

## Understanding the Concept of Space-time

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**Abstract:** Space-time is not a fictitious fabric but is creation of a vibrating Higgs Bosons. A vibrating particle only defines length and time simultaneously, making them inseparable. An agglomeration of such vibrating particles constitutes space-time continuum. It is the dark energy and defines the universe.

The inverse square law is the property of space-time dynamics

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### I. Introduction

Albert Einstein started with a premise that velocity of light is constant which implies length and time are interconnected. Before relativity, length and time were supposed to be independent of each other. Accordingly a point in space was represented by three length coordinates (x,y,z) with respect to three mutually perpendicular X, Y and Z axes respectively. But interdependency of length and time mandated that reference to a point in space must include time also as a parameter. Hence a point must have coordinates (x, y, z, t). To differentiate it from a conventional point, it has been named as event point. The length between two conventional points is called distance and the length between two event points is called interval. The equation for interval is given as

$$(cT)^2 = (ct)^2 - x^2 - y^2 - z^2 \dots\dots\dots (1)$$

Where T is difference of proper time of two event points  
t is difference of observed time of two event points  
x is difference of x-coordinates of two event points  
y is difference of y-coordinates of two event points  
z is difference of z-coordinates of two event points

In this article, the author investigates the following points:

- ✓ Concept of time with respect to Nature
- ✓ Whether Velocity of light being constant leads to interlacing of length and time OR because time and length are intertwined, velocity of light is constant.

Note: This article is based on the previous articles by Oruganti<sup>[5.1, 5.2]</sup>, which provide the mathematical proofs

### II. Importance Of The Article

Universe at absolute zero temperature made up of dark energy. At this juncture, except Higgs field, there are no other forces like gravitation, electric field or magnetic field.

Energy density per unit volume plays a major role in the events of universe. This article becomes the basis to understand how universe evolves and different visible objects come into existence.

### III. Understanding Concepts Of Space-Time

**Concept of space:** The characteristic of space is Volume. Volume is computed using three lengths measured along three mutually perpendicular directions.

**Concept of time:** For human beings, Clock represents time. A day is defined from a cyclic event from sunrise to sunrise. The essence of time depends on a cyclic event or a pulse. Even the man-made clocks have an element which performs a cyclic motion. From these discussions, we conclude that a cyclic motion always defines time.

The characteristics of Light are wavelength and frequency. The wave nature of light follows a simple harmonic motion.

The equation of a harmonic motion is represented by a sinusoidal curve  $x = a \sin(\omega t)$ , where  $x$  = displacement from mean position,  $a$  = amplitude or maximum displacement from mean position,  $\omega$  = angular velocity,  $t$ =time

This equation demonstrates length is a function of time.

**Inter-dependency of time and space :**

From the equation of sinusoidal curve, it is evident that a vibrating particle defines length and time simultaneously. It highlights the interdependency of length and time. As time is integral to space, it is called space-time.

**Direction of time and length :**

A vibrating particle moves from point A to point B and then returns from point B to point A. It takes same time to move from point A to point B and to move from point B to point A. From this discussion it clear that a particle can move in any direction but time is always increasing. It emphasizes length can be positive or negative but time will always be positive and increasing.

Velocity of light ( $c$ ) computed by measuring the time required ( $t$ ) to travel a known distance ( $s$ ).

Mathematically  $c = s/t$  or  $ct = s$  or  $(ct)^2 = s^2$

$$(ct)^2 = x^2 + y^2 + z^2 \quad (2)$$

$$(ct)^2 - x^2 - y^2 - z^2 = 0 \quad (3)$$

From (2)

$$ct = \pm(x^2 + y^2 + z^2) \dots\dots\dots (4)$$

From equation (4), We observe  $t = 0$  when  $x, y,$  and  $z$  are individually zero.  $t > 0$  implies at least one of  $x, y$  or  $z \neq 0$ .

it is clear that Velocity  $c$ , being a vector, can be positive or negative. The ambiguity sign highlights that the displacement and velocity are in the same direction. In either direction, time  $t$  is always positive. This is in agreement with the sinusoidal equation.

This also highlights: an observer has control over length and direction of motion but not on time. Time is a dictate of Nature.

Space-time is represented by three parameters: length, direction of motion and time. Hence this is tensor of rank 2.

Had Einstein considered equation (3) instead of equation (1), his analysis would have been valid as the term  $(cT)^2$  does not play any role in his analysis and findings.

**Vibrating Particle carrying field:** A vibrating particle performs Simple harmonic motion. In case of a particle performing SHM, the acceleration varies directly as displacement from its mean position of vibration and the direction of acceleration is opposite of displacement. Acceleration implies existence of force. It proves that a vibrating particle is endowed with some field. All forms of energy is associated with field proportional to its frequency<sup>[5.1]</sup>.

**Vibration of particle:** For existence of a vibrating particle, two forces must act on it in opposite directions alternately.

We observed that a vibrating particle is endowed with potential. If particles attract each other, they can occupy the same place resulting in increase in potential surrounded by other particles with low potential. This leads to a potential difference. The surrounding low potential particles exert force on particle in high potential zone to reduce the potential. This is in accordance with Newton's first law and third law of motion. As per Newton's first law, two particles attract each other to create a high potential zone. This action brings another force exerted by surrounding particles in opposite direction to restore the equilibrium. As the particle is subjected to two opposite forces alternately, it starts vibrating.

**Existence of a vibrating particle:** Higgs Boson as the fundamental vibrating particle is demonstrated by Oruganti<sup>[5.1]</sup>. At absolute zero temperature, the entire visible matter cannot retain its shape and convert into

point particles (Higgs Bosons). The visible matter converts in to energy form. The energy is Kinetic Energy of Higgs Bosons due to its vibration. This is highlighted by energy mass equivalence relation stated by Einstein. The product of mass and square of velocity represents kinetic energy only. This is the primitive source of energy or dark matter or dark energy <sup>[5.1]</sup>.

**Vacuum:** As the Higgs Bosons attract each other, they are glued to each other. At this juncture there is no other force to separate these particles from each other. This provides the space-time continuum as mentioned by Einstein. It implies Vacuum (absence of any particle in any part of space) does not exist. This highlights old adage “Nature abhors vacuum”.

It clearly indicates that Higgs Boson is the bridge between Quantum Mechanics and Space-time continuum. Quantum Mechanics, in other words, is Space-time Dynamics.

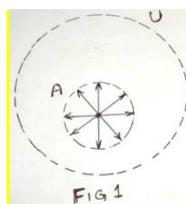
**Universe:** The entire agglomeration of the Higgs Bosons assumes the form of a sphere, as surface area of sphere is least and this represents lowest energy levels. This is akin to spherical water drop formed by water molecules due to cohesive force among the molecules. This agglomeration of vibrating Higgs Bosons defines Universe. Universe being spherical underscores the assertion by Einstein that Space-Time has an inherent curvature.

Here it is pertinent to define a straight line. In a circle, we know  $\theta = l / r$ , where  $\theta$  is angle subtended by arc at centre,  $l$  = length of arc,  $r$  = radius of circle. For a given length of arc, when  $r$  is equal to infinity,  $\theta$  equals to zero then Arc becomes a straight line as it does not have angle of curvature. It is equally applicable to a sphere also. We infer the following:

- ✓ Radius of Universe is infinite with inherent curvature
- ✓ The curvature is natural and is not due to any stress (application of force)
- ✓ At this juncture there is no other force other than Higgs field.
- ✓ Energy density per unit volume being the least, frequency of vibrating Higgs bosons is least. The least frequency is 1. At this juncture, the wavelength is “c”. This distance is covered in one second. This is highlighted by energy-mass equivalence law enunciated by Einstein.
- ✓ Energy density per unit volume being least results in mass density per unit volume being the least. Higgs boson has the least mass hence it will move with maximum velocity. Law of conservation of momentum dictates that as the mass of a particle increases, its velocity will decrease. Any particle having mass more than Higgs Bosons will have a velocity less than that of light. This confirms no object can move faster than light.

**Inverse Square Law:**

Refer to figure 1 below:



When all Higgs Bosons within sphere A shrink to its centre, it creates a high potential point. The Higgs Bosons around sphere A will be dragged due to cohesion among particles. This results into a potential gradient from centre of A (high potential) across radius “r” till the end of radius (Low potential). This is akin to existence of temperature gradient along a metal rod, when one end of the rod is heated.

Potential at any point at a distance “d” from centre of A along the radius decreases and at  $d = r$  it attains ground potential.

Mathematically  $p \propto 1/d$ , the differential of this gives  $f \propto - (1/d)^2$

This proves Inverse square law is the property of space-time. Hence it is reflected across all phenomena: light, gravitation and electric field. Magnetic field is caused by electric field; hence it also displays inverse square law <sup>[5.2]</sup>.

Energy, in any form, is transferred from high potential zone to low potential zone, which appears as radiation. It is true for light also. This underlines The Huygens–Fresnel wave front principle.

This also highlights that a radiation will travel a finite distance only. It never travels infinitely. A radiation travels in any direction till it reaches the ground potential.

#### **IV. Observations**

The entire universe is of infinite radius made up of dark energy at absolute zero temperature.

Einstein proved that gravitational field deforms space-time. It is other way round. Deformation of space leads to creation of high pressure zone, which appears as gravitational field. High pressure zone is akin to High temperature zone, when electrons, positron and neutrino come into existence. Once these particles are created, temperature becomes relevant. These need to be substantiated by a model of evolution of visible universe.

#### **REFERENCES**

- [1]. Relation between wave energy and field strength
- [2]. Magnetic field around current carrying conductor

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