

The Graviton Equations

Abstract

This paper proposes that there is a particle called a graviton that acts to cause a pushing force on a mass and hence is the mechanism for gravity. Isaac Newton's Law of Universal Gravitation has no mechanism. However Newton did propose that gravity could be caused by a particle which he called the fluxion. Einstein proposed that gravity was caused by the bending of space-time. His theory is not covered in this document. Equations have been developed for the graviton that attempts to calculate the force of gravity between two objects.

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Postulates for Gravity based on the Graviton

1. **Postulate 1 – The Graviton:** A particle, with mass and velocity, that imposes itself on an object from all directions. The source of the graviton is not known.
2. **Postulate 2 – Absorption rate:** As the graviton passes through an object, a small number of them are absorbed and the rest pass through. The absorption rate is the percent of gravitons absorbed per distance traveled through the object. Initially the absorption rate is assumed to be linear.
3. **Postulate 3 – Pushing force:** When the graviton is absorbed, and having mass and velocity, it imparts a

pushing force on the object causing it to move in the direction that the graviton is moving.

4. **Postulate 4 – Absorption Constant:** The absorption rate is proportional to the density of the object it passes through. Hence the absorption rate is equal to the Absorption constant (Ab_e) times the density of the object.

The Force of Gravity

If the the moon was an isolated object, and gravitons came at the moon from all directions, then there is no net force on the moon.

But when the earth is present, some of the gravitons that pass through the earth are absorbed. There are fewer of them that reach the moon from the earth. So there are more gravitons pushing the moon toward the earth than there are gravitons pushing it away from the earth. The net force on the moon is the force of gravity.

The Equation

The Number of Gravitons

The number of gravitons going toward the center of gravity of the moon is expected to be extremely high. This is true because gravity acts instantaneously on any object. But it is difficult to deal with a very high number, so a reasonably high but finite number is chosen for the calculations. Typically the calculations are done using 64,800 paths, one graviton per path. The 64,800 comes form using 180 planes and 360 paths per plane. A different number of paths can be used if the situation requires it.

In the graviton equation, the number of gravitons per path is labeled as ‘ N_g ’ and has a value of one graviton per unit of time. It is assumed that the unit of time can be selected such that there is only one graviton per path. The total number of gravitons used in the calculation is number of paths N_p times N_g .

The Number of Gravitons Absorbed by the Earth

As the graviton passes through the earth, they are reduced by a small percentage. The number absorbed is equal to the distance traveled though the earth times the absorption rate. The number absorbed is:

$$(1) \quad N_a = N_g Z_e A b_e$$

where: Z_e is the distance traveled through the earth

$A b_e$ is the absorption rate per unit distance of the earth

The Number of Gravitons Passing though the Earth

The number of gravitons passing through the earth and reaching the moon is:

$$(2) \quad N_{pe} = N_g (1 - Z_e A b_e)$$

If the graviton does not go through the earth, Z_e is set to zero.

The Number of Gravitons Imposed on the Moon

The number of gravitons imposed (N_{gi}) is the sum of all the gravitons going toward the center of gravity of the moon. In a single plane, the equation is:

$$(3) \quad N_{gi} = \sum_{a=0.5}^{359.5} N_g(1 - Z_e Ab_e) \sin(a)$$

Where: 'a' is the angle of the path. The sine function is used since it is the vertical component of gravity that is needed.

For a three dimensional calculation a second summation is added by selecting 180 planes.

$$(4) \quad N_{gi} = \sum_{p=0}^{179} \sum_{a=0.5}^{359.5} N_g(1 - Z_e Ab_e) \sin(a) \cos(|90 - p|)$$

The cosine is used to correct for the angle of the plane relative to vertical.

The Force of the Graviton on the Moon

The force of the graviton on the moon is proportional to N_{gi} times the absorption rate of the moon times the force that each graviton can impose on the moon. The equation for the force is:

$$(6) \quad F_m = N_{gi}(Z_m Ab_m F_g)$$

F_m is the force in Newtons on the moon.

Z_m is the distance the graviton passes through the moon.

Ab_m is the absorption rate of the moon.

F_g is the force in Newtons that each graviton imposes on the moon.

The equation for the force on the moon is:

$$(7) \quad F_m = \sum_{p=0}^{179} \sum_{a=0.5}^{359.5} N_g(1 - Z_e Ab_e) \sin(a) \cos(|90 - p|)(Z_m Ab_m F_g)$$

The Absorption Constant

The 4th postulate states that the absorption rate of an object is proportional to its density. This leads to the equation:

$$(8) \quad Ab_e = Ab_c D_e$$

Abe is the absorption rate of the earth.

Abc is the absorption constant, different but similar to G, the gravitational constant.

De is the density of the earth.

The value of Abc is not known, but is assumed to apply to all objects such as the moon, a lead ball, or a bag of feathers. When equation 8 is applied to equation 7, the force on the moon becomes:

$$(9) \quad F_m = \sum_{p=0}^{179} \sum_{a=0.5}^{359.5} N_g (1 - Z_e A b_c D_e) \sin(a) \cos(|90 - p|) (Z_m A b_c D_m F_g)$$

The absorption constant needs to have units that makes the term $(1 - Z_e * A b_c * D_e)$ dimensionless.

This is true when Abc has units of m^2 / Kg .

A Basic Equation

Equation 9 has been developed using the earth and moon as the defining configuration. As this equation was applied to different configurations, it seems clear that equation 9 is a basic equation that can be modified to fit any other configuration. In this sense equation 9 becomes a basic building block for other calculations.

For example:

The term $\sin(a)$ calculates the vertical force. If the horizontal force is desired, then $\cos(a)$ is used.

Different materials bring in different densities.

The value of Z is different for different configurations.

Particle or Continuum

It could be asked if gravity is a particle or a continuum. As a particle, it can have mass and velocity. As such it has momentum and can impart a force on an object. The double summation of the graviton equation supports the particle nature of gravity since it selects a finite number of paths.

Newton's equation appears to use a continuum since there is no terms requiring a particle theory. As a continuum, a means to impart a force would have to be established. The graviton equation could become a continuum if the double summation was change to a double integral, but it would have to account for the discontinuities of the physical configuration.

Calculations of the Force on the Moon

The following data was used to calculate the force that gravitons impose on the moon.

Data for the Moon

Mass: 7.475E+22 Kg, Radius: 1738 Km, Distance: 384,400 Km

Data for the Earth

Mass: $5.98E+24$ Kg, Radius: $6.3677E+6$ Km

Graviton Values

The values for the graviton are not known, but the following assumptions are used in order to do the calculations:

Number of planes: 180, Number of angles in the plane: 360

This gives 64,800 paths.

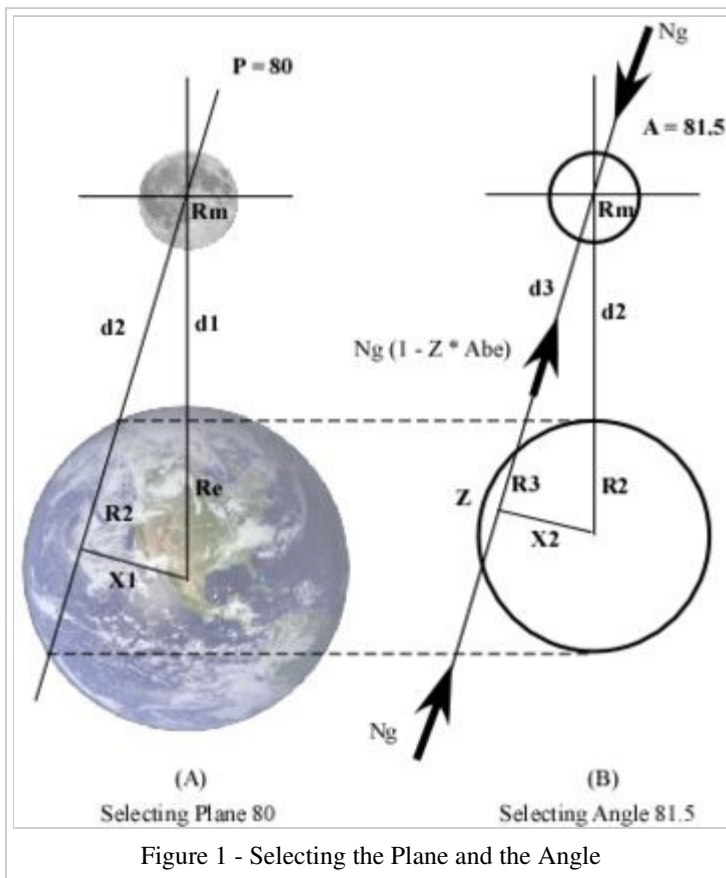
Number of gravitons per path per unit of time: 1

Absorption Constant: $1E-25$ (this is an arbitrary number, but it is used as a base for other calculations)

F_g is calculated to force the magnitude to match Newton or actual data.

Configuration

Figure 1 is the basic configuration used to do the calculations.



The section titled "Calculating Z" provides the supporting equations to calculate Z.

The Force Curves for the Moon

To generate the force curves, the moon is placed at different distances from the earth. Starting with 384,400 Km, distances were reduced by half and were doubled as follows:

24025, 48050, 96100, 192200, 384400, 768800, 1537600, 3075200 Km

These values corresponds to points 1 through 8 on the force curve. These distances are not realistic except for point 5. All 8 are used so that the curves can be compared.

Based on these values, the force curves are generated for the graviton equation and for Newton's equation.

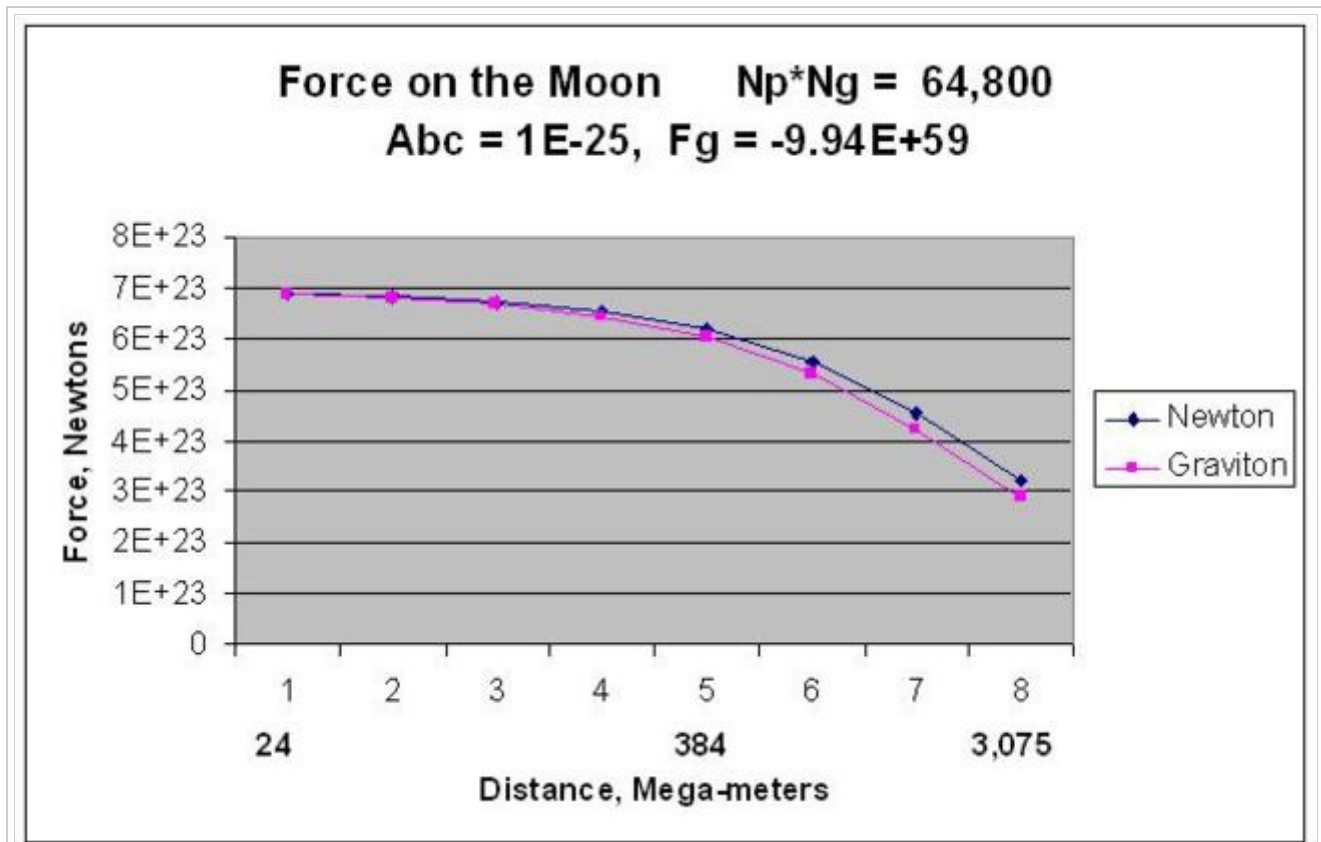
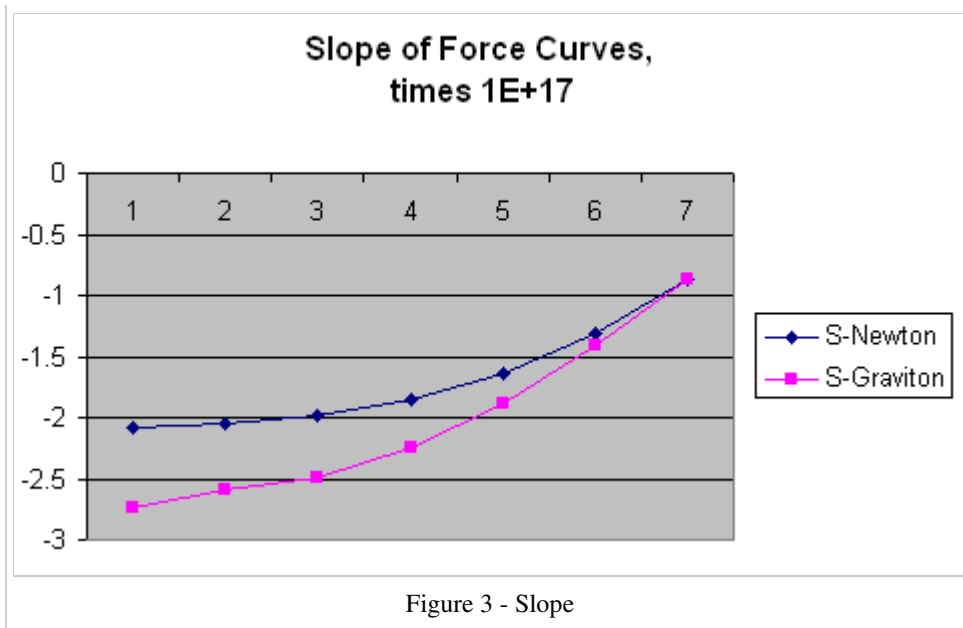


Figure 2 - Moon Force Curves

The values of 64,800 and 1E-25 are arbitrary values. Fg has been set to 9.94E+59 so that point one of the graviton force curve matches the Newtonian value. Since the magnitude has been forced, the only comparison to be made is in the shape of the curve.

To show how close the shape of the curves are, the slope of the curves have calculated.



The slope is 31% high for the short distances and gets closer at long distances. The differences may seem large, but the values have been multiplied by 10¹⁷.

Gravitational Acceleration

An equation for g

In the Physics book, "The Elements of Physics", values for the gravitational acceleration is shown. The values are:

Altitude(m)	g(m/sec ²)
0	9.80171
500	9.80017
1000	9.79864
2000	9.79554
4000	9.78937
8000	9.77702
16000	9.75233
32000	9.70296

“Quote: “values given are the accurate values of g ...at 40 degree latitude and for various altitudes. Even these are only mean values...” This is interpreted to mean that these values are measured data, not calculated data.

If these are true values then they can be compared to the values using the graviton equation. Equation 9 can be modified by placing a lead ball at the specific altitudes. The force on the lead ball is:

$$(10) \quad F_{Pb} = \sum_{p=0}^{179} \sum_{a=0.5}^{359.5} N_g (1 - Z_e A b_c D_e) \sin(a) \cos(|90 - p|) (Z_{Pb} A b_c D_{Pb} F_g)$$

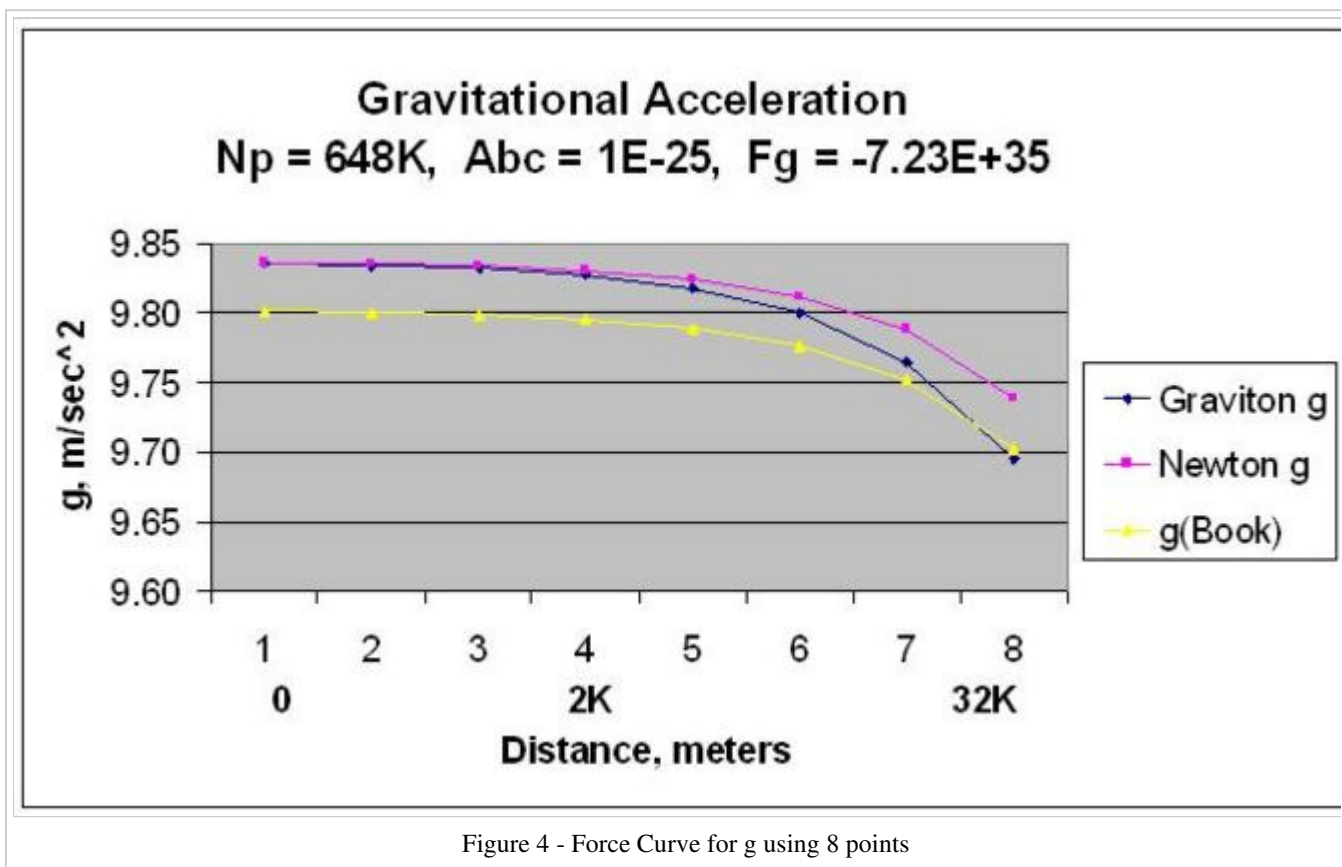
The term P_b is used for the lead ball in place of m for the moon. Gravitational acceleration is then obtained by dividing by the mass of the lead ball.

$$(11) \quad g = F_{P_b} / M_{P_b}$$

Force Curves for g

Using 8 Data Points

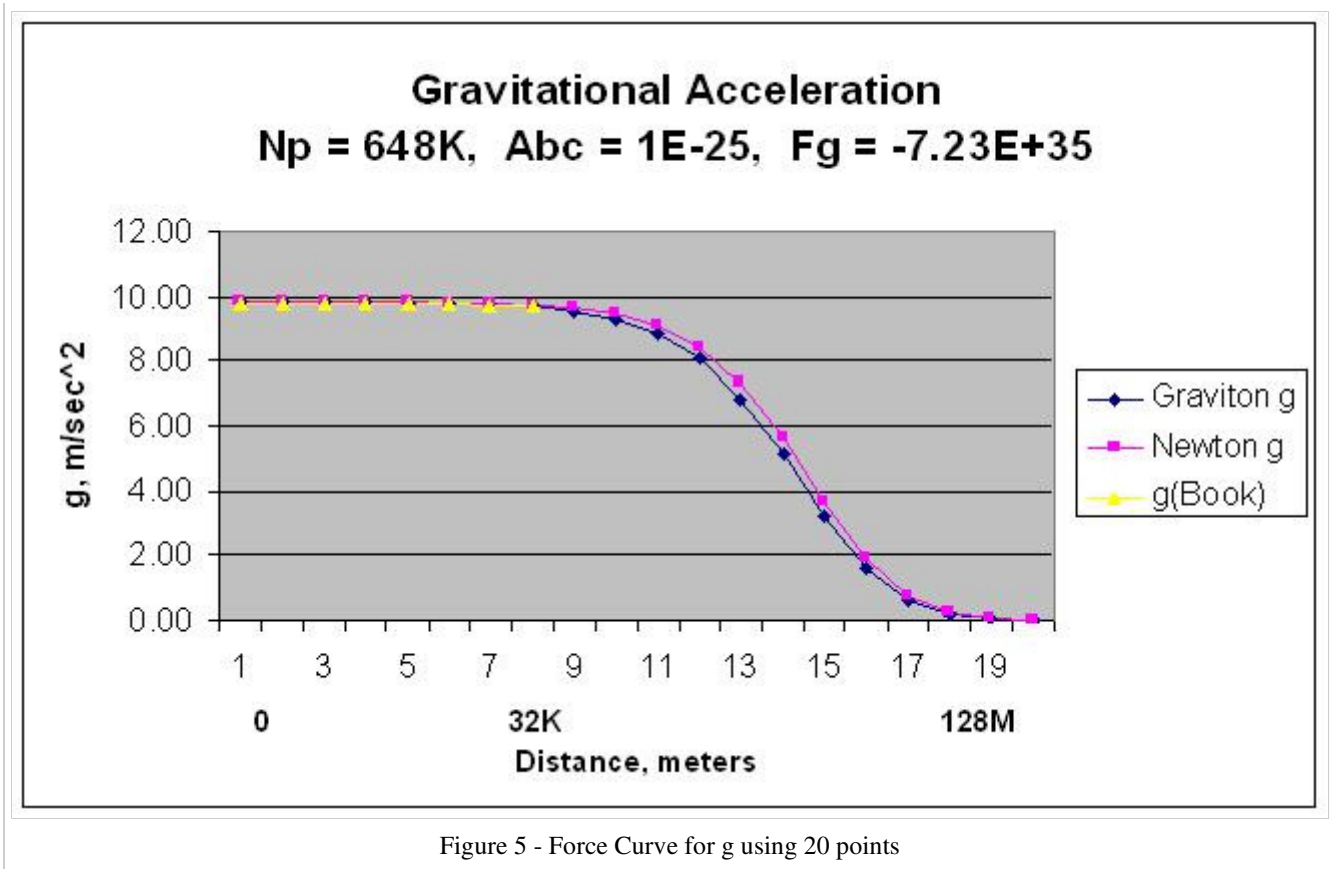
With these 8 data points and the calculated value of g , a comparison can be made of the force curves. The values for N_p , A_{bc} , and F_g are shown on the chart.



The altitude of point 1 is zero meters and point 8 is 32Km. The value of the graviton g at point 1 is forced to match Newton g by setting F_g to $7.23E+35$. Note that the shape of Newton g and g (measured) is the same but the values are different. Since F_g is forced, the value of the graviton g is invalid. Further, the slope of the graviton curve is greater than the measured values.

Using 20 Data Points

Using 20 data points gives a different picture of the force curves. Twenty points are calculated up to a value of 131,072,000 meters or 81,444.2 miles.



The first 8 points are the same as Figure 4. These curves show that the curves are similar, but different.

How?

How can the curves be so similar when the equations are different? The document titled "An Equation for G", attempts to answer this question.

More Gravitons, More Equations

The Center of Gravity of the Earth

Equation 9 only calculates the force on the center of gravity of the moon. But what about the center of gravity of the earth? There is another set of gravitons that are directed to the center of gravity of the earth that is totally different from the ones directed to the moon. A second term can be added to the equation.

$$(12) \quad F_e = \sum_{p=0}^{179} \sum_{a=0.5}^{359.5} N_g (1 - Z_m Ab_c D_m) \sin(a) \cos(|90 - p|) (Z_e Ab_c D_e F_g)$$

This equation is identical to equation 9, but the terms for the earth and the moon are switched. If this force is to be taken into consideration, the the force of equation 9 and 12 must be added together.

This process could go on for every point in the earth and the moon. This is more difficult to program and is time

consuming to calculate. However when you look at Figure 5, where only one point in the moon is used, the results are still remarkable.

Where There is Absorption, There is Force

While calculating the force on the center of gravity of the moon, there are gravitons being absorbed by the earth. Those gravitons cause a force on the earth. In this case the gravitons that come through the moon are reduced so that the net force on the earth is to push it towards the moon. For the same pair of gravitons there is force on the moon and the earth, causing the moon and the earth to move toward each other. This part of the calculation needs to be done to see if it has a different contribution to the force curves.

How many points? How many Equations?

There are so many points to consider, that it would be difficult to calculate a force curve using all of them. But when only one point is considered, the results are amazing.

Calculating Z

As equation 9 indicates the plane is selected first. Figure 1, repeated here as Figure 6, shows the earth and the moon. Section (A) on the left is a three dimensional picture of plane #80 cutting through the center of gravity of the moon. Plane #80 is the a plane that is 80 degrees from horizontal. Section (B) shows plane #80 and selects angle 81.5 for the path of the graviton.

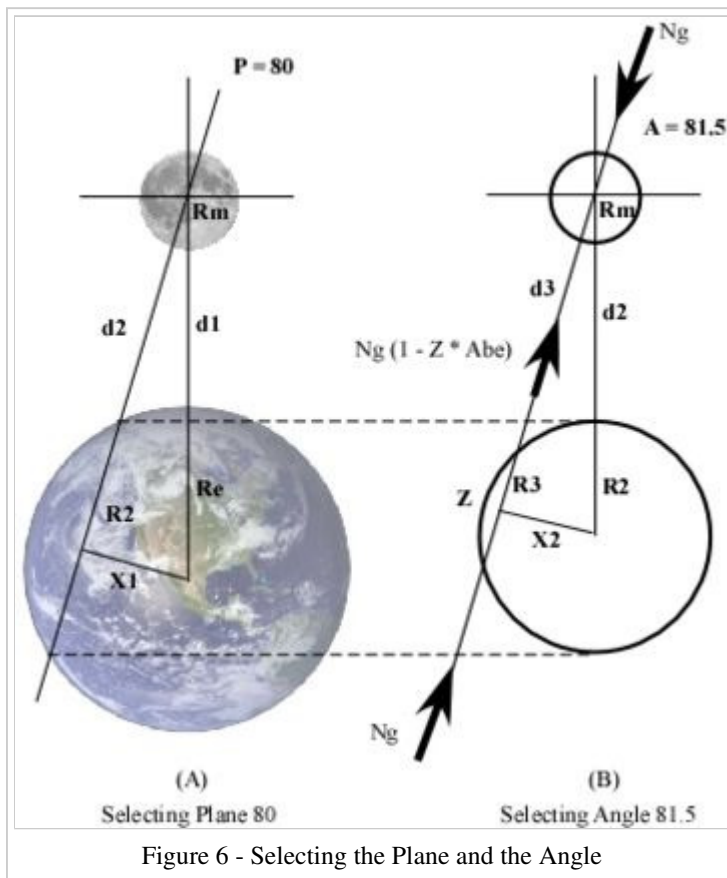


Figure 6 - Selecting the Plane and the Angle

Section A

The surface of the moon and earth are separated by the distance d_1 . But when plane #80 cuts through the earth, the distance to the plane is d_2 . The equations are:

$$(13) \quad P_2 = |90 - P|$$

$$(14) \quad X_1 = (R_m + d_1 + R_e)\sin(P_2)$$

$$(15) \quad d_2 = (R_m + d_1 + R_e)\cos(P_2) - (R_m + R_2)$$

$$(16) \quad R_2 = \sqrt{R_e^2 - X_1^2}$$

Section B

On the right side of Figure 6 is Section B. It shows the plane using the values calculated above. The angles start at 0.5 and have 1 degree steps. For any angle, the equations are:

$$(17) \quad X_2 = (R_m + d_2 + R_2)\sin(a)$$

$$(18) \quad R_3 = \sqrt{R_2^2 - X_2^2}$$

$$(19) \quad Z_e = 2R_3$$

$$(20) \quad d_3 = (R_m + d_2 + R_2)\cos(a) - (R_m + R_3)$$

Remember: Angles that do not go through the earth use $Z_e = 0$

Conclusions

What is the true mechanism for gravity? The Newtonian equations calculate the force but gives no mechanism. Einstein's theory of General Relativity suggests that gravity is caused by bending space-time. The graviton equation proposes a mechanism but it has not yet been proved.

The equations are not gravity. They only attempt to calculate the force between two objects. The apple dropping on Newton is an example of gravity. Gravity does it's own thing and ignores any equation.

Because the results of the these calculations are very interesting, the idea that the graviton could be the true cause of gravity should be investigated. Projections should be made, tests conducted, and results compared. During this process it may be necessary to modify the postulates, adjust the equations, and start over.

In any case, some test must be done to see which equation gives the best results. A separate paper titled "The Graviton Experiment" describes one possible test. There may be others.

In the end, if the theory of gravity as a particle proves false it will fade away. If it proves true, it would be an exciting day for physics.

If you have another theory, go for it. But make your projections and conduct the tests. Theory without experimentation, is just talk.

References

1. Elements of Physics by Shortley and Willams, Second Edition, copyright 1953 and 1955
2. Gravity Experiment NPA Presentation, by Robert de Hilster, David de Hilster, and Geoff Hunter. Presented at the NPA conference in May of 2007.
3. An Equation for G, by Robert de Hilster, presented at NPA 2008.
4. The Graviton Experiment, by Robert de Hilster, presented at NPA 2008.