An Equation for G

Abstract

The comparative results of the graviton equation to Newton's gravity equation show that the force curves and gravitational acceleration curves are similar but different. In an attempt to understand how they could be similar, a special case is developed that explains how this was possible. In the process, an equation for the gravitation constant G was developed. These calculations from the graviton equation have shown that G in fact may be a curve and not a constant. However, in extreme cases, the equation for G is may be either invalid or not needed at all. But it may also help determine if the graviton is the cause of gravity.

Contents

Equations

Newton's Law of Universal Gravitation

Newtons law states: *Every particle of matter in the universe attracts every other particle. The magnitude of the force of attraction between two particles is proportional to the product of the two masses of the particles and inversely proportional to the square of the distance between them; the gravitational forces between two particles act along the line joining the two particles.*

This law is stated as a proportionality and must have another factor to generate an equation. The gravitation constant G is used and the value of G is measured using an experiment by designed by Cavendish.

The Newtonian equation for Force is:

(1) $$F_m = G\frac{M_e M_m}{R^2}$$

The value of G as stated in the referenced physics book is 6.67(+/- 0.005)E-11 Nt m^2 / Kg^2. It is presummed to be a constant since there are no other variables in Newtons law to account for the force.

The Graviton Equation

In the document titled "The Graviton Equations", equation 9 is a basic version of the graviton equation. It is restated here as equation 2.

$$F_m = \sum_{p=0}^{179} \sum_{a=0.5}^{359.5} N_g(1 - Z_e Ab_c D_e)\sin(a)\cos(|90 - p|)(Z_m Ab_c D_m F_g) \qquad (2)$$

Unfortunately, equation 1 and 2 do not look anything alike, but they yield force curves that are very similar. It becomes clear how this could be when a specific case of the graviton equation is considered.

Special Case Using Graviton Pairs

Equation 2 can be re-written using pairs of gravitons. A simple way to explain what will happen is to look at Figure 1.

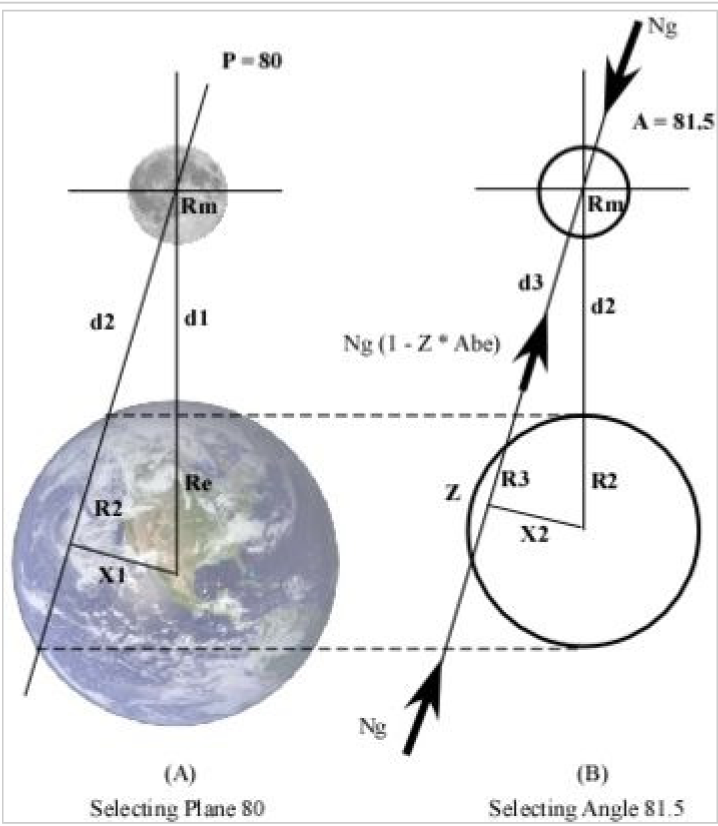

Figure 1 - Selecting the Plane and the Angle

This is the special case of the earth and the moon are both sphereical objects. In section B of Figure 1, gravitons coming form above are not absorbed by anything. So the number of gravitons per path remains Ng. Its matching pair, coming from below, is absorbed by the earth and has a reduction shown by Ng(1-Ze*Abe).

The graviton from above causes a positive force toward the earth while the graviton from below causes a negative force away from the earth. When they are added together the number of gravitons imposed on the moon is:

$$(3) \qquad N_{gi} = N_g - N_g(1 - Z_e Ab_c D_e) = N_g Z_e Ab_c D_e$$

By adding the pair of gravitons together a more simple term is obtained. However the number of angles in the plane must be reduced in half giving the following equation for force.

$$(4) \qquad F_m = \sum_{p=0}^{179} \sum_{a=0.5}^{179.5} N_g Z_e Ab_c D_e \sin(a) \cos(|90 - p|)(Z_m Ab_c D_m F_g)$$

Note that the range of values for the angle a is only 180 not 360.

Density

Equation 4 includes the density of the earth and the moon. Since density is mass divided by volume, the product of the two densities can be writtens as:

$$(5) \qquad D_e * D_m = \left[\frac{1}{(\frac{4}{3}\pi)^2}\right] \left[\frac{M_e M_m}{R_e^3 R_m^3}\right]$$

Noting the product of the two masses gives the first clue that there may be a similarity between the Newtonian equation and the graviton equation. Could it be possible to evolve the graviton equation to the be the same as Newton's?

Re-writing Equation 4

Equation 5 can be substituted into equation 4.

$$(6) \qquad F_m = \sum_{p=0}^{179} \sum_{a=0.5}^{179.5} N_g F_g Ab_c^2 \sin(a) \cos(|90 - p|) \left[\frac{Z_e Z_m}{(\frac{4}{3}\pi)^2}\right] \left[\frac{M_e M_m}{R_e^3 R_m^3}\right]$$

There are terms in the equation which are not affected by the double summation. The main terms that are affected by the double summation are: Ze, sin(a), and cos(|90-p|). Others may also be affected but at this time they will be considered constants for this configuration. So equaiton 6 can be re-written.

$$(7) \qquad F_m = \left[\frac{N_g F_g Ab_c^2 Z_m}{(\frac{4}{3}\pi)^2 R_e^3 R_m^3}\right] \left[\sum_{p=0}^{179} \sum_{a=0.5}^{179.5} Z_e \sin(a) \cos(|90 - p|)\right] M_e M_m$$

What is interesting is that the terms on the right have the product of the mass of the earth and the mass of the moon, but 1/R^2 is not explicitly there. No matter how the terms are used, modified, or manipulated, the term of d1 will never appear. To get this equation to match Newton's equation requires a forced change.

Multiplying by One

Figure 1 clearly shows that the distance between the center of gravity of the earth and moon is equal to (Rm + d1 + Re). This is the same as R in Newtons equation.

If equation 7 is multiplied by one, the value is not changed. In this case the following expression has a value of one.

$$(8) \quad \frac{(R_m + d1 + R_e)^2}{(R_m + d1 + R_e)^2} = 1$$

Now add this to equation 7.

$$(9) \quad F_m = \left[\frac{N_g F_g A b_c^2 Z_m (R_m + d1 + R_e)^2}{(\frac{4}{3}\pi)^2 R_e^3 R_m^3}\right] \left[\sum_{p=0}^{179} \sum_{a=0.5}^{179.5} Z_e \sin(a) \cos(|90 - p|)\right] \frac{}{(R_m}$$

Equation 8 is added to 9 by placing the numerator on the left and demominator on the right.

Equation 9 is in the exact form of Newtons equation. True, the value of 1/R^2 has been forced into the equation, but multiplying by 1 does not change the value of the calculation.

And so the two terms in the brackets are a possible equation for G.

$$(10) \quad G = \left[\frac{N_g F_g A b_c^2 Z_m (R_m + d1 + R_e)^2}{(\frac{4}{3}\pi)^2 R_e^3 R_m^3}\right] \left[\sum_{p=0}^{179} \sum_{a=0.5}^{179.5} Z_e \sin(a) \cos(|90 - p|)\right]$$

What are the units of G?

The key terms in equation 10 are

$$(11) \quad G = \frac{F_g A b_c^2 Z_m (R_m + d1 + R_e)^2 Z_e}{(R_e^3 R_m^3)}$$

$$(12) \quad UnitsofG = \frac{N_t (m^2/Kg)^2 m (m^2) m}{(m^6)} = \frac{N_t (m^8)}{Kg^2 (m^6)} = \frac{N_t (m^2)}{Kg^2}$$

These units are the exact units stated in every physics book.

The Calculated Values for G

Figure 2 plots the calculated values for G against the range of G given in text books.

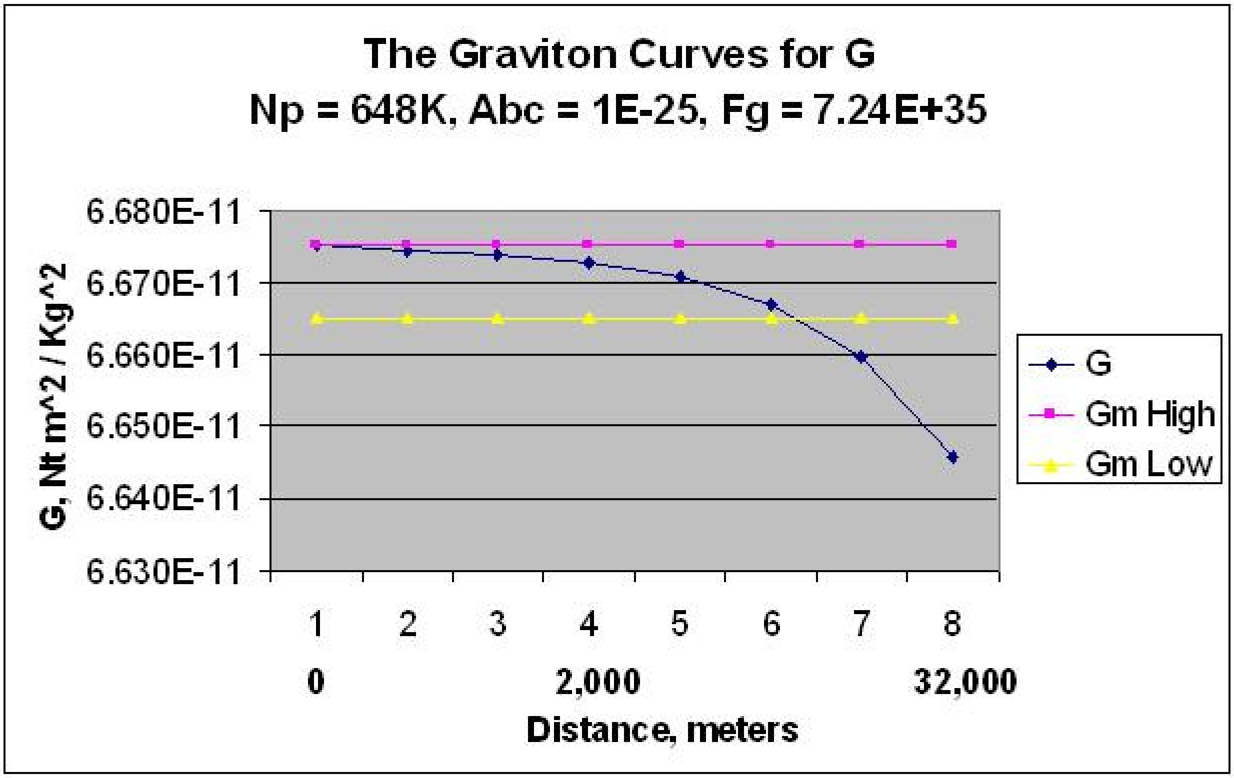

Figure 1 - Calculated Values for G

It is clear that the equation is not a constant. However there are two terms in the equation that work against each other. As d1 increases, the square of the distance increases while the double summation decreases. So what happens as d1 increase to a larger value.

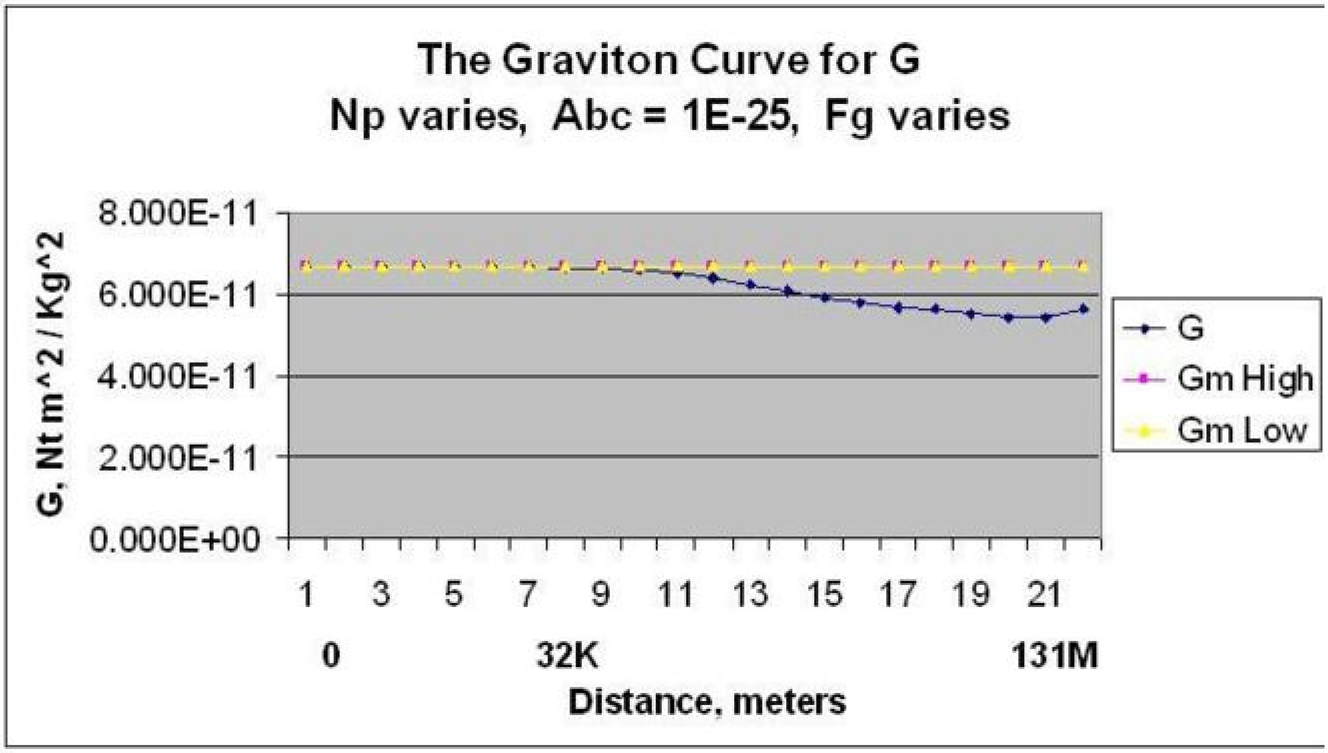

Figure 2 - Calculated Values for G Extended

It is interesting, that in order to get the true form of Newton's equation, required that the value of 1/R^2 to be forced into the graviton equation. But at the same time, the term that was forced causes the value of G to level out as d1 increases.

Thoughts on the Equation for G

A Tough Question

One of the questions that could be asked is: "How can the constant G change with distance?" The answer is that no constant, if it is truely constant, can vary with any other parameter. So the question is impossible to answer. But there is a way to understand the equation for G.

Both force equations are mathematical models which attempt to calculate the force between two objects. The equation for G defines the difference between the force calculated by Newton and the force calculated by the graviton equation. Whether G is a constant or changes for different situations can only be settled by performing tests and therefore coming to a better understanding of gravity.

Two Extreme Cases

If the quantum equation for gravity proves more accurate, then the value for G as used in Newton's equation may need to be adjusted. Since the graviton equation is difficult to use, Newton's equation could be used by selecting the value of G from Figure 2 to adjust Netwon's equation.

If this particular gravity quanta theory is proved wrong, then all the graviton equations are wrong, including G. But knowing where it is wrong may help identify changes that are needed. It is possible that the absorption rate is not linear with distance and may be dependent on temperature.

If the Double Summation were equal to 1/R^2

If this were true then the two terms cancel out. Equation 10 above reduces to equation 13 shown below

$$(13) \quad G = \left[\frac{N_g F_g A b_c^2 Z_m}{(\frac{4}{3}\pi)^2 R_e^3 R_m^3} \right]$$

This is still an equation for G. It has a constant value, but the units are wrong, and that makes equation 13 wrong. So the double summation is not equal to 1/R^2.

Derive 1/R^2?

Since the curves are so similar may the double summation could evolve to a series that had 1/R^2 as the main component.

Conclusion

Having made a special case of the graviton or gravity quantum equation allows for the comparison with Newton's equation. The equations are the same except that Newton's equation uses a constant called G and the graviton equation includes a physical/mathematical expression for G. What makes the curves so similar is the mathematical value of the double summation and 1/R^2.

References

1. Gravity Experiment NPA Presentation, by Robert de Hilster, David de Hilster, and Geoff Hunter. Preneted at the NPA conference in May of 2007.

2. The Graviton Equations, by Robert de Hilster, presented at NPA 2008.

3. The Graviton Experiment, by Robert de Hilster, presented at NPA 2008.