

# Gravitational Constant of Cubic Lattice Universe

Tufail Abbas

(B. Tech - Electrical, MBA)

## ABSTRACT

Starting with the basic assumptions that all physical parameters are properties of a background Cubic Lattice Frame as introduced in paper , [“Cubic Lattice Structure of the Universe”](#) this paper discusses the implication of C4 Cubit (or Mass Cubits) on Gravitation Constant. After discussing related concepts of Cubic Lattice Universe, Value of G have been derived as  $G = H_0 c R_u^2 / M_u = 6.674078 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-1}$  and  $G = H_0 (3/2 \pi c c_0) (h^2 / m_0^3) = 6.699946 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-1}$ , later being not a precise values but very close to accepted value of G which is  $6.67408 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-1}$ . Motivated by this result, the derivation is followed by a subjective narration describing Gravitation as a local anisotropic reactionary force caused due to Hubble Expansion itself. Contrary to current understanding about Hubble Expansion being caused by so called Dark Energy, it is proposed that expansion of Universe is caused by locally anisotropic emission of space by fundamental mass ( i.e.say electron) which travels through the Cubic Lattice to interact and cause isotropic expansion of the Universe, of which Gravitation is a local anisotropic effect.

## PARAMETERS AND VALUES

Parameters and Values used in this paper are stated below for ready reference:

Parameter	Symbol	Vakue	Dimension
Pi	$\pi$	3.14159265359	dimensionless
Byte Length	$c_0$	299792458	dimensionless
Speed of Light	c	299792458	$\text{ms}^{-1}$
Planck Constant	h	$6.62607004 \times 10^{-34}$	$\text{m}^2 \text{kg s}^{-1}$
Fundamental Mass	$m_0 = m_e$	$9.10938356 \times 10^{-31}$	kg
Radius of the Universe	$R_u$	$1.3626809470 \times 10^{26}$	m
Mass of the Universe	$M_u$	$1.8350344226 \times 10^{53}$	kg

## KEYWORDS

Dimensionless Constant, Speed of Light, Gravitational Constant, Cubic Lattice Universe.

## INTRODUCTION

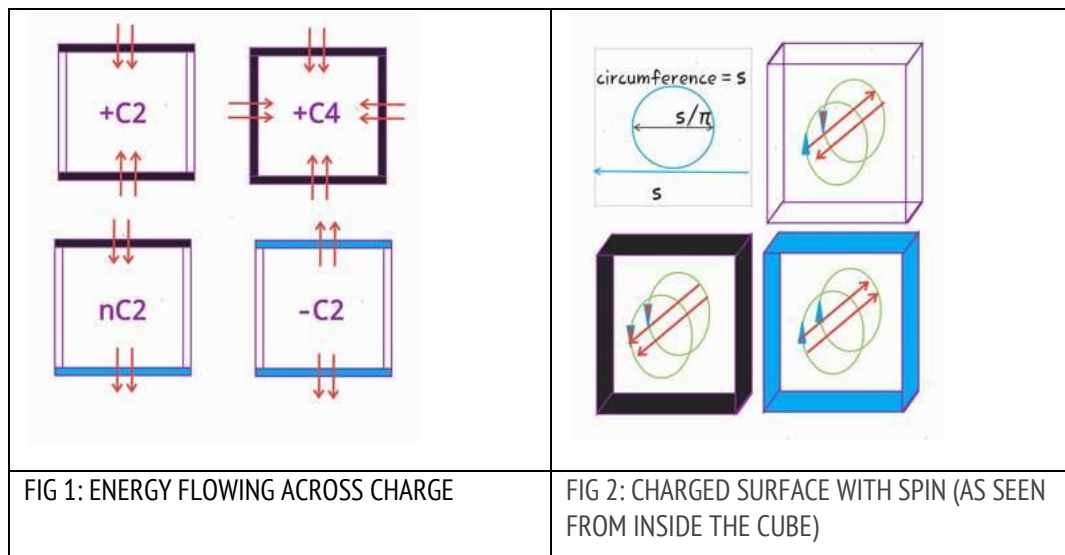
### Abstract of Base Model [“Cubic Lattice Structure of the Universe”](#).

This paper proposes an introductory conceptual framework for developing explanation about the Universe based upon stationery cubic lattice structure arranges as infinite matrix of infinitesimal cubes.

The space and time moves through this lattice resulting into all mass, charge and energy that we see. It is envisioned that through developing of this model based upon base lattice structure it would be possible to express all physical properties (i.e. space, time, energy, charge, momentum, temperature, velocity, force etc.), in terms of the geometric parameters (i.e. length, surface area, volume, angle, orientation, cycles) of the base structure. Physical reality being a function of perception, the paper discusses our general understanding of perception (of vision in particular), to make interpretations regarding the nature of observable reality and understanding about dimensions, based upon reasoning. Based upon these interpretation, concept of “velocity at rest” in introduced, which is envisioned to provide an explanation about rest mass and gravity.

### Building Blocks of Universe

A pictorial representation of basic building block of the Universe is given in Figure 1 and Figure 2, of which details are explained in the paper [“Cubic Lattice Structure of the Universe”](#).



Composite particles (electron, proton and neutron) are made of matter cubits(+C2, C4, nC2 and -C2). Exact configuration of each cubits in each particle is yet to be determined, as the Cubic Lattice Model is still under development. However, this indetermination does not restrict the Author to interpret from apparent behaviour of electron, that number of C4 Cubit in electron equal to ‘ $c_0$ ’, where  $c_0$  is proposed as a dimensionless constant equal in value to the speed of light  $c$ . Length of each side of these Cubits is ‘ $s$ ’ as shown in above Figure. Charged surface area of each C4 Cubit is ‘ $4s^2$ ’ which is shown as coloured surfaces of Cubits in above diagram.

### Creation of Space with Every Cycle of Change and Rest Velocity.

Each unit of fundamental mass particle consisting of  $c_0$  numbers of C4 Cubit emits  $4c_0^2$  units of space *per cycle of change* which is equivalent to minimum time of universe  $t_0$  as per derivation below. This emission of space per second corresponds

to **“Velocity at Rest”** of the mass particle. If this space is isotropically emitted over the sphere drawn on the center of the particle then the particle is at rest with respect to background Cubic Lattice. However in case of a deformation of internal configuration, mass particle emits more or less space along one axis as compared to other two axis, thereby acquiring a relative motion with respect to Cubic Lattice about a centre in local space to ensure that overall configuration still emits space isotropically. In this way, irrespective of how we are moving, we are still at rest with respect to background Cubic Lattice or in other words, at rest wrt to **distributed centers** of the Universe.

Another way of putting it is that state of rest is associated with isotropy of emission of space and local relative motion is associated with anisotropy of emission of space over the surface of sphere around the fundamental mass particle.

## DERIVATION OF GRAVITATIONAL CONSTANT G

1. Let Universe starts with a constant Area of  $A_0$  units of space each of area  $s^2$
2. Let this whole area be divided into three dimensions of space:

$$A_{x_0} = A_0 / 3 ; A_{y_0} = A_0 / 3 ; A_{z_0} = A_0 / 3 ; \text{ or}$$

$$A_{x_0} = A_{x_0} + A_{y_0} + A_{z_0}$$

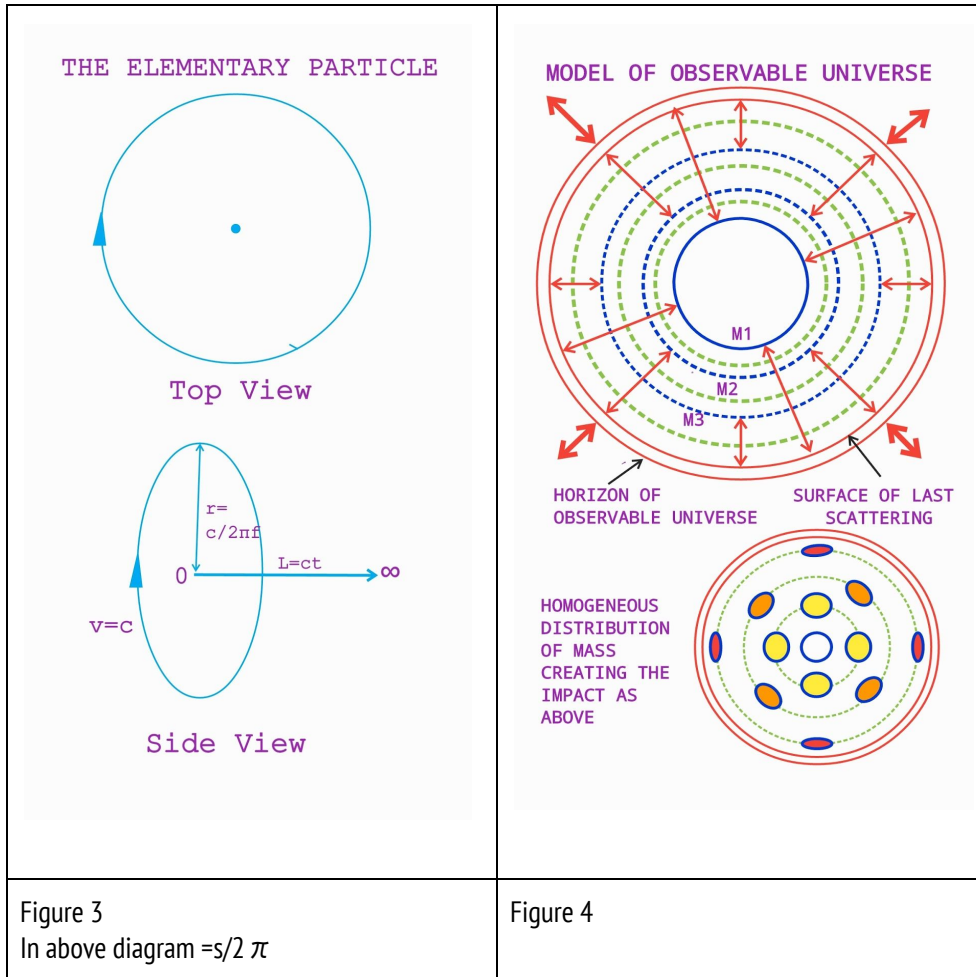
3. Let Mass of the Universe be proportional to area of each dimension.

$$\text{Hence } A_0 \text{ is proportional to } = 3M_u$$

4. Let the smallest unit of space be proportional to fundamental mass  $m_0$  so that each unit of fundamental mass contain  $c_0$  units of C4 Cubit of Cubic Lattice.
5. Since C4 units have 4 number of charged surfaces, total units of area in a fundamental mass  $m_0$  is  $4c_0$
6. Let the smallest measurable distance through interaction of particles be  $l_0 = c_0 s$ ,
7. And smallest time be  $t_0 = (c_0/c)s$
8. Each unit of area emits space perpendicular to its surface as shown Figure 3. Surface is determined by rotation of space in circular motion, which is also an equivalent of charge.
9. Units of space emitted per cycle of change by fundamental mass  $= 4c_0^2$
10. Space emitted per second by combined surface area of all 3 dimension:  $A_0 = 12(M_u/m_0)c_0^2$
11. Total Units of Space Emitted since  $t = 0$  is  $A_n = 12(M_u T_u / m_0 t_0)c_0^2$
12. Therefore to make one unit of volume, we need 6 units of area.
13. Therefore volume emitted since  $t = 0$  is;  $V_n = A_n s^3 / 6 = 2(M_u T_u / m_0 t_0)l_0^3 / c_0$

14. If the total volume is enclosed by an sphere of radius  $R_u$  then  $R_u^3 = (3/2 \pi)(M_u T_u / m_0 t_0) l_0^3 / c_0$

15. Solving with  $l_0 = h/m_0 c$  ;  $R_u^3 / M_u T_u = (3/2 \pi c c_0)(h^2 / m_0^3)$  or  $c R_u^2 / M_u = (3/2 \pi c c_0)(h^2 / m_0^3)$



16. In Figure 4,  $M_u = M_1 + M_2 + M_3 + \dots + M_n$

17. Surface Velocity  $v_n$  or **space per second** contributed by each mass at Surface of last Scattering =  $c M_n / M_u$   
 Note: Surface velocity  $v_n$  is not a velocity in usual sense, but it corresponds to **number of units** of area increasing per second.

18. Surface Velocity at Radius  $R_1$ :  $v_1 = (4 \pi R_u^2 / 4 \pi R_1^2)(c M_1 / M_u)$

19. Surface Acceleration for closed surface at  $v_1 = H_0 v_1 = H_0 c M_1 R_u^2 / M_u R_1^2 = G M_1 / R_1^2$

20.  $G = H_0 c R_u^2 / M_u$  closed from Equation 19.

21.  $G = H_0 (3/2 \pi c c_0)(h^2 / m_0^3)$  by solving Equation 20 and Equation 15.

## VARIANT EXPRESSION OF EQUATION 20

22.  $G = (8 \pi H_0 / c c_0 m_0^3) (3/4) (h^2 / 4 \pi^2) = (8 \pi H_0 / c c_0 m_0^3) * (\text{angular momentum of } 1/2 \text{ spin particles})^2$

23.  $4 \pi G m_0 = 6 H_0 I_0^2 c / c_0$ ; Possibly the physical interpretation of this expression is that Gravitational Flux ( $4 \pi G m_0$ ) of particle over a sphere is equivalent to increasing volume of Cube due to increase in surface area

## DISCUSSION

Physicist Matt Strassler made a very important statement as follows regarding Higgs Fields on his [website](#)

*“No matter how you are moving, you are not moving relative to the Higgs field. That sounds bizarre, but remember something else bizarre: that no matter how you are moving, light is moving about relative to you at the same speed, namely 300,000 meters per second. Our intuition for space and time is not correct – that’s what Einstein figured out – and it is possible for there to be fields that are at rest with respect to all observers!”*

Its intriguing to think about “No matter how you are moving, you are not moving relative to the Higgs field”. Matt tried to explain this bizarre field as below:

Well, think about ordinary empty space for a minute. If you were out floating in empty space, far from the earth, could you tell if you were moving through it? No. Empty space – vacuum – is as close to nothing as you can imagine. It doesn’t make any sense to ask if you are moving relative to it; there’s no experiment you could do to even ask this question. You can only ask if you are moving relative to physical objects. Even if you and I are moving relative to each other, there is no experiment that we can do which will be able to ask whether one or the other of us is stationary with respect *to space itself*.

As discussed under INTRODUCTION of this paper, Cubic Lattice Model recognizes the possible existence of such a bizarre field but with a simpler description as below:

*If you are moving with same velocity in all direction over the surface of the sphere, then you are not moving at all wrt to the field of space that you are creating through continuous emission of space per unit area per unit time. You not moving is same as if you are moving with same velocity in all direction, which is equivalent to EXPANSION.*

At [NASA Vacuum Chamber Experiment](#), ( video) we observed that feather and ball fell simultaneously in a vacuum chamber, which is amazing as it proves that **acceleration** due to gravity is independent of the mass of the falling object. Hold on! before the use of word acceleration let's hear the voice over of video at 4:20 min.

*Isaac Newton would say that the ball and the feather fall because there is a force pulling them down: Gravity. But Einstein imagined the same very differently. The HAPPIEST THOUGHT OF HIS LIFE WAS THIS: The reason that the bowling ball and the feathers fall together, is because they are NOT falling; they are standing still.*

Einstein reason out that there is no force at all acting at all on the feather or the ball in free fall. Since it is not possible to comprehend the background, there will be no way of knowing if the ball and feathers are accelerating towards the earth so he concluded: they weren't".

So what is here happening to ball and feather if they are not accelerating toward earth. If Einstein conclusion that **they are standing still** is correct then what should we make out of the apparent observation that space (or separation) between ball and earth progressively reduces in an accelerating manner until they meet. Definitely we cannot ignore the apparent observation for the sake of a theory even if it is from a Genius like Albert Einstein. At the same we also cannot ignore the conclusion of Einstein in the context of his theory of Relativity that both ball and feather are **standing still** . Why? Because both GR and SR has now passed the test of time for over a century with a large number of experimental confirmations of its equations. Therefore if both Einstein and apparent observation is correct then either of the following statement is true:

**Statement 1:** The ground beneath is expanding in an accelerating manner to meet the ball.

**Statement 2:** We lack understanding about the meaning of **"being still"** and may be in the context of theory of relativity **"being still"** carries an altogether different meaning than **"not in motion"** and we are yet not fully understood that deeper meaning.

Considering the aforementioned statement of Matt Strassler regarding Higgs Field, and the fact that despite substantive mathematical verification we have yet not been able to produce an intuitive physical description of GR and SR, I would consider that the **Statement 2** should be correct, and I reject **Statement 1** as it is neither supported by observation nor by popular contemporary theories.

So, what could be the meaning of **"being still"**. Newton Law of Inertia states that "An object shall continue to be in **state of rest** or **state of motion with constant velocity** unless acted upon by a Force. This is a very powerful statement indicating some equivalence between **state of mass particles at rest** or **state of motion with constant velocity**, which leads us to two possible interpretation:

1. The term **state** is characterized by some property, perhaps geometrical property, of mass particles which is unchanging at constant velocity.
2. Even the apparent **state of rest** is in some sense a state of **motion with constant velocity**.

For the purpose of further discussion we will denote that intrinsic property of particle (not changing at rest or constant velocity) as **state** of the mass particle. Similar to the case that we are apparently observing ourself as still wrt to ground but we are still moving at and speed of the 30,000 m/s about the Sun, it is possible that internal **state** of the object that we see at apparent rest with respect to ground is continuously changing. Since a constant state is associated with constant velocity, a **continuously changing state** characterizes **acceleration**.

Therefore the meaning of **acceleration at rest** is that **state is changing** despite being at **apparent rest**. The meaning of being **rest in accelerated motion** means the **state is unchanged** despite the **observed accelerated motion**.

So what is this **state** under discussion. *In the context of Cubic Lattice Model*, state of massive object is characterized by its geometric shape, where

- I. state of rest for a 3-D object is associated with isotropic shape of sphere and
- II. state of motion shall associated with anisotropic ellipsoidal or other distorted geometry of sphere, and
- III. state of acceleration is either associated with changing size of ellipsoidal geometry or
- IV. *state of acceleration is associated with changing orientation of the anisotropic ellipsoid of constant size.*

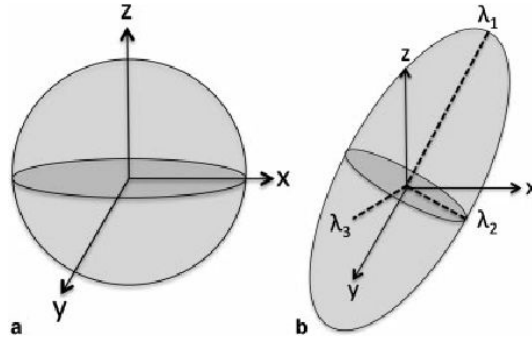


FIG 5 Isotropic and anisotropic geometry.

**Isotropic Geometry:** We shall take the help of simple diagram (Figure 5a) to explain the simple geometry of closed space or collapsed mass particles. Any collapsed massive object at complete rest (i.e minimum orbital radius or maximum curvature) shall be characterized by isotropic geometry of closed spheres, which is in effect equivalent to circular dimension of Elementary Particle ( Figure 3) embedded on the surface of an sphere at equal distance from each other. The linear dimension of the space of same Elementary Particle grows from zero to infinity as time progresses from zero to infinity. In this state, due to equal distance between the particles on surface, linear dimension emitted outwardly is isotropic. Which is same as saying that it has same Velocity in all direction, which in effect is zero velocity. **Volumetric expansion of this closed surface** (characterized by plane of circular dimension) can be thought as product of constant surface area of closed space and increasing linear dimension emitted outwardly.

**Anisotropic Geometry:** For mass particles to increase the radius of its orbital about a point external to itself, it deforms into an ellipsoidal geometry (Fig 5b) to emit more space to outside region than to inside region. Since overall space density of the Universe is uniform, the mass particle acquires a relative orbital velocity to distribute the emitted space over the outside volume to keep the overall space density as constant. To compensate the decreased emission of space on the inside region, there has to be an additional source of linear space or the **cause** at the centre. This source of additional space or **cause** is Gravitating Mass. If so, then a logical objection is that radius of orbital should normally increase over time, since space emitted at the inside region is continuously increasing. This problem can be explained in the context of Cubic Lattice Model, by interaction of space approaching from opposite direction (From Gravitating and Attracted Mass ) to transform along the direction **orthogonal\*** to the plane of Gravitation. However the detailed explanation of this interaction is beyond the scope of this Paper, hence planned to be addressed in future papers of Cubic Lattice Model.

\*Note: The use of the **orthogonal** instead of **perpendicular** is to signify that in the proximity of the source, space is not necessarily perpendicular, but over large distance space emitted by all gravitationally bound systems within a Galaxy is transformed to the direction perpendicular to the galaxy. That means the word orthogonal correspond to the notion that space emitted by mass particles finally finds a path of scale along the physical direction **perpendicular** to **Galactic Plane**. In the local space (say a laboratory) actual physical direction of emission of such orthogonal space cannot be determined, due to local interferences.

It shall be appreciated from above discussion that phenomenon of Gravity perceived as an impact of some **Pull Force** between the object, is on the contrary the result of **Push Effect between the Massive Objects** together with orthogonal transformation of spaces while interacting within the Cubic Lattice. Here in this video (<https://youtu.be/rv4lkye9PS8>) physicist Alan Guth is explaining that particle physics allow Gravity to be repulsive at extreme conditions like Big Bang. In the context of Cubic Lattice Model, nature of Gravity is still the same as it was at the Big Bang. It was a repulsive force back then and it is a repulsive force now also. Metric Expansion of Universe itself is Gravitation ( or reaction to Gravitation) , and no additional Dark Energy of Vacuum is required to explain the Expansion of the Universe.

## CONCLUSION

The value of G so obtained (Equation at Sl 21 under Derivation), may not be very precise but a value so close to the accepted value, indicates that by further refinement of value of G, it would be possible to develop Cubic Lattice Model as a credible model to explain the Universe. Nevertheless, we will have the opportunity to further improve the result, by refinement of Cosmological Parameters and expected correction with the initial volume( negative or positive) of the Universe which is assumed zero in above derivation. Ultimately, Cosmological Parameters may be completely eliminated from equation of Gravitational Constant to be replaced with electromagnetic parameters, so that the results are verifiable within laboratory, along with a physical description in the context of Cubic Lattice.

An attempt has been made under this paper to further explain the concept of **Rest Velocity** ( already introduced with the paper [Cubic Lattice Structure of the Universe](#)) proposed to be responsible for potential energy of mass particle. Following statement may particularly be noted in this regard:

*If you are moving with same velocity in all direction over the surface of the sphere, then you are not moving at all wrt to the field of space that you are creating through continuous emission of space per unit area per unit time. You not moving is same as if you are moving with same velocity in all direction, which is equivalent to expansion.*

It may be appreciated from above discussion and explanation in this paper, that Gravitation could be nothing but reactionary force due to Metric Expansion, and no additional dark energy is required to explain the expansion of the Universe. It is proposed that expansion of Universe is caused by locally anisotropic emission of space by fundamental mass ( i.e. say electron) which travels through the Cubic Lattice to interact with causing isotropic expansion of the Universe at large distances, of which Gravitation is a local anisotropic effect.

## REFERENCES

- [1] Values of Fundamental Constants. <http://physics.nist.gov/constants>
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- [3][NASA Vacuum Chamber Experiment](#),
- [4] Alan Guth about Inflationary Universe (<https://youtu.be/rv4lk9PS8>)
- [5] [Cubic Lattice Structure of the Universe](#)

## ACKNOWLEDGEMENT

I am thankful to all members of Task Force Gravitation, who have actively participated in discussions providing useful insights and criticism, without which it was not possible to write this Paper. Especially, I am thankful to Ruud Loeffen, the writer of "Mind Blowing Gravitation", who has extended every possible support to do calculation and provide data for deriving value of Gravitational Constant G.

## ABOUT TASK FORCE GRAVITATION

Task Force Gravitation was founded in 2016 A.D. by a group of curious, creative and motivated professionals ( 6 nos at inception) of diverse disciplines from six different countries on the globe, who volunteered to work together with a focused objective of discovering the Foundation for Gravitation.