion effect by engineering application of Einstein's Unified Field Theory (UFT) equations. Within the 1929 version of the Einstein UFT equations a linkage is found between the "vector magnetic potential" and Torsion. Put simply, in the Unified Field Theory the effects of curved space-time (resulting from a massive body, like the earth) can locally offset by creating Torsion. Thus electromagnetic interactions are harnessed to induce torsion, which in turn can then null out gravitation. This astounding possibility for gravity control is not predicted in either the special or general relativity theories and appears only in the Unified Field equations. Thus, a sort of counteraction to gravity or "antigravity" field would be the result. The heavy-duty concrete construction of the test-rig at the Wenceslas Mine, complete with heavy steel mounting-rings, bears witness to the massive scale of the forces that the research produced. While the full purpose and results of neither experiment is completely known, it is obvious that Nazi Bell possessed a great deal of value in terms of secret-weapons – with a range of choices at his disposal at the end of World War II, Hans Kammler considered only the Nazi Bell experiment as being valuable enough to save Germany from the encroaching Allied & Russian forces. As scientists, Kammler's team would have quickly realized that this scientific support wouldn't have come from either Relativity Theory or Quantum Mechanics, but they wouldn't have had to search very far, as the Germans had already reviewed just such a theory to unify Electromagnetism and Gravitational Forces …

On June 14th, 1928, a paper was published in German that would have certainly attracted the attention of anyone looking for a quick and easy way to convert from electricity to gravitational force. The English translation of the title is:"New possibility for a Unified Field Theory of Gravitation and Electricity", and it contains the beginnings of what later became known as Torsion Theory.

Starting in the early 1920's Einstein and others began to speculate that general relativity, which describes gravitation and space-time, could be modified to include the laws of Maxwell that describe electromagnetism. In essence Einstein sought to show that the laws of electricity and magnetism could be "unified" with the laws of gravitation. In other words such a theory would imply that all electrical and magnetic effects and all gravity effects are manifestations of an underlying "unified field".

By the late 1920's Einstein's papers on Unified Field theory began to be read by physicists interested in exploring experimental verification of his theories.

Thus, with the driving goal of building an electromagnetically powered UFO to replace the less than spectacular performance of the Coanda-Effect flying disks, Kammler's scientific team would have already been familiar with Einstein's work in gravity, and would have had a real basis from the published UFT tensor equations to begin rapid experimentation with a new technology for 1940's era Antigravity!

Reno described to Moore performing calculations for a 10% deflection in light, and also mentions working to some degree with Einstein's Unified Field Theory, which reinforces the idea that the Philadelphia Experiment was performed with the intent of making the USS Eldridge invisible to both radar and visible light. In effect, Reno described a real-life "Mirage Effect" nearly identical to the fictional invisibility device later portrayed in the 1987 science-fiction movie "Predator".

One of the real problems with regard to the Philadelphia Experiment story has been the amount of mythology surrounding it. In many ways, it serves as a modern-day extension of the many "ghost ship" tales such as the story of the Flying Dutchman from earlier eras.

Different retellings of the Philadelphia Experiment tale always seem to contain a unique twist – in some stories, the experiment was meant only to produce radar-invisibility to provide the Navy with a means of avoiding enemy radar

What makes Hutchison unique is that he has an eye for putting things together, and has been able to produce some rather spectacular effects simply through adjusting his equipment correctly.

Hutchison seems to be the middle ground between the Antigravity effects reported from the Nazi Bell experiments and the melting-materials effects of the Philadelphia experiment. His experimentation with high-voltage and high-frequency apparatus has produced effects ranging from antigravity and levitation in a variety of materials, to the melting and jellification of materials – including substances melting into each other at room temperature. .

There's a final factor that makes Hutchison's work especially notable: his experiments don't produce negative biological side effects. This may be the result of the higher-frequencies that Hutchison uses experimentally – the H-Effect occurs between 10 to 20 megahertz, instead of working in the kilohertz range like the Bell Device, or the 10 – 125 Hz range that Corum suggested for the Philadelphia Experiment.

Do the higher-frequencies make his device more efficient, or simply put the field-effects out of the range that damages living organisms? Dering is the first to acknowledge that this approach to technology carries risks – he's commonly used the phrase "when you pull the cat's tail you get the whole cat", by which he means that since the Unified Field Theory taps into multiple forces by warping the space-time manifold, tampering with a single force such as gravity will undoubtedly have side-effects that show up in unrelated forces as well.

Dering claims that as these experiments begin to tap into the force of gravity they create a "back-EMF" effect, which he explains as being gravitationally induced electromagnetic fields that are impossible to shield against using current technology.

What is the magnitude of these back-EMF effects in an experimental setting? "The AG experiments I have done produced a complicated field," writes Dering, "A torsion field induced by a rotating EM (electromagnetic) wave creates the curvature. The problem is that these fields are manifestations of the underlying unified fields that manifest as the five modes we call the fundamental forces."

"To induce torsion and make curvature the system is driven at several RF (radio frequency) frequencies with the appropriate modulation—there are lots of time derivatives flying around. The result is that the time varying AG (antigravity) field back induces an EM field that attempts to react against the input pump wave… and that back EM is intense, too! And there are those bloody cross terms this component linked to that one… what a soup."

We measured minor effects with the gravitational rotor test of the Unified Field relations - but it takes real power, at or above a critical intensity and field strength for at least a minimum amount of time (the nonlinear build up time constant) for powerful AG effects to manifest. Conceptually, the description of rotation in the Bell device connects with idea of torsion fields being used to create a shear-effect on the time-space manifold surrounding the Bell. The exact nature of this is poorly understood, but the crux of the idea involves modifying the background properties of time and space in the local vicinity of the device, which may serve to create a propulsive Antigravity Effect.

hile John Dering has speculated about torsion fields arising from rotating RF-waves circulating through frozen

The weak nuclear force is a force of interactions between quarks and leptons, both of which are fermions with spin 1/2. The force only affects particles which are spinning counter-clockwise while going away. In other words, the weak nuclear interaction affects left-handed particles. (and right-handed anti-particles) Leptons come in electron, muon, and tau flavors of charge -1, each with associated neutrinos of neutral charge. Quarks appear as the up and down, charm and strange, and top and bottom flavors. The flavors are conserved, and weak interactions transform leptons to other leptons and quarks to other quarks, while preserving this conservation.

The weak nuclear force has a limit in range of only 10 to the -18th meters. This means that the carrier particles must indeed have mass. The weak nuclear force is found to have three carrier particles, two W bosons; one charged -1 and one charged +1, and the electrically neutral Z boson. The W bosons have a mass of 80.22 GeV/(c squared), and the Z boson has a mass of 91.187 GeV(c squared). All carriers have a spin of 1, however. The weak force, as its name implies, is weaker than the electromagnetic or strong nuclear force, about five factors of magnitude smaller than the strong nuclear force distances in an atom's nucleus. However it is very important in beta decay and pair annihilation/production, as well as other interactions.

Fundamental Forces and Gravity

In previous chapters, we have discussed that space-time is a closed geometry, which fundamentally expands. However, our expanding geometry was wrinkled and collapsed onto itself, and increase in its circumference's size (space) was decelerated.

Let us develop our previous example of a balloon so that we can visualize this new state of balance. Imagine a balloon (or more properly, a spherical plastic bag) that isolates its interior volume from the exterior, and whose inner pressure is almost the same with its outer pressure. That balloon would have almost zero wall tension. This example represents our basic expanding geometry, which also contains no stress or energy of any kind.

Photo of an inflating balloon

We can pinch and tug at the balloon's surface and tie knots on its surface. Now, in this new state, the circumference of our balloon decreases, as some of its surface is knotted locally. Although knots tend to relax, they cannot do so, prevented by the tying nature of knots in their inner structure. Therefore, they behave like tension springs, which decrease the overall circumference. There also appears a tension on the wall of our balloon, because the decrease in its circumference increases its inner pressure. There is a mutual relation between the wall tension, pressure inside the balloon and quantity of knots. Additionally, there appear local wrinkles oriented around those knots on the surface of our balloon, as knots deform the balloon's surface geometry.

Photo of a knot on balloon

Stress relations on our balloon example resemble fundamental forces of Nature. However, there are very important differences that we should immediately emphasize. Our space-time geometry expands fundamentally; it is not static like our balloon example. Additionally, our geometric structure is not in a medium like atmosphere that causes pressure difference between in and out as in our balloon example. Its fundamental tendency to expand is dependent only on its logical cause. Moreover, plain space in our geometry is not able to contain such properties of mechanical stress, wall tension etc. like a balloon's complex molecular wall. We may only suggest that *expanding space* wrinkles (strained) when there is stress on the *expansion*.

Our balloon example may not be perfect, but it signifies the mutual relationship between the knots, the wrinkles around them, and their effect on the overall size of the circumference. It also reflects this paper's philosophical viewpoint. The balanced system in our balloon example is indivisible. If a part of the balloon like a single knot is cut out and extracted from the system, the balanced stress relations in both the whole system and the extracted knot will cease to exist. **Nature is also an indivisible complete structure** like the balanced system in our balloon example. In Nature, all elements interact with the wholeness, and they are dependent on the state of balance in the wholeness. This is similar to the knots in our balloon example, where inner stress of knots both effects and depends on the pressure and the wall tension of the balloon. In Nature, energy and mass form an almost stable state, which is in equilibrium as in our balloon example.

THE STRONG NUCLEAR FORCE

The strong nuclear force is an interaction between color, and particles that possess color. Quarks possess one of three colors, green, red, or blue, and the strong force is an attractive force between these and the mediating particle, gluons. Gluons have two colors, one normal color and one anti-color. The strong force has no theoretical limit to its range, as gluons have no mass. In addition, they have no electric charge, and a spin of 1. In reality, the strong force is so strong that all color-charged gluons and quarks are bound tightly together into color neutral hadrons, either the mesons which consist of a quark and antiquark with corresponding color and anticolor, or the baryons, which consist of three quarks of the three colors, which cancel to color-neutrality. Since color does not appear outside of any hadrons, the strong force only directly has effects inside a hadron, at distances around 10 to the negative 17th power.

The previous paragraph describes the direct effects of the strong force, usually referred to as the fundamental strong interaction. The strong force also has a residual effect. The color-neutral hadrons can interact with the strong force due to their color-charged constituents, similar to the electromagnetic interaction. The force carriers in this case are the mesons, and all hadrons are affected. The mesons, which include the pions, the kaons, the rhos, the Ds, the etas, and many others, have masses ranging from .140 Gev/(c squared) to around 3 GeV/(c squared). This gives the residual effects of the strong force a maximum distance to interact of about 10 to the negative 15 meters.

Strong force interactions are important in quark-antiquark reactions, and in holding hadrons together. The fundamental strong interaction holds the constituent quarks of a hadron together, and the residual force holds hadrons together with each other, such as the proton and neutrons in a nucleus.

DOUBLE CONSERVATION ROLE OF GRAVITY:

In the following we extensively quote from scintillating, shimmering, enlightening and illuminating article by JohnA.Gowan which unfortunately has not received the attention it should have. A series of papers follow from this very interesting work which seem to have gone in to grand limbo of oblivion and hibernation Article named 'The Double Conservation Role of Gravity: Entropy versus Symmetry'. For all practical purposes the following could be considered as literal reproduction of Sir John Gowan's article

The primordial conservation role of gravity is to provide negative energy sufficient to exactly balance the positive energy of the "Creation Event", so the universe can be born from a state of zero net energy as well as zero net charge (the latter due to the equal admixture of matter with antimatter). All subsequent conservation roles of gravity are secondary to and derived from this original creation-role. (Negative energy is created by the collapse (rather than expansion) of spacetime and by the explicit presence of the time dimension.)(See John A. Gowan)

Following on from its primary role of providing negative energy during the "Big Bang", gravity plays two further major conservation roles in the evolving universe:

1) Conserving light's spatial entropy drive (light's intrinsic motion), which is accomplished by the gravitational conversion of space to time - converting light's intrinsic motion to time's intrinsic motion. (See: "The Conversion of Space to Time".)

2) Conserving the non-local distributional symmetry of light's energy, which is accomplished by the gravitational conversion of bound to free energy in stars (partially), and (completely) in Hawking's "quantum radiance" of black holes (see: "Extending Einstein's "Equivalence Principle").

This double role is consequent upon Noether's Theorem and the double gauge role of "velocity c", which simultaneously regulates the entropy drive of free energy (the intrinsic spatial motion of light), and the non-local distributional symmetry of light's energy (vanishing time and the x (distance) spatial dimension). The entropy conservation role operates at all gravitational energy levels, while the symmetry conservation role must reach an energetic threshold before nuclear fusion can begin (in stellar interiors).

Noether's Theorem requires the conservation of light's various symmetries: the charges of matter are the symmetry debts of light. Charge conservation = symmetry conservation. All massive, immobile particles (bound electromagnetic energy) bear a gravitational "location" charge (-Gm) which represents the "non-local" distributional, metric, and entropic symmetry debt of the freely moving light (free electromagnetic energy) which created them. (See: "The Connection Between Gravitation, Time, Entropy, and Symmetry".)

At all energies, gravity pays the entropy-"**interest"** on the symmetry debt of matter by converting space to time, thus providing an alternative entropic domain in which charge conservation can have a deferred historical and causal meaning. At high energy levels (as in stars), gravity also begins to pay the "principle" on matter's symmetry debt, converting bound to free energy (vanishing the gravitational field as mass is vanished). The universal spatial expansion is reduced by the initial entropic conversion, **as space is converted to time; the original** expansion is restored, however, when mass is converted to light, reducing the total gravitational field energy and producing the impression of an "accelerating" universe. "Dark energy" is therefore simply the reduction of the cosmic gravitational field by the conversion of bound to free energy in stars or by any symmetry conservation/restoration process (which may also be operating in "dark matter").

The charges of matter are the symmetry debts of light (Noether's Theorem) (see: " Symmetry Principles of the Unified Field Theory"), but unlike the other charges and their forces, gravity and its "location" charge carries both a symmetry and an entropy **debt** of light. This **double debt accounts** for most of the mystery surrounding the role and activity of gravitation. Both debts are paid simultaneously by the conversion of mass to light, as in our Sun, the stars, and

Hawking's "quantum radiance" of black holes.

The origin of gravity's double conservation role stems from two conservation roles of the electromagnetic constant, c, which, among other regulatory functions (such as maintaining metric symmetry), gauges both the "non-local" spatial distributional symmetry of light, and the spatial entropy drive of light (the intrinsic motion of light). The intrinsic motion of light creates, expands, and cools space (entropy role), while also establishing light's "non-local" energy state, including the symmetric distribution of light's energy throughout space, the latter accomplished by the vanishing of time and distance (x, t) (symmetry role). As Einstein discovered, clocks stop and meter sticks shrink to nothing at velocity **c - light is a 2-dimensional transverse wave. Light's intrinsic motion (entropy drive) sweeps out** a 3rd spatial dimension. Space is the energetic, entropic, and symmetric conservation domain of light, created by the intrinsic motion of light.

When **free energy** is transformed **into bound energy**, gravity records the symmetry (and entropy) loss of light's intrinsic motion and non-local distribution (via gravity's "location" charge) - as required by Noether's Theorem. The active, entropic principle of gravity's "location" charge is time, a charge with intrinsic dimensional motion.

"Velocity c" also acts as the gauge of metric symmetry and equivalency, establishing the metric relationship within and between the dimensions (one second of temporal duration is metrically equivalent to 300,000 kilometers of linear distance = "velocity c"). Furthermore, c acts as the gauge of the energetic equivalency between free and bound energy: E = hv (Einstein-Planck), E = mcc (Einstein), hv = mcc (deBroglie). Finally, c is the gauge of the electromagnetic force, electric charge, causality, the "Interval", and the transmission of information. "Velocity c" is not an actual velocity at all, but rather a regulatory gauge of many related conservation functions concerning electromagnetic energy and the electromagnetic force.

The linkage between "causality" and "locality" is crucial to any understanding of the basis for gravitation. Gravity's time charge is required by energy conservation because immobile mass-matter is "local and causal": not only does matter require time to service its variable energy accounts (due to local relative motion), but matter also requires temporal **linkages** between all events to maintain the order of cause and effect ("causal chains" - "karma"). Time identifies the 4-dimensional location of matter, setting in motion the gravitational field or collapse of space, which energetically and metrically (dimensionally) records the spacetime position, quantity, and density of bound energy (symmetry role). Time endlessly renews itself from the temporal residue of the annihilated space, creating matter's historical entropy drive and historic spacetime, the conservation domain of matter's causal information web or "matrix" (entropy role). (See: "The Conversion of Space to Time".) Light requires no temporal dimension because being non-local, light is also a causal. Because the temporal entropy drive is also part of energy conservation and causality, we have to acknowledge four conservation roles for gravitation: energy, entropy, causality, and symmetry. (See: "The Tetrahedron Model".)

The intrinsic (entropic) motion of matter's time charge (moving into matter's historic domain or causal information field - at right angles to all three spatial dimensions) **creates a** gravitational field, which eventually **collects e**nough matter (as in stars) to initiate nucleosynthesis and begin **converting** mass back to light, repaying simultaneously both the entropy and symmetry debt ("interest" and "principle") of light's lost "non-local" energy state. This double conservation role of gravity is not evident on Earth, where gravity only creates our planet's time dimension (entropy, causality, and energy conservation), having not yet accumulated enough matter in Earth to ignite the nuclear fires and initiate symmetry conservation. Entropy, energy, and causality conservation is gravity's primary role (the creation of time from space); symmetry conservation is gravity's secondary, but ultimate role (the conversion of mass to light). (See: "Entropy, Gravity, and Thermodynamics".)

In our Sun (for example), both reactions go on simultaneously: gravity creates the Sun's time dimension by annihilating space, and yet creates new space by converting mass to light, a conversion which actually reverses the metric effect of the first reaction, reducing the Sun's gravitational field as it reduces the Sun's mass. This reciprocal gravitational action is possible simultaneously only because the first reaction is purely metric (entropy conservation) while the second involves particles (symmetry conservation). They do interfere with each other to some extent, resulting in a standoff between the gravitational force of compression and the radiative force of expansion - a seesaw battle between the symmetry and entropy conservation roles of gravitation whose final resolution (in favor of symmetry) is expressed through Hawking's "quantum radiance" of black holes. (See: "A Description of Gravitation".)

Financial metaphor of **"interest"** payments on a debt for the entropy conserving role of gravity, since the conversion of space to time (the dynamic on planet Earth, for example) does nothing to reduce the actual gravitational field of the Earth. The symmetry conservation role of gravity, however, which I compare to the paying-down of the "principal" of a debt, (the dynamic on our Sun, for example), actually does reduce the total gravitational field of the Sun because mass is converted to light: the latter does not produce a gravitational field. This is one of the more confusing aspects of gravitation, in that it appears to be playing different roles at different energy levels - it manifests in different ways at different scales of phenomena. Let us examine these roles - as best we can - in sequence, beginning with the smallest.

At the microscopic or quantum-mechanical level, we have the initial (non-gravitational) **production of time from space as a consequence of the collapse of a free electromagnetic wave to a bound energy form. "Frequency" multiplied by** "wavelength" = c, the electromagnetic constant, the "velocity of light". Even though light has no time or distance dimension (x, t), both time ("frequency") and space ("wavelength") are implicitly present in the formulation or composition of an electromagnetic wave (light). The wave itself contains an implicit temporal element expressed as "frequency", which switches to an explicit condition when the wave collapses, revealing the entropic time "charge" of bound energy. The collapse is a transition from the spatial, "wavelength", and symmetric expression of free electromagnetic energy to the temporal, "frequency", and asymmetric expression of bound electromagnetic energy; a transition from the intrinsic motion (c) of light in which "wavelength" is explicit, to the intrinsic motion (T) of matter's time dimension in which "frequency" is explicit. This is a transition from 2 to 4 dimensions, a transition from massless, non-local, atemporal, acausal light to massive, local, temporal, causal, matter. The electromagnetic entropy "coin" flips from implicit time and explicit space ("velocity c"), to explicit time and implicit space ("velocity T"). (See: "The Conversion of Space to Time" and "Gravity Diagram No. 2".) This is a transition between the entropy gauges, coefficients, or drives (c and T) associated with the free and bound forms of electromagnetic energy, and the dimensional conservation domains created by their intrinsic motions (space vs history).

The capacity of electromagnetic energy to have both a free and bound expression in light and matter is also reflected in the dual nature of spacetime and its spatial vs historical entropy drives. **Light, matter, space, and time are all creations of electromagnetic and gravitational energy.**

Intrinsic dimensional motion is entropic motion (whether positive as in expanding space and aging history, or negative as in the collapsing space of a gravitational field). The dimensions of spacetime are entropy domains, where both free and bound forms of electromagnetic energy can exist together and be simultaneously used and transformed, but nevertheless conserved.

The magnitude of "G" (the universal gravitational constant) is determined by the small energy difference between the symmetric spatial entropy drive (S) of light (the intrinsic motion of light as gauged by "velocity c"), and the asymmetric historical entropy drive (T) of matter (the intrinsic motion of matter's time dimension, as gauged by "velocity T"):

$S - T = -G$.

It takes energy to create a one-way historical entropy drive from an "all-way" spatial entropy drive, because an asymmetric, one-way temporal order must be imposed upon the symmetric, "all-way" spatial expansion. This entropy-energy cost of time is the origin of the "negative energy" characteristic of gravity and the negative sign of "-G". This cost is subtracted from the expansive entropy-energy of the Universe (via the gravitational annihilation of space), causing a deceleration of the spatial expansion of the Cosmos. (See: "Entropy, Gravitation, and Thermodynamics".)The intrinsic motion of light is actually due to the hidden or implicit presence of time. Time is an embedded property of the electromagnetic wave, implicit in "frequency", just as space is implicit in "wavelength". Wavelength multiplied by frequency = c: the intrinsic motion/"velocity of light". But what is the source of light's "intrinsic" (self-motivated) motion? Symmetry conservation is ultimately responsible for the intrinsic motion of light, which is caused by wavelength "fleeing" frequency, which however, is an asymmetric aspect of light's own nature, the classic "bur under the saddle". The symmetric aspect of the wave ("wavelength" - space) is actually "fleeing" the asymmetric aspect embedded in the same wave ("frequency" - time). Only by constant motion at velocity c can light suppress the embedded asymmetric element of time. "Wavelength" flees into the third dimension, escaping implicit time which exists as "frequency" embedded in the 2-dimensional transverse waveform of light. Hence light remains symmetric via its entropy function, that is, by moving, creating, expanding (and cooling) space. Intrinsic velocity c is just a symmetry condition (or "gauge", regulator) of free energy, maintaining light's massless, non-local, a temporal, and a causal symmetric energy state. In the intrinsic motion of light we glimpse the seamless intertwining of four fundamental physical principles: energy conservation, symmetry conservation, entropy, causality. (See: "The

Tetrahedron Model".)

When light stops moving and becomes bound energy, its non-local spatiotemporal symmetry is lost; time becomes explicit because bound energy, being local, requires the time dimension to establish and maintain its causal and relative energetic relations for reasons of energy conservation mentioned above. Causality requires time to be one-way; entropy requires time, like light, to move with an effectively infinite velocity. Symmetry conservation requires a gravitational response to the presence of **matter, the undistributed (asymmetric) lump of immobile, "massive" bound** energy, the consequence of light's lost "non-local" distributional and metric symmetry. The gravitational extraction of time from space ensures that the intrinsic motions of light and time are entropic as well as metric equivalents, allowing light and matter to interact freely within their **shared dimensional** conservation domain of spacetime. (See: "A Description of Gravitation".)

At the energy level or scale of planet Earth, gravity is in its entropic, causal, and energy conservation role only, creating **the Earth's time dimension and causally linking our expanding historic domain with the rest of cosmic spacetime. Time** is fully incorporated into and linked with ordinary space because it is created directly from space. The historic domain (the past), remains linked to the present by causality, and by the gravitational linkage between space and time. Spacetime is visible in our great telescopes as we look out to distant galaxies and see their historic past unfold before us - just as they see our past unrolling before them. The intrinsic motion or expansive entropic drive of light is also visible as the **cosmological "redshirt" of** the distant galaxies and expanding spacetime. Light is connected by space, matter is connected by time; gravity connects space and light with time and matter, converting the spatial entropy drive of light's intrinsic motion to the historical entropy drive of time's intrinsic motion - and vice-versa. **(See: "A Spacetime Map of the Universe".)**

(stars) At the energy level or scale of the stars, the symmetry conservation role of gravity comes into play, simultaneously with its entropic, temporal role. At the stellar energy level, gravity lights the thermonuclear fires of the nucleosynthetic pathway and begins converting mass to light, bound energy to free energy. Here for the first time we see that gravity is doing more than creating time and the historic domain; gravity is also conserving symmetry, in particular, the non-local symmetric energy state of light. The only way to get rid of gravity is to convert mass to light - since light (having no time dimension) has no gravitational field. The gravitational field of the Sun is reduced as gravity converts the Sun's mass into free energy, which is radiated away to be used by plants on Earth to fuel the negentropic engine of life and evolution. (See: "'Dark Energy': Does Light Produce a Gravitational Field"?)

From this we see directly that symmetry conservation is actually the ultimate "goal" of gravity, since gravity will not vanish until it fulfills this role; similarly, we can say that symmetry conservation is also the most fundamental role of entropic time, since time vanishes when bound energy and gravity vanish. A gravitational field is the spatial consequence of the intrinsic motion of time.

Einstein thought that "**gravity gravitates" (the energy content of a gravitational field itself produces more gravity). Since a gravitational field is caused** by the intrinsic motion of time, and time is also the active principle of gravity's "location" charge, while the "graviton" is a quantum unit of time, we can understand the basis for this notion. Be that as it may, the same consideration does not apply to light, which has no time dimension. Light has no mass and produces no gravitational field (when traveling freely in "vacuum" or spacetime) - contrary to the views of the "establishment". Being a non-local energy form, light cannot provide a spacetime center for a gravitational field, and an uncentered gravitational field is a violation of energy conservation.

We note the sequence: symmetry conservation (manifesting through the intrinsic motion of light - and the electrical annihilation of virtual particle-antiparticle pairs) maintains the massless, non-local, a temporal, and acausal nature of free energy. Symmetry-breaking converts free energy into immobile, massive, bound energy. Due to the requirements of energy conservation and entropy, as well as the causal requirements of bound energy, and due to the local, asymmetric distribution of mass in spacetime - energy, entropy, causality, and symmetry conservation all demand that the time dimension (always implicitly present in space) must become explicit. This conservation demand is satisfied by the quantum-mechanical "flipping" of the electromagnetic entropy "coin" (wave vs particle), transforming time from its implicit to its explicit expression (see: "Gravity Diagram No. 2"). This quantum-mechanical "switch" establishes the time charge, and seamlessly merges into the gravitational version of charge conservation: the gravitational charge is "location", whose active principle is time. Hence "location" charge has an entropic character, with intrinsic dimensional motion. Whereas the charges of the other forces are only symmetry debts of light, the gravitational "location" charge is both entropy and a symmetry debt of light. The explicit, intrinsic motion of time (into 4-D history) brings gravity into being; through the gravitational annihilation of space, time maintains itself and creates the causal linkage of the present to the cosmic domain of historic spacetime. Gravity conserves symmetry by returning bound energy to free energy (as in the stars, quasars, and the "quantum radiance" of black holes), completing the circle of symmetry and entropy conservation. (See :James A.Gowan's "Currents of Entropy and Symmetry".) Note that light "**escapes" into a third spatial dimension to create its entropic conservation domain**, whereas time "escapes" into a 4th historical dimension to create its entropic conservation domain. The dimensions of spacetime are entropic conservation domains **created b**y the "intrinsic" (entropic) motions of light and time.

(black holes) At the energy level or scale of the black hole, we find space accelerated to velocity c, at the black hole's "event horizon", so that in effect, gravity succeeds in returning bound energy to light's velocity, but in a backhanded way that only Einstein's "Equivalence Principle" could love. Was this gravity's "purpose" from the beginning? We think not, since the field does not vanish at $g = c$ (the black hole does not "swallow" its external gravitational field). Similarly, we expect that proton decay is so common inside the event horizon that black holes are filled with nothing but trapped light, solving the problem of the infinite compressibility of matter at the central "singularity". Even proton decay, however, does not seem to fulfill the original purpose of gravitation, because again the field does not vanish in the case of locally trapped and gravitationally bound light. Nevertheless, with space (and matter) accelerating at velocity c outside the hole, and matter converted to trapped light inside the hole, gravity is tantalizingly close to fulfilling its symmetry conservation goal. Finally, in the phenomenon of Hawking's "quantum radiance", we find the complete fulfillment of all gravity's conservation roles, in which the entire mass of the black hole is converted to free energy and radiated away, **vanishing t**he gravitational field in the process. In this final reaction we also see the conservation of the symmetry of light's entropy - the black hole is pure temporal entropy, but being one-way, temporal entropy has less symmetry than spatial entropy, which is "all-ways". Hence the conservation of the symmetry of light's entropy drive is another rationale for Hawking's "quantum radiance", the ultimate gravitational expression and fulfillment of Noether's Theorem.

In the "quantum radiance" of a black hole, we once again find matter-antimatter annihilation reactions responsible for the conversion of the hole's bound energy to light (via **virtual particle-antiparticle pairs created near the hole's event horizon by the extreme tidal effects of the intense gravitational field). So it appears that the symmetry conservation goal of** gravity is always to form a black hole, because only in this way can matter finally be brought together with, and be annihilated by, antimatter. Another way to view "quantum radiance" is as the direct conversion of matter into the positive energy and entropy drive of light, by the interaction of the spacetime metric with a high-energy gravitational field - the exact reverse of the original reaction between high-energy light and the spacetime metric which created matter. In both cases the spacetime metric is the source of the particles, which must be precise copies of one another.

The question posed to the Cosmos after the Big Bang is precisely this: how can the asymmetric residue of matter be returned to the symmetric energy state of light in the absence of antimatter? Gravity has the answer to this question in the "quantum radiance" of black holes, and the gravitational creation and capture of matter-antimatter particle pairs directly from the spacetime metric - perhaps reprising the "creation event" when $g = c$ - in much the same way as the weak force IVBs reprise the "Big Bang" electroweak era energy density when creating single, new elementary particles. In the gravitational case, the mass of the black hole is in the role of the mass of the IVB, and both produce single elementary particles which must be exactly the same as those originally created during the "Big Bang", lest symmetry and energy conservation be violated. When $g = c$, gravity takes over the role of all the other forces (the gravitational temporal metric completely replaces the electromagnetic spatial metric), even including the creation of single elementary particles by the weak force.

The planets and stars are just way-stations along gravity's journey toward the black hole, **the gravitational creation of antimatter**, and "quantum radiance". We also see that in the final annihilation, as in the initial creation, the metric structure of spacetime plus energy is the source of particles. It seems, therefore, that in the black hole, gravity is simply returning the material system to some sort of initial symmetry state to recover the original source of antimatter. This is actually similar to the strategy employed by the weak force IVBs when (by means of their great mass) they recapitulate the energy density of the Electroweak Era force unification symmetry state of the "Big Bang", in order to accomplish transformations of leptons and baryons (again, by means of particle-antiparticle pairs extracted from the spacetime metric or virtual vacuum "particle sea"). (See: "The Higgs Boson and the Weak Force IVBs".)

(galaxies) At the galactic level we have the mystery of "dark matter", which is evidently necessary to account for the observed gravitational binding with respect to the large rotational velocities of stars in galaxies, and likewise with respect to the rapid movements of galaxies relative to each other. No one knows what this dark matter might be, but it may consist of unknown massive neutrinos (the leptoquark neutrino?), exotic elementary particles (super symmetry, strings?), or possibly small black holes or other gravitational or "metric" particles originating in the "Big Bang". There may also be something wrong with our understanding of the gravitational field laws at very large scales ("MOND"). "Dark matter" remains a major outstanding mystery in physics, astronomy, and cosmology. (My own view favors a (very) heavy leptoquark neutrino. See: "The Origin of Matter and Information".)

(cosmos) At the energy level or scale of the Cosmos**, gravity reduces the expansion rate of the Universe, annihilating space, and in the process converts** space and the drive of spatial entropy into metric equivalents of time and the drive of historical entropy. Hence the spatial expansion of the Cosmos **provides the** energy for the expansion of the historic domain of matter. Here we see the mediating role of gravitation as the force which both **converts and conserves** the primordial drives of entropy in either form and direction. As the stars radiate their mass away, we can expect a small acceleration of the Cosmic expansion over the life of the Universe (if "dark matter" also converts bound to free energy by any process, this effect will be magnified). The "dark energy" or "cosmological constant" driving the "accelerated" cosmic expansion is simply the consequence of billions of years of constantly reducing the total gravitational energy of the Cosmos. On the other hand, if there is enough matter in the Universe, gravity will cause the final collapse of the Cosmos in a "Big Crunch". This will result in a new "Big Bang" when there is no more space left from which to create matter's time dimension, and the gravitational containment of light trapped in a cosmic-mass black hole will fail. Current observational data suggest, however, that the Universe will continue to expand forever. (See: "The Connection Between Inflation and the 'Big Crunch'"; and see: "A Spacetime Map of the Universe".)

On the Cosmic scale, the gravitational conversion of space and the drive of spatial entropy (S) (the expansive property of space, originating with light's intrinsic motion) to time and the drive of historical entropy (T) (the expansive property of history, originating with time's intrinsic motion), can be represented by a "concept equation" as:

$-Gm(S) = (T)m$

$-Gm(S) - (T)m = 0$

(Because I assume the general validity of Einstein's gravitational equations (other than the case of light in free space), it follows that I assume Einstein's formulation of the gravitational "warpage" of spacetime can be interpreted as the **conversion** of space to time. The **interconversion** ("covariance") of space with time is well known in other contexts involving moving or gravitational reference frames (Einstein's invariant "Interval", "Lorentz Invariance") in both Special and General Relativity. Hence the actual mathematics behind my grossly simplified "concept equation" has evidently already been done.) (See also the paper "The "Higgs" Boson vs the Spacetime Metric".

G) (metric vs entropic equivalency of space and time: c vs G) The metric equivalency between space, time, and free energy (light) is gauged (regulated in magnitude) by the universal electromagnetic constant c; the entropic equivalency between space, time, and bound energy (mass) is gauged by G, the universal gravitational constant. The quantity of time (the amount of temporal entropy-energy) allocated per given mass is gauged by the strength of G. This temporal requirement is satisfied via the gravitational annihilation of space, extracting a time residue which is metrically equivalent to the annihilated space. (See also: "Global vs Local Gauge Symmetry in Gravitation".)

H) Why is gravity so weak? Because mass is **connected t**o its entropic conservation domain of historic spacetime only by the tangential point of the "present moment" (time is at right angles to all three spatial dimensions). **Gravity creates** only enough time to provide the temporal entropy drive for this point-like tangential connection between matter and its historic conservation domain. The size of this **connectio**n for the entire mass-energy of the Earth (for example) is approximately the size of a ping-pong ball - the size of a black hole's "event horizon" containing Earth's mass. This point-like contact protects charge invariance and the energy content of matter from the vitiating effects of entropy. However, because this gravitational contact point between history and the spatial entropy domain of light is slightly greater than zero, there remains a (very small) potential for the direct entropic vitiation of matter by time and "g" - just as the spatial entropy gauge "c" enervates the energy of light. This small potential is actually realized through Hawking's "quantum radiance" and through "proton decay". See: "The Half-Life of Proton Decay and the 'Heat Death' of the Cosmos".

I) (entropy vs symmetry) When I refer to the "spatial entropy drive of light", or simply to "spatial entropy", or "light's entropy drive" or "light's entropy": I am referring to the expansive property of space, originating with the intrinsic motion of light, as "gauged" or regulated by "velocity c". The "intrinsic motion" of light (free electromagnetic energy) is the entropy drive of light and of light's expanding conservation domain, space. Space is the creation of light's entropy drive, created by light's intrinsic motion explicitly for the conservation of light's energy (and symmetry) content. The inertial symmetry of the spacetime metric as well as the "non-local" distributional symmetry of light's energy content - everywhere throughout its spatial conservation domain simultaneously - are likewise gauged by "c". Hence light's entropy drive and symmetric energy state are inextricably intertwined, a fact reflected in the double conservation role of gravity, which must conserve both if it conserves either one.

This universal spatial entropy drive or expansive property of light, although imperceptible locally, is directly observable in large telescopes as the cosmological "**red shift" of** distant galaxies. We are, of course, also aware locally of "velocity T". **It is not light itself that gravity is converting to time, but light's intrinsic motion, the entropy drive of light, the principle that causes light to move, the "intrinsic" or self**-motivated component of light's motion. As we have seen, this entropic, intrinsic, or self-motivating principle of light's mobile, symmetric, non-local, free energy state is actually implicit time, the same temporal component which becomes explicit when light stops moving and assumes the form of bound energy. It is the same implicit form of time that gravity reveals, lays bare, or exposes in its explicit form via the annihilation of space. The explicit form of time not only produces the historical entropy drive of matter, but also serves as the active principle of gravity's "location" charge. (See: "Spatial vs Temporal Entropy".) A gravitational field is the spatial consequence of the intrinsic motion of time. (See: "The Conversion of Space to Time"; and "Gravity Diagram No. 2".) (See also: "A Description of Gravitation"; and "Entropy, Gravity, and Thermodynamics".)

It is indeed a curious thought that the two great lights in our sky, the Moon and the Sun, which are so nearly equal in apparent size, also serve as examples of the two major conservation modes of gravity, which are so nearly equal in importance. In the Moon, we see (as on planet Earth) only the entropy conversion/conservation role of gravity, the creation of matter's time dimension via the annihilation of a metrically equivalent quantity of space. In the Sun, however, we see (in addition to gravity's entropy conservation role) the symmetry conservation role of gravity, the liberation of free energy from its bondage in mass-matter. The glorious difference between the Moon and Sun is just the difference between an entropy/symmetry debt passively maintained (gravity paying only the "interest" on matter's symmetry debt), and an entropy/symmetry debt actively repaid (gravity paying off the "principle" of matter's symmetry debt). Continuing this comparison, the spectacle of a solar eclipse is an apt metaphor for the most fearsome object in all nature, a black hole, demonstrating the ability of gravity's entropy conservation role to completely suppress its symmetry conservation role - while the glorious solar corona reminds us of Hawking's "quantum radiance". In the black hole, it is as if the entropy debt has become so enormous that all payments are consumed by "interest", with nothing left over to apply to "principle". In quantum radiance, however, we find the final triumph of Noether's symmetry conservation theorem, and of light over darkness.

Spontaneous Entropic Processes

In his book "Four Laws That Drive the Universe" (Oxford University Press, 2007), Peter Atkins offers a definition of the 2nd law of thermodynamics (page 62): "In any spontaneous process, the entropy of the universe must increase."How does this appealingly simple definition accord with our presentation of gravity and time as the ("spontaneous") entropy drives of bound energy (matter)? And especially - does this definition accord with our equation of the gravitational conversion of the spatial entropy drive of light (S) to the historical entropy drive of matter (T)?

$-Gm(S) = (T)m$

$-Gm(S) - (T)m = 0$

The intrinsic motion of light, the entropy drive of free energy, which motivates the expansion and cooling of the spatial universe, certainly fits this definition; and there can also be no doubt that both time and gravity, which we have classified with light as intrinsic dimensional motions and hence entropy drives, also qualify as "spontaneous" changes. However, gravity is characterized in most standard treatments as both negative energy and as a negative entropy drive (associated with bound energy), causing the contraction and heating of the spatial universe, in direct opposition to the expansion and cooling caused by the positive energy and entropy drive of light. I have elsewhere characterized time as the positive (historical) entropy drive of matter and bound energy generally (see: "Spatial vs Temporal Entropy"). Time is created by gravity through the annihilation of space and the extraction of a metrically equivalent temporal residue. Hence despite the negative entropy input of gravitation, entropy continues to increase, but as historical rather than spatial entropy..

In the case of bound energy in the form of atoms up to and including cold planetary-sized bodies such as the Earth (that are spherical but not yet large enough to become stars), we simply find the **gravitational conversion** of space to time. This is gravity's entropy conservation role but not yet its symmetry conservation role. Earth's gravitational field **creates** Earth's time dimension. The historical entropy domain so **created** is metrically **equivalent** to the spatial entropy domain **annihilated** by gravitation - or so we hypothesize. The spatial entropy drive of light (light's intrinsic motion) is **converted** to **and conserved** as the historical entropy drive of matter (time's intrinsic motion), via the action of gravitation. This conserved attribute of matter is demonstrated by the further action of a gravitational field in the Sun and stars, where bound energy is **converted t**o free energy, and with this energy conversion, the conserved temporal entropy drive of matter is also reconverted to the spatial entropy drive of light. (See: "Entropy, Gravitation, and Thermodynamics".)

On the cosmic scale - the "Big Crunch" returns the Universe to its original configuration as a "singularity" of infinite energy density. In such a completely reversible and isolated system, the total entropy change from beginning to end is zero. Gravity is a universal conservation force which conserves entropy and the non-local symmetric energy state of light - entropy is conserved at all scales, and symmetry is conserved at sufficiently energetic scales (such as stars).

B) The attractive principle of gravitation is one of its great mysteries. The notion of gravity as an agent of negative, temporal, or historical entropy does not help us understand the origins of this force, for in terms of entropy, the action of gravity seems contrary to the usual laws of thermodynamics: in gravitational processes, we see a decrease rather than an increase in entropy (negentropy). While it is true that historical or temporal entropy increases with gravitational action, this is at the expense of an at least (according to our equation) equal amount of spatial entropy, since gravity acts by the annihilation of space, extracting a metrically equivalent temporal residue, and as a consequence causing the contraction and heating of the remainder of spacetime. Hence we apparently cannot discover in gravity's entropic action any motivating principle for the attractive action of gravitation, such as a natural increase in (spatial) entropy might provide.

Explaining gravity's attractive principle is exactly where the double conservation role of gravity is so necessary to our understanding. In gravity's symmetry conservation role we can see the origins of its attractive principle, even at the level of an individual atom. It is the universal character and peculiar utility of all species of symmetry debts (charges), be they gravitational, electrical, identity, color, or spin, that they are produced and exist in a conserved state that is held indefinitely through time as a sort of promissory note, payable on demand in some future era, specifically upon the request of antimatter (charge conservation). Therefore, if we can discover that gravity originates as a symmetry debt of light, like the other charges and forces of matter, the mystery of its attractive principle may be solved, for we can find its rationale or conservation role in its future rather than present activity. In other words, we can see the rationale for gravitation in the activity and radiance of the Sun, rather than in individual atoms (or even cold planets), without concerning ourselves about the energetic of getting from individual atoms to stellar accumulations of matter - the motivating force or attractive principle on the level of the individual atom is through a symmetry debt or charge, not through the temporal entropy drive of matter. Gravity is a "spontaneous" force not because of the entropy debt represented by its "location" charge, but because "location" charge also carries a symmetry debt.

Gravity's double conservation role again becomes necessary to our understanding when we inquire about the exact nature of this symmetry debt. We find it originates as the (broken) non-local distributional symmetry of light's energy throughout spacetime (everywhere simultaneously), in direct contrast to the undistributed, concentrated lump of energy represented by mass-matter, locally present in the "here and now". The active principle of gravity's "location" charge is time itself, which unlike any other charge or symmetry debt of matter, happens to be an "entropic" charge with intrinsic dimensional motion, and one-way motion at that. Time marches into the historical domain to provide matter (bound energy) not only with its primary entropy drive, but also with a causal conservation domain of information (historic spacetime), and a metric accounting parameter for balancing the energy accounts of matter's relative rather than absolute motion.

Gravity's time charge ("location" charge) identifies the spatial location of matter's concentrated lump of immobile and undistributed mass-energy, indicating by the charge's relative strength and intensity the location, quantity, and density of the offending, asymmetrically distributed (undistributed) lump of energy. (Note that these are exactly the parameters relevant to matter's lack of spatial distributional symmetry, or the broken non-local distributional symmetry of light's energy). This spatial identification or "location" is actualized by the forceful action of a gravitational field (a metric or inertial asymmetry) which points to the center of mass of the lump of matter from everywhere in the Cosmos - the gravitational field is universal in its spatial extent. This gravitational force-field is mechanically caused by the intrinsic, entropic flow of time into history, the historic domain being located at right angles to all three spatial dimensions. Since time and space are connected, being aspects of one another, the flow of time into history pulls space along with it. This spatial flow is what we recognize as the gravitational field.

A Gravitational field is the spatial consequence of the intrinsic motion of time. The moving time charge enters the historic domain at the center of mass of the atom, planet, or star, causing the spherical collapse of space (because time is equally connected to all three spatial dimensions) as space tries to follow time into history. However, three-dimensional space cannot squeeze into the point-like beginning of the one-dimensional and one-way historical time line, and self-annihilates at the gravitational center, exposing a new temporal component, the exact metric equivalent of the annihilated space. (The one-way time component of spacetime cannot self-annihilate because unlike the spatial dimensions, there is + T but no -T.) This new temporal unit immediately marches off into history, pulling more space along behind it, etc., repeating the entropic cycle forever. The acceleration of gravity is due to the constant application of a force - the constant intrinsic motion of time. (See: " The Conversion of Space to Time".) This interpretation of gravitational action is completely in accord with Einstein's General Relativity through his own "Equivalence Principle".

The "payoff" for all this activity does not become apparent until we see sufficiently large gravitational accumulations, such as the Sun, where we find mass-matter being converted to light, that is, the restoration (conservation) of the non-local symmetric energy state of light. The "location" charge of gravity, whose active principle is time, is therefor acting like any other charge of matter (or symmetry debt of light), paying or discharging its symmetry debt by restoring bound and asymmetric energy (mass-matter) to its original free and symmetric energy state (light). This gravitational process begins with the nucleosynthetic pathway of stars and goes to completion in Hawking's "quantum radiance" of black holes. Hence it is only through the application of the concept of gravitation as both an active entropy and a time-deferred symmetry debt of light that we can fully comprehend the source of gravity's attractive action and conservation roles, and also bring gravitation under the symmetry conservation umbrella of Noether's Theorem, with all the other charges and forces of matter.This amounts to a unification of gravitation with time, which is how we unite gravity with the other forces of physics, and General Relativity with Quantum Mechanics. The "graviton" or field vector of gravity is a quantum unit of negative entropy, or time. The charges of matter are the symmetry debts of light. All forces act together (spontaneously) to return asymmetric matter to its original symmetric energy state, light. (See: "Symmetry Principles of the Unified Field Theory.")

Gravity pays the entropy-"interest" on the symmetry debt of matter through the creation of matter's time dimension - the only dimension in which charge conservation has extended duration and hence causal significance. Because gravity slows the spatial expansion of the Cosmos (via the annihilation of space), we see that matter's time dimension or historical entropy drive is actually funded by the intrinsic motion or spatial entropy drive of light, with gravity acting as the conversion (conserving/mediating) force. Gravity pays the entropy-"principal" in stars and ultimately and completely via Hawking's "quantum radiance" of black holes, converting asymmetric mass-matter to symmetric massless light. This mass conversion process reduces the total gravitational field of the Cosmos, giving the appearance of a mysterious universal "acceleration". Finally, the explicit time component that serves as the entropic driver of matter's historical information domain is the very same implicit time component that serves as the entropic driver of light's spatial conservation domain. Hence time, whether in its implicit form in light and space or its explicit form in matter, gravity, and history, is the single motivating agent of entropy and change in the Cosmos.

Any two masses attract each other through the very very weak force of gravity. It can be attributed to the mutual attraction between the gravitons that are embedded in each of the masses. The gravitons can be thought of as key blocks that bind energy into mass and hold the particle pieces together.

Production and Destruction of Gravity in Everyday Situations

We have a common example where gravity is **created and subsequently destroyed**. This is the process of positron/negatron pair production **caused** by capture, in the vicinity of a nucleus, of a photon having an energy greater than the rest masses of two electrons, or 1.022 MeV. Two oppositely charged particles appear, each having an amount of kinetic energy equal to half the excess photon energy above the rest masses. Both charge and mass, and consequently gravity, have been ***created*** from energy. The electrostatic force between particles is very much larger than the gravitational force, so that gravity is *usually* ignored in the process.

When the positron l**oses** all of its kinetic energy by collisions, it is **attracted** to an atomic electron by electrostatic force, and the two antiparticles **annihilate** to **form** a pair of 0.511 MeV photons emitted back-to-back to conserve momentum. **Both charge and mass, and consequently gravity, have been *destroyed*.**

It can be argued that the process of annihilation begins by electrostatic attraction but is *completed* by gravitational attraction For particles of the same type, the Pauli exclusion principle acts like a repulsive force and **prevents** merger. But for antiparticles, there is no Pauli exclusion and the particles can continue to **merge**. The particles **merge** sufficiently until the gravitational force between their centers is unbearably strong, **causing** whatever binds the mass together to fail to do its job, which releases it to form pure energy.

In general, this is probably what happens to eliminate gravity when any two antiparticles, such as a proton and an antiproton annihilate. S***ame*** process can happen in a sufficiently large black hole, where the process is **driven** by gravity.

Gravitons and Graviphotons?

What is the mechanism for the **production and destruction** of gravity? One possibility is that the graviton can exist in two separate states. When two particles **annihilate**, the bound graviton particles dissociate by **emitting** "graviphoton" waves, thus **releasing** the mass as its photon equivalent. In contrast, when a pair of particles is **created** from an energetic photon, graviphotons have to be ***pulled out*** of the wave continuum (-) **to create** the gravitons that bind the photon energy into mass The Heisenberg Uncertainty Principle would **hide** the actual locations of the graviphotons, which in general have very small reaction cross sections, thus spreading out their range of interaction. This implies that there is a ***tremendous*** and essentially undetectable graviphoton flux everywhere in space, available **to foster** these reactions. This is analogous to the extremely large neutrino flux that continuously passes through us almost completely undetected

Hence, gravitational force exists when gravitons are bound particles, and the force disappears when the gravitons have *disassociated* and have emitted graviphoton waves. The exchange between the two states goes on naturally on the microscopic scale when matter is created or destroyed.

Van Flandern argues that the attraction of gravity between two distant bodies is due to the **interaction** between the gravitons embedded in the matter and some related entities that he calls c-gravitons. In producing this attraction, he has *independently* proposed that there must **exist** a ***tremendous*** flux of c-gravitons that produce the attractive force by a shadowing process! Hence, c-gravitons are apparently ***equal*** to graviphotons.

One can even argue that these c-gravitons/graviphotons may also be the equivalent of the long postulated ***aether*** that light and electromagnetic waves propagate through.

He further demonstrates that gravity acts essentially *instantaneously* at a speed orders of magnitude greater than light speed, because the measured motion of distant celestial bodies is **not affected** by delays in the transport of light between them. Hence, gravity acts by a *different* mechanism than electromagnetic attraction/repulsion, which both act at the speed of light. He then argues that wave/particle duality is a consequence of the **interaction** between light-speed entities and non-light-speed entities.

Gravitation acts as if there was a background field that *instantaneously* **knows** the positions of all masses even though the bodies are located a universe apart. It may operate by a **bootstrap effect**, a kind of **whispering gallery** where each mass continuously tells its neighbors what it knows in terms of instantaneous positions and higher space-time derivatives, and this gives it the effect of faster-than-light-speed **analytic continuation** to continuously map the entire space. One can postulate that the intensity of the graviphoton field at any point is a **measure** of the summed distribution of mass around that point, and that it is possible to anticipate **the effect** of motion of these masses by the time behavior of the resultant field. A parallel to Einstein's EPR effect can be drawn.

Big Wave Model of a new Big Bang requires a coherent wave of photons and graviphotons moving out from the origin at the speed of light, **creating** neutrons as they go. If graviphotons moved ***faster*** than the speed of light, then they would **get out of coherence** with the photons. Hence, graviphotons must be components of a gravity wave that moves at light speed. Their role in instantaneous gravitational attraction is being explored.

The above arguments raise an interesting new question. What are the **effects** of the leakage loss of photons, neutrinos and graviphotons at the edge of the universe on the reversibility of a closed universe? It could be both positive and negative as we understand it. The only thing that makes sense is to assume that there is essentially a *zero current* boundary condition at the edge that exactly compensates for this loss. This implies that there are in fact billions of other universes distributed throughout the Cosmos, bumping up against one another, undetected, such that the leakage out of each one is exactly balanced by leakage in from its adjacent neighbors. On the grand scale, *nothing* is lost. Verily, like the individual debits and credits of a bank which are tallied and the holistic debits and credits that again tallied to write the General Ledger. If we do the same exercise in cosmology, the General Ledger is the General Theoru of various cosmological variables that provide the debits and credits to their account on every single tran**saction should there be there someone to record it.**

The fluctuation-dissipation theorem Causality and Kramers–Kr¨onig(Excerpts from Prof. Sethna's monograph on Ergodicity Cornell University)

Systems wiggle, and how they yield and dissipate energy when kicked. A material in thermal equilibrium may be macroscopically homogeneous and static, but it **wiggles on the micro scale** from thermal fluctuations. We measure how systems wiggle and evolve in space and time using *correlation functions*. X-rays, neutrons, and electrons) directly measure correlation functions. Statistical mechanics is used to calculate equal-time correlation functions using the ideal gas as an example. **Onsager's *regression hypothesis* to** derive the time-dependent correlation function. We **often want to know how a** system behaves when kicked in various fashions. *Linear response theory* is a broad, systematic method developed for equilibrium systems in the limit of gentle kicks**. Statistical mechanics to calculate the response when a system is kicked by elastic stress, electric fields, magnetic fields, acoustic waves, or light. T he space–**time-dependent linear response to the space–time dependent influence is described in each case by a *susceptibility* There are powerful relationships between the wiggling, yielding,2 and dissipation in an Equilibrium system. Yielding and dissipation are precisely the real and imaginary parts of the susceptibility. Static susceptibility is proportional to the equal-time correlation fun**ction. F*luctuation-dissipation theorem*, giving the dynamic susceptibility in terms of the time-**dependent correlation function. Causality (the fact that the response cannot precede the perturbation) to derive the *Kramers–Kr ӧnig* relation, When physicists encountered other structural levels of matter they found it easier to think of them as the result of other forces in nature. Since **electromagnetism** involves a field as does gravity, the comparison of atoms to gravitational systems took only slight modification to dynamics. The subatomic structures were a different story. As physicists investigated atoms and particles they added new forces to the list. A **strong nuclear force** was needed to hold protons and neutrons together against the repulsion of the proton's charge, a **weak nuclear force** involved radioactive decay, and the quarks theory for particle structure required an intense bonding mediated by gluons. .

Gravity only attracts, **electromagnetism** both attracts and repels, the **strong nuclear force** is a repulsion at distance less than 10-13 cm, and its attraction drops to zero rapidly at distance greater. The **weak nuclear force** cannot extend farther than the size of a particle. And in its perverse manner the force of the gluons for quarks is reversed and becomes stronger with distance.

Matter produces fields. In physics the world is divided into matter and energy. These two components are inter convertible on the particle level of matter by the equation $E = mc2$. There is no explicit explanation in physical theory how this happens, only that it does. Energy is left in the abstract.

The structural hierarchy

Dynamics leaves physicists without a structure theory. They have tied motion to mass as momentum for their energy concept, and this has prevented their imagining structures based on motion. We think of structures as solids and motion as change. A structure, however, is characterized, not by statics but by stability of form. In nature kinematic structures are produced in which the structural motion is self-contained and self-perpetuated. There is a non-material side of reality from which the material side evolved. The medium, light waves, and fields are non-material. In the formation of matter and its hierarchy, they are all i**nterrelated.**

Matter formed and evolved from the non-material side of reality.

The medium apparently is the pre-material condition from which the material universe developed. The single "physical" condition of the medium, and the reason it is recognized as a medium, is its capability to sustain wave motion. Light and fields are manifestations of this wave action in the medium. Motion can be **translated** to energy for dynamics, but it is motion itself that condenses to matter. Motion has the property of velocity, and this relates to distance and time. When these are self-contained they convert to size, and size is an absolute quantity.

The motion of particle formation is not consumed, it is converted to self-containment. This does two things which are responsible for matter's origin and evolution. Self-containment **detaches** particles from the medium and shifts **interaction** to other particles. And the contained structural motion **generates** fields in the surrounding medium which holds particles in suspension and creates the electric and gravitational field environment from which atoms and **gravitational systems evolved**.

Fields are from the structural motion of particles.

A field is a condition generated in the surround medium by structural motion, and this limits the types that can be generated. There are apparently only two types of fields: the electric field that involves **the tension of the medium**; and gravitational fields which are **deformations or reverberations** in the surrounding medium. The incredible weakness of gravity in comparison to electromagnetism,is very well known.. According to the force concept both forces **decrease** by the square of the distance, but the span between them is enormous. The **electric force** between an electron and a proton according to Coulomb's law is *e2/r2,* while the force of gravity between them by Newton's law is *Gmemp/r2*. The ratio, therefore, is *e2/Gmemp,* and the numerical difference is 2.3 X 1039. This is an enormous number. It takes forty digits to write in full. So weak is gravity in comparison to electromagnetism that if a hydrogen atom were held together by gravity it would be nearly as large as the universe.

Both forces follow the inverse square rule, but there is a distinct difference between gravity and electromagnetism. For every positive charge in the universe there is a negative one. The gravitational field, which is neutral and unconsumed, extends indefinitely, whereas the electric field, because it has an opposite counterpart, is always interrupted. Atoms are formed, and the entire electric fields of the electrons and protons are contained within the confines of the neutral atom. Their gravitational fields, on the other hand, being un reactive, extend in all directions to the far reaches of the universe.

Gravity and electromagnetism appear so extremely different in strengths; therefore, simply because of the way they are measured. We aren't measuring whole fields, we are **measuring an imaginary attraction** on a line between two points. The material world, however, is made up of compositions, not a skeletal frame of forces. The entire electromagnetic field of two opposing charges is **contained** within a neutral atom, while their gravitational fields extend out indefinitely**. To encompass the entire gravitational** field the electron would have to orbit out on the edge of the universe. In an elementary particle, therefore, there apparently is no difference in the amount of gravity and electromagnetism is produced. And because fields are produced from structural motion these may be the only fields in actuality.

The structural "forces"

When matter originated it had in its formation the potential for its evolution to the immense diversity we witness today. The giant steps of this evolution are the three tiers of the **hierarchy - particles, atoms, and gravitational systems. Evolution follows a path that has the greatest potential for diversity**. There are two principal procedures for the structure of matter that give this maximal potential: Form a structure on an expandable pattern so that a large variety can be assembled from only a few types of basic constituents. Form a structure which can couple with similar structures to give a variety of combinations. The result of these procedures is best shown from the structures of atoms. From only three basic constituents - protons, neutrons, and electrons - over 100 kinds of atoms are **formed. Furthermore, the orbital structure allows atoms to interact with each other to form the vast number** of organic and inorganic molecules. The formation of particles apparently followed the same pattern with different constituents. Since particles are the initial form of matter in the crossover from non-materiality, the constituents of particles must be without the basic properties of matter: mass and charge. Aside from the pre-material medium itself, only three things are known that have no mass or charge. They are photons, neutrinos, and fields. Since fields seem inappropriate, particles presumably have a structure consisting of **photons and neutrinos. In this way particles are in compliance with the same conditions of evolution as atoms.**

That nature created a unique force at each level of its development seems extremely improbable. Instead of nature being held together by a battery of unrelated forces it is more likely that this theory is the result of an over-extension of a particular way of solving problems.

Consider the **strong nuclear force**. This **interaction** is regarded by the virtual particle theory as an exchange of pions traveling at the speed of light back and forth between nucleons. The bonding has a maximum strength at the distance of one fermi (10-13 cm). At 1.4 fermi it is one-third the maximal strength, and at a distance of 4.2 fermis its attraction is so small as to be negligible. The force is an attraction up to 1.7 fermis, and repulsion closer than 0.7 fermi.

The **strong nuclear force** seems to have no relationship with the electrostatic force or gravity, which diminish by the square of the distance and extend indefinitely. Nor does it seem related to the **weak interaction**, which plays a more subtle role in the interaction between particles. The force is an exchange of pions over a distance approximately no more than the size of protons and neutrons. The attraction decreases rapidly with separation and becomes a repulsion if the distance is too short. This description is not that of an exchange particle bouncing back and forth, but rather a structural particle encircling more than one nucleus.

The circumstances associated with the strong nuclear force have a striking similarity to another bonding condition which is quite common and not attributed to any special force of nature whatsoever. When two hydrogen atoms, each with a single orbiting electron and spins opposite from the other, come together, they combine with the liberation of heat and the formation of the H2 molecule.

At large distances the system consists of two isolated hydrogen atoms which do not interact with each other. But as the atoms come closer they experience an attraction which gradually leads to an energy minimum. At the inter nuclear distance of 0.74 angstrom the attractive energy is about 104 kcal/mole of H2 and the system is at its most stable state. Any attempt to force the atoms closer results in an increase in the electrostatic repulsion of the nuclei and eventually leads to the repulsion exceeding the attraction.

The existence of the energy minimum is directly responsible for the stability of the hydrogen molecule. When the two hydrogen atoms come together the electron density is spread over the entire volume of the molecule instead of being confined to a particular atom. The nuclei remain separate but the electrons are paired and encircle both nuclear centers. There is no new force of nature involved. The electrostatic attraction of the electron to the nuclear proton is the same attraction each electron has for the other nucleus. Increasing the volume available to an electron decreases its kinetic energy, and in this way imparts stability to the system. But in consolidating the electrons' motions to incorporate both nuclei there is an overall savings of encapsulated space and a reduction in kinetic energy, which is radiated as heat.

The electromagnetic force that is responsible for the structure of the atom is the same force that is responsible for the binding of atoms by consolidating the action of a mutual component of their structures. The fusing of protons is analogous to the combining of hydrogen atoms. Pions form the outer shell of protons and neutrons, and they become the exchange particle by encircling both nuclei of the bonded particles. The strong nuclear force, therefore, is not a new force to be added for the fusing of protons and neutrons, it is a structure consolidation. Whatever is responsible for the complex structure of protons and neutrons is likely to be the same bonding mechanism used in coupling nucleons. There is in this analogy an important clue to the structure of particles. When protons and neutrons fuse there is a loss in the overall mass, and that mass is converted to energy by the equation $E = mc2$.The **weak interaction** seems to be completely misplaced in the scheme of things. It occurs in beta decay where the emission of an electron is accompanied by the emission of an antineutrino, the emission of a positron by that of a neutrino. In 1934 Enrico Fermi likened beta emission to the photon emission from atoms. This, however, is a questionable analogy. Certainly it has not led to a structural model for particles that is consistent with a hierarchy of matter. Beta decay is actually analogous to the transmutation of atoms. When an atom gains or loses a proton the element changes. When a particle loses a neutrino or antineutrino the identity of the particle changes. We need now to bear in mind that the **weak interaction** does not extend beyond the size of a particle. That is to say, the interaction is confined entirely within the confines of the particle. If the strong force in fusing of nucleons is analogous to the coupling of atoms, the weak nuclear force is analogous to neutral atoms having their electric fields confined entirely within the atom. The properties of **the strong nuclear and weak nuclear interactions** strongly suggest that they are structural forces. The quarks model for particles, however, bears no resemblance to a structure which would accommodate these forces in a simple arrangement.

GRAVITATIONAL LENSING

A **gravitational lens** refers to a **distribution** of matter (such as a cluster of galaxies) between a distant source (a background galaxy) and an observer, that is capable of **bending** (lensing) the light or electromagnetic radiation from the source, as it travels towards the observer. This effect is known as gravitational lensing and is one of the predictions of Albert Einstein's General Theory of Relativity Surface around a massive object (such as a galaxy cluster or a black hole) is curved, and as a **result** light rays from a background source (such as a galaxy) **propagating through spacetime**(medium) are bent. The lensing effect can magnify and distort the image of the background source.

Unlike an optical lens, maximum 'bending' **occurs** closest to, and minimum 'bending' furthest from, the center of a gravitational lens. Consequently, a gravitational lens has no single focal point, but a focal line instead. If the (light) source, the massive lensing object, and the observer lie in a straight line, the original light source will appear as a ring around the massive lensing object. If **there is any misalignment the** observer will see an arc segment instead. This phenomenon was first mentioned in 1924 by the St. Petersburg physicist Orest Chwolson and quantified by Albert Einstein in 1936. It is usually referred to in the literature as an **Einstein ring**, since Chwolson did not concern himself with the flux or radius of the ring image. More commonly, where the lensing mass is complex (such as galaxy groups and clusters) and does not **cause** a spherical **distortion of space–time**, the source will resemble partial arcs scattered around the lens. The observer may then see multiple distorted images of the same source; the number and shape of **these depending** upon the relative positions of the source, lens, and observer, and the shape of the gravitational well of the lensing object.

There are three classes of gravitational lensing:

1. Strong lensing: where there are easily visible distortions such as the formation of Einstein rings, arcs, and multiple images.

2. Weak lensing: where the distortions of background sources are much smaller and can only is detected by analyzing la**rge numbers of sources to find coherent distortions of only a few percent. The lensing shows up statistically as a preferred** stretching of the background objects perpendicular to the direction to the center of the lens. By measuring the shapes and orientations of large numbers of distant galaxies, their orientations can be averaged to measure the shear of the lensing field in any region. This, in turn, can be used to reconstruct the mass distribution in the area: in particular, the background distribution of dark matter can be reconstructed. Since galaxies are **intrinsically elliptical and the weak** gravitational lensing signal is small, a very large number of galaxies must be used in these surveys. These weak lensing surveys must carefully avoid a number of important sources of systematic error: the intrinsic shape of galaxies, the tendency of a camera's point spread function to distort the shape of a galaxy and the tendency of **atmospheric seeing to distort images must be understood and care**fully accounted for. The results of these surveys are important for cosmological parameter estimation, to better understand and improve upon the Lambda-CDM model, and to provide a consistency check on other cosmological observations. They may also provide an important future constraint on dark energy.

3. Microlensing: where no distortion in shape can be seen but the amount of **light received** from a background object **changes** in time. The lensing object may be stars in the Milky Way in one typical case, with the background source being stars in a remote galaxy, or, in another case, an even more distant quasar. The effect is small, such that (in the case of strong lensing) even a galaxy with a mass more than 100 billion times that of the sun will produce multiple images separated by only a few arcseconds. Galaxy clusters **can produce** s**eparation**s of several arc minutes. In both cases the galaxies and sources are quite distant, many hundreds of megaparsecs away from our Galaxy.

Gravitational lenses act equally on all kinds of electromagnetic radiation, not just visible light. Weak lensing effects are being studied for the cosmic microwave background as well asgalaxy surveys. Strong lenses have been observed in radio and x-ray regimes as well. If a strong lens produces multiple images, there will be a relative time delay between two paths: that is, in one image the lensed object will be observed before the other image.

According to general relativity, mass **"warps**" space–time to create gravitational fields and therefore bend light as a result. This theory was confirmed in 1919 during a solar eclipse, when Arthur Eddington observed the light from stars passing close to the sun was slightly bent, so that stars appeared slightly out of position.

Einstein realized that it was also possible for astronomical objects to bend light, and that under the correct conditions, one would observe multiple images of a single source, called a **gravitational lens** or sometimes a **gravitational mirage**.However, as he only considered gravitational lensing by single stars, he concluded that the phenomenon would most likely remain unobserved for the foreseeable future. In 1937, In the 1980s, astronomers realized that **the combination** of CCD imagers and computers would allow the brightness of millions of stars to **be measured** each night. In a dense field, such as the galactic center or the Magellanic clouds, many microlensing events per year could potentially be found. .

Explanation in terms of space–time curvature

In general relativity, light **follows** the curvature of spacetime, hence when **light passes** around a massive object, it is bent. This means that the light from an object on the other side will be bent towards your eye, just like an ordinary lens. Since light always moves at a constant speed, lensing **changes t**he direction of the velocity of the light, but not the magnitude. Light rays are the boundary between the future, the spacelike, and the past regions. The gravitational attraction can be viewed as the motion of undisturbed objects in a background curved *geometry* or alternatively as the response of objects to a *force* in a flat geometry. The angle of deflection is:

$$\theta = \frac{4GM}{rc^2}$$

toward the mass *M* at a distance *r* from the affected radiation, where *G* is the universal constant of gravitation and *c* is the speed of light in a vacuum.

Due to the high frequency used, the chances finding gravitational lenses increases as the relative number of compact core objects (e.g. Quasars) are higher (Sadler et al. 2006). This is important as the lensing is easier to detect and identify in simple objects compared to objects with complexity in them. This search involves the use of interferometric methods to identify candidates and follow them up at higher resolution to identify them. Full detail of the project is currently under works for publicationWherever there is electricity, there are also electric and magnetic fields, invisible lines of force created by the electric charges. Electric fields result from the strength of the charge while magnetic fields result from the motion of the charge, or the current. Electric fields are easily shielded: they may be weakened, distorted or blocked by conducting objects such as earth, trees, and buildings, but magnetic fields are not as readily blocked. Electric charges with opposite signs (positive and negative) at-tract each other, while **charges with the same sign repel each other. The forces of attraction and repulsion create electric fields whose strength is related to "voltage" (electrical pressure). These forces of attraction or repulsion are carried through space from charge to charge by the electric field. The electric field is measured in volts per meter (V/m) or in kilovolts per meter (kV/m). A group of charges moving in the same direction is called an "electric current." When charges move they create additional forces known as a "magnetic field." The strength of a magnetic** field is measured in "gauss" (G) or "tesla" (T),while the electric current is measured in "amperes" (amps).The strength of both electric and magnetic fields decrease as one moves away from the source of these fields.

It is pointed out that Special Relativity **together** with the principle of **causality implies** that the gravity of an electromagnetic wave is an **accompanying** gravitational wave **propagating** with the same speed. Since a gravitational wave **carries** energy momentum, this **accompanying** wave would make the energy-stress tensor of the light to be **different** from the electromagnetic energy-stress tensor, and thus can **produce** a geodesic equation for the photons. Moreover, it is found that the appropriate Einstein equation must additionally have the photonic energy-stress tensor **with** the **antigravity coupling** in the source term. This would correct that, in disagreement with the calculations for the bending of light, **existing solutions of gravity for an electromagnetic wave, is unbounded**. This rectification is confirmed by calculating the gravity of electromagnetic plane-waves. The gravity of an electromagnetic wave is indeed **an accompanying** gravitational wave. Moreover, these calculations show the first time that Special Relativity and General Relativity are compatible because the physical meaning of coordinates has been clarified.

The physical basis of Special Relativity is constancy of the light speed, **which is also** the velocity of an electromagnetic wave . On the other hand, the physical basis of quantum mechanics is that light can be considered as **consisting o**f the photons . However, since constancy of the light speed and the notion of photon are two aspects of the same physical phenomenon, from the viewpoint of physics, a theoretical **connection** of these notions must exist.

Moreover, such a connection would be a key to understand the relationship between these two theories. Fact that a photon follows the geodesic of a mass less particle manifests that there is a **connection** between the light speed and the photon. This suggests that General Relativity may provide some insight on the existence of the photons. In other words, the existence of the photons, though an observed fact, may be theoretically necessary because the light speed is the maximum. On the other hand, since **electromagnetism is a source for gravity** ,(gravity is produced by electromagnetism) an electromagnetic wave would **generate** gravity. Thus, it is natural to ask whether its gravity is **related** to the existence of the photon. In other words, would the existence of the photon be an integral part of the theory of General Relativity? In fact, this is also a **consequence** of Special Relativity provided that the theoretical framework of General Relativity is valid. Special Relativity and the accompanying gravity of an electromagnetic wave. In a light ray, the mass less light energy is **propagating** in vacuum with the maximum speed c. Thus, the gravity **due to** the light energy should be distinct from that **generated by** massive matter . Since a field **emitted** from an energy density unit (loses) means a non-zero velocity relative to that unit, **gains.**

ELECTROMAGNETIC FORCE

ASSUMPTIONS:

TOTAL EMF in the universe is classified into three categories;

Category 1 representative of the first interval 1 vis- à-vis category 1 of GF

Category 2 (second interval) comprising of EMF in the universe corresponding to category 2 of GF regimentation

Category 3 constituting EMF belonging to higher age than that of category 1 and category 2. This is concomitant to category 3 of GF classification. In this connection, it is to be noted that there is no sacrosanct time scale as far as the above pattern of classification is concerned. Any operationally feasible scale with an eye on the GF AND EMF EXTANT AND EXISTENTIAL IN THE UNIVERSE would be in the fitness of things. For category 3. “Over and above” nomenclature could be used. Similarly, a “less than” scale for category 1 can be used.

The speed of growth of EMF under category 1 is proportional to the speed of growth of EMF in the universe under category 2. In essence the accentuation coefficient in the model is representative of the constant of proportionality between EMF under category 1 and category 2 this assumptions is made to foreclose the necessity of addition of one more variable, that would render the systemic equations unsolvable

Reduction of electromagnetic force in the corresponding category in all the three categories is attributable to the following two phenomenon :

Aging phenomenon: The aging process leads to transference of the that part of the emf corresponding to expanding universe namely concomitant space to the next category, no sooner than the age of the GF in that part of the universe which is aged crosses the boundary of demarcation.

Depletion phenomenon: REDUCTION OF EMF vis- à-vis GF, .Model makes allowance for new SOURCES OF EMF also which continually come thereby counterpoising such a “loss”

NOTATION :

G_{13} : EMF corresponding the GF in category1

G_{14} : EMF corresponding to the GF in category 2

G_{15} :EMF corresponding to GF in category 3

$(a_{13})^{(1)}, (a_{14})^{(1)}, (a_{15})^{(1)}$: Accentuation coefficients

$(a'_{13})^{(1)}, (a'_{14})^{(1)}, (a'_{15})^{(1)}$: Dissipation coefficients

FORMULATION OF THE SYSTEM :

In the light of the assumptions stated in the foregoing, we infer the following:-

(a) The growth speed in category 1 is the sum of a accentuation term $(a_{13})^{(1)}G_{14}$ and a dissipation term $-(a'_{13})^{(1)}G_{13}$, the amount of dissipation taken to be proportional to the concomitant category of GF in the universe which has been classified depending upon the age.

(b) The growth speed in category 2 is the sum of two parts $(a_{14})^{(1)}G_{13}$ and $-(a'_{14})^{(1)}G_{14}$ the inflow from the category 1 ,

(c) The growth speed in category 3 is equivalent to $(a_{15})^{(1)}G_{14}$ and $-(a'_{15})^{(1)}G_{15}$ dissipation, or the slowing down of the pace EMF PRODUCTION It may also be due to transformation of one type of energy in to another. which accentuates the "loss* or "gain" depending upon the creation or destruction of matter which is to be noted is taking place simultaneously.

GOVERNING EQUATIONS:

The differential equations governing the above system can be written in the following form

1

$$\frac{dG_{13}}{dt} = (a_{13})^{(1)}G_{14} - (a'_{13})^{(1)}G_{13}$$

2

$$\frac{dG_{14}}{dt} = (a_{14})^{(1)}G_{13} - (a'_{14})^{(1)}G_{14}$$

3

$$\frac{dG_{15}}{dt} = (a_{15})^{(1)}G_{14} - (a'_{15})^{(1)}G_{15}$$

$(a_i)^{(1)} > 0 \quad , \quad i = 13,14,15$ 4

$(a'_i)^{(1)} > 0 \quad , \quad i = 13,14,15$ 5

$(a_{14})^{(1)} < (a'_{13})^{(1)}$ 6

$(a_{15})^{(1)} < (a'_{14})^{(1)}$ 7

We can rewrite equation 1, 2 and 3 in the following form

8

$$\frac{dG_{13}}{(a_{13})^{(1)}G_{14} - (a'_{13})^{(1)}G_{13}} = dt$$

9

$$\frac{dG_{14}}{(a_{14})^{(1)}G_{13} - (a'_{14})^{(1)}G_{14}} = dt$$

Or we write a single equation as

10

$$\frac{dG_{13}}{(a_{13})^{(1)}G_{14} - (a'_{13})^{(1)}G_{13}} = \frac{dG_{14}}{(a_{14})^{(1)}G_{13} - (a'_{14})^{(1)}G_{14}} = \frac{dG_{15}}{(a_{15})^{(1)}G_{14} - (a'_{15})^{(1)}G_{15}} = dt$$

The equality of the ratios in equation (10) remains unchanged in the event of multiplication of numerator and denominator by a constant factor.

For constant multiples α ,β ,γ all positive we can write equation (10) as

$$\frac{\alpha dG_{13}}{\alpha\left((a_{13})^{(1)}G_{14}-(a'_{13})^{(1)}G_{13}\right)}=\frac{\beta dG_{14}}{\beta\left((a_{14})^{(1)}G_{13}-(a'_{14})^{(1)}G_{14}\right)}=\frac{\gamma dG_{15}}{\gamma\left((a_{15})^{(1)}G_{14}-(a'_{15})^{(1)}G_{15}\right)}=dt$$ 11

$\alpha_i G_i+\beta_i G_i+\gamma_i G_i=C_i e_i{}^{\lambda_i t}$ Where $i=13{,}14{,}15$ and C_{13},C_{14},C_{15} are arbitrary constant coefficients.

STABILITY ANALYSIS :

Supposing $G_i(0)=G_i^0(0)>0$, and denoting by λ_i the characteristic roots of the system, it easily results that

1. If $(a'_{13})^{(1)}(a'_{14})^{(1)}-(a_{13})^{(1)}(a_{14})^{(1)}>0$ all the components of the solution, i.e all the three parts in the expanding universe tend to zero, and the solution is stable with respect to the initial data.

2. If $(a'_{13})^{(1)}(a'_{14})^{(1)}-(a_{13})^{(1)}(a_{14})^{(1)}<0$ and $\left(\lambda_{14}+(a'_{13})^{(1)}\right)G_{13}^0-(a_{13})^{(1)}G_{14}^0\neq 0,(\lambda_{14}<0)$, the first two components of the solution tend to infinity as $t\to\infty$, and $G_{15}\to 0$, ie. The category 1 and category 2 parts grows to infinity, whereas the third part category 3 tend to zero

3. If $(a'_{13})^{(1)}(a'_{14})^{(1)}-(a_{13})^{(1)}(a_{14})^{(1)}<0$ and $\left(\lambda_{14}+(a'_{13})^{(1)}\right)G_{13}^0-(a_{13})^{(1)}G_{14}^0=0$ Then all the three parts tend to zero, but the solution is not stable i.e. at a small variation of the initial values of G_i, the corresponding solution tends to infinity.

From the above stability analysis we infer the following:

1. The adjustment process is stable in the sense that the system of system of emf in the expanding universe converges to equilibrium.

2.The approach to equilibrium is a steady one , and there exists progressively diminishing oscillations around the equilibrium point

3.Conditions 1 and 2 are independent of the size and direction of initial disturbance

4.The actual shape of the time path of EMF PRODUCTION is determined by efficiency parameter , the strength of the response of the portfolio in question, and the initial disturbance

5. Result 3 warns us that we need to make an exhaustive study of the behavior of any case in which generalization derived from the model do not hold.

6. Growth studies as the one in the extant context are related to the systemic growth paths with full employment of resources that are available in question.

7. It is to be noted some systems pose extremely difficult stability problems. As an instance, one can quote example of pockets of open cells and drizzle in complex networks in marine stratocumulus. Other examples are clustering and synchronization of lightning flashes adjunct to thunderstorms, coupled studies of microphysics and aqueous chemistry.

GRAVITY

Tidal forces exerted on any system grow utterly extreme so that elementary particles and quarks in hadrons **become** disassociated as r ! 0. From the perspective of an external observer any object which **approaches** the horizon **slows down** and the radiation it **emits** becomes enormously redshifted so it effectively disappears. The external observer witnesses the object become irreversibly absorbed by the event horizon. It can never be reconstituted. The exterior observer is unable to access information from within the black hole. Yet the Bekenstein and Hawking results indicate the mass-energy, charge and angular momentum interior to a black hole may quantum tunnel to the outside as radiation.Susskind, Thorlasicus, and Ulgum demonstrated how transverse modes of a string are preserved on the stretched horizon[1], and this defines a world hologram [2]. The string becomes distended across the event horizon of the black hole as high frequency modes become observable to the exterior observer. The black hole in an anti de Sitter spacetime is perfectly stable and the field theoretic information held by the black hole is preserved on the horizon. This indicates that quantum **mechanics** obtains in black hole physics and that information which enters a black hole is preserved and **converted** into another form in Hawking radiation. Hawking radiation manifests itself away from the event horizon, but information preservation indicates the horizon is not a perfect classical membrane. The horizon is a null surface with a quantum uncertainty which permits information interior to a black hole to escape. The black hole interior is then in some form accessible to exterior observers. A distant observer sees quantum **oscillations of objects approaching the black hole become extremely red shifted as objects are absorbed** onto the horizon. Since the event horizon exhibits uncertainty fluctuations the quantum modes tied to the event horizon are **correlated** with the field theoretic content in the interior. This will **become** increasingly the case as the black hole **smaller** and approaches the Planck mass. Hence the event horizon is not a complete black membrane of ignorance to the outside. The field theoretic information on the event horizon is correlated quantum mechanically with quantum information interior to the black hole. The mysterious singularity of a black hole accessible to an observer who falls inward is **related** by some quantum Complementarity to **information absorbed** on the event horizon as detected by the exterior observer. A string which approaches singularity will become distended by the Weyl curvature terms and increase the string tension. The change in the string dynamics then has some relationship to the string dynamics as observed by an external observer on the stretched horizon. The critical difference between the two cases is that the string approaching the singularity has a rapidly **changing** tension, and this tension t1 associated with the D1-brane shares a duality with the NS5-brane, or so called black brane. This physics is then explored to examine whether there exist duality principles for quantum information and black holes. As a closed the string approaches the singularity it is transformed into an open string. The string is then dual to a D5-brane, and associated with a rank two tensor tensor for a two-form. With the **disappearance of**1the closed string the open strings assume tachyon properties which **form a** condensate. The **gravitational modes** which vanish t**ransform** into a condensate of tachyons that define an M2-brane. The M2-brane obeys anyonic statistics and exhibits quantum criticality similar to graphene. In the duality principle advanced dual fields which obey E8 £ E8 also exhibit a quantum phase transition. It is then advanced that this transition is what Einstein elected some properties of the observable universe from the string landscape.

This black hole duality is between an event horizon of spacetime and a type of quantum horizon, the

M2-brane identified with the interior singularity. A Complementarity principle between these two means some limited information is available concerning the interior of a quantum black hole. This limited information available **defines** the total quantum information of a black hole, as well as a cosmology, and the C**omplementarity** principle conserves quantum information.

Gravity and strings

The string in a gravity field in a gravity field will have its dynamics influenced by the curvature of spacetime across the string. A string parameterized according to its length sweeps out a world sheet of evolution. The string has a classical description, the motion of a body through this parameterized space, plus quantum modes which pertain to particular quantum modes. These quantum modes are similar to the vibration harmonics on a piano or guitar string. It is not difficult to determine the kinetic energy of the string, which is a **summation** of the square of the vibration velocities for each mode. For a string in a **gravity field** the vibration modes are perturbed. If the curvature of spacetime is significant over the length of the string the modes of the string are adjusted. The curvature might be thought of as increasing the tension along the string which raises the frequency of the vibration modes. This is analogous to tuning the pitch of a musical instrument to a sharper note by increasing the tension on a string. The motion of the string will contain a first order term, which is a frame dependent connection term that may be eliminated, and a second order term depending upon the curvature. The string world sheet of the string is similarly **adjusted** by gravity.A string approaching a black hole is observed by a distant observer to exhibit a time dilation. The periodicity of quantum oscillations is observed to **increase** to infinity as the string asymptotically reaches the horizon. Just as a longer string has a lower pitch, the string as observed by the distant observer becomes elongated and winds around the event horizon of the black hole This fact also indicates how the blackhole exhibits a holographic effect with quantum field theory According to an observer who falls in with the string, on a commoving reference frame, the string behaves in a completely different manner. For the spacetime curvature near the black hole much smaller than the reciprocal of the length of the string squared, the string changes little. The commoving observer detects no change in the string dynamics until the interior singularity is approached. The string is observed to have entirely different dynamics according to the wise observer who remains outside the black hole and the foolish observer who falls in with the string. The infilling observer will detect the **elongation** of the string due to tidal acceleration. **Tidal accelerations** are due to the existence of the **Weyl curvature**. In four dimensions a spacetime may be flat according to the standard Ricci curvature, but may exhibit an obstruction to conformal flatness, which is the source of tidal forces. The Weyl curvature is a tensor Cabcd which classifies spacetimes according to eigenvectors which satisfy the eigenvalued equation

Following points are collated, consummated, consolidated, consubstantiate from various sources primarily from The Quantum cosmos and Micro Universe Black Holes, Gravity, Elementary Particles, Creation and Destruction Of Matter (**Rhawn Joseph, PhD**)-We are extremely grateful for the author for such a scintillating and brilliant essay which made life slightly easier and tantalizing photographs of elementary particles and fundamental forces coordination with the medium of exchange which is reproduced herein below) and various other erudite and eminent articulators and thinkers like Bohr, 1934; DeWitt and Graham, 1973; Heisenberg 1930, 1955; von Neumann 1937, 1938, 1955 Drell and Yan, 1970; Eichten et al., 1983; Glasser and Leutwyler, 1985; Halzen and Martin 1985; Weinberg, 1967; Wilson, 1974), and bosons (Lee et al., 1977; Higgs, 1966). Shibata and Nakamura 1995

We write to state that the symbol (e) stands for engulf and (eb) stands for engulfed by. This is done for better comprehension of the postulation alcovishness even for a reader who does not have advanced knowledge of Quantum Mechanics. And that reassures many of the apprehensions that doggedly pursued the authors which turned in to dialectic deliberation and confrontational argumentation, and conjugatory confatalia, polemical conversation!

Universe continually recycles energy and mass at both the subatomic and macro-atomic level, thereby (e) destroying and then reassembling atoms, molecules, stars, planets and galaxies (Joseph 2010)

(2) Mass, molecules, atoms, protons, electrons, and elementary particles are continually created and destroyed, (e and eb) resulting in (eb) recycling of energy and mass

(3) matter and energy, including hydrogen atoms, are continually recycled and recreated(e and eb) by super massive black holes and quasars at the center of galaxies, and via infinitely small *gravity holes* also known as "black holes", "Planck Particles", "Graviton Particles", and "Graviton-holes." resulting in the recycling of energy and mass

(4)Holes smaller than a Planck length consist (e) of graviton particles and gravity waves and are a source (eb-produce) of infinite gravity.

(5)In local space graviton-holes counter balance (e) the gravitational pull of entire planets, thus giving rise (eb) to the false impression that gravity is weak.

(6)These holes are formed (eb-produced) by the liberation and radiation of electromagnetic energy and elementary particles which results(eb) in the breakdown and compression of photons, protons, electrons... with the compressed remnant contributing to the gravity-mass of the *hole(+)*

(7) The deflected energy acts to bind together (e and eb) liberated quarks and leptons to form (eb) protons and electrons,

(8)This deflected energy leads (eb) to the simplest and lightest of all atoms, hydrogen

(9) life(e) hydrogen and is essential (eb-produced) for the creation of stars which emit (eb)photons which are captured, whittled down, compressed, collapsed(e) and their energy expelled (eb)by gravity-holes, and which leads to the creation(eb) of hydrogen, and thus the cycle repeats itself again and again.

(10) The cosmos is infinite, eternal, and has no beginning and no end. What we call the "known" universe is an insignificant micro-macro-molecular micro-universe (eb) among infinity of micro-universes.

The Quantum Micro-Universe

(11) Electron is a composite of infinite space within which interacts a family of **elementary particles** INTERACTS (E AND EB) WITH energies (Bohr, 1934; Heisenberg 1930, 1955; Weinberg, 1967).

(12) Quantum mechanics tells us that matter consists (e) of elementary particles, such as quarks and leptons (Drell and

Yan, 1970; Eichten et al., 1983; Glasser and Leutwyler, 1985; Halzen and Martin 1985; Weinberg, 1967; Wilson, 1974), and bosons (Lee et al., 1977; Higgs, 1966).

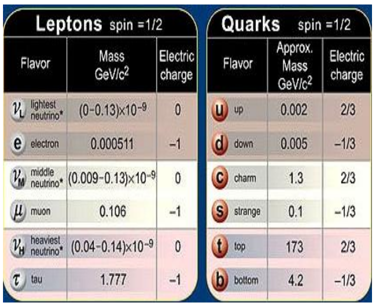
(13) Two quarks make (eb-produce) hadrons (protons, neutrons).

(14) Families of leptons create (eb) electrons.

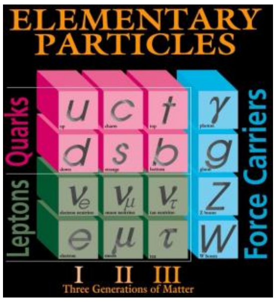
(15) Bosons mediate the weak nuclear force through which (along with two other fundamental forces: gravity and electromagnetism) leptons and quarks interact (e and eb) (Eisberg and Resnick, 1985; O'Reilly, 2002).

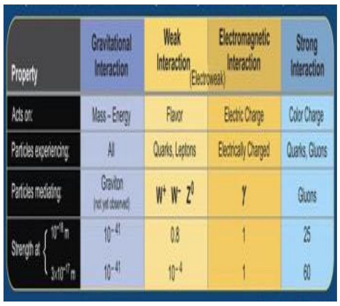
(16)Infinite space is the basic construct (eb) of matter,

(17) Space is divisible (e and eb) forever without ever reaching the end.



Leptons spin =1/2			Quarks spin =1/2		
Flavor	Mass GeV/c²	Electric charge	Flavor	Approx. Mass GeV/c²	Electric charge
ν_L lightest neutrino*	$(0-0.13)\times10^{-9}$	0	u up	0.002	2/3
e electron	0.000511	–1	d down	0.005	–1/3
ν_M middle neutrino*	$(0.009-0.13)\times10^{-9}$	0	c charm	1.3	2/3
μ muon	0.106	–1	s strange	0.1	–1/3
ν_H heaviest neutrino*	$(0.04-0.14)\times10^{-9}$	0	t top	173	2/3
τ tau	1.777	–1	b bottom	4.2	–1/3





Property	Gravitational Interaction	Weak Interaction (Electroweak)	Electromagnetic Interaction	Strong Interaction
Acts on:	Mass – Energy	Flavor	Electric Charge	Color Charge
Particles experiencing:	All	Quarks, Leptons	Electrically Charged	Quarks, Gluons
Particles mediating:	Graviton (not yet observed)	W^+ W^- Z^0	γ	Gluons
Strength at 10^{-18} m	10^{-41}	0.8	1	25
Strength at 3×10^{-17} m	10^{-41}	10^{-4}	1	60

(18)It is through this infinite space that quarks and leptons interact (e and eb)via electromagnetic nta) and particles (photons).

(19) photons have a discrete energy which is dependent on its= k(frequency)(Eisberg and Resnick, 1985; O'Reilly, 2002).

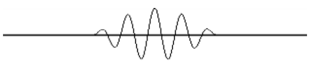
(20)Quanta and photons in fact share certain properties and posses a particle-wave duality in which they are neither one nor the other. Therefore, it could also be said that photons represent both a unity and a duality and e/eb –duality and unity is e(e/eb) such that it is "what it is not," and "is not what it is."

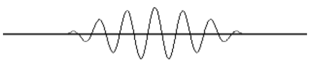
(21)This "to be or not to be" (SEPP)formulization is related to Heisenberg's (1955) "uncertainty principle" and provides insight into the nature of space-time within the infinite spaces through which quanta and photons necessarily must **pass and interact**.

(20)The Heisenberg (1955) uncertainty principle states that both the position and momentum of a particle cannot be known simultaneously. As a particle gives up information about its location,(e) information about its momentum (is lost).

(21) The more we know about one (e) (the less we know) knowledge about the about the other.

(22)whenever a particle assumes a precise position (e)momentum in that (IS LOST)





23)And whenever a particle is moving from one place to another,(e)specificity of location

Therefore, within this space-time, particles may have position or momentum, but not both (Bohr, 1934; Heisenberg 1930, 1955). This leaves us with at least three choices: 1) location is an illusion because everything is in motion (e) location is an illusion

(23) a particle has location whereas the wave has momentum, and/or 3) particles, including photons, are a particle/wave duality because they continually pass in and out of the infinite spaces of space-time, and this passage splits the wave from its particle (the wave being motion, the particle being location). Therefore, *something* about or within these infinite spaces splits (e and eb) singularities into dualities thus liberating (e of bondage) energy from the particle.

(24) Energy is equal to and binds (e and eb) together mass.

(25) Therefore, when energy (momentum) is liberated (e) it's associated particle-mass (location) no longer exists. (eb) momentum only

(26) When mass is liberated from its energy, (eb) all this is left is location, i.e. its *mass* which is gravity. Liberation of Mass from energy (e) gravity

(27) GTR e/eb UNCERTAINTY PRINCIPLE

(28)Infinite-Holes Within (eb) Infinite Space-Time

(29)Perception(e/eb) Reality

(30) Use of sense organs and instruments of measuring (e/eb) reality that one is in search of

(31)In the formalism of quantum mechanics, what we perceive as reality is best described (=)by a complex wave function whose characteristics consist of an infinite number of probabilities which may be calculated to determine(eb) the most probable outcome (Bohr, 1934; DeWitt and Graham, 1973; Heisenberg 1930, 1955; von Neumann 1937, 1938, 1955). Thus, for example, one can compute the probability of finding an electron in a particular location at a particular time and then make a prediction. However, the predicted outcome is just one of many. Various possibilities of outcome (e) the predicted outcome

(32) Quantum mechanics we face with an infinite number of possibilities within a sea of infinite space. Infinity is a basic construct (e) of quantum physics (von Neumann 19371938). From infinite possibilities arise quantum mechanics. Quantum mechanics (e) finite possibilities. Therefore, infinite possibilities yield (eb) uncertainty (e)finite possibilities. Infinite possibilities (e) certainty

(33) However, in between (e/eb) interactions (e/eb) the particle/photon/waves exist (eb) in another type of space-time; i.e. the infinite space *between interactions*. And within (eb) these infinite spaces are infinitely small holes in the fabric of space-time. Infinite space between interactions (e) particles/photons/waves. Infinite spaces (e) infinite holes.

Gravity-Holes

(34)Space is infinitely divisible (e/eb) into forever. **The sorting never ends at all. So you have infinite accounts in the General Ledger.**

(35)However, it is not a one way trip into eternity, if we accept some of the premises of particle physics (Griffiths 2008). Passageways may exist within these infinitely small spaces, which may lead (eb) to other dimensions (Appelquist and Chodos 1983; Aharony, et al., 2000; Greene 2003; Keeton and Petters 2005; Randall and Sundrum 1999) and thus to "other worlds" or another space-time (Hawking, 1988). Other dimensions (e) passageways within these infinitely small spaces. This is a case of financial embezzlement and fiscal misappropriation and which really leads to other worlds. Defalcation might land one in 'Jail' or 'cozy space and time' and such an action of omission and commission is tantamount to breaking the (e) rules and regulations of the institution. Well, institutionalization of breakage (e) 'Jail' or 'Punishment' and you may land in 'comfort and cozy zones. So infinite spaces have these zones in between them. .

(36)A singularity may exist on both sides of a *hole* in space-time, simultaneously, thereby creating duality from singularity. So singularity (e) duality and duality (e) singularity .An infinite number of holes would yield an infinite number of possibilities and would enable a *singularity* to have not just duality, but multiplicity via multiple dimensions existing on the other side of infinity of holes.

(37)In quantum physics, the smallest unit of space has a Planck length which is defined as 10^{-33} cm (Eisberg and Resnick 1985). Well this is one account that has minimum balance or if in positive world, or negative balance in the eventuality of the fact that I belongs to subterranean realm and ceratoid dualism of negative worlds.

(38)*Space* smaller than a Planck length, cannot be conceptualized by quantum mechanics or classical physics. **Geometry ceases to exist, Cartesian coordinates, x, y and z, cannot be applied, and time ceases to have meaning (Garay 1995). Spaces smaller than a Planck length (e) Geometry and time**

(39)Instead, a defining feature of these tiny spaces is gravity so powerful that it punches a *hole* in space-time. *Holes* may easily form within space smaller than a Planck length (Nouicer 2007; Scardigli 1999).Tiny spaces (eb) small holes. Small holes (e) tiny spaces

(40)According to General Relativity, associated (e and eb) to any mass *m* there is a length called the Schwarzschild radius, *Sr* such that compressing (e) the size radius etc.,) an object of mass *m*, to a size smaller than (eb) this radius *Sr*, generates (eb) tremendous gravity and immediately results (eb) in the formation (eb) of an infinitely small black hole in (eb) the fabric of space-time.

(41)Further, two lengths of the Schwarzschild radius, *Sr*, become (=)equal at the Planck length.

(42)Hence, an *object* with (=) a Planck mass and whose radius is less (eb) than the Planck length, would create (eb) a black hole. **What this also means is that gravity is extremely powerful in space smaller than a Planck length. According to General** Relativity, at least one *hole* may exist (eb) for every Planck length. Or,every Planck length (e) one black hole exists.

(43)Einstein's and Newton's theories of **gravity both predict that if mass is shrunk (e) to a subatomic space, its gravity will increase (+) and it will produce** (eb) black hole. In other words, Gravity (e) energy arising out of shrunk mass. Black hole produced (e) Increased gravity

.(44) **Likewise, quantum physics tells us that at the Planck length, coupled (e and eb) with the corresponding Planck energy (10^{19} GeV), that the gravitational forces between particles becomes incredibly powerful (Eisberg and Resnick 1985; Smolin, 2002).**

(45)Incredibly powerful gravity at the subatomic spaces (e) Couple of Planck length and Planck Energy.

(46)Because gravity becomes so powerful, these particles collapse and implode, liberating energy. Or, this liberated energy (e) powerful gravity arisen by implosion., and leaving behind(eb) only a concentrated mass of gravity.

(47) Or, concentrated mass of gravity (e) powerful energy produced by particle collision and implosion.

(48)Thus space-time, within the Planck scale, is subject to extreme uncontrollable quantum fluctuations, as if it is being bent, folded, crumpled, and torn apart by these powerful gravitational forces (Bruno, et al., 2001).So, this warping,woofing,wefting,clefting (e)power ful gravitational forces at the quantum scale.

(49)If elementary particles, including electrons, protons, or photons, were to interact with a Planck-sized object or *force* within a space smaller than a Planck length, or if they were to slam into a quark, lepton, electron, proton, or photon, this collision would release(eb) so much mass/energy/gravity it would immediately punch a *hole* in space-time. Or, mass energy, gravity released (- and +) due to collision between particles (e) space and time continuum,(to produce a hole)

(50) If these are actual holes in space-time, **what might pass through these holes**? The Planck length is 10^{-33} cm -- about 10^{-20} times the radius of a proton! Therefore, we can rule out protons, unless the proton is compressed or fractionated into its elementary particles, and this would occur only if stripped of its electromagnetic charge, leaving

only gravity in its wake, thereby causing it to collapse. As will be explained, this is exactly what happens: the energy associated with the particle's mass is stripped away and **defected back into space (+energy), along with liberated elementary particles. What is left is gravity which becomes the *hole*. So, Hole (e) Gravity. Hole is formed because of the gravitation in condensed form.**

(51)Einstein (1939) argued that because of the principles governing the speed of light, **particles could never enter the hole**. Thus, at the level of a black hole, a particle becomes (= or eb) a duality (Ahluwalia, 2000), with the gravity-mass of the particle disappearing (e) into and becoming the hole (location). Hole (e) gravity-mass of the particle. But with the electromagnetic energy associated (e and eb) with the particle being deflected and radiated (- and +) back into space (momentum). Space (=) (e) electromagnetic energy associated with the particle.

(52)However, the **mass** itself does not become (not=) the hole. Nor does **the particle** become (not=) the hole (Einstein 1939). **It is the gravity which holds the mass together (e/eb)which becomes (eb or =)the hole, i.e. a graviton (Joseph 2010). Hole (e) gravity which holds the matter together. Energy is related (e and eb) to matter. Thus, when energy** is stripped away and expelled, (e or -) that radiating energy (- and +) includes (e) "mass" (Hawking, 2005). The particles never enter the hole and this is because elementary particles are **no longer bound together due to the loss of gravity and energy. Loss of gravity and energy (e) association of the elementary particles. Instead, the particles are liberated and expelled back into space (Joseph 2010**).Space (e) particles that are disbanded.

(53)Therefore, only the gravitational aspect of the particle or the photon disappears (e) into and becomes (eb)the hole. Hole (e) gravitational aspect of the particle or the photon

(54) **Associated energy and dissociated particles (e) the gravitational aspect of the particle or the photon. They are left behind. The particle-wave duality becomes fragmented and indeterminate. In fact, at the Planck length the uncertainty principle and quantum indeterminacy becomes virtually absolute (Adler and Santiago, 1999; Maggiore 1993; Scardigli 1999).**

Gravitons and Gravity Holes

(55)As demonstrated by particle physics (Eisberg and Resnick, 1985; Green 2003; Griffiths, 2008), it is through (e and eb) these infinite spaces that particle-waves and the four fundamental forces interact, (e and eb) i.e. the electromagnetic force, the gravitational force, and the weak and strong interaction. Because they interact (e and eb) within these spaces, *holes* are continually forming (eb) in(e) spaces smaller than a Planck length. Interaction of these fundamental forces (eb) holes. **Holes (e) particle waves and four fundamental force interaction or rather the energy produced thereof.**

(56)Particles and energy interact (e and eb) within these infinite spaces because(e) of the gravity. In other words gravity (e) the particle waves and energy interaction through infinite spaces

(57)However, particles and energy also interact (e and eb) with the liberated energy and particles associated (e and eb) with the formation of these **graviton-holes**. They interact and recombine.

(58)In space smaller than a Plank length, matter is continually disassembled and reassembled.(e and eb) Holes (e) energy produced by interaction of particle waves and

(59) **Conventional wisdom is that "gravity is weak." However, according to quantum physics and General Relativity, at the Planck scale, within the space of a Plank length, the strength of gravity becomes equal to or even greater than the electromagnetic force and the weak and strong force (Smolin, 2002). Because of the strength of gravity within these infinitely small spaces, all the fundamental forces may be unified within the Planck length, thereby creating matter. The exact mechanism of this unification is triggered by the graviton-hole. That is, these forces interact, and become unified, precisely because of the tremendous gravity of these infinitely small gravity-laden holes which destroy matter and release energy and elementary particles which recombine to form new matter, beginning with the simplest of atoms, hydrogen (Joseph 2010; Joseph and Schild 2010).**

Holes in the Walls of Multiple Dimensions

(60)These infinitesimally small holes **within** the *walls* of these infinitely small spaces are directly responsible (e) for what is misperceived as the "weakness of gravity." According to conventional wisdom, because gravity is *weak* a single man, woman, or child, can overcome the gravitational pull of the entire Earth, and pick up small or large objects and walk about the face of the planet without being crushed to the ground.

(61)To account for the apparent weakness of gravity, Randall and Sundrum (1999) have proposed that gravity particles (gravitons) are leaking into an extra-dimensional space, from one space-time (or dimension) (-) to another dimension (+)via these holes. Randall and Sundrum's (1999) model would require at least one extra dimension, with some arguing for 9, 11, or more dimensions (Aharony, et al., 2000; Greene 2003; Keeton and Petters 2005).

(62)A number of scientists have proposed the possibility of additional dimensions which may be separated (e and eb) by membranes (branes) but which communicate (- and +) via infinitely small holes (Keeton and Petters 2005). Thus, instead of the 4 dimensions we associate (e and eb) with this reality, some have proposed 6, 9, 11 or more dimensions (Aharony, et al., 2000; Greene 2003; Keeton and Petters 2005), some of which are curled up (eb) within the 3 dimensions which make up this reality, and can be found (eb) in spaces smaller than a Plank length. If correct, then the extra-dimensions that exist within (eb) the space of a Planck length i.e. extra dimensions (e) space of quantum length) are not really part e (e and eb) of this space-time as characterized by the classic 4-dimensions be they Euclidian or Minkowskian. Instead, these tiny dimensions may belong (eb) to another space-time, or a different space and time than the one we live in (e) these tiny dimensions.

(63)However, alternative dimensions imply (eb) the existence (eb) of alternate realities and parallel universes which are linked (e and eb) to this space time via the passageways created (eb) by these infinitely small holes. Further, if these holes in the fabric of space time serve as passageways to "other worlds," then theoretically it is possible for energy, gravity, information, matter, men, women, and entire galaxies to pass from one reality and enter a parallel reality, via these holes, e.g. such as the super massive holes located in the center of spiral galaxies including the Milky Way.

(64)If these holes connect (e and eb) alternative realities, this could account why gravity appears weak, i.e. gravity is leaking (- and +) into another space-time reality (Keeton and Petters 2005; Randall and Sundrum 1999). **Or, it could explain why 95% of the mass of this universe appears to be missing; i.e. it exists in parallel dimensions which are on the other side of the branes (membranes) which separate this universe** from other parallel universes. These parallel universe, separated (e and eb) by branes, could therefore be considered a series of "bubble universes" which periodically bubble up(eb) from the theoretical quantum foam from which all existence may have its source. Bubble universes (e) theoretical quantum foam

(65)If there are parallel universes, then it could be predicted that they, in turn, are linked (e and eb) to yet other parallel universes, and this continues onward to infinity Whereas some of these extra-dimensions are believed to be curled (eb)up inside the 4 dimensions that make up our reality,('four dimensional real space and time' e' these other dimensions') it may be that these 4 dimensions are curled (eb)up inside yet other dimensions; and these too **continues onward for infinity**. However, this might also mean that our 4 dimensions our curled up in the infinitely small space of yet other dimensions making up other realities which are super-ordinant to our own.

(66)What predictions or assumptions can be made about these alternate realities and parallel universes, if they exist? First, time would not be parallel, **and time may not exist in some or all parallel universes. Note we are talking of multiverses attributable and ascribable to gravity at Planck Scale.**

*(67)**Time*** **is a dimension, not in Euclidian space, but in "Minkowski space**." Euclidian space consists of 4 spatial dimensions none of which encompass (e (e)) time, but (e) movement and geometric space. By contrast, "Minkowski space" is based on (e-i.e., the fons et origio) the concept of Special Relativity, and time is the 4th dimension. More specifically, 3 of the Euclidian dimensions of space are combined (e and eb) with a dimension of time thereby creating (eb)a four-dimensional manifold known as "space-time." For the model of space time continuum combination (e and eb)see Space- Time –Matter- Energy Part One

(68)This suggests that some alternative realities, if they exist (eb), might be timeless, particularly if they consist of 3 or fewer dimensions. Further, if these *holes* exist in space-time, then it can be assumed that time cannot be transported to other dimensions. The hole passes through (e and eb) space-time, not the other way around.

(69)**There are gravity-holes consisting entirely of gravity (Joseph 2010). Thus, there are no *holes* leading to other dimensions. There is only gravity. Gravity is the *hole***.

The "Weakness of Gravity" is figment of imagination and product of puerile prognostication and resultant orientationality of phantasmagoria.

(70)Gravity is so strong within these infinitely small spaces, which a hole is punched (eb) through space time. Holes in space and time (e) gravity like holes in glass panes are due to stones thrown at it. However, the gravitational force law tells us at scales below(eb) the Planck length the **force of gravity is enormous (Smolin, 2002**). By the very fact that gravity is so powerful within these spaces tells us that the gravity did not disappear into another dimension as proposed by Randall, Sundrum and others. Instead, the gravity must be bound up (e and eb) and concentrated within these holes. Therefore, the *hole* is not a hole in space time *per se* and is not really a hole at all, but is instead is a bundle of gravity. **And this concentrated gravity consists of *particles* i.e. the gravity particle known as the "graviton." The graviton particle is the hole**.

(71)Massive objects have gravity and interact (e and eb)via gravity through a gravitational field in much the same way that electromagnetism is communicated from one charged particle(-) to another(+) via a classical electromagnetic field (Smolin, 2002).

(72)In physics we know that any photon that enters (eb) a Planck-sized space would collapse (e) and create (eb) a particle (aka, a "Plank particle") . To put it in different language we can say that ‘Planck particle’ (e) the gobbled up and gormandized photon at the Planck Scale.

(73)This completely distorts (e and eb) the region of space (Sidharth 2001). The Planck particle has (e) gravity. Tremendous gravity is the defining (eb) feature of the *Planck particle* and of particles smaller than a Planck length (Smolin, 2002). Therefore, these holes and particles are best described and determined (eb)as a *gravity particle*,i.e. a graviton.

(74)In quantum theory (Eisberg and Resnick, 1985), the electromagnetic force involves an exchange (- and +) of a particle, the photon. **Therefore, quantum mechanics predicts the force of gravity must also be transmitted (-graviton from one to +graviton to another)via the exchange of a particle, a graviton (Deffayet et al., 2002). It is the exchange of gravitons which are responsible for Newton’s law of gravitational attraction.**

(75)Therefore, by combining (e and eb) classical physics with general relativity and quantum mechanics, we can deduce that ***gravity* may have a particle-wave duality**. Therefore, **gravity is a particle (a "graviton") and a "wave" of "magnetic force." Gravity waves are in fact predicted by Einstein's general relativity** (Hartle 2003) and their existence has been repeatedly confirmed (Arun et al., 2006; Hulse and Taylor 1974, 1975; Shibata and Nakamura 1995; Weisberg and Taylor 2004

(76) "Gravity waves" may be produced (eb) by gravity, or rather, by graviton-holes, as particles are stripped of their energy which is then expelled into space. Gravity (e) gravity waves or gravity (e) graviton holes or for that matter gravity (e) energy which is stripped off them.Infinitely small gravity holes and the *gravity waves* they radiate, which accounts for the "weakness of gravity" illusion. ‘Weak gravity illusion’ (e) infinity small gravity holes and the gravity holes they radiate. These are the three possibilities or probabilities that could be elucidated from the above analytical deliberation and confabulation.

(77)Infinite space is populated (eb) by an infinite number of infinitely small graviton-holes, which consist (e) of a single particle of gravity, the graviton. As an axiomatic predication ‘gravity appears weak at macro-atomic scales’ (e-because of the fact that)’ gravity is so powerful within these sub-atomic Planck length spaces’.

(78)The properties of black holes include mass, gravity angular momentum, and charge (Heusler, 1998). Charge created (e) graviton holes that have spin The fact that the black hole has a charge indicates(eb) that the black hole interacts(e and eb) with surrounding space, and this includes (e)repelling other charges, via gravity waves. **Interaction of black holes with the surrounding space (eb-produces) black hole that has a charge.**

(79)When gravity is liberated (eb) from matter, and as matter (stripped of energy and particles) collapses (e-destruction), all that is left (eb) is gravity, and it is thus gravity which collapses (e-destroyed). As gravitational density increases (+) the attractive forces is changed(e and eb) to a repelling force, and that *force* is the gravitational wave.

Thus, gravity waves can prevent (e) two objects from collapsing(e and eb) into one another, especially if both in motion and have spin. The wave/spin acts as a tidal force that repels e(e and eb)rather than attracts(e and eb).**Graviton-holes are in motion in respect to each other (and the entire planet) and they tumble around each other asymmetrically. Because they are in motion they release energy, i.e. gravity waves. Gravity waves act to keep graviton-holes apart. The waves from two graviton-holes repel one another. Thus, they do not join together and become more powerful.**

As the Earth and the moon rotate around each other, and as they rotate and orbit the rotating sun, they also radiate gravity waves. Gravity waves radiated by this planet and Moon, act to maintain their distance apart and also prevent Earth and Moon from falling into the sun which also radiates gravity waves. However, as they emit gravity waves they lose energy. As they lose energy the gravity waves emitted become weaker which causes Earth and Moon to draw closer to one another and to the Sun. The decreased distance will cause them to rotate more rapidly such that they lose more energy and the gravity waves become weaker still, causing them to draw even closer together. Theoretically, after about 15 billion years the gravity waves would be so weak Earth and Moon would fall into the sun (which, of course, would have ceased to exist long before this could happen).

An infinite number of graviton-holes exist in local space. Because of their close proximity, they move asymmetrically and their rates of rotation accelerate which causes them to emit more energy and thus more gravity waves. Asymmetric acceleration releases additional energy, i.e. gravity waves. Therefore, just as the gravity waves emitted by Earth and the Sun keep them apart, gravity waves emitted by an infinite number of gravity-holes, in local space, act as a force, counterbalancing and repelling not only each other but the more massive gravitational attraction of Earth. In local, personalized space, we are surrounded by graviton-holes which radiate gravity waves. This surrounding localized *free gravity* counters the tremendous gravitational pull of an entire planet via attractive (local) and repellant (distant) influences, so that a human can easily pick an object up off the surface of the earth although the entire planet and its gravity are opposing this effort.

The existence of an infinite number of gravity-laden black holes, less than a Planck length in size, explains why gravity appears to be weak. Because we are surrounded by free-agent gravitons, they would have a local attractive influence and via gravity waves a repellant influence thereby countering the gravity of Earth. Of course, it can be argued that gravity does not repel. Gravity attracts. However, gravity waves repel. And that's the point. By attracting local objects without spin, graviton-holes in local space counters the attractive influences of Earth which has spin. If there are an infinite number of gravity holes then what prevents them from merging? Further, why are we not compressed and torn apart into elementary particles and sucked inside these infinitely small gravity holes? Graviton holes repel one another by the emission of gravity waves. This prevents graviton-holes from merging. Moreover, as they radiate they lose energy, and they shrink and disappear (Hawking 1990). Planck length graviton-holes are continually forming and disappearing. The smaller the hole the more energy it radiates. Thus it will also radiate away its mass (Hawking 2005) which is gravity; the gravity particle--the graviton. Hypothetically, at some point there will be nothing left and the gravity hole disappears (Hawking 1990). For example, a gravity-hole with the concentrated mass of 100 pounds would *evaporati*on a nanosecond. A gravity hole of mass 1 TeV/c^2 would take less than 10^{-88} seconds to radiate away into nothingness.

However, the radiation they liberate and the gravity waves they emit, can also bind together elementary particles, thereby creating mass and matter. Because the graviton-hole consists of gravity, the gravity *per se* does not disappear into nothingness. Gravitons and their gravity waves are a primary force around which a proton and electron come to be organized. Thus the graviton never disappears but is incorporated into the construction of new atoms.

To summarize, in spaces smaller than a Plank length, matter and elementary particles are stripped of their energy which is radiated back into space, whereas the remaining particle collapses and forms a graviton-hole. An infinite number of infinitely small gravity-laden *holes* are continually created in Planck length space. These graviton-holes (also known as Planck particles) consist of a single particle: the graviton. An infinite number of free-agent gravitons in local-space are in motion and orbit and tumble about each other giving off gravity waves. The gravitons and gravity waves counter the massive gravitational effects of large objects, such as planets. This would mean that gravity is not really weak. Rather, gravity of super massive objects is counterbalanced and repelled by an infinite number of infinitely small graviton-holes in local infinite space each of which are radiating gravity waves. This would explain why a single human can overcome the gravity of an entire planet and pick up an object from the ground. The graviton-holes in local space assists in countering the gravitational pull of the planet. Gravity holes also repel other graviton-holes via gravity waves, and as they lose energy, they disappear and/or they become incorporated into new matter, the gravity (along with the other forces) holding the particles together and forming protons and electrons.

Gravity-holes, Energy and the Creation of Matter

Holes in space-time are associated with gravity, the manifestation of duality from singularity (e.g. particles and waves), the liberation and radiation of electromagnetic energy, and the creation of matter--tying together quarks and leptons to form protons and electrons, all of which leads to the simplest and lightest of all atoms, hydrogen. Hydrogen is vital to life and is essential for the creation of molecular clouds, stars, and galaxies.

Black holes are associated with the emission of energy (Giddings, 1995; Hawking, 1975, 2005; Preskills 1992;), i.e. Hawking's radiation. According to the theory of relativity, mass is just highly condensed energy ($E = mc^2$). Energy can be turned into mass and mass turned into energy; and energy (along with gravity) binds together quarks, leptons and other particles.

Super massive black holes are located in the center of spiral galaxies (Blanford 1999; Melia, 2003a,b; Jones et al., 2004; Ruffini and Wheeler 1971). As super massive black holes swallow gravity-matter, they also radiate energy which can bind elementary particles and create mass, starting with hydrogen atoms. This can be accomplished in a number of ways, including fueling the activities of quasars which are believed to harbor super massive black holes at their center (Dietrich, et al., 2009; Mateo et al., 2005; Vestergaard, 2010; Vestergaard and Osmer 2009).

Super massive black holes emit a constant electric charge, an electric flux, with charges trailing outward, streaming over the event horizon and spreading across the surface of the black hole (Heusler, 1998; Thorne et al., 1986). The event horizon is the point of no-return and, hypothetically, may be consist of a charged membrane. Thus, the surface membrane of a black hole is electrically charged and acts like a conductive sphere and selectively repels (or emits) certain charges and allows yet other material to fall inside.

In some respects, the surface of a black hole acts as a semi-permeable membrane which presumably only allows causal influences to cross in one direction, i.e. inside (Finkelstein 1958; Thorne et al., 1986) while simultaneously rejecting the energy and the elementary particles associated with those objects. That is, the outer membrane may be permeated by tiny electrically charged holes which selectively allow certain material (the particle's mass/gravity) to enter while selective repelling its charge and its elementary particles. When the charge and electromagnetic energy is liberated, and gravity extracted, the mass will collapse as its elementary particles are freed. That is, the final collapse is triggered as its elementary particles are liberated such that all that is left is gravity. Thus gravity becomes one with the singularity of the black hole; all else is expelled back into space.

Further, these tiny holes in the outer membrane may be configured to specific shapes and sizes, i.e. like a lock and key, such that when gravity-mass passes through it makes contact with the outer edges of these permeable holes creating friction. Therefore, hypothetically, the membrane oscillates (Thorne et al., 1986) due to this contact friction as gravity-matter (gravitons) pass through. This friction, or resistance, may also contribute to the membrane's electric charge Because it contains a charge, the membrane (or the event horizon) behaves like a classical conducting sphere with a definite resistivity (Thorne et al., 1986). It radiates energy. And energy can attract and bind together those elementary particles which had also been liberated, thereby creating matter. The fact that black holes have a charge indicates these holes interact with surrounding space, and this includes repelling and attracting other charges, such as those magnetic and electric forces necessary for binding together elementary particles thereby creating creating atoms and molecules.

The event horizon of a black hole is surrounded by radiation quanta, which has also been referred to as a "thermal atmosphere" (Thorne et al., 1986). Some of this radiation (e.g. gravity waves) may leak through the membrane (event horizon) and disappear into infinity. However, most of this quantum is deflected by the charge of the membrane and becomes "Hawking's radiation" (Hawking 1990). The radiation is accompanied by matter, i.e. the liberated elementary particles, e.g., leptons; quarks. Therefore, complex matter is dissociated into gravity, energy, elementary particles, and then recycled and recombined in the form of simple atoms.

The energy ejected or repelled from a black hole contains very little or no information about what passed through the membrane-event-horizon (Hawking 1990), and this is because the energy which binds together elementary particles (creating atoms and molecules), is not synonymous with the atoms and molecules it binds together. Thus, as energy is repelled, molecules and atoms disintegrate and the elementary particles are liberated as they are no longer bound together.

Consider for example, a proton, which is 19 orders of magnitude larger than a Planck length. As a proton is stripped of energy, it loses mass and grows smaller. As it shrinks its gravity increases and it will collapse thereby fitting inside a Planck length and becoming one with a black hole which it creates as it collapses. However, the hole consists of gravity. Therefore, all that may remain after energy and particles are liberated from the proton, electron, or particle, is the gravity and the gravitons which originally held the matter and particles and the proton and electron together. Thus a proton stripped of energy and its elementary particles leaves only gravity and the graviton particle. The gravity and the gravitons become the hole. The black hole, therefore, consist entirely of gravitons and the defining feature of a black hole is its gravity.

The Hole Is Gravity

According to Quantum theory there exists a vacuum field which is populated by virtual particles and virtual anti-particles which may or may not exist but which have the potential to exist. Presumably, these virtual particles and anti-particles annihilate one another. However, it is possible that at the surface membrane or event horizon of the black hole these virtual particles become separated, like twins split at birth, with one twin swallowed up and the other deflected and then ejected from the surface where they then radiate away in the form of Hawking's radiation.

However, given that the black hole grows denser and its gravity stronger as mass falls into it (Hawking 1999), it can be concluded that gravity and not virtual matter are in fact passing through or into the black hole.

Consider the nature of photons which have a particle-wave duality. Photons do not escape a black hole, but packets of energy (quanta) do. The particle-wave duality is split, with gravity-mass disappearing into the hole, and with the energy that held the mass together deflected back into space. The particle-wave singularity, therefore, becomes a dissociated duality: particle and wave. Hence, only the remnants of the particle, and not the electromagnetic wave disappears into the black hole, such that the particle-wave duality is split and all that is left behind is gravity which forms the gravity-hole.

The consensus opinion is that the energy associated with what went into the hole is repelled, or even turned into heat (Preskill 1994; Thorn 1994) and radiated into space (Hawking, 1990, 2005; Russell and Fender 2010). Therefore, the Hawking radiation does not originate from inside the hole, but just above the surface of the event horizon. Nothing escapes the "event horizon" except that which is repelled by the charge of the membrane. The energy is stripped away and expelled and this allows what remains to fall into the hole which gains gravity. Theoretically, this expelled quanta hovers above the membrane, at a distance less than the Planck length, as if held aloft by the charge, and then gradually drifts further away and becoming red-shifted as they are deflected.

FORMULATION OF THE SYSTEM :

a) The growth speed in category 1 is the sum of two parts:
b) A term $+(b_{13})^{(1)}T_{14}$ proportional to the balance of the GF universe in the category 2.A term $-(b'_{13})^{(1)}T_{13}$ representing the quantum of balance dissipated from category 1 .This comprises of gravitational force in universe which have grown old, qualified to be classified under category 2 of the growth speed in category 2 is the sum of two parts: It is to be noted that creation and destruction of MATTER is taking place in the world continuously.(Please see discussion above)
1. A term $+(b_{14})^{(1)}T_{13}$ constitutive of the amount of inflow from the category 1
2. A term $-(b'_{14})^{(1)}T_{14}$ the dissipation factor arising due to gravitational force in the expanding universe.
The growth speed under category 3 is attributable to inflow from category 2 .Any stalling, deceleration, of the gravitational force/field like in black holes or in regions of gravitylessness in expanding universe could also be taken in to consideration. , whatever the reasons attributable and ascribable for such reduction. In this connection, reference is invited to the comments made by Bohr, Dirac, and Others in the explanation and exposition hereinabove.

GOVERNING EQUATIONS:

Following are the differential equations that govern the the gravitational force/field Portfolio:

$\frac{dT_{13}}{dt} = (b_{13})^{(1)}T_{14} - (b'_{13})^{(1)}T_{13}$ 12

$\frac{dT_{14}}{dt} = (b_{14})^{(1)}T_{13} - (b'_{14})^{(1)}T_{14}$ 13

$\frac{dT_{15}}{dt} = (b_{15})^{(1)}T_{14} - (b'_{15})^{(1)}T_{15}$ 14

$(b_i)^{(1)} > 0 \quad , \quad i = 13,14,15$ 15

$(b'_i)^{(1)} > 0 \quad , \quad i = 13,14,15$ 16

$(b_{14})^{(1)} < (b'_{13})^{(1)}$ 17

$(b_{15})^{(1)} < (b'_{14})^{(1)}$ 18

Following the same procedure outlined in the previous section , the general solution of the governing equations is $\alpha''_i T_i + \beta'_i T_i + \gamma'_i T_i = C'_i e_i^{\lambda' i t}$, $i = 13,14,15$ where $C'_{13}, C'_{14}, C'_{15}$ are arbitrary constant coefficients and $\alpha'_{13}, \alpha'_{14}, \alpha'_{15}, \gamma'_{13}, \gamma'_{14}, \gamma'_{15}$ corresponding multipliers to the characteristic roots of the system

ELECTROMAGNETIC FORCE AND GRAVITATIONAL FORCE-THE DUAL SYSTEM PROBLEM

We will denote

1) By $T_i(t), i = 13,14,15$, the three parts of the GF analogously to the G_i of the EMF in expanding contracting universe portfolio

2) By $(a''_i)^{(1)}(T_{14}, t)$ $(T_{14} \geq 0, t \geq 0)$,the contribution of the GF to the dissipation coefficient of the EMF in the expanding universe
3) By $(-b''_i)^{(1)}(G_{13}, G_{14}, G_{15}, t) = -(b''_i)^{(1)}(G, t)$, the contribution of the gravitational force to the dissipation coefficient of the EMF It is of utmost and conspicuous and perceptible importance to refer to the discussion above based on which these equations have been written..

GOVERNING EQUATIONS

$\frac{dG_{13}}{dt} = (a_{13})^{(1)}G_{14} - \left[(a'_{13})^{(1)} + (a''_{13})^{(1)}(T_{14}, t)\right]G_{13}$ 19

$\frac{dG_{14}}{dt} = (a_{14})^{(1)}G_{13} - \left[(a'_{14})^{(1)} + (a''_{14})^{(1)}(T_{14}, t)\right]G_{14}$ 20

$\frac{dG_{15}}{dt} = (a_{15})^{(1)}G_{14} - \left[(a'_{15})^{(1)} + (a''_{15})^{(1)}(T_{14}, t)\right]G_{15}$ 21

$\frac{dT_{13}}{dt} = (b_{13})^{(1)}T_{14} - \left[(b'_{13})^{(1)} - (b''_{13})^{(1)}(G, t)\right]T_{13}$ 22

$\frac{dT_{14}}{dt} = (b_{14})^{(1)}T_{13} - \left[(b'_{14})^{(1)} - (b''_{14})^{(1)}(G, t)\right]T_{14}$ 23

$\frac{dT_{15}}{dt} = (b_{15})^{(1)}T_{14} - \left[(b'_{15})^{(1)} - (b''_{15})^{(1)}(G, t)\right]T_{15}$ 24

$+(a''_{13})^{(1)}(T_{14}, t) =$ First augmentation factor and $-(b''_{13})^{(1)}(G, t) =$ First detrition factor

Where we suppose

(A) $(a_i)^{(1)}, (a'_i)^{(1)}, (a''_i)^{(1)}, (b_i)^{(1)}, (b'_i)^{(1)}, (b''_i)^{(1)} > 0,$

$i, j = 13,14,15$

(B) The functions $(a_i'')^{(1)}, (b_i'')^{(1)}$ are positive continuous increasing and bounded.
Definition of $(p_i)^{(1)}, \ (r_i)^{(1)}$: 25

$(a_i'')^{(1)}(T_{14}, t) \leq (p_i)^{(1)} \leq (\hat{A}_{13})^{(1)}$ 26

$(b_i'')^{(1)}(G, t) \leq \ (r_i)^{(1)} \leq (b_i')^{(1)} \leq (\hat{B}_{13})^{(1)}$

(C) $lim_{T_2 \to \infty}(a_i'')^{(1)}(T_{14}, t) = (p_i)^{(1)}$ 27
$\lim_{G \to \infty}(b_i'')^{(1)}(G, t) = \ (r_i)^{(1)}$ 28

Definition of $(\hat{A}_{13})^{(1)}, (\hat{B}_{13})^{(1)}$:

Where $\boxed{(\hat{A}_{13})^{(1)}, (\hat{B}_{13})^{(1)}, (p_i)^{(1)}, \ (r_i)^{(1)}}$ are positive constants and $\boxed{i = 13,14,15}$

They satisfy Lipschitz condition:
$|(a_i'')^{(1)}(T_{14}', t) - (a_i'')^{(1)}(T_{14}, t)| \leq (\hat{k}_{13})^{(1)}|T_{14} - T_{14}'|e^{-(\hat{M}_{13})^{(1)}t}$ 29

$|(b_i'')^{(1)}(G', t) - (b_i'')^{(1)}(G, T)| < (\hat{k}_{13})^{(1)}||G - G'||e^{-(\hat{M}_{13})^{(1)}t}$ 30

With the Lipschitz condition, we place a restriction on the behavior of functions $(a_i'')^{(1)}(T_{14}', t)$ and $(a_i'')^{(1)}(T_{14}, t)$. (T_{14}', t) and (T_{14}, t) are points belonging to the interval $[(\hat{k}_{13})^{(1)}, (\hat{M}_{13})^{(1)}]$. It is to be noted that $(a_i'')^{(1)}(T_{14}, t)$ is uniformly continuous. In the eventuality of the fact, that if $(\hat{M}_{13})^{(1)} = 1$ then the function $(a_i'')^{(1)}(T_{14}, t)$, the first augmentation coefficient, would be absolutely continuous.

Definition of $(\hat{M}_{13})^{(1)}, (\hat{k}_{13})^{(1)}$: 31

(D) $(\hat{M}_{13})^{(1)}, (\hat{k}_{13})^{(1)}$, are positive constants

$\frac{(a_i)^{(1)}}{(\hat{M}_{13})^{(1)}} , \frac{(b_i)^{(1)}}{(\hat{M}_{13})^{(1)}} < 1$

Definition of $(\hat{P}_{13})^{(1)}, (\hat{Q}_{13})^{(1)}$:

(E) There exists two constants $(\hat{P}_{13})^{(1)}$ and $(\hat{Q}_{13})^{(1)}$ which together with $(\hat{M}_{13})^{(1)}, (\hat{k}_{13})^{(1)}, (\hat{A}_{13})^{(1)}$ *and* $(\hat{B}_{13})^{(1)}$ and the constants $(a_i)^{(1)}, (a_i')^{(1)}, (b_i)^{(1)}, (b_i')^{(1)}, (p_i)^{(1)}, \ (r_i)^{(1)}, i = 13,14,15,$ satisfy the inequalities

$$\frac{1}{(\hat{M}_{13})^{(1)}}[\,(a_i)^{(1)} + (a_i')^{(1)} + \ (\hat{A}_{13})^{(1)} + \ (\hat{P}_{13})^{(1)}\ (\hat{k}_{13})^{(1)}] < 1$$ 32

$$\frac{1}{(\hat{M}_{13})^{(1)}}[\ (b_i)^{(1)} + (b_i')^{(1)} + \ (\hat{B}_{13})^{(1)} + \ (\hat{Q}_{13})^{(1)}\ \ (\hat{k}_{13})^{(1)}] < 1$$ 33

Theorem 1: if the conditions (A)-(E) above are fulfilled, there exists a solution satisfying the conditions

Definition of $G_i(0), T_i(0)$:

$G_i(t) \leq \ (\hat{P}_{13})^{(1)}e^{(\hat{M}_{13})^{(1)}t}$, $\boxed{G_i(0) = G_i^0 > 0}$
$T_i(t) \leq \ (\hat{Q}_{13})^{(1)}e^{(\hat{M}_{13})^{(1)}t}$, $\boxed{T_i(0) = T_i^0 > 0}$
Proof:
Consider operator $\mathcal{A}^{(1)}$ defined on the space of sextuples of continuous functions $G_i, T_i: \mathbb{R}_+ \to \mathbb{R}_+$ which satisfy

$$G_i(0) = G_i^0 \, , \, T_i(0) = T_i^0 \, , \, G_i^0 \leq (\, \hat{P}_{13} \,)^{(1)} \, , T_i^0 \leq (\, \hat{Q}_{13} \,)^{(1)},$$ 34

$$0 \leq G_i(t) - G_i^0 \leq (\, \hat{P}_{13} \,)^{(1)} e^{(\, \hat{M}_{13} \,)^{(1)} t}$$ 35

$$0 \leq T_i(t) - T_i^0 \leq (\, \hat{Q}_{13} \,)^{(1)} e^{(\, \hat{M}_{13} \,)^{(1)} t}$$ 36

By

$$\bar{G}_{13}(t) = G_{13}^0 + \int_0^t \left[(a_{13})^{(1)} G_{14}\big(s_{(13)}\big) - \Big((a'_{13})^{(1)} + a''_{13})^{(1)} \big(T_{14}\big(s_{(13)}\big), s_{(13)}\big) \Big) G_{13}\big(s_{(13)}\big) \right] ds_{(13)}$$ 37

$$\bar{G}_{14}(t) = G_{14}^0 + \int_0^t \left[(a_{14})^{(1)} G_{13}\big(s_{(13)}\big) - \Big((a'_{14})^{(1)} + (a''_{14})^{(1)} \big(T_{14}\big(s_{(13)}\big), s_{(13)}\big) \Big) G_{14}\big(s_{(13)}\big) \right] ds_{(13)}$$ 38

$$\bar{G}_{15}(t) = G_{15}^0 + \int_0^t \left[(a_{15})^{(1)} G_{14}\big(s_{(13)}\big) - \Big((a'_{15})^{(1)} + (a''_{15})^{(1)} \big(T_{14}\big(s_{(13)}\big), s_{(13)}\big) \Big) G_{15}\big(s_{(13)}\big) \right] ds_{(13)}$$ 39

40
$$\bar{T}_{13}(t) = T_{13}^0 + \int_0^t \left[(b_{13})^{(1)} T_{14}\big(s_{(13)}\big) - \Big((b'_{13})^{(1)} - (b''_{13})^{(1)} \big(G\big(s_{(13)}\big), s_{(13)}\big) \Big) T_{13}\big(s_{(13)}\big) \right] ds_{(13)}$$

41
$$\bar{T}_{14}(t) = T_{14}^0 + \int_0^t \left[(b_{14})^{(1)} T_{13}\big(s_{(13)}\big) - \Big((b'_{14})^{(1)} - (b''_{14})^{(1)} \big(G\big(s_{(13)}\big), s_{(13)}\big) \Big) T_{14}\big(s_{(13)}\big) \right] ds_{(13)}$$

$$\bar{T}_{15}(t) = T_{15}^0 + \int_0^t \left[(b_{15})^{(1)} T_{14}\big(s_{(13)}\big) - \Big((b'_{15})^{(1)} - (b''_{15})^{(1)} \big(G\big(s_{(13)}\big), s_{(13)}\big) \Big) T_{15}\big(s_{(13)}\big) \right] ds_{(13)}$$ 42

Where $s_{(13)}$ is the integrand that is integrated over an interval $(0, t)$

(a) The operator $\mathcal{A}^{(1)}$ maps the space of functions satisfying 34,35,36 into itself .Indeed it is obvious that

$$G_{13}(t) \leq G_{13}^0 + \int_0^t \left[(a_{13})^{(1)} \left(G_{14}^0 + (\, \hat{P}_{13} \,)^{(1)} e^{(\, \hat{M}_{13} \,)^{(1)} s_{(13)}} \right) \right] ds_{(13)} =$$ 43
$$\big(1 + (a_{13})^{(1)} t\big) G_{14}^0 + \frac{(a_{13})^{(1)} (\, \hat{P}_{13} \,)^{(1)}}{(\, \hat{M}_{13} \,)^{(1)}} \left(e^{(\, \hat{M}_{13} \,)^{(1)} t} - 1 \right)$$

From which it follows that 44

$$\big(G_{13}(t) - G_{13}^0\big) e^{-(\, \hat{M}_{13} \,)^{(1)} t} \leq \frac{(a_{13})^{(1)}}{(\, \hat{M}_{13} \,)^{(1)}} \left[\big((\, \hat{P}_{13} \,)^{(1)} + G_{14}^0 \big) e^{\left(-\frac{(\, \hat{P}_{13} \,)^{(1)} + G_{14}^0}{G_{14}^0} \right)} + (\, \hat{P}_{13} \,)^{(1)} \right]$$

(G_i^0) is as defined in the statement of theorem 1

Analogous inequalities hold also for $G_{14}, G_{15}, T_{13}, T_{14}, T_{15}$

It is now sufficient to take $\frac{(a_i)^{(1)}}{(\, \hat{M}_{13} \,)^{(1)}} \, , \frac{(b_i)^{(1)}}{(\, \hat{M}_{13} \,)^{(1)}} < 1$ and to choose 45
$(\, \hat{P}_{13} \,)^{(1)}$ and $(\, \hat{Q}_{13} \,)^{(1)}$ large to have

$$\frac{(a_i)^{(1)}}{(\hat{M}_{13})^{(1)}} \left[(\hat{P}_{13})^{(1)} + \big((\, \hat{P}_{13} \,)^{(1)} + G_j^0 \big) e^{-\left(\frac{(\, \hat{P}_{13} \,)^{(1)} + G_j^0}{G_j^0} \right)} \right] \leq (\, \hat{P}_{13} \,)^{(1)}$$ 46

$$\frac{(b_i)^{(1)}}{(\hat{M}_{13})^{(1)}}\left[((\hat{Q}_{13})^{(1)}+T_j^0)e^{-\left(\frac{(\hat{Q}_{13})^{(1)}+T_j^0}{T_j^0}\right)}+(\hat{Q}_{13})^{(1)}\right]\leq(\hat{Q}_{13})^{(1)}$$

In order that the operator $\mathcal{A}^{(1)}$ transforms the space of sextuples of functions G_i, T_i satisfying 34,35,36 into itself

The operator $\mathcal{A}^{(1)}$ is a contraction with respect to the metric

$$d\left(\left(G^{(1)},T^{(1)}\right),\left(G^{(2)},T^{(2)}\right)\right)=$$
$$\sup_i\{\max_{t\in\mathbb{R}_+}\left|G_i^{(1)}(t)-G_i^{(2)}(t)\right|e^{-(\hat{M}_{13})^{(1)}t},\max_{t\in\mathbb{R}_+}\left|T_i^{(1)}(t)-T_i^{(2)}(t)\right|e^{-(\hat{M}_{13})^{(1)}t}\}$$ 47

Indeed if we denote

Definition of $\tilde{G},\tilde{T}$: $\left(\tilde{G},\tilde{T}\right)=\mathcal{A}^{(1)}(G,T)$ 48

It results

$$\left|\tilde{G}_{13}^{(1)}-\tilde{G}_i^{(2)}\right|\leq\int_0^t(a_{13})^{(1)}\left|G_{14}^{(1)}-G_{14}^{(2)}\right|e^{-(\hat{M}_{13})^{(1)}s_{(13)}}e^{(\hat{M}_{13})^{(1)}s_{(13)}}\,ds_{(13)}+$$
$$\int_0^t\{(a'_{13})^{(1)}\left|G_{13}^{(1)}-G_{13}^{(2)}\right|e^{-(\hat{M}_{13})^{(1)}s_{(13)}}e^{-(\hat{M}_{13})^{(1)}s_{(13)}}+$$
$$(a''_{13})^{(1)}\left(T_{14}^{(1)},s_{(13)}\right)\left|G_{13}^{(1)}-G_{13}^{(2)}\right|e^{-(\hat{M}_{13})^{(1)}s_{(13)}}e^{(\hat{M}_{13})^{(1)}s_{(13)}}+$$
$$G_{13}^{(2)}|(a''_{13})^{(1)}\left(T_{14}^{(1)},s_{(13)}\right)-(a''_{13})^{(1)}\left(T_{14}^{(2)},s_{(13)}\right)|\;e^{-(\hat{M}_{13})^{(1)}s_{(13)}}e^{(\hat{M}_{13})^{(1)}s_{(13)}}\}ds_{(13)}$$ 49

Where $s_{(13)}$ represents integrand that is integrated over the interval $[0,t]$

From the hypotheses on 25,26,27,28 and 29 it follows

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$$\left|G^{(1)}-G^{(2)}\right|e^{-(\hat{M}_{13})^{(1)}t}\leq\frac{1}{(\hat{M}_{13})^{(1)}}\left((a_{13})^{(1)}+(a'_{13})^{(1)}+(\hat{A}_{13})^{(1)}+(\hat{P}_{13})^{(1)}(\hat{k}_{13})^{(1)}\right)d\left(\left(G^{(1)},T^{(1)};\,G^{(2)},T^{(2)}\right)\right)$$

And analogous inequalities for G_i *and* T_i. Taking into account the hypothesis (34,35,36) the result follows

Remark 1: The fact that we supposed $(a''_{13})^{(1)}$ and $(b''_{13})^{(1)}$ depending also on t can be considered as not conformal with the reality, however we have put this hypothesis ,in order that we can postulate condition necessary to prove the uniqueness of the solution bounded by $(\hat{P}_{13})^{(1)}e^{(\hat{M}_{13})^{(1)}t}$ *and* $(\hat{Q}_{13})^{(1)}e^{(\hat{M}_{13})^{(1)}t}$ respectively of $\mathbb{R}_+$. 51
If instead of proving the existence of the solution on $\mathbb{R}_+$, we have to prove it only on a compact then it suffices to consider that $(a''_i)^{(1)}$ and $(b''_i)^{(1)}, i=13,14,15$ depend only on T_{14} and respectively on $G(and\ not\ on\ t)$ and hypothesis can replaced by a usual Lipschitz condition.

Remark 2: There does not exist any t where $G_i(t)=0$ *and* $T_i(t)=0$

From 19 to 24 it results 52

$$G_i(t)\geq G_i^0e^{\left[-\int_0^t\{(a'_i)^{(1)}-(a''_i)^{(1)}(T_{14}(s_{(13)}),s_{(13)})\}ds_{(13)}\right]}\geq0$$

$$T_i(t)\geq T_i^0e^{\left(-(b'_i)^{(1)}t\right)}>0\quad\text{for } t>0$$

Definition of $\left((\hat{M}_{13})^{(1)}\right)_1,\left((\hat{M}_{13})^{(1)}\right)_2$ *and* $\left((\hat{M}_{13})^{(1)}\right)_3$: 53

Remark 3: if G_{13} is bounded, the same property have also G_{14} *and* G_{15} . indeed if

$G_{13}<(\hat{M}_{13})^{(1)}$ it follows $\frac{dG_{14}}{dt}\leq\left((\hat{M}_{13})^{(1)}\right)_1-(a'_{14})^{(1)}G_{14}$ and by integrating

$G_{14} \leq \left((\widehat{M}_{13})^{(1)}\right)_2 = G_{14}^0 + 2(a_{14})^{(1)}\left((\widehat{M}_{13})^{(1)}\right)_1 / (a'_{14})^{(1)}$

In the same way , one can obtain

$G_{15} \leq \left((\widehat{M}_{13})^{(1)}\right)_3 = G_{15}^0 + 2(a_{15})^{(1)}\left((\widehat{M}_{13})^{(1)}\right)_2 / (a'_{15})^{(1)}$

If G_{14} *or* G_{15} is bounded, the same property follows for G_{13} , G_{15} and G_{13} , G_{14} respectively.
Remark 4: If G_{13} *is* bounded, from below, the same property holds for G_{14} *and* G_{15} . The proof is analogous with the preceding one. An analogous property is true if G_{14} is bounded from below. 54

Remark 5: If T_{13} is bounded from below and $\lim_{t\to\infty}((b_i'')^{(1)}(G(t),t)) = (b'_{14})^{(1)}$ then $T_{14} \to \infty$. 55

Definition of $(m)^{(1)}$ and ε_1 :
Indeed let t_1 be so that for $t > t_1$

$(b_{14})^{(1)} - (b_i'')^{(1)}(G(t),t) < \varepsilon_1, T_{13}(t) > (m)^{(1)}$

Then $\frac{dT_{14}}{dt} \geq (a_{14})^{(1)}(m)^{(1)} - \varepsilon_1 T_{14}$ which leads to

$T_{14} \geq \left(\frac{(a_{14})^{(1)}(m)^{(1)}}{\varepsilon_1}\right)(1 - e^{-\varepsilon_1 t}) + T_{14}^0 e^{-\varepsilon_1 t}$ If we take t such that $e^{-\varepsilon_1 t} = \frac{1}{2}$ it results

$T_{14} \geq \left(\frac{(a_{14})^{(1)}(m)^{(1)}}{2}\right), \quad t = \log\frac{2}{\varepsilon_1}$ By taking now ε_1 sufficiently small one sees that T_{14} is unbounded. The same property holds for T_{15} if $\lim_{t\to\infty}(b''_{15})^{(1)}(G(t),t) = (b'_{15})^{(1)}$
We now state a more precise theorem about the behaviors at infinity of the solutions of equations 37 to 42
Behavior of the solutions of equation 37 to 42 56

Theorem 2: If we denote and define

Definition of $(\sigma_1)^{(1)}, (\sigma_2)^{(1)}, (\tau_1)^{(1)}, (\tau_2)^{(1)}$:

(a) $\sigma_1)^{(1)}, (\sigma_2)^{(1)}, (\tau_1)^{(1)}, (\tau_2)^{(1)}$ four constants satisfying

$-(\sigma_2)^{(1)} \leq -(a'_{13})^{(1)} + (a'_{14})^{(1)} - (a''_{13})^{(1)}(T_{14},t) + (a''_{14})^{(1)}(T_{14},t) \leq -(\sigma_1)^{(1)}$ 57

$-(\tau_2)^{(1)} \leq -(b'_{13})^{(1)} + (b'_{14})^{(1)} - (b''_{13})^{(1)}(G,t) - (b''_{14})^{(1)}(G,t) \leq -(\tau_1)^{(1)}$ 58

Definition of $(\nu_1)^{(1)}, (\nu_2)^{(1)}, (u_1)^{(1)}, (u_2)^{(1)}, \nu^{(1)}, u^{(1)}$: 59

(b) By $(\nu_1)^{(1)} > 0, (\nu_2)^{(1)} < 0$ and respectively $(u_1)^{(1)} > 0, (u_2)^{(1)} < 0$ the roots of the equations $(a_{14})^{(1)}(\nu^{(1)})^2 + (\sigma_1)^{(1)}\nu^{(1)} - (a_{13})^{(1)} = 0$ 60
and $(b_{14})^{(1)}(u^{(1)})^2 + (\tau_1)^{(1)}u^{(1)} - (b_{13})^{(1)} = 0$ and

61

Definition of $(\bar{\nu}_1)^{(1)},, (\bar{\nu}_2)^{(1)}, (\bar{u}_1)^{(1)}, (\bar{u}_2)^{(1)}$: 62

By $(\bar{\nu}_1)^{(1)} > 0, (\bar{\nu}_2)^{(1)} < 0$ and respectively $(\bar{u}_1)^{(1)} > 0, (\bar{u}_2)^{(1)} < 0$ the roots of the equations $(a_{14})^{(1)}(\nu^{(1)})^2 + (\sigma_2)^{(1)}\nu^{(1)} - (a_{13})^{(1)} = 0$ 63
and $(b_{14})^{(1)}(u^{(1)})^2 + (\tau_2)^{(1)}u^{(1)} - (b_{13})^{(1)} = 0$

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Definition of $(m_1)^{(1)}, (m_2)^{(1)}, (\mu_1)^{(1)}, (\mu_2)^{(1)}, (\nu_0)^{(1)}$:- 65

(c) If we define $(m_1)^{(1)}, (m_2)^{(1)}, (\mu_1)^{(1)}, (\mu_2)^{(1)}$ by

$(m_2)^{(1)} = (\nu_0)^{(1)}, (m_1)^{(1)} = (\nu_1)^{(1)},\ if\ (\nu_0)^{(1)} < (\nu_1)^{(1)}$ 66

$(m_2)^{(1)} = (\nu_1)^{(1)}, (m_1)^{(1)} = (\bar{\nu}_1)^{(1)}, if\ (\nu_1)^{(1)} < (\nu_0)^{(1)} < (\bar{\nu}_1)^{(1)}$,

and $\boxed{(\nu_0)^{(1)} = \frac{G_{13}^0}{G_{14}^0}}$ 67

$(m_2)^{(1)} = (\nu_1)^{(1)}, (m_1)^{(1)} = (\nu_0)^{(1)},\ if\ (\bar{\nu}_1)^{(1)} < (\nu_0)^{(1)}$

and analogously

$(\mu_2)^{(1)} = (u_0)^{(1)}, (\mu_1)^{(1)} = (u_1)^{(1)},\ if\ (u_0)^{(1)} < (u_1)^{(1)}$ 68

$(\mu_2)^{(1)} = (u_1)^{(1)}, (\mu_1)^{(1)} = (\bar{u}_1)^{(1)}, if\ (u_1)^{(1)} < (u_0)^{(1)} < (\bar{u}_1)^{(1)}$,

and $\boxed{(u_0)^{(1)} = \frac{T_{13}^0}{T_{14}^0}}$ 69

$(\mu_2)^{(1)} = (u_1)^{(1)}, (\mu_1)^{(1)} = (u_0)^{(1)}, if\ (\bar{u}_1)^{(1)} < (u_0)^{(1)}$ where $(u_1)^{(1)}, (\bar{u}_1)^{(1)}$ are defined by 59 and 61 respectively 70

Then the solution of 19,20,21,22,23 and 24 satisfies the inequalities 71

$$G_{13}^0 e^{((S_1)^{(1)}-(p_{13})^{(1)})t} \le G_{13}(t) \le G_{13}^0 e^{(S_1)^{(1)}t}$$

where $(p_i)^{(1)}$ is defined by equation 25

$$\frac{1}{(m_1)^{(1)}} G_{13}^0 e^{((S_1)^{(1)}-(p_{13})^{(1)})t} \le G_{14}(t) \le \frac{1}{(m_2)^{(1)}} G_{13}^0 e^{(S_1)^{(1)}t}$$ 72

$$\left(\frac{(a_{15})^{(1)}G_{13}^0}{(m_1)^{(1)}((S_1)^{(1)}-(p_{13})^{(1)}-(S_2)^{(1)})}\left[e^{((S_1)^{(1)}-(p_{13})^{(1)})t} - e^{-(S_2)^{(1)}t}\right] + G_{15}^0 e^{-(S_2)^{(1)}t} \le G_{15}(t) \le \right.$$
$$\left.\frac{(a_{15})^{(1)}G_{13}^0}{(m_2)^{(1)}((S_1)^{(1)}-(a'_{15})^{(1)})}\left[e^{(S_1)^{(1)}t} - e^{-(a'_{15})^{(1)}t}\right] + G_{15}^0 e^{-(a'_{15})^{(1)}t}\right)$$ 73

$$\boxed{T_{13}^0 e^{(R_1)^{(1)}t} \le T_{13}(t) \le T_{13}^0 e^{((R_1)^{(1)}+(r_{13})^{(1)})t}}$$ 74

$$\frac{1}{(\mu_1)^{(1)}} T_{13}^0 e^{(R_1)^{(1)}t} \le T_{13}(t) \le \frac{1}{(\mu_2)^{(1)}} T_{13}^0 e^{((R_1)^{(1)}+(r_{13})^{(1)})t}$$ 75

$$\frac{(b_{15})^{(1)}T_{13}^0}{(\mu_1)^{(1)}((R_1)^{(1)}-(b'_{15})^{(1)})}\left[e^{(R_1)^{(1)}t} - e^{-(b'_{15})^{(1)}t}\right] + T_{15}^0 e^{-(b'_{15})^{(1)}t} \le T_{15}(t) \le$$

$$\frac{(a_{15})^{(1)}T_{13}^0}{(\mu_2)^{(1)}((R_1)^{(1)}+(r_{13})^{(1)}+(R_2)^{(1)})}\left[e^{((R_1)^{(1)}+(r_{13})^{(1)})t} - e^{-(R_2)^{(1)}t}\right] + T_{15}^0 e^{-(R_2)^{(1)}t}$$ 76

Definition of $(S_1)^{(1)}, (S_2)^{(1)}, (R_1)^{(1)}, (R_2)^{(1)}$:- 77

Where $(S_1)^{(1)} = (a_{13})^{(1)}(m_2)^{(1)} - (a'_{13})^{(1)}$

$(S_2)^{(1)} = (a_{15})^{(1)} - (p_{15})^{(1)}$ 78

$$(R_1)^{(1)} = (b_{13})^{(1)}(\mu_2)^{(1)} - (b'_{13})^{(1)}$$

$$(R_2)^{(1)} = (b'_{15})^{(1)} - (r_{15})^{(1)}$$

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Proof : From 19,20,21,22,23,24 we obtain

$$\frac{d\nu^{(1)}}{dt} = (a_{13})^{(1)} - \left((a'_{13})^{(1)} - (a'_{14})^{(1)} + (a''_{13})^{(1)}(T_{14},t)\right) - (a''_{14})^{(1)}(T_{14},t)\nu^{(1)} - (a_{14})^{(1)}\nu^{(1)}$$ 80

Definition of $\nu^{(1)}$:- $\boxed{\nu^{(1)} = \frac{G_{13}}{G_{14}}}$

It follows

$$-\left((a_{14})^{(1)}\left(\nu^{(1)}\right)^2 + (\sigma_2)^{(1)}\nu^{(1)} - (a_{13})^{(1)}\right) \le \frac{d\nu^{(1)}}{dt} \le -\left((a_{14})^{(1)}\left(\nu^{(1)}\right)^2 + (\sigma_1)^{(1)}\nu^{(1)} - (a_{13})^{(1)}\right)$$ 81

From which one obtains

Definition of $(\bar{\nu}_1)^{(1)}, (\nu_0)^{(1)}$:-

(a) For $0 < \boxed{(\nu_0)^{(1)} = \frac{G_{13}^0}{G_{14}^0}} < (\nu_1)^{(1)} < (\bar{\nu}_1)^{(1)}$

$$\nu^{(1)}(t) \ge \frac{(\nu_1)^{(1)} + (C)^{(1)}(\nu_2)^{(1)}e^{\left[-(a_{14})^{(1)}\left((\nu_1)^{(1)} - (\nu_0)^{(1)}\right)t\right]}}{1 + (C)^{(1)}e^{\left[-(a_{14})^{(1)}\left((\nu_1)^{(1)} - (\nu_0)^{(1)}\right)t\right]}} \quad , \quad \boxed{(C)^{(1)} = \frac{(\nu_1)^{(1)} - (\nu_0)^{(1)}}{(\nu_0)^{(1)} - (\nu_2)^{(1)}}}$$ 82

it follows $(\nu_0)^{(1)} \le \nu^{(1)}(t) \le (\nu_1)^{(1)}$

In the same manner , we get 83

$$\nu^{(1)}(t) \le \frac{(\bar{\nu}_1)^{(1)} + (\bar{C})^{(1)}(\bar{\nu}_2)^{(1)}e^{\left[-(a_{14})^{(1)}\left((\bar{\nu}_1)^{(1)} - (\bar{\nu}_2)^{(1)}\right)t\right]}}{1 + (\bar{C})^{(1)}e^{\left[-(a_{14})^{(1)}\left((\bar{\nu}_1)^{(1)} - (\bar{\nu}_2)^{(1)}\right)t\right]}} \quad , \quad \boxed{(\bar{C})^{(1)} = \frac{(\bar{\nu}_1)^{(1)} - (\nu_0)^{(1)}}{(\nu_0)^{(1)} - (\bar{\nu}_2)^{(1)}}}$$

From which we deduce $(\nu_0)^{(1)} \le \nu^{(1)}(t) \le (\bar{\nu}_1)^{(1)}$

(b) If $0 < (\nu_1)^{(1)} < (\nu_0)^{(1)} = \frac{G_{13}^0}{G_{14}^0} < (\bar{\nu}_1)^{(1)}$ we find like in the previous case, 84

$$(\nu_1)^{(1)} \le \frac{(\nu_1)^{(1)} + (C)^{(1)}(\nu_2)^{(1)}e^{\left[-(a_{14})^{(1)}\left((\nu_1)^{(1)} - (\nu_2)^{(1)}\right)t\right]}}{1 + (C)^{(1)}e^{\left[-(a_{14})^{(1)}\left((\nu_1)^{(1)} - (\nu_2)^{(1)}\right)t\right]}} \le \nu^{(1)}(t) \le$$

$$\frac{(\bar{\nu}_1)^{(1)} + (\bar{C})^{(1)}(\bar{\nu}_2)^{(1)}e^{\left[-(a_{14})^{(1)}\left((\bar{\nu}_1)^{(1)} - (\bar{\nu}_2)^{(1)}\right)t\right]}}{1 + (\bar{C})^{(1)}e^{\left[-(a_{14})^{(1)}\left((\bar{\nu}_1)^{(1)} - (\bar{\nu}_2)^{(1)}\right)t\right]}} \le (\bar{\nu}_1)^{(1)}$$

(c) If $0 < (\nu_1)^{(1)} \le (\bar{\nu}_1)^{(1)} \le \boxed{(\nu_0)^{(1)} = \frac{G_{13}^0}{G_{14}^0}}$, we obtain 85

$$(\nu_1)^{(1)} \le \nu^{(1)}(t) \le \frac{(\bar{\nu}_1)^{(1)} + (\bar{C})^{(1)}(\bar{\nu}_2)^{(1)}e^{\left[-(a_{14})^{(1)}\left((\bar{\nu}_1)^{(1)} - (\bar{\nu}_2)^{(1)}\right)t\right]}}{1 + (\bar{C})^{(1)}e^{\left[-(a_{14})^{(1)}\left((\bar{\nu}_1)^{(1)} - (\bar{\nu}_2)^{(1)}\right)t\right]}} \le (\nu_0)^{(1)}$$

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And so with the notation of the first part of condition (c) , we have

Definition of $\nu^{(1)}(t)$:-

$(m_2)^{(1)} \leq \nu^{(1)}(t) \leq (m_1)^{(1)}, \quad \boxed{\nu^{(1)}(t) = \frac{G_{13}(t)}{G_{14}(t)}}$ 87

In a completely analogous way, we obtain

Definition of $u^{(1)}(t)$:-

$(\mu_2)^{(1)} \leq u^{(1)}(t) \leq (\mu_1)^{(1)}, \quad \boxed{u^{(1)}(t) = \frac{T_{13}(t)}{T_{14}(t)}}$

Now, using this result and replacing it in 19, 20,21,22,23, and 24 we get easily the result stated in the theorem.

Particular case :

If $(a''_{13})^{(1)} = (a''_{14})^{(1)}, then\ (\sigma_1)^{(1)} = (\sigma_2)^{(1)}$ and in this case $(\nu_1)^{(1)} = (\bar{\nu}_1)^{(1)}$ if in addition $(\nu_0)^{(1)} = (\nu_1)^{(1)}$ then $\nu^{(1)}(t) = (\nu_0)^{(1)}$ and as a consequence $G_{13}(t) = (\nu_0)^{(1)} G_{14}(t)$ this also defines $(\nu_0)^{(1)}$ for the special case .

Analogously if $(b''_{13})^{(1)} = (b''_{14})^{(1)}, then\ (\tau_1)^{(1)} = (\tau_2)^{(1)}$ and then $(u_1)^{(1)} = (\bar{u}_1)^{(1)}$if in addition $(u_0)^{(1)} = (u_1)^{(1)}$ then $T_{13}(t) = (u_0)^{(1)} T_{14}(t)$ This is an important consequence of the relation between $(\nu_1)^{(1)}$ and $(\bar{\nu}_1)^{(1)}$, and definition of $(u_0)^{(1)}$.

Theorem 3: If $(a''_i)^{(1)} and\ (b''_i)^{(1)}$ are independent on t , and the conditions (with the notations 25,26,27,28) 88

$$(a'_{13})^{(1)}(a'_{14})^{(1)} - (a_{13})^{(1)}(a_{14})^{(1)} < 0$$

$$(a'_{13})^{(1)}(a'_{14})^{(1)} - (a_{13})^{(1)}(a_{14})^{(1)} + (a_{13})^{(1)}(p_{13})^{(1)} + (a'_{14})^{(1)}(p_{14})^{(1)} + (p_{13})^{(1)}(p_{14})^{(1)} > 0$$

$$(b'_{13})^{(1)}(b'_{14})^{(1)} - (b_{13})^{(1)}(b_{14})^{(1)} > 0 \,,$$

$$(b'_{13})^{(1)}(b'_{14})^{(1)} - (b_{13})^{(1)}(b_{14})^{(1)} - (b'_{13})^{(1)}(r_{14})^{(1)} - (b'_{14})^{(1)}(r_{14})^{(1)} + (r_{13})^{(1)}(r_{14})^{(1)} < 0$$

$with\ (p_{13})^{(1)}, (r_{14})^{(1)}$ as defined by equation 25 are satisfied , then the system

$$(a_{13})^{(1)} G_{14} - \left[(a'_{13})^{(1)} + (a''_{13})^{(1)}(T_{14})\right] G_{13} = 0 \quad 89$$

$$(a_{14})^{(1)} G_{13} - \left[(a'_{14})^{(1)} + (a''_{14})^{(1)}(T_{14})\right] G_{14} = 0 \quad 90$$

$$(a_{15})^{(1)} G_{14} - \left[(a'_{15})^{(1)} + (a''_{15})^{(1)}(T_{14})\right] G_{15} = 0 \quad 91$$

$$(b_{13})^{(1)} T_{14} - [(b'_{13})^{(1)} - (b''_{13})^{(1)}(G)\ ] T_{13} = 0 \quad 92$$

$$(b_{14})^{(1)} T_{13} - [(b'_{14})^{(1)} - (b''_{14})^{(1)}(G)\ ] T_{14} = 0 \quad 93$$

$$(b_{15})^{(1)} T_{14} - [(b'_{15})^{(1)} - (b''_{15})^{(1)}(G)\ ] T_{15} = 0 \quad 94$$

has a unique positive solution , which is an equilibrium solution for the system (19 to 24)

Proof:

(a) Indeed the first two equations have a nontrivial solution G_{13}, G_{14} if 95

$F(T) =$
$$(a'_{13})^{(1)}(a'_{14})^{(1)} - (a_{13})^{(1)}(a_{14})^{(1)} + (a'_{13})^{(1)}(a''_{14})^{(1)}(T_{14}) + (a'_{14})^{(1)}(a''_{13})^{(1)}(T_{14}) + (a''_{13})^{(1)}(T_{14})(a''_{14})^{(1)}(T_{14}) = 0$$

Definition and uniqueness of T_{14}^* :-

After hypothesis $f(0) < 0, f(\infty) > 0$ and the functions $(a_i'')^{(1)}(T_{14})$ being increasing, it follows that there exists a unique T_{14}^* for which $f(T_{14}^*) = 0$. With this value , we obtain from the three first equations

$$G_{13} = \frac{(a_{13})^{(1)}G_{14}}{[(a_{13}')^{(1)}+(a_{13}'')^{(1)}(T_{14}^*)]} \quad , \quad G_{15} = \frac{(a_{15})^{(1)}G_{14}}{[(a_{15}')^{(1)}+(a_{15}'')^{(1)}(T_{14}^*)]}$$ 96

(b) By the same argument, the equations 92,93 admit solutions G_{13}, G_{14} if

$$\varphi(G) = (b_{13}')^{(1)}(b_{14}')^{(1)} - (b_{13})^{(1)}(b_{14})^{(1)} - \left[(b_{13}')^{(1)}(b_{14}'')^{(1)}(G) + (b_{14}')^{(1)}(b_{13}'')^{(1)}(G)\right] + (b_{13}'')^{(1)}(G)(b_{14}'')^{(1)}(G) = 0$$ 97

Where in $G(G_{13}, G_{14}, G_{15}), G_{13}, G_{15}$ must be replaced by their values from 96. It is easy to see that φ is a decreasing function in G_{14} taking into account the hypothesis $\varphi(0) > 0\,, \varphi(\infty) < 0$ it follows that there exists a unique G_{14}^* such that $\varphi(G^*) = 0$

Finally we obtain the unique solution of 89 to 94

G_{14}^* given by $\varphi(G^*) = 0$, T_{14}^* given by $f(T_{14}^*) = 0$ and

$$G_{13}^* = \frac{(a_{13})^{(1)}G_{14}^*}{[(a_{13}')^{(1)}+(a_{13}'')^{(1)}(T_{14}^*)]} \quad , \quad G_{15}^* = \frac{(a_{15})^{(1)}G_{14}^*}{[(a_{15}')^{(1)}+(a_{15}'')^{(1)}(T_{14}^*)]}$$ 98

$$T_{13}^* = \frac{(b_{13})^{(1)}T_{14}^*}{[(b_{13}')^{(1)}-(b_{13}'')^{(1)}(G^*)]} \quad , \quad T_{15}^* = \frac{(b_{15})^{(1)}T_{14}^*}{[(b_{15}')^{(1)}-(b_{15}'')^{(1)}(G^*)]}$$ 99

Obviously, these values represent an equilibrium solution of 19,20,21,22,23,24

ASYMPTOTIC STABILITY ANALYSIS

Theorem 4: If the conditions of the previous theorem are satisfied and if the functions $(a_i'')^{(1)}$ *and* $(b_i'')^{(1)}$ Belong to $C^{(1)}(\mathbb{R}_+)$ then the above equilibrium point is asymptotically stable.

Proof: Denote

Definition of $\mathbb{G}_i, \mathbb{T}_i$:-

$$G_i = G_i^* + \mathbb{G}_i \qquad , T_i = T_i^* + \mathbb{T}_i$$ 100

$$\frac{\partial (a_{14}'')^{(1)}}{\partial T_{14}}(T_{14}^*) = (q_{14})^{(1)} \quad , \quad \frac{\partial (b_i'')^{(1)}}{\partial G_j}(G^*) = s_{ij}$$ 101

Then taking into account equations 89 to 94 and neglecting the terms of power 2, we obtain from 19 to 24

$$\frac{d\mathbb{G}_{13}}{dt} = -\left((a_{13}')^{(1)} + (p_{13})^{(1)}\right)\mathbb{G}_{13} + (a_{13})^{(1)}\mathbb{G}_{14} - (q_{13})^{(1)}G_{13}^*\mathbb{T}_{14}$$ 102

$$\frac{d\mathbb{G}_{14}}{dt} = -\left((a_{14}')^{(1)} + (p_{14})^{(1)}\right)\mathbb{G}_{14} + (a_{14})^{(1)}\mathbb{G}_{13} - (q_{14})^{(1)}G_{14}^*\mathbb{T}_{14}$$ 103

$$\frac{d\mathbb{G}_{15}}{dt} = -\left((a_{15}')^{(1)} + (p_{15})^{(1)}\right)\mathbb{G}_{15} + (a_{15})^{(1)}\mathbb{G}_{14} - (q_{15})^{(1)}G_{15}^*\mathbb{T}_{14}$$ 104

$$\frac{d\mathbb{T}_{13}}{dt} = -\left((b_{13}')^{(1)} - (r_{13})^{(1)}\right)\mathbb{T}_{13} + (b_{13})^{(1)}\mathbb{T}_{14} + \sum_{j=13}^{15}\left(s_{(13)(j)}T_{13}^*\mathbb{G}_j\right)$$ 105

$$\frac{d\mathbb{T}_{14}}{dt} = -\left((b'_{14})^{(1)} - (r_{14})^{(1)}\right)\mathbb{T}_{14} + (b_{14})^{(1)}\mathbb{T}_{13} + \sum_{j=13}^{15}\left(s_{(14)(j)} T^*_{14} \mathbb{G}_j\right)$$ 106

$$\frac{d\mathbb{T}_{15}}{dt} = -\left((b'_{15})^{(1)} - (r_{15})^{(1)}\right)\mathbb{T}_{15} + (b_{15})^{(1)}\mathbb{T}_{14} + \sum_{j=13}^{15}\left(s_{(15)(j)} T^*_{15} \mathbb{G}_j\right)$$ 107

The characteristic equation of this system is

$$\begin{aligned}
&\left((\lambda)^{(1)} + (b'_{15})^{(1)} - (r_{15})^{(1)}\right)\{\left((\lambda)^{(1)} + (a'_{15})^{(1)} + (p_{15})^{(1)}\right) \\
&\left[\left(\left((\lambda)^{(1)} + (a'_{13})^{(1)} + (p_{13})^{(1)}\right)(q_{14})^{(1)}G^*_{14} + (a_{14})^{(1)}(q_{13})^{(1)}G^*_{13}\right)\right] \\
&\left(\left((\lambda)^{(1)} + (b'_{13})^{(1)} - (r_{13})^{(1)}\right)s_{(14),(14)}T^*_{14} + (b_{14})^{(1)}s_{(13),(14)}T^*_{14}\right) \\
&+\left(\left((\lambda)^{(1)} + (a'_{14})^{(1)} + (p_{14})^{(1)}\right)(q_{13})^{(1)}G^*_{13} + (a_{13})^{(1)}(q_{14})^{(1)}G^*_{14}\right) \\
&\quad\left(\left((\lambda)^{(1)} + (b'_{13})^{(1)} - (r_{13})^{(1)}\right)s_{(14),(13)}T^*_{14} + (b_{14})^{(1)}s_{(13),(13)}T^*_{13}\right) \\
&\left(\left((\lambda)^{(1)}\right)^2 + \left((a'_{13})^{(1)} + (a'_{14})^{(1)} + (p_{13})^{(1)} + (p_{14})^{(1)}\right)(\lambda)^{(1)}\right) \\
&\quad\left(\left((\lambda)^{(1)}\right)^2 + \left((b'_{13})^{(1)} + (b'_{14})^{(1)} - (r_{13})^{(1)} + (r_{14})^{(1)}\right)(\lambda)^{(1)}\right) \\
&+\left(\left((\lambda)^{(1)}\right)^2 + \left((a'_{13})^{(1)} + (a'_{14})^{(1)} + (p_{13})^{(1)} + (p_{14})^{(1)}\right)(\lambda)^{(1)}\right)(q_{15})^{(1)}G_{15} \\
&+\left((\lambda)^{(1)} + (a'_{13})^{(1)} + (p_{13})^{(1)}\right)\left((a_{15})^{(1)}(q_{14})^{(1)}G^*_{14} + (a_{14})^{(1)}(a_{15})^{(1)}(q_{13})^{(1)}G^*_{13}\right) \\
&\left(\left((\lambda)^{(1)} + (b'_{13})^{(1)} - (r_{13})^{(1)}\right)s_{(14),(15)}T^*_{14} + (b_{14})^{(1)}s_{(13),(15)}T^*_{13}\right)\} = 0
\end{aligned}$$ 108

And as one sees, all the coefficients are positive. It follows that all the roots have negative real part, and this proves the theorem.

MINIMALIST CONCATENATIONAL APPROACH :

QUANTUM GRAVITY **Quantum gravity** (QG) is the field of theoretical physics which attempts to develop scientific models that unify quantum mechanics(describing three of the four known fundamental interactions) with general relativity (describing the fourth, gravity). It is hoped that development of such a theory would unify into a single mathematical framework all fundamental interactions and to describe all known observable interactions in the universe, at both subatomic and cosmological scales.

Such a theory of quantum gravity would yield the same experimental results as ordinary quantum mechanics in conditions of weak gravity (gravitational potentials much less than c^2) and the same results as Einsteinian general relativity in phenomena at scales much larger than individual molecules (action much larger than reduced Planck's constant), but moreover be able to predict the outcome of situations where both quantum effects and strong-field gravity are important (at the Planck scale, unless large extra dimension conjectures are correct.

Motivation for quantizing gravity comes from the remarkable success of the quantum theories of the other three fundamental interactions, and from experimental evidence suggesting that gravity can be made to show quantum effects. Although some quantum gravity theories such as string theory and other unified field theories (or 'theories of everything') attempt to unify gravity with the other fundamental forces, others such as loop quantum gravity make no such attempt; they simply quantize the gravitational field while keeping it separate from the other forces.

Observed physical phenomena can be described well by quantum mechanics or general relativity, without needing both. This can be thought of as due to an extreme separation of mass scales at which they are important. Quantum effects are usually important only for the "very small", that is, for objects no larger than typical molecules. General relativistic effects, on the other hand, show up mainly for the "very large" bodies such as collapsed stars. (Planets' gravitational fields, as of 2011, are well-described by linearized gravity except for Mercury'sperihelion precession; so strong-field effects—any effects of gravity beyond lowest nonvanishing order in φ/c2—have not been observed even in the gravitational fields of planets and main sequence stars). There is a lack of experimental evidence relating to quantum gravity, and classical physics adequately describes the observed effects of gravity over a range of 50 orders of magnitude of mass, i.e., for masses of objects from about 10−23 to 1030 kg.

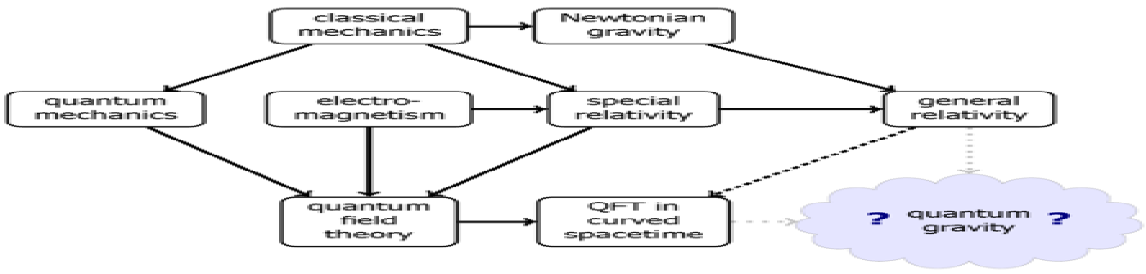


Diagram showing where quantum gravity sits in the hierarchy of physics theories

In this connection, we write to state that the predator-prey approach that has been used in the current paper could be successively used towards the end of obtention of a final theory on the schematic representation in the above. While the authors themselves are working on this, various constraints have bogged them down

Much of the difficulty in meshing these theories at all energy scales comes from the different assumptions that these theories make on how the universe works. Quantum field theory depends on particle fields embedded in the flat space-time of special relativity. General relativity models gravity as a curvature within space-time that changes as a gravitational mass moves. Historically, the most obvious way of combining the two (such as treating gravity as simply another particle field) ran quickly into what is known as the renormalization problem. In the old-fashioned understanding of renormalization, gravity particles **would attract** each other and adding together all of the interactions results in many infinite values which cannot easily be cancelled out mathematically to yield sensible, finite results. This is in contrast with quantum electrodynamics where, while the series still do not converge, the **interactions** sometimes evaluate to infinite results, but those are few enough in number to be **removable** via renormalization.

<u>Effective field theories</u>

Quantum gravity can be treated as an effective field theory. Effective quantum field theories come with some high-energy cutoff, beyond which we do not expect that the theory provides a good description of nature. The "infinities" then become large but finite quantities proportional to this finite cutoff scale, and correspond to processes that involve very high energies near the fundamental cutoff. These quantities can then be absorbed into an infinite collection of coupling constants, and at energies well below the fundamental cutoff of the theory, to any desired precision; only a finite number of these coupling constants need to be measured in order to make legitimate quantum-mechanical predictions. This same logic works just as well for the highly successful theory of low-energy pions as for quantum gravity. Indeed, the first quantum-mechanical corrections to graviton-scattering and Newton's law of gravitation have been explicitly computed (although they are so astronomically small that we may never be able to measure them). In fact, gravity is in many ways a much better quantum field theory than the Standard Model, since it appears to be valid all the way up to its cutoff at the Planck scale. (By comparison, the Standard Model is expected to start to break down above its cutoff at the much smaller scale of around 1000 GeV.le confirming that quantum mechanics and gravity are indeed consistent at reasonable energies, it is clear that near or above the fundamental cutoff of our effective quantum theory of gravity (the cutoff is generally assumed to be of the order of the Planck scale), a new model of nature will be needed. Specifically, the problem of combining quantum mechanics and gravity becomes an issue only at very high energies, and may well require a totally new kind of model.

]**<u>Quantum gravity theory for the highest energy scales</u>**

The general approach to deriving a quantum gravity theory that is valid at even the highest energy scales is to assume that such a theory will be simple and elegant and, accordingly, to study symmetries and other clues offered by current theories that might suggest ways to combine them into a comprehensive, unified theory. One problem with this approach is that it is unknown whether quantum gravity will actually conform to a simple and elegant theory, as it should resolve the dual conundrums of special relativity with regard to the uniformity of acceleration and gravity, and general relativity with regard to spacetime curvature. Such a theory is required in order to understand problems involving the combination of very high energy and very small dimensions of space, such as the behavior of black holes, and the origin of the universe.

Quantum mechanics and general relativity

The graviton

At present, one of the deepest problems in theoretical physics is harmonizing the theory of general relativity, which describes gravitation, and applies to large-scale structures (stars, planets, galaxies), with quantum mechanics, which describes the other three fundamental forces acting on the atomic scale. This problem must be put in the proper context, however. In particular, contrary to the popular claim that quantum mechanics and general relativity are fundamentally incompatible, one can demonstrate that the structure of general relativity essentially follows inevitably from the quantum mechanics of interacting theoretical spin-2 massless particles [(called gravitons).

While there is no concrete proof of the existence of gravitons, quantized theories of matter may necessitate their existence.[Supporting this theory is the observation that all fundamental forces except gravity have one or more known messenger particles, leading researchers to believe that at least one most likely does exist; they have dubbed these hypothetical particles *gravitons*. Many of the accepted notions of a unified theory of physics since the 1970s, including string theory, superstring theory, M-theory, loop quantum gravity, all assume, and to some degree depend upon, the existence of the graviton. Many researchers view the detection of the graviton as vital to validating their work.

The dilaton

Time dilation made its first appearance in Kaluza–Klein theory, a five-dimensional theory that combined gravitation and electromagnetism. Generally, it appears in string theory. More recently, it has appeared in the lower-dimensional many-bodied gravity problem based on the field theoretic approach ofRoman Jackiw. The impetus arose from the fact that complete analytical solutions for the metric of a covariant *N*-body system have proven elusive in General Relativity. To simplify the problem, the number of dimensions was lowered to *(1+1)* namely one spatial dimension and one temporal dimension. This model problem, known as *R=T* theory[11] (as opposed to the general *G=T* theory) was amenable to exact solutions in terms of a generalization of the Lambert. It was also found that the field equation governing the dilaton (derived from differential geometry) was the Schrödinger equation and consequently amenable to quantization.] Thus, one had a theory which combined gravity, quantization and even the electromagnetic interaction, promising ingredients of a fundamental physical theory. It is worth noting that the outcome revealed a previously unknown and already existing *natural link* between general relativity and quantum mechanics. However, this theory needs to be generalized in *(2+1)* or *(3+1)* dimensions although, in principle, the field equations are amenable to such generalization as shown with the inclusion of a one-graviton process and yielding the correct Newtonian limit in *d* dimensions if a dilaton is included. However, it is not yet clear what the full field equation will govern the dilation in higher dimensions. This is further complicated by the fact that gravitons can propagate in *(3+1)* dimensions and consequently that would imply gravitons and dilations exist in the real world. Moreover, detection of the dilaton is expected to be even more elusive than the graviton. However, since this approach allows for the combination of gravitational, electromagnetic and quantum effects, their coupling could potentially lead to a means of vindicating the theory, through cosmology and perhaps even *experimentally*.

Nonrenormalizability of gravity

Relativity, like electromagnetism, is a classical field theory. One might expect that, as with electromagnetism, there should be a corresponding quantum field theory.However, gravity is perturbatively nonrenormalizable.[For a quantum field theory to be well-defined according to this understanding of the subject, it must be asymptotically free orasymptotically safe. The theory must be characterized by a choice of *finitely many* parameters, which could, in principle, be set by experiment. For example, in quantum electrodynamics, these parameters are the charge and mass of the electron, as measured at a particular energy scale.On the other hand, in quantizing gravity, there are *infinitely many independent parameters* (counterterm coefficients) needed to define the theory. For a given choice of those parameters, one could make sense of the theory, but since we can never do infinitely many experiments to fix the values of every parameter, we do not have a meaningful physical theory: At low low energies, the logic of the renormalization group tells us that, despite the unknown choices of these infinitely many parameters, quantum gravity will reduce to the usual Einstein theory of relativity. On the other hand, if we could probe very high energies where quantum effects take over, then *every one* of the infinitely many unknown parameters would begin to matter, and we could make no predictions at all..

Any meaningful theory of quantum gravity that makes sense and is predictive at all energy scales must have some deep principle that reduces the infinitely many unknown parameters to a finite number that can then be measured. One possibility is that normal perturbation theory is not a reliable guide to the renormalizability of the theory, and that there really *is* a UV fixed point for gravity. Since this is a question of non-perturbative quantum field theory, it is difficult to find a reliable answer, but some people still pursue this option Another possibility is that there are new symmetry principles that constrain the parameters and reduce them to a finite set. This is the route taken by string theory, where all of the excitations of the string essentially manifest themselves as new symmetries.

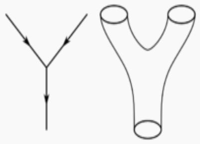
QG as an effective field theory

In an effective field theory, all but the first few of the infinite set of parameters in a non-renormalizable theory are suppressed by huge energy scales and hence can be neglected when computing low-energy effects. Thus, at least in the low-energy regime, the model is indeed a predictive quantum field theory.[(A very similar situation occurs for the very similar effective field theory of low-energy pions.) Furthermore, many theorists agree that even the Standard Model should really be regarded as an effective field theory as well, with "nonrenormalizable" interactions suppressed by large energy scales and whose effects have consequently not been observed experimentally.

Recent work [has shown that by treating general relativity as an effective field theory, one can actually make legitimate predictions for quantum gravity, at least for low-energy phenomena. An example is the well-known calculation of the tiny first-order quantum-mechanical correction to the classical Newtonian gravitational potential between two masses.

Spacetime background dependence AND Gravitational force

A fundamental lesson of general relativity is that there is no fixed spacetime background, as found in Newtonian mechanics and special relativity; the spacetime geometry is dynamic. While easy to grasp in principle, this is the hardest idea to understand about general relativity, and its consequences are profound and not fully explored, even at the classical level. To a certain extent, general relativity can be seen to be a relational theory,[15] in which the only physically relevant information is the relationship between different events in space-time. On the other hand, quantum mechanics has depended since its inception on a fixed background (non-dynamic) structure. In the case of quantum mechanics, it is time that is given and not dynamic, just as in Newtonian classical mechanics. In relativistic quantum field theory, just as in classical field theory, Minkowski spacetime is the fixed background of the theory. **String theory**



Interaction in the subatomic world: world lines of point-like particles in the Standard Model or a world sheet swept up by closed strings in string theory

String theory can be seen as a generalization of quantum field theory where instead of point particles, string-like objects propagate in a fixed spacetime background, although the interactions among closed strings give rise to space-time in a dynamical way. Although string theory had its origins in the study of quark confinement and not of quantum gravity, it was soon discovered that the string spectrum contains the graviton, and that "condensation" of certain vibration modes of strings is equivalent to a modification of the original background. In this sense, string perturbation theory exhibits exactly the features one would expect of a perturbation theory that may exhibit a strong dependence on asymptotics (as seen, for example, in the AdS/CFT correspondence) which is a weak form of background dependence.

Loop Quantum Gravity and Electromagnetic forces linkage

Loop quantum gravity is the fruit of an effort to formulate a background-independent quantum theory.

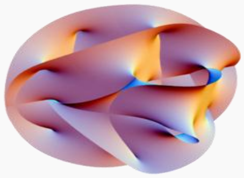
Topological quantum field theory provided an example of background-independent quantum theory, but with no local degrees of freedom, and only finitely many degrees of freedom globally. This is inadequate to describe gravity in 3+1 dimensions which has local degrees of freedom according to general relativity. In 2+1 dimensions, however, gravity is a topological field theory, and it has been successfully quantized in several different ways, including spin networks.[Quantum field theory on curved (non-Minkowskian) backgrounds, while not a full quantum theory of gravity, has shown many promising early results. In an analogous way to the development of quantum electrodynamics in the early part of the 20th century (when physicists considered quantum mechanics in classical electromagnetic fields), the consideration of quantum field theory on a curved background has led to predictions such as black hole radiation. Phenomena such as the Unruh effect, in which particles exist in certain accelerating frames but not in stationary ones, do not pose any difficulty when considered on a curved background (the Unruh effect occurs even in flat Minkowskian backgrounds). The vacuum state is the state with least energy (and may or may not contain particles). See Quantum field theory in curved spacetime for a more complete discussion.

<u>Points of Time and Quantum Gravity</u>

There are other points of tension between quantum mechanics and general relativity.

First, classical general relativity breaks down at singularities, and quantum mechanics becomes inconsistent with general relativity in the neighborhood of singularities (however, no one is certain that classical general relativity applies near singularities in the first place).Second, it is not clear how to determine the gravitational field of a particle, since under the Heisenberg uncertainty principle of quantum mechanics its location and velocity cannot be known with certainty. The resolution of these points may come from a better understanding of general relativity Third; there is the Problem of Time in quantum gravity. Time has a different meaning in quantum mechanics and general relativity and hence there are subtle issues to resolve when trying to formulate a theory which combines the two

String theory

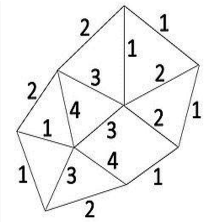


Projection of a Calabi-Yau manifold, one of the ways of compactifying the extra dimensions posited by string theory

One suggested starting point is ordinary quantum field theories which, after all, are successful in describing the other three basic fundamental forces in the context of the standard model of elementary particle physics. However, while this leads to an acceptableeffective (quantum) field theory of gravity at low energies, gravity turns out to be much more problematic at higher energies. Where, for ordinary field theories such as quantum electrodynamics, a technique known as renormalization is an integral part of deriving predictions which take into account higher-energy contributions, gravity turns out to be nonrenormalizable: at high energies, applying the recipes of ordinary quantum field theory yields models that are devoid of all predictive power. One attempt to overcome these limitations is to replace ordinary quantum field theory, which is based on the classical concept of a point particle, with a quantum theory of one-dimensional extended objects: string theory. At the energies reached in current experiments, these strings are indistinguishable from point-like particles, but, crucially, different modes of oscillation of one and the same type of fundamental string appear as particles with different (electric and other) charges. In this way, string theory promises to be a unified description of all particles and interactions.[25] The theory is successful in that one mode will always correspond to a graviton, the messenger of gravity; however, the price to pay are unusual features such as six extra dimensions of space in addition to the usual three for space and one for time.[

In what is called the second superstring revolution, it was conjectured that both string theory and a unification of general relativity andsupersymmetry known as super gravity form part of a hypothesized eleven-dimensional model known as M-theory, which would constitute a uniquely defined and consistent theory of quantum gravity.[28][29] As presently understood, however, string theory admits a very large number (10^{500} by some estimates) of consistent vacua, comprising the so-called "string landscape". Sorting through this large family of solutions remains one of the major challenges.

Loop quantum gravity



Simple spin network of the type used in loop quantum gravity

Another approach to quantum gravity starts with the canonical quantization procedures of quantum theory. Starting with the initial-value-formulation of general relativity (cf. the section on evolution equations, above), the result is an analogue of the Schrödinger equation: theWheeler–DeWitt equation, which some argue is ill-defined.[30] A major break-through came with the introduction of what are now known as Ashtekar variables, which represent geometric gravity using mathematical analogues of electric and magnetic fields.The resulting candidate for a theory of quantum gravity is Loop quantum gravity, in which space is represented by a network structure called aspin network, evolving over time in discrete steps.

Other approaches

There are a number of other approaches to quantum gravity. The approaches differ depending on which features of general relativity and quantum theory are accepted unchanged, and which features are modified Examples include:

In quantum field theory, the Weinberg–Witten theorem places some constraints on theories of composite gravity/emergent gravity. However, recent developments attempt to show that if locality is only approximate and the holographic principle is correct, the Weinberg–Witten theorem would not be valid[.

QUANTUM GRAVITATIONAL EFFECTS AND THE PLACE OF ELECTROMAGNETISM

As was emphasized above, quantum gravitational effects are extremely weak and therefore difficult to test. For this reason, the possibility of experimentally testing quantum gravity had not received much attention prior to the late 1990s. However, in the past decade, physicists have realized that evidence for quantum gravitational effects can guide the development of the theory. Since the theoretical development has been slow, the phenomenology of quantum gravity which studies the possibility of experimental tests, has obtained increased attention. There is presently no confirmed experimental signature of quantum gravitational effects. The most widely pursued possibilities for quantum gravity phenomenology include violations of Lorentz, imprints of quantum gravitational effects in the Cosmic Microwave Background (in particular its polarization), and decoherence induced by fluctuations in the space-time foam.

INTERRELATIONSHIPS OF FUNDAMENTAL FORCES ESPECIALLY GRAVITY AND ELECTROMAGNETISM IN COSMOLOGY

Quantum cosmology hopes to find explanations of present features of the universe on a variety of scales. On the largest scales it attempts to explain the approximate homogeneity and isotropy of the matter and radiation distributions, the approximate flatness of the spatial geometry universe, and the origin of the density fluctuations that were the seeds of galaxies. On more familiar scales, the initial condition may explain the approximate validity of classical physics over most of the history of the universe and the homogeneity of the thermodynamic arrow of time. Finally, the initial condition may play an important role in determining features of the universe on very small scales such as the dimensionality of spacetime, its topological structure and the value of the cosmological constant.

The usual textbook Copenhagen frameworks of quantum mechanics must be generalized to apply to quantum cosmology for two reasons: First quantum mechanics must be generalized so it is applicable to closed systems, most generally the universe, that are not measured by anything outside. Characteristically the Copenhagen formulations assumed a possible division of the world into "observer" and "observed", assumed that "measurements" are the primary focus of scientific statements and, in effect, posited the existence of an external "quasiclassical realm". However, in a theory of the whole thing there can be no fundamental division into observer and observed. Measurements and observers cannot be fundamental notions in a theory that seeks to describe the early universe when neither existed. In a basic formulation of quantum mechanics there is no reason in general for there to be any variables that exhibit classical behavior in all circumstances. The decoherent (or consistent) histories formulation of quantum theory of closed systems supplies the necessary generalization. A further generalization of usual quantum mechanics is needed for quantum gravity. That is because usual quantum mechanics relies in essential ways on a fixed, background spacetime geometry, for example to specify the time that plays a preferred role in the Schroedinger equation and in the reduction of the state vector. Centrally into the formalism. But in quantum gravity, spacetime is not fixed. Rather it is a quantum dynamical variable, fluctuating and generally without definite value. A generalization of usual quantum theory that does not require fixed spacetime geometry, but to which the usual theory is a good approximation in situations when the geometry is approximately fixed, is therefore needed for quantum gravity and quantum cosmology.

GOVERNING EQUATIONS

GRAVITATIONAL FORCE

$$\frac{dG_{13}}{dt} = (a_{13})^{(1)} G_{14} - (a'_{13})^{(1)} G_{13}$$

1a

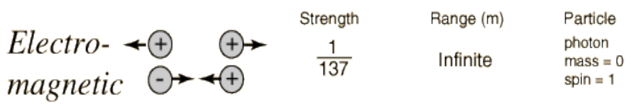
$$\frac{dG_{14}}{dt} = (a_{14})^{(1)} G_{13} - (a'_{14})^{(1)} G_{14}$$

2a

$$\frac{dG_{15}}{dt} = (a_{15})^{(1)} G_{14} - (a'_{15})^{(1)} G_{15}$$

ELECTROMAGNETIC FORCE: 3a

LINK BETWEEN ELECTROMAGNETIC FORCE AND GRAVITATIONAL FORCE



One of the four fundamental forces, the electromagnetic force manifests itself through the forces between charges (Coulomb's Law) and the magnetic force, both of which are summarized in the Lorentz force law. Fundamentally, both magnetic and electric forces are manifestations of an exchange force involving the exchange of photons. The quantum approach to the electromagnetic force is called quantum electrodynamics or QED. **The electromagnetic force is a force of infinite range which obeys the inverse square law, and is of the same form as the gravity force.**

The electromagnetic force holds atoms and molecules together. In fact, the forces of **electric attraction and repulsion of electric charges are so dominant over the other three fundamental forces that they can be considered to be negligible as determiners of atomic and molecular structure. Even magnetic effects are usually apparent only** at high resolutions, and as small corrections.

LINK BETWEEN WEAK NUCLEAR FORCE AND ELECTROMAGNETIC FORCE:

The fundamental force that acts between leptons and is involved in the decay of hadrons. The weak nuclear force is responsible for nuclear beta decay (by changing the flavor of quarks) and for neutrino absorption and emission. It is mediated by the intermediate vector bosons (the W boson and the Z boson), and is weaker than the strong nuclear force and the electromagnetic force but stronger than gravity. Some scientists believe that the

weak nuclear force and the electromagnetic force are both aspects of a single force called the electroweak force. Also called *weak nuclear force, weak interaction*.

$\frac{dT_{13}}{dt} = (b_{13})^{(1)}T_{14} - (b'_{13})^{(1)}T_{13}$ 4a

$\frac{dT_{14}}{dt} = (b_{14})^{(1)}T_{13} - (b'_{14})^{(1)}T_{14}$ 5a

$\frac{dT_{15}}{dt} = (b_{15})^{(1)}T_{14} - (b'_{15})^{(1)}T_{15}$ 6a

WEAK NUCLEAR FORCE:GOVERNING EQUATIONS

Spontaneous Symmetry Breaking

An example of linkage between weak and electromagnetic force

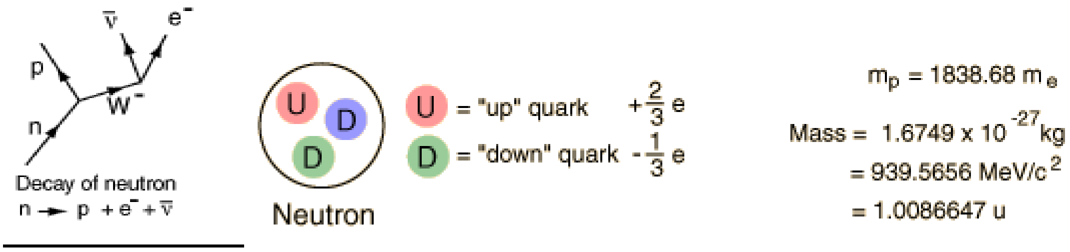
The **weak and electromagnetic fundamental forces** seem very different in the present relatively low temperature universe. But when the universe was much hotter so that the equilibrium thermal energy was on the order of 100 GeV, these forces may have appeared to be essentially identical - part of the same unified "electroweak" force. But since the exchange particle for the electromagnetic part is the massless photon and the exchange particles for the weak interaction are the massive W and Z particles, the symmetry was spontaneously broken when the available energy dropped below about 80 GeV and the weak and electromagnetic forces take on a distinctly different look. The model is that at an even higher temperature, there was symmetry or unification with the strong interaction, the grand. And higher still, the gravity force may join to show the four fundamental forces to be a single unified force. Trefil invokes some interesting analogies to illustrate the concept of spontaneous symmetry breaking.

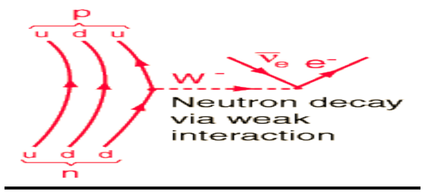
The concept of spontaneous symmetry breaking is important to the understanding of **electroweak unification and further unifications**. Trefil invokes some analogies in the realm of classical physics.

The snowflake: Both the hydrogen and oxygen molecules are quite symmetric when they are isolated. The electric force which **governs** their actions as atoms is also a symmetrically acting force. But when their temperature is lowered and they form a water molecule, the symmetry of the individual atoms is **broken** as they form a molecule with 105 degrees between the hydrogen-oxygen bonds. When they freeze to form a snowflake, they form another type of symmetry, but the symmetry of the original atoms has been lost. Since this **loss o**f symmetry **occurs** without any external intervention, we say that it has undergone spontaneous symmetry breaking

DECAY OF NEUTRON DUE TO WEAK INTERACTION ATTRIBUTABLE TO WEAK FORCE

A free neutron will decay with a half-life of about 10.3 minutes but it is stable if **combined i**nto a nucleus. This decay is an example of beta decay with **the emission** of an electron and an electron antineutrino. The decay of the **neutron involves** the weak interaction as indicated in the Feynman diagram below



	A more detailed diagram of the neutron's decay identifies it as the transformation of one of the neutron's down quarks into an up quark. It is an example of the kind of quark transformations that are involved in many nuclear processes, including beta decay

The decay of the neutron is a good example of the observations which led to the discovery of the neutrino.

N $m_n = 939.5656 \ MeV$ + $m_p = 938.2723 \ MeV$ − $m_e = 0.510999 \ MeV$ $0.7823 \ MeV = Q \ for \ n \rightarrow p + e^-$	Using the concept of binding energy, and representing the masses of the particles by their rest, the energy **yield** from neutron decay can be calculated from the particle masses. Because energy and momentum must be conserved in the decay, it will be shown that the lighter electron **will carry away most of the kinetic energy. With** a kinetic energy of this magnitude, the relativistic kinetic energy expression must be used

For the moment we presume (incorrectly) that the decay **involves** just the proton and electron as products. The energy yield Q would then be divided between the proton and electron. The electron will get most of the kinetic energy and will be relativistic, but the proton is non-relativistic. The energy balance is then

$$Q = 0.7823 \ MeV = KE_e + \frac{1}{2} m_p v_p^2 = KE_e + \frac{p_p^2 c^2}{2 m_p c^2}$$

In the rest frame of the neutron, conservation of momentum requires

$pc_{electron} = - pc_{proton}$

and $pc_{electron}$ can be expressed in terms of the electron kinetic energy

$$(pc_{electron})^2 = KE_e^2 + 2KE_e \cdot m_e c^2$$

The energy balance then becomes

$$0.7823\ MeV = KE_e + \frac{KE_e^2 + 2KE_e \cdot m_e c^2}{2m_p c^2}$$

When you substitute the numbers for this value of Q, you see that the KE_e^2 term is negligible, so the required kinetic energy of the electron can be calculated. The required electron kinetic energy for this two-particle decay scheme is

$$0.7823\ MeV = KE_e\left[1 + \frac{m_e}{m_p}\right]; \qquad KE_e = 0.7819\ MeV$$

Likewise, the momentum of the electron for this two particle decay is constrained to be

$$pc_{electron} = \sqrt{KE_e^2 + 2KE_e \cdot m_e c^2} = 1.188\ MeV$$

Momentum and energy for the two-particle decay are constrained to these values, but this is not the way nature behaves. The observed momentum and energy distributions for the electron are as shown below.

The mysterious particle was called a neutrino, but it was twenty five years before unambiguous experimental observation of the neutrino was made by Cowan and Reines. The present understanding of the decay of the neutron is

$$n \longrightarrow p + e^- + \underset{\substack{electron\\ antineutrino}}{\bar{\nu}_e}$$

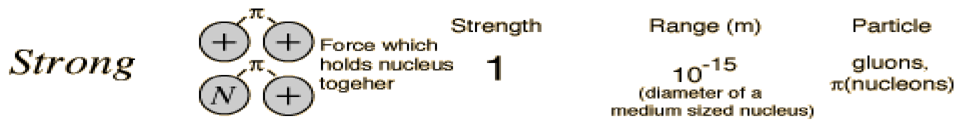
This decay illustrates some of the conservation laws which govern particle decays. The proton in the product satisfies the conservation of baryon number, but the emergence of the electron unaccompanied would violate conservation of lepton number. The third particle must be an electron antineutrino to allow the decay to satisfy lepton number conservation. The electron has lepton number 1, and the antineutrino has lepton number -1

$\frac{dG_{17}}{dt} = (a_{17})^{(2)} G_{16} - (a'_{17})^{(2)} G_{17}$ 7a

$\frac{dG_{18}}{dt} = (a_{18})^{(2)} G_{17} - (a'_{18})^{(2)} G_{18}$ 8a

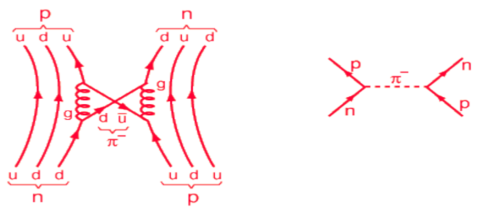
STRONG NUCLEAR FORCE GOVERNING EQUATIONS AND ITS LINK WITH WEAK FORCE AND ELECTROMAGNETIC FORCE 9a

The Strong Force



A force which can hold a nucleus together against the enormous forces of repulsion of the protons is strong indeed. However, it is not an inverse square force like the electromagnetic force and it has a very short range. Yukawa modeled the strong force as an exchange force in which the exchange particles are pions and other heavier particles. The range of a particle exchange force is limited by the uncertainty principle. It is the strongest of the four fundamental forces

Since the protons and neutrons which make up the nucleus are themselves considered to be made up of quarks, and the quarks are considered to be held together by the color force, the strong force between nucleons may be considered to be a residual color force. In the standard model, therefore, the basic exchange particle is the gluon which mediates the forces between quarks. Since the individual gluons and quarks are contained within the proton or neutron, the masses attributed to them cannot be used in the range relationship to predict the range of the force. When something is viewed as emerging from a proton or neutron, then it must be at least a quark-antiquark pair, so it is then plausible that the pion as the lightest meson should serve as a predictor of the maximum range of the strong force between nucleons.



The sketch is an attempt to show one of many forms the **gluon interaction** between nucleons could take, this one involving up-**antiup** pair production and **<u>annililation and producing a π^- bridging the nucleons.</u>**

10a

$$\frac{dT_{16}}{dt} = (b_{16})^{(2)}T_{17} - (b'_{16})^{(2)}T_{16}$$

11a

$$\frac{dT_{17}}{dt} = (b_{17})^{(2)}T_{16} - (b'_{17})^{(2)}T_{17}$$

12a

$$\frac{dT_{18}}{dt} = (b_{18})^{(2)}T_{17} - (b'_{18})^{(2)}T_{18}$$

<u>GOVERNING EQUATIONS OF DUAL CONCATENATED SYSTEMS</u>

<u>GRAVITATIONAL FORCE</u>:

$$\frac{dG_{13}}{dt} = (a_{13})^{(1)}G_{14} - \left[(a'_{13})^{(1)}\boxed{+(a''_{13})^{(1)}(T_{14},t)}\right]G_{13}$$

$$\frac{dG_{14}}{dt} = (a_{14})^{(1)}G_{13} - \left[(a'_{14})^{(1)}\boxed{+(a''_{14})^{(1)}(T_{14},t)}\right]G_{14}$$ 13a

$$\frac{dG_{15}}{dt} = (a_{15})^{(1)}G_{14} - \left[(a'_{15})^{(1)}\boxed{+(a''_{15})^{(1)}(T_{14},t)}\right]G_{15}$$ 14a

Where $\boxed{+(a''_{13})^{(1)}(T_{14},t)}$, $\boxed{+(a''_{14})^{(1)}(T_{14},t)}$, $\boxed{+(a''_{15})^{(1)}(T_{14},t)}$ are first **augmentation** coefficients for category 1, 2 and 3 15a

<u>ELECTROMAGNETIC FORCE</u>:

$$\frac{dT_{13}}{dt} = (b_{13})^{(1)}T_{14} - \left[(b'_{13})^{(1)}\boxed{-(b''_{13})^{(1)}(G,t)}\right]T_{13}$$

$\frac{dT_{14}}{dt} = (b_{14})^{(1)}T_{13} - \left[(b'_{14})^{(1)}\boxed{-(b''_{14})^{(1)}(G,t)}\right]T_{14}$ 16a

$\frac{dT_{15}}{dt} = (b_{15})^{(1)}T_{14} - \left[(b'_{15})^{(1)}\boxed{-(b''_{15})^{(1)}(G,t)}\right]T_{15}$ 17a

Where $\boxed{-(b''_{13})^{(1)}(G,t)}$, $\boxed{-(b''_{14})^{(1)}(G,t)}$, $\boxed{-(b''_{15})^{(1)}(G,t)}$ are first **detrition** coefficients for category 1, 2 and 3 18a

STRONG NUCLEAR FORCE AND WEAK NUCLEAR FORCE: CORRESPONDING CONCATENATED EQUATIONS:

WEAK NUCLEAR FORCE

$\frac{dG_{16}}{dt} = (a_{16})^{(2)}G_{17} - \left[(a'_{16})^{(2)}\boxed{+(a''_{16})^{(2)}(T_{17},t)}\right]G_{16}$

$\frac{dG_{17}}{dt} = (a_{17})^{(2)}G_{16} - \left[(a'_{17})^{(2)}\boxed{+(a''_{17})^{(2)}(T_{17},t)}\right]G_{17}$ 19a

$\frac{dG_{18}}{dt} = (a_{18})^{(2)}G_{17} - \left[(a'_{18})^{(2)}\boxed{+(a''_{18})^{(2)}(T_{17},t)}\right]G_{18}$ 20a

Where $\boxed{+(a''_{16})^{(2)}(T_{17},t)}$, $\boxed{+(a''_{17})^{(2)}(T_{17},t)}$, $\boxed{+(a''_{18})^{(2)}(T_{17},t)}$ are first **augmentation** coefficients for category 1, 2 and 3 21a

STRONG NUCLEAR FORCE:

$\frac{dT_{16}}{dt} = (b_{16})^{(2)}T_{17} - \left[(b'_{16})^{(2)}\boxed{-(b''_{16})^{(2)}(G_{19},t)}\right]T_{16}$

$\frac{dT_{17}}{dt} = (b_{17})^{(2)}T_{16} - \left[(b'_{17})^{(2)}\boxed{-(b''_{17})^{(2)}(G_{19},t)}\right]T_{17}$ 22a

$\frac{dT_{18}}{dt} = (b_{18})^{(2)}T_{17} - \left[(b'_{18})^{(2)}\boxed{-(b''_{18})^{(2)}(G_{19},t)}\right]T_{18}$ 23a

Where $\boxed{-(b''_{16})^{(2)}(G_{19},t)}$, $\boxed{-(b''_{17})^{(2)}(G_{19},t)}$, $\boxed{-(b''_{18})^{(2)}(G_{19},t)}$ are first **detrition** coefficients for category 1, 2 and 3 24a

GOVERNING EQUATIONS OF CONCATENATED SYSTEM OF TWO CONCATENATED DUAL SYSTEMS

EMF AND WNF AND SNF ANDGRAVITATIONAL FORCE AND WNF:A CROSS CULTURAL COMBINATION*GOVERNING EQUATIONS:*

WEAK NUCLEAR FORCE:

$\frac{dG_{16}}{dt} = (a_{16})^{(2)}G_{17} - \left[(a'_{16})^{(2)}\boxed{+(a''_{16})^{(2)}(T_{17},t)}\boxed{+(a''_{13})^{(1,1)}(T_{14},t)}\right]G_{16}$

$\frac{dG_{17}}{dt} = (a_{17})^{(2)}G_{16} - \left[(a'_{17})^{(2)}\boxed{+(a''_{17})^{(2)}(T_{17},t)}\boxed{+(a''_{14})^{(1,1)}(T_{14},t)}\right]G_{17}$ 25a

$\frac{dG_{18}}{dt} = (a_{18})^{(2)}G_{17} - \left[(a'_{18})^{(2)}\boxed{+(a''_{18})^{(2)}(T_{17},t)}\boxed{+(a''_{15})^{(1)}(T_{14},t)}\right]G_{18}$ 26a

27a

ELECTROMAGNETIC FORCE

$\frac{dT_{13}}{dt} = (b_{13})^{(1)}T_{14} - \left[(b'_{13})^{(1)}\boxed{-(b''_{13})^{(1)}(G,t)}\boxed{-(b''_{16})^{(2,2)}(G_{19},t)}\right]T_{13}$

$\frac{dT_{14}}{dt} = (b_{14})^{(1)}T_{13} - \left[(b'_{14})^{(1)}\boxed{-(b''_{14})^{(1)}(G,t)}\boxed{-(b''_{17})^{(2,2)}(G_{19},t)}\right]T_{14}$ 28a

$\frac{dT_{15}}{dt} = (b_{15})^{(1)}T_{14} - \left[(b'_{15})^{(1)}\boxed{-(b''_{15})^{(1)}(G,t)}\boxed{-(b''_{18})^{(2,2)}(G_{19},t)}\right]T_{15}$ 29a

30a

GRAVITATIONAL FORCE

$\frac{dG_{13}}{dt} = (a_{13})^{(1)}G_{14} - \left[(a'_{13})^{(1)}\boxed{+(a''_{13})^{(1)}(T_{14},t)}\right]G_{13}$

$\frac{dG_{14}}{dt} = (a_{14})^{(1)}G_{13} - \left[(a'_{14})^{(1)}\boxed{+(a''_{14})^{(1)}(T_{14},t)}\right]G_{14}$ 31a

$\frac{dG_{15}}{dt} = (a_{15})^{(1)}G_{14} - \left[(a'_{15})^{(1)}\boxed{+(a''_{15})^{(1)}(T_{14},t)}\right]G_{15}$ 32a

Where $\boxed{+(a''_{13})^{(1)}(T_{14},t)}$, $\boxed{+(a''_{14})^{(1)}(T_{14},t)}$, $\boxed{+(a''_{15})^{(1)}(T_{14},t)}$ **are first augmentation coefficients for category 1, 2 and 3** 33a

STRONG NUCLEAR FORCE:

$\frac{dT_{16}}{dt} = (b_{16})^{(2)}T_{17} - \left[(b'_{16})^{(2)}\boxed{-(b''_{16})^{(2)}(G_{19},t)}\right]T_{16}$

$\frac{dT_{17}}{dt} = (b_{17})^{(2)}T_{16} - \left[(b'_{17})^{(2)}\boxed{-(b''_{17})^{(2)}(G_{19},t)}\right]T_{17}$ 34a

$\frac{dT_{18}}{dt} = (b_{18})^{(2)}T_{17} - \left[(b'_{18})^{(2)}\boxed{-(b''_{18})^{(2)}(G_{19},t)}\right]T_{18}$ 35a

Where $\boxed{-(b''_{16})^{(2)}(G_{19},t)}$, $\boxed{-(b''_{17})^{(2)}(G_{19},t)}$, $\boxed{-(b''_{18})^{(2)}(G_{19},t)}$ are first **detrition** coefficients for category 1, 2 and 3 36a

GOVERNING EQUATIONS OF STRONG NUCLEAR FORCEAND GRAVITATIONAL FORCE

STRONG NUCLEAR FORCE:

$\frac{dT_{16}}{dt} = (b_{16})^{(2)}T_{17} - \left[(b'_{16})^{(2)}\boxed{-(b''_{16})^{(2)}(G_{19},t)}\boxed{-(b''_{13})^{(1,1)}(G,t)}\right]T_{16}$

$\frac{dT_{17}}{dt} = (b_{17})^{(2)}T_{16} - \left[(b'_{17})^{(2)}\boxed{-(b''_{17})^{(2)}(G_{19},t)}\boxed{-(b''_{14})^{(1,1)}(G,t)}\right]T_{17}$ 37a

$\frac{dT_{6}}{dt} = (b_{18})^{(2)}T_{17} - \left[(b'_{18})^{(2)}\boxed{-(b''_{18})^{(2)}(G_{19},t)}\boxed{-(b''_{15})^{(1,1)}(G,t)}\right]T_{18}$ 38a

Where $\boxed{-(b''_{16})^{(2)}(G_{19},t)}$, $\boxed{-(b''_{17})^{(2)}(G_{19},t)}$, $\boxed{-(b''_{18})^{(2)}(G_{19},t)}$ are **first detrition** coefficients for category 1, 2 and 3 $\boxed{-(b''_{13})^{(1,1)}(G,t)}$, $\boxed{-(b''_{14})^{(1,1)}(G,t)}$, $\boxed{-(b''_{15})^{(1,1)}(G,t)}$ are **second detrition** coefficients for category 1, 2 and 3 39a

GRAVITATIONAL FORCE

$\frac{dG_{13}}{dt} = (a_{13})^{(1)}G_{14} - \left[(a'_{13})^{(1)}\boxed{+(a''_{13})^{(1)}(T_{14},t)}\boxed{+(a''_{16})^{(2,2)}(T_{17},t)}\right]G_{13}$

$\frac{dG_{14}}{dt} = (a_{14})^{(1)}G_{13} - \left[(a'_{14})^{(1)}\boxed{+(a''_{14})^{(1)}(T_{14},t)}\boxed{+(a''_{17})^{(2,2)}(T_{17},t)}\right]G_{14}$ 40a

$\frac{dG_{15}}{dt} = (a_{15})^{(1)}G_{14} - \left[(a'_{15})^{(1)}\boxed{+(a''_{15})^{(1)}(T_{14},t)}\boxed{+(a''_{18})^{(2,2)}(T_{17},t)}\right]G_{15}$ 41a

Where $\boxed{(a''_{13})^{(1)}(T_{14},t)}$, $\boxed{(a''_{14})^{(1)}(T_{14},t)}$, $\boxed{(a''_{15})^{(1)}(T_{14},t)}$ are **first augmentation** coefficients for category 1, 2 and 3 $\boxed{+(a''_{16})^{(2,2)}(T_{17},t)}$, $\boxed{+(a''_{17})^{(2,2)}(T_{17},t)}$, $\boxed{+(a''_{18})^{(2,2)}(T_{17},t)}$ are **second augmentation** coefficients for category 1, 2 and 3 42a

WEAK NUCLEAR FORCE:

$\frac{dG_{16}}{dt} = (a_{16})^{(2)}G_{17} - \left[(a'_{16})^{(2)}\boxed{+(a''_{16})^{(2)}(T_{17},t)}\right]G_{16}$

$\frac{dG_{17}}{dt} = (a_{17})^{(2)}G_{16} - \left[(a'_{17})^{(2)}\boxed{+(a''_{17})^{(2)}(T_{17},t)}\right]G_{17}$ 43a

$\frac{dG_{18}}{dt} = (a_{18})^{(2)}G_{17} - \left[(a'_{18})^{(2)}\boxed{+(a''_{18})^{(2)}(T_{17},t)}\right]G_{18}$ 44a

Where $\boxed{+(a''_{16})^{(2)}(T_{17},t)}$, $\boxed{+(a''_{17})^{(2)}(T_{17},t)}$, $\boxed{+(a''_{18})^{(2)}(T_{17},t)}$ are **first augmentation** coefficients for category 1, 2 and 3 45a

ELECTROMAGNETIC FORCE:

$\frac{dT_{13}}{dt} = (b_{13})^{(1)}T_{14} - \left[(b'_{13})^{(1)}\boxed{-(b''_{13})^{(1)}(G,t)}\right]T_{13}$

$\frac{dT_{14}}{dt} = (b_{14})^{(1)}T_{13} - \left[(b'_{14})^{(1)}\boxed{-(b''_{14})^{(1)}(G,t)}\right]T_{14}$ 46a

$\frac{dT_{15}}{dt} = (b_{15})^{(1)}T_{14} - \left[(b'_{15})^{(1)}\boxed{-(b''_{15})^{(1)}(G,t)}\right]T_{15}$ 47a

Where $\boxed{-(b''_{13})^{(1)}(G,t)}$, $\boxed{-(b''_{14})^{(1)}(G,t)}$, $\boxed{-(b''_{15})^{(1)}(G,t)}$ are **first detrition** coefficients for category 1, 2 and 3 48a

GOVERNING EQUATIONS OF THE SYSTEM

WEAK NUCLEAR FORCE

$\frac{dG_{16}}{dt} = (a_{16})^{(2)}G_{17} - \left[(a'_{16})^{(2)}\boxed{+(a''_{16})^{(2)}(T_{17},t)}\boxed{+(a''_{13})^{(1,1,1)}(T_{14},t)}\right]G_{16}$

$\frac{dG_{17}}{dt} = (a_{17})^{(2)}G_{16} - \left[(a'_{17})^{(2)}\boxed{+(a''_{17})^{(2)}(T_{17},t)}\boxed{+(a''_{14})^{(1,1,1)}(T_{14},t)}\right]G_{17}$ 49a

$\frac{dG_{18}}{dt} = (a_{18})^{(2)}G_{17} - \left[(a'_{18})^{(2)}\boxed{+(a''_{18})^{(2)}(T_{17},t)}\boxed{+(a''_{15})^{(1,1,1)}(T_{14},t)}\right]G_{18}$ 50a

Where $\boxed{+(a''_{16})^{(2)}(T_{17},t)}$, $\boxed{+(a''_{17})^{(2)}(T_{17},t)}$, $\boxed{+(a''_{18})^{(2)}(T_{17},t)}$ are **first augmentation** coefficients for category 1, 2 and 3*And* $\boxed{+(a''_{13})^{(1,1,1)}(T_{14},t)}$, $\boxed{+(a''_{14})^{(1,1,1)}(T_{14},t)}$, $\boxed{+(a''_{15})^{(1,1,1)}(T_{14},t)}$ are **second augmentation** coefficient for category 1, 2 and 3 51a

ELECTROMAGNETIC FORCE:

$\frac{dT_{13}}{dt} = (b_{13})^{(1)}T_{14} - \left[(b'_{13})^{(1)}\boxed{-(b''_{13})^{(1)}(G,t)}\ \boxed{-(b''_{16})^{(2,2,2)}(G_{19},t)}\right]T_{13}$

$\frac{dT_{14}}{dt} = (b_{14})^{(1)}T_{13} - \left[(b'_{14})^{(1)}\boxed{-(b''_{14})^{(1)}(G,t)}\ \boxed{-(b''_{17})^{(2,2,2)}(G_{19},t)}\right]T_{14}$ 52a

$\frac{dT_{15}}{dt} = (b_{15})^{(1)} T_{14} - \left[(b'_{15})^{(1)} \boxed{-(b''_{15})^{(1)}(G,t)} \boxed{-(b''_{18})^{(2,2,2)}(G_{19},t)} \right] T_{15}$ 53a

Where $\boxed{-(b''_{13})^{(1)}(G,t)}$, $\boxed{-(b''_{14})^{(1)}(G,t)}$, $\boxed{-(b''_{15})^{(1)}(G,t)}$ are **first detrition** coefficients for category 1, 2 and 3 54a

$\boxed{-(b''_{16})^{(2,2,2)}(G_{19},t)}$, $\boxed{-(b''_{17})^{(2,2,2)}(G_{19},t)}$, $\boxed{-(b''_{18})^{(2,2,2)}(G_{19},t)}$ are **second detrition** coefficient for category 1, 2 and 3

GRAVITATIONAL FORCE

$\frac{dG_{13}}{dt} = (a_{13})^{(1)} G_{14} - \left[(a'_{13})^{(1)} \boxed{+(a''_{13})^{(1)}(T_{14},t)} \boxed{+(a''_{16})^{(2,2,2)}(T_{17},t)} \right] G_{13}$

$\frac{dG_{14}}{dt} = (a_{14})^{(1)} G_{13} - \left[(a'_{14})^{(1)} \boxed{+(a''_{14})^{(1)}(T_{14},t)} \boxed{+(a''_{17})^{(2,2,2)}(T_{17},t)} \right] G_{14}$ 55a

$\frac{dG_{15}}{dt} = (a_{15})^{(1)} G_{14} - \left[(a'_{15})^{(1)} \boxed{+(a''_{15})^{(1)}(T_{14},t)} \boxed{+(a''_{18})^{(2,2,2)}(T_{17},t)} \right] G_{15}$ 56a

Where $\boxed{+(a''_{13})^{(1)}(T_{14},t)}$, $\boxed{+(a''_{14})^{(1)}(T_{14},t)}$, $\boxed{+(a''_{15})^{(1)}(T_{14},t)}$ are **first augmentation** coefficients for category 1, 2 and 3 57a

$\boxed{+(a''_{16})^{(2,2,2)}(T_{17},t)}$, $\boxed{+(a''_{17})^{(2,2,2)}(T_{17},t)}$, $\boxed{+(a''_{18})^{(2,2,2)}(T_{17},t)}$ **are second augmentation** coefficient for category 1, 2 and 3

WEAK NUCLEAR FORCE

$\frac{dT_{16}}{dt} = (b_{16})^{(2)} T_{17} - \left[(b'_{16})^{(2)} \boxed{-(b''_{16})^{(2)}(G_{19},t)} \boxed{-(b''_{13})^{(1,1,1)}(G,t)} \right] T_{16}$

$\frac{dT_{17}}{dt} = (b_{17})^{(2)} T_{16} - \left[(b'_{17})^{(2)} \boxed{-(b''_{17})^{(2)}(G_{19},t)} \boxed{-(b''_{14})^{(1,1,1)}(G,t)} \right] T_{17}$ 58a

$\frac{dT_{18}}{dt} = (b_{18})^{(2)} T_{17} - \left[(b'_{18})^{(2)} \boxed{-(b''_{18})^{(2)}(G_{19},t)} \boxed{-(b''_{15})^{(1,1,1)}(G,t)} \right] T_{18}$ 59a

where $\boxed{-(b''_{16})^{(2)}(G_{19},t)}$, $\boxed{-(b''_{17})^{(2)}(G_{19},t)}$, $\boxed{-(b''_{18})^{(2)}(G_{19},t)}$ are first detritions coefficients for category 1, 2 and 3 60a

$\boxed{-(b''_{13})^{(1,1,1)}(G,t)}$, $\boxed{-(b''_{14})^{(1,1,1)}(G,t)}$, $\boxed{-(b''_{15})^{(1,1,1)}(G,t)}$ are second detrition coefficients for category 1,2 and 3

VERY IMPORTANT EPILOGUE:

In the above equations, we have explored all the possibilities if EMF, GF, SNF, WNF interacting in various PERMUTATIONS AND COMBINATIONS.. The equations can solved with the application of the processual formalities and procedural regularities of the paper which has been elucidated in detail. in the foregoing. Nevertheless such possibilities and probabilities would be discussed both with reference to structure orientation and process orientation in future papers. Notwithstanding , it can be said in unmistakable terms that with the same conditional ties and functionalities consummated we shall obtain the results as has been obtained in the above paper in the consolidated and concretized fashion.

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The introduction is a collection of information from various sources like Cornell University help, articles, books, references, even abstracts, and the internet including Wikipedia. We acknowledge all authors who have contributed to the same. List of references given is only illustrative and not exhaustive. In the eventuality of the fact that any act of omission is caused, it is purely inadvertent and in deliberate, and authors gratefully acknowledge the eminent, erudite, connoisseurs', rancouters, cognoscenti of various subjects who have allowed us playfully piggy ride on their back

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