Theoretical Deduction of Universal Gravitational Constant

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Abstract:
It is proposed that the so-called universal gravitational constant is actually the 'G of Earth' for its present speed. 'G of Earth' can be theoretically deduced from the electrostatic constant, based on the proposed structures of electron, proton and neutron. The deduced value is close to the measured value of G indicating that G depends on the nature of the body and its speed.

Key words: Anti-gravity, Force-equations, Inverse-square law, Force- energy equivalence, Force-constants, Force- energy balance

1. Introduction:

The gravitational constant 'G' is regarded as universal. Its value is experimentally determined, and no theoretical deduction has been proposed so far. However, in this paper it is proposed that the so-called universal constant is actually the 'G of Earth' and it is directly proportional to the 'square' of the speed of Earth. The measurement of 'G' does not give consistent values after three decimal places. This may due to the variation of 'G' with speed of Earth. The 'G of Earth' is theoretically deduced based on the concepts proposed in my previous papers, and is thus model dependent. However, the value obtained is close to the measured value of G, indicating the possibility that the proposed model is correct.

2. Model dependent deduction:

The theoretical deduction of 'G of Earth' involves a primary assumption: *the fundamental particle*[1] *of matter moves at speed 'c', and force*[2] *is reaction to this motion*. This leads to the following logical conclusions.

(i). Energy and force are equal, and both are finite

(ii). The forces of nature are manifestations of a basic force.

(iii). Energy units are enough for measuring force.

(iv). Force constants are not arbitrary.

(v). Energy acts against force, that is, acts as *anti-gravity,* and so force- energy balance exists in systems.

The integration of fundamental particles into a system which we call the universe is visualized to happen through the following steps[3].

Fundamental particles → particle pairs → spherical shells → electron-positron pairs→ neutrons → hydrogen atoms → large 'masses' of hydrogen atoms → orbiting systems of 'masses' → a pulsating system, the universe.

The formation of a system causes energy transfer between '*orbiting systems of masses*', and this leads to the creation of denser elements. Each of the above strucutres has its own G, and based on their internal structures, the G for each can be deduced from the known value, the Electrostatic Constant. The internal structures of electrons/positrons and neutrons are explained in a previous paper[4].

3. Force – equations, available force, constants, balance:

As energy and force are equal, separate force-units become unnecessary. Energy-units can be used for measuring force. This can be done by replacing d^2 (distance-square) in the *force-equations* by 'd'. Force decreases with distance, not with 'square' of the distance; *inverse-square law* is just an illusion. As speed opposes force, the force-equations[2] need correction when bodies remain moving in different directions.

Energy and force being finite, the *available energy/force* decreases as integration proceeds step by step as shown above. The energy used need not be equal to the force used in each step, but the available energy and force at each level will again appear to be equal – this can be called the concept of *force- energy equivalence*. When force is completly used, the body formed can no more interact.

The *force-constant*[2] depends on the available force and energy, and so is different at different levels. In the case of particles, the constant is directly proportional to radius- mass ratio and square of the speed. For atoms and higher structures, it is independent of mass and radius.

Force- energy balance gives stability to the structure by providing symmetry. Forces can be attractive and repulsive, and energy acts as pseudo repulsive force. So the balance is always between attractive and repulsive forces. For example, in the case of body orbiting in a gravitational field, the force is balanced by kinetic energy; that is, though the relation $GMm/d = mv^2$ is correct, the actual force is $mv^2/2 = GMm/2d$ [2].

4. The G of electron:

In electron/positron, the energy remains divided equally as internal energy and speed; so both are equal to $m_ec^2/4$ (the speed equivalent of this is $c/\sqrt{2}$). Internal energy (vibrations) is responsible for electrostatic force, and speed is responsible for gravity. So both forces are equal to $m_ec^2/4$ (that is, 20.467×10^{-15} J). The force between two electrons is maximum when they touch each other, and so it can be logically assumed that the force (either electrostatic or gravitational) is completely used when the distance between them is $2r_e$. So we get the relation,

$$Ee^2/2r_e = G_em_e^2/2r_e = m_ec^2/2 \text{ (the force of two electrons)}$$

Here E is the electrostatic constant = 8.9875×10^9, 'e' the unit charge = 1.6022×10^{-19}, 'm_e' the mass of electron = 9.10938×10^{-31} m and 'r_e' the classical radius of electron.

$$\text{So,} \quad r_e = Ee^2/m_ec^2 \quad \text{..... (i)}$$

$$Ee^2 = G_em_e^2 \quad \text{..... (ii)}$$

Equation (i) is the same as the existing equation for the classical radius of electron. However, the eqation is derived from an entirely new concept, thus justifying the assumptions behind the new concept. Equation (ii) is independent of 'r_e', and gives the relation between electrostatic and gravitational constants of electron.

$$\text{So,} \quad G_e = Ee^2/m_e^2$$
$$= [\ 8.9875 \times 10^9 \times (1.6022 \times 10^{-19})^2\ ] / (9.10938 \times 10^{-31})^2$$
$$= 2.78 \times 10^{32}\ m^3/kgs^2.$$

5. The force used inside hydrogen atom:

All higher stuctures are made up of electron-positron pairs, and so the above division of force is final, and gravity and electrostatic force act as two independent forces. Neutron[4] contains 919 electron-positron pairs. Both the forces remain completely used inside neutron. When it changes into an atom of hydrogen, one electron-positron pair splits, the positron

remains at the centre of proton, and the electron remains orbiting at a distance a_0, the Bohr radius.

Gravitational force used inside hydrogen atom = G_eMm_e/a_0

$= (\ 2.78\text{x}10^{32} \text{ x } 1.6726\text{x}10^{-27} \text{ x } 9.10938\text{x } 0^{-31}\ ) / 5.2917\text{x}10^{-11}$

$= 8\text{x}10^{-15}$ J. ..... (iii)

The electrostatic force used is Ee^2/a_0, and is is nearly 1/919 of the gravitational force and so is negligible.

6. The anti-gravity energy of electron and Bohr radius:

The energy required by electron to come out of neutron can be taken as its *anti-gravity* energy and it manifests as its speed and spin energy. It can be assumed that at the closest orbit, just outside the proton, one-third of it manifests as speed, and the rest as spin-energy – the logic behind this is that field restricts the motion of electron to one direction, perpendicular to the field. As the electron moves away from proton, the speed decreases and spin energy increases that in any orbit, the ag-energy of the electron remains the same and is balanced by attractive forces.

From the proposed structure[4] of neutron, radii of both proton and neutron is approximately $14r_e$. So the radius of the closest orbit is $15r_e$. If 'v' is the speed at that position, the relation can be given as, $mv^2 = Ee^2/15r_e$. The ag-energy of the electron, as pointed out above, is three times its kinetic energy = $3mv^2/2 = 3Ee^2/30r_e$. At Bohr radius, the sum of gravitational and electrostatic force is equal to the ag-energy, making that distance unique. The electrostatic force being negligible, the ag-energy is equal to the gravitational force.

So, $3Ee^2/30r_e = G_eMm_e/a_0$ ..... (here, $Ee^2 = G_em_e^2$)

so, $a_0 = 30Mr_e/3m_e$

$= (30 \text{ x } 1.6726 \text{ x} 10^{-27} \text{ x } 2.8179 \text{ x} 10^{-15}) / (3 \text{ x } 9.10938 \text{ x} 10^{-31})$

$= 5.174\text{x}10^{-11}$ m.

Thus using the approximate value for the radius of proton, we get the approximate value for Bohr radius, indicating that the proposed concept is correct.

7. Force available to a hydrogen atom:

The gravitational force available inside the hydrogen atom is the force of one electron-positron pair, that is, $2 \text{ x } 20.4675\text{x}10^{-15}$ J. The force used inside is $8\text{x}10^{-15}$ J (ref: eq. iii).

So force available to the atom $= 40.935\text{x}10^{-15} - 8\text{x}10^{-15}$

$= 32.935\text{x}10^{-15}$ J

Thus, out of the total force of $919 \text{ x } 40.935\text{x}10^{-15}$ J, the gravitatonal force available to a hydrgen atom is $32.935\text{x}10^{-15}$ J. That is, the force available to a hydrogen atom is,

$= 32.935\text{x}10^{-15} / 919 \text{ x } 40.935\text{x}10^{-15}$ of total force

$= 8.7548/10^4$ of the total force

8. A 'mass' of hydrogen atoms:

The hydrogen atoms bond together using electrostatic and gravitational forces forming a huge cloud of hydrogen with no centralised force. When this cloud starts moving, a force emerges towards its centre, confining the cloud into a 'mass of hydrogen'. This force also is gravity, and it depends on the speed of the 'mass'. The G for 'confining gravity' is very low, and the G for 'bonding gravity' is $(8.7548/10^4)G_e$.

The natural energy of the mass is $Mc^2/2$. Half of this remains inside the electron-positrons pairs in atoms. So the energy available to hydrogen atoms to form a mass is $Mc^2/4$ (neglecting the ag-energy of electrons). Force- energy equivalence implies that the force available will appear to be equal to this energy. Though the available electrostatic force and gravitational force are not actually equal, as far energy is considered both will appear to be equal again. The electrostatic force is completely used inside the mass, but gravity is only partly used and the mass can interact gravitationally.

In an 'ideal' mass of hydrogen, we can take that half the available gravity is used inside and the rest is available for the mass to interact, and also that the electrostatic force is completely used for attraction. Since both forces appear to be equal, half the available energy (that is, $Mc^2/8$) is balanced by electrostatic force and half by gravity. Out of the half balanced by gravity, half (that is, $Mc^2/16$) remains inside the mass and half remains as speed. So the natural speed of that mass is $c/2\sqrt{2}$.

9. The G of a mass:

The G of particles depend on mass- radius ratio. In proton, the electron-positron pairs form a closed chain using the whole force. So the force available to a proton is due to the unpaired positron at its centre. But in a 'mass', all atoms have surplus force, and force available is the net force. This structural difference makes the G of a mass independent of mass-radius ratio; the G depends on the available force and energy.

Since force and energy will appear to be equal, the G of an ideal mass of hydrogen would have been unity. But the actual constant will be unity only if the whole force was available. The available force, as obtained earlier, is $8.7548/10^4$ of the total force. So the constant is that much lower, that is $8.7548/10^4$. This is for the natural speed of the ideal mass, that is, $c/2\sqrt{2}$. So the constant for unit speed is $(8.7548/10^4) / (c/2\sqrt{2})^2 = 7.7929\text{x}10^{-20}\ m^3/kgs^2$.

Though the derived constant is for a hydrogen-mass, this is valid for all 'masses' having natural energy. The formation of other atoms changes the *availble force* and the *force required* relativly, that the same constant is valid for masses containing different elements. A mass having excess energy will have a lower G, and a mass having shortage of energy will have a higher G for unit speed.

10. The G of Earth:

Galaxy-clusters are taken as the individual units of the universe[3]. There is energy transfer between clusters, the innermost clusters having the least energy and the outermost clusters having the highest energy. Thus there is a gradation in the energy possessed and the middle region clusters have near normal energy. Earth, which supports life, a very delicate structure, cannot have extreme conditions. So we can assume that it belongs to a middle region cluster, and it possess near-natural energy. So G for unit speed is nearly the same as obtained above.The average speed of Earth is $2.978\text{x}10^4$ m/s.

$$\text{So the G of Earth} = 7.7929\text{x}10^{-20} \times (2.978\text{x}10^4)^2$$
$$= 6.911\text{x}10^{-11}\ m^3/kgs^2.$$

This is close to the expermentally deermined value of G, the so-called universal constant.

11. A mere coincidence?

The theoretically deduced value of G nearly agrees with the experimentally determined value. Is this just a chance coincidence? The deduction is model dependent. The model contains many logical assumptions regarding the distribution of energy and force in various structures. However, if the primary hypothesis that '*the fundamental particle moves at the*

speed 'c' and force is reaction to this motion' is correct, the rest of the assumptions follow naturally. That is, except for the primary assumption, the rest are not arbitrary.

Not only that, from the basic assumption, three important physical constants, not just one, have been deduced: (i). the Classical Radius of electron (ii). Bohr Radius (iii) the (so-called) Universal Gravitational constant. So the possibility of chance coincidence can be ruled out.

12. Conclusion:

In this paper, the so-called universal constant, 'G', has been theoretically deduced. This is for the first time in the history of physics that a theoretical deduction is proposed. The value nearly agrees with the measured value. The deduction, however, is model dependent. But based on the same model, the Classical Radius of electron and Bohr Radius have also been deduced, indicating that the proposed theoretical model is correct.

The argument that the so-called universal constant is actually '*the G of Earth for its present speed*' can be verfied by measuring 'G' on Moon/Mars. It can also be verified by analyzing the variations in the measured value of G with respect to the time of the year it is measured; if my argument is correct, there would be a strong correlation between the two.

Moreover, by deducing the gravitational constant from the electrostic constant, the proposal that both are are manifestations of the same fundamental force remains validated. Thus the proposed model unifies[5] gravity and electrostatic force, and thus solves the long-standing problem in physics.

Reference:

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