# Universe in a New Light: inconvenient Reality
## (iCRY); Precession (Eccentricity Rotation); LIGO(Fantasy Waves); GPS(No Relativity Here); LHC(Design Blunder)

**Bandula W. Dahanayake**
Farmfield Crescent, Kanata, ON, Canada
Bandula_Dahanayake@yahoo.com

*Abstract*—Reality is not convenient. Every successful countdown is a triumph for NASA, but a mass loss for the earth. A collision of the earth with an asteroid or meteorite results in a mass increase. In spite of mass fluctuations, planets remain elliptically stable. What keeps a planetary orbit elliptically stable against mass fluctuations is the adaptive radial distance adjustment that results in orbit contraction and dilation. The eccentricity of a planetary orbit is not a scalar quantity. Here, new Eccentricity Vector (EV) that represents both the eccentricity and the major axis is introduced. EV is both time-invariant and mass-invariant. The orbit dilation or contraction of a gravitational orbit under changing mass of an orbiting object is a result of mass-invariance of the EV. Planetary precession is a result of the rotation of EV. EV rotation is partly due to the continuously depleting mass of the sun, and also partly due to the cyclic change of the effective mass of the sun as a result of the variation of the gravitational pull from the other planets. Light does not take the shortest path or geodesic. Light follows the density gradient of the medium. In General Relativity, for the light to follow so-called space-time curvature, the permeability and the permittivity of space must vary with the space-time curvature. As a result, speed of light cannot be a constant in warped space-time even in a vacuum. It is the permittivity and the permeability of the medium that determines the velocity of light, not some mysterious space-time curvature. Time is independent of space and hence there are no space-time undulations or Gravitational Waves (GW). Laser Interferometer Gravitational Observatory (LIGO) wave bursts have nothing to do with GWs. No space-bending is required to determine the source of LIGO-Bursts GW150914; it is due to an earthly vibration source around Fort Collins and Denver. GWs cannot generate a relative motion such as vibrating beads relative to a rod. If GWs travel at the free-space speed of light, then, when GWs enter a medium, GWs will still be travelling at the same speed while the light will travel less than the speed of the GWs; this precludes the existence of gravitational waves since it is in direct conflict with Relativity. No two waves of different propagation characteristics travelling at constant speeds can co-exist in the universe. Gravitational field is static, not a wave. Frequency fading or red-shift cannot be attributed to Doppler's effect when light travels long distances where the red-shift due to propagation loss is significant. What generates a galactic red-shift is path electromagnetic energy loss. Space cannot move objects and objects cannot move space. Gravity cannot bend light. It is the density gradient of the medium created by a gravitational object that bends light. Our visible universe, which is a 3D-horizon, is the maximum distance light could travel before being frequency down-shifted below the visible region. Microwave background is the frequency down-shifted light below the visible region of the spectrum due to propagation loss. Orbiting systems do not collapse due to perturbations. Clock and Time are not synonymous. A clock is a measuring device engineered to display the right time for given specifications. Time is absolute; display of a clock is not. It is the mechanism of a clock that is affected by the environmental condition, not the time itself. Time is a definition. Time on a cell-phone is dependent on Time-Zone, day-light saving, strength of battery, and the environmental forces, and hence cannot be used in Global Positioning System (GPS). GPS avoids using client data to make the system client independent. If the time is relative, Global Positioning System (GPS) is not possible. Collisions of protons do not generate more protons. Large Hadrons Collider (LHC) does not generate mass. In LHC, extraneous electromagnetic wave bursts (exEMBs) due to the sudden deceleration of the charge particles at the collision are non-separable from any inherent electromagnetic wave bursts (inEMBs) due to the disintegration of the particles themselves into subatomic particles in the collision. It is the misinterpretation of the exEMBs as particles that has given the false impression of mass creation in the LHC. Bigger the accelerator is, bigger the exEMBs. Collisions of charge particles cannot reveal the subatomic particles since exEMBs are inseparable from inEMBs. Electromagnetic waves are not particles, particles are not waves. Universe cannot expand. Dark Matter is a result of orbit speed underestimation while Dark Energy is a result of red-shift misinterpretation. There is no Dark Matter or Dark

**Energy. Masses of celestial bodies are not time-invariant. Unchecked human activities contribute to the mass depletion of the earth. More the mass earth loses, more the orbit contraction it undergoes. If the perpetual mass depletion drives the earth's orbit below the life sustaining orbit zone, earth will become barren just like the rest of the planets making it unable to sustain life; the Real Inconvenient Perspective [RIP].**

*Keywords— Eccentricity; Precession; Universe; Global-Warming; Red-Shift; Time; GPS; LHC; Gravitational-Waves; Planetary Orbits*

## I. INTRODUCTION

The mechanics of planetary orbits started to immerge in the late 16$^{th}$ to 17$^{th}$ centuries, when Tycho Brahe and Johannes Kepler made the observations that the planets orbit on planer elliptical orbits with one of the foci as the center, the sun, scanning the area of the ellipse at a constant rate with the square of the orbiting time period proportional to the cubic distance of the semi-major axis of the elliptical path. The experimental observations of Brahe, Kepler, and Galileo presented Newton the necessary clue, in the late 17$^{th}$ century, in determining that it is the inverse square law of gravity that is hidden behind the observation of Brahe and Kepler. Inverse square law presented planetary motion mathematically [1]. However, these theories of planetary motions were made under the assumption that the masses of planets as well as the mass of the orbiting center or the sun in our solar system are time-invariant or constant. Under these assumptions, the elliptical orbit of a planet is considered to be fixed or time-invariant. It is considered that the planets are orbiting on same orbits perpetually, again and again no matter what perturbation they are subjected to. Newton had some uneasiness or doubt about an orbiting system's ability in maintaining a fixed orbit without some sort of occasional adjustments by some unknown entity.

The idea of fixed planetary orbits holds true if the masses of the planets, $m_i$, i=1, 2, …, n and the mass of the orbiting center or the sun, M in our solar system remain time-invariant or constant. The angular momentum is time-invariant if the mass of a planet remains time-invariant or constant and $m_i$<<M, ∀i. The Runge-Lenz vector that is used to derive planetary orbits remains time-invariant if the mass of the planet and the mass of the orbiting center remain time-invariant and $m_i$<<M, ∀i. The planetary orbits are time-invariant if the masses of the planets and the mass of the orbiting center are time-invariant. However, the masses of planets and the sun are not time-invariant; they are time varying. The mass of the orbiting center in an orbiting system is not time-invariant; it is time-varying. There are many causes for a mass of a planet to fluctuate. The major causes for the fluctuations of the mass of a planet vary from planet to planet. The mass of the sun depletes with time. In spite of mass fluctuations, planets maintain the elliptical stability of their orbits. Gravitational orbit systems are not in a critical stable point. Gravitational orbit systems are robustly stable. Planets keep orbiting perpetually on elliptical path in spite of mass fluctuation. In other words, planetary orbits are elliptically stable against mass fluctuations. No perturbation makes a planet to spiral in or spiral out of the orbiting system making the system to collapse. This holds true for planetary systems as well as for electrons in atoms [2]. Planets keep orbiting on elliptical paths despite the mass variations.

In order to explore how the planetary systems maintain the mass-invariant closed elliptical orbits, we have to start with elliptical orbits of planetary systems. The derivation of planetary orbits goes back to the time of Newton in late 17$^{th}$ century. The derivation of planetary orbits using Runge-Lenz vector is quite elegant [1]. However, Runge-Lenz vector lacks any link to the physical reality. Here, we use a new approach. We introduce a new vector, the Eccentricity Vector that describes an elliptical orbit.

We represent the eccentricity of an elliptical orbit as a vector, **e**, where the magnitude e=|**e**| of the Eccentricity Vector is the eccentricity e of the elliptical orbit, and the direction of the Eccentricity Vector **e** is the major-axis of the elliptical orbit. The Eccentricity Vector **e** also explains the underline mechanics of planetary orbit precession naturally. In fact, as we see later, the Eccentricity Vector and the elliptical orbit of a planet are synonymous. The Eccentricity Vector **e** and an elliptical orbit of a planet are one and the same. An Eccentricity Vector **e** has no existence without an elliptical orbit and elliptical orbit has no existence without an Eccentricity Vector **e**. So, it is more appropriate to use Eccentricity Vector **e** in the analysis of planetary motion.

The planets in the solar system satisfy the condition $m_i$<<M, ∀i and hence the mutual interaction of the planets can be disregarded and Kepler's Laws apply. For planetary systems where the masses of the planets are not negligible compared to the orbit center mass, the Kepler's Laws do not apply [7]. When $m_i$<<M, ∀i, the angular momentum of a planet can be assumed to be time-invariant; the Eccentricity Vector can be assumed to be time-invariant. If the planetary orbits are time-invariant, the planets will orbit on fixed closed elliptical paths. Although the planetary orbits are not fixed under changing masses, the Eccentricity Vectors are independent of the planetary masses and remain mass-invariant while maintaining planetary orbits elliptically stable. When an orbit of a planet remains elliptically stable, the planet keeps orbiting on a closed elliptical path. For the Eccentricity Vector of an orbit to be mass-invariant, it has to give something; it has to let something else to change. When the Eccentricity Vector of an orbit is mass-invariant against fluctuating mass of a planet, what happens to the radial distance? What keeps a planetary system

stable not just against the fluctuating masses, but against the fluctuations of any orbit parameter including any changes in the Gravitational Parameter?

The orbits of heavy-weight orbiting systems such as orbiting stars and galaxies cannot be assumed to be fixed even when the masses are time-invariant since the masses of the stars are not negligible compared to the mass of the orbit center star or orbiting center galaxy [7]. The angular momentum of an orbiting star or a galaxy is not time-invariant. The Eccentricity Vector of an orbiting star is not time-invariant. If the masses of the orbiting objects are comparable to the orbiting center, orbiting system is time-varying and hence Kepler's Laws do not apply [7]. However, the mass-invariance of the Eccentricity vectors of orbiting stars and galaxies maintain their orbits elliptically stable.

The precession of an elliptical orbit of a planet is a result of the Eccentricity Vector rotation due to the continuous depletion of the mass of the orbiting center, or the depletion of the mass of the sun, in our solar system. The Eccentricity Vector rotation due to the change of mass of the orbiting center is oscillatory. Although the rotation of the Eccentricity Vector is oscillatory, there is a continuous unidirectional overall rotation since the positive angle of swing and the negative angle of swing are different due to the non-uniform relative change of the mass of the sun. It is not just the direction of the Eccentricity Vector that undergoes an overall rotational change due to the relative change of the mass of the sun; the magnitude of the Eccentricity Vector also undergoes an overall increase resulting in more oblong orbit with time. The effect of gravitational pull from other planets in a multi-planet orbiting system is also equivalent to the cyclic change of the effective mass of the orbiting center, which also contribute to the orbit precession.

Although the Runge-Lenz vector is time-invariant and lies along the major axis, the use of the Runge-Lenz vector in the derivation of planetary orbits is quite mechanical. The Runge-Lenz vector does not represent any quantity related to an elliptical orbit except that it is a vector that lies on the major axis of an elliptical orbit of a planet. The Eccentricity Vector makes the derivation of the planetary orbits transparent and physically insightful since we have clear understanding of eccentricity of an elliptical orbit. In fact, the Eccentricity Vector is the elliptical orbit of a planet; the Eccentricity Vector and the elliptical orbit are synonymous. An elliptical planetary orbit cannot exist without the Eccentricity Vector. If the Eccentricity Vector is a null vector, the planetary orbit will be circular.

The interpretation of galactic red-shift as a result of universe expansion is incorrect. When light travels large distances, in addition to the loss of the strength or power, it also undergoes electromagnetic energy loss. The power of a light burst and electromagnetic energy of a light burst are two different entities. Since the frequency of an electromagnetic wave burst is determined by the electromagnetic energy of the light burst and vice versa, the electromagnetic energy loss due to propagation results in frequency down-shift or a red-shift. The larger the distance light travels, the larger is the propagation electromagnetic energy loss, and hence larger is the red-shift. Doppler's effect can be used to interpret frequency red-shift only for distances where the propagation electromagnetic energy loss is negligible. The electromagnetic energy loss due to propagation is significant for light travelling for billions of light years. When light travels for large distances resulting in a red-shift due to significant propagation electromagnetic energy loss, it is the increasing red-shift, not the red-shift that can be attributed to the Doppler's effect. The attribution of the galactic red-shift to universe expansion and the increasing galactic red-shift to accelerated universe expansion is incorrect. The notion of universe expansion is simply preposterous. Universe is not expanding; space cannot expand.

Nothing travels without energy loss; light is no exception. As light propagates large distances, light loses the magnitude due to attenuation; light also loses electromagnetic energy along the path causing a frequency red-shift. The galactic red-shift is a result of propagation electromagnetic energy loss. The increasing or decreasing galactic red-shift is a result of galactic mass fluctuations. Why we have a limited range of visible universe has nothing to do with an age of the universe or an origin of the universe from a hypothetical big-bang. There was no big-bang. The concept of time exists only in the human consciousness, not in the universe. As far as universe concerned, the concept of time does not exist. Time is a human definition. Universe has no time. Microwave background has nothing to do with a hypothetical big-bang or origin of the universe. Microwave background is the frequency faded or red-shifted light due to propagation loss. Microwave background contains the same information as of the visible light, but in a different frequency band. What frequency band the light or electromagnetic waves are in depends on the distance light has traveled. Nothing travels without an energy loss; light is no exception. The larger the distance light travels, the larger the propagation loss and hence larger the frequency down-shift or red-shift will be.

The speed of light is not a fundamental parameter of the universe. Any parameter that is a function of other parameters cannot be a fundamental parameter of the universe. As a result, the speed of light is neither a universal parameter nor a universal constant. It is the electromagnetic properties of space or the medium that determines the speed of light. Any change in the electromagnetic properties of the space result in the change of the speed of light. It is the permittivity and the permeability of the medium, or the space in the absence of a medium, that determine the direction and the speed of the light, not some hypothetical space-time curvature. Neither space-time

curvature nor anything else has anything to do with the direction and the speed of light except the electrical properties of the space or the medium. If you claim that light follows the space-time curvature, what you are implying is that the space-time curvature alters the permittivity and the permeability of medium or space. In other words, space-time curvature changes the velocity of light. Speed of the light is no longer a constant in the presence of space-time curvature. Light does not take the shortest path. Light does not follow the geodesic. Light follows the density gradient of the medium.

### Space-Time Curvature Conundrum:

If light follows the space-time curvature, the speed of light will no longer be a constant. If light follows the geodesic, the speed of light will not be a constant. The speed of light is a constant only on a linear path. If the speed of light is a constant, there will be no space-time curvature. In the absence of space-time curvature, there will be no General Relativity.

General relativity attributes the gravity to a bending of the space-time or the space-time curvature. Further, according to the General Relativity, the accelerated motion of a gravitational object or collision of gravitational objects is considered to generate space-time undulations that travel at the speed of light. There is no space-time [3] and hence there are no space-time undulations. If there is a warped space-time, the speed of light will not be a constant since the electromagnetic parameters of space, permittivity and the permeability, must vary with the curvature of the so-called space-time, if it exists, in order for the light to follow the curvature of the space-time. In other words, if General Relativity holds true, the speed of light will not be a constant in the presence of gravitational objects since gravitational objects suppose to create space-time curvature according to General Relativity.

The Laser Interferometer Gravitational Observatory (LIGO) measures the vibration or expansion and contraction of LIGO-Arms, which are in the order of a small fraction of a diameter of an atom, and attributes it to gravitational waves from a presume pair of black-holes collision billion light years away. It is not possible to attribute a LIGO-burst to gravitational waves just because the LIGO-Burst (GW150914) can be represented as gravitational waves due to a collision of a pair of black holes. Any earthly mechanical or acoustic vibration can produce LIGO-bursts; after all, LIGO measures the vibrations of LIGO-Arms. It is simply incorrect to claim that some earthly LIGO-Arms vibrations are a result of space-time undulations from a pair of black-holes collision billion light years away just because the data match a theoretical model. Black-hole collision model for the LIGO-Bursts is not unique. Unless the model is unique for the data, it is not possible to claim that the LIGO-Bursts are the result of the Gravitational Waves originated from a Collision of Black-Holes. Time does not depend on the space [3] and hence there is no space-time; without space-time there would be no space-time undulations or so-called mythical gravitational waves. Infinite span gravitational field is static and cannot be a wave.

The concept of time does not exist in the universe. Time is a human definition. Time does not depend on the space. There is no such thing called space-time [3]. Without space-time, there will be no space-time undulations. This makes the so-called gravitational waves a pure fantasy; fantasy waves, billion-dollar fantasy.

The display of a clock and the time are not necessarily the same. What is displayed on a clock depends on the environment the clock is at. The display of a clock represents the time only when the clock has met the design specification of the clock. Time displayed on clocks at different altitudes or different speeds differ from the actual time for the same reason why the displayed time on your wrist watch differs from the displayed time on your tabletop clock in your house, or why two clocks at different temperatures display different time. If time depends on the velocity, time would be directional and not unique. Time cannot be directional. Time must be unique. As a result, time cannot be relative.

If there is a space-time, the space-time must be unique. However, if time depends on the space, or space-time exists, the space-time will be not unique [3]. As a result, time cannot depend on the space and space-time does not exist. Since there is no space-time, the concept of space-time undulations or so called gravitational waves itself is a mere fantasy, fantasy waves.

In fact, if you use the data from stock market collapse, it is equally possible to fit the stock market crash data to a collision of a pair of black-holes and claim that the stock market crash was a result of a pair of black-holes collision some billion light years away. Even the data from epileptic seizure can be modeled as a collision of a pair of black-holes. Does that mean the collision of black-holes billions of light years in the past made the stock market to crash? Does that mean the epileptic seizure is a result of black hole collision? If we can attribute the vibration of a pair of LIGO-Arms to a pair of black-hole collision, we should equally be able to attribute epileptic seizures and stock market crash to pair of black-hole collision if the data match the model.

## II. PLANETARY MOTION DYNAMICS

The motion of a planet of mass m at the position **r** with the potential $\Psi(\mathbf{r})$ is given by,

$$m\frac{\partial}{\partial t}\mathbf{v} + \nabla\Psi(\mathbf{r}) = \mathbf{0} \tag{2.1}$$

where, $\mathbf{v} = \frac{\partial}{\partial t}\mathbf{r}$, $\mathbf{r} = (r_x, r_y, r_z)$, the radial distance r to the planet is given by $r = |\mathbf{r}|$, and $\nabla = (\frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial}{\partial z})$.

In the case of orbiting systems, where the masses of

the orbiting objects are negligible compared to the mass of the orbiting center or when $m_i \ll M \; \forall i$, we have,

$$\Psi(\mathbf{r}) = -(GMm/r) \qquad (2.2)$$
$$\nabla\Psi(\mathbf{r}) = (GMm/r^3)\mathbf{r} \qquad (2.3)$$

where, $\nabla^2\Psi(\mathbf{r}) = 0$, $\nabla^2 = \nabla \cdot \nabla$, G is the gravitational parameter, and • denotes the dot product, M is the mass of the orbiting center, or the sun in our solar system, and m is the mass of a planet.

Substituting for $\nabla\Psi(\mathbf{r})$ in equation (2.1), we have the planetary motion dynamics,

$$\frac{\partial}{\partial t}\frac{\partial}{\partial t}\mathbf{r} + (GM/r^3)\mathbf{r} = \mathbf{0} \qquad (2.4)$$

The planetary motion dynamics is independent of the mass m of the planet, but dependent on the mass M of the orbiting center or the mass M of the sun in our solar system.

**Definition:** Rotation Vector

The Rotation Vector $\boldsymbol{\ell}$ of an orbiting planet is defined as,

$$\boldsymbol{\ell} = \mathbf{r} \times \mathbf{v} \qquad (2.5)$$

**Lemma:**

The Rotation Vector, $\boldsymbol{\ell}$ of an orbiting planet is time-invariant when $m_i \ll M \; \forall i$.

**Proof:** When $m_i \ll M \; \forall i$, the mutual interaction of the orbiting object can be disregarded. Consider planet of mass m orbiting a sun of mass M. Then, the Rotation Vector, $\boldsymbol{\ell}$ of a planet of mass m at time t is given by,

$$\boldsymbol{\ell} = \mathbf{r} \times \mathbf{v} \qquad (2.6)$$
$$\frac{\partial}{\partial t}\boldsymbol{\ell} = \frac{\partial}{\partial t}\mathbf{r} \times \mathbf{v} + \mathbf{r} \times \frac{\partial}{\partial t}\mathbf{v} \qquad (2.7)$$

Since $\frac{\partial}{\partial t}\mathbf{r} = \mathbf{v}$, and $\frac{\partial}{\partial t}\mathbf{v} = -(GM/r^3)\mathbf{r}$, we have, $\frac{\partial}{\partial t}\mathbf{r} \times \mathbf{v} = \mathbf{0}$, $\mathbf{r} \times \frac{\partial}{\partial t}\mathbf{v} = \mathbf{0}$ and hence, $\frac{\partial}{\partial t}\boldsymbol{\ell} = \mathbf{0}$.

In other words, the Rotation Vector $\boldsymbol{\ell}$ is time-invariant.

If the orbiting masses of a multi-object orbiting system is comparable to the orbiting center mass M, then the angular momentum of an orbiting object will not be time-invariant. However, the total angular momentum of any orbiting system is time-invariant and always conserved [7].

In the case of the solar system, $m_i \ll M \; \forall i$, and hence, the Rotation Vector of a planetary orbit can be assumed to be time-invariant.

III. **THE ECCENTRICITY VECTOR OF PLANETARY ORBIT**
**Axiom: Eccentricity is Mass-Invariant**

The Eccentricity Vector of a planetary orbit is independent of the mass of the planet.

Orbit dynamics is independent of the mass of the orbiting planet. Since the Eccentricity Vector of an elliptical orbit is determined by the orbit dynamics, the Eccentricity Vector of an orbiting planet is independent of the mass of the planet. The Eccentricity Vector is mass-invariant. In spite of the changing mass of a planet, the Eccentricity Vector remains fixed.

However, the orbit of a planet is not fixed under changing mass. Orbit of a planet is dynamic. As we see later, orbit of a planet undergoes orbit dilation or orbit contraction with the changing mass of a planet while the Eccentricity Vector remains fixed. It is the mass-invariance of the Eccentricity Vector that is the key to the stability of planetary orbits under perturbations.

The planetary orbits have been considered to be fixed since the time of Newton. This long held belief of planetary orbits being fixed is incorrect. Planetary orbits are not fixed. Planetary orbits cannot be fixed when the masses of the planets as well as the mass of the sun are not time-invariant. Planetary orbits cannot be fixed when the parameters of the orbit are subjected to perturbations. Planetary orbits are dynamic. What is fixed is the Eccentricity Vector of a planetary orbit. As we will see later, the Eccentricity Vector of a planetary orbit remains fixed as a result of the adaptive radial distance adjustment due to the change of mass of the planet as well as the change of mass of the sun.

In planetary systems, the eccentricity of an elliptical orbit has always been treated as a scalar quantity; this is incorrect. The eccentricity of an elliptical orbit is a vector; it has a magnitude, which is the eccentricity, as well as a direction, which is the major axis. In fact, the Eccentricity Vector (EV) and an elliptical orbit are synonymous, one and the same. Deriving a planetary orbit is nothing more than specifying the Eccentricity Vector (EV) of a planetary motion. As a result, an elliptical orbit in a planetary system cannot be represented using a scalar eccentricity.

If we specify the eccentricity as a scalar quantity and ask several people to draw the elliptical orbit of specific area, each person will come up with a different ellipse; the elliptical orbit will not be unique. It is not possible to determine elliptical orbit of specific area uniquely from the scalar eccentricity alone. However, if we specify the eccentricity as a vector and ask several people to draw an elliptical orbit of specific area, each person will come up with the same elliptical orbit; the orbit will be unique. The Eccentricity Vector (EV) uniquely determines the elliptical orbit of a specific area.

When we draw an ellipse, we can specify the ellipse with scalar eccentricity only if we know the major axis. We can define an ellipse using a scalar eccentricity if and only if it is we who decide the major axis. In the case of planetary orbits, it is not we who decide the major axis; it is the parameters of the planetary system themselves that determine the major axis of an elliptical orbit. As a result, planetary orbits cannot be defined by a scalar eccentricity. In the case of a planetary system, the eccentricity of an elliptical orbit is a vector and that vector is determined by the parameters of the orbiting system itself. It is the Eccentricity Vector itself that defines the major axis of a planetary orbit. There can neither be a major axis

nor an elliptical orbit without the Eccentricity Vector. The magnitude of the Eccentricity Vector is the eccentricity of the elliptical orbit of a planet. The direction of the Eccentricity Vector is the major axis of an elliptical orbit of a planet in a planetary system.

The Eccentricity Vector and the elliptical orbit are synonymous. The existence of an elliptical orbit depends on the existence of a non-null Eccentricity Vector. If there is no Eccentricity Vector, then, there will not be an elliptical orbit. When eccentricity is a null vector, the orbit is circular.

We define the Eccentricity Vector of a planet in a planetary system using the parameters of the planetary system. For a planet of Rotation Vector $\boldsymbol{\ell}$ with velocity $\mathbf{v}$ at position vector $\mathbf{r}$ and the orbiting center mass or the mass of the sun in our solar system M, we define the Eccentricity Vector $\mathbf{e}$ as follow:

**Definition:** Eccentricity Vector (EV)

Eccentricity Vector $\mathbf{e}$ of a planetary orbit is defined as,
$$\mathbf{e}= -\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} -\nabla r \qquad (3.1)$$
where, G is the gravitational parameter, M is the mass of the orbiting center, Rotation Vector $\boldsymbol{\ell}=\mathbf{r}\times\mathbf{v}$, radial distance r=|$\mathbf{r}$|, $\mathbf{v}=\frac{d}{dt}\mathbf{r}$, eccentricity e=|$\mathbf{e}$|, and
$\nabla=(\frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial}{\partial z})$.

As we will see later, what is interesting about the Eccentricity Vector $\mathbf{e}$ is that the magnitude of the Eccentricity Vector $\mathbf{e}$ is the eccentricity e of the elliptical orbit and the direction of the Eccentricity Vector $\mathbf{e}$ is the major axis of the elliptical orbit. The Eccentricity Vector $\mathbf{e}$ defines the orbit of a planet completely and uniquely. In other words, we can derive the orbit in polar coordinates or in Cartesian coordinates in (x,y) plane exclusively from the Eccentricity Vector $\mathbf{e}$.

When, the Eccentricity Vector is a null vector, $\mathbf{e}=\mathbf{0}$, then, the orbit is circular. In other words, orbit is circular when,
$$\nabla r= -\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} \qquad (3.2)$$

---

Major Axis (Eccentricity Vector)
$$\mathbf{e}= -\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} -\nabla r$$
Orbit is Circular when $\mathbf{e}=\mathbf{0}$

---

**Corollary:** Circular Orbit

A planetary orbit is circular, when,
$$\nabla r= -\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v}$$
where, r=|$\mathbf{r}$|, the radial distance to the planet, $\boldsymbol{\ell}$ is the Rotation Vector or the angular momentum per unit mass, $\mathbf{v}$ is the velocity of the planet, and $\mathbf{r}$ is the position of the planet.

**Property:**

The Eccentricity Vector $\mathbf{e}$, where,

$$\mathbf{e}= -\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} -\nabla r$$

defines an elliptical orbit uniquely and completely.

*A.* **Eccentricity Vector in Polar Coordinates**

Assume that the orbiting plane is (x,y) and the position vector $\mathbf{r}$ in polar coordinates is given by,
$$\mathbf{r}=r(\cos\varphi, \sin\varphi, 0) \qquad (3.1.1)$$
The velocity of the orbiting object, $\mathbf{v}$ is given by,
$$\mathbf{v}=\frac{d\mathbf{r}}{dt} \qquad (3.1.2)$$
$$\frac{d\mathbf{r}}{dt}= r\frac{\partial\varphi}{\partial t}(-\sin\varphi, \cos\varphi, 0)+\frac{\partial r}{\partial t}(\cos\varphi, \sin\varphi, 0)] \qquad (3.1.3)$$
Then, the Rotation Vector, $\boldsymbol{\ell}=\mathbf{r}\times\mathbf{v}$ can be written as,
$$\boldsymbol{\ell}=[r(\cos\varphi, \sin\varphi, 0)] \times[r\frac{\partial\varphi}{\partial t}(-\sin\varphi, \cos\varphi, 0)$$
$$+\frac{\partial r}{\partial t}(\cos\varphi, \sin\varphi, 0)]$$
$$\boldsymbol{\ell}=r^2\frac{\partial\varphi}{\partial t}(0, 0, 1) \qquad (3.1.4)$$

The Rotation Vector $\boldsymbol{\ell}$ is in the z-direction perpendicular to the orbiting plane of (x,y). Now, $\boldsymbol{\ell}\times\mathbf{v}$ can be written as,
$$\boldsymbol{\ell}\times\mathbf{v}= [r^2\frac{\partial\varphi}{\partial t}(0, 0, 1)]\times[r\frac{\partial\varphi}{\partial t}(-\sin\varphi, \cos\varphi, 0)$$
$$+\frac{\partial r}{\partial t}(\cos\varphi, \sin\varphi, 0)]$$
$$\boldsymbol{\ell}\times\mathbf{v}=\{r^3[\frac{\partial\varphi}{\partial t}]^2(-\cos\varphi, -\sin\varphi, 0)\}+$$
$$\{r^2\frac{\partial\varphi}{\partial t}\frac{\partial r}{\partial t}(-\sin\varphi, \cos\varphi, 0)\} \qquad (3.1.5)$$
The Eccentricity Vector $\mathbf{e}$ is given by,
$$\mathbf{e}= -\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} - \nabla r$$
$$\mathbf{e}=\{\frac{1}{GM}r^3[\frac{\partial\varphi}{\partial t}]^2 -1\}(\cos\varphi, \sin\varphi, 0) -$$
$$\{\frac{1}{GM}r^2\frac{\partial r}{\partial t}\frac{\partial\varphi}{\partial t}\}(-\sin\varphi, \cos\varphi, 0) \qquad (3.1.6)$$
From equation (3.1.4), $\ell= r^2\frac{\partial\varphi}{\partial t}$.

Substituting in equation (3.1.6), we have,
$$\mathbf{e}=\{\frac{1}{GMr}\ell^2 -1\}(\cos\varphi, \sin\varphi, 0) -$$
$$\{\frac{1}{GM}\ell\frac{\partial r}{\partial t}\}(-\sin\varphi, \cos\varphi, 0) \qquad (3.1.7)$$
Since $\ell$ is time-invariant, when $\frac{1}{GMr}\ell^2-1=0$, the radial distance r will also be time-invariant, i.e. $\frac{\partial r}{\partial t}=0$. Therefore, when the Eccentricity Vector $\mathbf{e}$ is a null vector, the orbit is circular with the radius r=R, where,
$$R=\frac{1}{GM}\ell^2 \qquad (3.1.8)$$
Both $\ell$ and r are time-invariant for a circular orbit. As a result, since $\frac{\partial\varphi}{\partial t}= \ell/r^2$, $\frac{\partial\varphi}{\partial t}$ is a constant or time-invariant. Therefore, the angular velocity is a constant for a circular orbit.

When $\mathbf{e}=\mathbf{0}$, we have r=R and hence from eqn. (3.1.7), we also have,
$$\frac{1}{GM}R^3[\frac{\partial\varphi}{\partial t}]^2 -1=0,$$
$$\frac{\partial R}{\partial t}=0.$$
For circular orbits, we have, $\frac{\partial\varphi}{\partial t}=[GM/R^3]^{1/2}$, a constant. Integrating over complete orbit period, we get,
$$\int_0^{2\pi} d\varphi=[GM/R^3]^{1/2}\int_0^T dt$$
$$T=[2\pi/(GM)^{1/2}] R^{3/2}$$
The orbiting period T is proportional to $R^{3/2}$, where R is the radius of the circular orbit, one of the Kepler's laws. Here, we considered the orbit period for $\mathbf{e}=\mathbf{0}$. The derivation of orbiting period for elliptical orbit for

**e≠0** will be considered later. As we will see, the same relationship holds for elliptical orbits.

**Corollary:**
The orbiting period T for a circular orbit of radius R is given by, $T=[2\pi/(GM)^{1/2}] R^{3/2}$.

**Properties of Gravitational Orbits:**
1. When the Eccentricity Vector **e** is a null vector, the radius R of a circular orbit of a planet satisfy the relationship, $R=\frac{1}{GM}\ell^2$, where, $\ell$ is the Rotation Vector. If V is the speed of the planet on the circular orbit, $\ell=RV$ and hence, $R=GM/V^2$.
2. For an elliptical orbit, $r^2\frac{\partial\varphi}{\partial t}$ is time-invariant $\forall$ t. Since $r^2\frac{\partial\varphi}{\partial t}$ is time-invariant for elliptical orbits, as the radial distance becomes time invariant, $\frac{\partial\varphi}{\partial t}$ becomes time-invariant. When radial distance is time-invariant, orbit is circular and hence for circular orbits $\frac{\partial\varphi}{\partial t}$ is time-invariant.
3. For a circular orbit, the angular velocity $\frac{\partial\varphi}{\partial t}$ is time-invariant or a constant $\forall t$.

> The orbiting period T of a circular orbit of radius R is given by,
> $T=[2\pi/(GM)^{1/2}] R^{3/2}$

*B.* **Eccentricity Vector Time-Invariance**
An important characteristic of the Eccentricity Vector **e** is its time-invariance. The Eccentricity Vector **e** remains constant over time. The Eccentricity Vector is conserved if the orbit center mass M is time-invariant.

**Lemma:** Eccentricity Time-Invariance
The Eccentricity Vector **e** is time-invariant if the mass M of the orbiting center or the mass of the sun in our solar system is time-invariant.

**Proof:** The Eccentricity Vector **e** is given by,
$$e= -\frac{1}{GM}\ell\times v -\nabla r, \text{ where } \ell=r\times v.$$
Differentiating with respect to time, we get,
$$\frac{\partial e}{\partial t}=[-\frac{1}{GM}(\frac{\partial\ell}{\partial t}\times v+\ell\times\frac{\partial v}{\partial t}) - \frac{\partial}{\partial t}(\nabla r)] + [\frac{1}{M}\frac{\partial M}{\partial t}\frac{1}{GM}\ell\times v] \quad (3.2.1)$$
Since $\ell$ is time-invariant, $\frac{\partial\ell}{\partial t}=0$. In addition,
$$\frac{\partial}{\partial t}(\nabla r)= -[(1/r^3)(r\bullet v)r-\frac{1}{r}v], \text{ and } \frac{\partial}{\partial t}v= -(GM/r^3)r.$$
We now have,
$$\frac{\partial e}{\partial t}=[(1/r^3)\ell\times r + (1/r^3)(r\bullet v)r-\frac{1}{r}v] + [\frac{1}{M}\frac{\partial M}{\partial t}\frac{1}{GM}\ell\times v] \quad (3.2.2)$$
Since $\ell=r\times v$, we have,
$$\ell\times r=( r\times v)\times r$$
$$\ell\times r=(r\bullet r)v-(v\bullet r)r \quad (3.2.3)$$
This gives us,
$$[(1/r^3)\ell\times r + (1/r^3)(r\bullet v)r- \frac{1}{r}v]=0 \quad (3.2.4)$$
Substituting in equation (3.2.2), we get,
$$\frac{\partial e}{\partial t}=\frac{1}{M}\frac{\partial M}{\partial t}\frac{1}{GM}\ell\times v \quad (3.2.5)$$

We see that, $\frac{\partial e}{\partial t}=0$, if $\frac{\partial M}{\partial t}=0$.
The Eccentricity Vector **e** is time-invariant, $\frac{\partial e}{\partial t}=0$, irrespective of the mass of the orbiting object, m.

The Eccentricity Vector **e** of an elliptical orbit of a planet is time-invariant if the mass M of the orbiting center is time-invariant. In our solar system, as long as the mass of the sun M remains constant or time-invariant, the Eccentricity Vector **e** of the elliptical orbit of a planet remains time-invariant. However, the mass of the sun is decreasing with time and hence the M is not time-invariant. As a result, the Eccentricity Vector **e** is not time-invariant in reality.

> $$e= -\frac{1}{GM}\ell\times v - \nabla r$$
> is time-invariant if $\frac{\partial M}{\partial t}=0$

## IV. DERIVATION OF PLANETARY ORBITS FROM THE ECCENTRICITY VECTOR e

The Eccentricity Vector **e** describes the planetary motion. The Eccentricity Vector is an alternative representation of the geometrical elliptical orbit we are familiar with. The Eccentricity Vector **e** defines an elliptical orbit. Since the Eccentricity Vector is synonymous with the elliptical orbit of a planet, we can use the Eccentricity Vector **e** to obtain the elliptical orbit directly. In fact, by using the Eccentricity Vector to obtain the geometrical elliptical orbit we are familiar with, we can see that the vector **e** is indeed the Eccentricity Vector of a planetary orbit; we can see that they are different representation of the same thing. We first consider the circular orbits. Afterwards, we move to the more general elliptical orbits.

*A.* **Circular Orbits**
The Eccentricity Vector **e** for an orbiting system with an orbiting center of mass M is given by,
$$e= -\frac{1}{GM}\ell\times v -\nabla r \quad (4.1.1)$$
Since $\ell=r\times v$, we have,
$$e= -\frac{1}{GM}(r\times v)\times v -\nabla r \quad (4.1.2)$$
$$e= -\frac{1}{GM}[(r\bullet v)v-(v\bullet v)r]-\nabla r \quad (4.1.3)$$
Since $v=|v|$, $v\bullet v=v^2$, and $\nabla r=\frac{1}{r}r$, we have,
$$e= -\frac{1}{GM}[(r\bullet v)v]+[\frac{1}{GM}v^2 - \frac{1}{r}]r \quad (4.1.4)$$
When the orbit is circular, the Eccentricity Vector **e** is a null vector,
$$e=0 \quad (4.1.5)$$
From equation (4.1.4), **e=0**, when
$$r\bullet v=0, \text{ and} \quad (4.1.6)$$
$$\frac{1}{GM}V^2 -\frac{1}{r}=0, \text{ or } GM=rV^2 \quad (4.1.7)$$
where, the speed of the planet, v=V when **e=0**.
When **r•v=0**, the velocity vector **v** is orthogonal to the position vector **r** at any time t. In addition, from equation (4.1.7), when **e=0**, we also have,
$$GM/r^2=V^2/r \quad (4.1.8)$$

Since $r\frac{\partial r}{\partial t}=\mathbf{r}\cdot\mathbf{v}$, we have,

$$\mathbf{e}=\frac{r}{GM}\frac{\partial r}{\partial t}\mathbf{v}+[\frac{1}{GM}v^2-\frac{1}{r}]\mathbf{r} \qquad (4.1.9)$$

We have $\mathbf{e}=\mathbf{0}$, when,

$$\frac{\partial r}{\partial t}=0 \text{ and} \qquad (4.1.10)$$

$$[\frac{1}{GM}V^2-\frac{1}{r}]=0 \qquad (4.1.11)$$

When $\frac{\partial r}{\partial t}=0$, the velocity of the planet is perpendicular to the position vector **r**.

From eqn. (4.1.11), when $\frac{\partial r}{\partial t}=0$,

the speed V is time-invariant or a constant. We have the same result as in equation (4.1.6). For circular orbits, the radius of the orbit is given by, $GM/r^2=V^2/r$, which is a well known circular motion under gravity. We obtained this relationship using the Eccentricity Vector when it is a null vector.

### Lemma

When the Eccentricity Vector **e** of planetary orbit is a null vector, **e=0**, the orbit is circular and the radius of the orbit is given by,

$$|\nabla\Psi(r)|=V^2/r.$$

where, V is the speed of the planet on the circular orbit, and $\Psi(r)$ is the gravitational potential at radial distance r given by,

$$\Psi(r)=-GM/r,$$

where, $\nabla^2\Psi(r)=0$.

### Lemma

When the Eccentricity Vector **e** of planetary orbit is a null vector, **e=0**, the orbit is circular and acceleration **a** is given by,

$$\mathbf{a}=-(V^2/r)\nabla r.$$

The magnitude of the acceleration is $V^2/r$ and the direction of the acceleration is $-\nabla r$.

### Corollary:

For a time-invariant orbit, the Eccentricity Vector **e** is a time-invariant measure of offset between the gravitational force and the centrifugal force. It is a time-invariant measure of offset of a planetary orbit from the circular orbit.

### B. Elliptical Orbits in Polar Form

The derivation of the elliptical planetary orbits using the Runge-Lenz vector **k** has been well established [1],

$$\mathbf{k}=m\boldsymbol{\ell}\times\mathbf{v}+\frac{GMm}{r}\mathbf{r}, \text{ where, } \boldsymbol{\ell}=\mathbf{r}\times\mathbf{v}.$$

Although, the Runge-Lenz vector, which is time-invariant and lies along the major axis of an elliptical orbit of a planet, does provide a mathematically elegant way of deriving planetary orbits [1], the derivation is quite mechanical. Runge-Lenz vector does not provide a quantity that we can physically relate to except that it has the advantage of being time-invariant and lies along the major axis. The derivation is not transparent; it is highly mechanical. We require physically meaningful quantity that provides a transparent insight into the planetary orbits.

When we look at the Runge-Lenz vector, we have no idea if it even has anything to do with an ellipse. In any case, this lack of physical meaning and transparency of the Runge-Lenz vector does not undermine the ingenuity of the people who discovered it. It is indeed a very important discovery. After all, it is a time-invariant vector that lies on the major axis of an elliptical orbit. However, if possible, we prefer to have a vector that we can relate to an ellipse with its physical structure itself. We need a vector that is a direct representation of a planetary orbit instead of a vector that just facilitates the derivation of an elliptical orbit. This is where the Eccentricity Vector **e** comes handy.

Here, we use the eccentricity **e** of an elliptical orbit that we introduced earlier in deriving planetary orbits. We know what eccentricity e of an ellipse is without much of an introduction. The eccentricity e is the measure of the deviation of an ellipse from a circle. There would be no ellipse without eccentricity. Without eccentricity, it would be a circle. Every circle is an ellipse with zero eccentricity. We know what the major axis of an ellipse is. There would be no ellipse without a major axis. Without a major axis, it would be a circle. If we combine the eccentricity and the major axis of an ellipse together, what we have is the Eccentricity Vector **e** of an ellipse.

Let us consider the Eccentricity Vector **e**,

$$\mathbf{e}=-\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v}-\nabla r \qquad (4.2.1)$$

After we have derived the elliptical orbit of a planet, we can see why **e** is called the Eccentricity Vector.

Now, taking the dot product of the Eccentricity Vector **e** with the position vector **r**, we have,

$$\mathbf{e}\cdot\mathbf{r}=-\frac{1}{GM}(\boldsymbol{\ell}\times\mathbf{v})\cdot\mathbf{r}-(\nabla r)\cdot\mathbf{r} \qquad (4.2.2)$$

Since $(\boldsymbol{\ell}\times\mathbf{v})\cdot\mathbf{r}=\boldsymbol{\ell}\cdot(\mathbf{v}\times\mathbf{r})$, we have,

$$\mathbf{e}\cdot\mathbf{r}=-\frac{1}{GM}\boldsymbol{\ell}\cdot(\mathbf{v}\times\mathbf{r})-(\nabla r)\cdot\mathbf{r} \qquad (4.2.3)$$

Further, $\mathbf{r}\times\mathbf{v}=-\mathbf{v}\times\mathbf{r}$, $\boldsymbol{\ell}=\mathbf{r}\times\mathbf{v}$, $\mathbf{r}\cdot\mathbf{r}=r^2$, and hence,

$$\mathbf{e}\cdot\mathbf{r}=\frac{1}{GM}\ell^2-r \qquad (4.2.4)$$

where $\ell=|\boldsymbol{\ell}|$.

If the orbit is circular, the radius of the circular orbit R is given by,

$$R=\frac{1}{GM}\ell^2 \qquad (4.2.5)$$

Substituting in (4.2.4), we get,

$$\mathbf{e}\cdot\mathbf{r}=R-r \qquad (4.2.6)$$

This is an elliptical orbit. When we use the Eccentricity Vector, the derivation of an elliptical orbit is straight forward.

**Lemma:** Elliptical Orbit in Vector Form

If the Eccentricity Vector **e** of a planetary orbit is given by,

$$\mathbf{e}=-\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v}-\nabla r,$$

then, the elliptical orbit in vector form is given by,

$$\mathbf{e}\cdot\mathbf{r}=R-r$$

where, $R=\frac{1}{GM}\ell^2$, **r** is the position vector, and $r=|\mathbf{r}|$.

This is an elliptical orbit in vector notation with one

of the foci as the center. The fact that this elliptical orbit is centered at one of the foci will be clear when we represent it in the Cartesian (x,y) coordinates later.

We can easily represent an ellipse in vector form in somewhat familiar polar form. If the angle between the Eccentricity Vector **e** and the position vector **r** is φ, and e=|**e**|, we have,

$$er \cos φ = R-r \qquad (4.2.7)$$
$$r(1+e \cos φ) = R \qquad (4.2.8)$$

This is an elliptical orbit of eccentricity e with one of the foci as the center. The direction of the Eccentricity Vector **e** is the major axis of the ellipse. When e=0, the orbit is a circular orbit of radius R, where R=$\ell^2$/GM.

**Lemma:** Elliptical Orbit in Polar Coordinates

If the Eccentricity Vector **e** of a planetary orbit is given by,

$$\mathbf{e} = -\frac{1}{GM}\boldsymbol{\ell} \times \mathbf{v} - \nabla r,$$

then, the elliptical orbit in polar coordinates with one of the foci as the center is given by,

$$r(1+e \cos φ) = R$$

where, R=$\frac{1}{GM}\ell^2$, and φ is the angle between the position vector **r** of the planet and the Eccentricity Vector **e**, which is the major axis of the orbit, and r=|**r**|.

| |
|---|
| Elliptical Orbit with a focus as the center<br>**e•r**=R-r,<br>where, R=$\frac{1}{GM}\ell^2$, $\ell$=|$\boldsymbol{\ell}$|, $\boldsymbol{\ell}$=**r**×**v**<br>Major Axis (Eccentricity Vector)<br>$\mathbf{e} = -\frac{1}{GM}\boldsymbol{\ell} \times \mathbf{v} - \nabla r$ |

| |
|---|
| Elliptical Orbit with a focus as the center<br>r(1+e cos φ)=R,<br>where, R=$\frac{1}{GM}\ell^2$<br>Major Axis (Eccentricity Vector) $\mathbf{e} = -\frac{1}{GM}\boldsymbol{\ell} \times \mathbf{v} - \nabla r$ |

*C.* **Elliptical Orbits in** (x,y) **Coordinates**

So far, we have elliptical orbit in polar form related to eccentricity e centered at a focus. However, we are more familiar with an ellipse in Cartesian (x,y) coordinates than in polar coordinates. Therefore, here, we want to convert the ellipse in polar coordinates given in eqn. (4.2.8) into (x,y) coordinates. In this representation we can easily see that the elliptical planetary orbit is centered at a focus.

**Lemma:** Elliptical Orbit in (x,y) Coordinates

If the Eccentricity Vector **e** of a planetary orbit is given by,

$$\mathbf{e} = -\frac{1}{GM}\boldsymbol{\ell} \times \mathbf{v} - \nabla r,$$

then, the elliptical orbit in (x,y) coordinates is given by,

$$[(x+ea)/a]^2 + [y/b]^2 = 1$$

where, a=R/(1- $e^2$), $b^2$=(1- $e^2$)$a^2$ or $b^2$=aR, and R=$\frac{1}{GM}\ell^2$.

**Proof:** We already have the elliptical orbit in polar form,

$$r(1+e \cos φ) = R \qquad (4.3.1)$$
$$r = R- er \cos φ \qquad (4.3.2)$$

Squaring both sides, we get,

$$r^2 = (R- er \cos φ)^2 \qquad (4.3.3)$$

We can write eqn. (4.3.3) as,

$$r^2(\cos^2 φ + \sin^2 φ) = (R- er \cos φ)^2 \qquad (4.3.4)$$

Now, choose the vector **e** as the x-axis and let,

$$x = r \cos φ \qquad (4.3.5)$$
$$y = r \sin φ \qquad (4.3.6)$$

In other words, the direction of the Eccentricity Vector **e** is the major axis of the ellipse. The **x** is the projection of vector **r** on the Eccentricity Vector **e** or the major axis. The **y** is the projection of **r** on the axis perpendicular to the vector **e**, which is also the minor axis of the ellipse.

Substituting equations (4.3.5) and (4.3.6) in eqn. (4.3.4), we have,

$$x^2+y^2 = (R- ex)^2 \qquad (4.3.7)$$
$$x^2-(R-ex)^2 +y^2 = 0.$$
$$(x+ex-R)(x-ex+R)+y^2 = 0.$$
$$[(1+e)x-R)][(1-e)x+R)]+y^2 = 0 \qquad (4.3.8)$$
$$(1-e^2)x^2+2Rex-R^2+y^2 = 0.$$
$$x^2+2[Rex/(1-e^2)]-[R^2/(1-e^2)]+[y^2/(1-e^2)] = 0.$$
$$[x+Re/(1-e^2)]^2-[R^2/(1-e^2)][1+e^2/(1-e^2)]+[y^2/(1-e^2)] = 0.$$
$$[x+Re/(1-e^2)]^2-[R/(1-e^2)]^2+[y^2/(1-e^2)] = 0.$$
$$[x+Re/(1-e^2)]^2+[y^2/(1-e^2)] = [R/(1-e^2)]^2.$$

Let,

$$a = R/(1-e^2) \qquad (4.3.9)$$

Then, we have,

$$[x+ea]^2+[y^2/(1-e^2)] = a^2$$
$$[(x+ea)/a]^2+[y^2/(1-e^2)a^2] = 1$$

Let,

$$b^2 = (1-e^2)a^2 \qquad (4.3.10)$$

Now, we have,

$$[(x+ea)/a]^2+[y/b]^2 = 1 \qquad (4.3.11)$$

This is an ellipse centered at focus 'ea'. The Eccentricity Vector **e** is the major axis. The magnitude of the Eccentricity Vector **e** is the eccentricity e of the ellipse. The length of the semi-major axis, a, and the length of the semi-minor axis, b, are given by,

$$a = R/(1- e^2), \quad b^2 = (1- e^2)a^2, \text{ or } b^2 = aR$$

where, R=$\frac{1}{GM}\ell^2$, e=|**e**|, e≠1, and $\ell$ is the Rotation Vector.

If **e**=**0**, the orbit is circular with speed V, radius R, where, $\ell$=RV and R=GM/$V^2$.

**Theorem:** Planetary Orbit

If the Eccentricity Vector **e** of a planetary orbit is given by,

$$\mathbf{e} = -\frac{1}{GM}\boldsymbol{\ell} \times \mathbf{v} - \nabla r,$$

then, the elliptical orbit is given by,
**e•r**=R-r [in vector form]
r(1+e cos φ)=R [polar coordinates]
$[(x+ea)/a]^2+[y/b]^2$=1 [Cartesian (x,y) coordinates]
where, a=R/(1-$e^2$), $b^2$=(1-$e^2$)$a^2$, or $b^2$=aR,

and R=$\frac{1}{GM}\ell^2$, $\boldsymbol{\ell}$=$\mathbf{r}\times\mathbf{v}$, $\mathbf{v}$=$\frac{\partial \mathbf{r}}{\partial t}$.

**Property:**
If the Eccentricity Vector is give by,
$$\mathbf{e}= -\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} -\nabla r$$
then, the magnitude of the Eccentricity Vector $\mathbf{e}$ is the eccentricity e of an elliptical orbit, e=|$\mathbf{e}$|.

**Property:**
The direction of the Eccentricity Vector $\mathbf{e}$ is the major axis of the elliptical orbit.

---

Elliptical Orbit in (x,y) plane with a focus as center
$[(x+ea)/a]^2+[y/b]^2=1$
$a=R/(1-e^2)$, $R=\frac{1}{GM}\ell^2$, $b^2=(1-e^2)a^2$, or $b^2=aR$, $e\neq1$
Major axis (Eccentricity Vector),
$$\mathbf{e}= -\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} -\nabla r$$

---

### D. The Orbiting Period

The orbiting period of a planet is independent of the mass of the planet, m, if m is time-invariant. However, the orbiting period, T of a planet depends on the mass M of the orbiting center, irrespective of whether M is time-invariant or not. The orbiting period under time-invariant planetary mass, m, has been well known since the time of Newton [1].

**Lemma:** Orbiting Period

If the mass m of a planet is time-invariant, and the mass M of the orbiting center is time-invariant, then, the orbiting period T is time-invariant and given by,
$$T=[2\pi/(GM)^{1/2}] a^{3/2}$$
where, a is the semi-major axis of the elliptical orbit, $a=R/(1-e^2)$, $R=\ell^2/GM$, e is the eccentricity, $\ell$ is the rotation vector, or the angular momentum per unit mass, that is time-invariant if the mass m of the planet is time-invariant, M is the mass of the orbiting center, and G is the gravitational parameter.

**Proof:** If the orbiting planet is at radial distance r(t) with an angle φ(t) with the major-axis or the Eccentricity Vector $\mathbf{e}$ at any time t, then, the rotation vector or the angular momentum per unit mass, $\ell$(t) is given in eqn. (3.1.4),
$$\ell(t)=r^2(t)\frac{d\varphi(t)}{dt} \tag{4.4.1}$$
The area A of the ellipse is given by,
$$A=\frac{1}{2}\int_0^{2\pi} r^2(t)d\varphi \tag{4.4.2}$$
Substituting for $r^2$(t)dφ(t) from eqn. (4.4.1), we have,
$$A=\frac{1}{2}\int_0^T \ell(t)dt$$
If $\ell$(t) is time-invariant, $\ell$(t)=$\ell$,
$$A=\frac{1}{2}\ell T \tag{4.4.3}$$
If a and b are the semi-major and semi-minor axis respectively, the area of the ellipse A is given by,
$$A=\pi ab, \tag{4.4.4}$$

where, $a=R/(1-e^2)$, $b^2=(1-e^2)a^2$ or $b^2=aR$ and $R=\frac{1}{GM}\ell^2$ with $\ell$ being the Rotation Vector and M being the mass of the orbiting center or the mass of the sun in our solar system.
We now have,
$$A^2=\pi^2a^2[a\ell^2/GM] \tag{4.4.5}$$
$A^2=[\pi^2\ell^2/GM]a^3$ or,
$$A=[\pi\ell/(GM)^{1/2}]a^{3/2} \tag{4.4.6}$$
Substituting for A in eqn. (4.4.3), we have,
$$T=[2\pi/(GM)^{1/2}]a^{3/2} \tag{4.4.7}$$

**Corollary:** Relationship of Elliptic Period to Circular Period

If the orbiting period of a circular orbit is $T_c$, then, the orbiting period T of an elliptic orbit with eccentricity e under time-invariant mass is given by,
$$T=T_c/(1-e^2)^{3/2}, \text{ where } e\neq1.$$
Higher the eccentricity, higher is the orbiting period.

**Proof:** For an elliptical orbit, we have the elliptical period T,
$$T=\pi ab/(\ell/2) \tag{4.4.8}$$
Since $a=R/(1-e^2)$, and $b^2=Ra$, where $R=\ell^2/GM$, we have,
$$T=[\pi/(\ell/2)]a(Ra)^{1/2} \tag{4.4.9}$$
$$T=[\pi/(\ell/2)]a^2(1-e^2)^{1/2} \tag{4.4.10}$$
$$T=[\pi R^2/(\ell/2)]/[(1-e^2)^{3/2}] \tag{4.4.11}$$
When e=0, T=$T_c$, and hence, $T_c$=$\pi R^2/(\ell/2)$.
We now have,
$$T=T_c/(1-e^2)^{3/2} \tag{4.4.12}$$

---

Orbiting period T of an elliptical orbit
$$T=[2\pi/(GM)^{1/2}]a^{3/2}$$
where, 'a' is the length of the semi-major axis

---

The orbiting period T of an elliptical orbit is related to orbiting period of circular orbit $T_c$ by,
$$T=T_c/(1-e^2)^{3/2}$$

---

## V. PLANETARY ORBITS UNDER TIME-VARYING PLANETARY MASS m(t)

Now we want to find out what it takes for the Eccentricity Vector $\mathbf{e}$ to be mass-invariant. How does a planet maintain a mass-invariant Eccentricity Vector $\mathbf{e}$? What happens to the radial distance if the mass of a planet undergoes a change?

### A. Time-Varying Planetary Mass m(t)

The Eccentricity Vector $\mathbf{e}$ is given by,
$$\mathbf{e}= -\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} -\nabla r \tag{5.1.1}$$
Differentiating the Eccentricity Vector $\mathbf{e}$ with respect to mass m, we have,
$$\frac{\partial \mathbf{e}}{\partial m}= -\frac{1}{GM}(\frac{\partial \boldsymbol{\ell}}{\partial m}\times\mathbf{v}+\boldsymbol{\ell}\times\frac{\partial \mathbf{v}}{\partial m}) - \frac{\partial}{\partial m}(\nabla r) \tag{5.1.2}$$
Here, we are going to only consider the effect of the change of mass of a planet. Hence, we assume that the mass of the orbiting center M is time-invariant. The effect of the changing mass M of the orbiting

center is considered later.

When, M is time-invariant, we have,

$$\frac{\partial \mathbf{e}}{\partial m}= -\frac{1}{GM}(\frac{\partial \boldsymbol{\ell}}{\partial m}\times \mathbf{v}+\boldsymbol{\ell}\times \frac{\partial \mathbf{v}}{\partial m}) - \frac{\partial}{\partial m}(\nabla r) \qquad (5.1.3)$$

Since $\boldsymbol{\ell}=\mathbf{r}\times\mathbf{v}$, we have,

$$\frac{\partial}{\partial m}\boldsymbol{\ell}=\frac{\partial \mathbf{r}}{\partial m}\times \mathbf{v}+\mathbf{r}\times \frac{\partial \mathbf{v}}{\partial m} \qquad (5.1.4)$$

Substituting for $\frac{\partial}{\partial m}\boldsymbol{\ell}$ in eqn. (5.1.3), we have,

$$\frac{\partial \mathbf{e}}{\partial m}=-\frac{1}{GM}[(\frac{\partial \mathbf{r}}{\partial m}\times \mathbf{v}+\mathbf{r}\times \frac{\partial \mathbf{v}}{\partial m})\times \mathbf{v}+\boldsymbol{\ell}\times \frac{\partial \mathbf{v}}{\partial m})] - \frac{\partial}{\partial m}(\nabla r) \quad (5.1.5)$$

The vectors **r** and **v** can be written as,

$$\mathbf{r}=r\hat{\mathbf{r}} \text{ and } \mathbf{v}=v\tilde{\mathbf{v}} \qquad (5.1.6)$$

where, r=|**r**|, v=|**v**|, $\hat{\mathbf{r}}$ is the unit directional vector, and $\tilde{\mathbf{v}}$ is the unit velocity vector.

We also know that the unit direction vector $\hat{\mathbf{r}}$ and the unit velocity vector $\tilde{\mathbf{v}}$ are mass-invariant,

$$\frac{\partial \tilde{\mathbf{v}}}{\partial m}=\mathbf{0}, \text{ and } \frac{\partial \hat{\mathbf{r}}}{\partial m}=\mathbf{0}. \qquad (5.1.7)$$

Further, since, $\frac{\partial \hat{\mathbf{r}}}{\partial m}=\mathbf{0}$, we have,

$$\frac{\partial}{\partial m}(\nabla r)=\mathbf{0}. \qquad (5.1.8)$$

Hence, eqn. (5.1.5) becomes,

$$\frac{\partial \mathbf{e}}{\partial m}= -\frac{1}{GM}[v(v\frac{\partial r}{\partial m}+r\frac{\partial v}{\partial m})+rv\frac{\partial v}{\partial m}](\hat{\mathbf{r}}\times \tilde{\mathbf{v}})\times \tilde{\mathbf{v}} \qquad (5.1.9)$$

$$\frac{\partial \mathbf{e}}{\partial m}= -\frac{1}{GM}[v^2\frac{\partial r}{\partial m}+2vr\frac{\partial v}{\partial m}](\hat{\mathbf{r}}\times \tilde{\mathbf{v}})\times \tilde{\mathbf{v}} \qquad (5.1.10)$$

Since the instantaneous linear momentum is mass-invariant,

$$\frac{\partial}{\partial m}(m\mathbf{v}) =\mathbf{0}, \text{ or } \mathbf{v}+m\frac{\partial \mathbf{v}}{\partial m}=\mathbf{0},$$

$$m\frac{\partial v}{\partial m}\tilde{\mathbf{v}}=-v\tilde{\mathbf{v}} \qquad (5.1.11)$$

$$\frac{\partial v}{\partial m}= -\frac{v}{m} \qquad (5.1.12)$$

Substituting for $\frac{\partial v}{\partial m}$ in eqn. (5.1.10), we get,

$$\frac{\partial \mathbf{e}}{\partial m}= -\frac{1}{GM}v^2[\frac{\partial r}{\partial m}-2\frac{r}{m}](\hat{\mathbf{r}}\times \tilde{\mathbf{v}})\times \tilde{\mathbf{v}} \qquad (5.1.13)$$

When the Eccentricity Vector is independent of the mass of the orbiting object, $\frac{\partial \mathbf{e}}{\partial m}=\mathbf{0}$, and hence, we have,

$$\frac{\partial r}{\partial m}=2\frac{r}{m} \text{ or } \partial r=2[\frac{1}{m}\partial m]r \qquad (5.1.14)$$

If the mass change of $\partial m$ has taken place at time interval $\partial t$, then, as $\partial t \rightarrow 0$, we have,

$$\frac{dr}{dt}=(2\frac{1}{m}\frac{dm}{dt})r \qquad (5.1.15)$$

$$\frac{dr}{dt}=Hr \qquad (5.1.16)$$

$$\text{where, } H=2\frac{d}{dt}\ln(m) \qquad (5.1.17)$$

The mass-invariance of Eccentricity Vector **e** of an elliptical orbit is achieved by changing the orbital distance adaptively against the changing mass of the planet. The change of radial distance due to the change of mass of a planet is also proportional to the radial distance of the planet. The further is a planet away, the higher is the radial distance change against any change of the mass of a planet. Any increase in the mass of a planet results in orbit dilation. The decrease in the mass of a planet leads to obit contraction. The orbit dilation and orbit contraction is the result of mass-invariance of the Eccentricity Vector **e** of the elliptical orbit. It is the orbit dilation and orbit contraction that maintains the mass-invariance of the Eccentricity Vector **e** of an elliptical orbit. The orbit dilation and contraction maintains the stability of the

elliptical path of a planet against the mass variations of the planet. The time-invariance and the mass-invariance of Eccentricity Vector or the elliptical path of an orbiting planet are natural phenomena that keep planets orbiting perpetually irrespective of planetary mass variations; it is only the radial distance of a planet that varies with time against any change in the mass of the planet.

**Lemma:**

The Eccentricity Vector **e** of a planetary orbit remains mass-invariant by the adaptive adjustment of the radial distance r against the change of mass m of the planet,

$$\frac{dr}{dt}=Hr, \text{ where, } H=2\frac{d}{dt}[\ln m].$$

**Corollary:**

The Eccentricity Vector **e** defines a planetary orbit. The mass-invariance and the time-invariance of the Eccentricity Vector maintain the stability of a planetary orbit through orbit dilation and contraction against the changes of the mass of a planet. The increase in the mass of a planet results in orbit dilation while the decrease in the mass of a planet leads to orbit contraction.

**Corollary:**

Even when the relative change of mass of a planet, $\Delta m/m$ is negligible, $(\Delta m/m)r$ may not be negligible making radial distance of an orbit to be time-varying or not fixed.

> Change of radial distance r with the change of mass m,
> $$\frac{dr}{dt}=Hr, \text{ where, } H=2\frac{d}{dt}\ln(m)$$
> keeps the Eccentricity Vector **e** mass-invariant.

> The Eccentricity Vector remains mass-invariant through orbit Dilation and Contraction.

*B.* **The Effect of Changing Mass** m(t) **on Orbit**

We first consider the case where the planetary mass m is changing while the mass M of the orbiting center or the sun in our solar system remains time-invariant. We have already seen what happen to the Eccentricity Vector as a result of the changing mass of a planet. Although the Eccentricity Vector and the planetary orbit are synonymous, we want to find out specifically, what happens to the planetary orbit when the mass of a planet changes from m to m+$\Delta$m at any time t. There are many causes for the fluctuation of mass of a planet, specifically the earth, which we will consider later.

We already obtained the planetary orbit using the Eccentricity Vector **e**. The planetary orbit for eccentricity e is given by,

$$r(1+e \cos \varphi)=R \qquad (5.2.1)$$

where R=$\ell^2$/GM

$$r(1+e \cos \varphi)= \ell^2/GM \qquad (5.2.2)$$

When mass changes from m to m+$\Delta$m, at time t, the angular momentum $\ell$ changes from $\ell$ to $\ell_{new}$, and the radial distance r to $r_{new}$ at time t. Now, the elliptical orbit at time t is given by,

$$r_{new}(1+e_{new} \cos \varphi)= \ell_{new}^2/GM \qquad (5.2.3)$$

Since the Eccentricity Vector is independent of the mass of the object, $e_{new}=e$. Now, dividing eqn. (5.2.3) by eqn. (5.2.2), we get,

$$r_{new}/r=( \ell_{new}/\ell)^2 \qquad (5.2.4)$$

The Rotation Vector $\ell$ at any time t is given by,

$$\boldsymbol{\ell}=\mathbf{r}\times\mathbf{v} \qquad (5.2.5)$$

Now, if the mass of the planet m at time t changes from m to m+$\Delta$m, then, the instantaneous velocity $\mathbf{v}$ changes from $\mathbf{v}$ to $\mathbf{v}_{new}$. Since the instantaneous momentum is mass-invariant,

$$m\mathbf{v}=(m+\Delta m)\mathbf{v}_{new} \qquad (5.2.6)$$

$$\mathbf{v}_{new}=(1-\tfrac{\Delta m}{m})\mathbf{v}, \text{ where, } \Delta m<<m. \qquad (5.2.7)$$

Now, the new normalized angular momentum $\boldsymbol{\ell}_{new}$ at time t is given by,

$$\boldsymbol{\ell}_{new}=(1-\tfrac{\Delta m}{m})\mathbf{r}_{new}\times\mathbf{v} \qquad (5.2.8)$$

Let $\mathbf{r}=r\hat{\mathbf{r}}$, and $\mathbf{v}=v\tilde{\mathbf{v}}$, where, r is the radial distance, $\hat{\mathbf{r}}$ is the unit position vector, v is the speed of the planet, and $\tilde{\mathbf{v}}$ is the unit velocity vector. Now, $\boldsymbol{\ell}$ and $\boldsymbol{\ell}_{new}$ can be written as,

$$\boldsymbol{\ell}=rv\hat{\mathbf{r}}\times\tilde{\mathbf{v}} \qquad (5.2.9)$$

$$\boldsymbol{\ell}_{new}=(1-\tfrac{\Delta m}{m})r_{new}v\hat{\mathbf{r}}\times\tilde{\mathbf{v}} \qquad (5.2.10)$$

Note that the change of m to m+$\Delta$m at time t has no effect on the direction **r**. Let $\ell=|\boldsymbol{\ell}|$ and $\ell_{new}=|\boldsymbol{\ell}_{new}|$. The direction of $\boldsymbol{\ell}_{new}$ is the same as the direction of $\boldsymbol{\ell}$. Now, dividing equation (5.2.10) by equation (5.2.9), we get,

$$\ell_{new}/\ell=(1-\tfrac{\Delta m}{m})(r_{new}/r) \qquad (5.2.11)$$

Substituting for $\ell_{new}/\ell$ in eqn. (5.2.4), we get,

$$r_{new}/r=[(1-\tfrac{\Delta m}{m})(r_{new}/r)]^2 \qquad (5.2.12)$$

$$r=[1-\tfrac{\Delta m}{m}]^2 r_{new} \qquad (5.2.13)$$

Since $\Delta$m<<m, we have,

$$r_{new}=[1+2\tfrac{\Delta m}{m}]r \qquad (5.2.14)$$

Substituting $r_{new}=r+\Delta r$, we have,

$$\tfrac{\Delta r}{r}=2\tfrac{\Delta m}{m} \qquad (5.2.15)$$

If the change of $\Delta$m has taken place at time t within a time interval $\Delta$t, as $\Delta t\rightarrow 0$, we have,

$$\tfrac{dr}{dt}=2[\tfrac{1}{m}\tfrac{dm}{dt}]r \qquad (5.2.16)$$

$$\tfrac{dr}{dt}=Hr, \text{ where, } H=2\tfrac{d}{dt}[\ln m]. \qquad (5.2.17)$$

We can see that the effect of mass change on the elliptical orbit is the same as the effect of mass change on the Eccentricity Vector **e**. This also indicates that the Eccentricity Vector and the elliptical orbit are synonymous.

**Lemma:**

A planetary orbit remains mass-invariant by the adaptive adjustment of the radial distance r against the change of mass m of the planet,

$$\tfrac{dr}{dt}=Hr, \text{ where, } H=2\tfrac{d}{dt}[\ln m].$$

It is this mass-invariance of a planetary orbit that keeps planets orbiting on elliptically closed paths again and again irrespective of the change of the mass of planets at any time, all the time.

Contrary to the widely held belief, a gravitational pull from other planets cannot break up an elliptical orbit at the perihelion. A gravitational pull from other planets cannot open up a closed elliptical orbit. An elliptical orbit of a planetary orbit is always closed. The radial distance adjustment against the change of mass keeps a planet on a closed orbit against the any mass fluctuation of a planet. Mass-invariance of the Eccentricity Vector prevents the collapse of an orbiting system against the mass perturbations.

> Mass-invariance of Eccentricity Vector maintains planetary stability under perturbations.

**Corollary:**

The Eccentricity Vector of a planetary orbit remains mass-invariant while the radial distance of the orbit is mass-varying. Orbit of a planet is dynamic while the Eccentricity Vector remains fixed.

## VI. ORBITS UNDER TIME-VARYING ORBIT CENTER MASS M(t)

In the case of planetary motion, or the motion of any object in general, the motion dynamics [7] are independent of the mass of the planet or the mass of the moving object provided that the masses of the planets in the planetary system are negligible compared to the orbit center mass M. Therefore, we could analyze the effects due to the changes of the mass of a planet in an instant by instant basis. We could separate the orbit dynamics from whatever the changes associated with the change of the mass. We cannot use the same approach if the mass of the orbiting center or the mass of the sun in our solar system varies since the orbit dynamics are dependent upon the mass M of the orbiting center,

$$\tfrac{d}{dt}\tfrac{d}{dt}\mathbf{r}+(GM/r^3)\mathbf{r}=\mathbf{0} \qquad (6.1)$$

It is clear that the planetary dynamics are independent of the mass of the orbiting planet, but dependent upon the mass M of the orbiting center. If the central mass M changes from M to M+$\Delta$M, the motion dynamics are affected by it. Now, we want to find out the effect of changing mass M on an orbit. We first consider the circular orbits and then move to elliptical orbits.

## A. Circular Orbits under Time-Varying M(t)

Since the eccentricity is an alternative way of representing a planetary orbit, we use the Eccentricity Vector **e** to analyze the effect of time-varying M(t) on a circular orbit. The Eccentricity Vector is given by,

$$\mathbf{e}= -\tfrac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} -\nabla r \qquad (6.1.1)$$

Now, taking the dot product of the Eccentricity Vector **e** with the position vector **r**, we have,

$$\mathbf{e}\cdot\mathbf{r}= -\frac{1}{GM}(\boldsymbol{\ell}\times\mathbf{v})\cdot\mathbf{r} - (\nabla r)\cdot\mathbf{r} \quad (6.1.2)$$

Since $\boldsymbol{\ell}=(\mathbf{r}\times\mathbf{v})$, we have,

$$\mathbf{e}\cdot\mathbf{r}= -\frac{1}{GM}[(\mathbf{r}\times\mathbf{v})\times\mathbf{v}]\cdot\mathbf{r}-(\nabla r)\cdot\mathbf{r} \quad (6.1.3)$$

$$\mathbf{e}\cdot\mathbf{r}= -\frac{1}{GM}[(\mathbf{r}\cdot\mathbf{v})\mathbf{v}-(\mathbf{v}\cdot\mathbf{v})\mathbf{r}]\cdot\mathbf{r}-(\nabla r)\cdot\mathbf{r} \quad (6.1.4)$$

$$\mathbf{e}\cdot\mathbf{r}= -\frac{1}{GM}(\mathbf{r}\cdot\mathbf{v})^2+[\frac{1}{GM}rv^2-1)r \quad (6.1.5)$$

Since we are considering a circular orbit here, the Eccentricity Vector is a null vector, $\mathbf{e}=\mathbf{0}$. Since $\mathbf{r}\neq\mathbf{0}$, the Eccentricity Vector is a null vector when,

$$\mathbf{r}\cdot\mathbf{v}=\mathbf{0} \text{ and} \quad (6.1.6)$$

$$\frac{1}{GM}rV^2-1=0 \quad (6.1.7)$$

where, $v=|\mathbf{v}|$, the speed of a planet on a circular orbit, $v=V$ when $\mathbf{r}\cdot\mathbf{v}=\mathbf{0}$.

The condition $\mathbf{r}\cdot\mathbf{v}=\mathbf{0}$ indicates that the planetary orbit is circular. When an orbit is circular, we also have from the second condition given in equation (6.1.7),

$$GM/r^2=V^2/r \quad (6.1.8)$$

Since the instantaneous momentum at any instant of time t is mass-invariant,

$$\frac{d}{dm}(m\mathbf{v})=\mathbf{0}, \; m\frac{d}{dm}(\mathbf{v})+\mathbf{v}=\mathbf{0} \quad (6.1.9)$$

$$\frac{d}{dm}(\mathbf{v})= -\frac{1}{m}\mathbf{v} \quad (6.1.10)$$

At any instant of time t, we also have the orbit dynamics for a circular orbit given in equation (6.1.8),

$$GM =rV^2 \quad (6.1.11)$$

Although G is considered to be a constant, let us allow the parameter G the ability to face change. Planetary orbits should have the ability to adapt not only to the changes of the planetary mass, but also against any parameter change, including any changes in the gravitational parameter G. Any change in G should not make the orbiting system to collapse. Orbiting system should adapt to the changes in any orbiting parameter in order to maintain the orbit stability.

Differentiating equation (6.1.11), with respect to M, we have,

$$G+M\frac{\partial G}{\partial M} =2rV\frac{\partial V}{\partial M}+V^2\frac{\partial r}{\partial M} \quad (6.1.12)$$

From equation (6.1.10), we have,

$$\frac{\partial V}{\partial m}= -\frac{V}{m} \quad (6.1.13)$$

$$\partial V= -[\frac{1}{m}\partial m]V \text{ or } \frac{\partial V}{\partial M}= -\frac{V}{m}\frac{\partial m}{\partial M}$$

Substituting in equation (6.1.12), we get,

$$G+M\frac{\partial G}{\partial M} = -2rV^2\frac{1}{m}\frac{\partial m}{\partial M}+V^2\frac{\partial r}{\partial M} \quad (6.1.14)$$

Substituting for $V^2$ from equation (6.1.11), we have,

$$G+M\frac{\partial G}{\partial M} = -2\frac{GM}{m}\frac{\partial m}{\partial M}+\frac{GM}{r}\frac{\partial r}{\partial M} \quad (6.1.15)$$

Dividing by GM, we get,

$$\frac{\partial M}{M}+\frac{\partial G}{G}= -2\frac{\partial m}{m}+\frac{\partial r}{r} \quad (6.1.16)$$

$$\frac{\partial r}{r}=2\frac{\partial m}{m}+\frac{\partial M}{M}+\frac{\partial G}{G} \quad (6.1.17)$$

$$\frac{1}{r}\partial r=2\frac{1}{m}\partial m+\frac{1}{M}\partial M+\frac{1}{G}\partial G \quad (6.1.18)$$

If the change of parameters has taken place at time t within an interval $\partial t$, as $\partial t\rightarrow0$, we have,

$$\frac{dr}{dt}=Hr \quad (6.1.19)$$

$$H=2\frac{d}{dt}(\ln m)+\frac{d}{dt}(\ln M) +\frac{d}{dt}(\ln G) \quad (6.1.20)$$

The overall effect of changes of the orbit parameters m, M, and G is the change of orbit distance to the planet. The change of orbit distance is proportional to the orbit distance itself. The greater is the distance to a planet, higher is the change of orbit distance due to the changes in the orbit parameters such as the mass of the planet, the mass of the orbit center or the mass of sun in our solar system and the gravitational parameter. Any change, whether small or large has an effect on the orbit distance.

If the mass of the orbit center increases, then, the orbit dilates. The increase in the mass of the orbiting planet, galaxy, or super galaxy also leads to orbit dilation. The reduction in the mass of the orbit center or mass of the sun in our solar system results in orbit contraction. The reduction of the mass of a planet, galaxy, and super-galaxy also result in orbit contraction. When we see that the Andromeda galaxy is moving towards us, it is a result of mass loss of the galaxy. When we see that some of the galaxies are moving away from us, it is a result of increase in mass of these galaxies.

However, the red-shift of the light frequency spectrum from a galaxy does not indicate a radial movement of a galaxy. The red-shift of the light frequency spectrum from distant stars is due to the propagation electromagnetic energy loss. It is the increasing or decreasing red-shift of the light spectrum from distant stars that is related to the radial movement of galaxies due to mass changes. We will delve into this later.

> Red-shift of light from distance galaxies is due to the propagation electromagnetic energy loss. Increasing or decreasing red-shift of light from distance galaxies is a result of the radial distance change of the galaxies due to galactic mass variations.

**Theorem:** Global Warming
The decrease in the mass of the earth and the decrease in the mass of the sun lead to the contraction of the earth's orbit resulting in Global Warming.

**Corollary:** Minimizing Global Warming
The Global Warming can be minimized by minimizing the activities that result in the mass loss, and by enhancing the activities that increase the mass.

## *B*. **Elliptical Orbits under Changing Mass** M(t)

We have already derived the elliptical orbit of a planet for time-invariant m, M, and G,

$$r(1+e \cos \varphi)=\frac{1}{GM}\ell^2 \quad (6.2.1)$$

where $\ell=|\boldsymbol{\ell}|$, $\boldsymbol{\ell}=\mathbf{r}\times\mathbf{v}$.

If m, M and G changes to $m+\Delta m$, $M+\Delta M$, and $G+\Delta G$ respectively when the planet is at an angle $\varphi$, then, we have the orbit,

$$r_{new}(1+e_{new} \cos \varphi)= \frac{1}{(G+\Delta G)(M+\Delta M)}(\ell+\Delta \ell)^2 \quad (6.2.2)$$

where, $r_{new}=r+\Delta r$
Although the Eccentricity Vector is independent of the

mass of a planet m, it is dependent on the mass of the orbiting center, or the sun, M in our solar system. However, as we see later, the change of the eccentricity due to the change of the mass of the orbiting center is negligible. As a result $e_{new} \cong e$ and hence,

$$r_{new}(1+e \cos \varphi)= \frac{1}{(G+\Delta G)(M+\Delta M)}(\ell+\Delta \ell)^2 \quad (6.2.3)$$

Since the instantaneous linear momentum is mass invariant at any time t,

$$m\mathbf{v}=(m+\Delta m)\mathbf{v}_{new} \quad (6.2.4)$$

$$\mathbf{v}_{new}=\frac{m}{(m+\Delta m)}\mathbf{v} \quad (6.2.5)$$

Since the change of mass affect only the radial distance, not the direction, at any time t, we have,

$$\mathbf{r}_{new}=\frac{1}{r}r_{new}\mathbf{r} \quad (6.2.6)$$

Now, we have,

$$\boldsymbol{\ell}_{new}=\mathbf{r}_{new}\times \mathbf{v}_{new} \quad (6.2.7)$$

$$\boldsymbol{\ell}_{new}=\frac{1}{r}r_{new}\mathbf{r}\times \frac{m}{(m+\Delta m)}\mathbf{v} \quad (6.2.8)$$

$$\boldsymbol{\ell}_{new}=\frac{1}{r}r_{new}\frac{m}{(m+\Delta m)}\boldsymbol{\ell} \quad (6.2.9)$$

Since, $\ell_{new}= \ell+\Delta \ell$, substituting in equation (6.2.3), we get the resulting orbit at time t due to the changes of the parameters given by,

$$r_{new}(1+e \cos \varphi)= \frac{1}{(G+\Delta G)(M+\Delta M)} [\frac{1}{r}r_{new}\frac{m}{(m+\Delta m)}\ell]^2 \quad (6.2.10)$$

When $\Delta m=0$, $\Delta M=0$, and $\Delta G=0$, $r_{new}=r$, and hence, we have,

$$r(1+e \cos \varphi)=\frac{1}{GM}\ell^2 \quad (6.2.11)$$

Dividing equation (6.2.10) by equation (6.2.11) and substituting $r_{new}=r+\Delta r$, we get,

$$\frac{r+\Delta r}{r}= \frac{G}{(G+\Delta G)}\frac{M}{(M+\Delta M)}[\frac{m}{(m+\Delta m)}]^2[\frac{r+\Delta r}{r}]^2 \quad (6.2.12)$$

$$\frac{r+\Delta r}{r}=[1+\frac{\Delta G}{G}][1+\frac{\Delta M}{M}][1+\frac{\Delta m}{m}]^2 \quad (6.2.13)$$

Since, $\Delta m<<m$, $\Delta G<<G$, and $\Delta M<<M$, we have,

$$\frac{r+\Delta r}{r}=[1+\frac{\Delta G}{G}][1+\frac{\Delta M}{M}][1+2\frac{\Delta m}{m}] \quad (6.2.14)$$

$$\frac{\Delta r}{r}=\frac{\Delta G}{G}+\frac{\Delta M}{M}+2\frac{\Delta m}{m} \quad (6.2.15)$$

$$\Delta r=[\frac{\Delta G}{G}+\frac{\Delta M}{M}+2\frac{\Delta m}{m}]r \quad (6.2.16)$$

If the changes in the parameters of the elliptical path at time t are taken place at time interval $\partial t$, as $\partial t \to 0$, we have,

$$\frac{dr}{dt}=Hr \quad (6.2.17)$$

$$H=2\frac{d}{dt}(\ln m)+\frac{d}{dt}(\ln M)+\frac{d}{dt}(\ln G). \quad (6.2.18)$$

**Theorem:** Orbit Dilation & Contraction

The radial distance to an orbiting planet in an orbiting system varies with the variation of the parameters of the system as given by,

$$\frac{dr}{dt}=Hr$$

where, $H=2\frac{d}{dt}(\ln m)+\frac{d}{dt}(\ln M)+\frac{d}{dt}(\ln G)$,

m=the mass of the orbiting planet, M=the mass of the orbiting center, G=the gravitational parameter, r=radial distance to the planet.

Whether it is a circular orbit or an elliptical orbit, the effect of the change of orbiting parameters would be the same orbit dilation or contraction depending upon whether the parameters increasing or decreasing. It is this ability of an orbiting planet, not a divine power, which makes a planetary orbit stable against orbiting parameter perturbations, allowing a planet to orbit perpetually on an elliptically closed path. No so-called divine intervention is required to keep the planets in orbits in the presence of orbit parameter variations. Devine is simply a human ignorance dump site we have inherited from the flat-earth era blind faith ignorant religious doctrines. Flat-earth or earth-centric era religious doctrines have no place in today's world unless we want to remain ignorant. Orbits are self correcting or adaptive to the parameter changes.

**Corollary:**

Expansion or contraction of space cannot change the relative position of a galaxy or any object in space. It is the gravity and the momentum that determine the relative position of an object or galaxy in space. It is the change of parameters of an orbiting system that determines the change of relative position.

**Corollary:**

Gravitationally bound object cannot be changed by space expansion or contraction. Every object in the universe, irrespective of its size, is gravitationally bound.

**Corollary:**

Space does not expand or contract.

**Property:**

In order for a planet, a galaxy, or a galactic cluster to have an independent existence in space, each must have an independent orbit:

- Any planet must orbit central object of higher mass.
- Any galaxy must orbit a central galaxy of higher mass.
- Any galactic cluster must orbit a central galactic cluster of higher mass.
- Any mass that is not in an independent orbit will be absorbed by a bigger mass under gravity.
- No object in space can remains independent without motion.
- No freedom without motion.

**Corollary:**

Increasing parameters, m, M, and G of an orbit leads to orbit dilation while decreasing parameters of an orbit results in orbit contraction.

> Orbit Dilation and Contraction due to Changing Orbit Parameters at time t is given by
> $$\frac{dr}{dt}=Hr, \text{ where, } H=2\frac{d}{dt}(\ln m)+\frac{d}{dt}(\ln M)+\frac{d}{dt}(\ln G)$$

**Corollary:**

The change of a radial distance of a galaxy cannot be attributed to an expansion of universe since the expansion or contraction of space cannot change the radial distance of a galaxy. Every galaxy is orbiting on its own orbit bounded by a gravitational orbit system. Universe is not expanding. Universe cannot expand or contract.

## *C.* Orbiting Period under Changing Mass

As we have already seen, the changing mass m of an orbiting planet and the changing mass M of the orbiting center result in orbit dilation or contraction. The orbit dilation and contraction affect the orbiting period. Therefore, the changing mass of a planet as well as the changing mass of the orbiting center changes the time it takes for a planet to complete one cycle or orbiting period T.

**Lemma:** Orbiting Period under Changing Parameters

If the mass of a planet m, mass of the orbiting center M, and the gravitational parameter G have changed to $m+\Delta m$, $M+\Delta M$ and $G+\Delta G$ respectively during the orbiting period T, the new orbiting period $T_{new}$ is given by,

$$T_{new}=[1+\frac{\Delta G}{G}+\frac{\Delta M}{M}+3\frac{\Delta m}{m}]T$$

where, $T=[2\pi/(GM)^{1/2}]a^{3/2}$, $a=R/(1-e^2)$, $R=\frac{1}{GM}\ell^2$ with $\ell$ being the Rotation Vector, and 'a' is the length of the semi-major axis.

**Proof:** The proof is straight forward. From equation (4.4.7), we have the orbiting period,

$$T=[2\pi/(GM)^{1/2}]a^{3/2} \qquad (6.3.1)$$

where, a is the length of the semi major axis.

From equation (6.2.14), when m, M and G change to $m+\Delta m$, $M+\Delta M$ and $G+\Delta G$ respectively during the orbiting period T, the semi-major axis changes from a to $a_{new}$, where,

$$a_{new}=[1+\frac{\Delta G}{G}][1+\frac{\Delta M}{M}][1+2\frac{\Delta m}{m}]a. \qquad (6.3.2)$$

As a result of the parameter change during the orbiting period T, the orbiting period T changes from T to $T_{new}$, where,

$$T_{new}=\{2\pi/[GM(1+\frac{\Delta G}{G})(1+\frac{\Delta M}{M})]^{1/2}\}$$
$$\{[1+\frac{\Delta G}{G}][1+\frac{\Delta M}{M}][1+2\frac{\Delta m}{m}]a\}^{3/2} \qquad (6.3.3)$$

$$T_{new}=\{2\pi/[GM]^{1/2}\}[1+\frac{\Delta G}{G}][1+\frac{\Delta M}{M}]\{[1+2\frac{\Delta m}{m}]a\}^{3/2} \qquad (6.3.4)$$

Since $m \gg \Delta m$, $M \gg \Delta M$ and $G \gg \Delta G$, we have,

$$T_{new}=\{2\pi/[GM]^{1/2}\}[1+\frac{\Delta G}{G}][1+\frac{\Delta M}{M}][1+3\frac{\Delta m}{m}]a^{3/2} \qquad (6.3.5)$$

$$T_{new}=\{2\pi/[GM]^{1/2}\}[1+\frac{\Delta G}{G}+\frac{\Delta M}{M}+3\frac{\Delta m}{m}]a^{3/2} \qquad (6.3.6)$$

When the orbiting parameters m, M, and G change to $m+\Delta m$, $M+\Delta M$, and $G+\Delta G$ respectively, the orbiting period T changes to $T_{new}$ that is given by,

$$T_{new}=[1+\frac{\Delta G}{G}+\frac{\Delta M}{M}+3\frac{\Delta m}{m}]T \qquad (6.3.7)$$

where $T=[2\pi/(GM)^{1/2}]a^{3/2}$.

When $\Delta m=0$, $\Delta M=0$, and $\Delta G=0$, we have,

$$T_{new}=T$$
$$T=[2\pi/(GM)^{1/2}]a^{3/2} \qquad (6.3.8)$$

**Lemma:** Orbiting Period after n Periods

If the mass of the planet m, mass of the orbiting center M, and the gravitational parameter G have changed to $m+\Delta m$, $M+\Delta M$ and $G+\Delta G$ respectively during the orbiting period T, the orbiting period after n cycles, $T_n$ is given by,

$$T_n=T_o \exp[(\frac{\Delta G}{G}+\frac{\Delta M}{M}+3\frac{\Delta m}{m})n]$$

where, $T_o=[2\pi/(GM)^{1/2}]a_o^{3/2}$,
and $a_o$ is the semi-major axis when n=0.

**Proof:** If the change of parameters is the same for each orbiting period, then after n orbiting period, the orbiting period $T_n$ is given by,

$$T_n=[2\pi/(GM)^{1/2}][1+\frac{\Delta G}{G}+\frac{\Delta M}{M}+3\frac{\Delta m}{m}]^n(a_o)^{3/2} \qquad (6.3.9)$$

$$T_n=[1+\frac{\Delta G}{G}+\frac{\Delta M}{M}+3\frac{\Delta m}{m}]^n T_o \qquad (6.3.10)$$

where $T_o$ is given by,

$$T_o=[2\pi/(GM)^{1/2}](a_o)^{3/2} \qquad (6.3.11)$$

and $a_o$ is the semi-major axis when n=0.

Although the changing radial distance is not very significant within a single orbiting period, the change of the radial distance become significant with time. It is we who have limited time; in fact, our living span of time is so limited that the changes in the orbiting system due to the change of the orbiting parameters may appear as not significant for us. However, as far as an orbiting system is concerned, the change of radial distance with time due to the change of parameters is exponential. Even a small change becomes significant with time. Unlike for the living, the time has neither a limit nor a meaning for non-living. Time has a meaning only for living species. Time is a definition we have made for our own suiting. As far as other species are concerned, they may have their own definition of time.

We know that,

$$\lim_{k\to\infty}\left(1+\frac{1}{k}\right)^k=e \text{ (Euler's constant), or}$$

$$\lim_{k\to\infty}\left(1+\frac{\Delta x}{xk}\right)^k=\exp[\frac{\Delta x}{x}]. \qquad (6.3.12)$$

The same is true if we consider the continuous mass change instead of the mass change per orbiting period. Assume, we divide an orbiting period T into time interval t, then, as $t\to\infty$ the major axis is given by,

$$a_{new}=a_o \exp[(\frac{\Delta G}{G}+\frac{\Delta M}{M}+2\frac{\Delta m}{m})] \qquad (6.3.13)$$

After n orbiting periods, the semi-major axis, $a_n$ can be written as,

$$a_n=a_o \exp[(\frac{\Delta G}{G}+\frac{\Delta M}{M}+2\frac{\Delta m}{m})n]. \qquad (6.3.14)$$

where $a_o$ is the semi-major axis at n=0.

Now, the orbiting period $T_n$ after n orbits can be written as,

$$T_n=[2\pi/(GM)^{1/2}]\{\exp[(\frac{\Delta G}{G}+\frac{\Delta M}{M}+3\frac{\Delta m}{m})n]\}(a_o)^{3/2} \qquad (6.3.15)$$

We can also write $T_n$ as,

$$T_n=T_o \exp[(\frac{\Delta G}{G}+\frac{\Delta M}{M}+3\frac{\Delta m}{m})n] \qquad (6.3.16)$$

where, $T_o=[2\pi/(GM)^{1/2}](a_o)^{3/2}$.

**Corollary:** Semi-Major Axis after n Periods

The semi-major axis after n periods, $a_n$ is given by,

$$a_n=a_o \exp[(\tfrac{\Delta G}{G}+\tfrac{\Delta M}{M}+2\tfrac{\Delta m}{m})n]$$

where $a_o$ is the semi-major axis when n=0.

If G is time-invariant or constant as it is considered to be, $\Delta G=0$ and hence, we have,

$$T_n=[2\pi/(GM)^{1/2}]\{\exp[(\tfrac{\Delta M}{M}+3\tfrac{\Delta m}{m})n]\}(a_o)^{3/2} \quad (6.3.17)$$

The orbiting period $T_n$ can also be written as,

$$T_n=T_o \exp[(\tfrac{\Delta M}{M}+3\tfrac{\Delta m}{m})n] \quad (6.3.18)$$

where $T_o=[2\pi/(GM)^{1/2}](a_o)^{3/2}$.

Since mass m and M are decreasing with time, the orbiting period T is decreasing with time. In other words, the year is getting shorter with time.

---

The Orbiting Period after n orbits $T_n$
$$T_n=T_o \exp[(\tfrac{\Delta G}{G}+\tfrac{\Delta M}{M}+3\tfrac{\Delta m}{m})n],$$
where, $T_o=[2\pi/(GM)^{1/2}](a_o)^{3/2}$
decreases with the decrease of m and M

---

Semi-Major axis after n orbit periods $a_n$
$$a_n=a_o \exp[(\tfrac{\Delta G}{G}+\tfrac{\Delta M}{M}+2\tfrac{\Delta m}{m})n]$$

---

**Corollary:** Shortening Year

As the mass of the earth and the mass of the sun decrease, the orbiting period decreases, in effect, shortening the year. The year becomes shorter and shorter with time.

Though this shortening of the year is not significant within human life span, it is significant with time in the long run. It is the living who defined the time using the motion of the celestial bodies. So, time has a meaning only for living. As far as planetary systems are concerned, there is no time and there is no time limit. What is there is only the present, this moment, the 'now'. Time is a human concept, defined by human for human; time is a definition. Other living species may have their own definition of time. Non-living has no time; non-living objects have no meeting to attend in time. But non-living objects have gravity. Therefore, it makes no sense and it is incorrect to define gravity as space-time curvature as it is done in General Relativity using a human definition of time that is applicable only for human.

There is no dimension in time when all we have is the present moment; time is just a single point, not a continuum. Universe is not a stack of moments. There is no yesterday's universe. There is no tomorrow's universe. There is the Universe at this moment. Universe is an adaptive system that is updated continuously. What is there is the universe at this very moment, nothing more. Human defined time has no validity for non-human species or non-living objects. You can't define time axis when all we have is a single point, 'the now'.

---

Time is a moment, not a continuum.
Universe exists only at this moment.
There is no yesterday's universe or
tomorrow's universe

---

## D. Accelerated Orbits Dilation and Contraction

As we have seen, the orbit dilation or contraction under varying planetary mass m and varying orbit center mass M is given by,

$$\frac{dr}{dt}=Hr \quad (6.4.1)$$

where, $H=2\frac{d}{dt}(\ln m)+\frac{d}{dt}(\ln M)+\frac{d}{dt}(\ln G)$,

m=the mass of the orbiting planet, M=the mass of the orbiting center, G=the gravitational parameter, r=radial distance to the planet.

By differentiating equation (6.4.1|) with respect to time, we get,

$$\frac{dr}{dt}\frac{dr}{dt} = \frac{dr}{dt}(Hr) \quad (6.4.2)$$

$$\frac{dr}{dt}\frac{dr}{dt} = H\frac{dr}{dt} + r\frac{dH}{dt} \quad (6.4.3)$$

Substituting for $\frac{dr}{dt}$ from equation (6.4.1), we get,

$$\frac{dr}{dt}\frac{dr}{dt} = H^2r + r\frac{dH}{dt} \quad (6.4.4)$$

Since the change of G is negligible, from equation (6.4.1) we have,

$$H=2\frac{d}{dt}(\ln m)+\frac{d}{dt}(\ln M). \quad (6.4.5)$$

By differentiating with respect to time t, we get,

$$\frac{dH}{dt}=2\frac{d}{dt}[\frac{1}{m}\frac{dm}{dt}] + \frac{d}{dt}[\frac{1}{M}\frac{dM}{dt}] \quad (6.4.6)$$

$$\frac{d}{dt}[\frac{1}{m}\frac{dm}{dt}]= \frac{1}{m}\frac{d}{dt}\frac{d}{dt}(m)-(1/m^2)[\frac{dm}{dt}]^2 \quad (6.4.7)$$

Since $(1/m^2)<<(1/m)$, we can disregard the terms containing $(1/m^2)$. As a result, we have,

$$\frac{d}{dt}[\frac{1}{m}\frac{dm}{dt}]= \frac{1}{m}\frac{d}{dt}\frac{d}{dt}(m) \quad (6.4.8)$$

Similarly, we have,

$$\frac{d}{dt}[\frac{1}{M}\frac{dM}{dt}]= \frac{1}{M}\frac{d}{dt}\frac{d}{dt}(M) \quad (6.4.9)$$

Substituting in equation (6.4.6) we have,

$$\frac{dH}{dt}=2\frac{1}{m}\frac{d}{dt}\frac{d}{dt}(m)+\frac{1}{M}\frac{d}{dt}\frac{d}{dt}(M) \quad (6.4.10)$$

Now, substituting for $\frac{dH}{dt}$ in equation (6.4.4), we get,

$$\frac{dr}{dt}\frac{dr}{dt}=H^2r+[2\frac{1}{m}\frac{d}{dt}\frac{d}{dt}(m)+\frac{1}{M}\frac{d}{dt}\frac{d}{dt}(M)]r \quad (6.4.11)$$

We also have,

$$H^2 = [2\frac{d}{dt}(\ln m)+\frac{d}{dt}(\ln M)]^2 \quad (6.4.12)$$

$$H^2 = [2\frac{1}{m}\frac{dm}{dt}+\frac{1}{M}\frac{dM}{dt}]^2 \quad (6.4.13)$$

Since $(1/m^2)$, $(1/M^2)$ and $(1/Mm)$ are negligible compared to $(1/m)$ and $(1/M)$, we have,

$$H^2<< [2\frac{1}{m}\frac{d}{dt}\frac{d}{dt}(m)+\frac{1}{M}\frac{d}{dt}\frac{d}{dt}(M)] \quad (6.4.14)$$

In other words, we have, $H^2<<\frac{dH}{dt}$.

Now, from equation (6.4.11), we have,

$$\frac{dr}{dt}\frac{dr}{dt}=[2\frac{1}{m}\frac{d}{dt}\frac{d}{dt}(m)+\frac{1}{M}\frac{d}{dt}\frac{d}{dt}(M)]r \quad (6.4.15)$$

We can write this as,

$$\frac{dr}{dt}\frac{dr}{dt}= H_a r \quad (6.4.16)$$

where,

$$H_a =[2\frac{1}{m}\frac{d}{dt}\frac{d}{dt}(m)+\frac{1}{M}\frac{d}{dt}\frac{d}{dt}(M)] \quad (6.4.17)$$

Or, much more accurately,
$$H_a = 2\frac{d}{dt}\frac{d}{dt}(\ln m) + \frac{d}{dt}\frac{d}{dt}(\ln M). \qquad (6.4.18)$$

Orbit Dilation under time-varying mass is given by
$$\frac{dr}{dt} = Hr, \; \frac{dr}{dt}\frac{dr}{dt} = H_a \, r, \text{ and } H = 2\frac{d}{dt}(\ln m) + \frac{d}{dt}(\ln M)$$
$$H_a = H^2 + [2\frac{1}{m}\frac{d}{dt}\frac{d}{dt}(m) + \frac{1}{M}\frac{d}{dt}\frac{d}{dt}(M)]$$

Orbit dilation takes place at an accelerated phase with the increase of the planetary mass m and the orbit center mass M. The acceleration of the orbit dilation is proportional to the second order derivative of the logarithms of mass m and M. Similarly, the orbit contraction takes place at an accelerated phase with the decrease of the planetary mass m and the orbiting center mass M. The accelerated orbit contraction is approximately proportional to the normalized second order derivative of the planetary mass m and the normalized second order derivative of the orbiting center mass M. The accelerated orbit contraction is exactly proportional to the second order derivative of the logarithmic mass m and logarithmic mass M.

**Lemma:** Accelerated Orbit Dilation and Contraction
The orbit dilation or contraction of a planetary orbit takes place at an accelerated phase given by,
$$\frac{dr}{dt}\frac{dr}{dt} = H_a \, r$$
where, $H_a \approx [2\frac{1}{m}\frac{d}{dt}\frac{d}{dt}(m) + \frac{1}{M}\frac{d}{dt}\frac{d}{dt}(M)]$
or exactly,
$$H_a = H^2 + 2\frac{d}{dt}\frac{d}{dt}(\ln m) + \frac{d}{dt}\frac{d}{dt}(\ln M). \qquad (6.4.19)$$

Now, let us reconsider the equation (6.4.5),
$$H = 2\frac{d}{dt}(\ln m) + \frac{d}{dt}(\ln M). \qquad (6.4.20)$$
$$H = 2\frac{1}{m}\frac{dm}{dt} + \frac{1}{M}\frac{dM}{dt} \qquad (6.4.21)$$
If the change of mass per unit mass is a constant, or in other words, $\frac{1}{m}\frac{dm}{dt}$ and $\frac{1}{M}\frac{dM}{dt}$ are constants, we have,
$$H = constant \qquad (6.4.22)$$
In this case, the $n^{th}$ order differential,
$$d^n(r)/dt^n = H^n \, r \qquad (6.4.23)$$
When n=2, we have,
$$d^2(r)/dt^2 = H^2 \, r \qquad (6.4.24)$$
When H is a constant, the radial velocity, where n=1, and the radial acceleration, where n=2, of the orbit are given by,
$$\frac{dr}{dt} = Hr \qquad (6.4.25)$$
$$\frac{dr}{dt}\frac{dr}{dt} = H^2 \, r \qquad (6.4.26)$$

**Lemma:** Accelerated Orbit Dilation under Constant H
When the change of mass per unit mass is time-invariant or constant, H is time-invariant and hence, the accelerated orbit dilation is given by,
$$\frac{dr}{dt} = H \, r, \; \frac{dr}{dt}\frac{dr}{dt} = H^2 \, r.$$
where, $H = 2\frac{1}{m}\frac{dm}{dt} + \frac{1}{M}\frac{dM}{dt}$ assumed to be a constant.

Accelerated Orbit Dilation under Varying Masses with Constant H is given by
$$\frac{dr}{dt} = Hr \text{ and } \frac{dr}{dt}\frac{dr}{dt} = H^2 \, r,$$
where, $H = 2\frac{d}{dt}(\ln m) + \frac{d}{dt}(\ln M)$ is a constant.

## VII. SWINGING ROTATION OF THE ECCENTRICITY VECTOR, PRECESSION

In order to produce a continuous rotation of the major axis of an elliptical orbit, there must be a continuous increase or decrease of a parameter in the orbiting system. Only a continuous change of an orbit parameter can produce continuous unidirectional rotation of the major axis of an elliptical orbit or the precession. The precession of an elliptical orbit is an indication that there is an orbit parameter that is changing continuously.

We know that the precession of a planetary orbit is the continuous unidirectional rotation of the major axis of an elliptical orbit. Since the major axis of an elliptical orbit is the Eccentricity Vector **e**, the precession of a planetary orbit is the rotation of the Eccentricity Vector **e**. The rotation of the Eccentricity Vector **e** takes place when the mass M(t) of the orbiting center or the mass of the sun in our solar system changes with time, or when M(t) is time-varying. As the sun releases electromagnetic energy, the mass of the sun decreases. The continuous flow of high energy particles out of the sun decreases the mass of the sun; we witness these high energy emissions of the sun here on earth as Aurora Borealis. The mass of the sun is decreasing. The mass of the sun is decreasing by several tones every second. It is this decreasing mass of the sun with time that leads to the planetary precession.

The gravitational pull from other planets also contribute to the planetary precession. However, as far as the solar system is concerned, the contribution to the precession due to the gravitational pull from other planets is miner since the masses of the planets are negligible compared to the sun. We will consider the effect of the mutual interactions of the planets on the planetary precession separately, later. In effect, the gravitational pull from other planets is equivalent to the change of the effective mass of the orbiting center mass with time, resulting in time-varying orbit center mass M(t).

If the effective mass M of the orbiting center is time-invariant or constant, then, there will not be any major axis rotation and hence there would be no precession. Let us see how the time-varying mass M(t) of the sun results in the continuous unidirectional rotation of the Eccentricity Vector **e**.

The Eccentricity Vector **e** of a planetary orbit is given by,
$$\mathbf{e} = -\frac{1}{GM}\boldsymbol{\ell} \times \mathbf{v} - \nabla r \qquad (7.1)$$

Differentiating with respect to time, we get,

$$\frac{de}{dt}=[-\frac{1}{GM}(\frac{\partial\ell}{\partial t}\times\mathbf{v}+\boldsymbol{\ell}\times\frac{\partial\mathbf{v}}{\partial t}) - \frac{\partial}{\partial t}(\nabla r)] + [\frac{1}{M}\frac{\partial M}{\partial t}\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v}] \quad (7.2)$$

We have already shown that the Eccentricity Vector **e** is time invariant when M is time-invariant. Therefore,

$$-\frac{1}{GM}(\frac{\partial\ell}{\partial t}\times\mathbf{v}+\boldsymbol{\ell}\times\frac{\partial\mathbf{v}}{\partial t}) - \frac{\partial}{\partial t}(\nabla r)=\mathbf{0} \qquad (7.3)$$

Now, we have,

$$\frac{de}{dt}=\frac{1}{M}\frac{\partial M}{\partial t}\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} \qquad (7.4)$$

Now, the new Eccentricity Vector $\mathbf{e}_{new}$, when the mass of the orbiting center M changes to M+ΔM at time interval Δt can be written as,

$$\mathbf{e}_{new}=\mathbf{e}+\frac{d\mathbf{e}}{dt}\Delta t \qquad (7.5)$$

Substituting for $\frac{d\mathbf{e}}{dt}$, we get,

$$\mathbf{e}_{new}=\mathbf{e}+\frac{\Delta M}{M}\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} \qquad (7.6)$$

Taking the cross product of $\mathbf{e}_{new}$ with **e**, we get,

$$\mathbf{e}_{new}\times\mathbf{e}=\mathbf{e}\times\mathbf{e}+\frac{\Delta M}{M}\frac{1}{GM}(\boldsymbol{\ell}\times\mathbf{v})\times\mathbf{e} \qquad (7.7)$$

Since **e**×**e**=**0**, we have,

$$\mathbf{e}_{new}\times\mathbf{e}= \frac{\Delta M}{M}\frac{1}{GM}(\boldsymbol{\ell}\times\mathbf{v})\times\mathbf{e} \qquad (7.8)$$

Substituting for **e** on the right side, we get,

$$\mathbf{e}_{new}\times\mathbf{e}= \frac{\Delta M}{M}\frac{1}{GM}(\boldsymbol{\ell}\times\mathbf{v})\times[- \frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} -\nabla r] \qquad (7.9)$$

Since $(\boldsymbol{\ell}\times\mathbf{v})\times( \boldsymbol{\ell}\times\mathbf{v})=\mathbf{0}$, we have,

$$\mathbf{e}_{new}\times\mathbf{e}=\frac{\Delta M}{M}\frac{1}{GM}(\boldsymbol{\ell}\times\mathbf{v})\times(-\nabla r) \qquad (7.10)$$

$$\mathbf{e}_{new}\times\mathbf{e}= - \frac{\Delta M}{M}\frac{1}{GM}\frac{1}{r} (\boldsymbol{\ell}\times\mathbf{v})\times\mathbf{r} \qquad (7.11)$$

$$\mathbf{e}_{new}\times\mathbf{e}= - \frac{\Delta M}{M}\frac{1}{GM}\frac{1}{r} [(\boldsymbol{\ell}\cdot\mathbf{r})\mathbf{v}-(\mathbf{v}\cdot\mathbf{r})\boldsymbol{\ell}] \qquad (7.12)$$

Since $\boldsymbol{\ell}\cdot\mathbf{r}=\mathbf{0}$, we have,

$$\mathbf{e}_{new}\times\mathbf{e}= \frac{\Delta M}{M}\frac{1}{GM}\frac{1}{r} (\mathbf{v}\cdot\mathbf{r})\boldsymbol{\ell} \qquad (7.13)$$

Since $\mathbf{v}\cdot\mathbf{r}=r\frac{dr}{dt}$, we have,

$$\mathbf{e}_{new}\times\mathbf{e}= \frac{\Delta M}{M}\frac{1}{GM}\frac{dr}{dt} \boldsymbol{\ell} \qquad (7.14)$$

If the angle between $\mathbf{e}_{new}$ and **e** is Δθ, in other words, if the change of M to M+ΔM has rotated **e** by an angle Δθ to $\mathbf{e}_{new}$, we have,

$$e_{new}e \sin(\Delta\theta)= \frac{\Delta M}{M}\frac{\ell}{GM}\frac{dr}{dt} \qquad (7.16)$$

where $\ell=|\boldsymbol{\ell}|$.
Since Δθ is small, $\sin(\Delta\theta)\cong\Delta\theta$ and we now have,

$$e_{new}e \,\Delta\theta= \frac{\Delta M}{M}\frac{\ell}{GM}\frac{dr}{dt} \qquad (7.17)$$

Further, $e_{new}\cong e$. If e≠0, we have,

$$\Delta\theta=(1/e^2) \frac{\Delta M}{M}\frac{\ell}{GM}\frac{dr}{dt} \qquad (7.18)$$

If the change of mass from M to M+ΔM has taken place within time interval Δt, as Δt→0, we have,

$$\frac{d\theta}{dt}=(1/e^2)[\frac{1}{M}\frac{dM}{dt}]\frac{\ell}{GM}\frac{dr}{dt} \qquad (7.19)$$

$$\frac{d\theta}{dt}=(1/e^2)[\frac{d}{dt}\ln M]\frac{\ell}{GM}\frac{dr}{dt} \qquad (7.20)$$

This can also be written as,

$$\frac{d\theta}{dt}=(1/e^2)H\frac{\ell}{GM}\frac{dr}{dt} \qquad (7.21)$$

where $H=\frac{d}{dt}\ln M$.

The rotation of the major axis is related to H, which is associated with orbit contraction and dilation due to the change of the orbit center mass M, as well as to the $\frac{\ell}{GM}\frac{dr}{dt}$, which is related to the elliptic orbit dynamics. Therefore, for the orbit precession to exist, M must be time varying, i.e. $\frac{dM}{dt}\neq0$, and the orbit must be elliptic, i.e. $\frac{dr}{dt}\neq0$.

We can recognize H as the orbit dilation or contraction parameter due to the change of mass. The eccentricity rotation or the precession is also proportional to the orbit dilation or contraction parameter H due to the change of mass M. When the mass of the sun changes from M to M+ΔM, the resulting parameter H is responsible for both orbit dilation as well as the major axis rotation.

The rate of rotation of the major axis is also proportional to $\frac{dr}{dt}$, which is the rate of change of radial distance r due to the orbit dynamics that is independent of change of mass at any time t. This $\frac{dr}{dt}$ is not associated with the orbit dilation or contraction due to change of mass M; it is exclusively due to the change of r in a given elliptical path at any time t.

In general, for any eccentricity e,

$$e^2\frac{d\theta}{dt}=H\frac{\ell}{GM}\frac{dr}{dt} \qquad (7.22)$$

If $\frac{dr}{dt}=0$, we have, $e^2\frac{d\theta}{dt}=0$ for e≠0, and hence, there is no rotation of Eccentricity Vector **e** at points on the orbit where $\frac{dr}{dt}=0$. The earth's orbit is nearly circular. On a circular or near circular orbits, $\frac{dr}{dt}\approx0$ everywhere on the orbit and, as a result, there is no precession on circular or near circular orbits. Since the earth's orbit is nearly circular, there is no precession on the earth's orbit. In addition, when, $\frac{dM}{dt}=0$, we have H=0, and hence there is no precession on any elliptical orbit when the mass of the orbiting center is time-invariant or constant. It is the change of the mass of the orbiting center that drives the precession through the rotation of the Eccentricity Vector **e**, which is also the major axis of the orbit.

The rate of rotation of the Eccentricity Vector **e**, which is also the major axis of the elliptical orbit of a planet, is proportional to the rate of change of the orbiting center mass of the orbiting system or the rate of change of mass of the sun in our solar system. Further, if the Eccentricity Vector is zero or nearly zero, as it is in the case of the earth, there is no Eccentricity Vector to rotate and hence there is no precession. In the case of circular or near circular orbit, there is no Eccentricity Vector and hence there is no major axis.

It is the Eccentricity Vector rotation due to the decrease in mass of the sun with time that results in the precession of the planet Mercury. The precession of the planet Mercury is visible since the orbit of the planet Mercury is much more elongated due to the relatively higher end eccentricity e, where 0≤e<1. The angle of rotation Δθ is negligibly small since it is inversely proportional to the inverse square mass of the sun. Even though the angle of rotation of the Eccentricity Vector during an orbiting period is quite small, aΔθ is visibly significant since the length 'a' of the semi-major axis of the elliptical orbit of Mercury is

large.

**Theorem:** Orbit Precession

The precession of an orbit is the Eccentricity Vector, which is the major axis of the orbit, rotation as a result of the changing mass of the orbiting center or the sun in our solar system. The rate of rotation is given by,

$$\frac{d\theta}{dt}=(1/e^2)H\frac{\ell}{GM}\frac{dr}{dt},$$

where, $H=\frac{d}{dt}\ln M$,

$\theta$ is the angle of rotation, $\ell$ is the angular momentum at time t, r is the radial distance to the planet at time t, M is the mass of the orbiting center at time t, G is the gravitational parameter, e is the eccentricity of the elliptical orbit at time t, and $0 \le e < 1$.

**Corollary:**

When $\frac{dr}{dt} \to 0$, as in the case of a circular or near circular orbit, $\frac{d\theta}{dt} \to 0$, and hence there is no precession in circular orbits.

**Corollary:**

For a circular or near circular orbit, the Eccentricity Vector is a null vector, $\mathbf{e} \cong \mathbf{0}$. Hence, circular orbits do not have precession. The earth has no precession since earth's orbit is nearly circular.

> Circular or near circular orbits have no precession since the eccentricity vector of a circular orbit is a null vector.

> Precession of an Elliptical Orbit of a Planet at time t
> $$\frac{d\theta}{dt}=(1/e^2)H\frac{\ell}{GM}\frac{dr}{dt},$$
> $H=\frac{d}{dt}\ln M$, $e \neq 0$,
> $\theta$ is the angle of rotation of the Eccentricity Vector $\mathbf{e}$

**Precession or No-Precession:**
- If the effective mass of the sun is a constant, there will not be any precession even if the orbit is elliptical.
- If the orbit of a planet is circular, there will not be precession even if the effective mass of the orbiting center is changing.
- For precession to occur, orbit must be elliptic as well as the effective mass of the orbiting center must not be a constant.

**Oscillatory Eccentricity Vector Rotation**:

We have seen that the rotation of the Eccentricity Vector **e,** which is the major axis of the elliptical orbit of a planet due to the change of the mass of the sun is given by,

$$\frac{d\theta}{dt}=(1/e^2)H\frac{\ell}{GM}\frac{dr}{dt},$$

where, $H=\frac{d}{dt}\ln M$.

Since the sun's mass is decreasing, $\frac{dM}{dt} \le 0$ and hence $H \le 0$.

Further, for an elliptical orbit, the rate of change of radial distance to the planet is negative ($\frac{dr}{dt} \le 0$) for one half of the orbit, while the rate of change of radial distance is positive ($\frac{dr}{dt} \ge 0$) in the other half of the orbit. As a result, the eccentricity rotation is positive for one half of the orbit and the eccentricity rotation will be negative for the other half of the orbit. In other word, the rotation of the eccentricity or the major axis of the orbit is oscillatory within an orbiting period.

**Unidirectional Continuous Rotation of Major Axis or Precession:**

The precession is the unidirectional continuous rotation of the major axis or the Eccentricity Vector **e**. Let us see how the time-varying orbit center mass M(t) results in a unidirectional continuous rotation of the major axis.

Since the sun's mass is decreasing steadily, $\frac{dM}{dt} \le 0$, and hence $H \le 0$. As a result, $\frac{d\theta}{dt} \le 0$, if $\frac{dr}{dt} \ge 0$ and $\frac{d\theta}{dt} \ge 0$, if $\frac{dr}{dt} \le 0$.

The rotation of the major axis due to the change of the mass of the sun is oscillatory. When the planet is on one half of the orbit, the rotation of the major axis is in one direction, while the rotation of the major axis is in the opposite direction when the planet is on the other half of the orbit. Although the mass depletion of the sun also makes the major axis to swing, the positive swing and the negative swing within an orbit period are not equal due to the non-uniform relative change of mass of the sun. The relative change of the mass of the sun is the change of the mass of the sun per unit mass. As a result, depletion of mass of the sun creates an overall unidirectional rotation of the major axis or precession.

**Definition:** Relative change of the mass of the sun is defined as H, where $H=\frac{1}{M}\frac{dM}{dt}$ or $H=\frac{d}{dt}[\ln M]$.

Since the relative change of the mass, $\frac{1}{M}\frac{dM}{dt}$ is not uniform or, $\frac{1}{M}\frac{dM}{dt} \neq$ constant, the positive swing and the negative swing during a orbiting cycle are not equal and as a result there is an overall one direction rotation with the decrease of the mass of the sun. This overall unidirectional continuous rotation of the Eccentricity Vector or the major axis of an elliptical orbit of a planet with the decrease of the mass of the sun is the planetary precession.

**Lemma:** Oscillatory Precession

The precession of a planetary orbit is the rotation of the Eccentricity Vector or the major axis. The precession of a planetary orbit is oscillatory since the rotation of the major axis of an ellipse due to the

change of mass of the orbit center is oscillating. Since the relative change of the mass of the sun is not a constant, the positive swing is not equal to the negative swing of the major axis leading to an overall unidirectional rotation with the change of the mass of the sun. There is no precession if the mass of the sun is a constant or time-invariant.

**Corollary:**

Precession of a planetary orbit, in part, is proportional to the rate of mass depletion of the sun.

**Corollary:**

If the relative change of the mass of the sun is uniform or constant,

$$\frac{1}{M}\frac{dM}{dt}=\text{constant,}$$

or $\frac{d}{dt}(\ln M)=$constant.

then, there will be a swinging rotation of the major axis. However, there will not be a unidirectional overall rotation of the major axis or precession due to the decreasing mass of the sun since the positive swing in the one half of the orbit is canceled by the negative swing in the other half of the orbit.

If the relative change of the center mass is a constant, even though there is no unidirectional persistent overall rotation of the Eccentricity Vector over time due to the depletion of the mass of the sun, there still will be a persistent Eccentricity Vector rotation due to the gravitational pull from other planets. The gravitational pull from other planets is equivalent to the change of the effective mass of the orbit center.

**Persistent Eccentricity Vector Rotation due to Gravitational Pull from Other Planets:**

The gravitational pull from other planets on a planet is equivalent to the gradual increase of the effective mass of the sun for one half of the orbiting period and the gradual decrease of the effective mass of the sun for the other half of the orbiting period due to the change of the planetary distances to the other planets from the planet. Let the change of the effective mass of the sun due to the gravitational pull from the other planets is ∆M.

When ∆M>0, we have H>0.

Since, $\frac{d\theta}{dt}=(1/e^2)H\frac{\ell}{GM}\frac{dr}{dt}$, where $H=\frac{d}{dt}\ln M$, if $\frac{dr}{dt}\geq0$, we now have, $\frac{d\theta}{dt}\geq0$ for one half of the orbiting period when the pull from other planets on a particular planet, in effect, is equivalent to the gradual increase of the effective mass of the sun.

Similarly, when ∆M<0, we have H<0.

Since, $\frac{d\theta}{dt}=(1/e^2)H\frac{\ell}{GM}\frac{dr}{dt}$, where $H=\frac{d}{dt}\ln M$, if $\frac{dr}{dt}\leq0$, we still have, $\frac{d\theta}{dt}\geq0$ for the other half of the orbiting period when the pull of other planets on a particular planet, in effect, is equivalent to the gradual decrease of the effective mass of the sun. So, the effect of the gravitational pull from other planet is a persistent unidirectional rotation of the Eccentricity Vector resulting in precession.

The gravitational pull from other planets also affects the angular momentum. The angular momentum is no longer time-invariant in the presence of a gravitational pull from other planets [7]. When the mutual interactions of the planets are significant, the angular momentum of a planet is no longer conserved. Similarly, the angular momentum of an electron in a multi-electrons atom is not conserved. It is the total angular momentum of all the planets that is conserved, not the angular momentum of the individual planets; the same is true for electrons orbiting in atoms.

**The Total Precession:**

As we have seen the rotation of the Eccentricity Vector has two components:
1. The swinging Eccentricity Vector rotation due to the decrease of the mass of the sun.
2. The persistent Eccentricity Vector rotation due to the gravitational pull from other planets.

Therefore, the total Eccentricity Vector rotation is the sum of these two components. As a result, we have persistent unidirectional rotation superimposed with a swinging rotation.

**Total Precession for Circular Orbits**

In the case of circular orbits, dr/dt=0, and hence from eqn. (7.21), $\frac{d\theta}{dt}=0$. As a result, there will not be any Eccentricity Vector rotation, neither due to the decrease of the mass of the sun nor due to the gravitational pull from the other planets. In fact, this is understandable since Eccentricity Vector is a null vector, **e**=**0**, for circular orbits. Circular orbits do not have a major axis to rotate. Planetary orbit precession due to continuous decrease of mass of the sun as well as due to the gravitational pull from other planets is only present in elliptical orbits.

VIII. **THE EFFECT OF TIME-VARYING CENTRAL MASS** M(t) **ON THE MAGNITUDE OF ECCENTRICITY VECTOR,** e

We have already considered the effect of time-varying mass M(t) of the orbiting center on the rotation of the Eccentricity Vector **e** under the assumption that the change of the eccentricity e is negligible, where e=|**e**|. Although, it is a reasonable assumption as we will see later, we want to find out how the eccentricity e is affected by the change of M(t) in actuality.

We have already come across the Eccentricity Vector **e** when the mass of the orbiting center is M and the Eccentricity Vector **e**<sub>new</sub> when the mass of the orbiting center M has changed to M+∆M,

$$\mathbf{e}= -\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} -\nabla r \qquad (8.1)$$

$$\mathbf{e}_{new}=\mathbf{e}+\frac{\Delta M}{M}\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} \qquad (8.2)$$

If we take the dot product of **e**<sub>new</sub> with **e**, we have,

$$\mathbf{e}_{new}\bullet\mathbf{e}=[\ \mathbf{e}+\tfrac{\Delta M}{M}\tfrac{1}{GM}\boldsymbol{\ell}\times\mathbf{v}]\bullet\mathbf{e} \qquad (8.4)$$

$$\mathbf{e}_{new}\bullet\mathbf{e}=\mathbf{e}\bullet\mathbf{e}+\tfrac{\Delta M}{M}\tfrac{1}{GM}[\boldsymbol{\ell}\times\mathbf{v}]\bullet\mathbf{e} \qquad (8.5)$$

$$\mathbf{e}_{new}\bullet\mathbf{e}=\mathbf{e}\bullet\mathbf{e}+\tfrac{\Delta M}{M}\tfrac{1}{GM}\boldsymbol{\ell}\bullet(\mathbf{v}\times\mathbf{e}) \qquad (8.6)$$

$$\mathbf{e}_{new}\bullet\mathbf{e}=\mathbf{e}\bullet\mathbf{e}+\tfrac{\Delta M}{M}\tfrac{1}{GM}\boldsymbol{\ell}\bullet[\mathbf{v}\times(-\tfrac{1}{GM}\boldsymbol{\ell}\times\mathbf{v}-\nabla r)] \qquad (8.7)$$

$$\mathbf{e}_{new}\bullet\mathbf{e}=\mathbf{e}\bullet\mathbf{e}+\tfrac{\Delta M}{M}\tfrac{1}{GM}\boldsymbol{\ell}\bullet[-\tfrac{1}{GM}(\mathbf{v}\times(\boldsymbol{\ell}\times\mathbf{v}))-\mathbf{v}\times(\nabla r)] \qquad (8.8)$$

$$\mathbf{e}_{new}\bullet\mathbf{e}=\mathbf{e}\bullet\mathbf{e}+\tfrac{\Delta M}{M}\tfrac{1}{GM}\boldsymbol{\ell}\bullet\{-\tfrac{1}{GM}[(\mathbf{v}\bullet\mathbf{v})\boldsymbol{\ell}-(\boldsymbol{\ell}\bullet\mathbf{v})\mathbf{v}]-[\mathbf{v}\times\nabla r]\} \qquad (8.9)$$

Since $\boldsymbol{\ell}\bullet\mathbf{v}=0$, and $\mathbf{v}\times\nabla r=-\tfrac{1}{r}\boldsymbol{\ell}$, we have,

$$\mathbf{e}_{new}\bullet\mathbf{e}=\mathbf{e}\bullet\mathbf{e}+\tfrac{\Delta M}{M}\tfrac{1}{GM}\boldsymbol{\ell}\bullet[-\tfrac{1}{GM}(\mathbf{v}\bullet\mathbf{v})+\tfrac{1}{r}]\boldsymbol{\ell} \qquad (8.10)$$

Since $\boldsymbol{\ell}\bullet\boldsymbol{\ell}=\ell^2$, $\mathbf{e}\bullet\mathbf{e}=e^2$, $\mathbf{v}\bullet\mathbf{v}=v^2$, where $\ell=|\boldsymbol{\ell}|$, and $e=|\mathbf{e}|$, $v=|\mathbf{v}|$, we have,

$$\mathbf{e}_{new}\bullet\mathbf{e}=e^2+\tfrac{\Delta M}{M}\tfrac{1}{GM}\ell^2[\ -\tfrac{1}{GM}v^2+\tfrac{1}{r}\ ] \qquad (8.11)$$

Since the angle between $\mathbf{e}_{new}$ and $\mathbf{e}$ is $\Delta\theta$, we have,

$$e_{new}e\cos(\Delta\theta)=e^2\{1+\tfrac{\Delta M}{M}\tfrac{1}{GM}(\ell^2/e^2)[\ -\tfrac{1}{GM}v^2+\tfrac{1}{r}\ ]\} \qquad (8.12)$$

Squaring equation (8.12), we have,

$$(e_{new}e)^2\cos^2(\Delta\theta)=e^4\{1+\tfrac{\Delta M}{M}\tfrac{1}{GM}(\ell^2/e^2)[-\tfrac{1}{GM}v^2+\tfrac{1}{r}]\}^2 \qquad (8.13)$$

From equation (7.16), we have,

$$e_{new}e\sin(\Delta\theta)=\tfrac{\Delta M}{M}\tfrac{\ell}{GM}\tfrac{dr}{dt} \qquad (8.14)$$

Squaring equation (8.14), we have,

$$(e_{new}e)^2\sin^2(\Delta\theta)=[\tfrac{\Delta M}{M}\tfrac{\ell}{GM}\tfrac{dr}{dt}]^2 \qquad (8.15)$$

Adding equations (8.13) and (8.15), we get,

$$(e_{new}e)^2=[\tfrac{\Delta M}{M}\tfrac{\ell}{GM}\tfrac{dr}{dt}]^2+e^4\{1+\tfrac{\Delta M}{M}\tfrac{1}{GM}(\ell^2/e^2)[-\tfrac{1}{GM}v^2+\tfrac{1}{r}]\}^2 \qquad (8.16)$$

Since $[\Delta M/M]^2<<[\Delta M/M]$, we have,

$$(e_{new}e)^2\cong e^4\{1+2\tfrac{\Delta M}{M}\tfrac{1}{GM}(\ell^2/e^2)[-\tfrac{1}{GM}v^2+\tfrac{1}{r}]\} \qquad (8.17)$$

$$e_{new}\cong e\{1+\tfrac{\Delta M}{M}\tfrac{1}{GM}(\ell^2/e^2)[-\tfrac{1}{GM}v^2+\tfrac{1}{r}]\}$$

$$e_{new}\cong e+\tfrac{1}{e}\tfrac{\Delta M}{M}\tfrac{1}{GM}\ell^2[-\tfrac{1}{GM}v^2+\tfrac{1}{r}] \qquad (8.18)$$

When the mass of the sun changes from M to M+ΔM, the eccentricity changes from e to $e_{new}$, where $e_{new}=e+\Delta e$. Now, we have,

$$\Delta e=\tfrac{1}{e}\tfrac{\Delta M}{M}\tfrac{1}{GM}\ell^2[\ \tfrac{1}{r}-\tfrac{1}{GM}v^2\ ] \qquad (8.19)$$

Since Δe<<e, the approximation $e_{new}\cong e$ we made in the calculation of the major axis or the eccentricity rotation is a reasonable one.

If the change of mass from M to M+ΔM has taken place at time t in a small time interval Δt, as Δt→0, we have,

$$\tfrac{de}{dt}=\tfrac{1}{e}R[\ \tfrac{1}{r}-\tfrac{1}{GM}v^2\ ]\tfrac{1}{M}\tfrac{dM}{dt} \qquad (8.20)$$

where, $R=\tfrac{1}{GM}\ell^2$.

We can write equation (8.20) as,

$$\tfrac{de}{dt}=\tfrac{1}{e}R[\ \tfrac{1}{r}-\tfrac{1}{GM}v^2\ ]\tfrac{d}{dt}(\ln M) \qquad (8.21)$$

$$\tfrac{de}{dt}=\tfrac{1}{e}\tfrac{R}{GM}[(GM/r^2)-(v^2/r)]H \qquad (8.22)$$

where $H=\tfrac{d}{dt}(\ln M)$.

Let us define Ĥ as,

$$Ĥ=[(GM/r^2)-(v^2/r)]H \qquad (8.23)$$

Now, we have,

$$\tfrac{de}{dt}=\tfrac{1}{e}\tfrac{R}{GM}Ĥr \qquad (8.24)$$

This can also be written as,

$$\tfrac{d}{dt}(e^2)=2\tfrac{R}{GM}Ĥr.$$

The further is the planet away, the larger is the

change of the eccentricity with the changing mass M of the orbiting center, or the mass M of the sun in our solar system. On the other hand, the larger is the eccentricity, the smaller is the change of the eccentricity. The smaller the mass of the orbiting center M gets, the larger is the change of the eccentricity. Since the mass of the orbiting center is significantly large and the change of the eccentricity is proportional to the inverse of the square mass, the change of the eccentricity is quite negligible.

We can recognize here that Ĥr is the rate of orbit dilation due to the change of mass M. For any elliptical orbit, if the mass M is time-invariant, then,

$$\tfrac{dM}{dt}=0 \text{ and hence } H=0 \text{ and } \tfrac{de}{dt}=0.$$

As a result, there will be no change of the Eccentricity Vector or the major axis of the elliptical orbit if the mass M of the orbiting center is time-invariant.

If the orbit is circular, v=V, and we have,

$$[GM/r^2)-(V^2/r)]=0 \qquad (8.25)$$

From equation (8.22), the change of eccentricity is zero, $[GM/r^2)-(V^2/r)]=0$, i.e.,

$$\tfrac{de}{dt}=0 \text{ when, } [GM/r^2)-(V^2/r)]=0.$$

In the case of circular or near circular orbits, the Eccentricity Vector or the major axis is a null vector, and hence there will not be any change of eccentricity even if the mass M is time-varying. There is no Eccentricity Vector to rotate if the orbit is circular. A Circular orbit does not have Eccentricity Vector to rotate. A circular orbit does not have a major axis. Even though there is no eccentricity change for circular orbits, circular orbits still undergo orbit dilation or contraction if the mass of the orbiting center is time-varying since H≠0.

For circular orbit, Ĥ=0, H≠0,
where, $Ĥ=[(GM/r^2)-(V^2/r)]H$.
When orbit is circular, $GM/r^2=V^2/r$ and hence Ĥ=0.
For elliptical orbit, $[(GM/r^2)-(V^2/r)]\neq0$, and hence the eccentricity will change with the change of the mass M of the orbiting center.

Let us consider the equation (8.22),

$$\tfrac{de}{dt}=\tfrac{1}{e}\tfrac{R}{GM}[(GM/r^2)-(v^2/r)]Hr$$

In the case of the sun, mass is decreasing in tons due to the electromagnetic energy loss as well as due to the loss of high energy particles.

We have, H≤0 when $\tfrac{dM}{dt}\leq0$.

As a result, we have, $\tfrac{de}{dt}\geq0$ when $[(GM/r^2)-(v^2/r)]\leq0$ and

$$\tfrac{de}{dt}\leq0 \text{ when } [(GM/r^2)-(v^2/r)]\geq0.$$

The $[(GM/r^2)-(v^2/r)]$ is positive for one half of the orbit and negative for the other half of the orbit. As a result, the eccentricity is cyclic with the decrease of the mass M, the mass of the orbiting center or the sun. The eccentricity e, where e=|**e**|, decreases when the planet is on one half of the elliptical orbit, while the eccentricity increases when the planet is on the other half of the elliptical orbit. There is no change of eccentricity if the mass of the sun or the mass of the

orbiting center is a constant or time-invariant since H=0 when $\frac{dM}{dt}$=0, and $\frac{de}{dt}$=0 when H=0.

**Theorem:** Change of Orbit Eccentricity e

The rate of change of eccentricity e of an elliptical orbit due to the change of the mass M of the orbiting center or the sun in our solar system is given by,

$$\frac{de}{dt}=\frac{1}{e}\frac{R}{GM}Ӈr \text{ or equivalently,}$$

$$\frac{d}{dt}(e^2) =2\frac{R}{GM}Ӈr$$

where, $Ӈ=[(GM/r^2)-(v^2/r)]H$, $R=\frac{1}{GM}\ell^2$, $H=\frac{d}{dt}(\ln M)$,

v is the speed at time t, M is the mass at time t, r is the radial distance at time t, e is the eccentricity at time t, G is the gravitational parameter.

**Theorem:** Oscillatory Eccentricity e

Since $[GM/r^2)-(v^2/r)]$ is positive for one half of the elliptical path and negative for the other half of the path, the eccentricity e is oscillatory, where e=|**e**|. There is no variation of the eccentricity e if the mass of the sun is time-invariant or constant. Even though the eccentricity within a single orbiting cycle is oscillatory, since the relative change of mass of the sun is not uniform or H is not a constant, there will be a net increase in the eccentricity with time.

**Corollary:**

For a circular or near circular orbit, R=GM/V² and hence $Ӈ$=0, even when H≠0. As a result $\frac{d}{dt}(e^2)$=0. There is no change of eccentricity for near circular orbits.

---

Change of eccentricity e with Change of M
$$\frac{de}{dt}=\frac{1}{e}\frac{R}{GM}Ӈr \text{ or equivalently,}$$
$$\frac{d}{dt}(e^2) =2\frac{R}{GM}Ӈr$$
where, $Ӈ=[(GM/r^2)-(v^2/r)]H$, $H=\frac{d}{dt}(\ln M)$, $R=\frac{1}{GM}\ell^2$
When orbit is circular or nearly circular,
$Ӈ$=0 even when H≠0 and hence $\frac{d}{dt}(e^2)$=0.

---

**Eccentricity and the Gravitational Pull From other Planets:**

As we have already seen, the gravitational pull from other planets on a particular planet, in effect, is equivalent to the gradual reduction of the effective mass of the sun [7] for one half of the orbiting period and the gradual increase of the effective mass of the sun for the other half of the orbiting period.

When the effective mass of the sun is increasing, i.e. when, ∆M>0, we have H>0, $[(GM/r^2)-(v^2/r)]$≥0 and hence $Ӈ$>0, where, $Ӈ=[(GM/r^2)-(v^2/r)]H$, R= $\frac{1}{GM}$ $\ell^2$, $H=\frac{d}{dt}(\ln M)$.

As a result, we have $\frac{de}{dt}$≥0.

Similarly, when the effective mass is decreasing, i.e. when ∆M<0, we have H<0, $[(GM/r^2)-(v^2/r)]$<0 and hence $Ӈ$>0.

As a result, we have $\frac{de}{dt}$≥0.

Further, in the presence of non-negligible gravitational pull from other planets, the angular momentum is no longer time-invariant. This time varying angular momentum also affect the eccentricity, making it time varying.

The gravitational pull from other planets on a particular planet increases the eccentricity. Any elliptical orbit becomes more and more oblong with time. However, the change of the eccentricity is negligibly since M is significantly large.

**The Total Change of Eccentricity:**

As we have seen, the eccentricity of an elliptical orbit changes due to two reasons:
1. The change of the eccentricity due to the decrease of the mass of the sun with time.
2. The change of the eccentricity of a particular planet due to the gravitational pull from the other planets.

Therefore, the total change of the eccentricity is the sum of the change of eccentricity due to the change of the mass of the sun and the change of eccentricity as a result of the change of the effective mass of the sun due to the gravitational pull from the other planets. Any elliptical orbit in a planetary system becomes more and more oblong with time.

**Corollary:**

The eccentricity of a planet in a planetary system increases with time making the orbit more and more oblong.

**Change of Eccentricity due to Gravitational Pull for Circular Orbits:**

For a circular orbit, GM/r²=V²/r and hence $Ӈ$=0 even when H≠0. As a result we have, $\frac{d}{dt}(e^2)$=0.

As expected, there is no change in the eccentricity of an orbit when the orbit is circular as there is no Eccentricity Vector rotation in the case of the circular orbits. This is expected since the Eccentricity Vector is a null vector, **e**=**0**, for circular orbits. There is no Eccentricity Vector to rotate in the case of circular orbits.

However, the circular orbits still feel the change of the effective mass of the sun since the radial distance of planets are affected by the change of the effective mass of the sun in the form of orbit dilation and contraction. Increase of the effective mass leads to orbit dilation while the decrease in the effective mass of the sun results in orbit contraction. In the case of elliptical orbits, the variation of the effective mass of the sun affects both the Eccentricity Vector and the radial distance. For circular orbits, the variations of the effective mass of the sun only affect the radial distance.

**Corollary:**

There is no change of eccentricity due to the gravitational pull from other planets for circular orbits. Only the radial distance is affected by the gravitational pull from other planets.

**Planetary Precession:**

1. A continuous unidirectional rotation of the major axis of an elliptical planetary orbit is present when a parameter of a planetary orbit is changing non-uniformly or gradient is not a constant, $dM/dt \neq 0$ or $dM/dt \neq constant$.

2. Precession is in part a result of overall unidirectional major axis rotation due to the continuous non-uniform mass depletion of the sun.

3. If the mass depletion of the sun is uniform, or the gradient of the change of the mass of the sun is constant, then, there will be no overall rotation of the Eccentricity Vector or precession due to the depletion of the mass of the sun. However, there will still be a forward and backward swing of the Eccentricity Vector. The forward swing will be equal to backward swing resulting in a zero overall swing within an orbit period if the mass depletion of the sun is uniform.

4. The eccentricity of an elliptical orbit changes with time due to the depleting mass of the sun.

5. There is no precession, major axis swing, or the eccentricity variation if the orbit is circular since the rate of change of the radial distance is zero. Circular orbits do not have eccentricity vectors to rotate, and hence circular orbits do not have precessions.

6. There is also a persistent continuous unidirectional major axis or Eccentricity Vector of an elliptical orbit rotation due to the gravitational pull from other planets.

7. The gravitational pull from other planets is equivalent to the continuous change of the effective mass of the sun periodically.

8. The eccentricity of an elliptical orbit also changes with time due to the gravitational pull from other planets making the orbit more and more oblong with time.

9. The total precession is the sum of the swinging Eccentricity Vector rotation due to the changing mass of the sun and the persistent eccentricity rotation due to the effect of the cyclic gravitational pull from other planets on a particular orbit.

10. The effect of the gravitational pull from other planets is time varying. The angular momentum of a planet under a non-negligible influence of a gravitational pull from other planets is time-varying. As a result, the precession in a given orbiting period is time varying [7].

## IX. TIME, GRAVITY AND OBSERVER'S VELOCITY

The Special Relativity and the General Relativity originated with the misguided idea that the time is relative and depends on the observer's frame of reference as well as gravity. Time depends neither on the gravity nor on the speed of the observer or the observer's frame of reference. Not only time does not depend on the observer's frame of reference and the gravity, but also time does not dependent of any environment factors [3, 8].

### A. Time

There is no time. What exists is only the present. There does not exist a past or a future. The past and the future are human constructs that are imaginary. Time is the point, 'now', this moment, not a dimension. There is no stack of time. There is no continuum of time. Time is a definition. We use the change of state of objects to define time. You can travel neither forward nor backward in time. Once time is defined, it is always the time that travels, not you; you just take the ride. If you do not like the time you are in, you cannot move to another time; you just have to bear it. This is complete opposite of the space, where it is always you that travels, never the space. If you do not like the space you are in, you just move along; you cannot do that with time. You cannot move to a different time.

Time is a definition. Time and time on a clock are not the same. Time on a clock depends of the Geographical Time-Zone, Day-Light saving, Clock Hardware, Mechanism of the Clock, Strength of the Battery or Winding in the case of springs, and Environment Forces. The time on a cell-phone clock is client dependent. These are the very reasons why Global Positioning System (GPS) has to avoid the time data from client trans-receivers or cell-phones, not some bogus time dilation.

The universe is not a stack of states in time. Universe always has only a single 'now' state. What is there is adaptively changing now-state of the universe. Time is not a dimension since it has only one single point, 'now'. The change of 'now' is adaptive. You cannot stack them up separately. Planets, stars, galaxies, local galaxy-clusters, super galaxy-clusters, and the universe itself are adaptive systems. Once the state at present has morphed in to a new state, the old state is no longer there; the younger you are no longer there. The old state has been replaced by the new state and hence you are always at 'now' state. There is no yester-state. The change occurs on the present 'now' state morphing into a new 'now' state.

If you do not like the time you are in, you can complain about it or waste it working on something like multi-verse, space-time, inflation, or even quantum mechanics (obvious time waster). You can multiply time by the speed of light if you like, but in reality, it will only give you a point not a vector, not a dimension. You cannot make a fourth dimension multiplying the time by speed of light. Time can be a dimension only in your notebook or in your mind, not in the nature. In 3D-space, you can travel because it

is not a definition. In time, you cannot travel forward or backward, because it is a single point, a definition. There is no yesterday's 'you'. There is no tomorrow's 'you'. There really is in this moment's 'you'. Time must be unique.

## B. Time and Gravity

Time is independent of gravity. Time is absolute [3]. If a clock is placed in two different gravitational potentials, it is the mechanism of the clock itself that is affected by the gravitational potential, not the time, irrespective of what the mechanism is. The effect of gravitational potential on the mechanism of the clock varies from one gravitational potential to the other resulting in different readings on clocks. The gravitational force acting on one clock will be different from the gravitational force on a clock at different potential. The time difference between two clocks at different gravitational potentials is the result of the effect of gravity on the clocks themselves. Display of a clock is relative, time is not. Display of a clock represents the time only when a clock is in an environment that satisfy the design specifications of the clock.

A clock runs slow if the battery is weak or the winding of the spring is loose. It is not the time itself that slows down when the battery is low or the winding of the spring is loose, it is the mechanism of the clock that slows down. Two synchronize clocks with two different strengths of batteries display different times. Two synchronize clocks with two different winding strengths of springs will also display different time. We have all seen how time in our watches slow down when it is time to replace the batteries.

Two synchronized clocks at two different temperatures also display two different times, yet we are not going around claiming that the time depends on temperature. It is the mechanism of the clock that is affected by the temperature and hence what it displays, not the time itself. Similarly, it is the mechanism of a clock that is affected by gravity, not the time itself.

The display on a clock represents the correct time only when the clock is in an environment that meets the design specifications. Any engineered measuring device provides the correct measurement only when the device is at a position where the design specifications are met; clocks are no exception. Clocks also have design specifications that define the environment conditions the clocks suppose to be at for correct time measurements. Since the effect of the gravity, electromagnetic force, speed, temperature, pressure, humidity or any environmental condition, in general, on the mechanism of a clock is negligible for the accuracy required for our daily tasks, we tend to automatically assume that clocks display the correct time at all situations. We have forgotten the fact that a clock is an engineered device that works correctly only under given specifications just like any other measuring device.

It does not matter the kind of clock you use, the effect of gravity is always on the matter that clocks are made of, which affect the mechanism of the clocks resulting in a display-time bias. The time displayed on two perfectly synchronized clocks at the same environment will also drift apart in the long run due to the slight manufacturing differences of the clocks even when they are the clocks of the same mechanism.

Contrary to many claims, the position estimation in the Global Positioning System (GPS) has nothing to do with the Special Relativity and General Relativity. Time on a client receiver clock is Geographical Time-Zone dependent, environment dependent, daylight saving dependent, strength of battery dependent, and hardware dependent. Geographical Zone-Dependent, hardware dependent, and client dependent time cannot be used for position estimation. GPS has to avoid the use of zone-dependent, hardware dependent, and client dependent time. GPS uses four or more satellites to estimate the client time for the same reason why my wristwatch time is different from the time on a clock on the wall or the time on a clock tower in a city center on the other side of the Globe; it has nothing to do with general relativity. Further, in GPS, satellites are equipped with high accuracy clocks while the client receivers are equipped with low accuracy clocks. GPS avoids using data from low accuracy cheap client receiver clocks with zone-dependent time completely by using four or more satellites; this will provide client independent system with enhanced accuracy.

In GPS, the position and the client-time estimation is not based on even a single equation from Special Relativity or the General Relativity. There is nothing in GPS algorithms that link it in any form to Special Relativity or General Relativity. The working of GPS does not require Special Relativity or General Relativity. The design of GPS requires no knowledge of either the Special Relativity or the General Relativity. GPS uses four satellites to estimate the time and the location information in order to eliminate the bias of the mechanism clocks due to different operating environments, different time-zones, different day-light savings, different battery strengths, as well as the physical differences in the clocks themselves. Any service provider must provide a service that is client independent and time-zone independent; GPS is no exception. GPS avoids using client data for achieving full client independence and time-zone independence. GPS avoids the use of client data for the same reason why IKEA avoids the use of customers' screwdrivers. We will consider this in much more detail in a separate section.

## C. Time and Velocity:

Time is independent of the observer's frame of reference [3]. Since a moving frame contracts in all direction, a clock in a moving frame also contracts. It is this contraction of a clock in moving frame that affects the mechanism of the clock resulting in a time

bias. When an atom contracts, the electrostatic forces acting on electrons are no longer the same.

Time is a definition we have made using some periodic changes of nature. Clock is a mechanism that displays human definition of time. It is the mechanism of the clock that is affected by the gravity as well as the speed, not the time itself. This effect of the gravity and the speed on the mechanism of the clock is reflected on the display of the clock.

If the time is relative and depends on the observer's frame of reference, then, the time will be directional since the movement observer's frame is directional. Time cannot be directional and hence time must be independent of the observer's frame of reference. In addition, if the time is relative, time will not be unique. Time must be unique and non-directional. Time is not relative [3, 4].

In Special Relativity, the dimension of the moving object perpendicular to the direction of the motion was forced to remain unchanged or fixed. Special relativity disregarded the fact that the moving object contracts in all directions. It is this mistake of making the dimension of the moving object perpendicular to the direction of motion to be unchanged or fixed that necessitated the time to be relative.

Propagation of light is not relative [3]. As a result, time is not relative. The relative time in Special Relativity is a result of a conceptual error. Time is absolute. The dimension of a moving object is relative. A moving object contracts in all directions resulting in volume contraction. The mass is independent of the speed. Mass is absolute. It is the mass density of an object that varies with the speed of the object due to the change of volume with the speed [3, 4]. It is this increase in the mass density of an object with the speed of an object that results in a transient black-hole as an object reaches the speed of light. As the speed of an object reaches the speed of light mass density approaches infinity while the mass remains the same.

> As far as universe is concerned, time does not exist. Time is a human definition. Time is the moment, not a dimension.

> Time must be unique. If time is relative, time will not be unique. Time is absolute, not relative. It is the mechanism of a clock that is affected by the gravity as well as the speed of the clock, temperature, pressure, and the strength of the battery, which is indicated on the display.

> Time can be a dimension only in your notebook or in your mind, not in the nature. Nature has no time. Although the concept of time is natural for human, it is an alien concept for the nature.

## X. **MASS VARIATION OF PLANETS**

Contrary to popular belief, the mass of a planet is not constant or time-invariant. Mass of a planet fluctuates. Mass of the earth is time-varying due to natural causes as well as manmade causes. Mass of the orbiting center or the sun in our solar system is not a constant or time-invariant. Mass of the sun is decreasing with time due to radiation loss as well as particle emission in solar wind. In fact, the sun is losing mass in millions of tons is in every second. Every planet has its dominant causes for mass loss. As far as the earth is concerned, earth is losing mass, and there are many causes for the mass loss on earth; predominant are the manmade causes:

1) Every time, when a rocket or a space craft leaves the earth into the outer space, the earth is subjected to a permanent mass loss. In fact, the depletion of the mass of the earth due to the departure of a rocket is not limited to the mass of the rocket itself. When a rocket reaches the escape velocity, it is not the rocket itself that reaches the escape velocity; a large column of air that surrounds the rocket also reaches the escape velocity. As a rocket leaves the earth's gravitation, it also opens up a faucet of air that exceeds the escape velocity resulting in a continuous mass loss of the earth. The escape of the air mass out of the earth's gravitational hold continues for some time even after the rocket has long been gone. The mass loss due to the escape of the air mass will be more significant than the mass loss due to the departure of the rocket itself. This mass loss of the earth is manmade and it is permanent.

The cost of the space exploration is not the financial cost itself. In the process of space exploration, we send spacecrafts into outer space as well as into other planets away from the earth's gravity. This result in the reduction of the mass of the earth irrecoverably, permanently. We know that the mass loss leads to the contraction of the earth's orbit resulting in Global Warming. Despite the NASA's good intentions and the significant scientific contributions for the advancement of the humanity, NASA is slowly, but surely making the planet earth un-inhabitable un-intentionally. What is the purpose of scientific progress, if the means used for achieving that scientific progress could destroy the very ability of the planet to sustain the life and hence the scientific progress itself? If we aware the permanent negative consequences of sending a rocket into outer space, we may approach the space exploration differently, mainly through remote sensing most of the time and sending spacecrafts only when it is absolutely necessary, not as a mean to display one nation's technological superiority over another irresponsibly. The unavoidable fact is that the mass loss reduces the radial distance to the sun resulting in global warming.

2) Everywhere we turn, we hear the idea about

sending people to colonize another planet, especially Mars. There are even talks about a need to colonize some other planets to sustain the human existence if in case earth becomes uninhabitable. Some organizations even have started recruiting people for a one way trip to Mars, although its real intention is simply to create a reality TV series; an insidious business venture. If you are a misguided and blind-sighted preacher of human colonization of another planet, take note that, more the materials we export to other planets from our planet, more un-inhabitable the earth become due to the orbit contraction. It is not like exporting goods to another country. When we are exporting material to another planet, the earth loses its mass permanently. As the earth loses its mass, the earth undergoes orbit contraction. The contraction of the earth's orbit means the reduction of the radial distance to the sun, which in effect, lowers the earth's temperature bringing Global Warming. More the materials are exported from the earth, the more the orbit contraction. Since the mass of the earth is significantly large, one may tend to disregard the loss of the mass of a rocket and its associated mass loss due to the loss of a column of air in close proximity to the rocket, and even a cargo to Mars, as insignificant. So is the tilt of the earth, insignificant, yet its effect on the planet is not so insignificant. We feel its effect every year very harshly. What we are concerned here is the continued mass depletion. The accumulated mass loss over time is significant and the mass loss is permanent. The consequences of mass depletion of the earth are not insignificant as the effect of the tilt of the earth is not insignificant. The damage done to the health of the planet as a result of mass degradation is permanent; irreversible if the mass loss continues beyond a critical limit leading to an open-loop system.

3) Continuous, massive consumption (dig-out and burn) of fossil fuel or hydrocarbon, whether it is in liquid, gas, or solid form is associated with radiation energy loss contributing to mass loss. This mass loss is continuous and results in gradual orbit contraction. Since it is a gradual mass loss, its consequences are gradual and hence not noticeable for our short life span. When an effect of something is not directly noticeable, its effect becomes debatable leaving it to continue unabated until the point of no return is reached; at that point the damage is done, and nothing can remedy the damage; we will not be here to see or feel it's effect. At the point of no return, the earth is unable to sustain life. The earth can only support life when the earth mass is such the earth's orbit is within a very narrow Goldilocks zone.

4) Mass is lost due to radioactive decay. Accumulated mass loss due to natural causes such as radio-active decay is quite significant in the long run.

5) Although the most abandon element in the universe is hydrogen, the earth's atmosphere contains no hydrogen as an independent element in its natural form as a gas. This is because the earth's gravity is insufficient to hold on to lighter elements such as hydrogen in its natural form as a gas. Any hydrogen we release into the atmosphere will be lost resulting in a mass loss. Hydrogen fuel cells may not be environmentally friendly since the unintentional leakage of hydrogen into the atmosphere in the process is unavoidable.

6) The earth has a distinct advantage in maintaining the mass of the planet over the rest of the planet in our solar system due to its inherent ability to generate mass. The bio-mass on earth can generate mass. The destruction of the forest, in effect, has significantly reduced this extraordinary capability of the earth. We have treated the forest as an unlimited resource that is there for our taking without any negative consequences. When we cut down a tree, we don't consider it as an act of destroying a part of earth's ability to generate mass. We created an industry, the logging industry, where the sole purpose of it is to bring down maximum number of trees in minimum time, at minimum cost; nothing else is mattered as far as the logging industry and the economy is concerned. One time, we mowed down trees and dump them into the rivers, using the rivers as a transportation medium for trees, only to collect whatever that was brought down by the stream; the rest was left to rot in the river bed. A heartless destruction in the blind, the so called progress at any cost as long as it is not a financial cost at the moment to our patch of land within our picket fence with a guard post. When we have exhausted the trees in our patch of land, we invaded other distant land and continue the process of clearing the forest with no regards to the consequences. Any opposition to our actions was immediately dealt with our guns and enslaving the occupants; slavery, a disgraceful act by so-called advanced people.

The loss of the forest, in effect, reduced the earth's immunity in maintaining its healthy-self. With the lost of forest in such a short time, the earth lost its ability to regenerate a significant mass. In addition, the mono-crop culture we are surrounded by is hazardous for the health of human as well as the planet. The mono-crop culture provides a short term economic advantage at the expense of the long term sustenance towards irreversible destruction. We continue to on the destructive path using the claim that 'there are more than six billions to feed' as an excuse. We are blind to the fact that more than half the population in the world is starving not because of the lack of the food. Insincerity of the claim is quite transparent; hidden intensions are obvious. It is still not too late to rejuvenate the bio-mass so that the earth can maintain its ability to sustain life, sustain its own health, sustains its own echo system, sustain the life on earth.

**Mass Decrease of the Sun:**

Mass of the sun is not a constant. The decrease of the mass of the sun is continuous. Sun loses millions of tons of mass every second. Particles on the sun are at high energy and as a result mass loss is natural. There are many causes for the mass loss:

1. Mass loss due to radiation.
2. Mass loss due to atomic fusion. When lighter elements are fuse together at extreme temperature and pressure forming heavy elements, mass is lost and energy is released. It is this mass loss of the sun keeps us warm here on earth. If sun's mass is not lost continuously, we wouldn't be here.
3. When hydrogen atoms are fused together in the sun at high temperature and pressure forming helium, neutrinos are released. Since the gravitational force of the sun is insufficient to hold on to the extra-light neutrinos, neutrinos are released in massive quantities in every direction continuously at every second resulting in a significant mass loss.
4. Mass loss due to solar winds. Solar winds blows out high energy particles from the surface of the sun resulting a mass loss. The effect of the blown away particles is observable on earth at Polar Regions when the highly charged particles from the sun interact with the earth's intense magnetic flux at Polar Regions creating northern light or aurora borealis as well as southern light or aurora austral. We observe it as northern or southern light, which are quite entertaining natural light shows.
5. Since the sun is at high energy state, any collision with an object can result in a breakaway of a portion that is more massive than mass of the object it collided with resulting in a mass loss.

> In space exploration, the mass loss due to the escape of the air mass will be more significant than the mass loss due to the departure of the rocket itself.

## XI. GALAXIES ARE ORBITING SYSTEMS

The local galactic clusters are orbiting systems. The galaxies in a local galactic cluster orbit a central galaxy [4]. As in the case of an orbiting planetary system, the change of the radial distance of an orbiting galaxy is determined by the change of the mass of the central galaxy M, the mass of the galaxy m and the change of the gravitational parameter G given by,

$$\frac{dr}{dt} = Hr$$

$$\frac{dr}{dt}\frac{dr}{dt} = H_a\, r$$

where, r is the radial distance and,

$H = 2\frac{d}{dt}(\ln m) + \frac{d}{dt}(\ln M) + \frac{d}{dt}(\ln G)$,

$H_a = H^2 + [2\frac{d}{dt}\frac{d}{dt}(\ln m) + \frac{d}{dt}\frac{d}{dt}(\ln M) + \frac{d}{dt}\frac{d}{dt}(\ln G)]$

$H_a \approx [2\frac{1}{m}\frac{d}{dt}\frac{d}{dt}(m) + \frac{1}{M}\frac{d}{dt}\frac{d}{dt}(M) + \frac{1}{G}\frac{d}{dt}\frac{d}{dt}(G)]$

When H is a constant, then, $H_a = H^2$ and hence the accelerated orbit dilation when H is a constant is given by,

$$\frac{dr}{dt} = Hr$$

$$\frac{dr}{dt}\frac{dr}{dt} = H^2\, r$$

where, $H = 2\frac{d}{dt}(\ln m) + \frac{d}{dt}(\ln M) + \frac{d}{dt}(\ln G)$,

$\frac{d}{dt}(\ln m) =$ constant, $\frac{d}{dt}(\ln M) =$ constant, and $\frac{d}{dt}(\ln G) =$ constant.

This is indeed a special case, which is similar to the Hubble's observations.

The Eccentricity Vector **e** of the galactic orbit of a galaxy orbiting at velocity **v** is given by,

$$\mathbf{e} = -\frac{1}{GM}\boldsymbol{\ell}\times\mathbf{v} - \nabla r,$$

The elliptical galactic orbit under time-invariant mass is given by,

$$\mathbf{e}\cdot\mathbf{r} = R - r \text{ (Vector form)}$$
$$r(1 + e\cos\varphi) = R \text{ [polar coordinates]}$$
$$[(x+ea)/a]^2 + [y/b]^2 = 1 \text{ [Cartesian (x,y) coordinates]}$$

where, $a = R/(1-e^2)$, $b^2 = (1-e^2)a^2$, or $b^2 = aR$,

and $R = \frac{1}{GM}\ell^2$, $\boldsymbol{\ell} = \mathbf{r}\times\mathbf{v}$, $\mathbf{v} = \frac{\partial\mathbf{r}}{\partial t}$, and **r** is the position vector.

It is the gravity that holds the orbiting local galactic cluster together to a central galaxy, which is the orbiting center. Expansion or contraction of space cannot change the position of galaxies in a local galactic cluster as it is the case for orbiting planetary systems. Expansion of contraction of space or universe expansion cannot generate a radial movement of galaxies. Universe expansion cannot move galaxies that are held in orbits by gravitational forces. It is only the change of the parameters of the galactic orbiting system that can generate a radial movement of galaxies. The change of galactic mass m and the change of the galactic orbital center mass M can generate radial movements of galaxies. Any change of the gravitational parameter G can also generate radial movements of galaxies. Galactic orbiting systems also undergo precession as the precession of the planetary orbiting systems.

It is incorrect to attribute the radial movement of the galaxies to an expansion of universe. Expansion or contraction of universe, or in other words the expansion or contraction of space, cannot move objects in space. The objects in space are bounded by the orbiting gravitational systems. The position of any object in space is not determined by the space, it is determined by the gravity and the momentum. The galactic red-shift is due to propagation electromagnetic energy loss. The increasing galactic red-shift we observe is a result of orbit dilation due to the increase of the galactic mass. The decreasing galactic red-shift is a result of orbit contraction due to the decrease of galactic mass. Galactic red-shift cannot be attributed to a universe expansion. Universe is not expanding.

A group of local galactic cluster also forms a super galactic orbiting system. All the local galactic clusters

in the super galactic cluster orbit a central cluster, which is the orbiting center.

**Increasing/Decreasing Galactic Red-Shift and Galactic Orbital Motion Relative to Us:**

Since the galaxies are moving on their own orbits, the orbital motion of galaxies relative to us also results in an increased red-shift when the galaxies are moving away from us. Similarly, when the orbital motion of galaxies relative to us is such they are moving toward us, the effect will be a decreasing red-shift. As a result, the increasing or decreasing distances of the stars or galaxies relative to us may also be a result of the natural star/galactic orbital motion relative to us. Although stars/galaxies are having natural orbital motion around their orbital center as they always do, relative to us, we see them either as moving away from us or toward us. So, if the mass of an orbiting stars/galactic system remain time-invariant, the increasing or decreasing red-shift has nothing to do with a hypothetical universe expansion; the increasing or decreasing galactic red-shift is simply a result of the natural galactic orbital motion relative to us on earth.

Since the masses of an orbiting stars/galactic system are not time-invariant, the increasing or decreasing red-shift relative to us is partly due to the changing mass of the orbiting system and partly due to the natural orbital motion around the orbital center relative to us. Stars/galaxies orbit around their own orbit center as they always do periodically, but we see them as moving away or toward us relative to us resulting in an increasing or decreasing red-shift.

Any observed increasing or decreasing galactic red-shift relative to an observer on earth as a result of the natural orbital motion of galaxies around the orbiting center is also proportional to the distances to the galaxies relative to the observer provided that the galaxy where the observer is on is at or near the orbit center. As we have seen, the increasing or decreasing galactic red-shifts due to the changing masses of the galaxies are also proportional to the radial distances of the galaxies relative to the orbit center. The observed increasing or decreasing galactic red-shifts of the orbiting galaxies from the Milky Way galaxy we are in is also proportional to the radial distances to the nearby galaxies within the local galactic cluster relative to us, the observers. As a result, the Milky Way galaxy we are in must be at or near the galactic orbiting center of a local galactic cluster where the rest of the galaxies in the local cluster are orbiting.

## XII. ELECTROMAGNETIC FREQUENCY FADING (RED-SHIFT)

The amplitude of an electromagnetic wave burst determines its strength or power and vice versa. The frequency of an electromagnetic wave burst determines the electromagnetic energy of the burst and vice versa. As a light burst propagates, it loses its amplitude or strength due to attenuation. As light travels further and further, the strength or the amplitude of a light burst will fade away. In addition, as light propagates, it also loses electromagnetic energy along the path. The frequency of a light burst is the electromagnetic energy of the burst, E=hf, where E is the electromagnetic energy of the light burst, f is the frequency and h is the Plank constant. Electromagnetic energy has nothing to do with the magnitude of the electric field and vice versa. The Plank constant has nothing to do with the magnitude of an electromagnetic field and vice versa.

As a light burst loses electromagnetic energy along the path, the frequency of the burst fades away with distance. This frequency fading due to path electromagnetic energy loss is also known as red-shift.

The power of an electromagnetic wave burst and the electromagnetic energy are two distinct entities; they are not the same. As light travels further and further, the power loss along the path due to attenuation gradually makes the light burst itself to fade away with distance. On the other hand, the electromagnetic energy loss along the path makes the frequency of the wave burst to fade away with distance. As a result, as light travels further and further, we end up having weak low frequency wave burst that may not be even within the visible region of the spectrum. If a light burst travels a long distance, many billions of light years, the wave burst we receive will no longer be in the visible region; it will be below visible region of the spectrum or in the microwave band; this is what is referred to as the microwave background. The power or strength fading of a light burst with distance due to the attenuation of the medium determine how far into the distance frequency fading light burst is carried away.

The frequency fading, down-shift or red-shift can be attributed to Doppler's effect only when light travels for short distances, where the electromagnetic propagation energy loss is negligible. The Doppler's effect cannot be applied to the red-shift of light from distance galaxies where the electromagnetic propagation loss is dominant. In the presence of path electromagnetic energy loss, it is the INCREASING or DECREASING red-shift that corresponds to the Doppler's effect, not the red-shift itself. When we are considering lights from distance galaxies that travel billions of light years before they reach us, it is the propagation electromagnetic energy loss that causes frequency down shift or red-shift. This is the reason why light from stars from the distance appears red to us when we look at distant stars.

Let us consider and electromagnetic wave burst [4],

$$\exp\left(j\frac{ne}{\hbar}\right), n=1,2,3, \ldots.$$

where, e is the electromagnetic energy quantum, n is an integer, $\hbar=h/2\pi$, and h is the Plank constant.
The electromagnetic energy of the wave burst is 'ne' and the frequency of the wave burst is $f_n=ne/h$.

Assume that this wave burst of light wave of electromagnetic energy 'ne' travels r distance of light years and encounters a propagation electromagnetic energy loss of 'me', where m≤n, and m is an integer.

After travelling r distance of light years encountering electromagnetic energy loss of 'me', what is left at the end is a burst of electromagnetic energy (n-m)e,

$$\exp(j\frac{(n-m)e}{h}), n=1,2,3, ...., \text{ where } n≥m.$$

If the lowest frequency of the visible region is $f_L$, then, the light burst will be out of the visible frequency region after traveling r distance light years, if,

$$\frac{(n-m)e}{h}≤f_L.$$

Now, the electromagnetic light wave that travelled r distance of light years is below the visible region and it is in the microwave region. As it travels further and further, the electromagnetic wave burst is subjected to even further energy losses resulting in further frequency shift even below the microwave band. The idea that the microwave background is some remnants from a hypothetical big-bang is simply preposterous. Even more bizarre is the wide spread use of the microwave background to claim that the universe is a result of a hypothetical big-bang (big-nonsense).

So, the microwave background is the frequency shifted light from the stars in the distant galaxies. These frequency shifted light carries the same information as that of a light burst in the visible region of the spectrum. We can obtain the information about the stars and the galaxies beyond our visible region by using the electromagnetic energy in the microwave band and even in the radio frequency bands below.

The maximum distance light can travel before being frequency down-shifted below the visible region is the range of our visible universe. The visible universe varies from place to place, planet to planet, person to person. The visible universe is a moving 3D horizon. One person's visible universe is the microwave background for somebody somewhere else at a very far in to the distant. If we send a light burst, someone at very far into the distance will receive it in below the visible region in infra red, microwave or even in the radio frequency band depending on the distance. When we look into the distance, what we see is not our own past, but our distant neighbors. We cannot see our own past. We can only see somebody else's past.

> It is the INCREASING or DECREASING red-shift that corresponds to the Doppler's effect, not the red-shift itself.

> We cannot see our own past. We can only see somebody else's past.

**Definition:** Microwave Background

The light from distance sources that are being frequency down-shifted below the visible region of the electromagnetic frequency spectrum due to the electromagnetic propagation energy loss resulted from travelling a large distance is the microwave background. It is not some remnant from a mysterious hypothetical big-bang; there was never a big-bang.

**Definition:** Visible Universe

The visible universe is the maximum distance light can travel before being frequency down-shifted below the visible region of the electromagnetic spectrum. It is an observer dependent moving 3D-horizon.

## XIII. NO UNIVERSAL CONSTANTS

There are no universal constants. There are parameters that we consider to be constants due to their apparent unchanging nature during our life span. No system is going to collapse due to the change of so-called universal constants. No physical system such as universe itself could be in a precarious position that its very stability and existence is determined by the exact values of few constants. What we consider constants are not constants for the nature itself. Natural systems are robust. A change of one parameter in the universe that we consider to be a constant will be compensated for by adjustment of other parameters in the system. The physical systems adjust adaptively to the changes of the parameters.

There cannot be fixed orbits when the masses of planets and the mass of the sun are time-varying. Planetary orbits must have natural ability to adjust to the changing masses of the planets and the sun; it is done by the radial distance adjustment as we have seen before.

**Axiom:** Fundamental Universal Parameter

A fundamental universal parameter is a parameter that does not depend on the other parameters. A fundamental universal parameter is not a function of other parameters.

*A.* **Speed of Light is Not a Fundamental Universal Parameter**

The speed of light in free space is not a fundamental universal constant. Speed of light is not a fundamental universal parameter either, since the speed of light is a function of other space parameters. The speed of light depends on the permittivity ε and the permeability μ of the medium or the free space in the absence of a medium,

$$c=1/(\epsilon\mu)^{1/2} \tag{13.1.1}$$
$$\text{or } c^2=1/(\epsilon\mu) \tag{13.1.2}$$

where ε is the permittivity, μ is the permeability, and c is the speed of light.

Taking the logarithm of eqn. (13.1.2), we have,

$$2 \ln c=-[\ln \epsilon + \ln \mu] \tag{13.1.3}$$

Differentiating with respect to time t, we have,

$$\frac{2}{c}\frac{dc}{dt}= -[\frac{1}{\epsilon}\frac{d\epsilon}{dt}+\frac{1}{\mu}\frac{d\mu}{dt}] \tag{13.1.4}$$

$$\frac{dc}{c} = -\frac{1}{2}[\frac{d\varepsilon}{\varepsilon} + \frac{d\mu}{\mu}] \qquad (13.1.5)$$

We can also write this as,

$$\frac{dc}{dt} = H_{em}c \qquad (13.1.6)$$

$$H_{em} = -\frac{1}{2}[\frac{d}{dt}(\ln \varepsilon) + \frac{d}{dt}(\ln \mu)]. \qquad (13.1.7)$$

The speed of light in the free space or in any medium can only be considered a constant as long as the permittivity $\varepsilon$ and the permeability $\mu$ are constants.

Any change of the permittivity $\varepsilon$ or permeability $\mu$ or both will result in the change of the speed of light. On the other hand, there is no free space or perfect vacuum in space since the gravity is Omni-present. The permittivity $\varepsilon$ and the permeability $\mu$ depend on the density of matter in space. As a result, the speed of light in space is never a constant.

The speed of light is not a fundamental universal parameter since the speed of light is a function of other space or medium parameters. Any parameter that is a function of any other parameter is not a fundamental universal parameter. Light is not relative [3,4]. The propagation of light does not depend on the observer's frame of reference. The direction that the light propagates is independent of the observer's frame of reference. Speed of light is independent of the observer's frame of reference. The speed of the light is solely determined by the electromagnetic properties of the medium or the density of the medium. The direction of light is solely determined by the density gradient of the medium.

The speed of light is independent of any observer. The direction of light is independent of any observer. Light is not relative. Light cannot determine by itself where it wants to go or at what speed it should go; they are determined by the medium for light to follow. In the very essence, the light is a humble follower, a slave, not a supreme authority. When it comes to electromagnetic waves or light, it is the medium that is in charge. Passive observer has no influence on light. An observer can influence the speed and the direction of light only by altering the electromagnetic properties of the medium.

> Speed and the direction of light are determined by the electromagnetic properties of the medium, not an observer's frame of reference.

> Light cannot be relative since the speed as well as the direction of light are determined by the electromagnetic properties of the medium, or the space.

> Speed of light is NOT a Fundamental Universal Parameter.

*B.* **Gravity does not Bend Light**

The closer it is to a gravitational object the higher is the density of matter. A gravitational object generates a density gradient in a medium. Higher the mass of a gravitational object, higher is the density and the density gradient of the medium. The density and the density gradient of the medium will be higher closer to a gravitational object. As a result, the light is diffracted near a gravitational object. There is no light diffraction near a gravitational object if the space surrounding the gravitational object is a perfect vacuum. This diffraction of light due to the presence of medium density gradient near a gravitational object had been incorrectly interpreted to make the false claim that the "gravity bends light". No, gravity does not bend light. It is always the density gradient in the medium that bends light. Gravity has no effect on light at all in the absence of a medium, in a vacuum.

It does not matter how extreme the gravity is near a Black Hole, a Black Holes cannot prevent light from leaving since gravity has no effect on light. It is the total reflection due to high medium density in a black hole that prevents light from leaving a black hole.

Gravity is present only in the presence of a mass. It is only a mass that exerts gravity. It is only a mass that is affected by gravity. Light has no mass. Electromagnetic energy has no mass. Only the mechanical energy is associated with a mass. Electromagnetic energy and mechanical energy are not the same. Gravity exerts an influence on light only by altering the density gradient of the medium.

**Corollary:**

Gravity does not bend light. It is the medium density gradient created by a gravitational object that bends light. Even at a black hole where the gravity is strongest, gravity has no effect on light in the absence of a medium or in a perfect vacuum.

**Property:**

It does not matter how strong gravity is, gravity has no direct influence on light even in a black hole. It is the total reflection of light due to very high density in a black hole that prevents light from leaving a black hole.

> There is no light diffraction near a gravitational object if the space surrounding the gravitational object is a perfect vacuum.

> Light does not feel gravity. Gravity generates a density gradient in the presence of a medium. Medium Density decides the speed of light. Density Gradient of a medium dictates the path of light. Gravity has no effect on light in a vacuum.

> Gravity cannot bend light even at a black hole in the absence of a medium.

*C.* **Orbiting Systems do not Collapse Due to Change of the Gravitational Parameter** G

It is not necessary for the gravitational parameter G to be a constant. Any change in the gravitational

parameter G is not going to collapse an orbiting system. If the gravitational parameter G changes, then, the orbit distance will vary in accordance. In the case of planetary motion, we have already seen how the radial distance is adjusted automatically with the changes of the gravitational parameter G, the mass of the orbiting planet m, and the mass of the orbiting center M,

$$\frac{dr}{dt}=Hr \qquad (13.3.1)$$

$$\frac{dr}{dt}\frac{dr}{dt}= H_a\, r \qquad (13.3.2)$$

where, $H=2\frac{d}{dt}(\ln m)+\frac{d}{dt}(\ln M)+\frac{d}{dt}(\ln G)$,

$H_a =H^2 + [2\frac{d}{dt}\frac{d}{dt}(\ln m)+\frac{d}{dt}\frac{d}{dt}(\ln M)+ \frac{d}{dt}\frac{d}{dt}(\ln G)]$

$H_a \approx [2\frac{1}{m}\frac{d}{dt}\frac{d}{dt}(m)+\frac{1}{M}\frac{d}{dt}\frac{d}{dt}(M)+ \frac{1}{G}\frac{d}{dt}\frac{d}{dt}(G)]$

m=the mass of the orbiting planet, M=the mass of the orbiting center, G=the gravitational parameter, r=radial distance to the planet.

### D. Atoms Do Not Collapse Due to the Change of the Coulomb Parameter k

Coulomb parameter k is not necessary to be a constant. Coulomb parameter k is not a fundamental universal parameter either, since it is a function of another space parameter. The Coulomb parameter k is given by,

$$k =1/4\pi\varepsilon \qquad (13.4.1)$$

where, $\varepsilon$ is the permittivity.
Differentiating k with respect to time t, we get,

$$\frac{1}{k}\frac{dk}{dt}= -\frac{1}{\varepsilon}\frac{d\varepsilon}{dt} \qquad (13.4.2)$$

$$\frac{dk}{k}= -\frac{d\varepsilon}{\varepsilon} \qquad (13.4.3)$$

$$\frac{dk}{dt}=H_c k \qquad (13.4.4)$$

$$H_c= -\frac{d}{dt}(\ln \varepsilon). \qquad (13.4.5)$$

Any change of the permittivity $\varepsilon$ result in the change of the Coulomb parameter k as given in equations (13.4.4) and (13.4.5).

An atom is not going to collapse [2] due to the change of the coulomb parameter k. If the Coulomb parameter k changes, then, the orbital distance of an electron will change accordingly.

In the case of an electron orbiting an atom, we have,

$$kQq/r^2=mv^2/r \qquad (13.4.6)$$

where k is the Coulomb parameter, Q is the positive charge of the nucleus, q is the negative charge of the orbiting electron, m is the mass of the electron, v is the speed of the electron on circular orbit with radial distance r.
Under the assumption that Q, q and m are constants, we have,

$$rv^2/k=constant \qquad (13.4.7)$$

Differentiating eqn. (13.4.7) with respect to time t, we have,

$$\frac{1}{r}\frac{dr}{dt} = \frac{1}{k}\frac{dk}{dt} -2\frac{1}{v}\frac{dv}{dt} \qquad (13.4.8)$$

$$\frac{dr}{r} = \frac{dk}{k} -2\frac{dv}{v} \qquad (13.4.9)$$

We can also write this as,

$$\frac{dr}{dt}=H_e r \qquad (13.4.10)$$

$$H_e= \frac{d}{dt}(\ln k) -2\frac{d}{dt}(\ln v). \qquad (13.4.11)$$

Any change in the Coulomb parameter k and the circular speed v in an atom are compensated for by the radial distance adjustment. An atomic structure does not collapse due to the changes of the orbiting parameters of an atom.

If the Coulomb parameter k is assumed to be a constant, then we have,

$$\frac{dr}{dt}=H_e r$$

$$H_e= -2\frac{d}{dt}(\ln v).$$

Any change in the orbiting speed is compensated for by adaptive adjustment of the radial distance. Any increase in the orbiting speed is compensated for by orbit contraction while the decreasing speed is compensated for by orbit dilation. Any change in orbiting speed of an electron in an atom does not lead to the collapse of the atom.

> Change in the parameters of an atom, such as speed of electrons and the Coulomb parameter, does not lead to the collapse of an atom.

The natural systems are robust to the changes of the parameters of the systems. No parameter of a system is a universal constant. There are no universal constants. Any parameter that is a function of any other parameter is not a fundamental universal parameter. Since there is no matter-free space or an absolute vacuum, the permittivity is never a constant. As a result the Coulomb parameter is never a constant in space.

### Topology of an Atom:

Orbiting electrons on circular orbits in an atom do not radiate [2]. Therefore, atoms with electrons on circular orbits are stable. The orbiting dynamics of an electron in an atom is given by,

$$m\frac{\partial}{\partial t}\frac{\partial}{\partial t}\mathbf{r}+ (kQq/r^3)\mathbf{r}=\mathbf{0} \qquad (13.4.12)$$

where, m is the mass of the electron, $\mathbf{r}$ is the radial position vector of the electron, k is the Coulomb parameter, Q is the electric charge of the nucleus, and q is the electric charge of the electron.
If the velocity of the electron on the orbit at time t is $\mathbf{v}$, then, the Rotation vector or the normalized angular momentum $\boldsymbol{\ell}$ is given by,

$$\boldsymbol{\ell}=\mathbf{r}\times\mathbf{v} \qquad (13.4.13)$$

Differentiating $\boldsymbol{\ell}$ with respect to time t, we get,

$$\frac{d\boldsymbol{\ell}}{dt}=\frac{d\mathbf{r}}{dt}\times\mathbf{v} + \mathbf{r}\times\frac{d\mathbf{v}}{dt} \qquad (13.4.14)$$

Since $\frac{d\mathbf{r}}{dt}=\mathbf{v}$, substituting for $\frac{d\mathbf{v}}{dt}$ in equation (13.4.14) from electron orbit dynamics given in equation (13.4.12), we get,

$$\frac{d\boldsymbol{\ell}}{dt}=\mathbf{v}\times\mathbf{v}+(-kQq/mr^3)\mathbf{r}\times\mathbf{r} \qquad (13.4.15)$$

Since $\mathbf{v}\times\mathbf{v}=\mathbf{0}$ and $\mathbf{r}\times\mathbf{r}=\mathbf{0}$, we have,

$$\frac{d\boldsymbol{\ell}}{dt}=\mathbf{0} \qquad (13.4.16)$$

The angular momentum of an orbiting electron is time invariant. As it is in the case of planetary orbits, the direct consequence of time invariant Rotation Vector is that the electron orbits are planar. All the electrons orbiting the nucleus remain on a plane. However, unlike the planetary orbit where planets can take elliptical as well as circular orbits, electron-orbits in an atom are circular. Electrons on elliptical orbits are unstable since the electrons orbiting on elliptical orbits result in radiation loss.

Contrary to the popular belief, atoms are not spherical. Atoms take the shape of circular disks. Electrons in an atom are not on spherical shells. All the electrons in an atom are on circular orbits that lie on a single plane. An atom is not spherical as a direct consequence of the time-invariance of the Rotation Vector of an orbiting electron under an electrical potential that is proportional to the inverse distance as it is in the case of gravitational potential in a planetary system. An atom is a circular disk of thickness equivalent to the diameter of the nucleus. The radius of the atomic disk is equivalent to the radius of the outer most electron orbit. As a result, the minimum thickness a sheet of material achieves is equivalent to the diameter of the nucleus of that material.

**Corollary:**

Electrons orbit the nucleus on circular orbits. Electrons on circular orbits are radiation free and hence stable. Electron orbits in an atom are planar just like planetary orbits in a planetary system.

**Corollary:**

Atoms are not spherical. Atoms are circular disks of thickness of the nucleus and the radius of the outermost electron orbit.

> Atoms are NOT Spherical.
> They take the form of Circular Disks.

### E. The Path of Light

Light does not take the minimum distance path. Light has no ability to determine its own path. Light has no freedom to go wherever it wants to go. As we have seen, the light does not have freedom to determine the speed it wants to travel either. The direction of light is determined by the density gradient of the medium. The medium determines the speed for light. Light has to follow the gradient of the permittivity and permeability of the medium or space.

Light follows a straight line, which also happens to be the shortest path, only when the permittivity and the permeability of the medium or the space are constant, or in other words, when the medium density is a constant. The concept of hypothetical space-time in General Relativity collapses on this point alone since the General Relativity forces the light to follow the space-time curvature, which light is never be able to comply in reality if the speed of light to be a constant.

Light cannot take a non-linear path at constant speed. For the speed of light to be a constant, light must take a straight path.

The speed of light c is related to the permittivity $\varepsilon$ and the permeability $\mu$ by the relationship,

$$c = 1/(\varepsilon\mu)^{1/2} \tag{13.5.1}$$

By taking logarithm, we have,

$$2\ln c = -[\ln \varepsilon + \ln \mu] \tag{13.5.2}$$

The spatial gradient is given by,

$$\frac{1}{c}\nabla c = -\frac{1}{2}[\frac{1}{\varepsilon}\nabla\varepsilon + \frac{1}{\mu}\nabla\mu] \tag{13.5.3}$$

$$\nabla = (\frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial}{\partial z}). \tag{13.5.4}$$

The gradient $\nabla c$ is a function of the gradient of the permittivity $\nabla\varepsilon$ and the gradient of the permeability $\nabla\mu$ given by the relationship,

$$\nabla c = -\frac{1}{2}c[\frac{1}{\varepsilon}\nabla\varepsilon + \frac{1}{\mu}\nabla\mu] \tag{13.5.5}$$

Now we have,

$$\nabla c = H_{sL}c$$

where, $H_{sL} = -\frac{1}{2}[\nabla(\ln \varepsilon) + \nabla(\ln \mu)]$.

When $\nabla\varepsilon = 0$ and $\nabla\mu = 0$, we have,

$$\nabla c = 0 \tag{13.5.6}$$

Hence, light follows a straight path when $\nabla\varepsilon = 0$ and $\nabla\mu = 0$ or the medium density is constant.

If there is a change in the density gradient of the medium, as it is in the case in the presence of a gravitational object, we have $\nabla\varepsilon \neq 0$ and $\nabla\mu \neq 0$, and hence $\nabla c \neq 0$. In this case, the light follows the direction $\nabla c$ given by eqn. (13.5.5). The direction of light $\nabla c$ is not determined by a hypothetical space-time curvature. The direction of light $\nabla c$ is determined by the electromagnetic properties of the medium. Electromagnetic properties of a medium at any position are determined by the density of the medium at that position.

**Lemma:**

The direction of the light is determined by the gradient $\nabla c$ given by,

$$\nabla c = -\frac{1}{2}c[\frac{1}{\varepsilon}\nabla\varepsilon + \frac{1}{\mu}\nabla\mu].$$

**Corollary:**

Light does not follow the shortest path. Light does not follow the geodesic. Light does not follow the hypothetical space-time curvature.

> Light cannot go where ever it wants to go at its will. Light does not follow the shortest path. Light follows the density gradient of the medium.

> Light does not follow the geodesic.

**Corollary:**

Light cannot be relative since the speed as well as the direction of light are solely determined by the medium. A source of light determines the direction of light only at the source, not beyond the source.

> Light cannot be relative since it is the medium that determines the speed and direction of light.
> It is the density gradient of the medium that determines the direction of light, not an observer.

> Maxwell's equations are not relative [3].

**Property:**

Time is independent of space and space is independent of time. The concept of hypothetical space dependent time or space-time exists only in the human mind, not in reality, not in the nature.

## XIV. GRAVITATIONAL WAVES (Fantasy Waves): LIGO-Bursts are due to Earthly Vibrations

The so-called mythical gravitational waves are defined as undulations of hypothetical space-time due to an accelerated motion or the collision of objects. It is a predicted outcome of General Relativity based on hypothetical space-time or the space dependent time. However, as it is shown in [3], time is not a function of space. Time is absolute. There is no space-time. In the absence of space-time, there cannot be any space-time undulations or hypothetical gravitational waves.

There are no gravitational waves as such. However, still there are many who are under the illusion that there is a space-time and hence they are trying to find ways to detect the hypothetical undulations of space-time or hypothetical gravitational waves (fantasy waves). The Laser Interferometer Gravitational Wave Observatory (LIGO) is one such effort [5, 6], billion dollar blunder.

Laser Interferometer Gravitational Wave Observatory (LIGO) is a device in a geographically massive scale that is hoping to detect gravitational wave. When space-time undulation travels, it is expected that the physical matter that come across those space-time undulations undergoes contraction and expansion. LIGO is expected to pick up those space-time undulations, which is then converted to an electromagnetic wave interference pattern using the travel time variations of a laser beam split between two perpendicular arms. The change of the distance between LIGO mirrors or LIGO-bursts are considered as an indication of the presence of gravitational wave or space-time undulations if the LIGO-Burst matches the general relativity model of the black-hole collision or an accelerating/decelerating object. In order to decrease the false detection, LIGO observatories from two or more different locations, separated by large distances, are usually obtained. When the data is taken from multiple locations, it also has the added advantage of the ability to use the time delay between the bursts from different geographical sites to determine the direction of arrival of the wave burst.

In the case of the LIGO bursts, we have to take into account both distant sources as well as nearby sources. In the case of distant sources, the wave front can be assumed to be planar. However, in the case of nearby earthly vibration sources such as seismic sources or any other vibration source, the wave front cannot be considered planar. In the event LIGO wave bursts are detected, since we do not know if the burst is due to a planar wave front from a distance source or non-planar wave front from a nearby source, we have to consider both possibilities for the detected wave burst. Let us consider the conditions LIGO burst must satisfy for planar wave front as well as non-planar waves.

### A. Planar Wave Front

The so-called gravitational waves that are purported as real are planar waves since their origin is many light years away. Assume the locations of LIGO sites are at P and Q, and the distance between P and Q is d. If the source is at O, then for planar waves, we have OP>>PQ and OQ>>PQ. Then, if the propagation direction of the wave front with the line perpendicular to the PQ, or the angle of incidence, is θ, and the speed of the wave is v, then, the time delay τ between two LIGO bursts is given by,

$$\tau = d\sin(\theta)/v \qquad (14.1)$$
$$\sin(\theta) = \tau v/d \qquad (14.2)$$

Since $\sin(\theta) \leq 1$, we have,

$$\tau v/d \leq 1 \qquad (14.3)$$

$v \leq d/\tau$

$$v \leq v_{max} \qquad (14.4)$$

where, $v_{max} = d/\tau$.

In other words, the speed of the wave front v must satisfy the relationship,

$$v \leq v_{max}. \qquad (14.5)$$

The speed $v_{max}$ can be obtained from the LIGO burst parameters and hence it is known from the observations. It is not just the hypothetical gravitational waves presumed to be travelling at the free-space speed of light, any wave travelling at speed v that satisfies the relationship $v \leq v_{max}$ can produce LIGO-Bursts with time delay τ at those LIGO-Sites P and Q.

Since the hypothetical gravitational waves are considered to be travelling at the speed of light c, v=c and hence we must have,

$$c \leq v_{max}. \qquad (14.6)$$

This condition must satisfy for LIGO-Bursts to be produced by gravitational waves at LIGO-Sites P and Q with a time delay τ. In fact, any mechanical or acoustic vibration wave that travels at speed v satisfying the condition $v < v_{max}$ can produce the LIGO-Bursts. Gravitational waves travelling at speed of light, c are not the only waves that could generate LIGO-Bursts. Any earthly vibration can produce LIGO-Bursts. The use of two LIGO sites provides a good

check against this inequality. In addition, multiple LIGO sites also help to minimize the site specific spurious signals to some extent.

> Any earthly vibration can generate LIGO-Bursts.

### a) LIGO-Burst GW150914 [6]

On September 14, 2015, LIGO announced that it had detected gravitational waves, LIGO-Burst GW150914. The wave burst appeared first at the Livingston, Louisiana detector and then 6.9 milliseconds later the burst appeared at the Hanford, Washington State LIGO site [6].

If the observed time delay between the two LIGO bursts at two sites is $\tau$=6.9 milliseconds and the distance between the two LIGO sites d=3002 km, then, from eqn. (14.4), we have,

$v_{max}$=d/$\tau$ =(3002)(10$^3$)/[(6.9)(10$^{-3}$)] =(4.35)(10$^8$) m/s

Since the speed of light c=(3)(10$^8$) m/s, we have c<$v_{max}$. So, it is possible that a planar wave travelling at speed of light c=(3)(10$^8$) m/s could create the LIGO-Burst GW150914 at the two LIGO sites with a burst delay of 6.9 milliseconds. However, gravitational waves travelling at speed of c are not the only waves that could produce the LIGO-Burst GW150914. Any earthly vibrations travelling at speed v could produce the LIGO-Burst GW150914 since all the universal as well as earthly vibrations satisfy the condition v<$v_{max}$ when PQ=3002km and $\tau$=6.9 milliseconds. Any earthly vibration from source O can be considered as planar as long as OP>>d and OQ>>d, where d=PQ. Therefore, the claim that the LIGO-Burst GW150914 is a result of gravitational waves due to a collision of Black-Holes has no validity.

However, planar waves travelling at speed v satisfying v<d/$\tau$, where OP>>d, OQ>>d, and PQ=d, from a distance source are not the only waves that could generate the LIGO bursts at sites P and Q with time delay $\tau$. Any non-planar wave from a short range source could also generate the LIGO bursts. Earthly, near-field mechanical or acoustic vibration waves could also have generated the LIGO burst GW150914 with a time delay of 6.9 milliseconds at those LIGO sites P and Q that are 3002km apart.

### b) The Angle of Arrival:

In order to obtain exact angle of arrival in 3-dimension, at least LIGO bursts from three LIGO sites are required. However, with LIGO bursts from two sites P and Q, it is possible to obtain the angle of arrival related to the line joining two LIGO sites PQ. If the angle of arrival of the LIGO wave burst to line PQ is $\varphi$, then, the exact direction could be any radial direction 2$\pi$ radians around line PQ.

We have already seen that the angle of incidence, or the angle between the propagation direction of the wave with the line perpendicular to the line joining the LIGO sites P and Q, $\theta$ is given by,

$$\sin(\theta)=\tau v/d.$$
$$\theta=\sin^{-1}(\tau v/d).$$

The direction of arrival of wave $\varphi$ is given by,
$$\varphi=(\pi/2)-\theta.$$

If $\tau$=6.9 ms and d=3002 km, v=c, where c=(3)(10$^8$) m/s, the speed of light, then, we have,

$\theta=\sin^{-1}[\{(6.9)(10^{-3})(3)(10^8)\}/\{(3002)(10^3)\}]$

$\theta=\sin^{-1}[(6.9)(3)/30.02]\approx\sin^{-1}(0.69) = 44^o$

Therefore, the angle of arrival $\varphi$ is given by, $\varphi=90^o – \theta$

$\varphi\approx90^o – 44^o =46^o$

If the so-called mythical gravitational waves travel at the speed of light, the direction of arrival of the LIGO-burst (GW150914) is at an angle of 46$^o$ to the line PQ, where PQ is the line connecting the LIGO sites P and Q. However, there is no way to determine if the LIGO bursts are due to the gravitational waves traveling at speed of light. There is no way to be certain that the Gravitational Waves are the only waves that could have generated LIGO-Bursts at LIGO sites P and Q since there are many sources of earthly vibrations that could have generated LIGO-bursts. The LIGO bursts are assumed to be Gravitational Waves without any mean to justify the assumption. Black-Holes collision model of LIGO bursts is not unique. Any far-field earthly vibration wave travelling at speed v satisfying v<PQ/$\tau$, where $\tau$ is the time delay between the LIGO-Bursts at sites P and Q, can produce LIGO-Bursts.

It is simply impossible to call the vibration of LIGO-Arms measured on earth is caused by gravitational waves from a pair of black-hole collision some billion light years away. It is even beyond fiction since the amplitude of vibrations is considered to be in the range of a minute fraction of a size of an atom. There are many other plausible earthly vibrations, which are far greater magnitude than those gravitational waves that could have generated LIGO bursts. Since the speed v of any earthly vibration satisfies v<$v_{max}$, where $v_{max}$=d/$\tau$, when d=3002km and $\tau$=6.9 milliseconds, any far-field mechanical or acoustic vibrations could have generated LIGO-Bursts.

Now, let us see how any near-field earthly vibration could produce the LIGO-Burst GW150914.

> The direction of arrival of LIGO-Burst GW150914) is 46$^o$ degrees to the line joining the Livingston and Hanford LIGO sites.

> Space-Time Undulation or Gravitational Wave Model for LIGO-Bursts is Not Unique.

### B. Non-Planar Near-Field Earthly Vibrations

If the observed LIGO bursts are due to a wave source not far from the two LIGO sights, we cannot assume the waves to be planar. In this case we have to treat it differently. Assume the LIGO bursts at LIGO sites P and Q are due to a nearby source at location O. The source could be anywhere, on the surface, above the surface, or below the surface. We want to find out the location of the source.

Now, the LIGO-Site P is at distance OP from the

source and the LIGO-Site Q is at distance OQ from the source. If the vibration wave from source O travels at speed v and reach LIGO-Site Q with a time delay of τ compared to the LIGO-Site P, then we have,

$$OQ-OP=τv.$$

Any vibration wave traveling at speed v from a source at O that satisfy OQ-OP=τv could generate LIGO-Bursts with time delay τ at LIGO-Stations P and Q.

Consider the case where two LIGO-Bursts (GW150914) were observed at LIGO stations P and Q that are situated at distance PQ=3002 km apart. The LIGO-Burst GW150914 first appeared at Livingston and then 6.9 milliseconds later Hanford LIGO-Burst appeared. The Livingston LIGO burst matches the inverted and time shifted Hanford LIGO burst by τ=6.9 milliseconds. Since PQ>>τv for any vibration wave, any near surface acoustic or mechanical source located close to the midway between the two LIGO sites P and Q could produce the observed LIGO burst GW150914 as long as the source O is located such that OQ-OP=τv,

where τ=6.9 milliseconds, v is the speed of the vibration wave.

The source or the origin of the LIGO burst GW150914 may be as simple as a blast for a house foundation or underground detonation of an unwanted warhead by the US army somewhere around the midway between the LIGO sites P and Q. Any acoustic or mechanical source O around the middle of the two LIGO sites, where OQ-OP=τv could have produced the observed LIGO-Burst GW150914.

Since the LIGO sites are located in Livingston, Louisiana and Hanford, Washington States in the USA, the source of the vibration of the LIGO burst (GW150914) must have been somewhere around Fort Collins, Cheyenne, Greely and Denver within the region spanning Colorado, Nebraska, Wyoming, and Kansas in the USA. Any on the surface, below the surface, or in the air disturbance in this area would have created the LIGO burst GW150914. Perhaps a thunderstorm, seismic activity, construction related blast or any other military related activity that might have caused in the air or underground vibrations in the vicinity of Fort Collins or Denver would have been the source of LIGO-Burst on September 14, 2015.

Most probably, it could have been an underground detonation of an unwanted warhead by the US army in that area around Denver; if that could have been the case, it would have been done in secret and there would not have been any way for LIGO researchers to count the possibility out to be absolutely sure. The magnitude of vibrations measured in LIGO are negligible to be any interest to the observers in the meteorology and seismic survey; any activity that led to the LIGO burst would not be in meteorological or geological survey records. Therefore, it is not possible to rule out such natural or manmade vibration sources simply by making inquiries to government organizations.

---

The LIGO-Burst (GW150914) is a result of a manmade or natural disturbance surrounding Fort Collins, Cheyenne, Greely, and Denver; somewhere within Colorado, Nebraska, Wyoming, and Kansas USA.

---

### C. LIGO-Model and Reality

A mathematical model representing a data set and the real physical process that generated the data are not necessarily the same. As the outcome of the LIGO observations, all we have are data bursts measured as an expansion and contraction of LIGO arms on earth. Although interior of the LIGO arms is a vacuum, the LIGO arms themselves are in a medium that is affected by earthly vibrations. There is nothing to link the LIGO-Bursts to a black-holes collision. The LIGO-Bursts could have been due to any of many physical earthly vibration processes. It could be an event that has affected both LIGO sites equally with a time delay. It could be a seismic event that affected equally at both LIGO sites. It could be a result of a meteorological effect that affected equally at both LIGO sites. It could have been any other earthly event that we are not aware of. Now, our task is to find out what generated the LIGO-bursts.

If these data bursts are analyzed by people who developed LIGO for the whole purpose of proving the existence of gravitational waves, obviously, they will try to fit the LIGO-Bursts into a gravitational wave model as if the source of LIGO-Bursts was a collision of black-holes. After all, why did they spend billions of dollars in building LIGO sites all over the world? It is to show that that the gravitational waves exist. So, when some kind of burst appears in the LIGO stations, it is understandable that they attributed LIGO-Bursts to gravitational waves from a collision of black-holes.

However, just because you can fit the LIGO-bursts to a black-hole collision model does not mean that the LIGO-Bursts were generated from that model. Just because shoe fits you, you cannot claim it is your shoe; it could very well be somebody else's shoe. The model representing LIGO-Bursts as Gravitational waves due to a black-holes collision is not unique. A model does not have to be unique if the whole purpose of the modelling is to make predictions. However, if the purpose of the model is to discover the underline physical process that generated the data, then, the model must be unique.

However, the black-hole collision model is not the only model that fits the LIGO-bursts. After all, in the end, what we have is earthly vibration of a pair of LIGO-Arms or LIGO-Bursts. Without telling where the data comes from, if we ask an engineer to fit those LIGO-Burst into a model, there are number of models one can come up with for a perfect fit; one can always find a mathematical model that fits the data.

Assume that the LIGO-Bursts were given to a seismologist. In this case, the seismologist might use maximum entropy model or any other model and

come up with a perfect fit to describe the data burst as a seismic activity. Similarly, seismic data burst can also be modeled as a black-holes collision and come up with the masses of a pair of black holes that provides a perfect fit. Although, a seismic burst could be fitted with a black-holes collision model perfectly as gravitational waves, it does not mean that the seismic bursts are gravitational waves due to a black-holes collision.

Since the LIGO is able to pick up vibrations as small as a fraction of an atomic radius, LIGO stations can pick up even tiniest of seismic vibrations that no seismic station instruments could pick up or no seismic station has any interest in picking up. Seismic observation stations are not designed for picking up such minute vibrations. Seismologist has no interest in such minute vibrations. Therefore, there is no way to claim that the data burst GW150914 is not due to a seismic event just because no seismic station in the area had picked up the event. You cannot rule out the possibility of LIGO-Burst GW150914 being a result of a seismic event by making inquiries to nearby seismic stations since the amplitudes are too minute to be in their radar.

If the data burst is given to a biomedical engineer, the model will be different. A biomedical engineer might model it as an epileptic seizure burst in an electroencephalograph and find a perfect fit for the data burst using a prediction error model. Similarly, an epileptic seizure burst in an electroencephalograph can be modeled perfectly as gravitational waves due to a collision of black-holes and come up with the masses of black-holes that could have produced the seizure. Although we can obtain a perfectly fitting mathematical model for representing epileptic seizure bursts as gravitational waves due to black-holes collision, it does not mean that the epileptic seizure bursts are a result of black-holes collision in the outer space billions of light years away.

What if the LIGO data burst is given to a business data analyst knowledgeable in data modeling? Business data analyst may consider the data burst as a data from a stock market crash and model it using an Auto Regressive Moving Average (ARMA) process and come up with a perfect fit for the data burst. Although data bursts fit perfectly with ARMA model representing a stock market crash, the data was not generated from a stock market crash; the data was generated by the vibration of earthly LGO-Arms. Similarly, if we have data bursts from stock market crash, we can model them as gravitational waves resulted from a black-holes collision and obtain a perfect fit for the data and blame a pair of black-holes collision billions of light years in the past somewhere out there for the stock market crash today. We can always find someone in the dark beyond to blame for all our ills; just like all the flat-earth and earth-centric era man-serving and women-enslaving mythical religious doctrines do. You can achieve nothing by praying into the dark beyond irrespective of the direction you choose. Even if there is a creator in the dark beyond, why does he/she/it require our prayers (begging and bugging). If the universe is a work of a creator, quite certainly, creator did not have life on earth in mind in the process of creation since what we find in the universe is mostly useless junk except insignificant part of an insignificant planet that support life; creator must be an expert in junk creation. If the universe is a creation of a creator entity, given the enormity of the junk that is being created, that creator does not merit any appreciation. If you are praying towards a black box, you should first ask the question, 'what is in the box'.

Although we can obtain a perfectly fitting black-hole collision model representing the stock market crash data as gravitational waves, it does not mean that the stock market crash had anything to do with a black-holes collision somewhere billions of light years away in the universe.

Representing the data anyway you like in any form of mathematical model is fine as long as you are doing it for the purpose of making predictions based on available data. It is done in every discipline for providing a better service to the public, in process control in manufacturing, and also in natural disaster alert. However, if you building a model to uncover the real underline physical process that generated the data, then, the model must be unique; there is no way around it.

> If earthly vibration of LIGO-Arms or the LIGO-Bursts can be attributed to a collision of a pair of black-holes in billions of light years away, it is also possible to attribute the stock market crash and epileptic seizures to the collision of a pair of black-holes.

> If the purpose of the model is to discover the underline physical process that generated the data, then, the model must be unique. Gravitational wave model for LIGO-Bursts is not unique.

> Space-Time in Relativity is not unique [3].

### D. There is No Space-Time

State of the universe does not come in a stack one on top of the other for each time instant. There is no stack of events to have space-time. There is one state and the change of that state is adaptive. The old state is changed into the new state. There is no old state. There is no future state. What exist is only the current state, the 'now' state. The past does not exist in reality. The past only exists in our memory. We envision the future in our memory. Future does not exist in reality. Neither past nor future exists outside our memory. What exists in reality is the present, the 'now' state of the universe. Time is not a continuum.

Time is just a point, the 'now', the present. We define a continuum of time; time only exists in our memory, not in reality.

Time does not depend on the space, and the space does not depend on time. If time depends on the space, time will be directional and not unique. If time depends on space, space-time function will not be unique [3]. So-called hypothetical space-time is non-existent in reality.

**Corollary:**

There is no space-time. There can't be space-time undulations without space-time. Space and time are independent. Space is a 3D-continuum. Time is a moment not a dimension.

> There is no space-time [3] and hence there is no space-time undulation or gravitational waves (fantasy waves).

**Corollary:**

Time is the point, 'now', not a dimension. All there is the current state of the universe that is changing. We use the change of the state of the universe to define time.

**Corollary:**

Universe is not a stack of 3-dimensional states in a hypothetical time-line. There is no time-line. There is no space-time. Our inability to access neither past no future is an indication that there is no time-line.

*E.* **Space-Time and Speed of Light**

The speed of light c is not a universal constant since the speed is decided by the permittivity $\varepsilon$ and the permeability $\mu$ of the medium. The constancy of the speed of light depends on the constancy of the permittivity $\varepsilon$ and the permeability $\mu$ of the medium, or the space in the lack of a medium. The speed of light c is given by,

$$c=1/(\varepsilon\mu)^{1/2} \qquad (14.5.1)$$

The speed of light c is a constant as long as the permittivity and the permeability remain constant.

In general relativity, the light is expected to follow the curvature of the so-called space-time. Since the speed and the direction of the light are determined by the permittivity and the permeability of the space, if the light is to follow the curvature of the space-time, the permittivity and the permeability of the space must vary with the curvature of the space-time. If the permittivity and the permeability vary with the curvature of the space-time, the speed of the light cannot be a constant in a warped space-time since the speed of light is a parameter that is defined by the permittivity and the permeability of the space. What came first is not the speed of light. What came first were the permittivity and the permeability of space, which in turn determine the velocity of light. Speed of light and the direction of light are an outcome of the permittivity and the permeability of the space or the medium.

If there is a space-time curvature and the light has to follow the space-time curvature, then, the speed of light cannot be a constant. Similarly, if the speed of light is a constant there cannot be a space-time curvature. In fact, as it was shown in [3], there is no space-time. Further, if there is a space-time, the speed of light will not be constant in the presence of space time undulations or so called gravitational waves. Therefore, if the space-time undulations or gravitational waves travel at the speed of light, the speed of the gravitational waves will not be a constant. If the speed of light is a constant there cannot be a space-time curvature and hence there cannot have any space-time undulations or so-called gravitational waves; gravitational waves exist only in the fantasy of a few who are blind or chosen to be blind to the reality.

If there is a space-time and the light is expected to follow the curvature of the space-time, the curvature of the space-time generates a red-shift in light. As a result, the galactic red-shift is not due to a space expansion or the radial movement of galaxies. In general relativity, the galactic red-shift is a result of space-time curvature, if space-time exists. Even though, the general relativity and the space-time have been used to proclaim that the space is expanding, the argument does not hold true since it is the curvature of the space-time itself that generates a red-shift of light, not a universe expansion. However, as it is shown in [3,4], there is no space-time and universe is not expanding.

**Property:**

If the speed of light is a constant, there cannot be a space-time curvature, space-time undulations or gravitational waves (fantasy waves). If there is a space-time curvature, space-time undulations or gravitational waves, then, the speed of light cannot be a constant. Speed of light is mutually at odd with the space-time curvature in the General Relativity.

**Property:**

Universe is not a stack of 3D-states in time. Universe has a single state, the current state. Time has a single point, this moment.

If the light follows the curvature of the space-time, then, the speed of light cannot be a constant. Speed of the light must vary with the curvature of the space-time; the real irony of the General Relativity.

If gravity tells the space-time how to curve, then, in order for light to follow the space-time curvature, the space-time curvature must tell the space how to alter the permittivity and permeability.
When the permittivity and the permeability are altered, the speed of light is no longer a constant. Speed of light can never be a constant if light has to follow space-time curvature in General Relativity.

If there is a space-time, the permittivity and the permeability of space must vary with the curvature of the space time for light to follow the curvature.

Constant speed of light cannot co-exist with the so-called space-time curvature.

**Corollary:**

The real irony of the General relativity is that it requires the light to follow the space-time curvature at constant speed, yet light cannot follow a curvature at constant speed. The speed of light cannot be a constant in a warped space-time.

**Property:**

Light has no option but to follow what permittivity and the permeability of the medium, or space in the lack of a medium, asked light to do.

### F. Special Relativity and its Fallacy of Forcing a Mass on Electromagnetic Energy by a Hidden Assumption

Special relativity starts with by drawing a vertical light path for a light burst fired in vertical direction from the bottom of a moving train. When you draw a vertical path relative to the moving train for a light pulse fired in vertical direction from the bottom of a train, you are forcing a momentum on the light pulse by design. You are giving the light a momentum unintentionally by assumption. You are making the light pulse to behave as if it were a golf ball. It is this simple mistake that created havoc in science for almost a century. We have to ask the question, 'why are you drawing a vertical path relative to the moving train for a light pulse released in vertical direction from the bottom of a train?'

In reality, a light pulse fired from the bottom of a train in vertical direction does not take a vertical path relative to an observer in moving train. A light pulse fired in vertical direction in a moving train only takes a vertical path relative to an observer on a stationary platform outside the train. A light pulse fired in vertical direction in a moving train takes an angular path relative to an observer on the moving train. It is complete opposite to the path taken by a golf ball in similar situation [4].

In special relativity, light is given a momentum by a hidden assumption, the assumption that a light pulse behaves as if it is a golf ball; it is not the reality. This hidden assumption has steered everything in a wrong direction for more than a century. This error encapsulated in a hidden assumption transformed science into voodoo science; nothing was real any more. You can claim that particles appear and disappear; we were expected to believe it. You can claim that a particle can be at multiple places at the same time; we were expected to believe it. You can claim particle can take multiple paths at the same time; we were expected believe it. You can claim mass increases with speed (what a crap); we were expected to believe it. You can claim by colliding charged particles at high speed in a particle collider such as Large Hadrons Collider (billion-dollar blunder), you can generate mass; we are expected to believe it. It went on and on with no end to the weirdness. This simple mistake of line drawn vertically to represent a path of light relative to a moving train has turned the reality upside down, and has turned science into a voodoo science.

The reality is, you can't draw a vertical line to represent a path of light relative to a moving train for a light burst fired vertically from the bottom of a train without forcing light to have a mass. Light cannot be expected to behave as if it were a golf ball. Light has no momentum. Light has no mass or equivalent mass. Light does not travel relative to moving bodies even when the source of light is on the moving body. The direction of light is determined by the source only at the source. Once the light is out of the source, the speed and the path of light is solely determined by the medium.

Special Relativity started by drawing the path of vertically oriented light burst relative to a moving train as vertical. By this representation, momentum is forced upon light intentionally; a fatal error. Burst of light does not behave as a golf ball. Nothing without a mass has any momentum. Light is not a particle. Light has no momentum.

Light does not take shortest distance. Light does not take geodesic. Light always follows the density gradient of the medium; medium has nothing to do with the frame of reference or the observer. It is only when the medium is homogeneous and isotropic that the density and the density gradient are constants, and as a result, light takes the straight path, or shortest path. Irrespective of whether the source of light is on a moving body or not, the actual path of light and the speed of light are determined by the medium, neither the observer nor the source. Only the

original direction of light is determined by the source at the source; the path as well as the speed is determined by the medium. You can aim a light source in any direction you want, however, the speed is decided by the medium and the direction of diffraction or the path is decided by the density gradient of the medium.

> The actual path of light and the speed of light are determined by the medium, not by the observer or the frame of reference.

> Light is not relative [3].

### G. Power and Electromagnetic Energy: Not the Same

The power of an electromagnetic wave is not the same as the electromagnetic energy. The power is related to the square magnitude of the electromagnetic wave. The electromagnetic energy is related to the frequency of the wave. They are two completely different things. If you divide the power of an electromagnetic wave by $hf$, where $h$ is the Plank constant and the $f$ is the frequency of the electromagnetic wave, what you get is garbage, meaningless nonsense, not a photon count; this is a classic error in physics textbooks. This is a fundamental conceptual error. The quantity $hf$ has nothing to do with the square magnitude or power of an electromagnetic wave. The quantity $hf$ gives the electromagnetic energy, $E$ of an electromagnetic wave burst of universal time width. $E=hf$ relationship has no meaning without a time width. Photons only exist in human mind, not in reality. There are no photons. Light is not a particle. Light is always a wave. Light comes in bursts of fixed time width [9].

It is the frequency that burns your skin if you stay in the sun for a long period, not the magnitude. It is the frequency that dislodges electrons from the atoms in our cells causing cell damage, not the magnitude of an electromagnetic wave. When an electromagnetic wave travels long distances, the square magnitude or the power of electromagnetic wave fades away due to the attenuation in the medium while the electromagnetic energy of the wave fades due to the propagation loss leading to frequency degradation, down shift or red-shift. Most of the text books represent power of a wave and electromagnetic energy as equivalent; a recurrent error. Power of a wave and electromagnetic energy are not the same. Electromagnetic energy and the mechanical energy are not the same. Not all the energies are the same.

> If you divide square magnitude of an electric field by 'hf' what you get is garbage, not a photon count

### H. Quantum Fields: A Misnomer
**Axiom:** Any vector or a vector field cannot come in

quanta. Vectors cannot be quantized.

Field is a vector. Vectors cannot be quantized. Vectors do not come in quanta. Electromagnetic field is a vector. There are no electromagnetic field quanta. Angular momentum is a vector. There are no angular momentum quanta. Only a scalar quantity that is conserved can be quantized. It is electromagnetic energy that is quantized. Electromagnetic waves come in bursts of limited time duration. Electromagnetic energy is also proportional to the frequency and as a result, the electromagnetic frequency is also quantized. Electromagnetic spectrum is not continuous. Since the electromagnetic energy is quantized, electromagnetic frequency cannot be continuous. There are fields; fields do not come in quanta. Fields cannot be quantized. There are no quantum fields. Quantum or Quantized Field is an Oxymoron.

The same mistake is in the Bohr atom. Neil Bohr quantizes the magnitude of the angular momentum of an electron to develop atomic structure. The problem is that the angular momentum is a vector. Vectors do not come in quanta. You cannot quantize a vector, because, the direction does not come in quanta. If you break the direction into pieces, you cannot put them back together using the quantized pieces. You cannot disregard the direction and quantize the magnitude of the angular momentum like Bohr did out of desperation. In addition, the angular momentum is not conserved except for the Hydrogen atom. The angular momentum of an electron in any atom is time-varying except for the Hydrogen atom. You cannot quantize a time varying quantity. You cannot quantize a vector. You cannot quantize the angular momentum. Angular momentum does not come in quanta. You cannot quantize linear momentum either, since linear momentum is a vector. Linear momentum does not come in quanta.

Electromagnetic field does not carry a wallet full of mythical photons exchanging wherever it goes. The mythical photons are by definition spatially random; they do not have directional information. The quantity hf does not have any direction information. Electromagnetic field is not a collection of mythical photons. Electromagnetic field exerts a force on any electrical charge. If you break the magnitude of electromagnetic field to small quantities or so-called photons, the directional information is permanently lost since photons by definition are spatially random particles. If light consists of particles and particles are spatially random, what carries the directional information?

Electromagnetic field is not a collection of spatially random particles. Electromagnetic waves are not probability distributions of so-called hypothetical light particles. The derivation of photons makes the assumption that the photons or light particles are uniformly distributed spatially. Electromagnetic waves do not represent a uniform distribution.

Electromagnetic waves have nothing to do with probability. Probability is not real. Probability is human made. Electromagnetic waves are nature made. Electromagnetic waves are real. Light is not a collection of spatially random particles. Light is coherent. Light is always continuous. Light comes in short burst. Interaction with light does not constitute exchange of mythical particles of any sort. Electromagnetic waves cannot go wherever they want randomly. Where and at what speed an electromagnetic wave should travel is determined by the permittivity and the permeability of the medium, which in turn are determined by the density gradient and the density of the medium.

> Quantum or Quantized Field is an Oxymoron.

### I. No Particle Wave

A moving charge particle on a non-linear path generates an electromagnetic wave. That wave is not a particle wave [2]. Particles do not behave as waves; particles behave as particles whether they are macroscopic or macroscopic. If an unreal, non-existent, fantasy particle wave or de Broglie wave length λ is described as λ=h/p, where h is the Plank constant and the p is the momentum of the particle, how can you say it is a wavelength of a microscopic particle not a wave length of a massive body with the same momentum p? The momentum p says nothing about the size of the object. The momentum of a slow moving massive object can be the same as the momentum of a fast moving microscopic particle.

A charge particle moving on a non-linear path generates electromagnetic radiation. This electromagnetic radiation travels at the speed of light. The charge particle that generated electromagnetic radiation is not moving at the same speed; it is moving at a slower speed than the speed of electromagnetic waves. As a result, the radiating electromagnetic field does not say anything about the whereabouts of the particle. Electromagnetic wave is not a probability distribution. Radiated electromagnetic field of a moving charge particle is not a particle wave.

When a charge particle is stopped at the double slit barrier in the double-slit experiment, it generates electromagnetic radiation that goes through the two slits in the double-slit barrier. It is this electromagnetic radiation that generates an interfering pattern on the screen behind the double-slit barrier. The peaks of the interfering pattern say nothing about where the particle is. Particles never reach the screen in double slit experiment; all the particles were stopped at the double-slit barrier. Interference pattern on the display screen of the double-slit experiment is not a result of particles colliding with the display screen. No particle can reach the screen. All the particles in the double-slit experiment were stopped at the double-slit barrier. If you check for particles at the screen of the double-slit experiment, you will never find any particle there. Interference pattern on the screen of the double-slit

experiment for an input beam of charged particles is not a particle wave; it is a result of electromagnetic radiation due to the stopping of the charge particles at the double-slit barrier. There are no particle waves.

If you use a beam of neutrons with the double-slit experiment, you will still get an interference pattern since neutrons are unstable. Unstable neutrons will disintegrate as they collide with double slit barrier releasing electromagnetic radiation bursts that pass through the slits and generate an interference pattern on the screen. However, if you use a beam of electrically neutral and stable beam of particles in the double-slit experiment, you will not get an interference pattern on the screen. Electrically neutral golf balls do not generate an interference pattern in the double slit experiment.

### Property:

A charge particle moving on a non-linear path radiates generating an electromagnetic wave. This is not a mechanical wave. This wave is not a particle wave. This wave is an electromagnetic wave. This wave is not a wave function of a particle or a wave that describes the motion of a particle. This is not a function that describes the state of a particle.

> Particle Wave is an Oxymoron

### J. No Gravitational Waves: No two Waves with Distinctly Different Propagation Characteristics can have Constant Speeds

We have already seen that time is independent of space and hence there is no space-time [3]. Without space-time, there will be no space-time undulations or Gravitational Waves (GW). However, still there are many who are trying to detect GWs under the false and misguided belief that there are gravitational waves that travel at the speed equal to the speed of light c in free-space.

If Gravitational Waves are present, Gravitational Waves cannot generate a relative motion. If a stick with beads is subjected to Gravitational Waves, Gravitational Waves cannot vibrate beads relative to sticks. If Gravitational Waves exist, it is the whole composite object, both beads and the stick together, that is subjected to expansion and contraction, not a part of an object relative to the other part of the same object. The beads relative to the stick remains at standstill in the presence of Gravitational Waves. The Sticky-Beads-Thought-Experiment is false and meaningless.

Assume that the gravitational waves travelling at the free-space speed of light c enter a medium. The gravitational waves will be travelling at the same speed c in the medium. However, on the other hand the speed of light in the medium, $c_m$ will be lower than the free-space speed of light c, $c_m<c$. Now, we have a two waves travelling at two different speeds that are constants. The speed of Gravitational Waves is higher than the speed of light in the presence of a medium.

This will be in direct confliction with Relativity. Relativity cannot co-exist with two waves travelling at constant speeds that are independent of observers.

The gravitational waves are not electromagnetic waves. The propagation characteristics of Gravitational Waves are not the same as the propagation characteristic of the light in a medium. The propagation characteristic of light is determined by the electromagnetic properties of the medium, specifically, the permittivity and the permeability of the medium. However, the gravitational fields are not electromagnetic fields and hence, unlike the light, gravitational waves have nothing to do with the permittivity and the permeability of the medium. Unlike the propagation of light, the speed of Gravitational Waves is not determined by the permittivity and permeability of the medium. Unlike the light, the propagation directions of the Gravitational Waves are not determined by the permittivity and permeability of the medium. Permittivity and permeability of a medium, or space in the absence of a medium, command the light; they tell light where to go at what speed. However, they do not command Gravitational Waves. As a result, Gravitational Waves cannot behave as light in a medium.

Although the speed of gravitational waves is considered to be the same as the free-space speed of light, the propagation characteristics of gravitational waves are distinctly different from the propagation characteristics of the light in the presence or absence of a medium. As a result, the existence of gravitational waves will be in direct conflict with the Relativity. There cannot have gravitational waves or any other waves travelling at constant speed other than light. No other wave, other than electromagnetic waves, in the universe can travel at constant speed determined by the medium alone independent of an observer's frame of reference unless those other waves have the exactly the same propagation characteristics as those of light. Gravitational waves are not electromagnetic waves and hence the propagation characteristic of gravitational waves in the presence of a medium will not be the same as the propagation characteristics of light. As a result, there cannot have gravitational waves travelling at constant speed. It is only the light, and light alone, that can travel at constant speed determined solely by the medium, or the free-space in the absence of a medium, independent of any observer's frame of reference; nothing else can. Gravitational Waves travelling at constant speed cannot exist in the nature.

Light travels at constant speed determined by the permittivity and permeability of the medium, or the free-space in the absence of a medium, which is independent of any observer. The Relativity is defined by the observer independent propagation characteristics of light determined by the medium, or the free-space in the absence of medium. There cannot have any other waves travelling at constant speed determined by the properties of the medium, or

the free-space in the absence of a medium, since it comes into a direct conflict with Relativity unless those other waves have exactly the same propagation characteristics as those of the light in the presence or absence of a medium. Gravitational Waves are not electromagnetic waves and hence the propagation characteristic of Gravitational waves will be different from those of light in the presence of a medium or not. As a result Gravitational Waves or any other wave propagating at constant speed cannot co-exist with light.

The free-space speed of light is not a fundamental constant or parameter of the universe since it is a function of electromagnetic properties of space or the medium. It is the electromagnetic properties, permittivity and permeability, of the space or the medium that determines the speed of light. The permittivity and permeability of the space or the medium has nothing to do with the gravitational waves. No other wave can travel at the same speed as the speed of light since it is the electromagnetic properties of the medium that determine the speed of light and it varies from medium to medium. Although the electromagnetic properties of a medium determine the speed of light, electromagnetic properties of a medium do not determine the speed of gravitational waves. As a result, there cannot have gravitational waves travelling at the same speed as of light.

---

Except light, no other waves can travel at constant speed, unless those other waves have exactly the same propagation characteristics as of light since the presence of such waves will be in direct conflict with Relativity.

---

No two waves in the universe can travel at constant speeds that are determined by the properties of the space or medium alone.

---

It is only the light that can travel at constant speed determined by the medium or space alone.

---

Relativity precludes the existence of gravitational waves, or any other waves of constant speeds, other than light determined by the properties of the space or the medium.

---

## XV. CLOCK AND TIME

Clock and time are not synonymous. Display of a clock and time are not one and the same. Display of a clock and the time are the same only when the engineering specifications for the measuring conditions are satisfied since the clock is an instrument engineered to measure the time. Time is a definition. It is we who have defined the time in an internationally agreeable manner. A clock is a measuring instrument. A clock is a device we engineered to display the time that we have defined.

Clocks come in different forms, sun-dial clocks, water clocks, wound-spring mechanical clocks, electric clocks, electronic clocks, atomic clocks. The display time of these clocks vary with the material used and the environment conditions they are in as well as the strength of the battery and the winding of the spring. You can synchronize these clocks, but after some time they drift away each displaying different times since the mechanism of each clock is affected by the environment differently.

What is displayed on the clock depends on the environment the clock is in. If a clock is not in the environment that it is engineered to display the right measurement, it will not display the right measurement or the right time. Whether it is a mechanical clock, electronics clock, or atomic clock, what is displayed on a clock depends on the speed of motion of the clock, gravitational and electromagnetic forces as well as the ambient conditions such as temperature, pressure and the humidity at the location of the clock. If what is displayed on the dial of the clock differs from one location to the other, one speed to the other, or from one environment to the other, that is due to the effect of the variation of the environmental forces on the mechanism of the clock. When we engineer an instrument for measurement, we have to specify base line standard for the correct measurements for that instrument or give the design specifications; a clock is no exception. No engineered device gives the correct measurement under varying conditions. Any engineered device provides the correct measurements when the device is in an environment that meets the engineering specifications for that device.

Take a pair of atomic clocks, a pair of mechanical clocks, and a pair of electronic clocks and synchronizes them at one geographical location-A. Leave one atomic clock, one electronics clock, and one mechanical clock at that geographical location-A, and move the rest of the clocks to a different geographical location-B. What you will find is that the time displayed in all three clocks in geographical location-B will be different from the time displayed on all three clocks in the geographical location-A even thought all the clocks were initially synchronized at the geographical location-A before they were being brought to the geographical location-B. Further, time displayed in all three clocks in the geographical location-B will also be different from each other since the mechanisms of all three clocks are different and the effect of the environment variation on the different mechanisms of the clocks are different.

For the displays of two clocks of same kind to be the same, both clocks must be under the same operating environment conditions; the forces acting on the clocks must be the same. A clock is no different from any other engineered measuring device. Different reading on two synchronized clocks with same operating mechanism at different locations indicates the changes in the environmental forces at those two locations. You get the same reading on two synchronized clocks with the same operating mechanism in different location only if the forces acting on the two devices are the same. An atomic clock on a mountain peak displays a different time than the atomic clock in your lab even though both clocks were synchronized in the lab at the beginning. The reason for the two atomic clocks to display different time is that the environmental forces such as the gravitational and the electromagnetic forces those two clocks are subjected to are different. If you are using the difference in the reading of the atomic clock on the mountain from the atomic clock in your lab to proclaim that the gravity changes the time itself, what you are claiming is utter nonsense; you should not even be doing science. It is not possible to test the effect of gravity on time using a physical clock since the mechanism of the clock is affected by gravity. Time itself is independent of gravity. The mechanism of a physical clock is affected by the gravity.

Gravity affects mechanical energy only because the mechanical energy cannot exist without a mass. It is not the mechanical energy of a mass that is affected by the gravity; it is the mass, independent of its associated mechanical energy that is affected by the gravity. Unlike the mechanical energy, electromagnetic energy does not depend on a mass for its existence. Unlike mechanical energy, Electromagnetic energy has no associated mass. Gravity has no effect on electromagnetic energy. Gravity has no effect on time itself. It is the mechanism of a clock designed to display the time that is affected by gravity. As a result, the variations of the reading of clocks in different altitudes due to differing gravitational forces are the norm, not an exception.

If a clock is on a moving frame, then the electromagnetic forces and the ambient conditions acted on the mechanism of the clock are different from the engineering specifications of the clock for the correct measurement, and as a result reading on the display will be different. A clock is no different from any other measuring device. The mechanism of the measuring device is subjected to the environment the device is located at. It is not the time that varies with the frame of reference; it is the mechanism that generated the display of the clock that is affected by the frame of reference. It is not the time that is affected by the gravity; it is the mechanism of the clock that is affected by the gravity.

It is not possible to engineer an instrument to display the right measurement for all the environmental conditions; clock is not an exception. It doesn't matter how well you synchronize clocks according to the engineering specifications, it doesn't matter what types of clocks you use, and whether they are atomic clocks, electronics clocks, or mechanical clocks, when you move those clocks to different locations that does not satisfy the engineering specifications what you see on their display will be

different. It is we who define the time. It is we who designs the clocks to measure the time that we have defined. We can only design clocks to display the correct time for given baseline specifications; not for all environments.

Assume we synchronize three atomic clocks, Clock-A, Clock-B, and Clock-C at the Colombo Airport; all the clocks display the same time. Now, we take Clock-A on an airplane around the world in the clockwise direction and land back at Colombo Airport and place the Clock-A next to Clock-C. We take Clock-B on an airplane in the anticlockwise direction around the world and land back at the Colombo Airport and place Clock-B next to Clock-A. Clock-C remains at the Colombo Airport all the time. Once all the clocks are back at the Colombo Airport, what should we expect the display time of the three clocks to be? We cannot expect the display reading of all the clocks to be the same since the mechanism of the clocks were under different environments under different forces. We should be surprised if the three atomic clocks display the same reading when all the three clocks are back at the Colombo Airport. If the readings of the clocks are the same, the precision of the clocks are poor. If the readings are different, the precision of the clocks are higher. Of course, at the end, the reading of the Clock-A, Clock-B, and Clock-C should be different since the clocks were under different environmental forces. A clock is an engineered device for measurement and hence any two or more devices display the same reading if and only if they are under the same environmental forces. The use of these differences on the display of three atomic clocks to claim that the time is relative is simply preposterous, crazy.

If you place two synchronized clocks at the same geographical location but at different temperatures, the display time of the clocks will be different. Based on these display time variations on the clocks due to temperature changes, can we claim that the time is dependent on the temperature? If we place two synchronize clocks at different pressure, we will find that the display time on two clocks will be different. Based on the display time differences on the clocks at different pressures, can we claim that the time is dependent on the pressure? Of course, we know it is preposterous to claim that the time is dependent on the temperature and pressure. However, if we can claim that time is dependent on the frame of reference because two synchronized clocks at two different speeds displayed different times, if we claim that the time is dependent on the gravity because two synchronized clocks placed at different altitudes displayed different time, we can also claim time is also dependent of the temperature and pressure. This shows how preposterous it is to claim that the time depends on the frame of reference and gravity because two clocks at different speeds displayed different times, and two clocks at different altitudes displayed different times.

**Corollary:**

It is the mechanism of a clock that depends on the speed, gravity, electromagnetic forces, temperature, pressure, and the environmental conditions in general. It is the display of a clock that is relative, not the time itself.

**Corollary:**

Time itself is independent of the speed, gravity, electromagnetic forces, temperature, pressure, and the environmental conditions in general. Time is absolute.

When two atomic clocks are moving at the same speed in opposite directions in a magnetic field, the electromagnetic force on a charge particle due to the motion in a magnetic field in one clock will be in direct opposite to the force on the same charge particle on the other clock moving in opposite direction. The mechanism of an atomic clock is affected by the direction of motion. As a result, the time displayed in two synchronize atomic clocks moving in opposite direction will be different. The display-time on an atomic clock in motion in a magnetic field is different from the display-time on an atomic clock at stand-still for the same reason that the charge particles in the moving atomic clock is subjected to electromagnetic forces while the same charge particles in the atomic clock at stand-still are not.

Differences in the display time of clocks under different environments are extremely small and hence we considered them to be approximately same for our daily lives. However, these minute differences on the display of clocks from one environment to another have to be taken into account in the case of GPS (Global Positioning System). Further, here on earth, the time on any clock is dependent of the time-zone and day-light saving. The time-zone and day-light saving dependent time cannot be used in GPS.

Although some has gone to the extent to claim that the GPS is not possible without the Special Relativity, Special Relativity has nothing to do with GPS. We do not have to know anything about Special Relativity to design GPS. Most probably, the engineers who designed the GPS system might not even have had any idea what the Special Relativity was. Any engineer, who had no idea of what the Special Relativity was, could have design the GPS system in the same manner. If time is relative, GPS algorithm does not hold true since the low-orbit satellites are not at constant speeds.

Special Relativity itself is conceptually incorrect. Time is not relative. Time cannot be relative. If time is relative, time will not be unique. Further, if the time is relative, time will be directional [3]. No knowledge of Special Relativity is required for the design of GPS. Not a single equation from the Special Relativity is used in the GPS. Special Relativity is not required for the design of GPS. You don't even have to be aware

of the existence of the Special Relativity to design GPS.

In GPS, time t and geographical location (x,y,z) are estimated using four satellites in the vicinity of the requesting receiver in order to overcome the deviations of the display times of the clocks due to the hardware differences of the receivers, battery power variations of the receivers, time-zone differences of the receivers, day-light savings differences of the receivers, as well as the environment differences the receivers are in. We all have seen how clocks start to slow down when the batteries are partially drained out; it is for the same reason why time in your clock differs from mine. Further, if the time is relative, the distance relationship that is used in the GPS does not hold true since the low-orbit satellites are not at the same constant speed. GPS has nothing to do with Special Relativity or General Relativity.

Any system such as GPS that is designed to serve many clients in differing geographical locations with receivers of differing hardware must be client independent and time-zone independent. For the service to be client independent and time-zone independent, GPS must provide the service without relying on the data from the clients. It is for this reason GPS avoids using the clients data and instead use data four or more satellites in providing the client service. It easy to equip few satellites with high precision clocks than to equip all billions of receivers produced by differing manufactures with differing hardware with high accuracy clocks. GPS avoids the use of client data for the same reason why IKEA avoids the use of customers' screwdrivers. GPS avoids the use of client data to make the system client independent and time-zone independent [8].

Clocks and time are not synonymous. Clock is a measuring instrument designed to display time as we have defined the time. Every measuring instrument is subjected to baseline specification. Any measuring instrument works properly when the instrument satisfies the baseline specification; clocks are no exception.

**Property:**
A clock is a device engineered to display our definition of time. A clock displays the correct time only when the clock is in an environment that meets the design specifications, just like any other engineered measuring device.

**Property:**
Since the effect of the change of environmental conditions on the mechanism of a clock is negligible for our daily activities, it is always assumed that the display of a clock situated anywhere represents the correct time.

> Mechanism of an atomic clock is affected by the motion of the clock in a magnetic field. The display times of two synchronized clocks moving in opposite direction in a magnetic field will be different.

> Time itself is independent of the frame of reference and the gravity.
> Display on a clock is relative and depends on the frame of reference and gravity.

> Time and Time-Displayed on a Clock are the same only when the clock is in an environment that meets the design specifications.

## XVI. DIALOG BETWEEN A PHYSICIST AND AN ENGINEER [7]

**Physicist:** Hey my friend, I carried out two interesting experiments. It cost me a fortune, but the results are very clear. As always, it shows that Einstein was right; time does depend on the speed and gravity. Before you say anything, let me explain what I did:

## Experiment-1:
I synchronized three atomic clocks A, B, and C. I left clock-A at the airport of my home town. I flew the clock-B in the clockwise direction around the world and placed it back at the same airport next to clock-A. I flew the clock-C in the anticlockwise direction around the world and placed it back at the same airport next to Clock B. Now all the clocks A, B, and C are at the same airport.

**My Observation:** When I checked the clocks, all three clocks displayed three different times.

**My Conclusion:** Einstein was right; time does depend on the speed or the frame of reference.

## Experiment-2:
I synchronized two atomic clocks A and B in my laboratory. I left Clock-A in my laboratory. I took the clock-B to a mountain top with me and spend sometimes there and came back to the laboratory and placed the clock-B next to clock-A.

**My Observation:** When I checked clocks, two clocks displayed different times.

**My Conclusion:**
Einstein was right again; time does depend on the gravity.

So, my dear friend, it is clear that the time depends on the frame of reference. In addition, time also depends

on the gravity. We have proved Einstein was right. Halleluiah! Isn't this guy a genius or what?

## Engineer:

Halleluiah indeed! I have one more experiment for you to carry out. Take three synchronized clocks, Clock-A, Clock-B, and Clock-C. Keep Clock-B at different temperature at the same location. Keep Clock-C at different pressure at the same location. After some time, check their display. You may notice that the times on all three clocks are slightly different even though you had synchronized them at the beginning. Based on this observation, I am sure you would jump the gun and say, 'the display on a clock depends on the temperature and pressure', you are indeed right. Halleluiah! If you use the observation to claim, 'time depends on temperature and pressure', you are incorrect. No Halleluiah for you. Time and display on a clock are not necessarily the same; they are the same only when the design specifications of the clock are met.

Similarly, based on the observations you have made in your previous experiments, if you say, 'the display of a clock depends on the gravity and the speed' you are right. If you claim 'the display on a clock is relative', you are indeed right. However, if you use the observations to claim, 'time depends on the gravity and speed', you are incorrect. You cannot use the difference on the displays on two clocks at two different speeds to claim that the time is relative. The time and the display on a clock are not one and the same except when the clock is in an environment that satisfies the designer specifications.

My friend, don't blame the nature for your clocks displaying different times in different environments. Don't make wrong conclusions and impose them on the nature; that will make the nature to be spooky in appearance. The reading of any measuring device varies with the environment it is in; clocks are no exception. My advice is 'Read the MANUAL!'

## Golden Rule of Engineering:

No device could be engineered to give the correct measurement for all the environments.

By taking a clock on an airplane and demonstrating the drift on the display of the clock, the only thing you are proving is your ignorance. By taking a clock to a mountain and demonstrating the drift on the displayed time, the only thing you are demonstrating is also your ignorance. It also demonstrates the ignorance of the person who is funding the operation. Because, the time shift with the change of environment is the norm, not the exception; it is expected. However, you have demonstrated something the design engineer could be proud of; he/she can be proud of the sensitivity of his/her design, the highest honor any engineer craves for. If you have demonstrated no drift in the time when the clock is on an airplane and also on the mountain, you

have demonstrated something that design engineer had to worry about; the design of the clock is not great as far as the sensitivity of the device to changing environment is concerned.

A clock is an engineered measuring device that displays our definition of time. As with any other measuring device, a clock gives the correct measurement only when the clock is in an environment that meets the engineering specifications. The time displayed on a clock depends on the location of the clock since the gravitational and electromagnetic forces, as well as the temperature, pressure, humidity and any other environment factors varies from location to location. It is the mechanism of a device that is affected by the frame of reference, gravity or other environmental factors, not what is being measured.

The time displayed on a clock can be considered to be independent of the location since the effect of the variations of the environmental factors on a clock is not significant for our daily operations. If your clock deviates from the correct time for a certain environment, it is not because time is relative; it is because the mechanism of the clock is relative, and the environment you are in is different from the environment the clock is designed to give the correct time; don't blame the nature, read the manual.

Time is absolute. Time displayed on a clock is relative. Time displayed on a clock represents the actual time only when clock meets design specifications. Time on your clock varies not just with the gravity or speed, but also temperature and pressure. If you claim that the time is dependent on gravity just because the time on a clock varies with altitude, you can also say time depends on temperature and pressure too since the time on a clock varies with temperature and pressure.

When a measuring instrument is manufactured, it has to be calibrated for its proper use. The calibration is done under certain environment conditions, which is also known as design specifications. A measuring instrument displays the correct time when the instrument is in the environment that meets the calibrated environment conditions or design specifications; clock is no exception.

### XVII. UNREALISTIC RELATIVE TIME

Let us synchronize two clocks, Clock-A and Clock-B at one geographical location under the same ambient condition. Now, place Clock-A in a chamber of higher temperature than the ambient temperature. Now, although the two clocks are at the same geographical location under the same gravitational and electromagnetic forces, they are at two different temperatures. The display time of Clock-A will be different from the display time of the Clock-B. Can we use this result to claim that the time is dependent on the temperature? There is no doubt that we can't. Now, we have two very legitimate questions:
1. Why do we claim that the time is dependent on the

frame of reference just because the display of a clock on a moving vehicle was different from the display of time on a stationary clock? Shouldn't we have expected the display times to be different?

2. Why do we claim that the time is dependent on the gravity just because the display of the time on a clock on a mountain was different from the display of the time on a clock on a sea level? Shouldn't we have expected the display times to be different?

3. If we can claim that time depends on the frame of reference and the gravity, can't we also claim that time is dependent of the temperature, pressure and humidity?

Time is a definition. Time is a moment, not a continuum. A clock is an engineered device that works correctly for the baseline specifications the clock is designed for. A clock is like any other engineered measuring device that works correctly only for specified environment the device is designed for, no exception. When it comes to time, there are few noteworthy points:

- It is not the time that depends on the frame of reference; it is the mechanism of a clock that depends on the frame of reference.
- It is not the time that depends on the gravity; it is the mechanism of the clock that depends on the gravity.
- It is not the time that depends on the temperature and the pressure; it is the mechanism of the clock that depends on the temperature and the pressure.

If the battery of a clock has drained out, the voltage of the battery will not be the same. As the battery gets weaker and weaker, the voltage gets weaker and weaker resulting slowing down of a clock. It is not the time that depends on the voltage output of the battery; it is the mechanism of the clock that depends on the voltage output of the battery. We have all seen how clock slows down with the draining-out of the battery; yet, we do not claim that the 'time depends on the battery voltage'. It is obvious that it is the mechanism of the clock that was affected by the voltage decrease of the battery with the usage. It is the mechanism of the device that is affected by external forces, not what is being measured. A clock displays correct time only when the voltage output of a battery meets the design specifications of the clock. The same scenario applies for a clock run by wound spring mechanism.

Time is absolute; not relative. Gravity has no effect on time. Speed has no effect on time. Temperature has no effect on time. Pressure has no effect on time. Time is a moment, not a continuum. There exists only the present. Past does not exist. Future does not exist. Past exists only in human memory, human notebooks, or in history museums. Future exists only in human memory, human notebooks, or in movies. The present exists in reality as well as in human notebooks. Time is a concept derived by human

based on the change of the environment.

There is no fourth dimension; time is a moment, not a dimension. There is no stack of time. You can't travel in time, since it is not a dimension. It is always time that travel, not you. If you do not like position in the space you are in, you can always move to a different position in the space since it is you that travel, not the space. If you do not like the time you are in, you can't move to another time since it is the time that travels, not you. If you do not like the time you are in, you can complain about it, or you can waste it by working on big-bang, multi-verse, inflation, space-time, quantum mechanics and so-called modern physics, or praying to an invisible non-existent creator entity or following any religion; not a wise way to spend the life.

**Corollary:**

Time is absolute; the display of a clock is not. The display of a clock depends on the environmental condition the clock is at. The display of a clock represents the time if and only if the clock is in an environment that meets the design specification of the clock.

> Time itself is independent of the temperature, pressure, gravity, speed and electromagnetic forces and the environment in general.

> It is the mechanism of a clock that depends on the temperature, pressure, gravity, speed, electromagnetic forces and the environment the clock is in, in general.

*XVIII.* **GLOBAL POSITIONING SYSTEM (GPS) HAS NOTHING TO DO WITH SPECIAL RELATIVITY**

Global Positioning System (GPS) consists of a cluster of low orbit satellites providing location information to billions of ground trans-receivers. All the satellites contain high accuracy clocks of same standard and they are synchronized to a master clock on the ground in Colorado. When a ground receiver at location $(x,y,z)$ at time $t$ make a request for its location, few satellites in the vicinity responds to the request and each satellite sends its location and the reception time of the request back to the receiver. If the $j^{th}$ satellite in the vicinity sends the location of the satellite $(x_j,y_j,z_j)$ and its reception time of the request $t_j$ to the receiver, receiver have the relationship,

$(x-x_j)^2+(y-y_j)^2+(z-z_j)^2=[c(t_j-t)]^2$, j=1,2,3,4,

where c is the speed of light.

Using the data $(x_j,y_j,z_j,t_j)$ from three satellites, the receiver can obtain the location of the trans-receiver $(x,y,z)$ since the t is known to the receiver. However, if the time t from the receiver is used for the position estimation, it results in several problems:

1. The use of data from a requesting receiver makes the GPS client dependent. When a system is client dependent, the service will not be uniform.

2. Time on a receiver clock is Geographical Time-Zone dependent and Day-Time-Saving dependent. Zone-dependent time cannot be used in GPS.
3. The hardware of trans-receivers vary from manufacturer to manufacturer. The accuracy of the clocks on the receivers is low since they are made in billions to sell at cheaper price. The high accuracy data from satellites should not be combined with the low accuracy data from the requesting trans-receiver. The avoidance of the data from a low accuracy cheap clock in a local receiver prevents the degradation of the high accuracy data from the satellites.
4. The environment the receivers are in will be different. The changing environment affects the mechanisms that generate the data. The changing environment affects the mechanism of a clock that displays the time.
5. The voltage of the device is not regulated and depends of the battery output. As the battery drains out, the mechanism of the clock on the receiver is affected making the clock to slow down.

For these reason, in order to provide client independent, uniform, high accuracy service, the use of data from the client receiver is eliminated in GPS by treating the request time t as an unknown. Now, instead of three unknowns, (x,y,z), we have four unknowns (x,y,z,t). All that is required is to use data from four satellites in the vicinity instead of three. By incorporating data from one more satellite, GPS avoids the use of inferior low accuracy data from the client receiver and make the system client independent. By avoiding the use of data from the local receiver, it also avoids the contamination of high accuracy data with low accuracy data from the receiver. Using the high accuracy data from satellites alone, GPS increases the accuracy of the position estimation.

The location of the receiver, (x,y,z) and the time of the request, t are estimated by using the data from four or more satellites in the vicinity,

$(x-x_j)^2+(y-y_j)^2+(z-z_j)^2=[c(t_j-t)]^2$, j=1,2,3,4.

All the satellites in the vicinity are more or less in the same environment and hence the effects of environment variations on the mechanisms of the clocks are minimized. The accuracy of the data is the higher since the data from satellites alone are used. When a client receiver make a request to GPS for its position, GPS sends the client total data package that is necessary for estimating the client location, just like what IKEA does when a customer order a table. No client data is used and hence the GPS system is client independent.

Global Positioning System (GPS) has nothing to do with Special Relativity. In fact, since low orbiting satellites are not at the same speed, if time is relative, times $t_j$, j=1,2,3,4 become relative and the relationships,

$(x-x_j)^2+(y-y_j)^2+(z-z_j)^2=[c(t_j-t)]^2$, j=1,2,3,4 have no

common reference. As a result, these relationships cannot be used in the position estimation. If the time is relative Global Positioning System (GPS) is not possible.

The avoidance of the time data from the local clock in a requesting receiver in the Global Positioning System has nothing to do with Special Relativity. The time on a trans-receiver or cell-phone clock depends of the Geographical Time-Zone, Day-Light Saving, Environment Forces Trans-Receiver is Subjected to, Clock Hardware, Clock Mechanism, Strength of the Battery or Mechanical Winding, and the Trans-Receiver Manufacturer. Client dependent and Geographical Zone dependent time cannot be used in GPS. Since the cell-phones are manufactured in billions by different manufacturers, cheap cell-phone clocks are of low accuracy compared to the clocks on satellites. As a result, the avoidance of client data in GPS is also done in order to increase the accuracy of the position estimation and in the process to make the GPS client independent. When a system is client independent, the system can provides uniform service to all the clients independent of the receiver hardware, environment conditions, and the time-zone a receiver is in. Further, when GPS is client independent, GPS is scalable without agreements from multitude of cell-phone manufacturers.

> Time on a client receiver clock is Time-Zone, Day-Light Saving, Hardware, and Client dependent. Zone and Client dependent time cannot be used in GPS.

> GPS avoids the use of low accuracy data from cheap client clocks in order to prevent the degradation of the accuracy while making the system client independent and geographical time-zone independent.

> If the time is relative GPS is not possible.

## XIX. LARGE HADRONS COLLIDER (LHC): A Billion-Dollar-Blunder Hidden in the Swiss-Alps

In the Large Hadrons collider, charge particles are accelerated to very high speeds and make them collide. When the particles collide at very high speeds, it was hoped that the particles will disintegrate into its fundamental constituent sub-atomic particles. However, the idea that it is possible to obtain the fundamental constituent of particles by colliding charge particles is fundamentally misguided and wrong.

The idea that you can create mass by colliding charge particles is incorrect, simply preposterous. You cannot create mass by colliding particles. You cannot generate mass by dividing the electromagnetic energy by square of the speed of light. Electromagnetic energy has no association with a mass. Mass and

electromagnetic energy are not one and the same. Unlike kinetic energy or mechanical potential energy, electromagnetic energy has no association with a mass. It is only the mechanical energy that is associated with a mass. Mechanical energy has no existence without a mass. Existence of electromagnetic energy does not require an association with a mass.

When charge particles are decelerated in a sudden collision in the Large Hadrons Collider (LHC), it generates two types of electromagnetic wave bursts, extrinsic electromagnetic wave bursts (exEMB) and intrinsic electromagnetic wave bursts (inEMB).

When charge particles are accelerated and decelerated at a collision, it generates electromagnetic wave bursts that are extraneous to the outcome of the collision of the particles or exEMBs. These exEMBs are not a result of the disintegration of the particles. These exEMBS are contaminant. It is the misinterpretation of these exEMBs as particles that has led to the impression of mass creation in particles collision. Higher the speed particles are collided with, higher is the content of exEMBs. Electromagnetic wave bursts are not particles. Electromagnetic wave bursts have no association with mass. Collision of particles in a particle collider such as Large Hadrons Collider does not generate mass. You cannot generate mass by accelerating particles. You cannot generate mass by colliding particles. When a particle is accelerated, it is the mass density that increases, not the mass.

When particles undergo a high speed collision, if the speed at which they collide is high enough, they may break apart leaving constituent component of the particles. When particles are broken into its constituent components, it also releases electromagnetic wave bursts that are inherent to the particles themselves or inEMBs. What we want at the collision site is the physical debris as well as the inEMBs that are free of exEMBs. However, the exEMBs are non-separable from the inEMBs in a particle collision in any accelerator.

If we analyze the debris from a particle collision in an accelerator without removing the exEMBs from the crash site, what we get from the analysis is simply garbage. Unfortunately, there is no way to isolate the exEMBs from the inEMBs at the crash site. As a result, the Large Hadrons Collider (LHC) as well as any other particles collider is simply a billion dollar design blunder. Large Hadrons Collider (LHC) is a garbage production machine hidden in the Swiss-Alps.

If the neutral particles are collided at high speed, we do not have the contaminating exEMBs at the collision site and hence the constituent components of the neutral particles can be obtained by colliding neutral particles. However, particle colliders cannot accelerate neutral particles. Colliders are useless for neutral particles.

Large Hadrons Collider (LHC) or any other collider does not generate mass in a collision. You cannot generate mass by colliding particles. Electromagnetic wave bursts are not particles. Neither exEMBs nor inEMBs constitute a mass. Electromagnetic energy has no association with a mass. It is only the mechanical energy that is associated with a mass. A collision of two protons does not generate more protons. It is the misinterpretation of the exEMBs as particles that led to the impression of mass generation in a charge particles collision in LHC. LHC is useless unless the exEMBs are removed from the crash site. The isolation of exEMBs from the inEMBs is not possible. As a result, what you obtain by analyzing the LHC crash site data without removing exEMBs is simply garbage.

If you allow two electrically NEUTRAL peaches to collide at high speed, you will get the constituent element of the peaches, nothing more. However, if you allow two CHARGED peaches to collide at high speed, you will get the impression of creating not just more peaches but some apples, bananas and few dozen cherries too; all due the inclusion of exEMBs as particles. If you allow two CHARGED peaches to collide in an even bigger mega-collider at extreme high speeds, we may get the impression of creating not just more peaches, apples, bananas and few more dozen of cherries, but some pineapples, pears and avocados too; all due to the inclusion of exEMBs as particles. Higher the speeds use in a collision, more the exEMBs it will generate.

It is the presence of exEMBs that makes the outcome of the collision of a pair of charge particles different for each collision. The outcome of a collision of two neutral particles at a given speed will be nearly the same for any collision.

The idea that we have to build bigger and bigger colliders in order to reveal the fundamental particles of nature is simply preposterous. Bigger the collider, bigger the exEMBs that will contaminate the crash site making the outcome useless. There is no way to get rid of exEMBs from the crash site since exEMBs are non-separable from the inEMBs. The fact is that it is not possible to uncover the fundamental element of nature by colliding charge particles in a particle accelerator. Large Hadrons Collider (LHC) is a billion dollar design blunder hidden in the Swiss-Alp. There are few such lesser scale colliders in US too; they are all garbage production machines. What you get from analyzing the data from these machines is simply garbage. They are equally useless in revealing the fundamental particles of nature. However, even though LHC is useless for intended purpose, no one can deny what an engineering marvel LHC is. Unfortunately, Large Hadrons Collider (LHC) as well as other particle colliders remains as billion dollar garbage production machines.

You can use LHC or any other charge particle collider to prove anything you want since every collision of the same particles is different due to the

presence of extraneous Electromagnetic Bursts (exEMBs) radiation produced by the deceleration of charge particles at the collision. You can keep colliding until you get a collision that matches whatever the crap you want to prove and claim 'Eureka'; everybody will believe the claim since it came from a billion-dollar machine. The truth is that you can prove nothing by colliding charge particles in any particle collider including LHC.

> Collision of CHARGED particles at high speed CANNOT be used to reveal the fundamental elements of the particles in nature since exEMBs are non-separable from inEMBs.

> Although the collision of ELECTRICALLY NEUTRAL particles at high speed can reveal the fundamental elements of the particles, particle accelerators such as LHC cannot accelerate electrically neutral particles.

> Particle accelerators such as Large Hadrons Collider (LHC) are Billion-Dollar Design Blunders; garbage production machines.

## XX. NOTEWORTHY FACTS [2, 3, 4,7,8]

a) Light is not relative.

aa) Widely held view 'nothing can travel faster than light' is never proven. The volume of a moving physical object approaches zero as the speed of the object approaches the speed of light. As the speed of a physical object reaches the speed of light, the mass density of the object approaches infinity while mass remain absolute. It is this contraction of volume of a moving object that limits the speed of a mass to the speed of light. However, this speed limit of a material object to the speed of light does not apply to non-materials. The claim that 'nothing can travel faster than light' is incorrect. The correct statement would have been, 'No mass can travel faster than light'.

aaa) Light does not take the shortest path. Light does not follow the geodesic. The speed of light is solely determined by the permittivity and permeability of the medium. The path of light is determined by the density gradient of the medium or the gradient of the permittivity and permeability of the medium.

ab) It is the speed of a mass that cannot exceed the speed of light.

ac) Speed limited to speed of light is only applicable to material things with a mass; it does not apply to mass-less non-materials such as information, waves and fields.

ad) Speed of light is not a universal constant since it is a function of other medium parameters.

ae) There are no universal constants. What are there are universal parameters. Changes in universal parameters do not result in the collapse of natural systems. Natural systems are adaptive to the changes in the universal parameters. Any change in gravitational parameter G is compensated for by the self-adjustment of the radial distance to a planet in a planetary system.

af) If the time is relative, then the time will not be unique.

ag) Time must be unique.

ah) If time is relative or depends on the observer, then, the time will be directional.

ai) Time cannot be directional.

aj) Time cannot be relative since time must be unique and non-directional.

ak) Time is not relative. Time is absolute.

al) Clock and Time are not synonymous. Clock is a device engineered to display human definition of time. A clock displays the right time when the clock is at an environment that satisfy the baseline design specifications. A clock is no different from any other measuring instrument. The display of two clocks that are placed in two different environment forces will be different.

ala) It is the mechanisms of clocks that are affected by the environmental forces resulting in different display times under different conditions, not the time itself. The display of a clock represents the right time only if the design specification of the clock is met since clocks are design to indicate right time only for a specific environment.

alb) Clocks placed at different temperatures also display different times. Are we going to say that the time is dependent on the temperature? A clock slows down if the battery is partially drained. Are we going to say time is dependent on the battery? This shows it is incorrect to claim that the time is relative because the display on a moving clock was different. This also shows it is not possible to claim that the time is affected by gravity because the display of a clock on the sea level was different from the display of a clock on a mountain. It is the mechanism of the clock and hence the display of the clock that is affected by the gravity, not the time itself.

am) Time is a definition. What exists is only the 'now'. There is no time axis; time axis exists in the human mind. Time is just the point 'now'. There is no stack of states for a continuum of time. There is no dimension to time since time is the single point 'now'. Since time is the single point, you can't get a $4^{th}$ dimension by multiplying it by the speed of light. There is no $4^{th}$ dimension. There is no stack of spaces for time continuum since there is no time continuum. The state of the universe is changing continuously and we use these changes to define time. There is only one state of universe, it is its 'now' state. The universe is just like an adaptive algorithm; adaptive algorithm has only one state, its current state.

an) Time is independent of gravity.

ao) The time difference between two clocks at different gravitational potentials is the effect of gravity on the matter and hence the mechanism of the clock. When the forces acting on the mechanism of clocks

are different, the time indicated by those clocks will be different.

ap) The time difference between atomic clocks at different gravitational potentials are due to the effect of gravitational force on the mechanism. Use of the gravitational potential bias of a clock to claim that the time itself is affected by gravity is simply incorrect. It is the mechanism of a clock that is affected by the gravity, which in turn is observed as a bias on the display on the clock.

aq) Gravity affects the matter, not the time.

ar) Gravity influences the material, not the non-material.

as) Time on a client cell-phone depends on the geographical zone, day-light savings, gravity, speed, hardware, strength of the battery, manufacturer, and the environment. Geographical-Zone and client dependent time cannot be used in the position estimation in the Global Positioning System (GPS). GPS avoids the use of Zone and client dependent time by using data from four or more satellites in the vicinity of the receiver alone. The avoidance of cell-phone receiver time has nothing to do with Special Relativity.

b) Light is always a wave, never a particle.

ba) If the light is made of spatially random particles, coherent rays of light are not possible.

bb) If the light consists of spatially random particles or photons, the space will be in a uniform glow. No directional light is possible since photons are spatially random by definition.

bc) Particles are not waves and waves are not particles.

bd) Light consists of wave bursts of universal duration.

bdd) No particle with a mass can travel at the speed of light.

bde) Anything that travels at the speed of light cannot have a mass.

bdf) Only the things with no momentum can reach the speed of light.

bdg) Mass-less particle is an oxymoron.

be) If light is a particle of momentum p that travels at the speed of light, there is nothing to prevent any other particle with momentum p from travelling at the speed of light; a contradiction. Light cannot be a particle. Light has no mass and hence no momentum. Only a mass is responsible for momentum. Electromagnetic energy has no momentum. Only the kinetic energy has a momentum since kinetic energy has no existence without a mass. Electromagnetic energy and the kinetic energy are not the same. Only a mass can possess kinetic energy. We can use the electromagnetic energy to inject kinetic energy into a mass. We also can use the kinetic energy of a mass to generate electromagnetic energy.

be) The existence of kinetic energy depends on matter, a mass. Kinetic energy has no existence without a mass.

bea) The existence of electromagnetic energy does not depend on matter, a mass.

bf) Kinetic energy has no independent existence detached from a mass, whereas, the electromagnetic energy has an independent existence.

c) There are no photons. Photons exist only in the human mind, nowhere else.

ca) Power of an electromagnetic signal, which is the square magnitude, is not the electromagnetic energy. It is the electromagnetic energy that is proportional to the frequency of the wave. Power of a signal is not related to the frequency by the Plank constant. The power of a signal defines the signal strength. It is the frequency of an electromagnetic wave burst that is proportional to the electromagnetic energy.

caa) If you stay long in the sun shine, what burns you is the frequency of electromagnetic waves, not the magnitude of electromagnetic waves. It is the frequency of electromagnetic waves that ejects electrons from your skin cells causing skin damage, not the magnitude of the electromagnetic waves.

cab) If you divide the square magnitude or power of an electromagnetic field by $hf$, what you get is rubbish, not the number of photons. This way of counting number of so-called photons is equivalent to the claim that the electromagnetic field comes in quanta. Electromagnetic field is a vector; vectors do not come in quanta. Vectors cannot be quantized. The magnitude of an electromagnetic field has nothing to do with Plank constant. This is a recurring error in physics text books.

cb) The idea that the square magnitude divide by the $hf$ is equal to the number of photons is incorrect; meaningless. The power or the square magnitude of an electromagnetic wave has nothing to do with the electromagnetic energy or the Plank constant.

cb) It is the electromagnetic energy that is proportional to $hf$, not the power of the wave. Power of a wave has nothing to do with its frequency. Power fades with the distance due to attenuation of the medium. Frequency fades with the distance due to path electromagnetic energy loss.

cc) $e \neq mc^2$. e is electromagnetic energy and $mc^2$ is mechanical energy; they are not equal.

d) Einstein started relativity by drawing the path of an electromagnetic wave burst fired vertically from the bottom of a moving train relative to the train as vertical; when you do that you are making the presumption that the light has a mass as if light is behaving as a golf ball. In Special Relativity, the light is given a mass by presumption, not as a proven fact of nature, a hidden fatal error. Light has no mass. You can't force upon a mass on light as presumption, as it is done insidiously in the Special Relativity. The path of the light pulse relative to the train is not vertical. It is vertical relative to an observer at stand-still outside, not for someone inside the moving train. It is this fatal error that created all the havoc in science for almost a century.

da) If you read the related paper of Einstein's, you will discover that the equality $e = mc^2$ was never proven. It cannot be proven, because it does not hold true,

e≠mc$^2$. It is a deception in inception.

db) Only a mass has a momentum. Light has no mass. Light has no momentum.

e) Planetary orbits are not fixed. The change of mass of a planet affects the radial distance of the planet resulting in the orbit dilation or contraction.

f) Light is subjected to frequency-fading or frequency red-shift due to the path electromagnetic propagation energy loss with the distance.

fa) The Doppler's effect can only be applied for light that travels short distances where the propagation electromagnetic energy loss or path loss is negligible.

fb) When light travels for billions of light years, as it is the case for light from distant galaxies, the propagation electromagnetic energy loss or path loss is dominant and significant and as a result the Doppler's effect is not applicable.

g) The galactic red-shift is due to the path electromagnetic energy loss from the distance travelled.

ga) Increasing or decreasing red-shift of the light from distance galaxies is a result of the radial movement of galaxies due to the galactic mass variations.

gb) If the galactic red-shift is increasing, then, the galactic orbit is dilating due to mass increase.

gc) If the red-shift is decreasing, then, the galactic orbit is contracting due to a galactic mass decrease.

gd) Any galaxy in space must orbit a central galaxy.

ge) Expansion or contraction of space cannot change the position of an object in space. The relative position of an object is determined by the gravity and the momentum. The position of a planet, star or galaxy is determined by the gravitational bond between them. Expanding space cannot alter relative positions of galaxies, stars or planets that are determined by gravitational bonds. Increasing radial distance of a galaxy cannot be attributed to an expanding space since expanding space cannot alter the radial distance of a galaxy.

gf) Space does not determine the position or the behavior of an object.

gg) Neither does an object tell the space how to bend nor does the space tell an object how to move. There is no space bending.

gh) Space and the behavior of an object are mutually independent.

h) Universe is not expanding. The idea of expanding universe is a result of Cave-Man Syndrome.

ha-ha) Universe is here not because we are here to observe it. The existence of universe does not depend on the presence of a human observer. Anthropological principle is meaningless. Reality is independent of observers. Observer dependent reality is a dreamed up reality that exists only in the human imagination.

i) There is no space-time. There is no time. Time is a definition. We define time based on the motion of the celestial bodies.

j) Time is not relative. Mass is not relative. Light is not relative. It is the mass density that is relative. The mass density increases with the speed while the mass remains the same. It is the volume of an object that is relative. Volume of an object contracts with the speed.

ja) If the age of the universe is calculated as the inverse of the Hubble constant, then, the age of the universe is a constant since the Hubble constant is a constant. Forever young! You can't use a constant to calculate the age of the universe. Hubble's interpretation of the galactic red-shift is incorrect. Calculation of the age of the universe using Hubble's constant is invalid.

k) Quantum Mechanics is a Theoretical as well as a Practical blunder. In the double-slit experiment, particles do not pass through the double-slit barrier. All the particles are stopped at the double slit barrier. It is this sudden stopping of moving charged particles at the double-slit barrier that are responsible for what appears on the phosphor screen behind the double slit barrier. When a charge particle is stopped at the double-slit barrier, it generates an electromagnetic wave that travels through the two slits out of phase creating an interfering pattern on the phosphor screen. The brightness of phosphor screen at a particular point depends on the strength of the electromagnetic wave at that point. The peaks of the interfering electromagnetic wave appear as bright spots resulting in an interfering pattern of bright spots. If you replace the phosphor screen with a particle detector, you will not see any particle there. There are no particles behind the double-slit barrier at the phosphor screen in the double-slit experiment.

ka) Particles are not waves.

kb) You cannot generate more protons by colliding two protons in a particle accelerator such as Large Hadrons Collide (LHC).

kc) Collisions in particle accelerators do not generate mass. When moving charge particles are suddenly stopped by a collision in the Large Hadrons Collide (LHC), it generates extraneous Electromagnetic Wave Bursts (exEMBs) that are non-separable from the inherent Electromagnetic Wave Bursts (inEMBs) due to the disintegration of the particles by the collision into subatomic particles. It is the misrepresentation of the exEMBs as particles that led to the impression of mass creation in LHC. Electromagnetic bursts are not particles. LHC collisions do not generate mass.

kd) LHC is useless unless the exEMBs are removed from the crash site. The exEMBs are non-separable from inEMBs. As a result LHC is useless for subatomic particle exploration.

kda) It is the presence of exEMBs that makes the outcome of the collision of a pair of charge particles different for each collision. The outcome of a collision of two neutral particles at a given speed will be nearly the same for any collision.

ke) LHC is a billion-dollar design blunder hidden in the Swiss-Alp; a garbage production machine of an engineering marvel.

kf) Fundamental particles of nature cannot be separated by colliding charged subatomic particles in a particle accelerator due to the inability of removing

exEMBs from the crash site.

kg) If electrically neutral particles are collided at high speed, they can be broken down to constituent sub-particles. However, charge particle accelerators such as Large Hadrons Collider (LHC) are useless for accelerating electrically neutral particles.

l) Nothing can be at multiple places at the same instant irrespective of its size. To say a particle can be at many places at the same time is simply the Houdini-fication of science. Science is not magic; magic is not science.

la) Position and momentum pair is not a Fourier Transform pair since momentum cannot change without the change of position and the position cannot change the without change of momentum for a given mass. Position and momentum are not mutually independent unlike time and frequency. As a result, Heisenberg uncertainty principle is an outcome of Fourier Transform misunderstanding; it does not hold true.

m) The eccentricity of an elliptical orbit is a vector. The magnitude of the Eccentricity Vector is the eccentricity of the elliptical orbit. The direction of the Eccentricity Vector is the major axis.

n) Precession of a planetary orbit is the result of swinging rotation of the major axis due to the mass decrease of the sun.

o) The precession is a measure of the rate of mass depletion of the sun.

p) When the Eccentricity Vector is a null vector, the orbit is circular.

pa) When the Eccentricity Vector is a null vector, there is no major axis.

pb) When the Eccentricity Vector is a null vector, there is no Eccentricity Vector or major axis to rotate and hence there is no precession.

q) Planetary precession in our solar system is directly related to the orbit contraction.

r) Any rocket that leaves the earth into outer space will result in a mass reduction of the earth much more than the mass of the rocket itself since the column air surrounding the rocket also reaches the escape velocity leading to orbit contraction and hence global warming.

s) Multi-verse (Crapostology-101)

t) Inflation (Mythostology-101)

u) Expanding Universe (Cave-Man Syndrome)

uu) Dark energy (Sciencing in the Dark) is an outcome of forcing Keplerism onto star/galactic orbit systems. Keplerism does not apply to star/galactic orbit systems. Even for the solar system, Keplerism applies as an approximation.

ua) There are no universal constants. There are universal parameters. Any change in a universal parameter does not result in a collapse of a system. A change in a universal parameter results in an adaptive adjustment of the system. A change in the gravitational parameter G does not leads to a collapse of an orbiting system. Any change in the gravitational parameter G is compensated for by adjusting the radial distance to the orbiting object.

ub) Any change in the Coulomb parameter k does not leads to a spiraling down of an electron in an atom. A change in Coulomb parameter k does not lead to a collapse of an atom. A change in k results in a radial distance adjustment of electrons in an atom.

uc) Natural systems such as electrons orbiting in an atom, and planets orbiting the sun are robust to the changes in the universal parameters.

ud) Electron orbits in an atom are planar just as the planets in a planetary system are planar.

ue) An atom with electrons on circular orbits is stable since the electrons on circular orbits do not radiate.

uf) Atoms are not spherical balls.

ug) Atoms are circular disks of thickness equivalent to the diameter of the nucleus. The radius of the atomic disk is the radius of the outer most electron of the atom.

uh) Flat molecular structures are a result of the circular-disk atomic structure.

v) Any mathematical model of a particle must be able to uniquely define the state of a particle for the model to hold true. Modeling a particle to be at multiple places at the same time is magic, (Houdini-fication, Voodoo-fication, or Harry-Potter-ization); not science. Any mathematical model must be unique for it to hold true.

w) There is no dark-matter or dark-energy. What is there is darkness in our understanding or rather misunderstanding [7].

wa) We cannot probe the entire universe.

wb) Our ability to probe the universe is limited by the red-shift or frequency down-shift of the electromagnetic waves due the propagation loss of the medium or space.

x) The amount of matter or energy in the universe is not calculable.

xa) Not all the energies are the same.

y) Heisenberg uncertainty principle is a result of Fourier Transform ignorance or misunderstanding [8]. The position and the momentum of a particle are not a Fourier Transform pair. The product of change in position and the change in momentum is not limited by a constant. A particle of constant mass cannot change its momentum without changing its position [8]. The Position and the momentum of a particle are not independent and as a result they do not form a Fourier Transform Pair.

ya) A particle is either here or there. It does not matter how small a particle is, a particle cannot be in multiple places at once.

yb) If the wavelength $\lambda$ of a particle is determined by momentum $p$ alone, where $\lambda=h/p$, how do you determine if that momentum is a result of a microscopic object or a macroscopic object? Both microscopic object as well as a macroscopic object can have the same momentum. Momentum says nothing about the size of the object. The relationship $\lambda=h/p$ says nothing about the size of the object.

yc) $\lambda \neq h/p$.

z) Schrödinger equation is incorrect since the state of a particle is modeled using the eigenvalues. The eigenvalues are not unique and hence the state of a particle cannot be model uniquely by eigenvalues. Further the mechanical energy of a particle cannot be represented by $hf$, the product of the Plank constant and frequency. It is only the electromagnetic energy that is proportional to the frequency. Schrodinger equation is not a unique realistic model for a particle of reality.

za) Angular momentum is a vector. Vectors do not come in quanta. Vectors cannot be quantized. As a result, Bohr atom that is based on the quantization of the angular momentum is incorrect. Angular momentum does not come in quanta. Angular momentum cannot be quantized.

zaa) The angular momentum of an electron in an atom is not conserved except in the Hydrogen atom. It is the total angular momentum of all the electrons in an atom that is conserved.

zb) Eccentricity of a planetary orbit is not a scalar quantity.

zc) Eccentricity of planetary orbit is a vector.

zd) Eccentricity Vector of a planetary orbit is planetary-mass invariant and time invariant.

ze) Eccentricity Vector of a planetary orbit is a constant all the time irrespective of the fluctuations of the mass of the planet.

zf) When Eccentricity Vector is a null vector, the orbit is circular.

zg) Planetary precession is the swinging rotation of the Eccentricity Vector.

zh) Only a continuous increase or decrease of a parameter of an elliptical orbit of a planet can create a precession or the Eccentricity Vector rotation.

zi) Planetary precession is the swinging rotation of the Eccentricity Vector due to the continuous mass degradation of the sun. The gravitational pull from the other planets is equivalent to the increase of the effective mass of the sun for one half of the orbit and the decrease of the effective mass of the sun for the other half of the orbit resulting in a cyclic effective mass variation of the sun contributing to the precession.

zia) Radiation, loss of high energy particles due to solar winds degrade the mass of the sun.

(zib) We are able to witness the loss of the mass of the sun due to solar wind here on earth in the northern light (aurora borealis) or southern light (aurora austral).

zic) Gravity is not a wave. Although the Laser Interferometer Gravitational Wave Observatory (LIGO) is expected to measure gravitational waves (fantasy waves), there is no way to be certain what is being measured are gravitational waves. The changes in the lengths of LIGO arms as a result of earthly vibrations due to the local environment factors, both atmospheric and geological, as well as manmade vibrations far exceeds in many million folds the magnitude of changes due to the hypothetical gravitational waves the instrument is expected to measure. How do you say the changes in the lengths of LIGO arms are due to fantasy (gravitational) waves and not due to any one of many other possible factors that can generate LIGO arms contraction and expansion in many folds in magnitude?

zica) No space-bending is required to locate the real earthly source of LIGO-Burst (GW150914).

zid) The so-called gravitational wave or LIGO-Burst GW150914 is a result of a near surface vibration activity surrounding Fort Collins, Cheyenne, Greely, and Denver. Vibration activity could have originated anywhere in North Eastern Colorado, South West Nebraska, South East Wyoming, and North West Kansas in the USA.

zie) Gravity and time delay don't go together. Gravity must be present everywhere simultaneously without time delay. Gravity doesn't propagate; gravitational field of infinite range is inherent in mass.

zig) Mass and its infinite span gravitational field are a single entity. A mass does not exist without infinite span gravitational field; infinite span gravitational field does not exist without a mass.

zih) When two masses combine to form a single mass, each mass and its associated infinite span fields combine to form a unified mass with unified infinite span field through superposition.

zii) Universe cannot exist if the gravity is a wave that takes time to travel.

zij) If space-time exists, the permittivity and permeability of space must vary with the curvature of the space-time for light to follow the curvature of space-time.

zik) If light follows the curvature of the so-called space-time, the speed of light cannot be a constant since the permittivity and the permeability of space varies with the space-time curvature.

zil) There is no space-time and hence there is no space-time undulations or gravitational waves.

zim) It is possible to model the stock market crash or epileptic seizure as collisions of different pairs of black-holes; it is just the mathematical modeling of data. That does not mean that the stock market crash or epileptic seizures today are caused by black-holes collision somewhere billion of light years in the past.

zim) Just because we can represent the vibration of a pair of LIGO-Arms or LIGO-Bursts as gravitational waves due to a collision of a pair of black-holes does not mean that the LIGO bursts are a result of black-holes collision. The same LIGO-Bursts could have been generated by an earthly vibration source.

zin) If the model that the data is represented is unique or there is no other model that could represent the data, only then, it is possible to say that the data is generated by the physical process described by that model.

zio) Black-holes collision model for the LIGO-Burst is not unique. Therefore, it is not possible to claim that LIGO-Bursts are a result of gravitational waves or space-time undulations generated by a black-holes

collision.

zip) If the gravitational waves or fantasy waves travel at a speed that is a constant, what will the story be relative to an observer in motion (dé jè vu)?

ziq) Gravitational Waves (GW) cannot generate a relative motion. If there are gravitational waves, it is the whole object that is subjected to the contraction an expansion. In the case of beads on a stick, there will be no vibration of the beads relative to the stick in the presence of GWs. Sticky-Beads-Experiment is invalid and meaningless.

zj) Universe is not finite.

---

A particle cannot be mass-less.
There is no momentum without a mass.
There are no mass-less particles.

---

If you follow Physics Textbooks and divide the power of an electromagnetic wave by $hf$, what you get is rubbish, not the number of hypothetical photons.

---

If you draw a vertical line to represent a path of light burst fired in vertical direction from the bottom of a moving train relative to a train, what you get is a century of reality altering, time wasting, mass altering, particle waving, and space bending weirdness; pure waste of time, resources, and life.

---

Vectors do not come in quanta.
Vectors cannot be quantized.

---

## XXI. PLANETARY MOTION, EARTH, SUN AND THE LIFE UNDER THE SUN IN PERSPECTIVE

Mass of a planet or a galaxy is not a constant or time-invariant. Mass of a planet, a star, or a galaxy fluctuates due to radiation loss as well as for several other causes. Planets in a solar system are frequently bombarded by foreign objects resulting in mass fluctuation. In addition, the earth loses mass due to man-made causes. The mass loss of the earth is predominantly due to human activities. Although mass of a planet fluctuates, planets in our solar system as well as any other orbiting system always keep orbiting elliptically irrespective of the perturbations they are subjected to; the secret for this stability is the orbit adaptability.

Contrary to the popular belief, planets do not have fixed orbits since the mass of a planet as well as the mass of the sun are not constants or not time-invariant. The mass of a planet as well as the mass of the sun are time-varying. A planet cannot be in a fixed orbit when the mass of the planet as well as the mass of the orbiting center, or mass of the sun in our solar system are time-varying or not constants. For planetary orbits to be stable, they must be robust to mass fluctuations. The planetary orbits are elliptically closed. No perturbation of planetary parameters results in the spiraling down of planets leading to the collapse of a planetary system.

Newton thought that the planetary orbits are fixed and that it was necessary to tweak the planets back into their permanent orbits occasionally in order to maintain perpetually stable orbits, and it was perhaps done by some sort of divine intervention. In any case, the divine is not real and it is a human construct that only exists in human consciousness. Divine is a human ignorance dump site. No such imaginary divine intervention or any other outside intervention is required for planets to go around and around perpetually on elliptically closed orbits regardless of the perturbations they are subjected to. The elliptical stability of planetary systems is real.

Planetary orbits are elliptically time-invariant. Planetary orbits are elliptically closed irrespective of time, all the time. Gravitational pull from other planets cannot open elliptically closed planetary orbits. A planetary orbit takes elliptically closed path in the presence of gravitational pull from other planets. Planetary orbits are elliptically stable. It does not matter what mass perturbation a planet is subjected to, the orbit of the planet always remains a closed stable elliptical orbit irrespective of the mass fluctuations, all the time. Planetary orbits remain stable on closed elliptical orbits against mass fluctuations through orbit dilation and contraction.

Although the planetary orbits are always closed elliptically, the radial distance to a planet at any given angle is not time-invariant and depends on the mass of the planet at that instance. The orbit dynamics remains unaffected as expected due to the mass variations of the planets even though the radial distance varies. If the mass of a planet increases at any instant of time t, then, the radial distance of the planet increases at that instant of time t, or the orbit dilates at that instant of time t. On the other hand, if the mass of a planet decreases at any instant of time t, the radial distance decreases at that instant of time t, or the orbit contracts at that instant of time t.

Any change in the speed of an orbiting object, whether it is a planetary orbit or an orbiting electron in an atom, does not lead to the collapse of the system from continuous spiraling-in or spiraling-out of that orbiting object due to speed perturbations. As the parameters of an orbiting system undergoes change in time, what takes place is orbits adjustment, not a collapse. Any change in the parameters of an orbiting system is compensated for by orbit distant adjustment. Neither atom nor planets or universe in general could exist without this inherent adaptive ability for orbit dilation or contraction against the change of the parameters of an orbiting system. Even any change in the gravitational parameter G in an orbiting planetary system or any change in the Coulomb parameter k in an electron orbit in an atom is compensated for by radial distant adjustment.

It is not just the planetary orbits that are elliptically

stable against varying planetary masses. Galactic and super-galactic orbits are elliptically stable against varying galactic and super galactic masses. As it is in the case of planetary orbits, galactic and super-galactic orbits are both elliptically stable. When a galactic orbit is time-invariant, the galaxy always keeps orbiting on a closed elliptical loop irrespective of time, all the time. When a galactic orbit is elliptically stable, the galaxy keeps orbiting on a closed elliptical path all the time irrespective of the mass fluctuations, although the radial distance varies with the fluctuations of mass.

In other words, whether it is an electron orbit in an atom, planetary orbit, galactic orbit, or super-galactic orbit, they keep going around and around irrespective of the mass variations or the variation of any other parameters of the orbiting system. No outside intervention of an imaginary divine force is required to keep the orbiting planets on track. No divine intervention is required. The only possible difference between electrons orbiting in an atom and the planets orbiting around the sun is that the planetary orbits are elliptical while the electron orbits are strictly circular [2]. Further, in the case of planetary orbits, planets are subjected to a gravitational force, while the electrons in an atom are subjected to a dominant electrostatic force. A charged object orbiting under an electrostatic force can only be stable if the orbit is circular. Electrons orbiting on circular orbits are radiation free. On the other hand, any object orbiting under gravitational force can be both elliptical as well as circular. An electrically charged particle on circular orbit remains stable orbiting perpetually since a charged particle on a circular orbit is radiation free.

The eccentricity defines an ellipse. An ellipse defines a planetary orbit. Although, it has been customary to treat the eccentricity as a scalar quantity, the eccentricity of an ellipse is not a scalar quantity. A scalar eccentricity cannot define an elliptical orbit uniquely. The eccentricity of an ellipse is a vector. The Eccentricity Vector **e** determines an elliptical path of a planet uniquely. The magnitude of the Eccentricity Vector e=|**e**| is the eccentricity of an elliptical orbit. The direction of the Eccentricity Vector **e** is the major axis of an elliptical planetary orbit. There is no existence of an elliptical orbit without a non-null Eccentricity Vector.

When the Eccentricity Vector is a null vector, **e=0**, the orbit is a circular orbit. A circular orbit has no major axis or minor axis; a circular orbit has no especial axis. The Eccentricity Vector **e** is time-invariant. The Eccentricity Vector is also mass-invariant. The mass-invariance of the Eccentricity Vector **e** is achieved through adaptive radial distance adjustments or, in other words, through orbit dilation and contraction against mass variations.

The time-invariance property of the Eccentricity Vector **e** keeps a planet orbiting on a closed elliptical path irrespective of time. The mass-invariance of the Eccentricity Vector **e** keeps a planet orbiting on a closed elliptical path irrespective of the mass

variations of the planet, which is realized by adjusting the radial distance against the mass variations. As a result, the mass-invariance of the Eccentricity Vector **e** results in orbit dilation and contraction against mass fluctuations. No matter what the mass fluctuation is, the elliptical orbit of a planet remains closed elliptically against mass fluctuations all the time as a result of the mass-invariance and the time-invariance of the Eccentricity Vector **e**. The Eccentricity Vector provides a natural as well as transparent orbit representation for a planetary system.

A gravitational pull from other planets do not open up an elliptical orbit of a planet. A gravitational pull from other planets cannot open up an elliptical orbit of a planet. A planet takes an elliptically closed orbit in the presence of gravitational pull from other planets. A gravitational pull from other planets can change the elliptical orbit depending on the mass of the other planets; however, elliptical orbit remains close all the time [7].

The effects of the gravitational pull from other planets are the cyclic increase and decrease of the effective mass of the orbit center. The change of the mass of the orbit center results in the rotation of the Eccentricity Vector of a planetary orbit. It is the Eccentricity Vector that changes in the presence of a gravitational pull from other planets. In the presence of gravitational pull from other planets, the effective mass of the sun gradually increases for one half of the cycle and decreases for the other half of the cycle, but the average mass of the sun within a cycle remains a constant if the mass of the sun is a constant.

Planetary precession has a long history. All throughout history, there has been many efforts to describe and estimate the precession of a planetary orbit. The Eccentricity Vector **e** provides the real cause of the planetary precession. The Eccentricity Vector has a direct relationship to the planetary precession. We know that the planetary precession is a result of the rotation of the major axis of the planetary orbit. Major axis of an elliptical orbit is the Eccentricity Vector **e**. So, the planetary precession is the result of the rotation of the Eccentricity Vector **e**. For the planetary precession to be present, the Eccentricity Vector must be a non-null vector, **e≠0**.

What makes the Eccentricity Vector to rotate? It is the change of mass of the sun or the change of the effective mass of the orbiting center of a planet that makes the Eccentricity Vector to rotate. The Eccentricity Vector **e** rotates when the effective mass of the orbiting center of a planet changes. The real mass of the sun changes continuously due to the mass depletion of the sun. In addition, the effective mass of the sun on a planetary orbit changes cyclically due to the gravitational pull from other planets. The effect of gravitational pull from other planets on a planetary orbit can be interpreted as a gradual increase of the effective mass of the sun for one half of the orbit, and the decrease of the effective mass of the sun for the other half of the orbit. The

Eccentricity Vector rotation also directly related to the Rotation Vector or the angular momentum per unit mass of a planet. Since the Rotation Vector of a planet varies with the gravitational pull from the other planets, the Eccentricity Vector rotation or the precession is also directly affected by the gravitational pull from the other planets.

In our solar system, the Eccentricity Vector rotation is also partly due to the continuous depletion of the mass of the sun, and partly due to the change of the effective mass of the sun due to the gravitational pull from the other planets. The rate of change of the Eccentricity Vector or the precession is also proportional to the rate of change of the mass of the sun. Further, the rotation of the Eccentricity Vector is also proportional to the rate of change of the radial distance, dr/dt of the orbit. As the rate of change of radial distance of the orbit approaches zero, dr/dt→0, the precession also approaches zero; the orbit become circular and the Eccentricity Vector is a null vector **e**=**0**, and as a result there is no Eccentricity Vector to rotate. Without Eccentricity Vector or, in other words, without a major axis to rotate, there would be no rotation and hence there is no precession in circular orbits.

The rate of rotation of the Eccentricity Vector is proportional to the rate of change of the radial distance of the elliptical orbit and the rate of change of the mass of the sun; this leads to an interesting outcome. The rate of change of the radial distance is positive for one half of the elliptical orbit and the rate of change of radial distance is negative for the other half of the elliptical orbit. As a result, the rotation of the Eccentricity Vector or the major axis of the elliptical path is oscillatory as the mass of the sun depletes. The precession of an elliptical orbit due to the mass depletion of the sun is oscillatory; just like a pendulum that swings between two angles, the Eccentricity Vector or the major axis swings from one positive angle to a negative angle and vice versa. However, the positive angle of the swing is not equal to the negative angle of the swing within an orbit period since the change of mass is not uniform. As a result there is an overall continuous unidirectional eccentricity rotation or precession with the change of the mass of the sun. The rotation of the Eccentricity Vector due to the gravitational pull from other planets is unidirectional and persistent. The total precession of an orbit is the sum of the precession due to the depletion of the mass of the sun, and the precession due to the effect of the gravitational pull from the other planets.

The eccentricity or the magnitude of the Eccentricity Vector is also increases as the mass of the sun depletes. The variation of the eccentricity is negligible since it is inversely proportional to the square mass of the sun. The effect of gravitational pull from other planets increases the eccentricity persistently making an elliptical orbit more and more oblong with time.

As we have seen, the orbit dilation and contraction keep a planet orbiting on a close elliptical path all the time in spite of the mass fluctuations of the orbiting system. The eccentricity vector is invariant against planetary mass perturbations. Planetary orbits are elliptically stable. In the case of a mass depletion of a planet, the mass-invariance of the eccentricity vector and orbit stability are achieved through orbit contraction that brings the planet closer to the orbiting center or the sun in our solar system.

Even though, the orbit contraction keeps the earth going around and around on a closed elliptical orbit all the time against the mass fluctuations of the earth, it is not without unintended consequences. It brings about the undesired side effect of Global Warming that affects the well being of the living species, and the sustainability of life on earth. A perpetual Global Warming is harmful to the planets ability to sustain life. More the mass loss the earth undergoes, the more the orbit contraction and hence more the warming of the earth. Although a certain amount of mass depletion of the earth is due to natural causes, the majority of the mass loss on earth is due to unintended human activities.

We seem to have a long held misguided belief that the earth has a constant mass and a fixed orbit. Although there is no proof that a planet has a fixed mass and a fixed orbit, it has been ingrained in us. It allowed us to do whatever we desired, treating the earth as an object with inexhaustible resources; we even talk about sending cargos to other planets. We are treating the earth as a pool of unlimited resources; a bottomless pit to extract resources from. We seem to think the people who could extract and consume the most resources are the most cultured and the smartest. We reason that the patch of land we are on and the resources on that patch and underneath our feet are given to us by some creator entity for our exclusive use and for us to exploit whatever the way we desire. So we put up a picket fence and a guard post and call it our country and keep exploiting the resources to the extreme. We use the phrase 'it is a sovereign country' and whatever we do within our picket fence is nobody's business for the defense of our actions against critiques. We dig and burn, squeeze out whatever we can, clear cut whatever on the surface, dump whatever garbage into rivers. We are blinded or purposely disregard the fact that whatever we do within our picket fence or the country affects the heath of the entire planet earth, not just that patch of land. We seem to think in order to secure our patch of land from other's wrong doing, all we have to do is to build a wall around it. A wall is not going to protect the planet. If we aware that our actions affect the mass of the earth and hence its radial distance to the sun, we might have change our view of the earth and act differently. The continuation of mass depletion of the earth means the continuation of the orbit contraction and hence the continuation of global warming; this in effect gradually makes the life

on earth not sustainable.

There are many different causes for the mass depletion of the earth. When we launch a rocket into outer space, it is obvious that the mass of the earth is depleted by the mass of the rocket, yet we seem to pay no attention to it; we celebrate it as a triumph. Yes, it is a triumph; no question about that. Not only that, when a rocket reaches the escape velocity of the earth's gravity, it is not just the rocket itself that reaches the escape velocity of the earth's gravity. A large column of air surrounding the rocket also reaches the escape velocity of the earth's gravity, in effect, opening a faucet of air that flows out of the earth's gravity into the space; it is going to continue even after the rocket has long gone resulting in further mass depletion. This mass loss is permanent. We have completely forgotten that the earth's mass is limited. We even talk about sending massive cargos to the planet Mars to make a permanent settlement there. The fact is, it is not possible to export mass to other planets without altering the health of the planet earth as well as the state of the other planets. When the planet Mars receives a cargo from another planet, its mass increases resulting in orbit dilation and hence planetary cooling, while the sender is subjected to planetary warming due to mass loss.

There are many other ways the mass of the earth is lost. When we dig out and burn fossil fuel in massive scale continuously, earth undergoes a continuous mass loss. It is an unending mass loss that continues every second. When we generate hydrogen gas, any hydrogen that leaks out into the atmosphere will be lost since the earth's gravity is not sufficient to hold onto the hydrogen in its natural form as a gas. Although the most abundant element in the universe is hydrogen, the lack of hydrogen in our atmosphere in its natural form as a gas is a good indication to the fact that the earth's gravity is insufficient to hold on to the hydrogen as a free agent. Hydrogen fuel cells are not environmentally friendly means for generating energy for this very reason.

There are also ways for earth to gain mass. The trees or the bio-mass, in general, are the mass generators. They convert electromagnetic energy into mass. When we destruct the forest in large scale, we are in effect, destructing the earth's capacity to generate mass. Just look around and see how much wood is used to build a single house; see how much wood is used in a single paper mill; see how much wood is used in fencing and walk ways; add them together and see how many trees had to be cleared to achieve all those per day, you will see the enormity of the effect. We are destructing the earth's ability to generate mass to compensate any mass loss. What happened to the trees in British Isles? When we create a forestry industry for the whole purpose of clearing the forest as economically efficiently as possible, of harvesting maximum amount of trees in minimum amount of time at minimum expense, we are, in effect, creating an industry to prevent or mean to prevent the earth's ability to compensate the mass loss as efficiently as possible.

Occasionally, the earth can also gain mass through the collision with asteroids and meteorites. In the event the earth collides with a massive asteroid, the earth's orbit can dilates even to the extent of bringing the ice age; this might have been the cause for the disappearance of the dinosaurs. Earth has the natural ability to remain balanced within these extremes, and to remain within the life sustaining Goldilocks zone. However, the natural balance mechanisms are ineffective at extremes, especially if the mass loss is man-made and perpetual. Earth's perpetual mass loss leads to global warming. Global warming reduces its ability to generate mass and hence leads to further mass loss driving the earth into an everlasting vicious cycle, a feed forward global warming system that is irreversible.

We know how People in Easer Island destroyed themselves by destroying the environment they lived in. Easter Islanders exhausted resources to make offering to a mythical non-existent creator until all the resources were exhausted. They were in competition erecting bigger and bigger statues to satisfy a mythical non-existent creator they believed in and to show who satisfy the mythical creator the most that they lost the touch with reality. There was no creator for their rescue once they had exhausted the island's trees that their survival depended upon. They did not even have a single tree left to make a boat to escape out of the island. In our case, unlike the Easter Islanders, even we have mean to leave the planet, if the planet becomes un-inhabitable, there is no place else to go to. The fate of the Easter Island Inhabitants is a humbling example of unchecked reality.

Unchecked competition under limited resources can be dangerously fatal. If we clear the ocean of species, if we clear the land of tress and bio-mass, sky-high concrete structures and crude oil reservoirs are not going to be any help to sustain the life, and we may face the same fate of the Easter Islanders, but in a bigger scale. Easter Islanders had a choice of managing the resources sustainably, but they didn't and they had to face the tragic consequences. We have the choice of managing the resources on earth sustainably, but are we doing that? We are so involved in the competition, we have one goal, the growth of the economy, one track mind, which will come back to haunt us all. Continuous economic growth is not possible under limited resources in a volatile environment.

The idea of expanding universe and the Quantum Mechanics have become the new religion. They preach that a particle can be at several places at once, and expect others to believe it. If you model a particle, the parameters of the model must be unique. If you use the eigenvalues to model the parameters of a particle, parameters will not be unique since the eigenvalues are not unique [8]. It is this non-unique parameter modeling that had led to the Quantum

Mechanics bizarreness [2].

Some claim that the gravity can bend light. How can gravity bend light when light has no mass? Light is not going to possess a mass just because we make the presumption that light has a momentum. When we represent a path of a vertical beam of light from the bottom of a horizontally moving train as vertical relative to the moving train, what we are doing is we are forcing a mass on light; this is exactly how light started to possess a mass in Special Relativity; by false assumption. They used the bending of light near a gravitational object to falsely substantiate the assumption that light has a mass. They overlook the fact that it is the medium density gradient created by gravity that bends the light. In the absence of a medium, gravity has no effect on light [3]. Light has no mass. Electromagnetic radiation has no mass. Electromagnetic energy and mechanical energy are not the same. Mechanical energy is associated with a mass. Electromagnetic energy has no association with a mass.

Universe is not expanding. The Doppler's effect is not applicable for the waves that travel large distances where the propagation electromagnetic energy loss is significant. The Doppler's effect is only applicable for short distances where the propagation loss is negligible. For situations where light travels billions of years, the path electromagnetic energy loss is significant and Doppler's effect is not applicable. The observed galactic red-shift is not an indication of universe expansion. When the light or electromagnetic waves travel large distances, they undergo electromagnetic energy loss or propagation energy loss. Electromagnetic energy of an electromagnetic wave burst is proportional to the frequency of the wave burst. As a result, when an electromagnetic wave loses electromagnetic energy along the path, its frequency will be faded, down-shifted or red-shifted. This is the reason why distant stars appear red. This is the reason why our visible universe is limited.

The maximum distance light can travel before it is down shifted below the range of the visible frequency spectrum due to the propagation loss is our visible universe. Frequency down-shifted light below the visible region of the spectrum is what has been referred to as the microwave background. Frequency downshifted light below the visible region, which is referred to as the microwave background, carries the information about the universe from beyond our visible region. The visible universe is a moving 3D horizon relative to the observer. The visible universe relative to another planet will be different.

The INCREASING or DECREASING galactic red-shift indicates the radial movement of a galaxy due to the galactic mass fluctuations. Universe is not finite. When we receive light from distance, what we see is not our past, but it is the past of our distant neighbor's. Similarly, when our distance neighbor's looked into distance, what they would see is not their past, but our own past.

Whether the earth is able to support life or not depends on the radial distance of the planet from the sun, or the location of the orbit. The radial distance of the earth from the sun, or the location of the orbit depends on the mass of the planet. Mass of the earth fluctuates. Our actions can shift the balance of mass fluctuation to a perpetual mass loss, which leads to a perpetual orbit contraction. The earth is not a bottomless pit we could extract resources from endlessly. Continuous growth of economy without destruction of the planet is not possible; self-destruction. Unregulated competition under limited resources without harming the planet is not possible. We cannot keep transporting material to the outer space endlessly without adverse effect on earth, without reducing the radial distance to the sun. We cannot dig and burn endlessly without negative consequences. The mass of the planet should not be allowed to decline below the point of no return.

If we have only one known place that support life, and that place is where we are now, it is worth reconsidering the way we look at that place and see how we can maintain its ability support life before it is too late. It does not matter within which picket fence with a guard post we are in; it is the earth as whole that determines whether it can sustain life. It doesn't matter how harmoniously with nature you are living within you picket fence with a guard post that you call your country, it does not matter how strong homeland security system you have, or how strong high-tech space weapon shield you have, if the people outside of picket fence is contributing to the perpetual deterioration of the earth's mass, you will be in the same boat as others. Our existence is not determined by within which picket fence we are in or how strong the guard post is at our picket fence; a wall is not going to protect us against planetary degradation.

The idea that the universe and everything in it is a work of a creator entity began in the dark ages. The concept of a creator has been passed down from generation to generation religiously as an unquestionable fact. However, what we see in the universe is mainly useless real estate that serves no apparent purpose, mainly junk, except a negligibly small portion of real estate that can support life in a negligibly small planet, the earth. It shows that if the universe was created by a creator entity that creator entity did not have any priority of creating human life or any other life. If the universe and everything in it has been created by an almighty creator, that creator has to be so ignorant to create so much useless real estate. Look at the planets, just in our solar system alone, except the earth, all the rest are barren, toxic, and useless; they are either balls of barren rocks with deadly atmosphere or toxic gas balls.

In addition, if the living species had been a creation of a creator, that creator has to be so cruel to create species in a way one has to eat each other to survive. Why did the creator create human as the cruelest creature to the fellow human as well as to the

rest of all the living creatures? If you are the creator, do you want the creatures you have created to torture other creatures including fellow human as offering to a creator? If you are the creator, do you want the creatures you have created to waste life praying for next life? Why does a creator need our offering of goats? Shouldn't the creator be able to create goats or whatever it needs for itself? You don't have to offer a goat to a guy who creates goats. If you are wasting the life you got now by praying for a next life, by torturing other species as offerings to a creator instead of living meaningfully the life you already got, why do you need a next life? Why should you be given another life; just to pray more?

Assume you are so happy with the Windows Operating System and you want to show the appreciation to the creator. So, you go to Seattle and make a temporary camp in front of the creator's house. Do some chanting, beat drums, light some candles, spread some flower petals, light some incense, make some noise and at the climax destroy one or two of his creations hoping to please the creator. Do you think creator will be happy to see his creation been destroyed in such a manner? If creator had a peek through the window to see what has been going on, what would the creator's response be? Most probably, the creator's response would be: 'These ignorant people don't know how difficult it had been to create such a perfect product. I spent most of my younger years creating and perfecting this marvelous creation and this is what these idiots do to it.' Certainly, the creator wouldn't be happy. The response would not be that mild either. It is easy for you to destroy a creation because you don't know how hard it had been for the creator to create.

Every goat you destroy hoping to please an imaginary creator is a display of you own selfishness and cruelty since it is always some other innocent helpless creature that you are willing to destroy or sacrifice for your selfish benefit. If there is a creator, creator is able to see that. You cannot please a creator by destroying a creation; you can only annoy by doing that. If there is a creator and universe and everything in it is a creation, creator is not going to like it when its creations are destroyed; the common sense. Instead, if there is a creator, the creator would be happy to see its creations have been looked after with great care; the common sense. Just because some ignorant dark-age religious doctrine asks you to or forces you to do some senseless things does not mean those activities are right. Just because something was written in an ancient dark-age text does not mean it is right. Ancient customs and text must be changed or discarded according to new reality. Most of the ancient customs were results of downright ignorance. We have to discard the meaningless customs irrespective of whether they are religious or not. You cannot make your action right by quoting from an ancient religious text written by somebody who thought the earth was either flat or sun

goes around the earth.

There are many other forms of institutionalized human ignorance as well. The biggest is the concept of a creator, packaged in different forms of religions based on different myths. Some of these are play-boy religions founded by play-boys. Some are play-none religions founded by play-nones. There are also play-in-the-middle religions founded by play-in-the-middles. And some are in between. Some even worship pieces of ancient meteorite rocks. Some of the religions are princely ones, where they enjoy doing nothing while expecting others to provide for them; they expect us not only to provide food, shelter, clothing and etc. but also wash their feet; they even expect you to fall in to your knees in their presence, and if we fail to do that they get angry and curse us. Some of the others were founded by people who had a pathetic end as convicted; rightly or wrongly, convicted nonetheless. How can someone with such a pathetic end be a son of a creator? Some even talk about a virgin mother giving birth to a son of a creator. In the flat-earth or the stone-age era people might have been ignorant enough to believe such nonsense. Today we know better. There are no virgin mothers. The very idea of virgin mother is naturally incorrect, simply preposterous. The phrase 'virgin mother' itself is an oxymoron.

Some even went to war over whether a founder of one religion is the creator or the creator's son with catastrophic result. Some even went on a no-age-barred marriage-spree after claiming they were messengers of a creator. Do you choose such characters as messengers if you are the creator? If a husband can have multiple wives, why can't a wife have multiple husbands? The pick-up line "I am a messenger of a creator" appears to have worked extremely well for some people in the dark-age. Yet in some religions, they even worship male reproductive parts; don't they know male reproductive parts are useless without the female reproductive parts in procreation, and hence they both should be considered in equal reverence and stature; if the male reproductive parts are worthy of worship, so do the female reproductive parts.

Even stranger is the consideration of a creator as a mythical guy with multiple pairs of arms with an elephant head or monkey head; can it get any weirder than this? In a sense, a creator not having a human head is understandable since a human head can never achieve happiness with whatever it does, and also a human head will be second guessing endlessly whatever it does; monkey head or elephant head will be free of those.

If there is a creator why should the creator favor men at the expense of the freedom of women as most of the religions founded by so called prophets or messengers of a creator did? Why should the religions founded by men impose women what to wear or what to cover? All the religions were founded by people who thought the earth was flat or the sun

goes around the earth. How can a person who think earth is flat or the sun goes around the earth be a messenger of a creator? Shouldn't a messenger of creator or a so called prophet know the earth is round and goes around the sun, to say the least? If anybody who doesn't know that the earth orbits the sun calls himself a messenger of a creator or a prophet, he is no more than an imposter. The creator had time to tell those so called prophets that a man can have multiple wives, but he did not have time to tell the prophets that the earth orbits the sun; it shows the priority of the so called prophets. If there is a creator why does creator always chooses a man as messenger or prophet, never a woman? Why women are prohibited from certain places of worship? Shouldn't a creator, if there is one, treat both men and women in equal stature?

Most religions treat women as a property of men; that shows who created the religions, and for whose benefit religions have been created? Why does an almighty creator require our prayers, if such creator exists, and the creator is so almighty? If you are the creator, do you want the creatures you have created to bug you all the time several times a day? On the other hand, if the universe and everything on it has been created by an almighty creator, that creator has to be so ignorant to create so much useless real estate? Look at the planets just in our solar system alone. Except the earth, all the rest are barren, toxic, and useless; they are either balls of barren rocks with deadly atmosphere or toxic gas balls. In addition, if the living species had been a creation of a creator, that creator has to be so cruel to create species in a way one has to eat each other to survive. Why the creator did create the human as the cruelest creature to the fellow human as well as to the rest of all the living creatures? If you are the creator, do you want the creatures you have created to torture other creatures including fellow human as offering to the creator? If you are the creator, do you want the creatures you have created to waste life praying for next life? If you are wasting the life you got now by praying for a next life instead of living the life you already got meaningfully, why do you need a next life? Why should you be given another life; just to pray more?

There is no point in trying to show your creator is better than somebody else's creator; there is no creator. If the universe is a result of a creator, how come the universe mainly consists of junk real estate? How can a creator be so cruel to create species in such a way one has to consume the other to survive? If an engineer has created the universe wasting so much real estate and displaying extreme cruelty in creating species in a way one has to eat the other to survive in a seemingly negligible part of real estate in a seemingly negligible planet, that engineer should have lost its head in the town square. People who founded flat-earth era or earth centric era religious doctrines claimed that they were the messengers of a

hypothetical creator? How can a guy who had no idea of what goes around what in the universe be a messenger of a creator? When we see the way how all the religious doctrines discriminate women, it is not difficult to see who created these self-serving meaningless doctrines and why they are holding on to them by enforcing their ancient mythical ideologies militarily even to this day. If man can have multiple wives, why can't a woman have multiple husbands? It is time we all ask these questions without being blind followers of ancient myths designed for the benefit of few despotic rulers?

If someone appear today claiming that he/she is a messenger of a creator, what would our response be today? We certainly laugh at him/her hysterically, and assume he/she is simply nuts, yet this person is someone who at least understands the fact that earth is round and it is the earth that orbits the sun, and also there is no reason to keep praying at the sun, stars above, some ancient relics, mountains, space above or debris from a meteorite. If so, why are we still following the flat-earth, and earth centric era religious doctrines? Kings and Queens need a creator to justify their hereditary rule, but why does the rest? Isn't it ridiculous to choose a head of a picket fence with a guard post or a country based on the heredity? To be a janitor, you need qualification. Yet, to be a king/queen (a head of the state or a head of a picket fence with a guard post) you do not need any qualification; what a joke! The passing of the head of a picket fence with a guard post based of heredity is an indication how badly we still have got stuck in stone-age; heredity should not be a determining factor for any position. The mockery of religion is clear when some ignorant hereditary ruler whose only serious duty is to produce an heir, build castles, and to entertain one or two harems is also the head of a religion. Royalty is one big fat joke. Nobody is born majestic; everybody is born the same, naked. Royal tradition is an ignorant and totally silly outdated shameless pageantry that somehow seems to continue irrespective of scientific and technical advancement. Why do we have hereditary rulers, despotic military rulers, ruling families? Why are we still following flat-earth and earth centric era mystical ancient human Crafted Prophesies (human-CRAP) that make no sense to our current understanding of nature and the universe? One human Crafted Prophesy even went on selling admission tickets to mythical heaven for a fee and became very wealthy. Does that mean only the people who could afford tickets are admitted to mythical human created heaven in the eyes of those religions? Can these dark-age religious doctrines be any more ludicrous than this? Why should the prayer (begging and bugging) be directional? A mythical creator, if there is one, cannot favor a direction. Why we never had a woman as a messenger of a creator? Answer is quite obvious; it is because it is the man who created a mythical creator for his selfish benefit. If there is a

creator and that creator has sent messengers, that creator must not have allowed the messengers to be discriminatory, self-serving, ignorance-promoting and cruel. Religious doctrines have no place in politics.

We considered the shooting of big species a sport, trophies to treasure. It is what aristocrats consider entertainment; no surprise there since no education qualification is needed to be a king, a queen, or an aristocrat. To become a janitor, we need qualification. Yet, to be a head of a state, a king or a queen, no qualifications are necessary. Isn't that interesting?

As we have seen, throughout the history of human existence to this day, human capacity to be cruel to fellow humans, to other species and to the planet itself has no limit and bound. Human desire to enslave others and treat them as a property that one can buy and sell as they wish is outrageous; some groups even went to war to hold on to that despicable practice of slavery; it is even hard to imagine those people who enslave fellow human as human; using the term animal to refer to these slave-holders would be a disgrace to animals. The slave holders must have been the lowest form of life to ever to walk on earth.

We shamelessly still practice barbaric cast system that treats fellow human as trash; cast system and the aristocracy are the modern slavery in disguise. We forget to realize the fact that every child is born equally; nobody should be royal or paraya by birth. It is surprising we are still practicing royal nonsense. Royalty, aristocracy, upper class, lower class has no place in humanity. There are no royals, aristocrats, slaves or untouchables; all are humans. We will become truly human when we stop following meaningless discriminatory mythical customs, dark-age doctrines, religious texts and turn to the reality of today. Questionable practices are not justifiable just because they were passed down from generation to generation, or they were written in some ancient archaic text. It is time to question every ancient text as well as modern text; retain the logical and discard the rest.

Building of bigger weapons is not going to protect the earth and the well-being of the species. Building a space weapon shield is not going to protect the earth and the well-being of the species. We can't build a wall around us and forget how others outside the wall are affecting the planet. We are the ones responsible for our own destruction. Weapons cannot stop the orbit contraction and hence the global warming. It is the mass of the earth that determine whether the earth is in an orbit at a proper distance that life can be evolved and sustained. Lose mass perpetually, we are in danger of get heated and annihilated; it is that simple. The reality is that the never ending prayers not going to be any help; just the waste of life. Offering goats to a guy who creates goats is simply a continuation of ancient ignorance; a cruel useless and silly act. When the earth's orbit is dynamic, the solution entails affecting the parameters of the orbit

dynamics. Protection of the earth's ability to sustain life is a united activity. There is no existence of species, societies, provinces, countries, or humanity, without the existence of the earth's orbit within the Goldilocks zone; it is that simple; the inConvenient Reality (iCRY).

## XXII. EIGHT-FOLD PATH TO NIRWANA

1. Time is not relative. Time is not a constituent of the universe. Universe neither has a beginning nor an end. Universe does not get old. Time is a definition, a human definition.
2. No Space-Time. Light cannot follow the curvature of a warped space-time at constant speed. So-called Gravitational Waves are Human Fantasy Waves.
3. Waves are not particles and Particles are not waves. You cannot generate mass by colliding particles. You cannot uncover fundamental particles of matter by colliding charge particles.
4. Gravity has no direct effect on light. Gravity does not bend light in the absence of a medium.
5. [Position, Momentum] is not a Fourier Transform pair. The position and momentum are mutually dependent. Neither the position nor the momentum is an independent variable and as a result operators commute. When operators commute, Quantum Mechanics seizes to exist. There is no uncertainty in position and momentum. The position and the momentum of a particle are not independent and hence cannot be a Fourier Transform Pair. A particle cannot be in multiple states or multiple places at the same time.
6. No Dark Matter. No Dark Energy. No anti-matter. Gravitational Orbits are dynamic, not static.
7. Microwave background is the frequency down shifted light below the visible region due to path electromagnetic wave propagation energy loss.
8. Universe is not expanding. No Big-Bang.

You can achieve enlightenment not by believing or memorizing a flat-earth era ancient text, but by exploring the underline physics of the universe. No blind faith prayers or 40-day (What is special about 40?) blind faith solitary contemplation could bring in a universal enlightenment. In the dark ages, some men went into solitary contemplations only to come out and go on a no-age-barred limitless marriage spree claiming that they were the messengers of a mythical imaginary creator. Blind faith has no place in reality.

## XXIII. CONCLUSIONS

There are no universal constants. What we consider universal constants are universal parameters that appears to be constants. Natural systems are robust to the changes of the universal parameters. Natural systems do not collapse under the variations of the universal parameters. Any change in the gravitational parameter G changes the radial distance to the planet accordingly. Any change in the Coulomb parameter k in an atom is compensated for by the

adjustment of the radial distance to an electron in an atom. That must be the reason why there is a plenty of empty space in an atom; an electron has sufficient space in an atom to adapt its radial distance from the nucleus to compensate for any change in the orbiting parameters.

The speed of light cannot be considered a constant. The speed of light is not a fundamental universal parameter since the speed of light is a function of the space parameters, the permittivity and the permeability. There is no free space or a perfect vacuum in the universe and hence the permittivity and the permeability are not constants. As a result, the speed of light is never a constant in the space. The speed of light in space depends on the medium density, and the direction of light depends on the density gradient. Light travels at a velocity that is decided by the permittivity and the permeability of the medium. Neither the so-called space-time nor anything else can decide where or at what speed light has to travel. If space-time wants light to follow its curvature, space-time can only make the light to do so by altering the permittivity and the permeability of the space; however, as soon as it is done, the speed of light is no longer a constant.

Scalar eccentricity cannot represent an elliptical orbit of specified area uniquely. The unique representation of a planetary orbit of a given area is essential since the radial distance to a planet from a focus scans the area of the orbit at constant rate. It is only an Eccentricity Vector that can represent an elliptical orbit of specified area uniquely. Therefore, the determination of a planetary orbit, in essence, is the same as the specifying the Eccentricity Vector of a planetary orbit.

In a planetary, galactic or super galactic system, the eccentricity of an elliptical orbit is a vector. The direction of the Eccentricity Vector is the major axis of the elliptical planetary orbit. The magnitude of the Eccentricity Vector is the eccentricity of the elliptical orbit. The Eccentricity Vector is both time-invariant and mass-invariant. In other words, the Eccentricity Vector remains constant all the time in spite of the mass fluctuations of a planet. When the Eccentricity Vector is a null vector, the major axis ceases to exist, turning the orbit into a circular orbit. It is the Eccentricity Vector that makes ellipse distinct from a circle. Elliptical orbit in a planetary system has no existence without an Eccentricity Vector.

Planetary orbits are closed elliptical orbits all the time. Elliptical planetary orbits do not open up in the presence of a gravitational pull from other planets. Planetary orbits are always elliptically closed paths irrespective of whether a gravitational pull from other planets present or not. A gravitational pull from other planets on a particular planet is equivalent to the fluctuation of the effective mass of the sun. Gravitational pull from other planets gradually increases the effective mass of the sun on particular planet for one half of the orbit, while the gravitational pull from the other planets gradually decreases the effective mass of the sun for the other half of the orbit.

The Eccentricity Vector rotation due to the gravitational pull from other planets is a persistent unidirectional rotation or planetary precession. There is no Eccentricity Vector rotation or precession for circular orbits. Although, the effective mass of the sun on a particular planet fluctuates within an orbiting period due to the gravitational pull from other planets, the average effective mass of the sun within an orbiting cycle remains a constant if the mass of the sun is a constant. However, the mass of the sun is not a constant; in fact, no star has a constant mass. The presence of a gravitational pull from other planets changes the Eccentricity Vector; however, the elliptical orbit remains closed all the time.

In addition to the gravitational pull from other planets, the continuous increase or decrease of a parameter of the Eccentricity Vector of a planetary orbit also contributes to the planetary precession or the Eccentricity Vector rotation. The depletion of the mass of the sun leads to the rotation of the Eccentricity Vector. When the mass of the sun depletes continuously, the Eccentricity Vector rotates in one direction for a small angle for one half of the orbit while it rotates in the opposite direction for a small angle for the other half of the orbit. Since the relative decrease of the mass is not uniform, the positive angle of rotation is not the same as the negative angle of rotation resulting in an overall unidirectional continuous rotation of the major axis. So, the planetary precession due to the depletion of the mass of the sun is a swinging rotation. The Eccentricity Vector swings back and forth while generating unidirectional continuous overall rotation in each orbiting period.

If the mass of the sun is time-invariant or a constant, the rotation of the Eccentricity Vector is only due to the effect of the gravitational pull from the other planets. However, mass degradation of the sun is continuous and hence Eccentricity Vector rotation due to the mass loss of the sun is continuous. Since the Eccentricity Vector of a circular orbit is a null vector, there is no precession in circular orbits. There is no Eccentricity Vector to rotate in circular orbits and as a result circular orbits do not have precession. The total precession is the sum of the eccentricity rotation due to the depleting mass of the sun, and eccentricity rotation due to the effect of the gravitational pull from other planets. The gravitational pull from other planets is equivalent to the change of the effective mass of the sun cyclically.

The eccentricity, which is the magnitude of the Eccentricity Vector, of an elliptical orbit increases with time due to the mass depletion of the sun as well as due to the gravitational pull form other planets. The eccentricity also varies with the change of the angular momentum due to the effect of the gravitational pull from other planets. The lop-sidedness of an elliptical orbit slowly increases with time. The change of

eccentricity due to the mass depletion of the sun is negligible since it is inversely proportional to the square mass of the orbiting center. The eccentricity increases gradually persistently due to the effect of the gravitational pull from the other planets making the orbit more and more oblong with time. The change of eccentricity is non-existent for circular orbits, since a circular orbit does not have an Eccentricity Vector. There is always an eccentricity increase, however small, since the mass of the sun is gradually depleting in tons every second due to various causes, and the mutual gravitational effects of other planets are not negligible in reality.

The mass of the earth is not a constant. The mass of the sun is not a constant. Planetary mass is time-varying. The mass of an orbiting center is time varying. The Eccentricity Vector of a planetary orbit remains constant all the time irrespective of planetary mass fluctuations for a given orbiting center mass. A planet always remains on a closed elliptical orbit irrespective of its mass fluctuations all the time. Nothing can open up a closed elliptical path of a planet. The Eccentricity Vector of a planetary orbit is planetary-mass invariant. Planetary orbits are elliptically stable. However, the radial distance of a planet depends on the mass of the planet at any given time. If the mass of a planet increases, then the radial distance of the planet increases or orbit dilates. Similarly, if the mass of a planet decreases at any given time, the radial distance to the planet decreases, or orbit contracts.

The mass-invariance of an elliptical orbit is maintained against mass fluctuations through radial distance adjustment. Contrary to Newton's suggestion, no divine intervention is required for orbit stability. Divine is a human creation, not the natures; divine exists only in the misguided mind of some. Divine is simply a human ignorance dump. Orbits are dynamic, not fixed. Orbits expand or contract under planetary mass variations. Orbits expands or contracts under orbit parameter perturbations. Planets do not spiral-in or spiral-out leading to the collapse of the system in the presence of perturbations; neither do orbiting electrons on circular orbits in atoms.

Orbit dilation moves a planet away from the sun resulting in planetary cooling. Similarly, orbit contraction moves a planet towards the sun resulting planetary warming. Perpetual mass loss of the earth leads continuous orbit contraction moving the earth gradually closer and closer to the sun resulting in global warming. Global warming is a vicious feed forward cycle that feeds itself once started. If the earth moves away from the orbital region that the earth could support life into the point of no return, the life on earth will face extinction.

Universe is not expanding. Light does not travel long distances without being subjected to frequency down-shift due to propagation electromagnetic energy loss. Nothing travels without energy loss, light is no exception. When light loses electromagnetic energy,

frequency is down-shifted. Our visible universe is the maximum distance light could travel before being frequency down-shifted below the visible region of the spectrum. The visible universe is a 3D-horizon that depends on an observer. The cosmic microwave background is the frequency down-shifted light below the visible region. Universe is not finite.

In General Relativity, since the light is assumed to follow the space-time curvature, the permittivity and the permeability of space must change with the space-time curvature. When the permittivity and the permeability change with the space-time curvature, the speed of light cannot remains a constant. If there is a space-time, the space-time curvature should command the permittivity and the permeability of the space to change. The permittivity and the permeability tell the light in no uncertain terms where to travel at what speed. As a result, in general relativity, the speed of light cannot remain a constant in warped space-time. In general relativity, in the presence of a gravitational object, speed of light cannot be a constant. In General Relativity, it is the space-time curvature that is responsible for a red-shift, not a space expansion. Universe is not expanding. There is no space-time. General Relativity does not hold true; it is an outcome of a conceptual blunder.

The Gravitational Wave model of the LIGO-Bursts is not unique. Data cannot be attributed to a physical process unless the data is unique to that physical process. You do not have to look into the dark beyond to find the origin of LIGO-Bursts. There are many earthly processes that could have generated the LIGO-Bursts. Any earthly vibration could produce LIGO-Bursts.

The fact is that LIGO bursts are not due to gravitational waves. Gravitational waves are fantasy waves. LIGO-Bursts are not gravitational waves. LIGO bursts are due to a near surface wave front from an earthly vibration source not far from the midway between the LIGO sites P and Q. Just because it is possible to fit LIGO-Bursts with a black-holes collision model, it is not possible to claim LIGO-Bursts are gravitational waves. You could have generated LIGO-Burst GW150914 by placing a vibratory source somewhere close to the midway between the LIGO-Sites P and Q in such a way that it satisfies OQ-OP=τv, where O is location of the vibration source, v is the speed of vibration waves and τ is the time delay between the received LIGO-Bursts at LIGO stations P and Q.

If Gravitational Waves exist, Gravitational Waves cannot initiate a relative motion. Gravitational Waves cannot vibrate beads in a stick relative to the stick. If Gravitational wave exists, it is the whole object that undergoes expansion or compression, not a part of an object relative to the other part. In the case of beads in a stick, it is the beads and stick together that undergoes expansion and contraction, not the beads relative to the stick. There will not be any vibration of the beads relative to the stick. In the presence of

Gravitational Waves, the beads on a stick relative to the stick will be at standstill. Widely used Sticky-Beads argument is wrong and meaningless.

Time does not depend on the space and hence there is no space-time [3]. Without space dependent time, there will not be space-time or space-time undulation or gravitational waves. If the gravity is a wave that takes time to travel, the universe will not be held together. Time delay cannot exist in gravity.

The LIGO-Burst GW150914 was a result of a near surface vibration activity originated around Fort Collins and Denver; somewhere near midway between the Hanford, southeastern Washington State LIGO site and the Livingston Baton Rouge, Louisiana LIGO site. The source could have been anywhere in Wyoming, Nebraska, Colorado or Kansas.

It is not just the LIGO bursts, stock market crash could have also been represented as gravitational waves due to a collision of black-holes with a perfect fit. That does not mean the stock market crash was a result of a black-holes collision somewhere billion light years away in space. Gravity cannot be a wave. If gravity is a wave that takes time to travel, universe as we know it not possible. There are no gravitational waves. Mass of an object and its infinite span of gravitational field are a single entity. Mass cannot exist without its associated gravitational field and gravitational field cannot exist without its associated mass.

Our activities affect the planet and the nature we live in. If we want to see the enormity of our destructive power of the nature, all we have to do is, count the pieces of timber we have used for one mile of railway track and multiply it by the number of miles of tracks we have laid so far all over the world. We can do the same for telephone poles too. You can also include the amount trees require to build a timber frame for a house multiplied by the number of houses too. How many trees have we cut down jut for laying the rail track, telephone wires, and frames for houses? It is a pretty frightening number. Are we going to say warming of the planet has nothing to do with human activities? Trees are mass generators, environment protectors, and life givers. Try to live in a place where there are no trees for a week. Some of us in certain dessert areas may keep enjoying the abundance and keep praying blindly to a hypothetical creator for the bounty until oil wells run dry; sooner or later they will run dry. Once the oil wells run dry, there will not be anybody from dark beyond to our rescue.

Human activities that reduce the mass of the planet result in the planetary orbit contraction leading to global warming. If the planet moves away from the Goldilocks orbit zone or the orbit zone that earth can support life, it will be a point of no return, the extinction of life on earth.

Who rule the world is not the one with smartest weapons. Ruling is no longer a process of subduing and enslaving the others with the might; that foolishly arrogant era is history. Advancement is no longer a process of digging for more and producing more and more gadgets. What is the purpose of digging for gold if all you do with it is lock up in a bank vault under high security? Why don't you leave it in the ground; it is more secure there. If you dig and burn as fast as you can, what is the long term effect of it? What do you do when that dig runs dry? The one who rule the world is the one possess the foresight, not the weapons, for sustainable existence without harming the planet.

Homeland security, the security of a picket fence with a guard, or in other words the security of a so-called country, is not a security for the sustenance of life on the earth. The security of life sustenance on earth does not depend on the strength of fortification or High-Tech weapons system of a particular picket fence with a guard post. Our security as a whole depends on the earth's ability to remain within the life sustaining orbital zone. Weapons cannot provide true security for the maintenance of the earth potential to sustain life. The true security for the living species on earth could only be achieved through the reduction of the earth's mass-loss. The increased armed security of a country can no longer secure the sustainability of life on earth. Collective unified action for maintaining the life sustainability on earth cannot be achieved successfully without a binding unified regulatory framework of the world. The maintenance of the life sustainability on earth is possible when we all can truly say it is our world, not my country. The era of shallow nationalism is gone. It is the time to enter into the era of 'It is my world'. The phrase 'my country or my nation' has no meaning if the earth's orbit is contracting to the point where it cannot support life.

The concept that the universe is a creation by a creator entity, which gave rise to religious doctrines, was originated in the flat-earth era or dark ages and has been with us to this day. All the dark-age religious doctrines are based on this mythical concept of a creator. All the religions were founded by people who thought either the earth was flat or the sun goes around the earth. How can a person who think the earth is flat or the sun goes around the earth be a messenger of a creator? Shouldn't a messenger of creator have known that the earth is round and goes around the sun, to say the least? If anybody who doesn't know that the earth orbits the sun calls himself or herself a messenger of a creator, he/she couldn't be more than an imposter. The creator had time to tell those so called messengers that a man can have multiple wives, but the same creator did not have time to tell them that the earth orbits the sun; it shows the priority of the so called self proclaimed messengers. It appears that some ancient religious doctrines were founded by play boys while others were by play-none and some by play in the middle. If a man can have multiple wives, why can't a woman have multiple husbands? If there is a creator why does the creator always chooses a man as messenger, never a woman? Why women are prohibited from certain places of worship? Shouldn't a creator, if there is one,

treat both men and women equally? All religions discriminate women by design on purpose; that shows who created the religions, and for whose benefit? Why does a creator require our prayers, if such creator exists, and the creator is so almighty? If you are the creator, do you want the creatures you have created to bug you all the time asking for more? It is the man who created the creator for the selfish benefit of the man; this is very evident from the lifestyle of so-called self-declared messengers of a mythical creator.

Time! Clock and Time are not synonymous. A clock is a device engineered to display time under given specifications. A clock displays the right time when the clock is in an environment where the design specifications are met. It is the mechanism of a clock that is affected by the strength of the battery and the hardware as well as the environment that the clock is situated at, such as the temperature, pressure, speed, gravity as well as electromagnetic forces, not the time itself. Time is independent of temperature, pressure, speed, gravity, electromagnetic forces, and any environment condition in general or anything else.

Time is a human definition. Time is absolute; the display of a clock is not. The display of a clock depends on the mechanism of the clock, strength of the battery, and the environment condition the clock is at. The display of a clock represents the time only when the clock is in an environment that meets the design specification of the clock. Since the effect of the changing environmental conditions on the mechanism of a clock is negligible, we always assume the display of clocks to be the correct time for all situations; that is good enough for our daily tasks. However, when precise time measurements are required, the effect of the environmental conditions on the mechanism of a clock cannot be disregarded and hence an alternative method of time estimation has to be used as in the case of Geographical Positioning System (GPS).

GPS has nothing to do with special relativity. Time on cell-phone depends on the Geographical Time-Zone, day-light saving, clock hardware, mechanism of the clock, battery strength, and the environmental forces. Hence, client-receiver time cannot be used in position estimation in GPS. GPS has to avoid the use of client trans-receiver time. In addition, the accuracy of client data is not under the control of GPS. Since cell-phone trans-receivers are made in billions, they are accompanied with cheap low accuracy clocks. As a result GPS completely avoids the use of client data by using the data from four or more satellites in the vicinity. By avoiding the use of client data completely, GPS provides the location information with increase accuracy, and at the same time make the system client independent. GPS is independent of the Geographical Time-Zone, day-light savings, receiver hardware, product differences, trans-receiver battery strength, and the environmental factors client trans-receivers are under.

GPS has nothing to do with Special Relativity or General Relativity. If time is relative, GPS is not possible. GPS avoids the use of client data for the same reason why IKEA avoids the use of customers' screwdrivers. By avoiding the use of client data, GPS can provide a uniform service with increase accuracy and make the system client independent and time zone-independent. The client independence of GPS allows GPS to be scalable without the consents of client cell-phones manufacturers.

Light is not relative. Time is not dependent on the space, and as a result Special Relativity and General Relativity are invalid. Time is not relative. Time is absolute. Mass is not relative. It is the volume of an object that is relative. It is the mass density that is relative. Mass is absolute.

It does not matter how high energies are used, you cannot generate mass by colliding particles in an accelerator or anywhere else. You cannot generate more protons by colliding two protons. When moving charge particles are suddenly decelerated at a collision, extraneous electromagnetic radiation bursts (exEMBs) are generated. When particles are disintegrated in a collision, electromagnetic bursts inherent to the particles (inEMBs) are also released. The exEMBs are inseparable from inEMBs. It is the misrepresentation of extraneous electromagnetic wave bursts (exEMBs) resulted from the acceleration and deceleration of the charge particles at the collision, which are inseparable from the inherent electromagnetic wave bursts (inEMBs) due to the disintegration of the colliding particles themselves, as particles that led to the false impression of mass creation. The extraneous electromagnetic radiation bursts (exEMBs) are not constituents of particles. Electromagnetic wave bursts are not particles. Electromagnetic energy has no association with a mass. It is only the mechanical energy that is associated with a mass. Not all the energies are the same. A particle collider does not generate mass. The exEMBs are contaminants at the crash site that must be eliminated. The exEMBs must be removed from the crash site before analyzing the data from the crash site. The Large Hadrons Collider (LHC) is useless unless the exEMBs are removed from the crash site. However, the exEMBs are non-separable from the inEMBs. As a result, the Large Hadrons Collider (LHC) is a billion-dollar blunder. In fact LHC is a billion dollar garbage generator hidden under the Swiss-alp.

You can use Large Hadrons Collider (LHC) to prove anything you want since the outcome of each collision is different due to the presence of exEMBs. To prove anything you want, all you have to do is keep colliding until you get the outcome that can support your conjecture. If there are no exEMBs, each collision would have given the same result and hence all you can prove is what is real. The idea that we have to build bigger and bigger particle accelerators to uncover the fundamental matter of particles is simply preposterous. Higher the energy of particles used in a

collision, higher is the exEMBs making the outcome useless. You cannot uncover fundamental particles of nature by colliding charge particles due to the inseparability exEMBs from inEMBs.

Fundamental subatomic particles of nature cannot be separated by colliding charge particles at high speed. Although neutral particles can be broken into their constituent sub atomic particles in a high speed collision, charge particle accelerators such as Large Hadrons Collide (LHC) are useless for electrically neutral particles. Any result obtained and any conclusion made by analyzing the crash site data from the Large Hadrons Collider (LHC), or any other collider for that matter, are simply garbage since exEMBs cannot be isolated from inEMBs. LHC is a billion-dollar design blunder; a massive garbage production machine hidden in the Swiss-Alp.

Waves are not particles and particles are not waves. Electromagnetic wave burst are not particles. Mass of a matter particle is not relative. It is the volume of a matter particle that is relative. It is the density of a matter particle that is relative. It is the mass density that increases with the speed, not the mass itself. Time and mass are absolute. Light is not relative. Directional light cannot consist of spatially random particles or photons. Light is always a wave, never a particle. Light comes in burst of finite duration. Light is not relative. Gravitational waves are human fantasy waves. No wave can travel at constant speed except light. You cannot generate mass by colliding particles. Position and momentum of a particle are mutually dependent and hence does not constitute a Fourier Transform Pair [8]; as a result, Heisenberg Uncertainty Principle is invalid. Observables of a particle cannot be represented as eigenvalues since eigenvalues are not unique; as a result Schrodinger equation is invalid. Vectors do not come in quanta. Vectors cannot be quantized. Quantum operators are commutative. When Quantum Operators commute, Quantum Mechanics seizes to exist. That is the Real Inconvenient Perspective (RIP).

## References

1. Manton, Nicholas, and Nicholas Mee, "The Physical World: An Inspirational Tour of Fundamental Physics", Oxford University Press, 2017.
2. Dahanayake Bandula, "Quantum Mechanics: A Double-Slit Blunder", Journal of Multidisciplinary Engineering Science Studies (JMESS), vol.3 Issue 8, August-2017.
3. Dahanayake Bandula, "Maxwell's Equations and Propagation of Light: Not Relative", International Journal of Astrophysics and Space Science, vol. 3, Issue 6, Dec. 2015.
4. Dahanayake Bandula, "General Universal Relativity (GURL): No Big Bang", International Journal of Astrophysics and Space Science, vol. 4, Issue 4, Aug. 2016.
5. Schilling, Govert, "Ripples in Space-Time", Harvard University Press, 2017.
6. Abbott B. P. *et al.* "Observation of Gravitational Waves from a Binary Black Hole Merger", Physical Review Letters, Feb. 2016.
7. Dahanayake W. Bandula, "General Orbit Dynamics (GOD): Dark Nothing – No Dark Matter, No Dark Energy, No Space-Time, No Surprise", Journal of Multidisciplinary Engineering Science Studies (JMESS), vol. 6 Issue 3, March-2019.
8. Dahanayake W. Bandula, "Quantum Uncertainty and Superposition: Deception in Inception; LHC-Blunder (Direct Manifestation of a Fallacious Model)", Journal of Multidisciplinary Engineering Science Studies (JMESS), vol. 6 Issue 4, April-2019.
9. Dahanayake Bandula, "The Light in a New Light: Always a wave, never a particle", Science Discovery, vol. 3, Issue 4, Aug. 2015.