Forces: Explained and Derived by Wave Equations

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Draft: June 11, 2016

Summary

In current physics, there are four fundamental forces that can cause a change in the motion of an object: strong, weak, electromagnetic and gravitational forces. The strong and weak forces are only witnessed in distances the size of atoms, forming nucleons, binding them into atomic nuclei or changing their structure. Likewise, the electromagnetic force is seen in the atomic level, but it also exists on larger scales such that it can be seen visibly in objects such as magnets. Gravity is a much weaker force by comparison given that it takes many atoms together, assembled in large bodies like planets, before its effects cause a change in the motion of an object. Likely, for this reason, gravity has been the most difficult for physics to connect with the other forces to find a unified force that governs all motion.

This paper unifies three of the four forces into one equation with a clear explanation for the different properties of each force. The three forces detailed in this paper are the strong force, electromagnetic force and gravity. An explanation for the weak force is provided, but it has not been unified into the general equation for force.

Using wave equations as the root of the derivation, force becomes the required energy to move a particle's wave center to its defined edge, or the radius of the particle. Its radius is the transition from longitudinal standing waves (stored energy or mass) to longitudinal traveling waves. Wave amplitude is the variable in the wave equation that causes motion as particles move to minimize amplitude. The strong, electromagnetic and gravitational forces are governed by the same force equation, yet they have different characteristics of wave amplitude based on constructive and destructive wave interference, or amplitude loss, that modify the characteristics of the particle's wave.

This paper details equations that model properties for each of these forces (strong, electromagnetic and gravity). Using a newly proposed Force Equation, calculations are provided for varying distances and particle counts for the three forces. These calculations match known measurements and existing laws of physics. The equations and steps to reproduce each of the calculations is provided. Furthermore, each force is explained as the equations were generated from assumptions about the forces and how they affect the motion of particles.

Lastly, for further proof that the wave equations are a simpler model for particle energy and forces, Coulomb's constant (k) and the gravitational constant (G) have been derived in this paper and match the existing values and the units of these well-known physical constants.

1. Unified Force Equation

There are four known forces in physics today: strong force, weak force, electromagnetic force and the gravitational force. In this paper, a Force Equation was created to unify the strong, electromagnetic and gravitational forces. The weak force will be explained separately in Section 5. The Force Equation has its root in energy, specifically from the Longitudinal Energy Equation responsible for particle energy and mass, as described in the *Particle Energy and Interaction*[1] paper. The results of these forces were calculated at various distances and compared to known results that have been verified with classical equations: Newton's law of gravity and Coulomb's law for electromagnetism. The findings are nearly identical and are shown below in Table 1.1.

The strong force only applies to objects at small distances, so the third and fourth columns contain calculations at distances of 8.45E-16 m (0.845 fm) and 1.13E-15 m (1.13 fm), calculating these forces to be 44.2K and 24.9K newtons respectively. Similarly, the gravity of planets is measured over large distances, so the last and second to last columns contain distances between the Earth and the Sun and Moon. In the last column, the gravitational force between the Sun and Earth is calculated at 3.539E+22 newtons, which is a variation of 0.11% when using Newton's law. In the second to the last column, the gravitational force between the Earth and Moon is calculated at 1.974E+20 newtons, also a variation of 0.11% from the traditional calculation. Yet, the same calculations on particles such as the proton or electron in the gravitational force are identical with no difference (0.00%). Also, a test of different electron and positron combinations across various distances, from the distance between two quarks to the distance between the Earth and Sun, were used to calculate the electromagnetic force. All calculations agree with the traditional calculation using Coulomb's law with no difference (0.00%).

Each of the calculations in Table 1.1 are provided in detail in this paper, beginning in Section 2. However, since this paper introduces new equations, constants and naming convention, they are addressed first. All of the above calculations can be reproduced with the wave equations and constants. Further, the three forces (strong, electromagnetic and gravity) are unified from one Force Equation with an explanation for their differences in coupling constants. The difference between these forces is the separation distance between two or more objects and how their wave patterns produce constructive or destructive wave interference. The newly proposed Force Equation is a variant of the Longitudinal Energy Equation, used to calculate particle rest energy and mass.

Before the Force Equation can be derived, an explanation of the constants and notation is required since there are many new constants and values introduced as a part of these wave equations. Section 1.1 highlights these additions. First, a summary of the results is shown below in Table 1.1.

Force Distance (m)	Count (Q1, Q2)	8.45E-16	1.13E-15	1.40E-10	1.00E+00	3.85E+08	1.50E+11
Electromagnetism							
Two Electrons (Calculated)	**-1, -1**	**3.228E+02**	**1.816E+02**	**1.177E-08**	**2.307E-28**	**1.556E-45**	**1.031E-50**
Two Electrons (Coulomb's Law)		3.228E+02	1.816E+02	1.177E-08	2.307E-28	1.556E-45	1.031E-50
% Difference		*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*
Multiple Electrons (Calculated)	**-5, -10**	**1.614E+04**	**9.079E+03**	**5.885E-07**	**1.154E-26**	**7.782E-44**	**5.154E-49**
Mult. Electrons (Coulomb's Law)		1.614E+04	9.079E+03	5.885E-07	1.154E-26	7.782E-44	5.154E-49
% Difference		*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*
Electron/Positron (Calculated)	**-1, 1**	**-3.228E+02**	**-1.816E+02**	**-1.177E-08**	**-2.307E-28**	**-1.556E-45**	**-1.031E-50**
Elect. / Posit. (Coulomb's Law)		-3.228E+02	-1.816E+02	-1.177E-08	-2.307E-28	-1.556E-45	-1.031E-50
% Difference		*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*
Gravity							
Two Electrons (Calculated)	**-1, -1**	**7.749E-41**	**4.359E-41**	**2.826E-51**	**5.538E-71**	**3.736E-88**	**2.475E-93**
Two Electrons (Newton's Law)		7.749E-41	4.359E-41	2.826E-51	5.538E-71	3.736E-88	2.475E-93
% Difference		*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*
Two Protons (Calculated)	**1, 1**	**2.613E-34**	**1.470E-34**	**9.526E-45**	**1.867E-64**	**1.260E-81**	**8.343E-87**
Two Protons (Newton's Law)		2.613E-34	1.470E-34	9.526E-45	1.867E-64	1.260E-81	8.343E-87
% Difference		*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*
Earth / Moon (Calculated)	**3.57E51, 4.39E49**					**1.974E+20**	
Earth / Moon (Newton's Law)						1.976E+20	
% Difference						*0.109%*	
Earth / Sun (Calculated)	**3.57E51, 1.19E57**						**3.539E+22**
Earth / Sun (Newton's Law)							3.542E+22
% Difference							*0.109%*
Strong Force							
Strong Force (Calculated)	**-1, -1**	**4.424E+04**	**2.488E+04**				
Strong Force (Measured)		~	*2.500E+04*				
% Difference			*0.468%*				

Table 1.1 – Summary of Calculations using Force Equation (force calculated in newtons)

1.1. Wave Equation Constants

Notation

The wave equations include notation to simplify variations of energies and wavelengths at different particle sizes (K) and shells (n), in addition to differentiating longitudinal and transverse waves. The following notation is used:

Notation	Meaning
λ_l	l - longitudinal
λ_t	t - transverse
K_e	e – electron
$E_{(K)}$	Energy at particle wave center count (K)
$\lambda_{t(K,n)}$	Transverse wavelength at particle wave center count (K) and shell (n)

Table 1.1.1 – Wave Equation Notation

Constants and Variables

The following are the wave constants and variables used in the wave equations, including constants for the electron that are commonly used in this paper.

Symbol	Definition	Value (units)
	Wave Constants	
A_l	Amplitude (longitudinal)	$3.662799228 \times 10^{-10}$ (m)
λ_l	Wavelength (longitudinal)	$2.817940327 \times 10^{-17}$ (m)
ρ	Density (aether)	$9.422329851 \times 10^{-30}$ (kg/m^3)
c	Wave velocity (speed of light)	299,792,458 (m/s)
	Variables	
δ	Amplitude factor	variable - (m^3)
K	Particle wave center count	variable - *dimensionless*
n	Particle shells	variable - *dimensionless*
N	Particle orbits *(formerly n)*	variable - *dimensionless*
Q	Particle count in a group	variable - *dimensionless*

Electron Constants		
δ_e	Amplitude factor – single electron	0.9936344 - (m^3)
δ_{Ge}	Amplitude factor – Gravity of electron	0.9827420 - (m^3)
K_e	Particle wave center count - electron	10 - *dimensionless*
O_e	Shell energy multiplier – electron	2.138743820 - *dimensionless*

Table 1.1.2 – Wave Equation Constants and Variables

Gravity Coupling Constants

The following are coupling constants derived and found in Section 3 that are used in gravity equations for the electron (Ge), proton (Gp) and large bodies (G).

Symbol	Value (units)
α_{Ge}	2.4005×10^{-43} - *dimensionless*
α_{Gp}	8.0933×10^{-37} - *dimensionless*
α_G	8.0933×10^{-37} - *dimensionless*

Table 1.1.3 – Gravity Coupling Constants

1.2. Force Equation

Force (F) can be explained as a change in energy over distance. In wave theory, it is represented as the following (Eq. 1.2.1), where it is the change in energy (E) over a distance of $K^2\lambda$, which is the edge of a particle where standing waves convert to traveling waves as discovered in the Longitudinal Energy Equation from the *Particle Energy and Interaction* paper. Force is therefore:

$$F = \Delta E\,(K^2\lambda_l) \tag{1.2.1}$$

Energy from Eq. 1.2.1 can be replaced with the energy of a particle like the electron, whose value was derived in *Particle Energy and Interaction* in long form and the more readable short form (Eqs. 1.2.2 and 1.2.3 respectively).

$$E_{l(K)} = \frac{4\pi\boldsymbol{\rho} K^5 A_l^6 c^2}{3\lambda_l^3} \sum_{n=1}^{K} \frac{n^3 - (n-1)^3}{n^4} \quad \textbf{(1.2.2)}$$

$$E_e = E_{l(10)} = \frac{4\pi\boldsymbol{\rho} K_e^5 A_l^6 c^2}{3\lambda_l^3} O_e \quad \textbf{(1.2.3)}$$

For a single particle, like the electron, its change in energy is based on amplitude. In expanded form, because amplitude is based on in-waves and out-waves in three dimensions, the energy equation takes the following shape. Since force is a vector - the difference in amplitude between two objects – it is calculated in the X direction (assumes both objects reside on the X-axis as the vector). Wave centers move to reduce amplitude, therefore objects will be attractive if amplitude is minimized between the objects, or be repelled if amplitude is greater between the objects than the surrounding amplitude. Further, only the in-wave amplitude in the X-axis affects the particle, therefore it has the change symbol (Δ) in Eq. 1.2.4.

$$F = \frac{4\pi\boldsymbol{\rho} K_e^5 c^2 O_e A_{x(out)} A_{y(out)} A_{z(out)} A_{z(in)} A_{y(in)} \Delta A_{x(in)}}{3\lambda_l^3} (K_e^2 \lambda_l) \quad \textbf{(1.2.4)}$$

In the case of two objects, where Object 1 is the affected object and Object 2 is at a distance of r, there will be a change in amplitude that is based on the out-wave amplitude of Object 2 (A_{x2}) and the square of its distance. This is the in-wave amplitude in Object 1, which can be expressed as:

$$\Delta A_{x(in)} = \frac{A_{x2(out)}}{r^2} \quad \textbf{(1.2.5)}$$

Out-waves in the X direction of the object being affected (Object 1) do not have an effect on force. Only in-waves in the X direction (vector direction with a distance of r) impact Object 2, thus Eq. 1.2.5 can be inserted into Eq. 1.2.4, and shown below in the expanded force equation:

$$F = \frac{4\pi\boldsymbol{\rho} K_e^5 c^2 O_e A_{x(out)} A_{y(out)} A_{z(out)} A_{y(in)} A_{z(in)}}{3\lambda_l^3} \left(\frac{A_{x2(out)}}{r^2}\right) (K_e^2 \lambda_l) \quad \textbf{(1.2.6)}$$

Since the Y and Z directions are unaffected by the two objects in the X direction, the equation can be simplified for readability. The amplitudes in the Y and Z directions are equal, shown in Eq. 1.2.7. They replace the values from Eq. 1.2.6 to become more readable in Eq. 1.2.8, and then finally, the force equation is simplified in Eq. 1.2.9.

$$A_{y\,(out)} A_{z\,(out)} A_{y\,(in)} A_{z\,(in)} = A_l^4 \qquad \textbf{(1.2.7)}$$

$$F = \frac{4\pi \boldsymbol{\rho} K_e^5 c^2 O_e A_l^4 A_{x\,(out)}}{3\lambda_l^3} \left(\frac{A_{x2\,(out)}}{r^2} \right) (K_e^2 \lambda_l) \qquad \textbf{(1.2.8)}$$

$$F = \frac{4\pi \boldsymbol{\rho} K_e^7 c^2 O_e A_l^4 A_{x\,(out)}}{3\lambda_l^2} \left(\frac{A_{x2\,(out)}}{r^2} \right) \qquad \textbf{(1.2.9)}$$

Force Equation – Single Electron Interactions

In most cases, the force equation is not used to measure two particles such as two electrons. Rather, it is the sum of two groups of particles at distance. This method works if the groups are in close proximity or if the distance between the groups is significantly large (relative to the distance of particles within each group). For example, the distance between atoms in the Earth is large, but relative to the distance between the Earth and Moon at which it will be calculated, the distances between atoms on Earth are significantly smaller and thus can be approximated by grouping these particles together.

Each group is given a variable (Q), which is an integer to represent the number of particles in the group. There are two groups: Q_1 for Group 1 and Q_2 for Group 2. The following equation can be used to derive what will become the Force Equation. It uses the single electron force equation in Eq. 1.2.9, adding the particle interactions for all objects counted in Group 1 and Group 2 (Q_1 and Q_2 respectively). The summation is then simplified to become Eq. 1.2.11.

Note: Although it is not a charge (q), the capital letter Q is used here since it is similar to the method used in Coulomb's law to count the number of particles in the equation. Q_1 is the particle count in Group 1; Q_2 is the particle count in Group 2. Below, A_x has been renamed A_{x1} to match the naming convention Q_1, for Group 1.

$$F = \sum_{1}^{Q1} \sum_{1}^{Q2} \frac{4\pi \boldsymbol{\rho} K_e^7 c^2 O_e A_l^4 A_{x1\,(out)}}{3\lambda_l^2} \left(\frac{A_{x2\,(out)}}{r^2} \right) \qquad \textbf{(1.2.10)}$$

$$F = \frac{4\pi \boldsymbol{\rho} K_e^7 c^2 O_e A_l^4 \,(Q_1 A_{x1\,(out)})\,(Q_2 A_{x2\,(out)})}{3\lambda_l^2 r^2} \qquad \textbf{(1.2.11)}$$

Since Q is the particle count of each of the particles in the groups, these equations are assumed to have the same initial amplitude. Thus they can be replaced with A_l in the equation for readability. The remaining variables become Q_1, Q_2 and r. These are separated to the right side of the equation since they are variable. Eq. 1.2.14 becomes the Force Equation that will be used for calculations of the electromagnetic force, gravitational force and strong force in the next sections.

Note: Q is negative for electrons and positive for positrons.

$$A_{x1\,(out)} = A_l \tag{1.2.12}$$

$$A_{x2\,(out)} = A_l \tag{1.2.13}$$

$$F = \frac{4\pi\boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2}\frac{Q_1 Q_2}{r^2} \tag{1.2.14}$$

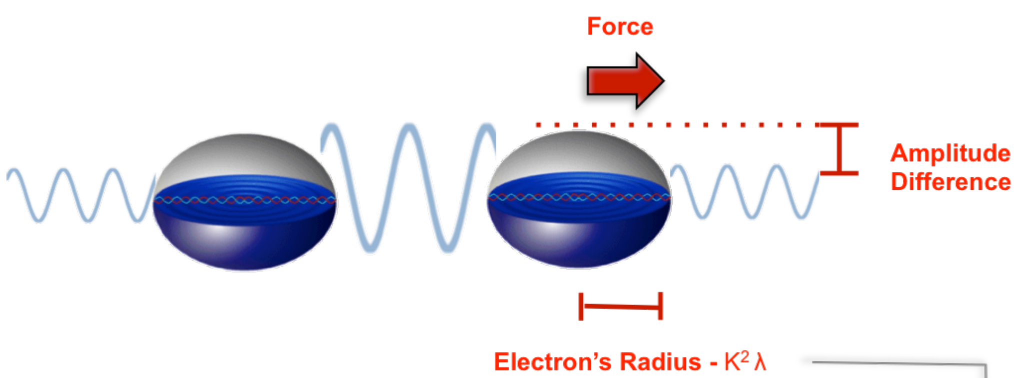
The Force Equation

2. Electromagnetism - Derived and Explained

The electromagnetic force for an electron is its energy multiplied by its radius. Force, in this interpretation, is the energy for an electron's wave centers (the electron core) to move to its defined edge where standing waves convert to traveling waves. In other words, where stored energy becomes kinetic energy. Refer to Eq. 1.2.4 where the radius of the electron ($K^2\lambda$) is added to the energy equation to become a force.

The variable in the Force Equation is amplitude. Wave centers move to reduce amplitude. The preferred position on a wave for the electron's wave centers is the node. Therefore, if amplitude is equal on all sides of the electron, there is no movement of the wave center. If amplitude is not equal, wave centers move in the direction where amplitude is minimized. This is one of the laws of wave theory, as outlined in *Particle Energy and Interaction*.

Amplitude is affected by other particles, causing constructive or destructive wave interference. An electron in proximity to another electron will have constructive waves. An electron in proximity to a positron will have destructive waves. In Fig. 2.1, two electrons are shown with amplitude that is constructive between the particles, resulting in greater amplitude. As amplitude is minimized in the direction away from the other electron (see Force arrow), the electron will move in this direction. Amplitude is reduced based on the square of the distance from the external object as was reflected in Eq. 1.2.5 when deriving the Force Equation. The electron's movement is solely dependent on a difference in amplitude, based on other particles in its vicinity.



Electron Energy & Force $E_e = \dfrac{4\pi\rho K_e^5 A_l^6 c^2 O_e}{3\lambda_l^3}$ $F = \dfrac{4\pi\rho K_e^5 A_l^6 c^2 O_e}{3\lambda_l^3}\boxed{(K_e^2\lambda_l)}$

Fig 2.1 - Electromagnetism

The Force Equation is an expanded version of the simplified equation for single electrons, as it considers multiple electrons, protons and their anti-particles. It adds or subtracts waves (i.e. constructive wave interference or destructive wave interference) in integers, representing each particle. Particles are grouped together (Q) at a distance (r) from each other. These become the variables in the Force Equation (Eq. 1.2.14).

2.1. Examples

Each of the examples in this section demonstrates an example of two groups (Q_1, Q_2) at a distance (r) and these calculations are compared against the equivalent using Coulomb's law. The calculations match the example data shown earlier in Table 1.1. From small distances to large, positive charges or negative, or single electrons or groups, the results are an exact match (0.00%) with Coulomb's law.

<u>Example 1 – Two Electrons at Distance 1.40E-10</u>

In this example (the results are also found in Table 1.1), two electrons are separated at a distance (r) of 1.40E-10 meters. Therefore Q_1 and Q_2 are both equal to -1 (electron). These values are inserted into Eq. 2.1.1.

$r = 1.40 \times 10^{-10}$ m
$Q_1 = -1$
$Q_2 = -1$

$$F_{E1} = \frac{4\pi\boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2}\frac{Q_1 Q_2}{r^2} \tag{2.1.1}$$

Calculated Value: 1.177E-8 newtons
Difference – Coulomb's Law: 0.000%

<u>Example 2 – Two Electrons at Distance 1.13E-15</u>

In this example, two electrons are separated at a shorter distance than Example 1. In this case, they are separated at a distance (r) of 1.127E-15 meters.

$r = 1.127 \times 10^{-15}$ m
$Q_1 = -1$
$Q_2 = -1$

$$F_{E2} = \frac{4\pi\boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2}\frac{Q_1 Q_2}{r^2} \tag{2.1.2}$$

Calculated Value: 181.6 newtons
Difference – Coulomb's Law: 0.000%

Example 3 – Electron and Positron at Distance 1.40E-10

In this example, the same distance is used as Example 1, but using an electron and a positron. Therefore Q_1 = -1 and Q_2 = +1. The result is a negative force, meaning that it is an attractive force between the particles.

r = 1.4 x 10^{-10} m
Q_1 = -1
Q_2 = +1

$$F_{E3} = \frac{4\pi\boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2}\frac{Q_1 Q_2}{r^2} \qquad \textbf{(2.1.3)}$$

Calculated Value: **-**1.177E-8 newtons
Difference – Coulomb's Law: 0.000%

Example 4 – Multiple Electrons at Distance 1.00E0

In this example, multiple electrons are placed into two groups at a larger distance (r) of 1 meter. The first group (Q_1) contains 5 electrons. The second group (Q_2) contains 10 electrons.

r = 1.0 m
Q_1 = -5
Q_2 = -10

$$F_{E4} = \frac{4\pi\boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2}\frac{Q_1 Q_2}{r^2} \qquad \textbf{(2.1.4)}$$

Calculated Value: 1.154E-26 newtons
Difference – Coulomb's Law: 0.000%

2.2. Coulomb Constant (k)

Using the Force Equation, Coulomb's constant can be derived. It is also derived in the *Fundamental Physical Constants* as a commonly used physics constant. Two electrons are used for the purpose of the derivation, thus Q_1=-1 and Q_2=-1 are used in the Force Equation (Eq. 2.2.1) and then simplified in Eq. 2.2.2.

$$F = \frac{4\pi \boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2} \frac{Q_1 Q_2}{r^2} \tag{2.2.1}$$

$$F = \frac{4\pi \boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2} \left(\frac{1}{r^2}\right) \tag{2.2.2}$$

In current physics, electromagnetic forces are calculated using Coulomb's law as follows in Eq. 2.2.3. For the purpose of deriving Coulomb's constant, two electrons of a single elementary charge (e) will be used to match the value using the Force Equation in Eq. 2.2.2. Thus, a simplified version of the equation in Eq. 2.2.4 using the elementary charge (e).

$$F = k_e (q_1 q_2) \left(\frac{1}{r^2}\right) \tag{2.2.3}$$

$$F = k_e (e_e^2) \left(\frac{1}{r^2}\right) \tag{2.2.4}$$

Eqs. 2.2.4 and 2.2.2 are set equal to each other since the calculations are equal for the force of two electrons at distance (r). Since it appears on both sides of the equation, distance (r) will drop so that Coulomb's constant (k) can be solved in Eq. 2.2.6.

$$k_e (e_e^2) \left(\frac{1}{r^2}\right) = \frac{4\pi \boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2} \left(\frac{1}{r^2}\right) \tag{2.2.5}$$

$$k_e = \frac{4\pi \boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2} \frac{1}{e_e^2} \tag{2.2.6}$$

The elementary charge (e) was derived in the *Fundamental Physical Constants*[2] paper. It can be replaced in Eq. 2.2.6 to solve for Coulomb's constant.

$$k_e = \frac{4\pi\boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2} \frac{1}{\left(\frac{A_l^4}{2K_e^6}\sqrt{\left(\frac{\pi O_e}{\lambda_l^3 \delta_e}\right)}\right)^2} \qquad \textbf{(2.2.7)}$$

$$k_e = \frac{16\boldsymbol{\rho} K_e^{19} \lambda_l c^2 \delta_e}{3A_l^2} \qquad \textbf{(2.2.8)}$$

As explained in the *Fundamental Physical Constants* paper, some of the constants require a modifier to readjust for imperfections in the wave constants due to volume assumptions that were perfect spheres for particles and cylindrical shapes for photons. This is why the amplitude factors for the electron for electromagnetism and gravity were not perfect at an integer of one (1). The modifiers are the same value for these amplitude factors, but are dimensionless, to account for this imperfection. They are:

$$\mathit{\Delta}_e = \delta_e = 0.993634 \qquad \textbf{(2.2.9)}$$

$$\mathit{\Delta}_{Ge} = \delta_{Ge} = 0.982742 \qquad \textbf{(2.2.10)}$$

When the modifiers are accounted for, the value of Coulomb's constant is within 0.005% of the known value. The units also match when considering that charge is measured in meters (see note below).

$$k_{e'} = \frac{16\boldsymbol{\rho} K_e^{19} \lambda_l c^2 \delta_e}{3A_l^2} (\mathit{\Delta}_{Ge}\mathit{\Delta}_e)^2 \qquad \textbf{(2.2.11)}$$

Calculated Value: 8.9880E+9
Difference from CODATA[3]: 0.005%
Calculated Units: kg m / s^2

Note: The above units are based in kg * m/s^2. By comparison Coulomb's constant (k) is measured in N * m^2/C^2. However, in wave theory C (Coulombs) is measured in m (meters) as charge is based on amplitude. N (newtons) can be expressed in kg * m/s^2, so when N is expanded and C is represented by meters, it resolves to the correct units expected for the Coulomb constant.

3. Gravity - Derived and Explained

Like electromagnetism, gravity is a force on particles when there is a difference in amplitude. In the case of gravity, there is a slight loss of amplitude when particles convert in-waves to out-waves (see Appendix for possible explanations for the amplitude loss). This amplitude difference is modeled as a coupling constant in the Force Equation to be consistent with current physics and experiments.

Gravity is illustrated in Fig 3.1. In single particles, the amplitude loss is α_G. A separate value will be calculated for the electron and proton below. The amplitude loss is very weak compared to electromagnetism, so constructive or destructive waves interference controls wave center movement until a large body contains sufficient particles that the summation of the amplitude loss is greater than the effect of electromagnetism. Most large bodies consist of atoms that are neutral (protons and electrons), such that there is negligible constructive or destructive wave interference on bodies consisting of atoms. In this case, gravity is the force that controls large bodies due to the reduction of amplitude. The larger the number of particles in a body, the greater its amplitude loss. Amplitude is also reduced by the square of the distance naturally, so distance affects the force of attraction.

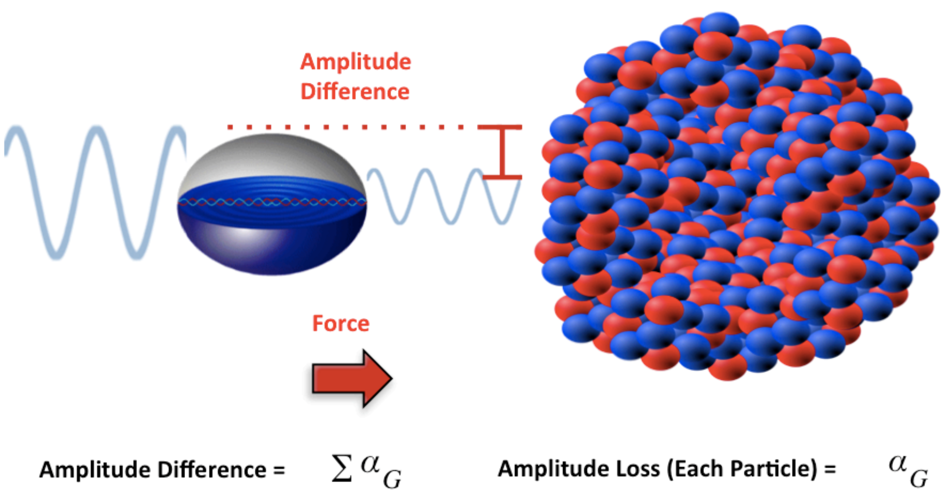


Fig 3.1 - Gravity

First, the amplitude loss for each particle is calculated. Later, the number of particles is estimated for large bodies such that the total amplitude loss for the body can be obtained.

Gravity of Electron – Coupling Constant

The amplitude loss for each electron starts with a relationship between its mass and its core. It was noticed during the derivation of the fine structure constant that it had a relationship with mass and the electron core ($K\lambda$). It was then noticed that the strength of gravity versus electromagnetism was also related to the electron's mass squared and another electron property – its charge. The strength of gravity versus electromagnetism for the electron, divided by its mass, is the inverse of 2 Planck charges. Planck charge and its derivation are found in the *Fundamental Physical Constants* paper. Planck charge is amplitude. This is the basis of Eq. 3.2. The amplification factor (δ_{Ge}) is added because of slight imperfections in the wave equations and constants, likely due to volume assumptions or wave construction.

$$\sqrt{\alpha_e} \cdot m_e = (K_e \lambda_l)^2 \tag{3.1}$$

$$\frac{\alpha_{Ge}}{m_e^2} = \frac{K_e^8}{A_l \delta_{Ge}} \tag{3.2}$$

Eq. 3.2 is rewritten to solve for the gravity of electron coupling constant. The mass of the electron is represented in terms of the fine structure constant and electron core in Eq. 3.1. It replaces m_e in Eq. 3.3 to become Eq. 3.4.

$$\alpha_{Ge} = \frac{m_e^2 K_e^8}{A_l \delta_{Ge}} \tag{3.3}$$

$$\alpha_{Ge} = \frac{\left(\frac{(K_e \lambda_l)^2}{\sqrt{\alpha_e}}\right)^2 K_e^8}{A_l \delta_{Ge}} \tag{3.4}$$

$$\alpha_{Ge} = \frac{K_e^{12} \lambda_l^4}{A_l \delta_{Ge} \alpha_e} \tag{3.5}$$

The fine structure constant (α_e) in Eq. 3.5 is replaced by the derivation found in the *Fundamental Physical Constants* paper in Eq. 3.6. Finally, the equation is simplified for the gravity of electron coupling constant (Eq. 3.7). Its value is consistent with existing physics. The force of gravity for the electron is 2.4E-43 weaker than the force of gravity.

$$\alpha_{Ge} = \frac{K_e^{12} \lambda_l^4}{A_l \delta_{Ge} \left(\frac{\pi K_e^4 A_l^6 O_e}{\lambda_l^3 \delta_e}\right)} \tag{3.6}$$

$$\alpha_{Ge} = \frac{K_e^8 \lambda_l^7 \delta_e}{\pi A_l^7 O_e \delta_{Ge}} \tag{3.7}$$

Gravity of Electron – Coupling Constant

Calculated Value: 2.4005E-43

Note: The coupling constant could have been modeled as an amplification factor (δ_{Ge}) instead, and the coupling constant would be modeled as the imperfection. It is truly a reduction in amplitude according to the equation. It was chosen to model the coupling constant as 2.4E-43 to be consistent with current physics.

Gravity of Proton – Coupling Constant

The proton has its own coupling constant associated with gravity. It's based on the ratio of the square of the masses of the proton and the electron, as seen in Eq. 3.8. The strength of gravity for the proton is 8.1E-37 weaker when compared to the strength of electromagnetism.

$$\alpha_{Gp} = \alpha_{Ge} \frac{m_p^2}{m_e^2} \tag{3.8}$$

Gravity of Proton – Coupling Constant

Calculated Value: 8.0933E-37

Gravity – Coupling Constant

Most calculations involving gravity are based on large bodies, not single particles like the electron and proton. However, gravity is based on amplitude loss of particles, so a single coupling constant is determined to model the effect on atoms containing these particles. The coupling constant for gravity assumes an equal number of protons and electrons in a large body. Therefore, the gravitational coupling constant is the sum of the proton and electron gravity coupling constants, shown in Eq. 3.9. The effect of the electron is negligible on the effect and the value is the same as the proton to at least five digits shown in the calculated value. This value will be used to calculate the gravity of large bodies.

$$\alpha_G = \alpha_{Gp} + \alpha_{Ge} \tag{3.9}$$

Gravitational Coupling Constant

Calculated Value: 8.0933E-37

Group Particle Count

The Force Equation for gravity uses a coupling constant for each particle in a large body (group), so the number of particles in the group must be estimated to use the equation. To do this, the mass of the group is divided by the mass of the proton and electron as shown in Eq. 3.10. This becomes the Group Particle Count equation to arrive at the number of particles (Q) that will be needed for the Force Equation.

$$Q_{group} = \frac{m_{group}}{(m_p + m_e)} \tag{3.10}$$

Group Particle Count (Q)

Note: Eq. 3.10 assumes an equal number of protons and electrons in a body, and that the combination of these two particles leads to the gravity coupling constant in Eq. 3.9. The neutron was not estimated separately as the mass is nearly equivalent to the mass of the proton and electron combined. Therefore, it was treated in these equations as a combination of the electron and proton in both Eq. 3.9 and 3.10.

3.1. Examples

Each of the examples in this section demonstrates two groups (Q_1, Q_2) at a distance (r) and these calculations are compared to the equivalent calculation using Newton's gravitational law. These are example calculations matching the results shown earlier in Table 1.1. The gravitational force on single particles, for the electron and proton, match expected values (difference of 0.00%). When applied to larger bodies, the accuracy of the gravitational force of the Earth on the Moon and the Sun both have a difference of 0.109%. The latter is likely due to the method used to estimate the number of particles in the Earth, Moon and Sun.

Example 1 – Two Electrons at Distance 1.4E-10

In this example, two electrons are separated a distance (r) of 1.4E-10 meters. Therefore Q_1 and Q_2 are both -1. The gravity of electron coupling constant is used to obtain the gravitational force.

$r = 1.4 \times 10^{-10}$ m

$Q_1 = -1$

$Q_2 = -1$

$$F_{G1} = \frac{4\pi \boldsymbol{\rho} K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2} \frac{Q_1 Q_2}{r^2} (\alpha_{Ge}) \tag{3.1.1.1}$$

Calculated Value: 2.826E-51 newtons
Difference – Newton's Gravitation Law: 0.000%

Note: The electromagnetic force of an electron at the same range was calculated in Eq. 2.1.1. The strength of electromagnetism for an electron versus gravity of an electron is 4.16E42.

$$\frac{F_e}{F_{Ge}} = 4.1649E42 \tag{3.1.1.2}$$

Example 2 - Two Protons at Distance 1.4E-10

In this example, two protons are separated a distance (r) of 1.4E-10 meters. Therefore Q_1 and Q_2 are both +1. The gravity of proton coupling constant is used to obtain the gravitational force.

$r = 1.4 \times 10^{-10}$ m
$Q_1 = +1$
$Q_2 = +1$

$$F_{G2} = \frac{4\pi\boldsymbol{\rho} K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2} \frac{Q_1 Q_2}{r^2} (\alpha_{Gp}) \tag{3.1.2.1}$$

Calculated Value: 9.526-E45 newtons
Difference – Newton's Gravitation Law: 0.000%

Note: The strength of electromagnetism for a positron versus gravity of a proton is 1.236E36.

$$\frac{F_e}{F_{Gp}} = 1.236E36 \tag{3.1.2.2}$$

Example 3 – Earth and Moon at Distance 3.85E8

In this example, the force of gravity of the Earth on the Moon is calculated. To do this, the Group Particle Count Equation (Eq. 3.9) is used to estimate the number of particles (Q) that will be used in the Force Equation. Eq. 3.1.3.1 calculates the particles in the Earth to be 3.569E51. *Note that the electron and proton are considered one combination particle for the purpose of using the gravity coupling constant.*

$m_{earth} = 5.972 \times 10^{24}$ kg
$m_p = 1.67262 \times 10^{-27}$ kg
$m_e = 9.10938 \times 10^{-31}$ kg

$$Q_{earth} = \frac{m_{earth}}{(m_p + m_e)} \tag{3.1.3.1}$$

Calculated Value (Q_{earth}**):** 3.569E51 particles

Using a similar method, the particles of the Moon are calculated in Eq. 3.1.3.2 to be 4.391E49 particles.

$m_{moon} = 7.34767 \times 10^{22}$ kg

$$Q_{moon} = \frac{m_{moon}}{(m_p + m_e)} \tag{3.1.3.2}$$

Calculated Value (Q_{moon}**):** 4.391E49 particles

The above values for the Earth and Moon are used as the values for Q_1 and Q_2 respectively. The distance (r) from the Earth to the Moon used in this example is 3.85E8 meters. Lastly, the gravitational coupling constant is used for large body calculations. These are inserted into Eq. 3.1.3.3 and a value of 1.974E20 newtons is obtained.

$r = 3.85 \times 10^8$ m
$Q_1 = Q_{earth} = 3.569 \times 10^{51}$
$Q_2 = Q_{moon} = 4.391 \times 10^{49}$

$$F_{G3} = \frac{4\pi \boldsymbol{\rho} K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2} \frac{Q_1 Q_2}{r^2} (\alpha_G) \tag{3.1.3.3}$$

Calculated Value: 1.974E20 newtons
Difference – Newton's Gravitation Law: 0.109%

Example 4 - Earth and Sun at Distance 1.50E11

In this example, the force of gravity of the Sun on the Earth is calculated. To do this, the Group Particle Count Equation (Eq. 3.9) is used to estimate the number of particles (Q) that will be used in the Force Equation. Eq. 3.1.4.1 calculates the particles in the Sun to be 1.189E57 particles. The Earth was calculated in the previous example to be 3.569E51.

$m_{sun} = 1.989 \times 10^{30}$ kg
$m_p = 1.67262 \times 10^{-27}$ kg
$m_e = 9.10938 \times 10^{-31}$ kg

$$Q_{sun} = \frac{m_{sun}}{(m_p + m_e)} \quad \textbf{(3.1.4.1)}$$

Calculated Value (Q_{earth}): 1.189E57 particles

The values for the Sun and Earth above become the values for Q_1 and Q_2 respectively. A distance (r) of 1.50E11 meters is used as the mean distance. These values are inserted into Eq. 3.1.4.2, along with the gravitational coupling constant, to arrive at a calculated value of 3.539E22 newtons.

$r = 1.49598 \times 10^{11}$ m
$Q_1 = Q_{sun} = 1.189 \times 10^{57}$
$Q_2 = Q_{earth} = 3.569 \times 10^{51}$

$$F_{G4} = \frac{4\pi\boldsymbol{\rho} K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2} \frac{Q_1 Q_2}{r^2} (\alpha_G) \quad \textbf{(3.1.4.2)}$$

Calculated Value: 3.539E22 newtons
Difference – Newton's Gravitation Law: 0.109%

3.2. Gravitational Constant (G)

The gravitational constant comes from the Force Equation, above in Section 3.1. Note it is also derived in the *Fundamental Physical Constants* paper as one of the common constants in physics. From the Force Equation, a gravitational coupling constant is required (α_{Ge}) that models the reduction of amplitude of each electron when losing energy as it reflects in-waves to out-waves.

$$F = \frac{4\pi\boldsymbol{\rho} K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2} \frac{Q_1 Q_2}{r^2} (\alpha_{Ge}) \quad \textbf{(3.2.1)}$$

The derived gravitational coupling constant from Eq. 3.6 can be added into the Force Equation in Eq. 3.2.1. The variables Q_1, Q_2 and r have been isolated for convenience as they are variable. Eq. 3.2.3 is a simplified version of Eq. 3.2.2.

$$F = \frac{4\pi \boldsymbol{\rho} K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2} \left(\frac{Q_1 Q_2}{r^2}\right) \left(\frac{K_e^{12} \lambda_l^4}{A_l \delta_{Ge} \alpha_e}\right) \tag{3.2.2}$$

$$F = \frac{4\pi \boldsymbol{\rho} K_e^{19} A_l^5 c^2 \lambda_l^2 O_e}{3\delta_{Ge} \alpha_e} \left(\frac{Q_1 Q_2}{r^2}\right) \tag{3.2.3}$$

Eq. 3.2.3 is the force equation for gravity of the electron. To solve for the gravitational constant (G), the equation can be set equal to Newton's version of the gravity equation for two electrons, where $F=G*mm/r^2$. In this case, the mass of two electrons (m_e^2) is used.

$$F = \frac{4\pi \boldsymbol{\rho} K_e^{19} A_l^5 c^2 \lambda_l^2 O_e}{3\delta_{Ge} \alpha_e} \left(\frac{Q_1 Q_2}{r^2}\right) = \frac{G\,(m_e)^2}{r^2} \tag{3.2.4}$$

On the left side of the equation (the wave equation force for gravity of the electron), Q_1 and Q_2 are set to one, since it is based on two electrons (one for Q_1; one for Q_2). This equals the force of Newton's gravitational formula for the mass of two electrons. The mass of the electron was solved in the *Fundamental Physical Constants* paper; it can be replaced in the equation. Likewise, the fine structure constant was also solved in the same paper and can be replaced in Eq. 3.2.5.

$$F = \frac{4\pi \boldsymbol{\rho} K_e^{19} A_l^5 c^2 \lambda_l^2 O_e}{3\delta_{Ge} \left(\frac{\pi K_e^4 A_l^6 O_e}{\lambda_l^3 \delta_e}\right)} \left(\frac{(1)\ (1)}{r^2}\right) = \frac{G\left(\frac{4\pi \boldsymbol{\rho} K_e^5 A_l^6}{3\lambda_l^3} O_e\right)^2}{r^2} \tag{3.2.5}$$

Now, the gravitational constant (G) can be isolated as shown in Eq. 3.2.6, and finally simplified in Eq. 3.2.7. Note that the value and units of G match its existing CODATA value.

$$G = \frac{4\pi\boldsymbol{\rho} K_e^{19} A_l^5 c^2 \lambda_l^2 O_e}{3\delta_{Ge}\left(\dfrac{\pi K_e^4 A_l^6 O_e}{\lambda_l^3 \delta_e}\right)} \left(\frac{(1)\ (1)}{r^2}\right) \frac{(r^2)}{\left(\dfrac{4\pi\boldsymbol{\rho} K_e^5 A_l^6}{3\lambda_l^3} O_e\right)^2} \tag{3.2.6}$$

$$G = \frac{3K_e^5 \lambda_l^{11} c^2 \delta_e}{4\pi^2 \boldsymbol{\rho} A_l^{13} O_e^2 \delta_{Ge}} \tag{3.2.7}$$

Calculated Value: 6.6741E-11
Difference from CODATA: 0.000%
Calculated Units: m^3 / s^2 kg

4. Strong Force - Derived and Explained

Measurements of the strong force have shown that it is the inverse of the fine structure constant (~137 times) stronger than electromagnetism.[4] This is expressed in Eq. 4.1 and is the coupling constant used in the Force Equation when calculating the strong force.

$$\alpha_S = \frac{1}{\alpha_e} \tag{4.1}$$

The strong force is known to apply only at short distances, less than 2.5 fm, or roughly the radius of the electron.[5] At distances less than the radius of the electron, longitudinal waves are standing in form. Beyond the radius, they are traveling waves. When two particles, such as two electrons, have wave centers that are within these boundaries, they are affected by and contribute to the standing wave structure of other particles to form a new wave core. In essence, they become a new particle. It would take incredible energy to overcome electromagnetic repelling of two electrons to reach this short distance, but once pushed to within the electron's radius, two electrons would lock together and take a new form.

The strong force calculations in Section 4.1 model the separation of particles at three electron wavelengths and four electron wavelengths (one and two electron wavelength separations respectively if considering the two electrons being separated have a particle core distance of an electron wavelength each). The separation of four electron wavelengths matches experimental evidence of the strong force of nucleon binding at this distance.

Section 4.2 attempts to model possible structures to match the distance values of three and four electron wavelengths to explain the nature of gluons in the proton and nuclear binding. In addition, when the strong force coupling constant is modeled as the inverse of the fine structure, there is an interesting relation to atomic orbitals that is also modeled in the section.

4.1. Examples

This section uses the Force Equation with the strong force coupling constant found in Eq. 4.1.

Example 1 – Particles Separated at Distance 8.45E-16

In this example, the strong force is modeled with two electrons and a separation of one electron wavelength (Kλ) between the edges of the two electron cores. Because the electron cores have a radius of Kλ each, the total distance (r) between the two electron core centers is 3Kλ, or 0.85 fm. This is modeled visually in Section 4.2. Q_1 and Q_2 are -1 and -1 each for two electrons. A strong force value of 4.424E4 newtons is obtained.

$$r_{S1} = 3K_e\lambda_l \tag{4.1.1}$$

r_{S1} = 8.454 x 10^{-16} m
Q_1 = -1
Q_2 = -1

$$F_{S1} = \frac{4\pi\boldsymbol{\rho} K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2} \frac{Q_1 Q_2}{r_{S1}^2} (\alpha_S) \tag{4.1.2}$$

Calculated Value: 4.424E4 newtons
Difference – Observation: -

Note: The fine structure constant is not a fundamental constant in wave theory. In the *Fundamental Physical Constants* paper, it was derived in terms of wave constants. The force equation for the strong force can be rewritten without the use of the fine structure by replacing its value in Eq. 4.1.2 with the derived value as shown in Eq. 4.1.3.

$$F_{S'} = \frac{4\pi\boldsymbol{\rho} K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2} \frac{Q_1 Q_2}{r_S^2} \left(\frac{1}{\frac{\pi K_e^4 A_l^6 O_e}{\lambda_l^3 \delta_e}} \right) \tag{4.1.3}$$

$$F_{S'} = \frac{4\boldsymbol{\rho} K_e^3 \lambda_l c^2 \delta_e}{3} \frac{Q_1 Q_2}{r_S^2} \tag{4.1.4}$$

<u>Example 2 – Particles Separated at Distance 1.13E-15</u>

Example 2 is very similar to Example 1, using two electrons but now with a separation distance of two electron wavelengths (2Kλ). Considering the radius of each electron core, the total distance between the two particle cores is four electron wavelengths (4Kλ) or 1.13 fm, measured in femtometers. At this distance, the calculated force is 2.488E4 newtons and is consistent with measurements for nucleon binding.[6]

$$r_{S2} = 4K_e\lambda_l \tag{4.2.1}$$

r_{S2} = 1.127 x 10^{-15} m
Q_1 = -1
Q_2 = -1

$$F_{S2} = \frac{4\pi \boldsymbol{\rho} K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2} \frac{Q_1 Q_2}{r_{S2}^2} (\alpha_S) \tag{4.2.2}$$

Calculated Value: 2.488E4 newtons
Difference – Observation: - 0.468%

4.2. Quark and Nucleon Binding

This section theorizes possible structures for the proton and atomic nuclei binding, matching data from the Force Equation for the strong force and the radius of the proton that was calculated in *Fundamental Physical Constants*. There may be other possible explanations, so it should be noted that this section is theoretical, especially considering that it contains a very different explanation of the nucleon from today's explanation of three quarks.

An explanation about the detection of three quarks, gluon color and nucleon spin was addressed in *Fundamental Physical Constants*. Here, the proton structure related to gluons and the strong force is addressed.

In Example 1 of Section 4.1, it was found that two electrons with a separation distance of one electron wavelength between particle cores had a force of 4.424E4 newtons. This is modeled in Fig. 4.2.1 showing potential gluons separating electrons.

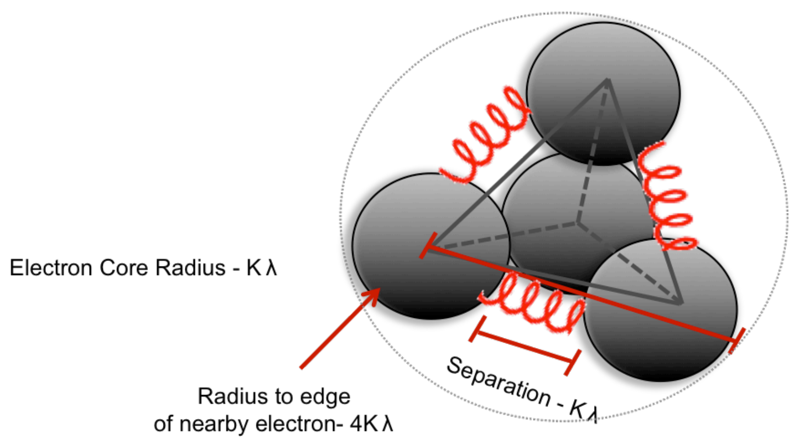


Fig 4.2.1 – Electron Gluons

Notes:

- The inside edges of the electron cores are separated by one electron wavelength, Kλ.
- The radius of each electron core is Kλ, thus the total distance between two electron centers is 3Kλ, or 0.85fm.
- The distance from one electron center to the far edge of the other electron core is 4Kλ. If four electrons form a tetrahedral shape, constructive wave interference would cause a new amplitude of 4KA, and a new wavelength of 4Kλ. In other words, all of the electrons would be compact in a new particle core.
- The distance of the base of the tetrahedron, i.e. the edge of one electron to the far edge of the other electron, is 5Kλ. In the *Fundamental Physical Constants* paper, a tetrahedron with this base length is calculated to have a radius of 0.863fm to the circumsphere, in between recent measurements of the radius of the proton.[7]

In Example 2 of Section 4.1, it was found that two electrons (or positrons) with a separation distance of two electron wavelengths had a force of 2.488E4 newtons, which is consistent with the force and distance for nuclear binding. Using the example structure of the proton from the section above, a potential model has been created separating the center of the proton and the center of the neutron at two electron wavelengths of separation from the particle core edges (four electron wavelengths total including the radii of each particle). This is modeled in Fig. 4.2.2 as a potential example to match the calculations.

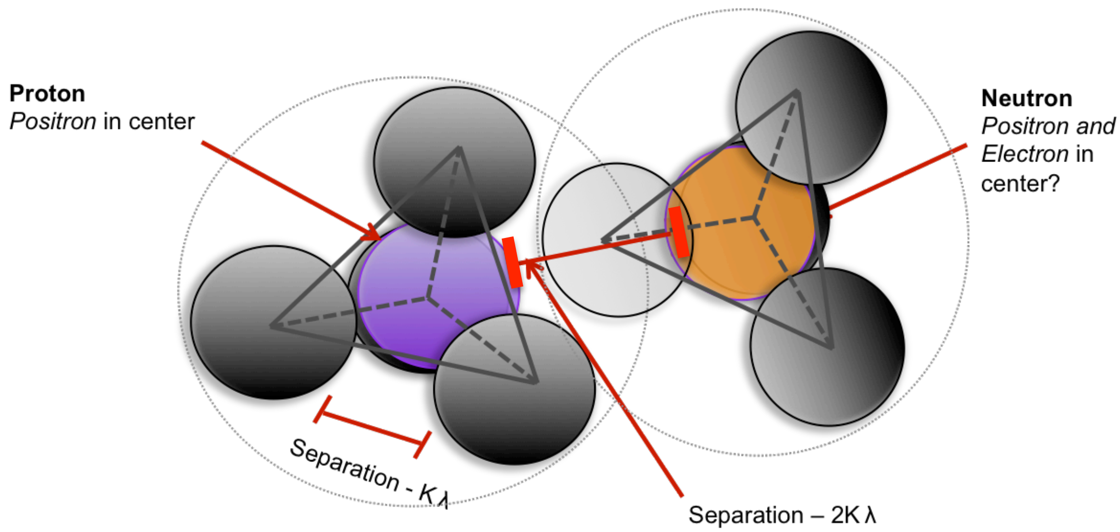


Fig 4.2.2 – Nucleon Binding

Notes:

- The proton is modeled with a positron in the center of the tetrahedron, responsible for its positive charge. It is equidistant between each of the electrons, never annihilating with any electron until disrupted (e.g. particle collider experiment, in which three highly energetic electrons would be detected).
- The neutron is modeled as a possible combination of a positron and electron in the center, in addition to the four electrons at the vertices of the tetrahedron. Destructive wave interference would cause the particle to be neutral. If the electron at the center were disrupted, it would be ejected and the neutron would become a proton. This is consistent with beta decay experiments (note that the neutron likely has an antineutrino and the proton has a neutrino as well to be consistent with beta decay).[8]
- The particle cores are separated by two electron wavelengths (2Kλ), or from center-to-center of each of these cores, it is a separation of 4Kλ, or 1.13fm.

Strong Force Relation to the Fine Structure Constant

If the proton does consist of electrons, there is an interesting find related to the fine structure constant that is found in both the strong force coupling constant and the Orbital Equation, found in *Particle Energy and Interaction*. The strong force coupling constant is based on the inverse of the fine structure constant (α). The calculation of orbitals for the electromagnetic force, measured in wavelengths using the Orbital Equation, is based on the inverse of the fine structure constant squared. The Orbital Equation accurately models the orbital distances of hydrogen in wavelengths and meters. Further, it accurately describes the photon wavelengths and energies of electrons in these orbitals.

The positions of the electron for both the strong force and electromagnetic force is shown below in Fig 4.2.3. Each of the electron positions in the figure is a position in the electromagnetic wave where the electron has stability. Note the relationship to the fine structure constant for each of these positions.

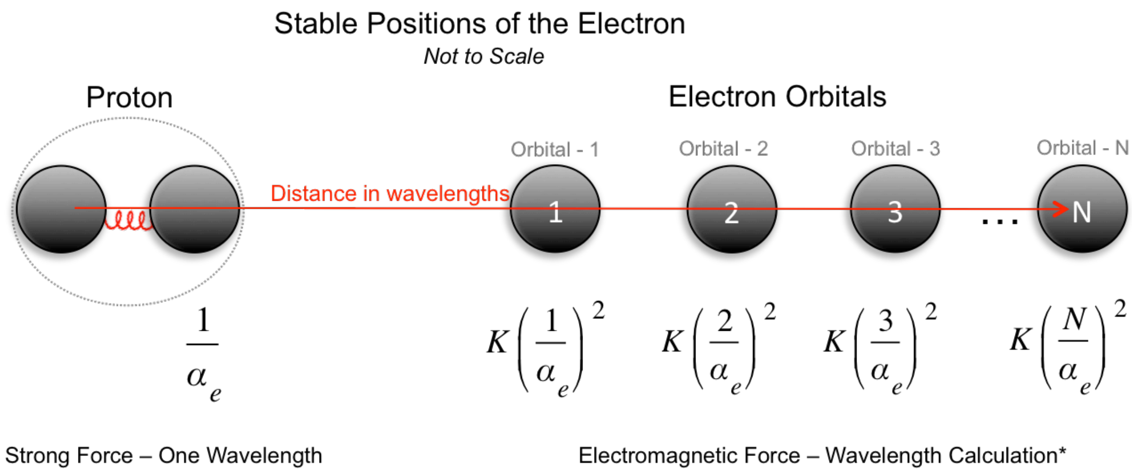


Fig 4.2.3 – Electron Placement Relation to Fine Structure Constant
**Wavelength Calculation – Orbital Equation (from Particle Energy and Interactions)*

5. Weak Force

The weak force was not modeled as a separate force. It may potentially be modeled as an aggregate of strong force and electromagnetic force reaction, but it does not have a separate coupling constant with an explanation provided in this paper.

In Section 4.2, it is theorized that nuclear binding may occur due to the strong force interaction between a positron (proton) and an electron-positron combination (neutron). Refer to Fig 4.2.2. In this potential structure, nucleons would consist of the following.

- The proton and neutron would both have four electrons tightly bound in a tetrahedral shape. The electrons have no external charge as their energies are converted into gluons, binding the wave centers together to form a new particle.
- In addition to the above, the proton would have a positron and a neutrino in its center. This would give the particle a positive charge.
- In addition to the above, the neutron would have an electron and an antineutrino in its center. The destructive wave interference of the positron and electron in the center would give it a neutral charge.
- The particles in the center are held in place by electromagnetic and strong forces (the interaction with the positron and other nucleon binding). If the electron and antineutrino in the neutron are disrupted, they are ejected and it becomes a proton.

The definition above is consistent with the beta decay of a neutron in which it becomes a proton. If this were the case, the weak force would be the electromagnetic/strong force that holds the electron in the center of the neutron. If a force greater than the force holding it in place disrupts it, it would be ejected.

In beta decay, neutrons in stable nuclei may exist forever, while a free neutron decays after ~15 minutes into a proton.[9] The free neutron may be explained by the fact that the electron (and antineutrino) in the neutron's center is only held in place by the electromagnetic force. It takes a force greater than the electromagnetic force holding it in place to be ejected. Meanwhile, the stable neutron in nuclei formation is also governed by the strong force. The forces disrupting the neutron in atomic nuclei are not sufficient to overcome the strong force and it does not decay.

If this is the weak force, then it must account for the event that causes a free neutron to decay at regular intervals. One possibility is solar neutrinos. If a particle, such as a neutrino emitted from the Sun, collides with a free neutron with sufficient force, it may be able to eject the electron in the neutron's center. It has been found that the neutron's decay rates vary slightly with the distance between the Earth and the Sun during annual modulation. The decay rate is faster when the Earth is closer to the Sun in January, and slower when the Earth is farther from the Sun in July.[10] The probability of a random event of a solar neutrino collision may not be as random, given a stable Sun (in the absence of solar flares, etc.) and distance between the Earth and Sun. If this is the case, then the same neutron decay experiment conducted on another planet, such as Mars or Pluto, should yield different results for beta decay timing.

A new test is proposed to validate this theory of solar neutrinos being responsible for beta decay. Neutron decay is based on an element like a solar neutrino that collides at some predictable frequency. Thus, it would be expected to decay at a slower rate further from the Sun, likely slowing at a rate equal to the square of the distance from the Sun (if it is indeed a solar particle that is responsible for decay).

6. Conclusion

This paper accurately represents electromagnetic and gravitational forces of particles from the size of atoms to distances measured between planets, as illustrated by a difference of 0.000% between the calculations using the Force Equation and Coulomb's law and Netwon's law respectively for electromagnetism and gravity. For the gravitational force calculation of large bodies, the difference was 0.109% for both the Earth-Moon and the Earth-Sun gravitational forces. This is possibly due to the method used to estimate the number of electrons, protons and neutrons in each of these large bodies, as the Force Equation requires a calculation based on the number of particles. The calculations may be refined in the future as a better method for calculating the exact number of particles and their type is obtained for large bodies.

A derivation of Coulomb's constant (k) and the gravitational constant (G) was also provided. They are a representation of wave constants in the Force Equation (density, amplitude, wavelength and wave speed). Although Coulomb's constant required a modifier that is consistent with other constants that were derived in *Fundamental Physical Constants*, the gravitational constant did not require a modifier. Both values and units for these constants match. The derivations of these two constants, in addition to 16 other well-known constants, were calculated in *Fundamental Physical Constants*.

In addition to the calculations, explanations were provided for the equations that were used to derive the coupling constants for the strong force, electromagnetism and gravity, providing a physical reason for these forces. The weak force was explained, but not calculated, as it is not believed to be a fundamental force but instead is a combination of electromagnetism and strong forces. In the explanations, a model for the proton's quark nature and atomic nuclei bonding were provided, although these illustrations are theoretical and one of the possibilities based on the equations.

In conclusion, based on the equations and calculations, it is shown that three forces are indeed one force. Particles respond to waves as they attempt to minimize amplitude, which is the node position on a wave. The strong force is a modification of wave amplitude based on two particles in close proximity, within each other's standing wave structure. Electromagnetism is the effect of wave amplitude based on traveling waves that constructively or destructively interfere. And lastly, gravity is a slight loss of wave amplitude as particles reflect in-waves to become out-waves. This has been modeled as one Force Equation, based on the energy equation for particle mass from *Particle Energy and Interaction*, over the distance of a particle's radius where it transitions from standing waves to traveling waves. In short, force is the change in energy required to move the particle core from standing waves (stored energy) to traveling waves (kinetic energy).

Appendix

Gravitational Amplification Factor

The gravity of electron coupling constant was derived in Section 3. During the derivation, the coupling constant was found to be in relation to the fine structure constant (Eq. 3.5). It is shown again for reference in Eq. A.1 below. It was chosen to model the coupling constant (α_{Ge}) as the value of 2.40E-43 instead of the amplitude factor (δ_{Ge}) to be consistent with current physics that establishes a relationship between the coupling constants for the relative strengths of forces. The difference between the two is the coupling constant is dimensionless while the amplitude factor has units of meters cubed (m^3).

$$\alpha_{Ge} = \frac{K_e^{12}\lambda_l^4}{A_l \delta_{Ge} \alpha_e} \qquad \textbf{(A.1)}$$

Modeling the same equation above as an amplitude factor would appear as the following.

$$\delta_{Ge} = \frac{K_e^{12}\lambda_l^4}{A_l \alpha_{Ge} \alpha_e} \qquad \textbf{(A.2)}$$

In Eq. A.2, it is apparent that the amplitude factor is based on the wavelength to the fourth degree (m^4) divided by amplitude (m). However, the question is why? The following, theoretical explanation is provided in the Appendix because it is not supported by equations.

It is known that the electron and proton, which are used by the Force Equation with gravity coupling constant, have spin. In fact, they have a strange spin of ½. If the electron (and proton if indeed it has a positron at its center) consists of 10 wave centers, as concluded by the Longitudinal Energy Equation in *Particle Energy and Interaction,* then these wave centers would be in a geometric formation that is stable as the electron itself is a stable particle.

Wave centers move to minimize amplitude, positioned at nodes on the wave, thus a potential arrangement for a particle of 10 wave centers is a three-level tetrahedron. In this arrangement, nearly all the wave centers would be on the node of a spherical, longitudinal wave. The wave centers that are slightly off the node, would attempt to move to the node. Once this wave center is on the node, it forces another wave center off the node, and it then attempts to reposition onto the node itself. This process repeats itself constantly as each wave center in the electron's structure attempts to reposition. This is illustrated in Fig A.1 with a red circle representing the wave center off node. This model would explain the electron's strange spin of ½.

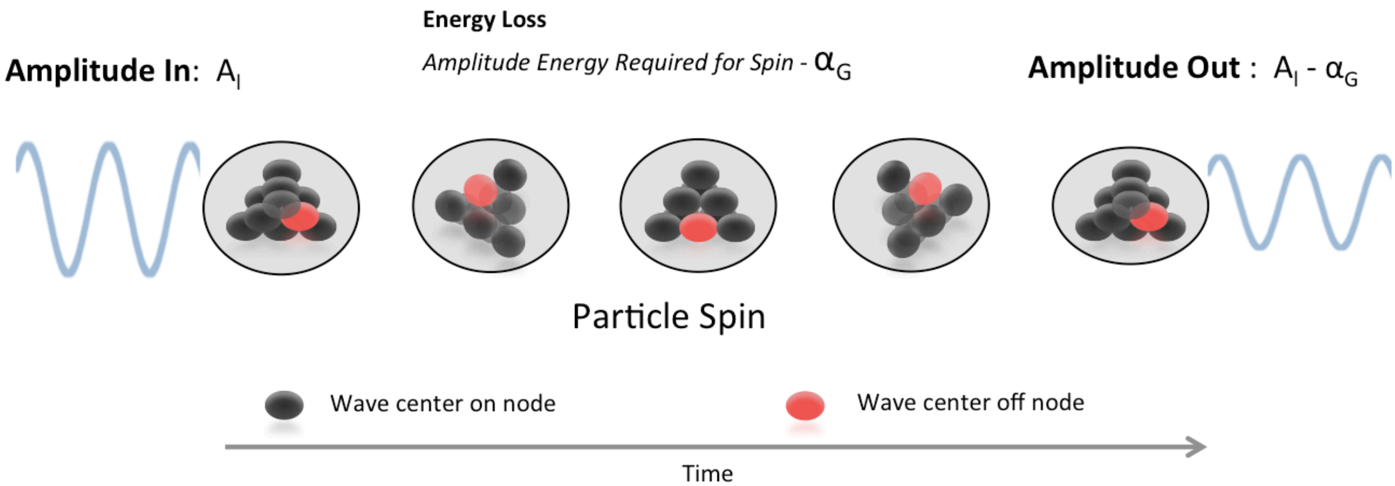


Fig A.1 – Particle Spin and Amplitude Effect

This model of the electron spin would always require energy as the wave center that needs to reposition is constantly changing. The energy that is required for spin reduces in-wave amplitude as it reflects to become an out-wave. The loss is an amplification factor (Eq. A.2), or what has been used in the Force Equation as a coupling constant (Eq. A.1). It is a loss of 2.40E-43 for amplitude. It is a negligible loss when considering one particle, but when considering large bodies containing a significant amount of particles, the loss becomes measurable and is the force known as gravity.

Acknowledgements

These findings would not be possible without the research of the late Dr. Milo Wolff, Gabriel LaFreniere and Xavier Borg from whom this theory is based upon as a derivative of the Wave Structure of Matter (WSM). Special thanks to Dr. Karoly Kehrer, Susan Barlow, Declan Traill, Gary Simpson and members of the WSM group for reviewing components of this theory and providing valuable feedback. Lastly, my sincere appreciation to my family, who were considerably patient and understanding while I worked on this paper.

References

[1] "Particle Energy and Interaction: Explained and Derived by Wave Equations." Vixra. http://vixra.org/author/jeff_yee

[2] "Fundamental Physical Constants: Explained and Derived by Wave Equations." Vixra. http://vixra.org/author/jeff_yee
[2] "Fundamental Physical Constants: Explained and Derived by Wave Equations." Vixra. http://vixra.org/author/jeff_yee

[3] "CODATA Recommended Values of the Fundamental Physical Constants 2014." Arxiv. http://arxiv.org/pdf/1507.07956.pdf

[4] "Coupling Constants for the Fundamental Forces." Hyperphysics. http://hyperphysics.phy-astr.gsu.edu/hbase/forces/couple.html

[5] "Nuclear Force." Wikipedia. https://en.wikipedia.org/wiki/Nuclear_force

[6] "Reid Force." Wikipedia. https://en.wikipedia.org/wiki/Nuclear_force#/media/File:ReidForce2.jpg

[7] "The Shrinking Proton: Particle is Smaller Than Thought". Live Science. http://www.livescience.com/26563-shrinking-proton-smaller-measurement.html

[8] "Beta Decay." Wikipedia. https://en.wikipedia.org/wiki/Beta_decay

[9] "Mystery of the Neutron Lifetime Discrepancy Deepens." Physics World. http://physicsworld.com/cws/article/news/2013/dec/04/mystery-of-neutron-lifetime-discrepancy-deepens

[10] "The Mystery of the Varying Nuclear Decay." Physics World. http://physicsworld.com/cws/article/news/2008/oct/02/the-mystery-of-the-varying-nuclear-decay