QUANTUM NEWTONIAN GRAVITY – WORKING MODEL

(Gravitation by Radiation)

Leonard J. Malinowski
LJMalinowski@gmail.com

MARCH 21, 2019
PUBLISHED BY SCALATIVITY LLC
Scalativity.com

Abstract

A quantum theory of the gravitational field remains a desired goal for theoretical physics. This effort follows a simple, visual approach. A working model depicting universal gravitation between masses using lines of force, combined with universal absorption and emission of electromagnetic radiation between masses, is presented. Blackbody radiation, self-gravitation energy, standing waves, and geometry are used to explain gravitation between two masses. The gravitational field is patterned with photon strings of electromagnetic radiation and equations are developed therefrom that reproduce forces calculated by the Newtonian gravity equation. The physical equivalence of inertial mass and gravitational mass is apparent with this model as is the need for gravitational energy to propagate between masses at the speed of light.

Key words: Quantum gravity, radiation, gravitons

1. Introduction

Gravitation describes the observation that all material objects in the universe appear to attract each other. General Relativity has successfully attributed gravitational attraction to the curvature of space-time for over a century. A quantum description of gravity that includes the exchange of particles would harmonize the four fundamental interactions. Claus Kiefer discusses many current approaches to this end in his text, Quantum Gravity [1]. This article takes a simplistic approach, using pre-General Relativity physics.

It is well established that matter continuously absorbs radiation impinging upon it that was emitted from distant masses, as well as continuously emits radiation from its surface, that subsequently travels to distant masses. Physics at the end of the 19th century included the theoretical and experimental study of the spectral energy distribution from a black body – an object that is a perfect emitter and absorber of radiation. Max Planck punctuated this work by his discovery and derivation of an equation, requiring the introduction of energy quanta, which reproduced experimental data. It was determined that radiation density inside an enclosure is independent of the composition of the walls of the enclosure. Radiation density depends on the enclosure's temperature.

Matter is mostly empty space. A sphere (to simplify geometry) of matter is considered in this article to be an enclosure.

2. Gravitation energy density equated to radiation energy density

Let the self-gravitational potential energy (J) of an object be determined by:

$$U = -\frac{GM^2}{R} \tag{1}$$

$$G = 6.674 \times 10^{-11} \frac{Nm^2}{kg^2}$$

where G is the gravitation constant, M is the mass (kg), and R is the radius (m). The gravitational potential energy per volume (energy density U/V) for each object is equated to radiation energy density (aT^4) to determine a temperature (T) multiplied by the square root of imaginary number, $\sqrt{i}$.

A complex number, z = a + bi, can be thought of as a two-dimensional vector with components (a, b). The absolute value of z is always a nonnegative, real number, and is the length of vector (a, b) in the complex plane:

$$|z| = (a^2 + b^2)^{\frac{1}{2}} \tag{2}$$

The square root of i is a complex number with both positive, 0.5√2 + 0.5√2i, and negative, − 0.5√2 − 0.5√2i, roots. The vector (±0.5√2, ±0.5√2) has length 1 in the complex plane. The radiation applies to photons of gravity, but are not ready to be called gravitons. As proposed in Section 4, it takes two gravity photons (γ) traveling in opposite directions to make one virtual graviton (G).

$$\frac{U}{V} = aT^4 \tag{3}$$

$$a = \frac{\frac{8\pi^5}{15}k^4}{(hc)^3} = 7.565756 \times 10^{-16} \frac{J}{m^3K^4}$$

where k is the Boltzmann constant 1.38065 × 10^{-23} J/K, h is the Planck constant 6.62607 × 10^{-34} Js, and c is the speed of light in vacuum 299,792,458 m/s. Throughout this discussion the number of significant figures is limited by the gravitation constant, and rounding is withheld until the final value is listed. Solving Equation 3 for the gravitation temperature T (K) and grouping constants into g_a:

$$T = g_a \left(\frac{M^{\frac{1}{2}}}{R}\right) i^{\frac{1}{2}} \tag{4}$$

$$g_a = \left(\frac{3G}{4\pi a}\right)^{\frac{1}{4}} = 12.047 \frac{mK}{kg^{\frac{1}{2}}}$$

Continuing to repurpose historical blackbody radiation equations, this temperature is used to calculate the number N, of gravity photons emitted from each object's surface per second per square meter, and the average gravity photon: energy $\langle E\rangle_\gamma$, period $\langle t\rangle_\gamma$, and wavelength $\langle\lambda\rangle_\gamma$.

$$N = AT^3 = 2.6580 \times 10^{18} \frac{\gamma m}{skg^{\frac{3}{2}}} \left(\frac{M^{\frac{3}{2}}}{R^3}\right) i^{\frac{3}{2}} \tag{5}$$

$$A = \frac{4\pi\zeta(3)k^3}{c^2h^3} = 1.52046 \times 10^{15} \frac{\gamma}{sm^2K^3}$$

where ζ(3) is Apéry's constant ≈ 1.202057, and $i^{3/2} = 0.5\sqrt{2}(-1 + i)$.

$$\langle E\rangle_\gamma = BT = \left(4.4926 \times 10^{-22} \frac{Jm}{kg^{\frac{1}{2}}}\right) \left(\frac{M^{\frac{1}{2}}}{R}\right) i^{\frac{1}{2}} \tag{6}$$

$$B = \frac{\pi^4 k}{30\zeta(3)} = 3.72938 \times 10^{-23} \frac{J}{K}$$

$$\langle t\rangle_\gamma = \frac{h}{\langle E\rangle_\gamma} = \left(1.4749 \times 10^{-12} \frac{skg^{\frac{1}{2}}}{m}\right) \left(\frac{R}{M^{\frac{1}{2}}}\right) i^{-\frac{1}{2}} \tag{7}$$

$$\langle\lambda\rangle_\gamma = \langle t\rangle_\gamma c = \left(4.4216 \times 10^{-4}\, kg^{\frac{1}{2}}\right)\left(\frac{R}{M^{\frac{1}{2}}}\right) i^{-\frac{1}{2}} \tag{8}$$

3. Gravitational field lines of force

The gravitational flux Φg counts the number (#)*i* of gravitational field lines entering into and leaving from an object's surface. The number of gravity photons N, emitted from an object's surface per second per square meter, times its surface area $4\pi R^2$, times its average gravity photon period $<t>_\gamma$, provides the flux:

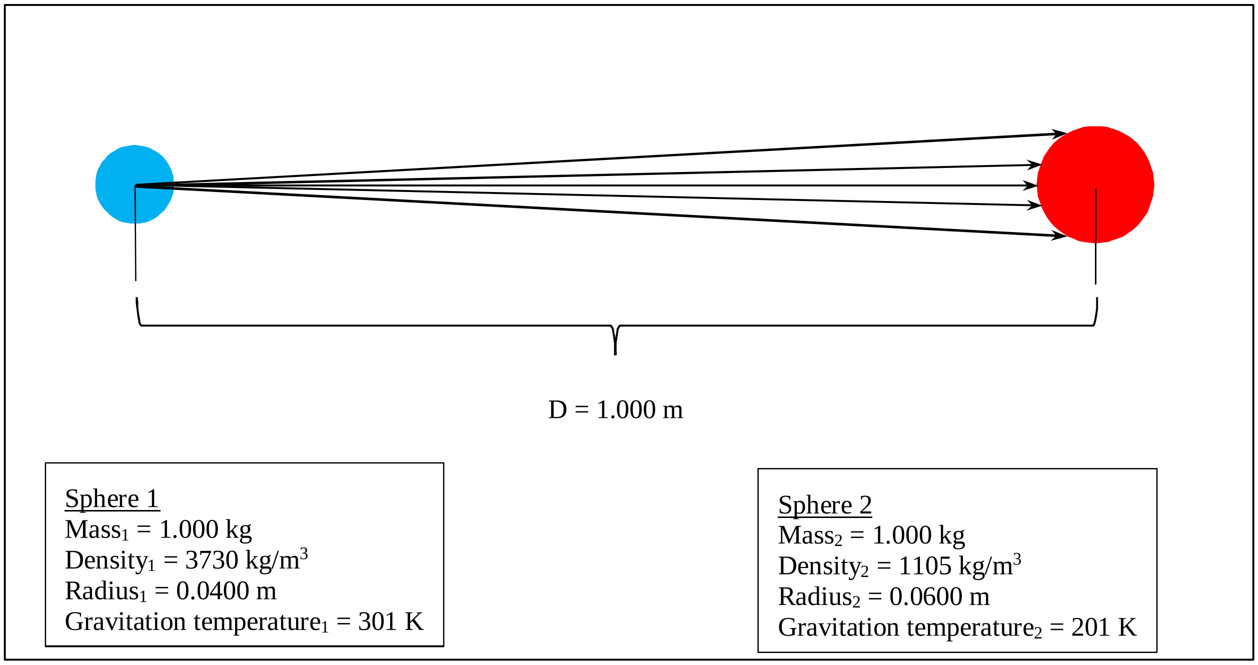
$$\Phi_g = N4\pi R^2\langle t\rangle_\gamma = \left(4.9264 \times 10^7 \frac{lines}{kg}\right) Mi \tag{9}$$

Notice the gravitational flux is proportional to the objects' mass alone. The number of gravitational (g) field lines leaving the first object and intersecting the second object is determined using the distance D between the center of mass of the two objects, and the cross-section πR^2 of the second object (Figure 1):

$$\Phi_{g1}@M_2 = \frac{(\Phi_{g1})(\pi {R_2}^2)}{(4\pi D^2)} = \Phi_{g1}\left(\frac{R_2}{2D}\right)^2 \tag{10}$$

where $\Phi_{g1}@M_2$ is the gravitational flux emitted from the first object that geometrically intersects the second object, and R_2 is the radius of the second object.

Figure 1 Gravity photon field lines from sphere 1 that intersect sphere 2



Caption: Figure 1 is a two dimension slice of Sphere 1 gravitational field lines that originate in the center of Sphere 1 and intersect the cross section of Sphere 2. The gravitation temperature is calculated with Equation 4.

The number of g-field lines leaving the second object and intersecting the first object is determined similarly:

$$\Phi_{g2}@M_1 = \frac{(\Phi_{g2})(\pi {R_1}^2)}{(4\pi D^2)} = \Phi_{g2}\left(\frac{R_1}{2D}\right)^2 \tag{11}$$

where $\Phi_{g2}@M_1$ is the gravitational flux emitted from the second object that geometrically intersects the first object, and R_1 is the radius of the first object.

String tension physics is applied to photonic standing wave tension. Consider a horizontal taunt string of length L fixed at both ends. Plucking the string near one end by a vertical displacement transmits a pulse at velocity v along the string to the other fixed end. The tension force F_T in the string is related to the pulse velocity by:

$$F_T = \mu v^2 \tag{12}$$

where μ is the linear density of the string (kg/m). Equation 12 is applied to a string of photons, a standing wave of electromagnetic radiation (emr) connected at each end to two masses. A segment of the emr string is approximated by 2 photons, each traveling in opposite directs at constant velocity c. The segment has approximate length λ, and rest mass $2E/c^2$. Substituting variables into Equation 12, using hc/λ for E, and rearranging provides an emr standing wave force:

$$F_\gamma = \frac{2hc}{\lambda^2} \tag{13}$$

The photonic standing wave string tension force is the same whether the string consists of two photons or two trillion photons, provided the linear density of the string remains constant along its entire length.

Does Equation 13 accurately depict the force of a single gravitational field line with this model? Objects are considered to have a total number of internal graviton standing waves, providing binding tension, equal to the surface gravitational flux (Φg) divided by two; each internal graviton standing wave has two endpoints on the object's surface. For a sphere, the internal graviton standing waves are each one sphere diameter long. All these sphere diameters intersect at the sphere's center of mass. A sum of all a sphere's internal graviton standing waves multiplied by the binding force of a single graviton standing wave will equal the potential gravitation force of the sphere. Consider a sphere's potential gravitational force to be its gravitational potential energy from Equation 1 divided by the sphere's radius ($F_{total} = U/R$). Dividing F_{total} by 0.5Φg leaves factor 8/3 instead of the factor 2 in Equation 13. Therefore, a gravitational field line has force:

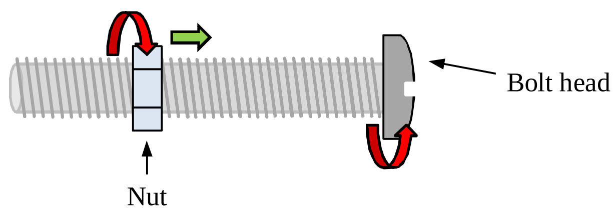
$$F_{g-line} = \frac{8hc}{3{\langle\lambda\rangle_\gamma}^2} = \left(2.7095 \times 10^{-18}\,\frac{Nm^2}{kg}\right)\left(\frac{M}{R^2}\right) i \tag{14}$$

where $\langle\lambda\rangle_\gamma$ is the average gravity photon wavelength $m i^{-1/2}$.

4. Virtual graviton

In theories of quantum gravity the graviton is a massless boson of spin 2 that mediates the force of gravity. To visualize a graviton with this model consider a threaded fastener of nut and bolt as in Figure 2. If a clockwise spinning nut fastens onto a bolt spinning clockwise at the same rate, the nut-bolt contact areas spin past each other at twice the rate of either alone. Now consider photons with spin = ħ traveling in opposite directions forming the standing waves of gravity with binding force of Equation 14. Two circularly polarized photonic wave trains traveling in opposite direction are suggested here to fasten together as in Figure 2. A gravitational line of force is composed of two circularly polarized oppositely traveling electromagnetic wave trains, interfering to form standing waves. Each line of force travels in opposite directions, both at the speed of light c, and standing wave segments of the line can be considered gravitons with spin = 2ħ.

Figure 2 Graviton Spin 2 Fastener Model



Caption: In Figure 2 the nut and the bolt are both right-handed. Turning the nut clockwise (Spin 1) moves it to the right, closer to the bolt head. Turning the bolt head clockwise (Spin 1), at the same rate as the nut, moves the bolt head closer to the nut. The relative nut – bolt fastener has Spin 2.

5. Results

5.1. Counting gravitational field lines of a mass using radiation

The average energy of one graviton $\langle E\rangle_G$ is approximately twice the average gravity photon energy $\langle E\rangle_\gamma$:

$$\langle E\rangle_G \cong 8.9852 \times 10^{-22}\,\frac{Jm}{kg^{\frac{1}{2}}}\left(\frac{M^{\frac{1}{2}}}{R}\right) i^{\frac{1}{2}} \tag{15}$$

The number of gravitons (G) in an object is estimated by dividing its mass self-gravitational energy by its average graviton energy:

$$\#\ of\ Gravitons = \frac{U}{\langle E\rangle_G} = \left(-7.4278 \times 10^{10}\,\frac{G}{kg^{\frac{3}{2}}}\right)\left(M^{\frac{3}{2}}\right) i^{-\frac{1}{2}} \tag{16}$$

Data calculated using the equations discussed for spherical masses ranging from 2×10^{-8} kg to 238 solar masses, all with density 5000 kg/m^3, are presented in Tables 1.a, 1.b. Sphere 5 (M = 1.000 kg, R = 0.0362783 m) from Table 1 will be used to illustrate calculations.

$$T = \left(12.047\,\frac{mK}{kg^{\frac{1}{2}}}\right)\left(\frac{M^{\frac{1}{2}}}{R}\right) i^{\frac{1}{2}} = 332.1\ K i^{\frac{1}{2}}$$

$$N = \left(2.6580 \times 10^{18} \frac{\gamma m}{skg^{\frac{3}{2}}}\right)\left(\frac{M^{\frac{3}{2}}}{R^3}\right) i^{\frac{3}{2}} = \left(5.567 \times 10^{22} \frac{\gamma}{sm^2}\right) i^{\frac{3}{2}}$$

$$\langle E\rangle_G = \left(8.9852 \times 10^{-22} \frac{Jm}{kg^{\frac{1}{2}}}\right)\left(\frac{M^{\frac{1}{2}}}{R}\right) i^{\frac{1}{2}} = 2.477 \times 10^{-20}\, J i^{\frac{1}{2}}$$

$$\langle t\rangle_\gamma = \left(1.4749 \times 10^{-12} \frac{skg^{\frac{1}{2}}}{m}\right)\left(\frac{R}{M^{\frac{1}{2}}}\right) i^{-\frac{1}{2}} = 5.351 \times 10^{-14}\, s i^{-\frac{1}{2}}$$

$$\Phi_g = N4\pi R^2\langle t\rangle_\gamma = \left(4.9264 \times 10^7 \frac{lines}{kg}\right) Mi = (4.926 \times 10^7\, lines) i$$

$$\langle \lambda\rangle_\gamma = \langle t\rangle_\gamma c = \left(4.4216 \times 10^{-4}\, kg^{\frac{1}{2}}\right)\left(\frac{R}{M^{\frac{1}{2}}}\right) i^{-\frac{1}{2}} = 1.604 \times 10^{-5}\, m i^{-\frac{1}{2}}$$

$$F_{g-line} = \left(2.7095 \times 10^{-18} \frac{Nm^2}{kg}\right)\left(\frac{M}{R^2}\right) i = 2.059 \times 10^{-15}\, Ni$$

$$\#\, of\, Gravitons = \left(-7.4278 \times 10^{10} \frac{G}{kg^{\frac{3}{2}}}\right)\left(M^{\frac{3}{2}}\right) i^{-\frac{1}{2}} = -7.428 \times 10^{10}\, G i^{-\frac{1}{2}}$$

Table 1.a Counting gravitational field lines of a mass using radiation

Sphere	Mass (kg)	T (K)$i^{1/2}$	N ($\gamma m^{-2}s^{-1}$)$i^{3/2}$	$\langle E\rangle_G$ (J)$i^{1/2}$	$\langle t\rangle_\gamma$ (s)$i^{-1/2}$
1	4.734E+32	9.270E+7	1.211E+39	6.914E-15	1.917E-19
2	1.989E+30	3.724E+7	7.851E+37	2.777E-15	4.771E-19
3	5.972E+24	4.473E+6	1.360E+35	3.336E-16	3.972E-18
4	1.000E+06	3.321E+3	5.567E+25	2.477E-19	5.351E-15
5	1.000E+00	3.321E+2	5.567E+22	2.477E-20	5.351E-14
6	1.000E-03	1.050E+2	1.760E+21	7.832E-21	1.692E-13
7	1.000E-06	3.321E+1	5.567E+19	2.477E-21	5.351E-13
8	1.000E-07	2.262E+1	1.760E+19	1.687E-21	7.854E-13
9	5.456E-08	2.045E+1	1.300E+19	1.525E-21	8.688E-13
10	2.176E-08	1.755E+1	8.212E+18	1.309E-21	1.013E-12

Caption: Table 1.a includes data calculated for spherical objects of density 5000 kg/m^3. The gravitation temperature, T, used Equation 4. The number N, of gravity photons emitted from each object's surface per second per square meter, used Equation 5. The average graviton energy used Equation 15. The average gravity photon period used Equation 7.

Table 1.b Counting gravitational field lines of a mass using radiation

Sphere	Mass (kg)	Φg (lines)*i*	$\langle\lambda\rangle_\gamma$ (m)$i^{-1/2}$	$F_{g\text{-line}}$ (N)*i*	|Gravitons (G)|
1	4.734E+32	2.332E+40	5.746E-11	1.604E-04	7.651E+59
2	1.989E+30	9.799E+37	1.430E-10	2.589E-05	2.084E+56
3	5.972E+24	2.942E+32	1.191E-09	3.735E-07	1.084E+48
4	1.000E+06	4.926E+13	1.604E-06	2.059E-13	7.428E+19
5	1.000E+00	4.926E+07	1.604E-05	2.059E-15	7.428E+10
6	1.000E-03	4.926E+04	5.073E-05	2.059E-16	2.349E+06
7	1.000E-06	4.926E+01	1.604E-04	2.059E-17	7.428E+01
8	1.000E-07	4.926E+00	2.354E-04	9.556E-18	2.349E+00
9	5.456E-08	2.688E+00	2.605E-04	7.808E-18	9.466E-01
10	2.176E-08	1.072E+00	3.036E-04	5.748E-18	2.384E-01

Caption: Table 1.b continues to calculate sphere values using Table 1.a data. The gravitational flux Φg used Equation 9. The average gravity photon wavelength used Equation 8. The force of one gravitational field line used Equation 14. The absolute value of the complex number was taken after applying Equation 16 for the number of Gravitons. Compare Sphere 9 data to Figure 3.

The gravitation temperature for the Sun is the same order of magnitude as expected at the Sun's center by standard solar models, whereas the Planck mass gravitation temperature is 17.5 K. This model has a lower limit near the Planck mass as shown in Table 1.b and idealized in Figure 3. At least one or two gravitons should be in the mass or leaving/entering the mass. Perhaps the difficulty in increasing the precision of the gravitational constant (see S. Schlamminger et al, for a compilation of published measurements [2]) can be traced to variations in gravitational flux at lower masses. The author speculates the Planck mass is in the transition region where electromagnetic radiation equations no longer describe the binding force for gravitation scaled with $G = 6.674 \times 10^{-11}$ Nm^2/kg^2. Efforts by the author to extend this model below the Planck mass requires "subquantum scale" electromagnetic radiation (akin to neutrino energy) and a corresponding "quantum scale" gravitation constant – which is beyond the scope of this article (see L. J. Malinowski, Fractal Physics Theory – Neutrinos And Stars [3]).

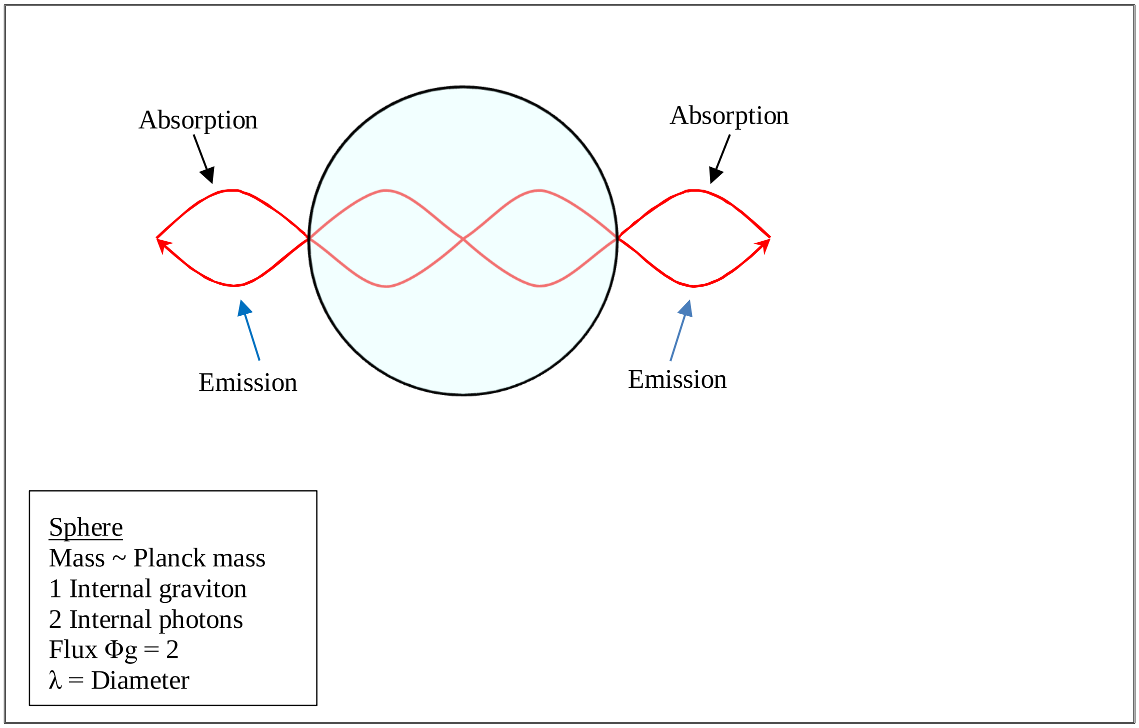
5.2. Equivalent force of gravity data: Quantum Newtonian Gravity vs. Newtonian Gravity

The magnitude of the force of a gravitational field line from M_1 times the number of gravitational field lines emanating radially from M_2 that intersect M_1 equals the magnitude of the force of a gravitational field line from M_2 times the number of gravitational field lines emanating radially from M_1 that intersect M_2:

$$\left(F_{g1-line}\right)\left(\Phi_{g2}\ @M_1\right) \ = \ \left(F_{g2-line}\right)\left(\Phi_{g1}\ @M_2\right) \tag{17}$$

The g-field line "receiving mass" determines the g-field line tension. Notice the product of $F_{g\text{-line}}$ and Φ_g is a negative real number. The negative sign is taken to indicate attraction here.

Figure 3 Idealized lowest mass for graviton binding



Caption: Figure 3 approaches the lower mass limit for this concept. A spherical mass near 40 µg contains ~ 1 internal vibrating graviton (2 antinodes) and 2 gravitational field lines entering / leaving its surface. The gravity photons being absorbed and emitted by the mass are part of extended wave trains binding to distant masses.

The Quantum Newtonian gravitation force between the two masses combines both terms from Equation 17:

$$F_g = (F_{g1-line})(\Phi_{g2} @M_1) + (F_{g2-line})(\Phi_{g1} @M_2) \qquad (18)$$

The Newtonian gravitation force:

$$F_g = \frac{GM_1M_2}{D^2} \qquad (19)$$

$$G = 6.674 \times 10^{-11} \frac{Nm^2}{kg^2}$$

where G is the gravitation constant, M_1 is the mass (kg) of object 1, M_2 is the mass (kg) of object 2, and D is the distance between each object's center of mass (m).

The Quantum Newtonian gravitation force (Equation 18) and the Newtonian gravitation force (Equation 19) are calculated for several examples in Table 2. Table 2.a lists a wide range of masses and with a variety of common Earth found material densities for two spherical objects separated by the distance listed.

Table 2.a Data to Compare Quantum Newtonian Gravity with Newtonian Gravity

Example	**Mass$_1$ (Kg)**	**Mass$_2$ (kg)**	**ρ_1 (kg/m^3)**	**ρ_2 (kg/m^3)**	**Distance (m)**
1	1.989E+30	5.974E+24	1.409E+03	5.515E+03	1.496E+11
2	1.989E+30	1.898E+27	1.409E+03	1.326E+03	7.783E+11
3	1.989E+30	1.303E+22	1.409E+03	1.860E+03	5.914E+12
4	1.989E+30	4.734E+32	1.409E+03	9.000E+03	9.461E+15
5	1.989E+30	1.000E+06	1.409E+03	1.000E-03	1.496E+11
6	1.989E+30	1.000E+06	1.409E+03	2.500E+04	1.496E+11
7	5.974E+24	1.000E+12	5.515E+03	1.000E+04	7.000E+07
8	5.974E+24	1.500E-01	5.515E+03	1.000E+03	6.378E+06
9	1.000E+12	1.000E+12	1.000E-03	2.500E+04	1.000E+09
10	1.000E+03	1.000E+00	2.500E+04	2.500E+04	1.000E+01
11	1.000E-03	1.000E-03	1.000E+03	1.000E+04	1.000E+00
12	1.000E-06	1.000E-06	1.000E+03	1.000E+04	1.000E-03
13	1.000E-06	1.000E-06	2.500E+04	1.000E-03	1.000E+00

Caption: Table 2.a lists example sphere masses and densities with their center of masses separated by the distance shown. This data is used to compare gravitation forces calculated by Quantum Newtonian gravitation, Equation 18, to Newtonian gravitation, Equation 19, in Table 2.b.

The example data listed in Table 2.a was used to generate the values listed in Table 2.b. The force of one gravitational field line of each mass, calculated with Equation 14, is presented in Table 2.b, column 2 and column 3. The gravitational line flux from one mass that geometrically intersects the cross-sectional area of the other mass, is presented in Table 2.b, column 4 (Equation 11) and column 5 (Equation 10). The absolute value of the force of Quantum Newtonian Gravity between masses of each example, calculated with Equation 18, is presented in Table 2.b, column 6. Lastly, the force of Newtonian Gravity between masses of each example, calculated with Equation 19, is presented in Table 2.b, column 7.

Remarkably, Table 2.b shows the force of gravity calculated by Quantum Newtonian Gravity equals the force of gravity calculated by Newtonian Gravity!

Table 2.b Equivalent Force Results: Quantum Newtonian Gravity vs. Newtonian Gravity

Ex.	$F_{g1\text{-line}}$ (N)*i*	$F_{g2\text{-line}}$ (N)*i*	Φg_2 @M_1 (#)*i*	Φg_1 @M_2 (#)*i*	|Quantum Newton (N)|	Newton (N)
1	1.11284E-05	3.98779E-07	1.59206E+27	4.44283E+28	3.5434E+22	3.5434E+22
2	1.11284E-05	1.05214E-06	1.86878E+28	1.97659E+29	4.1593E+23	4.1593E+23
3	1.11284E-05	2.50575E-08	2.22197E+21	9.86812E+23	4.9454E+16	4.9454E+16
4	1.11284E-05	2.37420E-04	3.15436E+25	1.47852E+24	7.0206E+20	7.0206E+20
5	1.11284E-05	7.04066E-18	2.66498E+08	4.21224E+20	5.9314E+03	5.9314E+03
6	1.11284E-05	6.01968E-13	2.66498E+08	4.92666E+15	5.9314E+03	5.9314E+03
7	3.98779E-07	3.26799E-11	1.02021E+17	1.24493E+21	8.1368E+10	8.1368E+10
8	3.98779E-07	3.74091E-16	1.84336E+06	1.96501E+15	1.4702E+00	1.4702E+00
9	7.04066E-16	6.01968E-11	4.73960E+10	5.54346E+05	6.6740E-05	6.6740E-05
10	6.01968E-14	6.01968E-15	5.54346E+03	5.54346E+04	6.6740E-10	6.6740E-10
11	7.04066E-17	3.26799E-16	4.73960E-01	1.02111E-01	6.6740E-17	6.6740E-17
12	7.04066E-18	3.26799E-17	4.73960E+00	1.02111E+00	6.6740E-17	6.6740E-17
13	6.01968E-17	7.04066E-22	5.54346E-07	4.73960E-02	6.6740E-23	6.6740E-23

Caption: Table 2.b shows equivalent force magnitudes calculated from Table 2.a data between Quantum Newton Gravity and Newton Gravity. The input terms for Equation 18 are listed in column 2 through column 5, followed by the equation's output (column 6). Column 7 calculates Newton Gravity with Equation 19.

6. Discussion

Table 3 makes it clear that for a constant mass, varying the density over a wide range does not change the surface gravitational flux, the number of internal gravitons, or the number or contiguous wavelengths that fit across a sphere diameter. Changing the volume of a mass does not change the mass' number of gravitons or gravitational flux.

The virial theorem, for a mass in thermodynamic equilibrium, predicts ½ the gravitational potential energy gained during contraction of the mass is radiated away. The remaining ½ of the gravitational potential energy gained by contraction supplies thermal energy to heat the mass. Applying Quantum Newtonian Gravity to these statements, one expects the "radiated away" radiation to increase the force of the gravitational field lines between the contracted mass and distant masses, while the increase in thermal energy is expected to increase the force of the internal gravitational field lines binding the contracted mass.

Finally, a gravitational mass is a measure of the strength of an object's interaction with a gravitational field, while an inertial mass is a measure of an object's resistance to acceleration when a force is applied. The model presented herein has the same number and strength of gravitational field lines involved in the measurement of the gravitational mass and the inertial mass.

Table 3 Gravitons and force field lines are constant with constant mass

Sphere	Mass (kg)	ρ (kg/m^3)	|Gravitons (G)|	Φg (#)*i*	|2r/<λ>$_\gamma$|
1	2.000E+30	1.000E+06	2.101E+56	9.853E+37	6.397E+18
2	2.000E+30	1.000E+00	2.101E+56	9.853E+37	6.397E+18
3	2.000E+30	1.000E-06	2.101E+56	9.853E+37	6.397E+18
4	1.000E+00	1.000E+06	7.428E+10	4.926E+07	4.523E+03
5	1.000E+00	1.000E+00	7.428E+10	4.926E+07	4.523E+03
6	1.000E+00	1.000E-06	7.428E+10	4.926E+07	4.523E+03
7	1.000E-07	1.000E+06	2.349E+00	4.926E+00	1.430E+00
8	1.000E-07	1.000E+00	2.349E+00	4.926E+00	1.430E+00
9	1.000E-07	1.000E-06	2.349E+00	4.926E+00	1.430E+00

Caption: Table 3 lists three masses at three densities to highlight the constancy per mass of gravitons, gravitational flux, and diameter to gravity photon wavelength ratio. Raising the temperature of an object, to overcome electromagnetic binding forces and thereby expand the object's volume, is not expected to alter the number of internal gravitons or the number of gravitational field lines (Flux).

7. Conclusion

This article introduces Quantum Newtonian Gravity − Working Model and equations derived therefrom that calculate gravitational forces between two masses equal to gravitational forces calculated by Newtonian Gravity. Applying black body radiation equations to potential gravitation energy, enables a visual quantitative picture of virtual gravitons with lines of force binding masses together. This model can help understand the equivalence of gravitational and inertial mass and has potential to extend into the quantum scale.

8. Acknowledgement

The author believed this model could account for the force of gravity since 2013 but could not determine equations that reproduced Newtonian gravity calculations. After several nights in December 2017 of praying to the Lord, the God of my ancestors, the God of Abraham, Isaac, and Jacob, where I acknowledged my inability to complete this effort without divine help, I beseeched the Lord God to send me the Wisdom that sits by his throne (like King Solomon). The same week I determined working equations.

References

[1] C. Kiefer, Quantum Gravity, *Second Edition*, Oxford University Press, 2007.

[2] S. Schlamminger, J. H. Gundlach, and R. D. Newman, Recent measurements of the gravitational constant as a function of time, Phys. Rev. D 91, 121101(R) – Published 11 June 2015.

[3] L. J. Malinowski, Fractal Physics Theory – Neutrinos And Stars, Fundamental J. Modern Physics 2(1) (2011), 73-88.