SPACE AND TIME, MASS AND ENERGY ACCENTUATION DISSIPATION MODELS

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ABSTRACT: *A system of space-time continuum and parallel system of space that contribute to the dissipation of the velocity of production of space 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 revitalized and rejuvenated with the explanations, we write the governing equations with the nomenclature for the systems in the foregoing, including those of energy- mass system. An alternate explanation is provided for the mass energy equivalence which shall be dealt copiously in another paper. On one hand models act as a determinate a priori, they also act as a bastion and pillar and post for a differential a posteori in coming papers which would incorporate more number of equations attributable and ascribable for the process of concatenation. A Grand Unified Theory of these four important variables in quantum mechanics and classical mechanics is proposed and the equations are given in the annexure. These can be solved based on the same methodology of the present paper. Various permutational and combinational possibilities are also discussed.*

Key words: **Chronological future, Non Singular Space and time, Euclidian space precept, Relativistic Quantum mechanics, Hawking-Penrose Theorems**

INTRODUCTION

Two-dimensional analogy of space-time **distortion** is that, **matter changes the geometry of space-time**, the curved geometry being **interpreted** as gravity. Lines do not represent the curvature of space but instead **represent** the coordinate system **imposed o**n the curved space-time, which would be rectilinear in a flat space-time.

In physics, space-time (or space-time, space time, space-time continuum) is any mathematical model that **combines** space and time into a single continuum. Space time is usually interpreted with space as being three-dimensional and time playing the role of a fourth dimension that is of a different sort from the spatial dimensions. According to certain Euclidean space perceptions, the universe has three dimensions of space and one dimension of time. By **combining** space and time into a single manifold, physicists have significantly simplified a large number of physical, as well as described in a more uniform way the workings of the universe at both the super galactic and subatomic levels.

In non-relativistic classical mechanics**, the use** of Euclidean space instead of space-time is appropriate, as time is **treated** as universal and constant, being **independent** of the state of motion of an observer. In relativistic contexts, time **cannot be separated** from the three dimensions of space, because the observed rate at which time passes for an object **depends** on the object's velocity relative to the observer and also on the strength of gravitational fields, which **can slow** the passage of time.

In cosmology, the concept of space-time **combines** space and time to a single abstract universe. Mathematically it is a manifold **consisting** of "events" which are described by some type of coordinate system. Typically three spatial dimensions (length, width, height), and one temporal dimension (time) are required. Dimensions are independent components of a coordinate grid needed to locate a point in a **certain defined** "space". For example, on the globe the latitude and longitude are two independent coordinates which together **uniquely determine** a location. In space-time, a coordinate grid that spans the 3+1 dimensions **locates events** (rather than just points in space), i.e. time is **added** as another dimension to the coordinate grid. This way the coordinates specify where and *when* events **occur**. However, the **unified** nature of space-time and the freedom of coordinate choice it allows imply that to express the temporal coordinate in one coordinate system requires both temporal and spatial coordinates in another coordinate system. Unlike in normal spatial coordinates, there are still **restrictions for** how measurements can be made spatially and temporally (see Space-time intervals). These **restrictions** correspond roughly to a model, which differs from Euclidean space in its **manifest symmetry**.

Until the beginning of the 20th century, time was believed to be **independent of** motion, progressing at a fixed rate in all reference frames; however, later experiments revealed that time **slowed down** at higher speeds of the reference frame relative to another reference frame (with such slowing called "**time dilation**" explained in the theory of "special relativity"). Many experiments have confirmed time dilation, such as atomic onboard a Space

Shuttle running slower than synchronized Earth-bound inertial clocks and the **relativistic decay of muons** f**rom** cosmic ray showers. The duration of time can therefore **vary** for various events and various reference frames.

When dimensions are understood as mere components of the grid system, rather than physical attributes of space, it is easier to understand the alternate dimensional views as being simply the result of coordinate transformations.

The term *space-time* has taken on a generalized meaning beyond treating space-time events with the normal 3+1 dimensions. **It is really the combination of space and time**. Other proposed space-time theories include additional dimensions—normally spatial but there exist some speculative theories that include additional temporal dimensions and even some that include dimensions that are neither temporal nor spatial. **How many dimensions are needed to describe the universe is still an open question. Speculative theories such as string theory predict 10 or 26 dimensions** (with M-theory predicting 11 dimensions: 10 spatial and 1 temporal), but the existence of more than four dimensions would only appear to make a difference at the subatomic level.

Incas regarded space and time as a single concept, named pacha . Arthur Schopenhauer wrote in *On the Fourfold Root of the Principle of Sufficient Reason*: "...the representation of coexistence is impossible in Time alone; it depends, for its completion, upon the representation of Space; because**, in mere Time, all things follow one another, and in mere Space all things are side by side; it is accordingly only by the combination of** Time and Space that the representation of coexistence arises.". It is generally regimented principle that our consciousness moves along space time continuum.

MATHEMATICAL CONCEPT

Early venture was by Joseph Louis Lagrange in his *Theory of Analytic Functions* (1797, 1813). said, "One may view mechanics as geometry of four dimensions, and mechanical analysis as an extension of geometric analysis

After discovering **quaternion's,** William Rowan Hamilton commented, "Time is said to have only one dimension, and space to have three dimensions. ... The mathematical quaternion partakes of both these elements; in technical language it may be said to be **'time plus space'**, or **'space plus time'**: and in this sense it has, or at least involves a reference to, four dimensions. **Whenever there is a plus sign in a mathematical equation we mean that we are adding one quantity to another. In the eventuality of time lag, such an addition would go on until one quantity is dissipated by the other. And more often than not, such a dissipation would take place with a 'Time Lag'. And how the One** of Time, of Space the Three, Might of Symbols girdled be." Hamilton's bi quaternion's, which have algebraic properties sufficient to model space-time and its symmetry, were in play for more than a half-century before formal relativity. .

Another important antecedent to space-time was the work of James Clerk Maxwell as he used partial differential equations to develop electrodynamics with the four parameters. Lorentz discovered some invariance's of Maxwell's equations late in the 19th century, which were to become the basis of Einstein's theory of special relativity. It has always been the case that time and **space are measured using real numbers, and the suggestion that the dimensions of space and time are comparable could have been raised by the** first people to have formalized physics, but ultimately, the contradictions between Maxwell's laws and Galilean relativity had to come to a head with the realization of the import of finitude of the speed of light.

While space-time can be viewed as a consequence of Albert Einstein's 1905 theory of special relativity, it was first explicitly proposed mathematically by Minkowski, in 1908. His concept of **Minkowski space is the earliest treatment of space and time as two aspects of a unified whole, the essence of** special **relativity. The idea** of Minkowski space also led to special relativity being viewed in a more geometrical way, this geometric viewpoint of space-time being important in general relativity too.

BASIC CONCEPTS

Space times are the arenas in which all physical events take place—an event is a point in space-time specified by its time and place. For example, the motion of planets around the sun may be described in a particular type of space-time, or the motion of light around a rotating star may be described in another type of space-time. The basic elements of space-time are events. In any given space-time, an event is a unique position at a unique time. Because events are space time points, an example of an event in classical relativistic physics is (x, y, z, t), the location of an elementary (point-like) particle at a particular time. A space time itself can be viewed as the **union** of all events in the same way that a line is the union of all of its points, formally organized into a manifold, a space which can be described at small scales using coordinates systems.

A space-time is independent of any observer. However, in describing physical phenomena (which occur at certain moments of time in a given region of space), each observer chooses a convenient metrical coordinate system. Events are specified by four real numbers in any such coordinate system. The trajectories of elementary (point-like) particles through space and time are thus a continuum of events called the world line of the particle. Extended or composite objects (consisting of many elementary particles) are **thus a union of many world lines twisted together** by virtue of their **interactions through space-time into a "world-braid**".

However, in physics, it is common to treat an extended object as a "particle" or "field" with its own unique (e.g. center of mass) position at any given time, so that the world line of a particle or light beam is the path that this particle or beam takes in the space time and represents the history of the particle or beam. The world line of the orbit of the Earth (in such a description) is depicted in two spatial dimensions *x* and *y* (the plane of the Earth's orbit) and a time dimension orthogonal to *x* and *y*. The orbit of the Earth is an ellipse in space alone, but its world line is a helix in space-time.

The unification of space and time is exemplified by the common practice of **selecting a metric** (the measure that specifies the interval between two events in spacetime) such that all four dimensions are measured in terms of units of distance: representing an event as $(x_0, x_1, x_2, x_3) = (ct, x, y, z)$ (in the Lorentz metric) or $(x_1, x_2, x_3, x_4) = (x, y, z, ict)$ (in the original Minkowski metric) where c is the speed of light. The metrical descriptions of Minkowski Space and space like light like and time like intervals given below follow this convention, as do the conventional formulations of the Lorentz transformation.

SPACE-TIME INTERVALS

In a Euclidean space, the separation between two points is measured by the distance between the two points. A distance is purely spatial, and is always positive. In space-time, the separation between two events is measured by the interval between the two events, which takes into account not only the spatial separation between the events, but also their temporal separation. The interval between two events is defined as:

$s^2 = \Delta r^2 - c^2 \Delta t^2$ (space-time interval),

where *c* is the speed of light, and Δ*r* and Δ*t* denote differences of the space and time coordinates, respectively, between the events.

(Note that the choice of signs for s^2 above follows the space-like convention (-+++). Other treatments reverse the sign of s^2.)

Space-time intervals may be classified into three distinct types based on whether the temporal separation ($c^2 \Delta t^2$) or the spatial separation (Δr^2) of the two events is greater.

Certain types of world lines (called geodesics of the space-time) are the shortest paths between any two events, with *distance* being defined in terms of space-time intervals. The concept of geodesics becomes critical in general relativity, since **geodesic motion may be thought of as "pure motion" (inertial motion) in space-time, that is, free from any external influences.**

TIME-LIKE INTERVAL

$$c^2 \Delta t^2 > \Delta r^2$$
$$s^2 < 0$$

For two events separated by a time-like interval, enough time passes between them for there to be a cause-effect relationship between the two events. For a particle traveling through space at less than the speed of light, any two events, which occur to or by the particle, must be separated by a time-like interval. Event pairs with time-like separation define a negative squared space-time interval ($s^2 < 0$) and may be said to occur in each other's future or past. There exists a reference frame such that the two events are observed to occur in the same spatial location, but there is no reference frame in which the two events can occur at the same time.

The measure of a time-like space-time interval is described by the proper time:

$$\Delta\tau = \sqrt{\Delta t^2 - \frac{\Delta r^2}{c^2}}$$ (Proper time).

The proper time interval would be measured by an observer with a clock traveling between the two events in an inertial reference frame, when the observer's path intersects each event as that event occurs. (The proper time defines a real number, since the interior of the square root is positive.)

Light-like interval

$$c^2\Delta t^2 = \Delta r^2$$
$$s^2 = 0$$

In a light-like interval, the spatial distance between two events is **exactly balanced** by the time between the two events. The events define a squared space-time interval of zero ($s^2 = 0$). Light-like intervals are also known as "null" intervals. Events which occur to or are initiated by a photon along its path (i.e., while traveling at c, the speed of light) all have light-like separation. Given one event, all those events which follow at light-like intervals **define the** propagation of a light cone, and all the events which preceded from a light-like interval **define a** second (graphically inverted, which is to say "*past ward*") light cone.

SPACE-LIKE INTERVAL

$$c^2\Delta t^2 < \Delta r^2$$
$$s^2 > 0$$

When a space-like interval separates two events, **not enough time passes between their occurrences for there to exist a causal relationship crossing the spatial distance between the two events at the speed of light or slower. Generally**, the events are considered not to occur in each other's future or past. There exists a reference frame such that the two events are observed to occur at the same time, but there is no reference frame in which the two events can occur in the same spatial location.

For these space-like event pairs with a positive squared space-time interval ($s^2 > 0$), the measurement of space-like separation is the proper distance:

$$\Delta\sigma = \sqrt{\Delta r^2 - c^2\Delta t^2}$$ (Proper distance).

Like the proper time of time-like intervals, the proper distance ($\Delta\sigma$) of space-like space-time intervals is a real number value.

Planckian dissipation

In quantum systems there is a fundamental limit to the "dissipation time" (See Zanen et al)
h/(2 pi k_B T).).

In fact, according to the laws of quantum physics, it is impossible for any form of matter to dissipate more than these metals do....**the laws of quantum physics forbid the dissipation time to be any shorter** at a given temperature than it is in the high-temperature superconductors. If the timescale were shorter, the motions in the super fluid would become purely quantum mechanical, like motion at zero temperature, and energy **could not be** turned into heat. In analogy with gravity, this timescale could be called the 'Planck scale' **of dissipation** (or 'Planckian dissipation'). They concern dissipation of the energy of quasi-particles and whether or not they are fermionic. In such a case, one could not have an electron-phonon system **with a** dimensionless coupling constant lambda larger than one. [Above the Debye temperature the electron scattering rate (times hbar) is roughly lamba T].

MATHEMATICS OF SPACE-TIME CONTINUUM:

For physical reasons, a space-time continuum is mathematically defined as a **four-dimensional, smooth**, **connected Lorentzian manifold** (M, g). This means the smooth **Lorentz metric** g has signature $(3, 1)$. The metric **determines** the geometry of space-time, as well as **determining** the geodesics of particles and light beams. About each point (event) on this, manifold, coordinate charts **are used to** represent observers in reference frames. Usually, Cartesian coordinates (x, y, z, t) are used. Moreover, for simplicity's sake, the speed of light c is usually assumed to be unity. A reference frame (observer) can be identified with one of these coordinate charts; any such observer can describe any event p. Another reference frame may be identified by a second coordinate chart about p. Two observers (one in each reference frame) may describe the same event p but obtain different descriptions.

Usually, many overlapping coordinate charts are **needed t**o cover a manifold. Given two, coordinate charts, one containing p (representing an observer) and another containing q (representing another observer), the intersection of the charts represents the region of space-time in which both observers can measure physical quantities and hence compare results. The relation between the two sets of measurements is given by a non-singular coordinate transformation on this intersection. The idea of coordinate charts as local observers who can perform measurements in their vicinity also makes good physical sense, as this is how one actually collects physical data—locally.

For example, two observers, one of whom is on Earth, but the other one who is on a fast rocket to Jupiter, may observe a comet crashing into Jupiter (this is the event p). In general, they will disagree about the exact location and timing of this impact, i.e., they will have different 4-tuples (x, y, z, t) (as they are using different coordinate systems). Although their kinematic descriptions will differ, dynamical (physical) laws, such as momentum conservation and the first law of thermo dynamics will still hold. In fact, relativity theory requires more than this in the sense that it stipulates these (and all other physical) laws must take the same form in all coordinate systems. This introduces tensors into relativity, by which all physical quantities are represented. Geodesics are said to be time-like, null, or space-like if the tangent vector to one point of the geodesic is of this nature. Paths of particles and light beams in space time are represented by time-like and null (light-like) geodesics (respectively).

TOPOLOGY

The assumptions contained in the definition of a space-time are usually justified by the following considerations. The connectedness assumption serves two main purposes. First, different observers making measurements (represented by coordinate charts) should be able to compare their observations on the non-empty intersection of the charts. If the connectedness assumption were **dropped,** this would not be possible. **Observations on non empty intersections base on connectedness of space and time. This is an important property. Second,** for a manifold, the properties of connectedness and path-connectedness are equivalent, and one requires the existence of paths (in particular, geodesics) in the space-time to represent the motion of particles and radiation.

Every space-time is paracompact. This property, allied with the smoothness of the space-time, gives rise to a smooth linear connection, an important structure in general relativity. Some important theorems on constructing space-time's from compact and non-compact manifolds include the following

A compact manifold can be **turned into** a space-time if, and only if, its Euler characteristic is 0. Lorentzian metric is shown to be equivalent to the existence of a nonvanishing vector field. **Any non-compact 4-manifold can be turned into a space-time.**

SPACE-TIME SYMMETRIES

Often in relativity, space-time's that have some form of symmetry are studied. As well as helping to classify space-time, these symmetries usually serve as a simplifying assumption in specialized work. Some of the most popular are:

(1)Axisymmetric space-time's

(2)Spherically symmetric space-time's

(3)Static space-time's

(4)Stationary space-time's.

CAUSAL STRUCTURE

The causal structure of a space-time **describes** causal relationships between pairs of points in the space-time based on the existence of certain types of curves joining the points. The geometry of space-time in special relativity is described by the Minkowski metric on R^4. This space-time is called Minkowski space. The Minkowski metric is usually denoted by η and can be written as a four-by-four matrix:

$$\eta_{ab} = \mathrm{diag}(1, -1, -1, -1)$$

Where the Landau–Lipschitz space-like convention is being used. A basic assumption of relativity is that coordinate transformations must leave space-time intervals invariant. Intervals are invariant under Lorentz transformations. This invariance property leads to the use of four-vectors (and other tensors) in describing physics.

Strictly speaking, one can also consider events in Newtonian physics as a single space-time. This is Galilean-Newtonian relativity, and the coordinate systems are related by Galilean transformations. However, since these preserve spatial and temporal distances independently, such a space-time can be decomposed into spatial coordinates plus temporal coordinates, which is not possible in the general case.

SPACE-TIME IN GENERAL RELATIVITY

In general relativity, it is assumed that space-time is curved by the presence of matter (energy), this curvature being represented by the Riemann. In special relativity, the Riemann tensor is identically zero, and so this concept of "non-curvedness" is sometimes expressed by the statement *Minkowski space-time is flat.*

The earlier discussed notions of time-like, light-like and space-like intervals in special relativity can similarly be used to classify one-dimensional curves through curved space-time. A time-like curve can be understood as one where the interval between any two infinitesimally close events on the curve is time-like, and likewise for light-like and space-like curves. Technically the three types of curves are usually defined in terms of whether the tangent vector at each point on the curve is time-like, light-like or space-like. The world line of a slower-than-light object will always be a time-like curve, the world line of a massless particle such as a photon will be a light-like curve, and a space-like curve could be the world line of a hypothetical tachyon. In the local neighborhood of any event, time-like curves that pass through the event will remain inside that event's past and future light cones, light-like curves that pass through the event will be on the surface of the light cones, and space-like curves that pass through the event will be outside the light cones. One can also define the notion of a 3-dimensional "space like hyper surface", a continuous 3-dimensional "slice" through the 4-dimensional property with the property that every curve that is contained entirely within this hyper surface is a space-like curve.

Many space-time continua have physical interpretations which most physicists would consider bizarre or unsettling. For example, **a compact space-time** has **closed time like curves**, which violate our usual ideas of causality (that is, **future events could affect past ones**). For this reason, mathematical physicists usually consider only restricted subsets of all the possible space-time. One way to do this is to study "realistic" solutions of the equations of general relativity. Another way is to add some additional "physically reasonable" but still fairly general geometric restrictions and try to prove interesting things about the resulting space-time's. The latter approach has led to some important results, most notably **the Penrose–Hawking singularity theorems.**

Quantized space-time

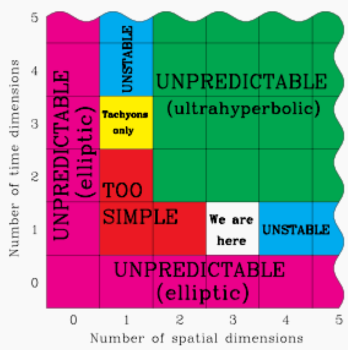
In general relativity, space-time is assumed smooth, continuous—, and not just in the mathematical sense. In the theory of quantum mechanics, there is an **inherent discreteness** present in physics. In attempting to reconcile these two theories, it is sometimes postulated that space-time should be quantized at the very smallest scales. Current theory is focused on the nature of space-time at the scale. Causal, loop quantum gravity, string theory, and black hole thermodynamics all **predict** a quantized space-time with agreement on the order of magnitude. Loop quantum gravity **makes** precise predictions about the geometry of space-time at the Planck scale.

Privileged character of 3+1 space-time

There are two kinds of dimensions, spatial (bidirectional) and temporal (unidirectional). Let the number of spatial dimensions be N and the number of temporal dimensions be T. That $N = 3$ and $T = 1$, setting aside the compactified dimensions invoked by string theory and undetectable to date, can be explained by appealing to the physical consequences of letting N differ from 3 and T differ from 1. The argument is often of an anthropic character.

Immanuel Kant argued that 3-dimensional space was a consequence of the inverse square law of universal gravitation. While Kant's argument is historically important, John D. Barrow says that it "...gets the punch-line back to front: it is the **three-dimensionality of space that explains why we see inverse-square force laws in Nature**, not vice-versa." (Barrow 2002: 204). This is because the law of gravitation (or any other inverse-square law) follows from the concept of flux and the proportional relationship of flux density and the strength of field. If $N = 3$, then 3-dimensional solid objects have surface areas proportional to the square of their size in any selected spatial dimension. In particular, a sphere of radius r has area of $4\pi r^2$. More generally, in a space of N dimensions, the strength of he gravitational attraction between two bodies separated by a distance of r would be inversely proportional to r^{N-1}.

In 1920, Paul Ehrenfest showed that if we fix $T = 1$ and let $N > 3$, the orbit of a planet about its sun cannot remain stable. The same is true of a star's orbit around the center of its galaxy. Ehrenfest also showed that if N is even, then the different parts of a wave impulse will travel at different speeds. If $N > 3$ and odd, then wave impulses become distorted. Only when *N* = 3 or 1 are both problems avoided. In 1922, Hermann Weyl showed that Maxwell's theory of electromagnetism works only when *N* = 3 and *T* = 1, writing that this fact "...not only leads to a deeper understanding of Maxwell's theory, but also of the fact that the world is four dimensional, which has hitherto always been accepted as merely 'accidental,' become intelligible through it." Finally, Tangherlini showed in 1963 that when *N* > 3, electron orbitals around nuclei cannot be stable; electrons would either fall into the nucleus or disperse.



Properties of *n*+*m*-dimensional spacetimes

Max Tegmark expands on the preceding argument in the following anthropic manner. If *T* differs from 1, the behavior of physical systems could not be predicted reliably from knowledge of the relevant partial differential equations. In such a universe, intelligent life capable of manipulating technology could not emerge. Moreover, if *T* > 1, Tegmark maintains that protons and electrons would be unstable and could decay into particles having greater mass than themselves. (This is not a problem if the particles have a sufficiently low temperature.) If *N* > 3, Ehrenfest argument above holds; atoms as we know them (and probably more complex structures as well) could not exist. If *N* < 3, gravitation of any kind becomes problematic, and the universe is probably too simple to contain observers. For example, when *N* < 3, nerves cannot cross without intersecting.

In general, it is not clear how physical law could function if *T* differed from 1. If *T* > 1, subatomic particles which decay after a fixed period would not behave predictably, because time-like geodesics would not be necessarily maximal. *N* = 1 and *T* = 3 has the peculiar property that the speed of light in a vacuum is a *lower bound* on the velocity of matter; all matter consists of tachyons.

Hence anthropic and other arguments rule out all cases except *N* = 3 and *T* = 1—which happens to describe the world about us. Curiously, the cases *N* = 3 or 4 have the richest and most difficult geometry and topology. There are, for example, geometric statements whose truth or falsity is known for all *N* except one or both of 3 and 4 . *N* = 3 was the last case of the Poincare conjecture to be proved.

For an elementary treatment of the privileged status of *N* = 3 and *T* = 1, see chpt. 10 (esp. Fig. 10.12) of Barrow; for deeper treatments, see §4.8 of Barrow and Tipler (1986) and Tegmark. Barrow has repeatedly cited the work of Whitrow. String theory hypothesizes that matter and energy are **composed of tiny** vibrating strings of various types, most of which are embedded in dimensions that exist only on a scale no larger than the Planck length. Hence *N* = 3 and *T* = 1 do not characterize string theory, which embeds vibrating strings in coordinate grids having 10, or even 26, dimensions.

The Causal dynamical triangulation (CDT) theory is a background independent theory which derives the observed 3+1 space-time from a minimal set of assumptions, and needs no adjusting factors. It does not assume any pre-existing arena (dimensional space), but rather attempts to show how the space-time fabric itself evolves. It shows space-time to be 2-d near the Planck scale, and reveals a fractal structure on slices of constant time, but space-time becomes 3+1-d in scales significantly larger than Planck. So, CDT may become the first theory which doesn't postulate but really explains observed number of space-time dimensions.

TIME

ASSUMPTIONS:

Categorization of time is based on a simple idea. It is like the age of an account as on say last Friday of some month say March 2012. Let us say the accounts which have balance standing on the account, is classified as between 1-10 years, 10-20 years and 20 years and more scale. This is the classification of Time as on the last Friday of March 2012. When all the accounts under a category say 1-10 years is closed, we say there is no balance in that category. Space classification since time immemorial and primordial, consequent destruction, construction all provide a rich repository and receptacle for the analogy mentioned in the foregoing. The increase in the disorder or entropy with time is one example that distinguishes the past from the future giving direction to time. There is also thermodynamic arrow of time in the direction of which the entropy increases. And, cosmological arrow is the direction in which universe is expanding. When the curvature of space-time becomes large, due to matter in it, quantum gravitational effects will become important and the classical theory becomes null and void. Disorder increases in the same direction in which universe expands. Expansion of universe **produces** disorder. **In that case, there will be no thermodynamic arrow of time (Hawking Page 160,A Brief History Of Time)**

Einsteinian time, assumes a universalism very much like Newtonian space. Although typically "entangled" as in "spacetime" for example, in a 3+1 Minkowski space, "time" is an unrestricted continuous (*modeled* as a "real number") value. It is true, Hawking has played around with "virtual time" in using a "two dimensional" notion of **time**, as represented in a complex number. And lastly, Peter Horava has broached the subject by a hint of freeing **time** from the historical strait-jacket of conventional physics. But these efforts are hampered by their myoptic concentration on the limited processes in physics (and the physics community limited understanding of "open systems"). Life, as a metaphor for physics been broached, but the notion of time as still conceived as single dimension entangled in "spacetime."

What is time?

Robert Rosen has a whole chapter on different uses of the concept of **time** [Anticipatory System, Chapter 4, and Encodings of Time]. Einstein did a detailed gedanken experiment with "light" and "time" but he did not examine closely the concept of "an event." What is "an event" -- this concept needs to be looked from an "information theoretic" perspective. Current theories fail to account for life (the complex) and quantum mechanics (the small) suggests there needs to be another gedanken experiment. In physics**: mass, energy, space, and time are treated as measures, which are related, but "space" and "time" are concepts whereas "mass" and "energy" are percepts. In other words, space and time do not physically exist (nor does space, e.g., 3 + 1, exist either as simple construct), whereas mass and energy do physically exist. Now, having** only one dimension of time is mathematically and conceptually simple, but it maybe no longer is productive to have that simple of an encoding. It is time to consider "multiple dimensions of time." **But before that one must examine the nature of reality, reference, inference, and reasoning. Sir James Gowan gives an interesting analysis of the progression of the ideas and the culminatory denouement thereof.**

Energy and mass are related. Of course, Einstein has found a "law" that seems to apply to most of the current Universe. But we know that if there was a "big bang" that his "law," $E=mc^2$, does not apply "at the beginning" -- So what gives? Let us do a simple gedanken experiment on the Universe.Consider the equation **E/c=mc**. This is just a rewrite of Einstein's equation.First let's unpack this equation. **c** is the speed of light, assumed to be a *constant* by Einstein. Since it, **c**, is a constant, let us assume a different amount of information that involves that "constant." For example, consider a "precise" constant like *e, Euler's number*. Euler's number has, given enough time, -- an infinite amount of time -- it contains (or generates) an infinite amount of information. So what if we decide to represent **c** as a constant with an infinite amount of information. Now **c** as a constant has units associated with it: **c = D/T**, that is distance over time. So let us rewrite the equation again. **E/(D/T)=m*(D/T)**

So if those who like real numbers (that can represent an infinite amount of information) might stick in a real number constant. Let us chose our units so for energy E = 1, and mass m = 1. (That is we will count the Energy of the Universe = 1, and the Mass of Universe = 1, and the time of the universe as 1. So let's rewrite the equation, using these unit choices. **1/(D/1)=1*(D/1).**

Simplifying. **1/D=D.** Of course this **"doesn't seem to make sense." (unless you use D=1) --** Maybe this demonstrates the Universe does exist. However, what does it mean from an informational point of view. **If** I use a "infinite information constant," **is there** any 'choice" that does make *some* sense? How about the "constant" ∞. So **1/∞ = ∞/1**. You jest -- most people would say. But could you **physically** tell the difference between 1/∞ and ∞/1? Both require *explicitly* an *infinite* amount of information -- like 0 does *implicitly*. .

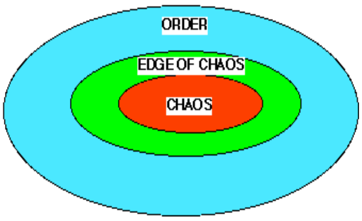
The process structure metaphor is a metaphor that uses the combined notions of process and structure as the two equal metaphors to characterize existence. Process implies functional properties and structure implies material properties. Both material and function are necessary to characterize existence. Initially, the material complexity of existence is defined, for that is the most visually accessible view. The functional complexity will be eventually developed and modeled and related to the material complexity, but functional complexity is more difficult to characterize because it has never been developed and can be very abstract. However, one must *assume* that a process structure always has a context and that it is "an open system."

Assumptions about "Systems"

The first phenomenological issue of dissipative/ replicative structures is the realization that there is no such thing as a "closed" physical system. Even though physics has made significant progress by modeling closed systems (using the notion of equilibrium or near equilibrium), it no longer works when modeling complex systems. And I assert all natural systems are complex systems. So, every dissipative/ replicative structure (a model of a natural system), by definition, must have a context. Of course, there is the problem with infinite digression, so eventually, the overall context must be assumed. But the assumptions of this context cannot be in the form "closed". That is, one cannot do as Newton stated "Hypotheses nonfingo". The "meta-universe" context of our universe must be a dissipative /replicative structure in form, but the underlying process mechanisms and defining structures will probably never be known for sure. Physics appears to be the closest form of modeling the meta-universe.

The second part of the first phenomenological issue is what kind of context the massive dissipative/replicative structure is in. Clearly, if the dissipative/replicative structure is growing or shrinking, then the structure is either growing or shrinking because of itself, or the surrounding context is adding or subtracting to the process-structure. It is important to connect, at some level of abstraction, a particular structure within the total context, that is, the universe, both in material and functional terms. The overall analysis of material complexity is the first and easiest thing to do. The following is a defining the basic structure of material complexity so to give an overarching context.

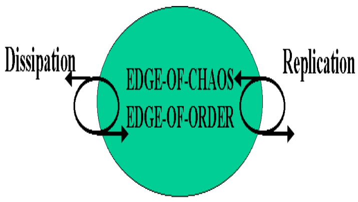
Three basic regimes within a dissipative/replicative structure in terms of material complexity have been defined: chaos, order, and the edge-of-chaos/edge-of-order.(Biocosmology by Miles Osmaston See Home page)



A Dissipative/Replicative Structure: A Macrosystem

The edge-of-chaos metaphor (and it associated mathematical and computational methods: Crutchfield, Mitchell, and Langton) is useful in describing massive dissipative/replicative structures. Every massive dissipative/replicative structure is on some edge-of-chaos, and some structures are part of multiple levels of edge-of-chaos. A large part of the edge-of-chaos metaphor involves both a macro-process and a macro-structure. But also it includes micro-structures and micro-processes. **The combination of macro-process, macro-structure, micro-processes, and micro-structures will be the basis for the metaphor.(See authors Prigogine's Dissipative Structures-A Haimovician Analysis)**

The edge-of-order metaphor is a new metaphor borrowed from the edge-of-chaos metaphor, to make crucial link to the other important metaphor of replication and link it to the notion of life, which also applies to non-life phenomena. It is important to realize the edge-of-order is the same as the edge-of-chaos, but viewed from a different point of view. For Darwin's metaphor of evolution can be applied to non-life systems, because some kind of replication exists in these systems.



The material complexity of the universe can viewed as a processes of successive layers of chaos, order, and the edge of chaos, thereby called **involution**.

Clearly, if the dissipative/replicative structure is growing or shrinking, then the structure is either growing or shrinking because of itself, or the surrounding context is adding or subtracting to the process-structure. It is important to connect, at some level of abstraction, a particular structure within the total context, that is, the universe.

TIME

1) Time in the universe is classified into three categories; Category 1 representative of the in the first interval 1 vis-à-vis category 1 of space
2) Category 2 (second interval) comprising of time in the universe corresponding to category 2 of space regimentation
3) Category 3 constituting time belong to higher age than that of category 1 and category 2.
4) This is concomitant to category 3 of time 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 space/matter stratification 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.

a) The speed of growth of time AS MEASURED FROM THE POINT OF BIG bang under category 1 is proportional to the speed of growth of time (TIME SINCE THE BIGBANG) in the universe under category 2. In essence the accentuation coefficient in the model is representative of the constant of proportionality between TIME 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

b) The dissipation of time which is concomitant in the corresponding category in all the three categories is attributable to the following two phenomenon :

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

   2) **Depletion phenomenon**: Natural calamities leading to destruction of universe and galaxy dissipates the growth speed by an equivalent extent. It is assumed that with the destruction of a certain amount of space, corresponding amount of time is also lost with the matter so destroyed. It is like the death of an individual ,when we say" so much say 70 years of life is lost". Model makes allowance for new babies (space and corresponding time)also which continually come thereby counterpoising such a "loss"

NOTATION :

G_{13} **:** Time corresponding the matter or space in category 1

G_{14} :Time corresponding to the space or matter in category 2

G_{15} :Time corresponding to space or matter 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 an 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 space or matter 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

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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 of time due to galactic or natural calamities with distorts and has disastrous consequences, 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. It is a classic case of transformation of one type of energy in to another. Like in a Bank, the individual debits and credits are tallied, with the holistic conservativeness preserved, General Ledger is written, and here also, the General Theory takes in to consideration the individual transformations and jots them down for the universalistic conservation and preservation of the Mass and Energy in the Universe.AS for time is concerned ,we have already specified that during some time interval in the past, there would be corresponding and concomitant expansion of space, which the model takes in to consideration.

GOVERNING EQUATIONS:

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

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

$$\frac{dG_{14}}{dt} = (a_{14})^{(1)}G_{13} - (a'_{14})^{(1)}G_{14} \quad 2$$

$$\frac{dG_{15}}{dt} = (a_{15})^{(1)}G_{14} - (a'_{15})^{(1)}G_{15} \quad 3$$

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

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

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

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

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

$$\frac{dG_{13}}{(a_{13})^{(1)}G_{14} - (a'_{13})^{(1)}G_{13}} = dt \quad 8$$

$$\frac{dG_{14}}{(a_{14})^{(1)}G_{13} - (a'_{14})^{(1)}G_{14}} = dt \quad 9$$

Or we write a single equation as

$$\frac{dG_{13}}{(a_{13})^{(1)}G_{14} - (a'_{13})^{(1)}G_{13}} = \frac{dG_{14}}{(a_{14})^{(1)}G_{13} - (a'_{14})^{(1)}G_{14}} = \frac{dG_{15}}{(a_{15})^{(1)}G_{14} - (a'_{15})^{(1)}G_{15}} = dt \quad 10$$

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

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

$\alpha_i G_i + \beta_i G_i + \gamma_i G_i = C_i e_i^{\lambda_i t}$ 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'/'contracting 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 time in the expanding /universe 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 time(note that we are here talking of the how the variation of space took place over a certain period as on a particular date-Please see the Bank example given above) in the expanding universe 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.

SPACE:

SPACE is classified into three categories analogous to the stratification that was resorted to in TIME in expanding universe with an eye on the TIME PERIOD CLASSIFICATION FROM THE BIG BANG. Process of transmission from one category to another is based on the phenomenon that takes place on the expanding universe.

Matter Creation/Destruction in a Variable Gravitational Field

Newton's second law: "force = time-derivative of momentum", may also be defined for theories of gravitation endowing space-time with a curved metric (SEE. **Mayeul ARMINJON)** Thus, Einstein's assumption of a geodesic motion may be rewritten in that form, and it **corresponds to a** velocity-dependent gravity acceleration **g**. In contrast, in the preferred reference frame assumed by the theory, **g** **does not depend** on the velocity. It **recovers** geodesic motion only for a constant gravitational field. This leads to a different equation for continuum dynamics, as compared with general relativity. For a perfect space time continuum,, this alternative dynamics **predicts** tenuous **amounts of matter production or destruction, by a reversible exchange with the gravitational field. This exchange is completely determined** by the dynamical equation and the scalar equation of the gravitational field. In contrast, the usual equation for relativistic continuum dynamics allows matter production only if some additional field is assumed, and the production rate must be phenomenologically postulated. With the alternative equation, the mass conservation is very nearly recovered for a weak field. The explosion **(implosion**) of a spherical compact body **implie**s some matter production (destruction).

The key to this modification is Einstein's equivalence principle between gravitational effects and inertial effects, which **leads to admit** that gravitation **affects o**ur space and time standards, thus giving a "curved space-time metric". Among the most striking experimental confirmations of this concept, we may quote the effects on light rays, i.e. the gravitational red-shift, the bending of light, and the delay of the radar echo - although a true "theory of gravitation in a flat space-time", thus without any curved metric, has been recently found, that reproduces the experimentally confirmed predictions of GR for light rays. Now NG is a scalar theory, whereas GR is a tensor theory: in GR, the gravitational field is the space-time metric tensor that involves 10 independent components. Some early attempts to account for special relativity (SR) in a modified version of NG were indeed scalar theories, including two theories restricted to static fields, proposed by Einstein However, a theory of gravitation that accounts for SR **must replace** the mass density, which is the source of the gravitation field in NG, by some energy density, and this **precludes** that any "relativistic" scalar theory may be a covariant theory. For the energy concept of SR does not **lead t**o any invariant scalar field (even if one restricts oneself to Lorentz transformations); instead, it leads to a 4-vector, the mass current, and to a second-order space-time tensor, the energy-momentum tensor. Only the latter takes fully into account the mass-energy equivalence, and it is indeed the source of the field in GR.

Thus, any scalar modification of NG that aims at describing "relativistic" effects such as the mass-energy equivalence must be a preferred-frame theory. Any "worthy" theory must have the correct Newtonian limit; hence it must **recover the** Galilean invariance in the limit of weak and slowly varying fields. Undoubtedly, it must be "relativistic" in the sense that "in the limit as gravity is "turned off", the nongravitational laws of physics must reduce to the laws of special relativity" . Certainly also, any such theory must explain the three gravitational effects on light rays, because those effects are confirmed by precise and repeatable experiments. It still should predict that gravitation **propagates with** the velocity of light and that, for a non-stationary insular matter distribution, gravitational energy is **radiated towards** outside, because we are now almost sure that it is indeed the case. Although other experimental facts are relevant to gravitation, it seems interesting to note that the foregoing set of facts turns out to be accounted for by a certain scalar, preferred-frame theory without any adjustable parameter. The same effects of gravitation on light rays are predicted as in GR at the current level of accuracy, because the theory predicts no preferred-frame effect for photons at the first post-Newtonian (pN) approximation [9]. Furthermore, this theory predicts a "bounce" instead of a singularity for the gravitational collapse of a dust sphere [7b]. The preferred-frame effects that this theory will predict for massive bodies, already at the first pN approximation, might contribute to explain the anomalous rotation curves in galaxies, currently interpreted by appealing to large amounts of **unseen matter**. Moreover, it is not unreasonable to hope that these preferred-frame effects could **explain why** the empirically determined inertial frames have a uniform motion and, in particular, no rotation with respect to the average rest frame of matter ("Mach's principle" or rather Mach's problem). Of course, such effects also represent a risk as to celestial mechanics, especially for the explanation of Mercury's advance in perihelion. However, some astrodynamical constants such as the masses of the planets are in practice adjusted to fit the observations. Since this adjustment is theory-dependent, it has been argued that the existence of preferred-frame effects in celestial mechanics does not kill the theory (See. **Mayeul ARMINJON)**

In this theory, motion is governed by a natural extension of Newton's second law, which implies Einstein's geodesic motion only for a static field. This extended Newton law implies a local conservation equation for the total energy, including the gravitational energy which has a simple, physically understandable expression: this equation is first deduced for dust and then induced for a general behavior, characterized by any *energy-momentum tenso*r. Consequence of this formulation: is a ***reversible creation/destruction of matter*** for a perfect fluid in a variable gravitational field.. This extension may actually be defined for any theory endowing the space-time with a (pseudo-) Riemannian metric **g** with (+ - --) signature and in which SR holds true at the local scale Then, in any possible reference frame F (defined by a spatial network of observers equipped with measuring rods and clocks), we have a spatial metric $\mathbf{g} = \mathbf{g}_F$ (it depends on the frame) and, at any point **x** bound to F, a local time $t_{\mathbf{x}}$ [13-14]. The latter may be synchronized along any line*x* ®(x^a(*x*))in space-time, whose spatial projection is open, according to the relation

$$\frac{dt_{\mathbf{x}}}{d\xi} = \frac{\sqrt{\gamma_{00}}}{c}\left(\frac{dx^0}{d\xi} + \frac{\gamma_{0i}}{\gamma_{00}}\frac{dx^i}{d\xi}\right)$$

SPACE DISSIPATION

Fractal structures in the phase space of simple chaotic systems with Transport. Dissipation of space is expressed in fractals. Non equilibrium processes in chaotic systems can be described in terms of fractal structures , that develop in systems phase space. These structures form exponentially rapidly in phase space as an initial non equilibrium mode. Connections between Diffusion Coefficient and moving particle in Chaotic Lorentz gas and Hausdorf dimension of the hydrodynamic modes of diffusion at small waves. Formation of galaxies and stars involve gravitational collapse. Heat generation in contraction leads to formation of clouds of original size.

Visual representation of a strange attractor

An attractor is a set towards which a variable, moving according to the dictates of a dynamical system, evolves over time. That is, points that get close enough to the attractor remain close even if slightly disturbed. The evolving variable may be represented algebraically as an n-dimensional vector. The attractor is a region in n-dimensional space. In physical systems, the n dimensions may be, for example, two or three positional coordinates for each of one or more physical entities; in economic systems, they may be separate variables such as the inflation rate and the unemployment rate.

If the evolving variable is two- or three-dimensional, the attractor of the dynamic process can be represented geometrically in two or three dimensions, as for example in the three-dimensional case depicted to the right. An attractor can be a point, a finite set of points, a curve, a manifold, or even a complicated set with a fractal structure known as a strange attractor. If the variable is a scalar, the attractor is a subset of the real number line. Describing the attractors of chaotic dynamical systems has been one of the achievements of chaos theory.

A trajectory of the dynamical system in the attractor does not have to satisfy any special constraints except for remaining on the attractor. The trajectory may be periodic or chaotic. If a set of points is periodic or chaotic, but the flow in the neighborhood is away from the set, the set is not an attractor, but instead is called a repeller (or repellor).A dynamical system is generally described by one or more differential or difference equations. The equations of a given dynamic system specify its behavior over any given short period of time. To determine the system's behavior for a longer period, it is necessary to integrate the equations, either through analytical means or through iteration, often with the aid of computers.

Dynamical systems in the physical world tend to be dissipative: if it were not for some driving force, the motion would cease. (Dissipation may come from internal friction, thermodynamic losses, or loss of material, among many causes.) The dissipation and the driving force tend to combine to kill out initial transients and settle the system into its typical behavior. This one part of the phase space of the dynamical system corresponding to the typical behavior is the attractor, also known as the attracting section or attractee.

Invariant sets and limit sets are similar to the attractor concept. An invariant set is a set that evolves to itself under the dynamics. Attractors may contain invariant sets. A limit set is a set of points such that there exists some initial state that ends up arbitrarily close to the limit set (i.e. to each point of the set) as time goes to infinity. Attractors are limit sets, but not all limit sets are attractors: It is possible to have some points of a system converge to a limit set, but different points when perturbed slightly off the limit set may get knocked off and never return to the vicinity of the limit set.

For example, the damped pendulum has two invariant points: the point of minimum height and the point of maximum height. The point is also a limit set, as trajectories converge to it; the point is not a limit set. Because of the dissipation, the point is also an attractor. If there were no dissipation, would not be an attractor..
Since the basin of attraction contains an open set containing A, every point that is sufficiently close to A is attracted to A. The definition of an attractor uses a metric on the phase space, but the resulting notion usually depends only on the topology of the phase space. In the case of Rn, the Euclidean norm is typically used.
Many other definitions of attractor occur in the literature. For example, some authors require that an attractor have positive measure (preventing a point from being an attractor), others relax the requirement that B(A) be a neighborhood.

Attractors are parts of the phase space of the dynamical system. Until the 1960s, as evidenced by textbooks of that era, attractors were thought of as being simple geometrical subsets of the phase space: points, lines, surfaces, volumes. The (topologically) wild sets that had been observed were thought to be fragile anomalies. Two simple attractors are the fixed point and the limit cycle. There can be many other geometrical sets that are attractors. When these sets (or the motions on them), are harder to describe than the classical geometric objects, then the attractor is a strange attractor, as described in the section below. Weakly attracting fixed point for a complex number evolving according to a complex quadratic polynomial. The phase space is the horizontal complex plane; the vertical axis measures the frequency with which points in the complex plane are visited. The point in the complex plane directly below the peak frequency is the fixed point attractor.

A fixed point is a point of a function that does not change under some transformation. If we regard the evolution of a dynamical system as a series of transformations, then there may or may not be a point which remains fixed under each transformation. The final state that a dynamical system evolves towards, such as the final states of a falling pebble, a damped pendulum, or the water in a glass, corresponds to an attracting fixed point of the evolution function, but the two concepts are not equivalent because not all fixed points attract the evolution of nearby points. A marble rolling around in a basin may have a fixed point, but if the marble is externally driven it may not be attracted to that fixed point. But in the absence of an external driving force, it will settle into the fixed point at the bottom of the bowl, so in this case that point is an attractor.

From a computational point of view, attractors can be naturally regarded as self-exciting attractors or hidden attractors. Self-exciting attractors can be localized numerically by standard computational procedures, in which after a transient sequence, a trajectory starting from a point on an unstable manifold in a small neighborhood of an unstable equilibrium reaches an attractor (like classical attractors in the Van der Pol, Beluosov–Zhabotinsky, Lorenz, and many other dynamical systems). In contrast, the basin of attraction of a hidden attractor does not contain neighborhoods of equilibria, so the hidden attractor cannot be localized by standard computational procedures.

SPACE ACCENTUATION:

It sounds like a conspiracy theory: 'cosmic rays' from deep space might be creating clouds in Earth's atmosphere and changing the climate. Yet an experiment at CERN, Europe's high-energy physics laboratory near Geneva, Switzerland, is finding tentative evidence for just that. The findings, are stoking a long-running argument over the role of radiation from distant stars in altering the climate. For a century, scientists have known that charged particles from space constantly bombard Earth. Known as cosmic rays, the particles are mostly protons blasted out of supernovae. As the protons crash through the planet's atmosphere, they can ionize volatile compounds, causing them to condense into airborne droplets, or aerosols. Clouds might then build up around the droplets. The number of cosmic rays that reach Earth depends on the Sun. When the Sun is emitting lots of radiation, its magnetic field shields the planet from cosmic rays. During periods of low solar activity, more cosmic rays reach Earth.Scientists agree on these basic facts, but there is far less agreement on whether cosmic rays can have a large role in cloud formation and climate change. Since the late 1990s, some have suggested that when high solar activity lowers a level of cosmic rays, that in turn reduces cloud cover and warms the planet. Others say that there is no statistical evidence for such an effect.

NOTATION :

T_{13} : Balance standing in the category 1

T_{14} : Balance standing in the category2

T_{15} : Balance standing in the category 3.

By balance we mean the total quantum of the space

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

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

FORMULATION OF THE SYSTEM :

Under the above assumptions, we derive the following :

a) The growth speed in category 1 is the sum of two parts:
   1. A term $+(b_{13})^{(1)}T_{14}$ proportional to the balance of the space in the expanding universe in the category 2.A term $-(b'_{13})^{(1)}T_{13}$ representing the quantum of balance dissipated from category 1 .This comprises of space in expanded 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 space is taking place in the world continuously both at the galactic level and at subatomic level**
   2. A term $+(b_{14})^{(1)}T_{13}$ constitutive of the amount of inflow from the category 1

A term $-(b'_{14})^{(1)}T_{14}$ the dissipation factor arising due to space of expanding universe

The growth speed under category 3 is attributable to inflow from category 2 Any stalling, deceleration, of the spatial regions like in black holes or in regions of expansion universe could also be taken in to consideration., whatever the reasons attributable and ascribable for such reduction.

GOVERNING EQUATIONS:

Following are the differential equations that govern the growth in the spatial regions 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 gravitational system

SPACE AND TIME-THE DUAL SYSTEM PROBLEM

We will denote

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

2) By $(a''_i)^{(1)}(T_{14}, t)$ $(T_{14} \geq 0, t \geq 0)$,the contribution of the SPACE to the dissipation coefficient of the TIME 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 time in expanding universe to the dissipation coefficient of the SPACE

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 attributable to EXPANDING UNIVERSE to the dissipation of TIME in EXPANDING universe. Examples how dissipation is governing the flow can be found abundantly in nature. Since the dissipation characteristic time isn't commonly studied in a ``regular" fluid mechanics we first introduce two classical examples of dissipation problems. One problem is dealing with the oscillating manometer and two, ``rigid body" brought to a rest in a thin cylinder. Examples are the oscillating manometer for the example = 0.5rigid body brought into rest. These examples illustrate that the characteristic time of dissipation can be assessed by thus given by put Eckert's explanation

$-(b''_{13})^{(1)}(G,t) =$ First detrition factor contributed by EXPANDING UNIVERSE to the dissipation of TIME.

<u>DISSIPATION OF TIME</u>:

T-symmetry

T Symmetry is the symmetry of physical laws under a **time reversal** transformation:

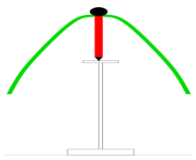
$$T : t \mapsto -t.$$

Although in restricted contexts one may find this symmetry, the observable universe itself does not show symmetry under time reversal, primarily due to the second law of thermodynamics.

Time *asymmetries* are generally distinguished as between those intrinsic to the dynamic laws of nature, and those due to the initial conditions of our universe. The T-*asymmetry* of the weak force is of the first kind, while the T-asymmetry of the second law of thermodynamics is of the second kind.

Invariance

Physicists also discuss **the time-reversal invariance** of local and/or macroscopic descriptions of physical systems, independent of the invariance of the underlying microscopic physical laws. For example, Maxwell's equations with material absorption or Newtonian mechanics with friction are not time-reversal invariant at the macroscopic level where they are normally applied, even if they are invariant at the microscopic level when one **includes the atomic motions the "lost" energy is translated into.**



A toy called the teeter-totter illustrates the two aspects of time reversal invariance. When set into motion atop a pedestal, the figure oscillates for a very long time. The toy is engineered to minimize friction and illustrate the reversibility of Newton's laws of motion. However, the mechanically stable state of the toy is when the figure falls down from the pedestal into one of arbitrarily many positions. This is an illustration of the law of increase of entropy through Boltzmann's identification of the **logarithm of the number of states with the entropy.**

Macroscopic phenomena: the second law of thermodynamics

Of these macroscopic laws, most notable is the second law of thermodynamics. Many other phenomena, such as the relative motion of bodies with friction, or viscous motion of fluids, reduce to this, because the underlying mechanism is the **dissipation of usable energy (for example, kinetic energy) into heat**.Heat in turn using the kinetic energy for the production of itself.

Is **<u>this time-asymmetric dissipation</u>** really inevitable? This question has been considered by many physicists, often in the context of **Maxwell's demon**. The name comes from a thought experiment described by James Clerk Maxwell in which a microscopic demon guards a gate between two halves of a room. It only lets slow molecules into one half, only fast ones into the other. By eventually making one side of the room cooler than before and the other hotter, it seems to reduce the entropy of the room, and reverse the arrow of time. Many analyses have been made of this; all show that when the entropy of room and demon are taken together, this total entropy does increase. Modern analyses of this problem have taken into account Claude E. Shannon's **relation between entropy and information**. Many interesting results in modern computing are closely related to this problem — **reversible computing, quantum computing and physical limits to computing, are examples. Slowly but steadily call it quantum gravity or consciousness the entry of such ideas are more or less legion.**

The current consensus hinges upon the Boltzmann-Shannon identification of the **logarithm of phase space volume** with the **negative of Shannon information**, and hence to entropy. Thus phase space volume together with entropy is equivalent to zero and hence conserved. In this notion, a fixed initial state of a macroscopic system corresponds to relatively low entropy because the coordinates of the molecules of the body are constrained. As the system evolves in the presence of dissipation, the molecular coordinates can move into larger volumes of phase space, becoming more uncertain, and thus leading to increase in entropy.

One can, however equally well imagine a state of the universe in which the motions of all of the particles at one instant were the reverse (strictly, the CPT reverse). Such a state would then evolve in reverse, so presumably entropy would decrease (Loschmidt's paradox). Why is 'our' state preferred over the other?

One position is to say that the constant increase of entropy we observe happens *only* because of the initial state of our universe. Initial state of the universe produces constant increase in entropy.Other possible states of the universe (for example, a universe at heat death equilibrium) would actually result in no increase of entropy. In this view, the apparent T-asymmetry of our universe is a problem in cosmology: **why did the universe start with low entropy**? This view, if it remains viable in the light of future cosmological observation, would connect this problem to one of the big open questions beyond the reach of today's physics — **the question of *initial conditions* of the universe**. Notwithstaning the fact that the initial conditions are responsible for the increase in entropy. It would be interesting to connect these two variables and see what happens under assumed conditions.

MACROSCOPIC PHENOMENA: BLACK HOLES

An object can cross through the event horizon of a black hole from the outside, and then fall rapidly to the central region where our understanding of physics breaks down. Since within a black hole the forward light-cone is directed towards the center and the backward light-cone is directed outward, it is not even possible to define time-reversal in the usual manner. The only way anything can escape from a black hole is as Hawking radiation.

The time reversal of a black hole would be a hypothetical object known as a white hole. From the outside they appear similar. While a black hole has a beginning and is inescapable, a white hole has an ending and cannot be entered. The forward light-cones of a white hole are directed outward; and its backward light-cones are directed towards the center. The event horizon of a black hole may be thought of as a surface moving outward at the local speed of light and is just on the edge between escaping and falling back. The event horizon of a white hole is a surface moving inward at the local speed of light and is just on the edge between being swept outward and succeeding in reaching the center. They are two different kinds of horizons—the horizon of a white hole is like the horizon of a black hole turned inside-out.

The modern view of black hole irreversibility is to relate it to the second law of thermodynamics, since black holes are viewed as thermodynamic. Indeed, according to the Gauge-gravity duality conjecture, all microscopic processes in a black hole are reversible, and only the collective behavior is irreversible, as in any other macroscopic, thermal system.

Onsager reciprocal relations

In physical and chemical kinetics, T-symmetry of the mechanical microscopic equations implies two important laws: the principle of detailed balance and the Onsager reciprocal relations. T-symmetry of the microscopic description together with its kinetic consequences are called microscopic reversibility.

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 $(p_i)^{(1)}, \ (r_i)^{(1)}$:

$(a_i'')^{(1)}(T_{14}, t) \leq (p_i)^{(1)} \leq (\hat{A}_{13})^{(1)}$ 25

$(b_i'')^{(1)}(G, t) \leq (r_i)^{(1)} \leq (b_i')^{(1)} \leq (\hat{B}_{13})^{(1)}$ 26

27

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

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

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

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 attributable to space /spatial regions, would be absolutely continuous.

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

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

$$\frac{(a_i)^{(1)}}{(\hat{M}_{13})^{(1)}} , \frac{(b_i)^{(1)}}{(\hat{M}_{13})^{(1)}} < 1$$ 31

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

$G_i(t) \leq (\hat{P}_{13})^{(1)}e^{(\hat{M}_{13})^{(1)}t}$, $G_i(0) = G_i^0 > 0$
$T_i(t) \leq (\hat{Q}_{13})^{(1)}e^{(\hat{M}_{13})^{(1)}t}$, $T_i(0) = T_i^0 > 0$

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

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

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

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

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

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

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

Where $s_{(13)}$ is the integrand that is integrated over an interval $(0, t)$ 42

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

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

From which it follows that

$$(G_{13}(t) - G_{13}^0) e^{-(\hat{M}_{13})^{(1)} t} \leq \frac{(a_{13})^{(1)}}{(\hat{M}_{13})^{(1)}} \left[\left((\hat{P}_{13})^{(1)} + G_{14}^0 \right) e^{\left(-\frac{(\hat{P}_{13})^{(1)} + G_{14}^0}{G_{14}^0} \right)} + (\hat{P}_{13})^{(1)} \right] \quad 44$$

(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
$(\hat{P}_{13})^{(1)}$ and $(\hat{Q}_{13})^{(1)}$ large to have

$$\frac{(a_i)^{(1)}}{(\hat{M}_{13})^{(1)}} \left[(\hat{P}_{13})^{(1)} + \left((\hat{P}_{13})^{(1)} + G_j^0 \right) e^{-\left(\frac{(\hat{P}_{13})^{(1)} + G_j^0}{G_j^0} \right)} \right] \leq (\hat{P}_{13})^{(1)} \quad 45$$

$$\frac{(b_i)^{(1)}}{(\hat{M}_{13})^{(1)}} \left[\left((\hat{Q}_{13})^{(1)} + T_j^0 \right) e^{-\left(\frac{(\hat{Q}_{13})^{(1)} + T_j^0}{T_j^0} \right)} + (\hat{Q}_{13})^{(1)} \right] \leq (\hat{Q}_{13})^{(1)} \quad 46$$

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

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

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

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

$$\left|G^{(1)}-G^{(2)}\right|e^{-(\widehat{M}_{13})^{(1)}t}\leq$$
$$\frac{1}{(\widehat{M}_{13})^{(1)}}\left((a_{13})^{(1)}+\;(a'_{13})^{(1)}+(\widehat{A}_{13})^{(1)}+(\widehat{P}_{13})^{(1)}(\widehat{k}_{13})^{(1)}\right)d\left(\left(G^{(1)},T^{(1)};\;G^{(2)},T^{(2)}\right)\right)$$ 50

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 $(\widehat{P}_{13})^{(1)}e^{(\widehat{M}_{13})^{(1)}t}$ *and* $(\widehat{Q}_{13})^{(1)}e^{(\widehat{M}_{13})^{(1)}t}$ 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

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

$$T_i\,(t)\geq T_i^0e^{\left(-(b'_i)^{(1)}t\right)}>0\quad\text{for } t>0$$ 52

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

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

$G_{13}<(\widehat{M}_{13})^{(1)}$ it follows $\frac{dG_{14}}{dt}\leq\left((\widehat{M}_{13})^{(1)}\right)_1-(a'_{14})^{(1)}G_{14}$ and by integrating 53

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

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 $T_{14} \to \infty$.

Definition of $(m)^{(1)}$ and ε_1 : 55

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 $(\sigma_1)^{(1)}, (\sigma_2)^{(1)}, (\tau_1)^{(1)}, (\tau_2)^{(1)}$: 57

(a) $\sigma_1)^{(1)}, (\sigma_2)^{(1)}, (\tau_1)^{(1)}, (\tau_2)^{(1)}$ four constants satisfying 58

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

$-(\tau_2)^{(1)} \leq -(b_{13}')^{(1)} + (b_{14}')^{(1)} - (b_{13}'')^{(1)}(G,t) - (b_{14}'')^{(1)}(G,t) \leq -(\tau_1)^{(1)}$ 59

Definition of $(\nu_1)^{(1)}, (\nu_2)^{(1)}, (u_1)^{(1)}, (u_2)^{(1)}, \nu^{(1)}, u^{(1)}$: 60

(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 61
$(a_{14})^{(1)}(\nu^{(1)})^2 + (\sigma_1)^{(1)}\nu^{(1)} - (a_{13})^{(1)} = 0$
and $(b_{14})^{(1)}(u^{(1)})^2 + (\tau_1)^{(1)}u^{(1)} - (b_{13})^{(1)} = 0$ and

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 63
roots of the equations $(a_{14})^{(1)}(\nu^{(1)})^2 + (\sigma_2)^{(1)}\nu^{(1)} - (a_{13})^{(1)} = 0$
and $(b_{14})^{(1)}(u^{(1)})^2 + (\tau_2)^{(1)}u^{(1)} - (b_{13})^{(1)} = 0$ 64

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 66

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

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

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

$(m_2)^{(1)} = (\nu_1)^{(1)}, (m_1)^{(1)} = (\nu_0)^{(1)},\ if\ (\bar{\nu}_1)^{(1)} < (\nu_0)^{(1)}$ 68

and analogously 69

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

$(\mu_2)^{(1)} = (u_1)^{(1)}, (\mu_1)^{(1)} = (\bar{u}_1)^{(1)}\ , if\ (u_1)^{(1)} < (u_0)^{(1)} < (\bar{u}_1)^{(1)},$ 70

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

$(\mu_2)^{(1)} = (u_1)^{(1)}, (\mu_1)^{(1)} = (u_0)^{(1)}, if\ (\bar{u}_1)^{(1)} < (u_0)^{(1)}$ where $(u_1)^{(1)}, (\bar{u}_1)^{(1)}$ are defined by 59 and 61 respectively 71

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

$$G_{13}^0 e^{((S_1)^{(1)} - (p_{13})^{(1)})t} \leq G_{13}(t) \leq G_{13}^0 e^{(S_1)^{(1)}t} \quad 72$$

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

$$\frac{1}{(m_1)^{(1)}} G_{13}^0 e^{((S_1)^{(1)} - (p_{13})^{(1)})t} \leq G_{14}(t) \leq \frac{1}{(m_2)^{(1)}} G_{13}^0 e^{(S_1)^{(1)}t} \quad 73$$

$$\left(\frac{(a_{15})^{(1)} G_{13}^0}{(m_1)^{(1)}((S_1)^{(1)} - (p_{13})^{(1)} - (S_2)^{(1)})}\left[e^{((S_1)^{(1)} - (p_{13})^{(1)})t} - e^{-(S_2)^{(1)}t}\right] + G_{15}^0 e^{-(S_2)^{(1)}t} \leq G_{15}(t) \leq \right. \quad 74$$
$$\left. \frac{(a_{15})^{(1)} G_{13}^0}{(m_2)^{(1)}((S_1)^{(1)} - (a_{15}')^{(1)})}\left[e^{(S_1)^{(1)}t} - e^{-(a_{15}')^{(1)}t}\right] + G_{15}^0 e^{-(a_{15}')^{(1)}t}\right)$$

75

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

$$\frac{1}{(\mu_1)^{(1)}} T_{13}^0 e^{(R_1)^{(1)}t} \leq T_{13}(t) \leq \frac{1}{(\mu_2)^{(1)}} T_{13}^0 e^{((R_1)^{(1)} + (r_{13})^{(1)})t} \quad 76$$

$$\frac{(b_{15})^{(1)} T_{13}^0}{(\mu_1)^{(1)}((R_1)^{(1)} - (b_{15}')^{(1)})}\left[e^{(R_1)^{(1)}t} - e^{-(b_{15}')^{(1)}t}\right] + T_{15}^0 e^{-(b_{15}')^{(1)}t} \leq T_{15}(t) \leq \quad 77$$

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

<u>Definition of</u> $(S_1)^{(1)}, (S_2)^{(1)}, (R_1)^{(1)}, (R_2)^{(1)}$:- 78

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

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

$(R_1)^{(1)} = (b_{13})^{(1)}(\mu_2)^{(1)} - (b_{13}')^{(1)}$ 79

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

<u>Proof</u> : From 19,20,21,22,23,24 we obtain

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

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

81

It follows

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

From which one obtains

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

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

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

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

In the same manner , we get

$$\nu^{(1)}(t) \leq \frac{(\bar{\nu}_1)^{(1)} + (\bar{C})^{(1)}(\bar{\nu}_2)^{(1)} e^{\left[-(a_{14})^{(1)}\left((\bar{\nu}_1)^{(1)} - (\bar{\nu}_2)^{(1)}\right)t\right]}}{1 + (\bar{C})^{(1)} e^{\left[-(a_{14})^{(1)}\left((\bar{\nu}_1)^{(1)} - (\bar{\nu}_2)^{(1)}\right)t\right]}} \quad , \quad \boxed{(\bar{C})^{(1)} = \frac{(\bar{\nu}_1)^{(1)} - (\nu_0)^{(1)}}{(\nu_0)^{(1)} - (\bar{\nu}_2)^{(1)}}}$$ 82

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

83

(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,

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

$$\frac{(\bar{\nu}_1)^{(1)} + (\bar{C})^{(1)}(\bar{\nu}_2)^{(1)} e^{\left[-(a_{14})^{(1)}\left((\bar{\nu}_1)^{(1)} - (\bar{\nu}_2)^{(1)}\right)t\right]}}{1 + (\bar{C})^{(1)} e^{\left[-(a_{14})^{(1)}\left((\bar{\nu}_1)^{(1)} - (\bar{\nu}_2)^{(1)}\right)t\right]}} \leq (\bar{\nu}_1)^{(1)}$$ 84

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

$$(\nu_1)^{(1)} \leq \nu^{(1)}(t) \leq \frac{(\bar{\nu}_1)^{(1)} + (\bar{C})^{(1)}(\bar{\nu}_2)^{(1)} e^{\left[-(a_{14})^{(1)}\left((\bar{\nu}_1)^{(1)} - (\bar{\nu}_2)^{(1)}\right)t\right]}}{1 + (\bar{C})^{(1)} e^{\left[-(a_{14})^{(1)}\left((\bar{\nu}_1)^{(1)} - (\bar{\nu}_2)^{(1)}\right)t\right]}} \leq (\nu_0)^{(1)}$$ 85

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

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

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

In a completely analogous way, we obtain 86

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

$$(\mu_2)^{(1)} \leq u^{(1)}(t) \leq (\mu_1)^{(1)}, \quad \boxed{u^{(1)}(t) = \frac{T_{13}(t)}{T_{14}(t)}}$$ 87

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 $(u_0)^{(1)}$.

We can prove the following

<u>Theorem 3</u>: 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

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

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

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

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

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

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

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

<u>Proof:</u>

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

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

95

<u>Definition and uniqueness of</u> 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

$G_{13} = \frac{(a_{13})^{(1)} G_{14}}{[(a'_{13})^{(1)} + (a''_{13})^{(1)}(T^*_{14})]}$, $G_{15} = \frac{(a_{15})^{(1)} G_{14}}{[(a'_{15})^{(1)} + (a''_{15})^{(1)}(T^*_{14})]}$ 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 98

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

$$T_{13}^* = \frac{(b_{13})^{(1)} T_{14}^*}{[(b'_{13})^{(1)} - (b''_{13})^{(1)}(G^*)]} \quad , \quad T_{15}^* = \frac{(b_{15})^{(1)} T_{14}^*}{[(b'_{15})^{(1)} - (b''_{15})^{(1)}(G^*)]}$$ 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 $\mathbb{G}_i, \mathbb{T}_i$:- 100

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

$$\frac{\partial (a''_{14})^{(1)}}{\partial T_{14}}(T_{14}^*) = (q_{14})^{(1)} \quad , \quad \frac{\partial (b''_i)^{(1)}}{\partial G_j}(G^*) = s_{ij}$$ 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

$$\left((\lambda)^{(1)} + (b'_{15})^{(1)} - (r_{15})^{(1)}\right)\left\{\left((\lambda)^{(1)} + (a'_{15})^{(1)} + (p_{15})^{(1)}\right)\right.$$
$$\left[\left(\left((\lambda)^{(1)} + (a'_{13})^{(1)} + (p_{13})^{(1)}\right)(q_{14})^{(1)} G_{14}^* + (a_{14})^{(1)}(q_{13})^{(1)} G_{13}^*\right)\right]$$

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

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

A DISCUSSION APOSTEORI IN CONSIDERATION TO THE CONCATENATED SET OF EQUATIONS

The whole of the phenomenon in the Universe are directly or indirectly linked with the presence of space matter
1) What is the fact behind starlight bending and gravitational lensing?
2) Space matter in atoms.
3) Ordinary matter is made of space matter.
4) How chemical energy and nuclear energy are released?
5) How electric field, magnetic field and gravitational force etc are transmitted through the space?
6) How are attraction and repulsion works?
7) Properties of space matter.
8) What is light and how is light propagated?

Space matter is filled everywhere in the universe. Since the gravitational force exerted on space matter, all massive bodies have a denser medium of space matter envelop. Starlight bending and gravitational lensing, both are the evidences for space matter in the macro world. Increasing of mass of a fast moving body, change in shape of a body resulting from its motion; the effect, known as the Lorentz-FitzGerald contraction etc are also the evidence for space matter in space. Nucleus of an atom is surrounded by a denser medium space matter and most of the phenomenon in the atomic world is closely linked with the presents of space matter in atoms (watch video structure of atom). Ordinary matter is a highly compressed state of space matter and most of the energy forms are released because of the releasing, expansion or explosion of space matter. The releasing of energy in a nuclear reaction is due to the rapid- huge increasing of volume of ordinary matter to space matter. That is, in a nuclear reaction the missing mass (mass defect) is converted into space matter. Electric field lines and magnetic field lines both are created by the line-up and alignment of space matter units. Attraction between unlike electric charges and between unlike magnetic poles is caused by the contraction of space matter units between the charges and poles respectively. Light propagation: - How is light propagated? Light is a mixture of longitudinal and transverse wave. The longitudinal part is for the propagation of the compressing of space matter units and the transverse part is for the oscillating magnetic lines. That is, light travels as transverse wave in magnetic lines. Structure of electron has a standing- electric field and magnetic field in right angle regardless of any kind of its motions. How is radio wave created? In a radio wave antenna, electrons make oscillations parallel to its electric field and perpendicular to its magnetic field. This oscillation creates transverse wave on the electrons magnetic lines and the oscillating magnetic lines (radio wave) will be radiated to space. How is light emitted by an atom? In an atom the electric fields of its electrons will be always directed to the nucleus and magnetic fields will be horizontal to the nucleus. When a shell in an atom is excited, electrons in the shell make oscillations parallel to their electric field and perpendicular to their magnetic field. This oscillation creates transverse wave on the electrons magnetic lines and the light will be radiated to space. Bending of radio wave and straight line travel of light As the length of oscillating magnetic lines increase, the chances of mutual repulsion between them will be also increased (radio wave to microwave) and they bend significantly. But short wavelength photons make minimum mutual repulsions and they travel almost straightly. * Near a massive object like the Sun, light will be bended (for example, the light coming from distant stars) because of the density of the space matter is greater at the near surface of the Sun than the outer space, and it only is the refraction of light. * We can calculate the magnitude of bending, if we know the mass of the object (for calculating the gravitational pull that exerted on the space matter) and the space matter-producing rate (quantity of matter that converted into space matter / second in the nuclear reaction process). Experiment: Since the photon (intermittent) nature of light, it is very difficult to influence on light by magnetic field. But a continues radio wave transmitted by a radio wave transmitter, can be disturbed with the help of a strong magnetic field

GOVERNING EQUATIONS

TIME

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

$$\frac{dG_{14}}{dt} = (a_{14})^{(1)}G_{13} - (a'_{14})^{(1)}G_{14}$$ 2a

$$\frac{dG_{15}}{dt} = (a_{15})^{(1)}G_{14} - (a'_{15})^{(1)}G_{15}$$ 3a

SPACE:

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

ENERGY

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

$$\frac{dG_{17}}{dt} = (a_{17})^{(2)}G_{16} - (a'_{17})^{(2)}G_{17}$$ 8a

$$\frac{dG_{18}}{dt} = (a_{18})^{(2)}G_{17} - (a'_{18})^{(2)}G_{18}$$ 9a

MATTER

$$\frac{dT_{16}}{dt} = (b_{16})^{(2)}T_{17} - (b'_{16})^{(2)}T_{16}$$ 10a

$$\frac{dT_{17}}{dt} = (b_{17})^{(2)}T_{16} - (b'_{17})^{(2)}T_{17}$$ 11a

$$\frac{dT_{18}}{dt} = (b_{18})^{(2)}T_{17} - (b'_{18})^{(2)}T_{18}$$ 12a

GOVERNING EQUATIONS OF DUAL CONCATENATED SYSTEMS

SPACE TIME CONTINUUM

$(-b''_i)^{(1)}(G_{13}, G_{14}, G_{15}, t) = -(b''_i)^{(1)}(G, t)$, $i = 13,14,15$ the contribution of TIME.

TIME

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

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

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

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

SPACE

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

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

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

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

MATTER AND ENERGY CORRESPONDING CONCATENATED QUATIONS:

ENERGY:

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

$\frac{dG_{17}}{dt} = (a_{17})^{(2)}G_{16} - \left[(a'_{17})^{(2)} \boxed{+(a''_{17})^{(2)}(T_{17},t)}\right]G_{17}$ 20a

$\frac{dG_{18}}{dt} = (a_{18})^{(2)}G_{17} - \left[(a'_{18})^{(2)} \boxed{+(a''_{18})^{(2)}(T_{17},t)}\right]G_{18}$ 21a

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

MATTER

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

$\frac{dT_{17}}{dt} = (b_{17})^{(2)}T_{16} - \left[(b'_{17})^{(2)} \boxed{-(b''_{17})^{(2)}(G_{19},t)}\right]T_{17}$ 23a

$\frac{dT_{18}}{dt} = (b_{18})^{(2)}T_{17} - \left[(b'_{18})^{(2)} \boxed{-(b''_{18})^{(2)}(G_{19},t)}\right]T_{18}$ 24a

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

GOVERNING EQUATIONS OF CONCATENATED SYSTEM OF TWO CONCATENATED DUAL SYSTEMS

GOVERNING EQUATIONS

ENERGY

$\frac{dG_{16}}{dt} = (a_{16})^{(2)}G_{17} - \left[(a'_{16})^{(2)} \boxed{+(a''_{16})^{(2)}(T_{17},t)} \boxed{-(a''_{13})^{(1,1)}(T_{14},t)}\right]G_{16}$ 25a

$\frac{dG_{17}}{dt} = (a_{17})^{(2)}G_{16} - \left[(a'_{17})^{(2)} \boxed{+(a''_{17})^{(2)}(T_{17},t)} \boxed{-(a''_{14})^{(1,1)}(T_{14},t)}\right]G_{17}$ 26a

$\frac{dG_{18}}{dt} = (a_{18})^{(2)}G_{17} - \left[(a'_{18})^{(2)} \boxed{+(a''_{18})^{(2)}(T_{17},t)} \boxed{-(a''_{15})^{(1,1)}(T_{14},t)}\right]G_{18}$ 27a

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 $\boxed{-(a''_{14})^{(1,1)}(T_{14},t)}$, $\boxed{-(a''_{15})^{(1,1)}(T_{14},t)}$ are second detritions coefficients for category 1, 2 and 3

SPACE

$\frac{dT_{13}}{dt} = (b_{13})^{(1)}T_{14} - \left[(b'_{13})^{(1)} \boxed{-(b''_{13})^{(1)}(G,t)} \boxed{+(b''_{16})^{(2,2)}(G_{19},t)}\right]T_{13}$ 28a

$\frac{dT_{14}}{dt} = (b_{14})^{(1)}T_{13} - \left[(b'_{14})^{(1)} \boxed{-(b''_{14})^{(1)}(G,t)} \boxed{+(b''_{17})^{(2,2)}(G_{19},t)}\right]T_{14}$ 29a

$\frac{dT_{15}}{dt} = (b_{15})^{(1)}T_{14} - \left[(b'_{15})^{(1)} \boxed{-(b''_{15})^{(1)}(G,t)} \boxed{+(b''_{18})^{(2,2)}(G_{19},t)}\right]T_{15}$ 30a

Where $\boxed{-(b''_{13})^{(1)}(G,t)}$, $\boxed{-(b''_{14})^{(1)}(G,t)}$, $\boxed{-(b''_{15})^{(1)}(G,t)}$ are first detritions coefficients for category 1, 2 and 3 due to TIME

$\boxed{+(b''_{16})^{(2,2)}(G_{19},t)}$, $\boxed{+(b''_{17})^{(2,2)}(G_{19},t)}$, $\boxed{+(b''_{18})^{(2,2)}(G_{19},t)}$ are second augmentation coefficients for category 1, 2 and 3

TIME

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

$\frac{dG_{14}}{dt} = (a_{14})^{(1)}G_{13} - \left[(a'_{14})^{(1)} \boxed{+(a''_{14})^{(1)}(T_{14},t)}\right]G_{14}$ 32a

$\frac{dG_{15}}{dt} = (a_{15})^{(1)}G_{14} - \left[(a'_{15})^{(1)} \boxed{+(a''_{15})^{(1)}(T_{14},t)}\right]G_{15}$ 33a

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 due to TIME

MATTER:

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

$\frac{dT_{17}}{dt} = (b_{17})^{(2)}T_{16} - \left[(b'_{17})^{(2)} \boxed{-(b''_{17})^{(2)}(G_{19},t)}\right] T_{17}$ 35a

$\frac{dT_{18}}{dt} = (b_{18})^{(2)}T_{17} - \left[(b'_{18})^{(2)} \boxed{-(b''_{18})^{(2)}(G_{19},t)}\right] T_{18}$ 36a

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

**GOVERNING EQUATIONS OF
MATTER AND TIME**

As one of the few astrophysical events that most people are familiar with, the Big Bang has a special place in our culture. And while there is scientific consensus that it is the best explanation for the origin of the Universe, the debate is far from closed. However, it's hard to find alternative models of the Universe without a beginning that are genuinely compelling.
That could change now with the fascinating work of Wun-Yi Shu at the National Tsing Hua University in Taiwan. Shu has developed an innovative new description of the Universe in which the roles of time space and mass are related in new kind of relativity.
Shu's idea is that time and space are not independent entities but can be converted back and forth between each other. In his formulation of the geometry of spacetime, the speed of light is simply the conversion factor between the two. Similarly, mass and length are interchangeable in a relationship in which the conversion factor depends on both the gravitational constant G and the speed of light, neither of which need be constant.So as the Universe expands, mass and time are converted to length and space and vice versa as it contracts.This universe has no beginning or end, just alternating periods of expansion and contraction. In fact, Shu shows that singularities cannot exist in this cosmos. During a period of expansion, an observer in this universe would see an odd kind of change in the red-shift of bright objects such as Type-I supernovas, as they accelerate away. It turns out, says Shu, that his data exactly matches the observations that astronomers have made on Earth This kind of acceleration is an ordinary feature of Shu's universe. That's in stark contrast to the various models of the Universe based on the Big Bang.
The most commonly discussed idea is that the universe is filled with a dark energy that is forcing the universe to expand at an increasing rate. For this model to work, dark energy must make up 75 per cent of the energy-mass of the Universe and be increasing at a fantastic rate.

MATTER

$\frac{dT_{16}}{dt} = (b_{16})^{(2)}T_{17} - \left[(b'_{16})^{(2)} \boxed{-(b''_{16})^{(2)}(G_{19},t)} \boxed{-(b''_{13})^{(1,1)}(G,t)}\right] T_{16}$ 37a

$\frac{dT_{17}}{dt} = (b_{17})^{(2)}T_{16} - \left[(b'_{17})^{(2)} \boxed{-(b''_{17})^{(2)}(G_{19},t)} \boxed{-(b''_{14})^{(1,1)}(G,t)}\right] T_{17}$ 38a

$\frac{dT_{6}}{dt} = (b_{18})^{(2)}T_{17} - \left[(b'_{18})^{(2)} \boxed{-(b''_{18})^{(2)}(G_{19},t)} \boxed{-(b''_{15})^{(1,1)}(G,t)}\right] T_{18}$ 39a

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 due MATTER

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

TIME

$\frac{dG_{13}}{dt} = (a_{13})^{(1)}G_{14} - \left[(a'_{13})^{(1)} \boxed{+(a''_{13})^{(1)}(T_{14},t)} \boxed{+(a''_{16})^{(2,2)}(T_{17},t)}\right] G_{13}$ 40a

$\frac{dG_{14}}{dt} = (a_{14})^{(1)}G_{13} - \left[(a'_{14})^{(1)} \boxed{+(a''_{14})^{(1)}(T_{14},t)} \boxed{+(a''_{17})^{(2,2)}(T_{17},t)}\right] G_{14}$ 41a

$\frac{dG_{15}}{dt} = (a_{15})^{(1)}G_{14} - \left[(a'_{15})^{(1)} \boxed{+(a''_{15})^{(1)}(T_{14},t)} \boxed{+(a''_{18})^{(2,2)}(T_{17},t)}\right] G_{15}$ 42a

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 ACE

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

Zero-point energy is the lowest possible energy that a quantum mechanical physical system may have; it is the energy of its ground state. All quantum mechanical systems undergo fluctuations even in their ground state and have associated zero-point energy, a consequence of their wave-like nature. The uncertainty principle requires every physical system to have a zero-point energy greater than the minimum of its classical potential well, even at absolute zero. For example, liquid helium does not freeze under atmospheric pressure at any temperature because

of its zero-point energy.
The concept of zero-point energy was developed in Germany by Albert Einstein and Otto Stern in 1913, using a formula developed by Max Planck in 1900.The term zero-point energy originates from the German Nullpunktsenergie. The German name is also spelled Nullpunktenergie (without the "s").
Vacuum energy is the zero-point energy of all the fields in space, which in the Standard Model includes the electromagnetic field, other gauge fields, fermionic fields, and the Higgs field. It is the energy of the vacuum, which in quantum field theory is defined not as empty space but as the ground state of the fields. In cosmology, the vacuum energy is one possible explanation for the cosmological constant. A related term is zero-point field, which is the lowest energy state of a particular field..
Then in 1913, using this formula as a basis, Albert Einstein and Otto Stern published a paper of great significance in which they suggested for the first time the existence of a residual energy that all oscillators have at absolute zero. They called this residual energy Nullpunktsenergie (German), later translated as zero-point energy. They carried out an analysis of the specific heat of hydrogen gas at low temperature, and concluded that the data are best represented if the vibrational energy is TAKEN IN TO CONSIDERATION. According to this expression, an atomic system at absolute zero retains an energy of ½hv.In 1916 Walther Nernst postulated that the vacuum of space is filled with zero-point electromagnetic radiation
Zero-point energy is fundamentally related to the Heisenberg uncertainty principle. Roughly speaking, the uncertainty principle states that complementary variables (such as a particle's position and momentum, or a field's value and derivative at a point in space) cannot simultaneously be defined precisely by any given quantum state. In particular, there cannot be a state in which the system sits motionless at the bottom of its potential well, for then its position and momentum would both be completely determined to arbitrarily great precision. Therefore, the lowest-energy state (the ground state) of the system must have a distribution in position and momentum that satisfies the uncertainty principle, which implies its energy, must be greater than the minimum of the potential well. A more thorough treatment, showing that the energy of the ground state actually is requires solving for the ground state of the system..

The concept of zero-point energy occurs in a number of situations.

In ordinary quantum mechanics, the zero-point energy is the energy associated with the ground state of the system. The professional physics literature tends to measure frequency, as denoted by above, using angular frequency, denoted with and defined by = . This leads to a convention of writing Planck's constant with a bar through its top to denote the quantity /. In those terms, the most famous such example of zero-point energy is associated with the ground state of the quantum harmonic oscillator. In quantum mechanical terms, the zero-point energy is the expectation value of the Hamiltonian of the system in the ground state.
In quantum field theory, the fabric of space is visualized as consisting of fields, with the field at every point in space and time being a quantum harmonic oscillator, with neighboring oscillators interacting. In this case, one has a contribution of from every point in space, resulting in a calculation of infinite zero-point energy in any finite volume; this is one reason renormalization is needed to make sense of quantum field theories. The zero-point energy is again the expectation value of the Hamiltonian; here, however, the phrase vacuum expectation value is more commonly used, and the energy is called the vacuum energy.
In quantum perturbation theory, it is sometimes said that the contribution of one-loop and multi-loop Feynman diagrams to elementary particle propagators are the contribution of vacuum fluctuations or the zero-point energy to the particle masses.
A phenomenon that is commonly presented as evidence for the existence of zero-point energy in vacuum is the Casimir effect, proposed in 1948 by Dutch physicist Hendrik B. G. Casimir (Philips Research), who considered the quantized electromagnetic field between a pair of grounded, neutral metal plates. The vacuum energy contains contributions from all wavelengths, except those excluded by the spacing between plates. As the plates draw together, more wavelengths are excluded and the vacuum energy decreases. The decrease in energy means there must be a force doing work on the plates as they move. This force has been measured and found to be in good agreement with the theory. However, there is still some debate on whether vacuum energy is necessary to explain the Casimir effect. Robert Jaffe of MIT argues that the Casimir force should not be considered evidence for vacuum energy, since it can be derived in QED without reference to vacuum energy by considering charge-current interactions (the radiation-reaction picture).[6]
The experimentally measured Lamb shift has been argued to be, in part, a zero-point energy effect
Gravitation and cosmology
Why doesn't the zero-point energy density of the vacuum change with changes in the volume of the universe? And related to that, why doesn't the large constant zero-point energy density of the vacuum cause a large cosmological constant? What cancels it out?
In cosmology, the zero-point energy offers an intriguing possibility for explaining the speculative positive values of the proposed cosmological constant. In brief, if the energy is "really there", then it should exert a gravitational

force. In general relativity, **mass and energy are equivalent; both produce a gravitational field. One obvious difficulty with this association is that the zero-point** energy of the vacuum is absurdly large. Naively, it is infinite, because it includes the energy of waves with arbitrarily short wavelengths. But since only differences in energy are physically measurable, the **infinity can be removed by renormalization. In all practical calculations, this is how the infinity is handled. It is also arguable** that undiscovered physics relevant at the Planck scale reduces or eliminates the energy of waves shorter than the Planck length, making the total zero-point energy finite.]Free-energy devices

As a scientific concept, the existence of zero-point energy is not controversial although the ability to harness it is. In particular, perpetual motion machines and other power generating devices supposedly based on zero-point energy are highly controversial and, in many cases, in violation of some of the fundamental laws of physics. **However, many persons claim to have invented such over-unity devices.**

Thus, current claims to zero-point-energy-based power generation systems have the status of pseudoscience. The discovery of zero-point energy did not alter the implausibility of perpetual motion machines. Much attention has been given to reputable science suggesting that zero-point-energy density is infinite, but in quantum theory, zero-point energy is a minimum energy below which a thermodynamic system can never go. Thus according to the standard quantum-theoretic viewpoint, none of this energy can be withdrawn without altering the system to a different form in which the system has a lower zero-point energy.

It is possible that the discovery of new physics will alter this conclusion. For example, in stochastic electrodynamics, the zero-point field is viewed as simply a classical background isotropic noise wave field which excites all systems present in the vacuum and thus is responsible for their minimum-energy or "ground" states. The requirement of Lorentz invariance at a statistical level then implies that the energy density spectrum must increase with the third power of frequency, implying infinite energy density when integrated over all frequencies. If this theory is correct, there is no reason that energy, or for that matter, momentum, could not be extracted, and would of course still leave infinite energy density and infinite momentum density, isotropic in all directions simultaneously, remaining in the wave field.

The calculation that underlies the Casimir experiment, a calculation based on the formula predicting infinite vacuum energy, shows the zero-point energy of a system consisting of a vacuum between two plates will decrease at a finite rate as the two plates are drawn together. The vacuum energies are predicted to be infinite, but the changes are predicted to be finite. **Casimir combined** the projected rate of change in zero-point energy with the principle of conservation of energy to predict a force on the plates. The predicted force, which is very small and was experimentally measured to be within 5% of its predicted value, is finite. Even though the zero-point energy is theoretically infinite, there is as yet no practical evidence to suggest that infinite amounts of zero-point energy are available for use, that zero-point energy can be withdrawn for free, or that zero-point energy can be used in violation of conservation of ENERGY

ENERGY

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

$$\frac{dG_{17}}{dt} = (a_{17})^{(2)}G_{16} - \left[(a'_{17})^{(2)} \boxed{+(a''_{17})^{(2)}(T_{17},t)}\right]G_{17}$$ 44a

$$\frac{dG_{18}}{dt} = (a_{18})^{(2)}G_{17} - \left[(a'_{18})^{(2)} \boxed{+(a''_{18})^{(2)}(T_{17},t)}\right]G_{18}$$ 45a

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

SPACE:

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

$$\frac{dT_{14}}{dt} = (b_{14})^{(1)}T_{13} - \left[(b'_{14})^{(1)} \boxed{-(b''_{14})^{(1)}(G,t)}\right]T_{14}$$ 47a

$$\frac{dT_{15}}{dt} = (b_{15})^{(1)}T_{14} - \left[(b'_{15})^{(1)} \boxed{-(b''_{15})^{(1)}(G,t)}\right]T_{15}$$ 48a

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

GOVERNING EQUATIONS OF THE SYSTEM

ENERGY

$$\frac{dG_{16}}{dt} = (a_{16})^{(2)}G_{17} - \left[(a'_{16})^{(2)} \boxed{+(a''_{16})^{(2)}(T_{17},t)} \boxed{+(a''_{13})^{(1,1,1)}(T_{14},t)}\right]G_{16}$$ 49a

$$\frac{dG_{17}}{dt} = (a_{17})^{(2)}G_{16} - \left[(a'_{17})^{(2)} \boxed{+(a''_{17})^{(2)}(T_{17},t)} \boxed{+(a''_{14})^{(1,1,1)}(T_{14},t)}\right]G_{17}$$ 50a

$$\frac{dG_{18}}{dt} = (a_{18})^{(2)}G_{17} - \left[(a'_{18})^{(2)} \boxed{+(a''_{18})^{(2)}(T_{17},t)} \boxed{+(a''_{15})^{(1,1,1)}(T_{14},t)}\right]G_{18}$$ 51a

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

SPACE

$$\frac{dT_{13}}{dt} = (b_{13})^{(1)}T_{14} - \left[(b'_{13})^{(1)}\boxed{-(b''_{13})^{(1)}(G,t)}\ \boxed{-(b''_{16})^{(2,2,2)}(G_{19},t)}\right]T_{13} \quad 52a$$

$$\frac{dT_{14}}{dt} = (b_{14})^{(1)}T_{13} - \left[(b'_{14})^{(1)}\boxed{-(b''_{14})^{(1)}(G,t)}\ \boxed{-(b''_{17})^{(2,2,2)}(G_{19},t)}\right]T_{14} \quad 53a$$

$$\frac{dT_{15}}{dt} = (b_{15})^{(1)}T_{14} - \left[(b'_{15})^{(1)}\boxed{-(b''_{15})^{(1)}(G,t)}\boxed{-(b''_{18})^{(2,2,2)}(G_{19},t)}\right]T_{15} \quad 54a$$

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

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

TIME

$$\frac{dG_{13}}{dt} = (a_{13})^{(1)}G_{14} - \left[(a'_{13})^{(1)}\boxed{+(a''_{13})^{(1)}(T_{14},t)}\boxed{+(a''_{16})^{(2,2,2)}(T_{17},t)}\right]G_{13} \quad 55a$$

$$\frac{dG_{14}}{dt} = (a_{14})^{(1)}G_{13} - \left[(a'_{14})^{(1)}\boxed{+(a''_{14})^{(1)}(T_{14},t)}\boxed{+(a''_{17})^{(2,2,2)}(T_{17},t)}\right]G_{14} \quad 56a$$

$$\frac{dG_{15}}{dt} = (a_{15})^{(1)}G_{14} - \left[(a'_{15})^{(1)}\boxed{+(a''_{15})^{(1)}(T_{14},t)}\boxed{+(a''_{18})^{(2,2,2)}(T_{17},t)}\right]G_{15} \quad 57a$$

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

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

MATTER

$$\frac{dT_{16}}{dt} = (b_{16})^{(2)}T_{17} - \left[(b'_{16})^{(2)}\boxed{-(b''_{16})^{(2)}(G_{19},t)}\ \boxed{-(b''_{13})^{(1,1,1)}(G,t)}\right]T_{16} \quad 58a$$

$$\frac{dT_{17}}{dt} = (b_{17})^{(2)}T_{16} - \left[(b'_{17})^{(2)}\boxed{-(b''_{17})^{(2)}(G_{19},t)}\ \boxed{-(b''_{14})^{(1,1,1)}(G,t)}\right]T_{17} \quad 59a$$

$$\frac{dT_{18}}{dt} = (b_{18})^{(2)}T_{17} - \left[(b'_{18})^{(2)}\boxed{-(b''_{18})^{(2)}(G_{19},t)}\ \boxed{-(b''_{15})^{(1,1,1)}(G,t)}\right]T_{18} \quad 60a$$

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

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

VERY IMPORTANT EPILOGUE:

In the above equations, we have explored all the possibilities if SPACE, TIME, MATTER, ENERGY interacting in various ways. The equations can solved with the application of the processual formalities and procedural regularities of the paper which has been elucidated in detail. 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 conditionalities and functionalities consummated we shall obtain the results as has been obtained in the above paper in the consolidated and concretized fashion.

Acknowledgments

The introduction is a collection of information from, articles, abstracts of the articles, paper reports, home pages of the authors, textbooks, research papers, and various other sources including the internet including Wikipedia. We acknowledge all authors who have contributed to the same. Should there be any act of omission or commission on the part of the authors in not referring to the author, it is authors' 'sincere entreat, earnest beseech ,and fervent appeal to pardon such lapses as has been done or purported to have been done in the foregoing. With great deal of compunction and contrition, the authors beg the pardon of the respective sources. References list is only illustrative and not exhaustive. We have put all concerted efforts and sustained endeavors to incorporate the names of all the sources from which information has been extracted. It is because of such eminent, erudite, and esteemed people allowing us to piggy ride on their backs, we have attempted to see little forward, or so we think.

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