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► **To cite this version:**

Rohit Rohit Kumar. Variation in Value of Universal Gravitational Constant - 'G' And Rise of Current Universe. 2020. hal-02867435

HAL Id: hal-02867435

<https://hal.science/hal-02867435>

Preprint submitted on 14 Jun 2020

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Variation in Value of Universal Gravitational Constant - 'G'

And

Rise of Current Universe

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Abstract: In 1686 Newton gave his famous gravitational equation describing movement of planets around star. He left from the conventional notion of equilibrium of mass in which all the particles revolved around their center of mass. This led to creation of 4 fundamental forces of nature. Value of 'G' thus created in due process is in the foundation of every astrophysical analysis whether it be Newtonian or Einstein's gravitational field. Here, it is shown that the value of 'G' varies with difference position, velocity and mass. Calculation is made for difference in value of 'G' for each planet with variation in distance ie; apogee and perigee. Change in monthly and daily variation of "G" is also shown, along with effect of height and depth from mean sea level. Force of gravity is equivalent to Centripetal force from center of mass of planet-star system. Calculation for value of G is made for an atom which is found to be 10^{29} , thus cancelling the concept of the separation of forces of nature on basis of size. Such concept will be very useful for space exploration activity.

KEY WORDS: Centripetal force, Gravitational constant -G, Gravitational Force, Hydrostatic equilibrium, Linear acceleration, Mass, Orbital and escape velocity, Time.

1. Introduction:

Inverse square is at the center of gravitational and electromagnetic theory. Squaring the distance between the center of particles are considered to compare the movement w.r.t. other and thus begins issues in gravitation and electromagnetism. Issues in gravitation are easy to detect because of the sheer size of the gravitating bodies. But in case of electromagnetism it's difficult to identify due to its, below microscopic size. Center of mass, a theory known since ancient times are left out, although everyone would agree that every particle can be balanced using this concept.

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Considering center of mass [3] as primary concept and considering colour as primary particles due to its presence in everything, entire theory of gravitation and electro-magnetism can be laid out. Colour is a complex concept which can't be created by itself, as our brain is not trained to create such a complex thing [1]. So, considering colour as the fundamental particle, 'beginning of universe' is conceptualized. Discussion is made, how the universe where we live-in and visualize might have come into existence along with role of infinite vacuum in movement of particles. Conceptualization of mass is discussed by maintaining the fundamentals of conservation of mass. Here equation of mass is discussed with varying conditions. Continuous change in relative volume of mass is introduced that leads to introduction of drag force and said that it is required for creation & existence of mass and might be the principal reason for formation of universe and time.

In later part it is shown how the count of particle(s) can lead to the creation of universe(s). Even in case we have single universe how these particles can get moved is discussed. Distance between particles can lead to the movement of particles, its speed and density, and to this when drag force is added it can lead to creation of multiple universes.

Dirac in his Large number hypothesis introduced the variation in 'G' with respect to time. This led to crisis in the Einstein's field equation, which was overcome by the introduction of another term. But here while calculating it is found that the value of 'G' attains variable value with change in position, velocity and mass. Using the variation in the value of 'G' would help to combine the two fields, i.e., QM & GR. It can be said with surety because all the visible matter is made of small atomic or sub-atomic particles.

1. **Hydrostatic equilibrium for initiation of forces of nature:**

Concept is developed regarding the hydrostatic equilibrium that lead to initiation of gravity and electromagnetism is discussed by maintaining conservation of mass. Here "**System pair concept**" is introduced. It is shown that it is linear acceleration and not circular acceleration of objects around their center of mass is the reason for all the forces that exist in nature, utmost circular motion can only be consequence with introduction of trigonometric values. Even 'Newtons Gravitational law' containing gravitational force and gravitational constant-G is the resultant of hydrostatic equilibrium of linear acceleration.

It is considered that the constants of nature are static, and their values are unchangeable, but variation in speed of light has shown, it does change. Moreover, if constants are true and rigid, it will need the very fabric of space to be fixed to maintain its value else it would become variable. So, it can be assumed that the value of "universal gravitational constant-G" will also vary. Numerous experiments had been performed by many renowned scientists to obtain the most precise value, but in vein. With development in technology it was expected to get more precise instead the difference increased.

As mentioned in Wikipedia centripetal force is a force that makes a body follow a curved path. Its direction is always orthogonal to the motion of the body and towards the fixed point of the instantaneous center of curvature of the path. Isaac Newton described it as "a force

by which bodies are drawn or impelled, or in any way tend, towards a point as to a center". In Newtonian mechanics, gravity provides the centripetal force responsible for astronomical orbits [6]. Gravity as per Newton's law, is the proportionality constant(G) connecting the gravitational force between two bodies with the product of their masses and the inverse square of their distance. In the Einstein field equations, it quantifies the relation between the geometry of spacetime and the energy–momentum tensor[5,8,9]. Mathematically centripetal acceleration can be achieved and derived using trigonometric functions of linear acceleration and the linear acceleration equation of hydrostatic equilibrium can provide values of gravity and gravitational constant.

In research done by “Michael R. Feldman [10]” he tried to show that the value of Newton's gravitational constant varies with the length of day for a period of almost 5.5 years. It appeared to be a false claim as the variation in length of day depends on the inclination of earth towards sun. His claim was later challenged by J.D. Anderson, who claimed it to be highly favored, as they could not replicate his findings [14] in his reply.

G. L. Gershteyn [12] in his experiment found that the value of “ G ” varies significantly with orientation of test masses relative to the system of fixed star using different techniques. Over here effect of change in distance of planets revolution around the star is shown to be the main reason for variation in “ G ”. In this paper it is shown that the gravitational constant “ G ” is different for different planets, stars, or even atomic or subatomic particles at different location, or in simpler words different for different pair system. It is shown that the gravity is different at different locations of earth at the same time and will be different at the same location in different time interval.

Gravitational waves passing through earth -sun system will even affect the value of “ G ” and gravitational force due to elongation in distance of separation between sun and earth. [13]

Value of “ G ” becomes very high at sub-atomic level. It might be the reason for strong or electromagnetic force, and there are possibilities that other forces of nature might be the resultant of different pair combinations. Considerations of gravitational constant not being a force is also discussed. Various conditions were derived by changing the parameters. Euler’s Variable instead of constant is suggested to be the new name for “ G ” with symbol “ E_v ”. Using the gravitational constant ‘ G ’ new equation of gravitational force is derived.

2. Theoretical Approaches

2.1 Movement of Particles & Beginning of Universe

When the universe is infinite, it will have no boundary. Thus, no area / volume can get created or every particle will have infinite area / volume. Thus, on considering an infinite universe the equation of mass = density*volume can be contradicted, as for infinite volume, effective mass will also be infinite. If equation of mass as we know (density*volume (for fixed volume)) if used, this would fix the volume of universe. On introducing a particle in a fixed volume, the particle would move towards its central region, since force/area will be maximum only at central

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region. This would contradict the expansion theory of universe particles, which would otherwise move towards the central area instead of moving outward.

Now when universe is considered infinite

$$Pressure = \frac{Force}{Surface Area} = \frac{Force}{Infinite Surface Area} = 0 \quad (1)$$

So, an infinite universe will create no pressure irrespective of the number of particles it contained. This basic understanding will create an issue for the conceptualization of single structure, a criterion required for 'Big-Bang'.

2.2 Conceptualization for existence of Mass:

2.2.1 Fixed and variable volume: From 'Conservation of mass'

As per this "mass" can neither be created nor be destroyed, it remains constant. The equation of mass suggests that mass = density*volume. But considerations regarding fixed volume in an empty space is difficult to imagine. With this fixed mass the universe will not have any entropy. Entropy can only be created for mass having variable effective volume. This "variable volume" along with conservation of effective mass value, movement of particles can be created. If the volume is fixed, it will create an obstacle for any other particle to pass, thus creating a stagnant/dead universe. So, with equation mass = density *Volume, 2 conditions can be derived:

Condition1:



Figure1. Circumference of Colour particles

= Volume of fundamental particles (say colour particles) without considering the surrounding space. Surrounding space is required for its movement.

Condition2:

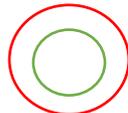


Figure2. Circumference of Colour particles with space around

= Fundamental particles (colour particles) with surrounding space. If this space is fixed for each individual particles with restriction for other particles to enter, the volume of entire universe will be fixed without any movement.

Here both the conditions are difficult to imagine. In both the case universe will be stiff and none of our physics equation will work.

Variable space around colour particles will allow the particles to move thereby creating entropy & mass. So, considering some modification in mass equation would solve this problem. Let's consider

$$Mass(m) = Density(\rho) * Vol(V)$$

Where, $Vol(V) = Avr (V) \pm \Delta vol$

From Charles & Boyles law,

$$\Delta V = \frac{\Delta T}{\Delta P} \quad (2)$$

The inequality of space will create the particles to move which leading to increase or decrease in volume, which would create drag force and

$$\Delta P = \frac{\Delta F}{A} = \frac{\Delta Drag Force}{Area}$$

And, $\Delta T = \frac{1}{\lambda}$

$$\text{So, } \Delta V = \frac{\Delta T}{\Delta P} = \frac{\Delta T}{\Delta Drag Force} * Area = \Delta \frac{Area}{Drag Force * \lambda} \quad (3)$$

Thus, mass(m):

$$\rho * \{V \pm \Delta V\} = \rho * \left\{V \pm \Delta \frac{Area}{Drag Force * \lambda}\right\} = \rho * \left\{V \pm \Delta \frac{2 * Surface Area}{(\rho u^2 C_d A) * \lambda}\right\} \quad (4)$$

Here ρ for change in volume will always be 1, since drag force can be created with change in position of single particle and at a time for one direction only one particle will move. Observations made from the above equations:

- When $\Delta vol = 0$: Universe will be still/dead.
- When $\Delta vol \sim$ infinity: mass will cease to exist in absence of any governing force. This condition is impossible to get created as there will always be drag force.
- In infinite universe: F/Ar (by infinite universe over particle) = 0, thus no movement of particles, as well absence of drag force.

2.3 Particle dependency for existence of current universe:

2.3.1 Case1: Universe has just one particle:

- Pressure exerted by universe = 0
- Pressure exerted by surrounding particles (due to drag force) = 0

So, there is no way, current universe can come into existence by having just 1 particle. Thus, no big-bang.

2.3.2 Case2: Universe has multiple particles

- Pressure exerted by universe = 0
- Pressure exerted by surrounding particles (due to drag force) comes into existence to maintain equilibrium.

It's hard to imagine that there can be perfect distance between all the particle. Even if there is perfect distance between particles all along the length and breadth, it will not remain between multiple consecutive layers, whether the particles are compact or loosely held. The force applied

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either at center of mass or on top of any two consecutive or alternate layer will always be different. In the below figure, the force between the edge and center (red arrow) will be different to that of the force of particles between the circumference (yellow arrow) due to difference in length of center of mass.

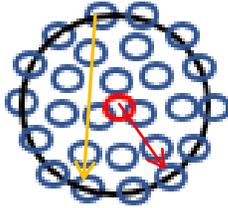


Figure4. Distance between the edge and center to edge in universe

This inequality will make particles move, to attain the optimum distance or minimum pressure. This shifting of particles will create “entropy”. The same can be true for multiple universes. In case there are multiple universes they will be in continuous motion along with continuous motion of particles within them arising from the same phenomenon. Collision, absorption and separation will be part of them, and all due to drag force. Infinite number of universes can exist and each attempting to acquire hydrostatic equilibrium.

2.4 What made the particle move or “Time – t” to get created?

Here adding or subtracting change in distance - ΔH or change in volume- Δvol , from any distance some ‘variable’ needs to be introduced in relation to which this spatial change in the position of particle can be done or observed. Let’s say that variable is “t – Time”. In case there is no spatial change in the particle position, time can’t be introduced. If in universe change between the particles are precisely identical the observable time ‘t’ can’t be introduced as from observation point things will remain same. But even in such case, change can be visible in relation to other universes or multiverse if taken into consideration. Since time is a variable showing the relative change in position of particles, so it can never be negative. Moreover, “Time” is always relative and can be considered as resultant of entropy.

2.5 Creation of Universe from the colour particles:

Colour is present in every particle. It can’t be separated from it. The various spectrum of light shows that the light itself has colour in it. Moreover, it is known that these color approaches to blackish appearance when it is monochromatic. So, it can be assumed that the individual red or blue or green must have black or near black appearance. But when mixed with other colour it gets its contrast form.

3. Hydrostatic equilibrium for initiation of forces of nature and creation of current Universe

From above discussion it can be considered that for creation and existence, minimum a pair of mass particle must exist in equilibrium, at distance – ‘d’, irrespective of time – ‘t’ with motion.

3.1 Equilibrium in parallel path:

Equilibrium between 2-particles can be easily maintained when moved in parallel or circular paths. In case of 3 and 4 particles it can move in parallel by maintaining the equilateral triangle(s). But when it becomes more than 4, equidistance between them is difficult to be visualized. In such a case particle will be seen to have circular motion, although in case of free fall it will still be having linear motion.

2. For 2 particles:

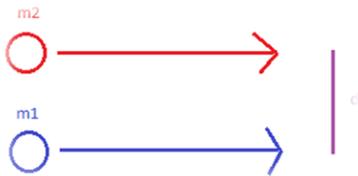


Figure5. Particles in parallel direction

Or $m_1v_1 = m_2v_2$

- More than 2 particles, look-a-like circular motion:** It is well known that particles revolve around their common center, but with respect to each other for smallest time ‘t’ they tend to move parallel to maintain equilibrium at every moment of time. But the overall observable path will be circular. Any consideration of smaller object rotating around larger object can be neglected. It can be understood using the below picture. For more than 2 particles:

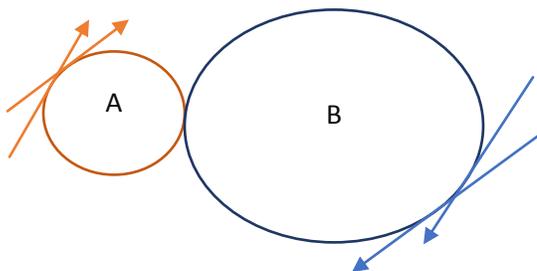


Figure6. Linear acceleration of particles resulting in circular path

In the above figure let’s consider circle “A” to be the path of star and circle “B” to be the path of planets around their center of mass. While revolving they tend to move between two nodes in straight line. Two arrow shows their actual direction of movement.

3.2 Geometric explanation of above concept:

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Geometric explanation of above concept: A circle consists of large number of points connected in close proximity, i.e., between any two points there is always a straight line.

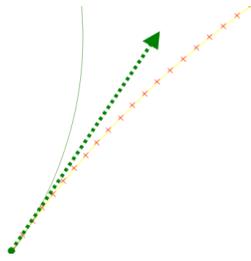


Figure7. Circles showing actual path while arrow represents linear momentum of particles

There can be change only when there is presence of other object.

Newton while making considerations for equation of gravity, considered the distance between the center of rotating objects [2]. The concept of center of mass for mutually rotating object was known during his time (known since ancient times of Archimedes [3,4]). Still it's not clear why did he considered the centers of mutually rotating bodies instead of center of mass? In any case the distance between the center of two can't be taken into consideration. This concept will adversely affect the equations used for gravitation/electromagnetism at different spatial position.

- **Linear Acceleration:** Prime cause of all the forces of nature

“Linear acceleration” of mutually rotating object that can be used to replace the distance of center between mutually rotating object:

$$m_1 v_1^2 r_1 \sin^2 90 = m_2 v_2^2 r_2 \sin^2 90 \quad (10)$$

r_2 = Average distance of revolution from their center of mass for object 2

r_1 = Average distance of revolution from their center of mass for object 1

v_1 & v_2 = Orbital velocity for m_1 & m_2 .

$\sin^2 90$ = Tangential velocity of two mutually rotating particles of equal mass

In the above equation v_1 & v_2 are simplified trigonometric form of v_1 & v_2 . In every case $v_1 \sin^2 90$ will be equal to $v_2 \sin^2 90$. The value of $\sin^2 \theta$ will change, but for simplicity of understanding we considered $\theta = 90$ for every case for the reason weather we have any combination, to remain in equilibrium these particles will have to have equal value. In case ' θ ' is disturbed we can have the trajectory of mercury.

4. Orbital Velocity:

It is the velocity at which the objects revolve around their common center. Using the equivalence equation, orbital velocity of particles rotating around its counterpart can be obtained. Orbital velocity of both large and small object can be obtained using above equation of equivalence:

$$m_1 v_1^2 r_1 = m_2 v_2^2 r_2 \quad (11)$$

$$v_1^2 = \frac{m_2 v_2^2 r_2}{m_1 r_1}$$

4.1 Orbital velocity of artificial satellite using Newton's equation:

$$v_1^2 = \frac{Gm_E}{r_E} \quad (12)$$

$$v_1 = \left\{ \frac{[(5.97 * 10^{24}) * (6.673 * 10^{-11})]}{[(6.78 * 10^6)]} \right\}^{1/2} = 7672 \text{ m/sec}$$

here m_E = mass of earth &

r_E = radius of earth (638000 m) + height of satellite above earth surface 400km, (400000 m) = $6.78 * 10^6$ m.

4.2 Orbital velocity of artificial satellite by considering "Linear acceleration":

Let's consider an artificial satellite rotates around the earth at velocity v_E & distance ' r_E ' from earth with velocity v_{AS} & distance r_{AS} from earth and linear acceleration L_E being of earth while L_{AS} for artificial satellite. Here mass of sun ' m_S ' is considered instead of mass of satellite for the reason satellite's mass is very less as compared to sun or planet's and will have no effect in its rotation while sun's mass will help in balancing the motion of satellite.

So, linear acceleration around the center of rotation for earth/planet:

$$L_E = m_E * v_E^2 * r_E \quad (13)$$

Similarly, linear acceleration experienced by rotating artificial satellite due to Sun / star:

$$L_{AS} = m_S * v_{AS}^2 * r_{AS} \quad (14)$$

For satellite to remain balanced the two linear acceleration should remain in equilibrium. Thus,

$$m_E * v_E^2 * r_E = m_S * v_{AS}^2 * r_{AS}$$

$$\text{Or, } v_{AS}^2 = \frac{m_E * v_E^2 * r_E}{m_S * r_{AS}} \quad (15)$$

Now, on putting the value as above orbital velocity thus obtained is:

$$\text{or, } v_{AS} = \left\{ \frac{[(5.97 * 10^{24}) * ((2.98 * 10^4)^2) * (1.496 * 10^{11})]}{[(1.989 * 10^{30}) * (6.78 * 10^6)]} \right\}^{1/2} = 7668 \text{ m/sec}$$

The value thus obtained is almost identical to that obtained using Newton's orbital velocity with difference of just 4m. This difference is negligible when compared to the orbital distance of satellite which is 67.8 km. In Newton's equation, how the orbital distance of satellite rotation has come is not derived, instead it has been assumed based on observation. This might not give correct result in every case. So, it can be said that, since Newton's equation is based on assumption. As well the two values are same (also an approximation to observational velocity) so, Newton's orbital velocity can be replaced using above derived equation.

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In case of meteors, planets, or even electron, proton or neutron the same concept can be used to find the orbital & escape velocity. Thus, the equation for planets will be:

$$m_E * v_E^2 * r_E = m_S * v_S^2 * r_S$$

Or, Escape velocity from Sun:

$$'v_S^2' = \frac{m_E * v_E^2 * r_E}{r_S * m_S} \quad (16)$$

And Escape velocity from Sun:

$$'v_S^2' = \frac{m_E * v_E^2 * r_E}{r_{AS} * m_S} \quad (17)$$

5. Gravitational Constant Extraction:

Equating the two value of escape velocity, i.e. newton's gravitational equation and escape velocity from linear acceleration.

$$\frac{Gm_E}{r} = \frac{m_E * v_E^2 * r_E}{r_S * m_S} \quad (18)$$

Value or "r" in Newton's law is given as distance between the planet & its host star. It is based on assumption that the planets rotate around star, while in reality they rotate around their center of mass. So, any assumption regarding distance between the centers can be neglected.

So, the value of 'r' would represent radius of star rotation around the center of mass from planet. So, on calculating the two sides, obtained value of 'G' is:

$$"G" = \frac{v_E^2 * r_E}{m_S} \text{meter}^3 \text{kg}^{-1} * \text{sec}^{-2} \quad (19)$$

5.1 Equating Gravitational Constant "G" for Earth-Sun system:

$$'G' = \frac{v_E^2 * r_E}{m_S} = \frac{[(2.98 * 10^4)^2] * (1.496 * 10^{11})}{(1.989 * 10^{30})} = 6.679 * 10^{-11} \text{meter}^3 \text{kg}^{-1} * \text{sec}^{-2}$$

The obtained value of "G" is even identical to that of value of Newton for earth-sun system. It also indicates that the value will vary for other planets.

5.1.1 Value of gravitational constant "G" varies spatially. Different values of "G" is derived and given in the result section.

6. **Deriving Gravitational Force equation:** Putting the value of ‘G’ in Newton’s gravitational force.

$$F = \frac{GM_s m_E}{r_{S-E}^2} \quad (20)$$

Where r_{S-E}^2 is Sun-Earth system center distance.

$$F = \frac{GM_s m_E}{r_{S-E}^2} = \frac{v_E^2 * r_E}{m_S} * \frac{M_s m_E}{r_{S-E}^2} \quad (21)$$

Since $r_{S-E}^1 \sim r_E$ and as the actual revolution takes place around center of mass, so replacing the value of distance between the centers with distance from the center of mass:

$$F = \frac{GM_s m_E}{r_{S-E}^2} = \frac{v_E^2 * m_E}{r_{S-E}} \sim \frac{v_E^2 * m_E}{r_E} \quad (22)$$

6.1 Gravitational constant for proton – electron system:

$$'G' = \frac{v_E^2 * r_E}{m_p} = \frac{[2190219.458^2 * 5.291 * 10^{-11}]}{[1.67262192369 * 10^{-27}]} = 1.51745 * 10^{29} \text{meter}^3 \text{kg}^{-1} * \text{sec}^{-2}$$

“G” has very high value at atomic level indicating that it plays a very different role at different level. As well this “G” will continuously vary with change in the radial position, mass and velocity of all the rotating objects (planets or its moon or even electrons)

Newton in his equation of gravitation just tried to create the balance by calculating the gravitational constant value. At local level it provides the solutions, but at larger scale or at atomic scale, it created a lot more problems than the solutions. There was no logic in creating the equation with ‘distance between the planets and their parent star’, that too when both rotate around their center of mass.

It would be incorrect to say it to be gravitational constant or even add the word gravity to it, as the phenomenon is held true even for sub-atomic particles like electron revolving around nucleus of an atom. Naming like “VRaM” would be best suitable where “V” represent velocity, “Ra” for radius & “M” indicates Mass of heavier body around which smaller objects revolves. Alternately since ‘Euler’ gave us the equation for acceleration, It would be recommended to use E_v – **representing Euler’s Variable**, instead of gravitational constant.

➤ **SI unit calculation of ‘ E_v ’ :**

$$\frac{v_E^2 (\text{meter/sec}) * r_E (\text{meter})}{m_S (\text{Kg})} = \text{meter}^3 \text{kg}^{-1} * \text{sec}^{-2} \quad (23)$$

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6.2 Methods for obtaining different values of "G"

6.2.1 Value of "G" for each planet:

From the above equation, it can be seen that, value of "G" depends upon the mass, velocity and radius from center of mass whether the path is circular or elliptical. Table 2A & 2B in Table section shows values of "G" at perigee & apogee for each planet.

The most simplistic method to obtain the value of "G" can be:

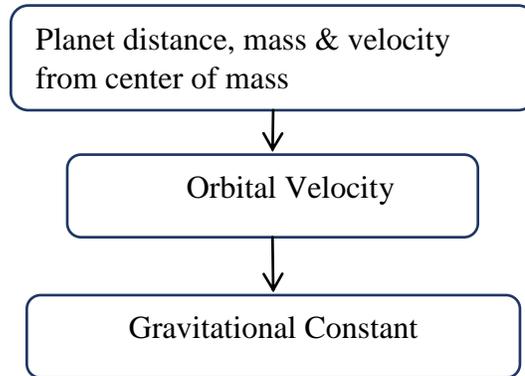


Figure8. Value of "G" for each planet

6.2.2 Monthly increase or decrease in value of "G":

Method has been developed to obtain the monthly variation in value of "G" in generalized form. It is shown that for plane earth, there is variation in values of "G", even if orbital velocity is kept constant for entire month. Identically for all the object this value can be obtained.

Table 3 & graph shows the average value of "G" for each month for planet earth.

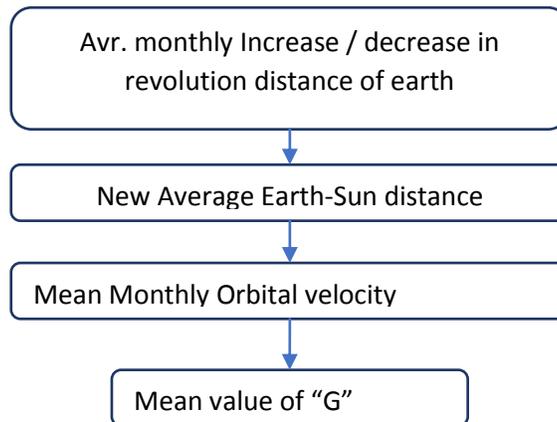


Figure9. Monthly increase or decrease in value of "G"

6.2.3 Variation in value of “G” by change in spatial position over the surface of earth:

In Newton’s law, value of “G” is constant. The effect of distance of center of mass of rotating bodies must had been in calculating the value of “G”.

The above two method gives how the values of “G” can be obtained using the center of mass of mutually rotating object from their center of mass of revolution. Although this is true but has no significance for us, as we reside over the surface of earth. So, effective value of “G” must be obtained for the surface of earth instead of center of earth / planet.

Table 4 represent, how the value of “G” will change with change in its spatial position over the surface of earth / planet for any object.

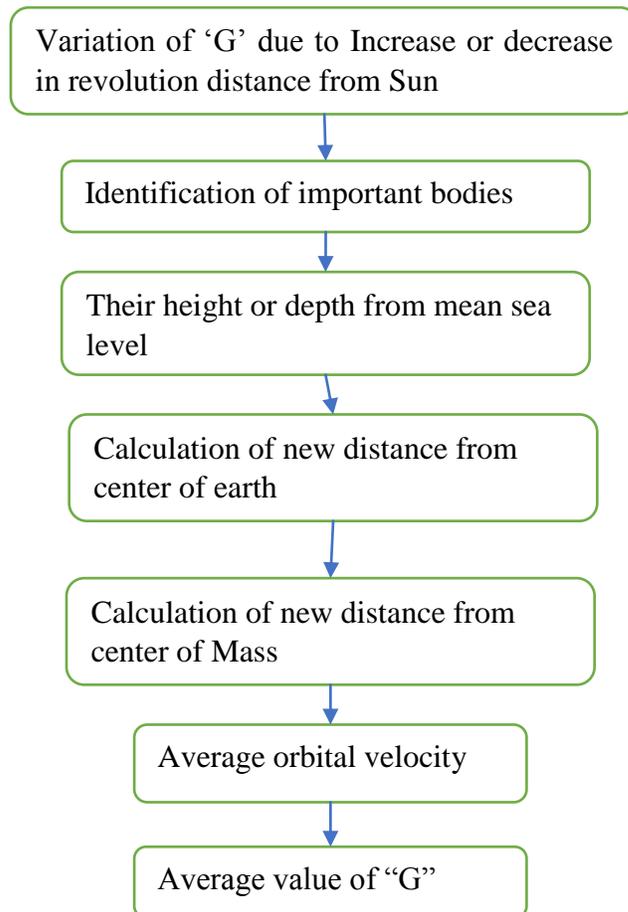


Figure10. Variation in value of “G” by change in spatial position over the surface of earth

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7. Result and Discussion

Value of "G" is constantly being monitored and being updated by scientific society. Reference of their updates along with uncertainty. The most recently updated values can be found at NIST [16]. With the development of instrument, it was assumed that the accuracy of "G" will increase, but the instead of being more accurate it created concern for the scientists. Below is the table showing different experimental values performed by various scientists [11,15].

Table 1: Experimental Value of "G"

Sl. No.	Author	Year	Method	"G" (in units of $10^{-11} \text{ m}^3 \text{ s}^{-2} \text{ kg}^{-1}$)
1	H. Cavendish	1798	torsion balance (deflection)	6.754
2	J.H. Poynting	1891	common balance	6.698
3	C.V. Boys	1895	torsion balance (deflection)	6.658
4	C. Braun	1897	torsion balance (deflection)	6.658
5	C. Braun	1897	torsion balance (period)	6.658
6	P.R. Heyl	1930	torsion balance (period)	6.669
7	J. Zahradnicek	1932	torsion balance (resonance)	6.659
8	P.R. Heyl, P. Chrzanowski	1942	torsion balance (period)	6.672
9	C. Pontikis	1972	torsion balance (resonance)	6.6714
10	G.G. Luther and W.R. Towler	1982	torsion balance (period)	6.6726
11	H. de Boer	1987	mercury flotation (deflection)	6.667
12	W. Michaelis et al.	1996	flotation (null deflection)	6.7164
13	C.H. Bagley and G.G. Luther	1997	torsion balance (period)	6.674
14	O.V. Karagioz et al.	1998	torsion balance (period)	6.6729
15	J. Luo et al.	1999	torsion balance (period)	6.6699
16	M.P. Fitzgerald, T.R. Armstrong	1999	torsion balance (null deflection)	6.6742
17	F. Nolting et al.	1999	common balance	6.6754
18	U. Kleinvoss et al.	1999	pendulum deflection	6.6735
19	J.H. Gundlach, S.M. Merkowitz	2000	torsion balance (acceleration)	6.67422
20	T.J. Quinn et al.	2001	torsion balance (servo)	6.67553
21	T.J. Quinn et al.	2001	torsion balance (deflection)	6.67565

1. No chance of Big bang, as with the initiation itself the particles must be in motion to acquire minimum entropy.

2. For the smallest moment of time particles move parallel to its surrounding exerting highest force on it. Centripetal acceleration and force can be considered as resultant of ‘Linear acceleration’ with tangential values.
3. Infinity does not have any role in movement of particles, it is the drag force between the particles that creates movement.
4. Colour can be considered as fundamental particles, since except colour every other forces of nature can be derived.
5. Time is variable representing change in entropy.
6. Entropy could exist between the particles and between the universes (for multiple universes).
7. The density, area and speed of the interacting particles will get effected by each other.
8. From ‘Hydrostatic equilibrium for initiation of forces of nature’
 - a. ‘Gravitational constant - G’ is not a ‘constant’ as considered by Newton and Einstein in their gravitational equation.
 - b. Universe works identically at smallest as well as largest level.
 - c. Since conversation of energy, momentum, etc., is maintained at all time, thus universe has non-ending timeline.
 - d. ‘Euler’s variable- E_v ’ and ‘gravitational force’ will be different at every location on earth surface due to absence of perfect circular surface of earth.
 - e. The gravitational pull will keep on changing with the rotation of earth around the center of mass (can’t say sun). That is gravitational value will change at every moment of time / day. The same location on earth will provide different value of gravity when measured at different time interval.
 - f. The mass may remain same, but the weight of the object will vary.
9. Ratio of electromagnetic force and gravitational force is 10^{39} . Ratio of values for proton – electron system to that of star – planet system (earth-sun) is identical.

10. Values of “G”:

Universal gravitational constant as suggested by Newton is actually a variable. Depending upon its distance from the sun and height or depth above the surface of earth there is change in the value of “G”.

a. Value of “G” of planets at their Apogee and Perigee:

Table2A: Mean Orbital Velocity of planets

A	B	C	D	E	F	G
Sl. No	Object / planets	Object Mass = $\ast(10^{24})$	Mean Distance from rotating center (million km)	Perigee of Planets (r)	Apigee of Planets (r)	Mean Orbital Velocity (known) $(m)\ast 10^3$

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0	Sun M =*10^30	1.989	10^10	10^10	10^10	
1	Mercury	0.33	57.9	4.6	6.9817079	47.4
2	Venus	4.87	108.2	10.7476	10.894185	35
3	Earth	5.97	149.6	14.7098074	15.2097701	29.8
4	Mars	0.642	227.9	20.6644545	24.922873	24.1
5	Jupiter	1898	778.6	74.07426	81.608146	13.1
6	Saturn	568	1433.5	134.9467	150.3983	9.7
7	Uranus	86.8	2782.5	273.555503	300.63894	6.8
8	Neptune	102	4495	445.96315	453.68743	5.4

Source: From column "A to G" NASA, Planetary Facts Sheet [3,4,7] was used.

Table2B: Value of "G" at Apogee and Perigee of planets.

	J	K	L	M	N	O
Sl. No	Earth Orbital Velocity at Perigee (v)= (r1v1 = r2v2)	Earth Orbital Velocity at Apigee (v) = (r1v1 = r2v2)	"G" at Perigee (=earth(v2*r)*r) / m(sun))	"G" at Apigee (=earth(v2*r) / m(sun))	Average value of "G" (from Apogee & Perigee)	"G" from avr. dist., velocity
0						
1	59662.17391	39309.29279	8.2323E-11	5.42397E-11	6.82814E-11	6.54034E-11
2	35235.77357	34761.66414	6.70879E-11	6.61852E-11	6.66366E-11	6.66390E-11
3	30306.855	29310.6337	6.79288E-11	6.56959E-11	6.68124E-11	6.67928E-11
4	26578.92566	22037.5476	7.33946E-11	6.08541E-11	6.71243E-11	6.65493E-11
5	13769.50644	12498.33564	7.06105E-11	6.40919E-11	6.73512E-11	6.71772E-11
6	10304.03115	9245.417003	7.20347E-11	6.46340E-11	6.83344E-11	6.78120E-11
7	6916.695074	6293.595899	6.57973E-11	5.98698E-11	6.28336E-11	6.46872E-11
8	5442.826386	5350.15925	6.64222E-11	6.52913E-11	6.58567E-11	6.58995E-11

b. Average value of "G" for each month: For Earth:

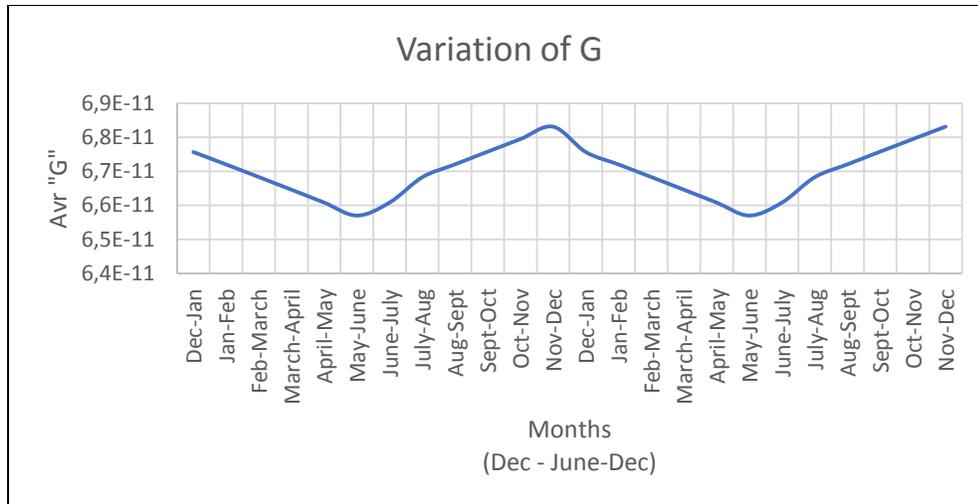


Figure11. Average value of “G” for each month.

In the above graph value of “G” is shown for two year starting with Dec-Jan period while ending with Nov-Dec period. It can be seen that the value of “G” varies with the movement of earth. It is identical to the sign wave created due to rotation of any two heavier object like two neutron star in short time interval, or electromagnetic waves but only in very large time interval.

- **Tabular representation of the above graph:**

Table3: Average value of "G" at each Month

	AA	BB	CC	DD	EE	FF
Sl. No	Month	Avr. Increase / decrease in revolution distance of earth	Average Earth-Sun distance	Increase / decrease in orbital velocity	Orbital Velocity in a month	Avr. "G" at each Month
1	Dec-Jan	8.33E+08	1.47931E+11	166.0369	30140.82	6.76E-11
2	Jan-Feb	8.33E+08	1.48765E+11	166.0369	29974.78	6.72E-11
3	Feb-March	8.33E+08	1.49598E+11	166.0369	29808.74	6.68E-11
4	March-April	8.33E+08	1.50431E+11	166.0369	29642.71	6.65E-11
5	April-May	8.33E+08	1.51264E+11	166.0369	29476.67	6.61E-11
6	May-June	8.33E+08	1.52098E+11	166.0369	29310.63	6.57E-11
7	June-July	8.33E+08	1.51264E+11	166.0369	29476.67	6.61E-11
8	July-Aug	8.33E+08	1.51264E+11	166.0369	29642.71	6.68E-11
9	Aug-Sept	8.33E+08	1.50431E+11	166.0369	29808.74	6.72E-11
10	Sept-Oct	8.33E+08	1.49598E+11	166.0369	29974.78	6.76E-11
11	Oct-Nov	8.33E+08	1.48765E+11	166.0369	30140.82	6.79E-11
12	Nov-Dec	8.33E+08	1.47931E+11	166.0369	30306.86	6.83E-11

Thus, for each day, “G” will differ by value:

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$$(6.79288E-11 - 6.56959E-11)/365 = 6.11753E-15 \text{ m}^3\text{s}^{-2}\text{kg}^{-1}$$

c. Variation in value of “G” with increase or decrease in height or depth:

Universal gravitational constant is calculated by considering the center of mass of the revolving bodies, while all the creature lives at the surface of planetary body. The correct way to calculate the value of “G” impacting an individual is only be possible when the radius of planets is considered. In below table distance between mean sea level and center of earth is considered to be radius of earth. Then it is tried to show that the value of “G” varies with the movement of bodies when there is difference in distance with the center occurs. Although this variation is so small that it is not observed.

Table4: Variation in value of “G” due to change in height or depth

Important bodies	Distance from mean sea level	Distance from Earth center	Distance from center of mass earth-Sun system	Avr. Orbital velocity in the month	Average "G" at each Month over earth surface
	mean sea level	638000	147930707166.67	30140.81812	6.7566842289E-11
	5	638005	147930707161.67	30140.81812	6.7566842286E-11
	10	638010	147930707156.67	30140.81812	6.7566842284E-11
	15	638015	147930707151.67	30140.81812	6.7566842282E-11
	20	638020	147930707146.67	30140.81812	6.7566842279E-11
	-5	637995	147930707171.67	30140.81812	6.7566842291E-11
	-10	637990	147930707176.67	30140.81812	6.7566842293E-11
	-15	637985	147930707181.67	30140.81812	6.7566842295E-11
Mt Everest	8848	646848	147930698318.67	30140.81812	6.7566838247E-11
Mt. K2	8611	646611	147930698555.67	30140.81812	6.7566838355E-11
Mariana Trench	-10994	627006	147930718160.67	30140.81812	6.7566847310E-11
Atlantic Ocean	-8486	629514	147930715652.67	30140.81812	6.7566846164E-11
Arctic Ocean	-5450	632550	147930712616.67	30140.81812	6.7566844778E-11
Indian Ocean	-8047	629953	147930715213.67	30140.81812	6.7566845964E-11

Using the above table difference (change) in value of “G” can be calculated for difference in

- height of 5 meter:

..1 $6.7566842286E-11 - 6.7566842284E-11 = 2.2837E-21 / 5 \text{ meter -----}24$

- And for 1 cm: dividing the above result by 500
- ..2 4.56741E-24 -----25

11. Unlike Newton’s gravitational equation, Einstein’s field equation which is “G” dependent will become incorrect as Newton considered the distance between the centers of particles instead of center of mass. If criteria specific value of “G” is used it will fetch different values for the same object depending upon spatial location.
12. Gravitational Force: using equation 22 the change in value of gravity each month can be found. As well change in value of gravity with change in height can also be found.
13. **Gravity and Electromagnetism:** It is an attempt by two or more massive bodies to remain in balance. The motion of body towards each other is due to difference in mass acceleration balance and is actually their motion in parallel direction attempting equilibrium position for themselves.
14. Gravitation, electromagnetism and other forces of nature have same property and can be defined in same way. Thus, forces of nature (electromagnetism, strong, weak & gravitational) can be combined.
15. Use of this process - Detecting Earthquake: Variation in value of “G” can be used to detect the earthquake using the principle of LIGO. Setup could consist of a geo-stationary satellite, mobile network tower fit over a spring and balanced by magnet, so spring don’t get suppressed. A small movement in earth crust might get amplified by spring resulting into movement of tower. It needs verification.

8. Conclusion

Inverse square method can be considered as a good theory but only for the targeted pair particles. When we try to build something general that could govern all the reality to greater extent center of mass theory is found to be more accurate from smallest to largest of body.

This paper presents orbital velocity $v_1^2 = \frac{m_2 v_2^2 r_2}{m_1 r_1}$, gravitational force $\frac{v_E^2 * m_E}{r_E}$ and VRaM

(Euler’s variable - E_v) $\frac{v_E^2 * r_E}{m_S}$ is suitable for all the cases and new research can be simplified on this understanding.

9. Acknowledgment

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I am thankful to my father who taught me how to visualize and gave basic skill of mathematics. I am also thankful to now unknown German Engineer who challenged me to prove my skills almost 7.5 years ago and uncle Dr. M. K. Rai, physics dept. from Mohan Lal Sukhadiya University – Udaipur who suggested my parents to allow me to take admission for higher studies.

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