Forces: Explained and Derived by Energy Wave Equations

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Summary

In physics, there are four fundamental forces in the Standard Model 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. The electromagnetic force is seen at the atomic level too, but it also exists on larger scales such that it can be seen visibly by the human eye 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 fundamental forces into one equation with a clear explanation for the different properties of each force. The three forces detailed in this paper are the electromagnetic force, strong force and gravity. An explanation for the weak force is provided, but it has not been unified into the general equation that determines forces.

As it will be shown in this paper, the cause of all forces is the motion of a particle to minimize wave amplitude. Using energy wave equations, the electric force is modeled mathematically as longitudinal waves traveling through the space between particles. The remaining forces are modeled as changes to the electric force, changing in wave amplitude, or changing wave forms to become transverse waves. The electromagnetic force will be split into its components for the electric force and magnetic force to describe the difference in wave types and its effects. And the strong force will be split into two components to describe the attraction within the nucleus, and an effect on electrons in an atom that keeps electrons in orbitals.

Calculations are provided for varying distances and particle counts for each of these 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 illustrated and explained in detail, matching the mathematical description as each force equation is derived from a single energy equation.

Lastly, Newton's second law of motion, Newton's universal law of gravitation and Coulomb's law are naturally derived by equations and explained. Further proof is the derivation of constants associated with the latter two laws, deriving the Coulomb constant (k) and the gravitational constant (G) in terms of energy wave constants.

1. Forces – Particle Motion

A force causes an object to change its velocity or direction. Although there are different types of forces, the descriptions and equations in this paper unify the cause of forces to be based simply on the motion of a particle to minimize wave amplitude. In the *Particle Energy and Interaction*[1] paper, wave amplitude is one of the variables for energy, so it would also be appropriate to also say that the motion of a particle is to minimize energy. In that paper, the energy of particles is calculated based on standing, longitudinal waves and the energy of photons as transverse waves. Here, forces will be shown to be based on these same waves. After all, energy is force exerted over a distance.

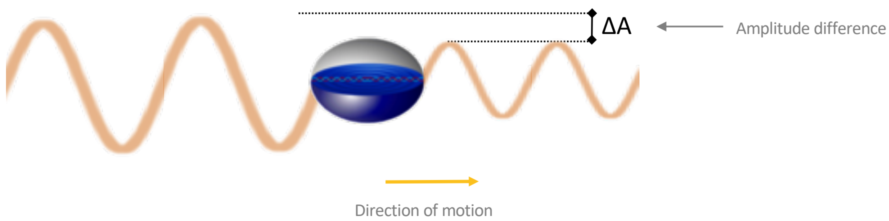


Fig 1 – Forces: particle motion to minimize wave amplitude

Explanation of Forces

The electric force is the fundamental force. It is the force of traveling, longitudinal waves. In fact, it is also the cause of particle energy and mass, described in the *Particle Energy and Interaction* paper. When longitudinal waves converge on a wave center and are reflected, they become standing, longitudinal waves (stored energy). Beyond a particle's radius, waves convert back to traveling, longitudinal waves. As a result, the electron's energy (E_e) and radius (r_e) are closely linked to the electric force in the following equation. Later in this paper, these constants will be represented in wave equation format. But for purposes of explanation, the classical forms are used throughout this paper before conversion to their true wave equation format. For example, the electric (Coulomb) force can be expressed using **classical terms** for the electron as follows, where two groups of particles (Q) are separated at distance (r). *Note that Q is a (dimensionless) numerical count of particles in close proximity and* ***not*** *units of Coulomb charge.*

$$F = E_e \frac{Q_1 r_e}{r} \frac{Q_2}{r} \qquad \textbf{(1)}$$

Electric force – classical terms

Amplitude decreases naturally over distance (r) as it spreads out spherically from the electron. But the waves from one group of particles (Q_1) will interfere with waves from a second group of particles (Q_2), affecting amplitude. This is a known phenomenon in waves – constructive wave interference. In the *Particle Energy and Interaction* paper, particles were explained as stable on one of two standing wave nodes per wavelength of a longitudinal wave. This leads to a particle and an antiparticle, such as an electron (-) and a positron (+). Particles on the same phase of the wave experience constructive wave interference – increasing amplitude between particles – forcing them away. A particle and antiparticle are on opposite phases of the wave and experience destructive interference – decreasing amplitude between particles – causing an attraction. This is illustrated in the next figure.

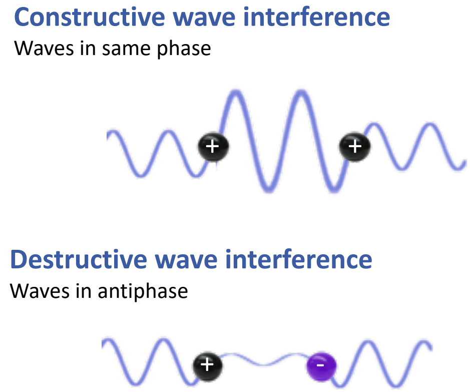
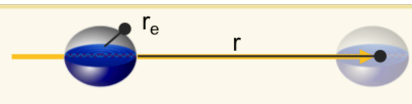
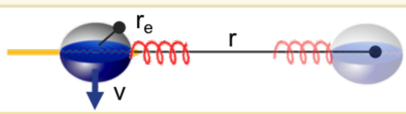
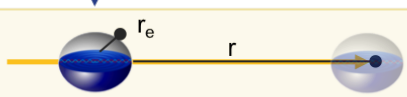
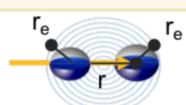
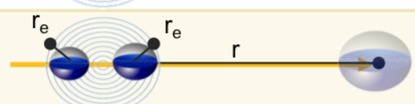


Fig 2 – Constructive and destructive wave interference affecting amplitude and particle motion

The electric force (Eq. 1) is the fundamental force. The other forces that are described in this paper will be derived in subsequent chapters. Here, the forces are summarized in classical terms, showing the slight differences between each equation.

Force	Visual	Description	Equation
Coulomb's Law (Electric Force)		Energy a distance (r) from electrons (Q_1). Waves have passed through standing waves of electron (classical radius) and are traveling again. Interfere (+ or -) with distant electrons (Q_2).	$F = E_e \frac{Q_1 r_e}{r} \frac{Q_2}{r}$
Distinti's Magnetism (Magnetic Force)		Energy converted from longitudinal waves to transverse (spin) from electrons (Q_1). Constructive or destructive spin waves at a distance r from distance electrons (Q_2).	$F = m_e v^2 \frac{Q_1 r_e}{r} \frac{Q_2}{r}$
Newton's Gravitation (Gravitational Force)		Energy difference a distance (r) due to lost energy (α_{Ge}) from particle spin (Q_1). The difference produces a shading effect on Q_2 and is attractive.	$F = E_e \frac{Q_1 r_e \alpha_{Ge}}{r} \frac{Q_2}{r}$
Strong Interaction (Strong Force)		Energy stored from particle kinetic energy (α_e) of Q_1 and Q_2. When at standing wave nodes (stable) at a distance (r), particles are attractive. Energy becomes a stored "gluon".	$F = E_e \frac{Q_1 r_e}{\alpha_e r} \frac{Q_2}{r}$
Strong Interaction (Orbital Force)		Energy a distance (r) from the proton after wave passes through two particles (Q_1) with gluon energy and goes through energy change. The force decreases at the cube of distance.	$F = E_e \left(\frac{Q_1 r_e}{\alpha_e r}\right)^2 \frac{Q_2}{r}$

Q (number) of Particles — Wave (Energy) — r Particle Distance — r_e Electron Radius — Proton

Fig 3 – Visual and simplified equation format of forces

The forces are a change in wave form or amplitude, yet the principle always remains the same. Particles move to the point of minimal wave amplitude. The following are the differences between the equations in Fig. 3. It is expressed in terms of energy change, where force is energy over distance.

- **Electric Force** – the fundamental force – longitudinal wave energy of two particle groups over distance (r).
- **Magnetic Force** – change in electric energy from rest where c^2 is replaced by v^2 in E_e ($E_e = m_e c^2$).
- **Gravitational Force** – change in electric energy where α_{Ge} is applied to wave amplitude. The energy loss is due to particle spin and is converted to transverse (spin) energy.

- **Strong Force** – change in energy from kinetic energy, now stored, where α_e is applied to wave amplitude. *Note wave amplitude increases by the inverse of wave structure constant which is why the fine structure constant appears in the denominator.*
- **Orbital Force** – change in energy as a wave passes linearly through two particles affected by the strong force where α_e is applied to wave amplitude. It is squared because it passes through two particles before affecting the orbiting electron, now decreasing at the cube of distance. A complete derivation is included in *Atomic Orbitals*.[2]

Calculations of Forces

In this paper, forces are derived in wave equation format and used for calculations of the electric, magnetic, gravitational and strong forces in Table 1.1. They were calculated at various distances and compared to known results that have been verified with classical equations: Coulomb's law for the electric force, Distinti's New Magnetism for the magnetic force and Newton's law of universal gravitation for gravity. The strong force only applies to objects at small distances, so the third and fourth columns of Table 1.1 contain calculations at distances of 8.45E-16 m (0.845 fm) and 1.13E-15 m (1.13 fm) – estimated distances for quark separation and nucleon separation respectively.

The first calculated value (**bold**) for each of the calculations in Table 1.1 uses the wave equation equivalent found in later sections of this paper. With the exception of the strong force, all calculations agree to an accuracy of at least 0.000%. The calculations for the strong force are more difficult to compare to experimental results, which will be explained in a later section.

Force Distance (m)	***Count (Q1,Q2)***	**8.45E-16**	**1.13E-15**	**1.40E-10**	**1.00E+00**	**3.85E+08**	**1.50E+11**
			Electric Force				
Two Electrons (Calc)	**-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 (Calc)	**-5,-10**	**1.614E+04**	**9.079E+03**	**5.885E-07**	**1.154E-26**	**7.782E-44**	**5.154E-49**
Multiple Electrons (Coulomb)		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 (Calc)	**-1,1**	**-3.228E+02**	**-1.816E+02**	**-1.17E-08**	**-2.307E-28**	**-1.556E-45**	**-1.031E-50**
Electron/Positron (Coulomb)		-3.228E+02	-1.816E+02	-1.17E-08	-2.307E-28	-1.556E-45	-1.031E-50
% Difference		*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*
			Magnetic Force				
Two Elect (v=2.5E-4 m/s)	**-1,-1**	**2.245E-22**	**1.263E-22**	**8.185E-33**	**1.604E-52**	**1.082E-69**	**7.169E-75**
Two Electrons (Distinti)	2.50E-04	2.245E-22	1.263E-22	8.185E-33	1.604E-52	1.082E-69	7.169E-75
% Difference		*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*

Two Electrons (v=1 m/s)	**-1,-1**	**3.592E-15**	**2.020E-15**	**1.310E-25**	**2.567E-45**	**1.732E-62**	**1.147E-67**
Two Electrons (Distinti)	1	3.592E-15	2.020E-15	1.310E-25	2.567E-45	1.732E-62	1.147E-67
% 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**					**1.976E+20**	
Earth / Moon (Newton's Law)						1.976E+20	
% Difference						*0.000%*	
Earth / Sun (Calculated)	**3.57E51, 1.19E57**						**3.523E+22**
Earth / Sun (Newton's Law)							3.523E+22
% Difference							*0.000%*
Strong Force							
Strong Force (Calculated)	**-1, -1**	**4.424E+04**	**2.489E+04**				
Strong Force (Measured)		~	*2.500E+04*				
% Difference			*0.466%*				

Table 1.1 – Summary of force calculations (in units of newtons)

Before the force equations are derived, an explanation of the constants and notation is required since there are many new constants and values introduced as a part of these energy wave equations. Section 1.1 highlights these additions.

1.1. Energy Wave Equation Constants

Notation

The energy wave equations include notation to simplify variations of energies and wavelengths of different particles, in addition to differentiating longitudinal and transverse waves.

Notation	Meaning
K_e	Particle wave center count (e – electron)
λ_l λ_t	Wavelength (l – longitudinal wave, t – transverse wave)
g_λ g_A g_p	g-factor (λ – electron orbital g-factor, A – electron spin g-factor, p – proton g-factor)
F_g, F_m	Force (g - gravitational force, m – magnetic force)
$E_{(K)}$	Energy (K – particle wave center count)

Table 1.1.1 – Energy Wave Equation Notation

Constants and Variables

The following are the wave constants and variables used in the energy wave equations:

Symbol	Definition	Value (units)
Wave Constants		
A_l	Amplitude (longitudinal)	$9.215405708 \times 10^{-19}$ (m)
λ_l	Wavelength (longitudinal)	$2.854096501 \times 10^{-17}$ (m)
ρ	Density (aether)	$3.859764540 \times 10^{22}$ (kg/m^3)
c	Wave velocity (speed of light)	299,792,458 (m/s)
Variables		
δ	Amplitude factor	variable - *dimensionless*
K	Particle wave center count	variable - *dimensionless*
Q	Particle count in a group	variable - *dimensionless*
Particle Constants		
K_e	Electron particle count	10 - *dimensionless*
O_e	Electron outer shell multiplier	2.138743820 – *dimensionless*

g_λ	Electron orbital g-factor (*revised*)	0.9873318320 – *dimensionless*
g_A	Electron spin g-factor (*revised*)	0.9826905018 – *dimensionless*
g_p	Proton orbital g-factor (*revised*)	0.9898125300 – *dimensionless*

Table 1.1.2 – Energy Wave Equation Constants and Variables

Method for calculating the values of the constants

The method used for deriving and calculating each of the constants is found in the *Fundamental Physical Constants* paper.[3] The values may continue to be refined, and if so, will be posted online at: energywavetheory.com/equations.

1.2. Energy Wave Equations - Forces

The following are the force equations, in wave equation format, that are used for the calculations in this paper. They are derived and explained in detail in their respective sections.

$$F_e = \frac{4\pi\rho K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2} g_\lambda \left(\frac{Q_1 Q_2}{r^2}\right) \tag{1.2.1}$$

Electric Force

$$F_g = \frac{\rho\lambda_l^2 c^2 O_e}{2K_e^{31}} \left(\frac{A_l}{36}\right)^2 g_\lambda^3 g_p^2 \left(\frac{Q_1 Q_2}{r^2}\right) \tag{1.2.2}$$

Gravitational Force

$$F_s = \frac{16\rho K_e^{11} A_l^7 c^2 O_e}{9\lambda_l^3} g_\lambda \left(\frac{Q_1 Q_2}{r^2}\right) \tag{1.2.3}$$

Strong Force

$$F_o = \frac{64\rho K_e^{17} A_l^8 c^2 O_e}{27\pi\lambda_l^3} g_\lambda^2 \left(\frac{Q^2}{r^3}\right) \tag{1.2.4}$$

Orbital Force

$$F_m = \frac{4\pi\rho K_e^7 A_l^6 O_e}{3\lambda_l^2} g_\lambda \left(\frac{Q_1 Q_2}{r^2} v^2\right) \tag{1.2.5}$$

Magnetic Force (Electromagnetism)

2. Electric Force - Derived and Explained

The energy of particles such as the electron were calculated in *Particle Energy and Interaction*, including the volume of a particle and its radius. An illustration of in-waves, reflecting off wave centers to become out-waves, and the combination of these waves create standing waves until the particle's radius, is shown in Fig. 2.1. The electron's energy and mass were calculated as the stored energy of standing waves. Here in this paper, it will be shown that traveling, longitudinal waves re-emerge at the electron's radius as amplitude declines to match in-wave amplitude, and once the waves are traveling in form again, that this energy is recognized as a force between two or more particles at distance.

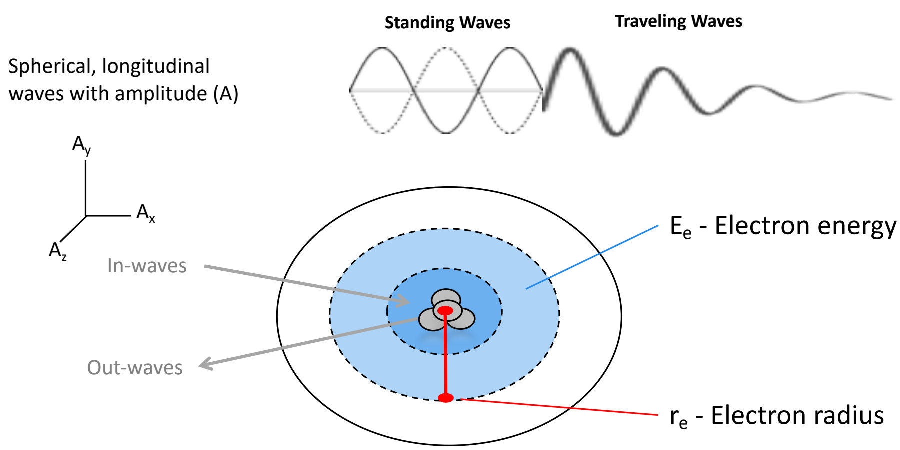


Fig 2.1 – Longitudinal waves creating the energy of the electron and its charge (electric force)

The wave amplitude along a single axis was calculated in *Particle Energy and Interaction* to be half of the Planck charge. Amplitude is magnified by the number of wave centers (K) and arrives from two sides of a sphere when measured along a given axis. Once reflected, the waves are standing waves in form as illustrated in Fig. 2.1. It is charted as a decline of amplitude for a single electron from its core, along a given axis in Fig. 2.2.

In Fig. 2.2, the total displacement of the first wavelength is the Planck charge (q_P) for a single wave center. For the electron, due to energy for spin converting some longitudinal energy to transverse energy, the total displacement in the *longitudinal* direction of the first wavelength is the elementary charge (e_e). In energy wave theory, charge is measured in units of distance (meters), as wave amplitude. It is displacement from equilibrium.

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. 2.3, two electrons are shown with amplitude that is constructive between the particles, resulting in greater amplitude (green line).

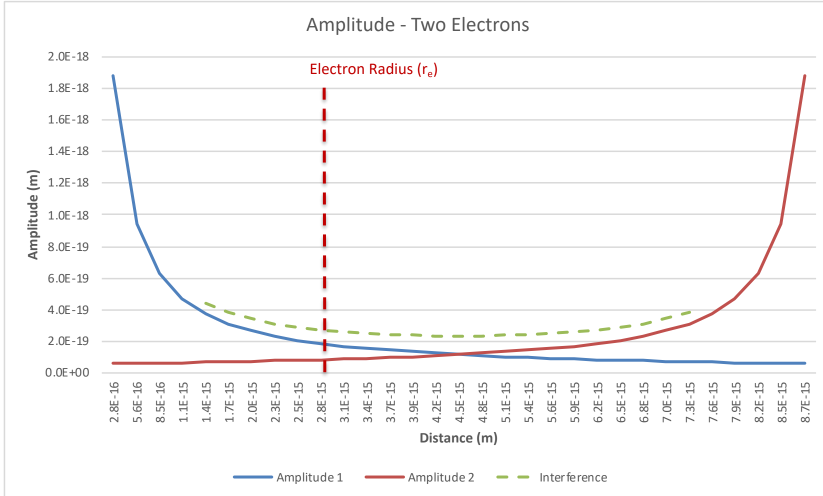


Fig 2.3 – Amplitude at Distance – Two Electrons

The wave amplitude of a positron and an electron are destructive. Unlike a proton, which is a composite particle, the electron will annihilate with a positron. Due to destructive wave interference, the combination of waves reaches zero amplitude between the particles. The positron and electron are attracted due to minimized amplitude between the particles until a resting point. In Fig. 2.4, the distance between the positron and electron is shown to be half the electron radius. This is the distance at which the Compton wavelength is derived and calculated in *Particle Energy and Interaction.*

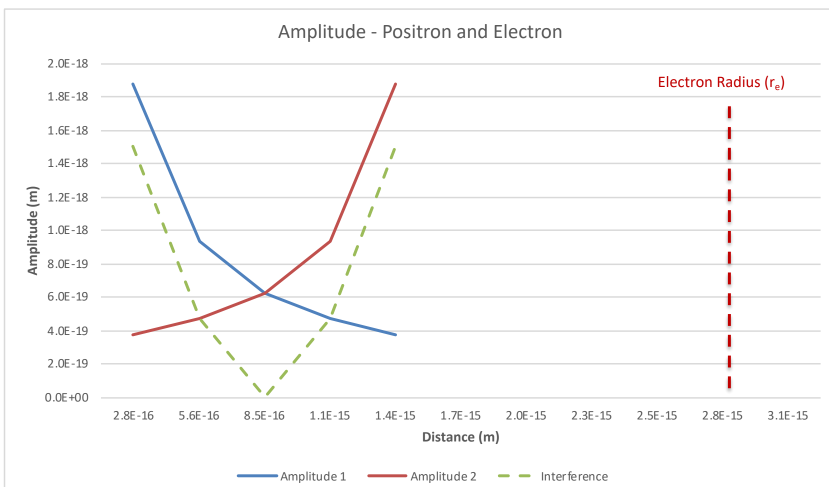


Fig 2.4 – Amplitude at Distance –Positron and Electron

The electric force is typically measured not by a single particle, but as a collection of many particles. The constructive wave interference of an entire group needs to be considered to calculate wave amplitude. For particles within reasonable vicinity, it can be estimated as fully constructive within the group, where it is the number of particles (Q) times the amplitude of a single particle. The electric force is the effect of wave interference of these particle groups (Q_1 and Q_2) separated at a distance (r). These are the variables of the electric force and all forces in this paper.

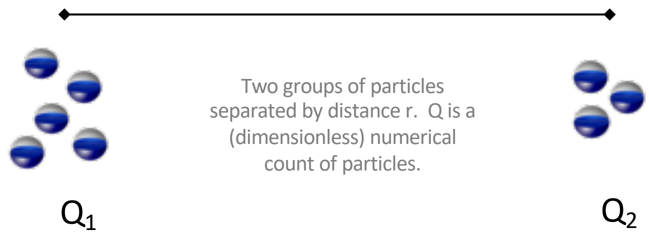


Fig 2.5 – Particle groups (Q) separated by distance (r)

From Fig. 3, the electric force in classical terms is:

$$F_e = E_e \frac{Q_1 r_e}{r} \frac{Q_2}{r} \tag{2.1}$$

To understand the previous equation, refer again to Fig. 2.1. As an energy (not force), setting distance r equal to the electron radius (r_e) results in the electron's energy (E_e). Beyond the radius, the energy of waves traveling from Q_1 to Q_2 now declines proportional to the electron radius and distance (r_e/r) as traveling waves, until reaching Q_2.

In *Particle Energy and Interaction*, the electron's energy and radius were derived in wave constant form as:

$$E_e = \frac{4\pi\rho K_e^5 A_l^6 c^2 O_e}{3\lambda_l^3} \tag{2.2}$$

Electron Energy

$$r_e = K_e^2 \lambda_l g_\lambda \tag{2.3}$$

Electron Radius

Substituting Eqs. 2.2 and 2.3 into Eq. 2.1 and then simplifying yields the electric force equation expressed in true wave constant format. It is used in the next section for calculations to prove its equivalence to known measurements.

$$F_e = \frac{4\pi\rho K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2} g_\lambda \left(\frac{Q_1 Q_2}{r^2}\right) \tag{2.4}$$

Electric Force

2.1. Electric Force Examples

The following examples demonstrate two particle groups (Q_1, Q_2) at a distance (r) calculated with the equation for the electric force in wave equation format (Eq. 1.2.1) and are compared against the equivalent using Coulomb's law.

Example 1 – Two electrons at a distance of 1.40E-10 meters

Eq. 1.2.1 is used for the electric force calculation with the following parameters. A negative sign is applied to the electron, whereas a positive sign will be used later for protons and positrons. These values are inserted into Eq. 2.1.1 and solved. There is no difference between this calculation and measured results validated with Coulomb's law.

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

$$F_e = \frac{4\pi\rho K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2} g_\lambda \left(\frac{(-1)\ (-1)}{(1.4\times10^{-10})^2} \right) = 1.177\cdot10^{-8} \left(\frac{kg\ (m)}{s^2} \right) \tag{2.1.1}$$

Calculated Value: 1.177E-8 newtons (kg m/s^2)
Difference – Coulomb's Law: 0.000%

Example 2 – Five electrons and ten protons at a distance of 1 meter

Q_1 is -5, representing five electrons. Now, Q_2 has a positive sign for 10 protons. A negative result for the force indicates an attractive force.

- $Q_1 = -5$
- $Q_2 = 10$
- $r = 1$ m

$$F_e = \frac{4\pi\rho K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2} g_\lambda \left(\frac{(-5)\ (10)}{(1)^2} \right) = -1.154\cdot10^{-26} \left(\frac{kg\ (m)}{s^2} \right) \tag{2.1.2}$$

Calculated Value: = -1.154E-26 newtons (kg m/s^2)
Difference – Coulomb's Law: 0.000%

This methodology was applied to additional calculations and placed in Table 1.1. From small distances to large, positive charges or negative, or single electrons or groups, the results are an exact match with Coulomb's law to 0.000% accuracy.

2.2. Deriving Coulomb's Constant (k)

Calculations in the previous section match Coulomb's law because Coulomb's constant (k) is a proportionality constant that represents many other constants. These other constants are wave constants. However, one issue that has prevented forces from being merged and consolidated into a single force is that one of the variables in Coulomb's law is charge. The units of charge are misleading. Instead of units of Coulombs, it should be given the units of distance (meters). When doing so, forces from Coulomb's law to Newton's 2nd law of motion align under a single force. This will be illustrated in the upcoming chapters.

Charge should be expressed as wave amplitude. Referring to Fig. 2.2 in the previous section, the Planck charge is the wave amplitude at the first wavelength from the electron's core. The amplitude at the core is calculated as K_eA_l in *Particle Energy and Interaction.* It is a combination of two waves along an axis combined at the core, so the Planck charge is half the amplitude (arriving from one side before merging with the other half at the core). It is expressed as:

$$q_P = 2A_l g_A^{-1} = 1.876 \cdot 10^{-18}\,(m) \tag{2.2.1}$$

Planck Charge

Note that the g-factor for amplitude (g_A) appears in charge equations. It is explained in *Fundamental Physical Constants.* In Fig. 2.2, amplitude declines from the electron core to become the elementary charge after transitioning to traveling waves. This decline is represented classically as the relationship between Planck charge and the elementary charge:

$$e_e = q_P\sqrt{\alpha_e} \tag{2.2.2}$$

The fine structure constant in Eq. 2.2.2 can be expressed in wave equation format. From *Fundamental Physical Constants,* the fine structure constant is:

$$\alpha_e = \frac{3\pi\lambda_l}{4K_e^4 A_l} = 0.00729736 \tag{2.2.3}$$

Fine Structure Constant

Eqs. 2.2.3 and 2.2.1 can be substituted into Eq. 2.2.2 and simplified:

$$e_e = \sqrt{\frac{3\pi\lambda_l A_l}{K_e^4}} \cdot g_A^{-1} = 1.602 \cdot 10^{-19}\,(m) \tag{2.2.4}$$

Elementary Charge

The challenge with the conversion of Coulomb's law to the electric force in wave constants is that the variables are represented as charge (q) in Coulomb's law. To simplify forces to a unified equation, it is necessary to use the dimensionless particle group count (Q), not charge. For example, Newton's 2nd law does not have variables of charge so the equations cannot be reconciled with Coulomb's law unless this is done.

The conversion from the dimensionless count of particles to charge is straightforward. The total charge (q) is calculated classically as the number of particles (Q) times the elementary charge (e_e). It is shown for Q_1 (Q_2 is the same and is not repeated).

$$q_1 = Q_1 e_e \tag{2.2.5}$$

$$Q_1 = \frac{q_1}{e_e} \tag{2.2.6}$$

Now, the particle group count (Q) can be replaced in the electric force equation (Eq. 1.2.1) and replaced with charge (q) to make the variables in the equation equivalent to the variables in Coulomb's law.

$$F_e = \frac{4\pi\rho K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2} g_\lambda \left(\frac{q_1}{e_e}\frac{q_2}{e_e}\frac{1}{r^2}\right) \tag{2.2.7}$$

The variables in Eq. 2.2.7 are q_1, q_2 and r. The elementary charge (e_e) is a constant and can be substituted using Eq. 2.2.4 and then simplified.

$$F_e = \frac{4\pi\rho K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2} g_\lambda \left(\frac{1}{\sqrt{\frac{3\pi\lambda_l A_l}{K_e^4}\cdot g_A^{-1}}}\right)^2 \left(\frac{q_1 q_2}{r^2}\right) \tag{2.2.8}$$

$$F_e = \frac{4\rho K_e^{11} A_l^5 c^2 O_e}{9\lambda_l^3} g_\lambda g_A^2 \left(\frac{q_1 q_2}{r^2}\right) \tag{2.2.9}$$

The variables in Eq. 2.2.9 are in parentheses. The remainder are constants, which can be aggregated into one – Coulomb's constant (k). It matches the known CODATA value to an accuracy of 0.000%.[4]

$$k_e = \frac{4\rho K_e^{11} A_l^5 c^2 O_e}{9\lambda_l^3} g_\lambda g_A^2 = 8.988\cdot 10^9 \left(\frac{kg\ (m)}{s^2}\right) \tag{2.2.10}$$

Coulomb's Constant

$$F_e = k_e \left(\frac{q_1 q_2}{r^2}\right) \tag{2.2.11}$$

Coulomb's Law

Note: The units of Coulomb's constant are kg * m/s^2, which is a force. Classically, Coulomb's constant (k) is measured in N * m^2/C^2. However, in energy wave theory the units of C (Coulombs) is measured in m (meters). 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. Gravitational Force - Derived and Explained

Gravity is a force on particles, like all other forces, when there is a difference in wave amplitude. In the case of gravity, there is a slight loss of longitudinal wave amplitude when particles convert in-waves to out-waves due to the spin of a particle. Particle spin requires energy and this energy is then transferred to a new, transverse wave that becomes magnetism – a change in wave form yet fully compliant with the conservation of energy principle. Magnetism is explained in Section 5, but the mechanism for spin is required here to explain gravity.

It is known that the electron and proton have spin. In fact, they have a strange spin of ½. If the electron consists of 10 wave centers (K_e), 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, most of 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 3.1 with a red circle representing the wave center off node. This model would explain the electron's strange spin of ½, which means it has a 720-degree rotation before returning to its original position.

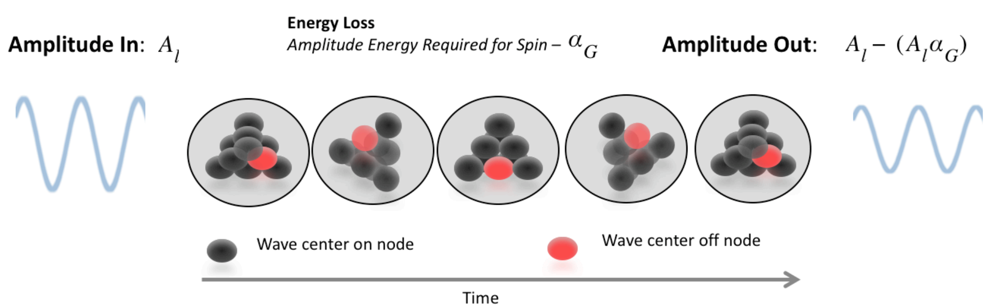


Fig 3.1 – Particle spin and amplitude effect

This model of the electron spin would always require energy because the wave center that needs to reposition is constantly changing. The energy for any particle that is required for spin reduces in-wave amplitude as it reflects to become an out-wave (α_G). For the electron, it is given a notation of α_{Ge}.

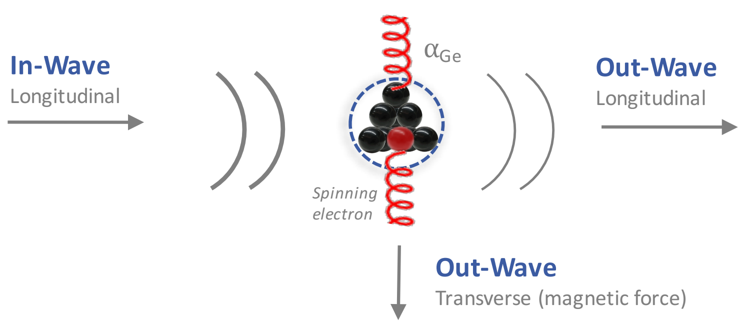


Fig 3.2 – Conservation of energy as longitudinal wave energy is absorbed for spin, creating a new transverse wave (spin of electron)

Due to the conservation of energy, the loss of longitudinal wave amplitude that becomes the force of gravity is converted to a new, transverse wave form that is the force of magnetism. Magnetism is the energy of a new wave that is created as the electron spins (illustrated as red spirals in Fig. 3.2). The loss of longitudinal out-wave amplitude is negligible for a single particle like an electron. However, it is a cumulative effect, such that a large group of particles that experience spin will be added to the loss of amplitude. In a large body, such as a planet with atoms that are electrically neutral, the amplitude difference is noticeable. It produces a shading effect between two bodies as amplitude is now lower on the interior between two bodies, causing an attraction. In Fig 3.3, a single electron is illustrated with an attraction to a large body consisting of many atoms (on right). The amplitude loss is the cumulative loss of each particle in the large body that is spinning. The equation for gravity is modeled to calculate this cumulative effect.

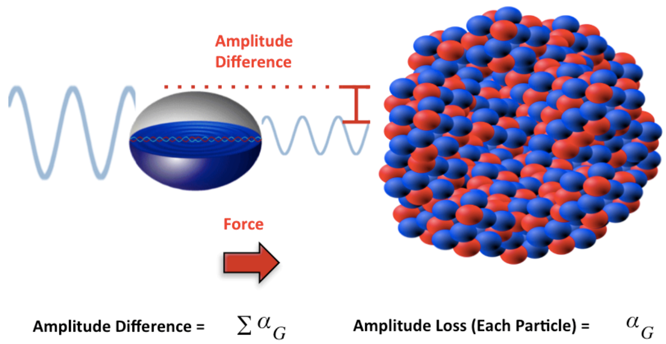


Fig 3.3 - Gravity

Coupling Constants

There are two coupling constants for gravity used in this paper. One for the electron and one for the proton. A coupling constant is a dimensionless value of a change in wave amplitude, relative to the electric force. As the electric force is the fundamental force – traveling longitudinal waves in space – any change in wave amplitude relative to this force will cause particle motion.

The coupling constant for the electron is described in the following figure. It is a slight change in wave amplitude of the in-wave compared to the out-wave leaving the electron.

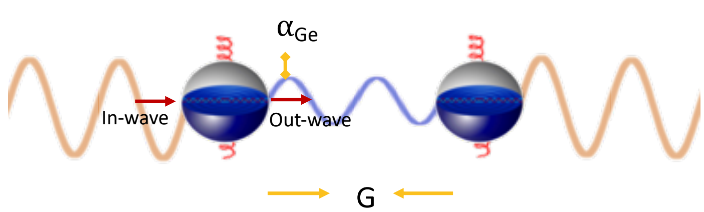


Fig 3.3 – Gravitational coupling constant for the electron

In classical terms, the gravitational coupling constant for the electron is expressed as the relationship between the gravitational constant (G) and Coulomb's constant (k_e), and the mass (m_e) and charge (e_e) of the electron as:

$$\alpha_{Ge} = \frac{G}{k_e}\left(\frac{m_e}{e_e}\right)^2 \tag{3.1}$$

The proton has a different gravitational coupling constant (α_{Gp}). It is similar to the electron's coupling constant (α_{Ge}), but since the proton has more mass, it is proportional to the proton-electron mass ratio squared, expressed as:

$$\alpha_{Gp} = \alpha_{Ge}\left(\frac{m_p}{m_e}\right)^2 \tag{3.2}$$

Both coupling constants can be expressed in terms of wave constants. For the electron, Coulomb's constant and the elementary charge were derived in Section 2. The electron mass was derived in *Particle Energy and Interaction*. And the gravitational constant (G) is derived coming up in this section later. For the proton, the proton-electron mass ratio is derived in *Fundamental Physical Constants*. The substitutions are made into the equations above and simplified.

$$\alpha_{Ge} = \frac{K_e}{6\pi}\left(\frac{\lambda_l}{4K_e^{15}A_l}\right)^3 g_\lambda^2 = 2.40\cdot 10^{-43} \tag{3.3}$$

Gravitational Coupling Constant - Electron

$$\alpha_{Gp} = \frac{K_e^7\lambda_l}{54\pi A_l}\left(\frac{\lambda_l}{4K_e^{15}A_l}\right)^3 g_\lambda^2 g_p^2 = 8.09\cdot 10^{-37} \tag{3.4}$$

Gravitational Coupling Constant - Proton

Gravitational Force Equation

From Fig. 3, the classical representation of the gravitational force is shown again in Eq. 3.5. The difference between the electric force and the gravitational force is the addition of the coupling constant (α_{Ge}) in the numerator. It is the reduction of wave amplitude for particle spin relative to the electric force.

$$F_g = E_e\frac{Q_1 r_e \alpha_{Ge}}{r}\frac{Q_2}{r} \tag{3.5}$$

Similarly, the force for the proton is the same equation as Eq. 3.5, but using the coupling constant for the proton.

$$F_g = E_e\frac{Q_1 r_e \alpha_{Gp}}{r}\frac{Q_2}{r} \tag{3.6}$$

Most of the calculations in this paper will be based on the much heavier proton in the atom's nucleus. The electron's coupling constant will be used later in this section for the derivation of the gravitational constant (G) and the Bohr magneton.

To derive the gravitational force equation in wave constant format, the classical constants for electron energy (E_e), electron radius (r_e) and gravitational coupling constant for the proton (α_{Gp}) can be replaced in Eq. 3.6. They can be found in Eqs. 2.2, 2.3 and 3.4 respectively.

$$F_g = \frac{4\pi\rho K_e^5 A_l^6 c^2 O_e}{3\lambda_l^3} \frac{Q_1 (K_e^2\lambda_l g_\lambda)\left(\frac{K_e^7\lambda_l}{54\pi A_l}\left(\frac{\lambda_l}{4K_e^{15}A_l}\right)^3 g_\lambda^2 g_p^2\right)}{r} \frac{Q_2}{r} \tag{3.7}$$

$$F_g = \frac{\rho\lambda_l^2 c^2 O_e}{2K_e^{31}}\left(\frac{A_l}{36}\right)^2 g_\lambda^3 g_p^2\left(\frac{Q_1 Q_2}{r^2}\right) \tag{3.8}$$

Gravitational Force

Eq. 3.8 will be used in the upcoming section for gravitational force calculations and will be compared to measurements and force calculations using Newton's law of universal gravitation.

Surface Gravity Equation (Acceleration)

In addition to gravitational forces, the acceleration due to gravity can be calculated using the same coupling constant for the proton, particle count (Q) and radius (r) of a large body. In classical format, the force of gravity can be rewritten from Eq. 3.6 to separate the components of the electron energy (E_e) as $m_e c^2$.

$$F_g = m_e c^2 \frac{Q_1 r_e \alpha_{Gp}}{r} \frac{Q_2}{r} \tag{3.9}$$

Using Newton's 2nd law of motion, where F=ma, mass can be separated from this equation to solve for gravitational acceleration (a_g). In removing the electron mass, since the coupling constant is based on the proton, the proton-electron mass ratio is appended to the equation for the conversion.

$$a_g = c^2 \frac{Q_1 r_e \alpha_{Gp}}{r} \frac{Q_2}{r}\left(\frac{m_e}{m_p}\right) \tag{3.10}$$

The proton-electron mass ratio is found in the *Fundamental Physical Constants* paper. Replacing the constants in Eq. 3.10 and then simplifying yields an equation for surface gravity acceleration in wave constant format.

$$a_g = c^2 \frac{Q_1 (K_e^2\lambda_l g_\lambda)\left(\frac{K_e^7\lambda_l}{54\pi A_l}\left(\frac{\lambda_l}{4K_e^{15}A_l}\right)^3 g_\lambda^2 g_p^2\right)}{r} \frac{Q_2}{r}\left(\frac{3\sqrt{A_l}\cdot K_e^{-3}}{g_p\sqrt{\lambda_l}}\right) \tag{3.11}$$

$$a_g = \frac{c^2}{9\pi K_e^{39}}\sqrt{\frac{\lambda_l^9}{(4A_l)^7}}\cdot g_\lambda^3 g_p\left(\frac{Q_1 Q_2}{r^2}\right) \tag{3.12}$$

Surface Gravity (Acceleration)

3.1. Gravitational Force Examples

This section demonstrates example calculations of the gravitational force and surface gravity wave equations from the previous section. Two examples are provided for gravity, calculating the force of the Earth on the Moon and also on the Sun. The remaining calculations are provided in Table 1.1, all of which match expected values (accurate to 0.000% when compared to calculations using Newton's law of universal gravitation). One example is provided for the acceleration of surface gravity on Earth.

The calculation of the number of particles (Q) is required for the calculation of any force in this paper. For gravitational calculations, it must be estimated from a known property of large bodies – its mass. Since the proton is used as the coupling constant in the gravitational force equation, the mass of a large body is divided by the mass of proton to arrive at the particle count (Q) – Eq. 3.1.1. *Note that this value represents a good estimate of the number of nucleons (protons and neutrons) in a large body since they are much heavier than an electron.*

$$Q_{planet} = \frac{m_{planet}}{m_p} \tag{3.1.1}$$

Particle Count (Q) for Large Bodies

The example calculations below use the mass of the Earth, Sun and Moon divided by the proton's mass:

$$Q_{earth} = \frac{m_{earth}}{m_p} = \frac{5.972\times10^{24}}{1.67262\times10^{-27}} = 3.570\cdot10^{51} \tag{3.1.2}$$

$$Q_{sun} = \frac{m_{sun}}{m_p} = \frac{1.989\times10^{30}}{1.67262\times10^{-27}} = 1.189\cdot10^{57} \tag{3.1.3}$$

$$Q_{moon} = \frac{m_{moon}}{m_p} = \frac{7.348\times10^{22}}{1.67262\times10^{-27}} = 4.393\cdot10^{49} \tag{3.1.4}$$

Example 1 – Earth and Sun at a distance of 1.50E11 meters

In this example, the gravitational force of the Earth and Sun is calculated using a mean distance of 150 million kilometers (1.50E11 meters). The wave equation for gravitational force (Eq. 1.2.2) requires a particle count for these two bodies. From the previous section, the Q values for the Earth and Sun are found in Eqs. 3.1.2 and 3.1.3 respectively and summarized below:

- $Q_1 = 3.570 \times 10^{51}$
- $Q_2 = 1.189 \times 10^{57}$
- $r = 1.50 \times 10^{11}$ m

$$F_g = \frac{\rho \lambda_l^2 c^2 O_e}{2K_e^{31}} \left(\frac{A_l}{36}\right)^2 g_\lambda^3 g_p^2 \left(\frac{(3.57\cdot 10^{51})\ (1.189\cdot 10^{57})}{(1.5\times 10^{11})^2}\right) = 3.523\cdot 10^{22} \left(\frac{kg\,(m)}{s^2}\right) \qquad \textbf{(3.1.5)}$$

Calculated Value: 3.523E22 newtons (kg m/s^2)
Difference – Newton's Law: 0.000%

Example 2 – Earth and Moon at a distance of 3.85E8 meters

In this example, the force of gravity of the Earth on the Moon is calculated using the same equation as above, but replacing Q_2 with the value for the moon from Eq. 3.1.4 and the distance between the Earth and Moon.

- $Q_1 = 3.570 \times 10^{51}$
- $Q_2 = 4.393 \times 10^{49}$
- $r = 3.85 \times 10^8$ m

$$F_g = \frac{\rho \lambda_l^2 c^2 O_e}{2K_e^{31}} \left(\frac{A_l}{36}\right)^2 g_\lambda^3 g_p^2 \left(\frac{(3.57\cdot 10^{51})\ (4.393\cdot 10^{49})}{(3.85\times 10^{8})^2}\right) = 1.976\cdot 10^{20} \left(\frac{kg\,(m)}{s^2}\right) \qquad \textbf{(3.1.6)}$$

Calculated Value: 1.976E20 newtons (kg m/s^2)
Difference – Newton's Law: 0.000%

The remainder of the planets in the solar system were calculated using the same methodology and found to agree with Newton's law of universal gravitation. The results for some of these planets were added to Table 1.1.

Example 3 – Surface Gravity of Earth (Gravitational Acceleration)

In the previous section, an equation for acceleration was derived from the gravitational force (Eq. 3.12). It can be used to calculate the surface gravity of planets, such as Earth which has a known surface gravity of 9.81 m/s^2. To use this equation, the number of particles for Earth is used as Q_1, from Eq. 3.1.2. All objects accelerate at the same rate, so Q_2 is set to a single particle (*additional particles do not increase the rate of acceleration in a body*). The radius of the Earth is 6,375,223 meters. These are the variables for Eq. 3.12:

- $Q_1 = 3.570 \times 10^{51}$
- $Q_2 = 1$
- $r = 6{,}375{,}223$ m

$$a_g = \frac{c^2}{9\pi K_e^{39}} \sqrt{\frac{\lambda_l^9}{(4A_l)^7}} \cdot g_\lambda^3 g_p \left(\frac{(3.57\cdot 10^{51})\ (1)}{(6.37522\times 10^{6})^2}\right) = 9.81 \left(\frac{m}{s^2}\right) \qquad \textbf{(3.1.7)}$$

Calculated Value: 9.81 m/s^2
Difference – Surface Gravity Measurements: 0.00%

The same methodology was applied to the planets in the solar system and are presented in the following table. **The source values of g was available to two decimal places**. However, the calculated values extend beyond two decimal places, resulting in a difference in the known values and calculated values. Upon closer inspection, rounding up or down to the nearest decimal would result in a match against the known values for each of the calculations.

Surface Gravity (g)	Radius	Mass	Nucleon Count	Value	Calculated	% Diff
Sun	695,700,000	1.9886E+30	1.18888E+57	274.00	**274.21**	-0.08%
Jupiter	71,492,000	1.8986E+27	1.1351E+54	24.79	**24.79**	-0.01%
Saturn	60,268,000	5.6836E+26	3.39802E+53	10.44	**10.44**	-0.03%
Uranus	25,559,000	8.681E+25	5.19006E+52	8.87	**8.87**	0.01%
Neptune	24,764,000	1.0243E+26	6.12392E+52	11.15	**11.15**	0.02%
Earth	6,375,223	5.972E+24	3.57044E+51	9.81	**9.81**	0.00%
Venus	6,051,800	4.8675E+24	2.9101E+51	8.87	**8.87**	0.00%
Mars	3,396,200	6.4171E+23	3.83655E+50	3.71	**3.71**	-0.06%
Mercury	2,439,700	3.3011E+23	1.97361E+50	3.70	**3.70**	-0.04%
Moon	1,738,100	7.3477E+22	4.39291E+49	1.62	**1.62**	-0.20%
Pluto	1,187,000	1.303E+22	7.79016E+48	0.62	**0.62**	0.45%

Table 3.1 –Surface gravity calculations (force calculated in m/s^2)

Notes about the references for values in Table 3.1:

- Values for radius, mass and the surface gravity value (g) were obtained from Wikipedia pages for each of the planets with the exception of Uranus. The NASA fact sheet on Uranus was used for its surface gravity value.[5]
- Equatorial radius was used as the radius for planets unless it was not present, in which case the mean radius was used. Earth is the only exception for radius. The radius used for the Earth is 6,375,223 meters to be consistent with Newton's calculation to arrive at the known surface gravity of Earth.

3.2. Deriving the Gravitational Constant (G)

Calculations in the previous section match Newton's law of universal gravitation because the Gravitational constant (G) is a proportionality constant that represents many other constants. The other constants are wave constants. However, for purposes of explaining the derivation, the starting point will use classical terms and the illustration in the summary section from Fig. 3. The gravitational force is described as the electrical force with a loss of wave amplitude, and for the electron, this loss is based on the gravitational coupling constant for the electron. The equation is shown again in Eq. 3.2.1.

$$F_g = E_e \frac{Q_1 r_e \alpha_{Ge}}{r} \frac{Q_2}{r} \qquad \textbf{(3.2.1)}$$

The electron's energy can be split to be electron mass and wave speed, according to $E=mc^2$. The variables for the equation are also re-arranged to be on the right in parentheses.

$$F_g = m_e c^2 r_e \alpha_{Ge} \left(\frac{Q_1 Q_2}{r^2} \right) \qquad \textbf{(3.2.2)}$$

Newton's law of universal gravitation uses mass (m), not particle count (Q) as variables. For the same reason that Coulomb's law needs to be converted from charge to particle count, as shown in Section 2, the same is done here. This allows all of the force equations to be reconciled to common variables to unify force equations. The relationship of total mass (m) to particle count is the summation of the number of electron masses ($Q * m_e$). It is shown for Q_1 in the following equation and not replicated for Q_2 which is the same.

$$m_1 = Q_1 m_e \tag{3.2.3}$$

$$Q_1 = \frac{m_1}{m_e} \tag{3.2.4}$$

Eq. 3.2.4 can be substituted into Eq. 3.2.2 for both particle counts (Q_1 and Q_2). One electron mass then cancels.

$$F_g = m_e c^2 r_e \alpha_{Ge} \left(\frac{m_1}{m_e} \frac{m_2}{m_e} \frac{1}{r^2} \right) \tag{3.2.5}$$

$$F_g = \frac{1}{m_e} c^2 r_e \alpha_{Ge} \left(\frac{m_1 m_2}{r^2} \right) \tag{3.2.6}$$

The constants on the left of the parentheses are now the constants of the gravitational constant (G). However, they can be converted to true wave equation format by substituting the classical constants with wave constants. The wave constant forms of the electron mass, electron radius and electron gravitational coupling constant are found in Eqs. 2.2 (energy without c^2), 2.3 and 3.3 respectively. They are substituted into Eq. 3.2.6 and then simplified.

$$F_g = \frac{1}{\frac{4\pi \rho K_e^5 A_l^6 O_e}{3\lambda_l^3}} c^2 (K_e^2 \lambda_l g_\lambda) \left(\frac{K_e}{6\pi} \left(\frac{\lambda_l}{4K_e^{15} A_l} \right)^3 g_\lambda^2 \right) \left(\frac{m_1 m_2}{r^2} \right) \tag{3.2.7}$$

$$F_g = \frac{\lambda_l^7 c^2}{\pi^2 \rho K_e^{47} O_e} \frac{1}{(2A_l)^9} g_\lambda^3 \left(\frac{m_1 m_2}{r^2} \right) \tag{3.2.8}$$

The constants to the left of the parentheses are the components of the gravitational constant. When combined into one "proportionality" constant (G), it is the force of Newton's law of universal gravitation. The value of G matches in both units and value.

$$G = \frac{\lambda_l^7 c^2}{\pi^2 \rho K_e^{47} O_e} \frac{1}{(2A_l)^9} g_\lambda^3 = 6.674 \cdot 10^{-11} \frac{m^3}{(kg)\, s^2} \tag{3.2.9}$$

Gravitational Constant

$$F = G \frac{m_1 m_2}{r^2} \tag{3.2.10}$$

Newton's Law of Universal Gravitation

3.3. Deriving the Bohr Magneton (μ_B)

The Bohr magneton expresses the electron's magnetic moment. A separate section is dedicated to the magnetic force, but the derivation of the Bohr magneton is included here in this section on gravity to prove the relation of magnetism and gravity – as the conservation of energy – as longitudinal out-waves lose some energy to transverse waves created as the electron spins. It was described and illustrated earlier in this section in Figs. 3.1 and 3.2.

The starting point for the explanation and proof that gravity and magnetism are related is an understanding of the units of the Bohr magneton. Energy is always conserved, but the Bohr magneton is not represented in terms of energy. Its units are J/T (joules per Tesla). Joules are energy, but Tesla requires a derivation in units for wave constants to understand its meaning. A Tesla is units of kg / (C * s), but as it was shown in Section 2, Coulombs are wave amplitude, which is a distance (meters). When this is replaced, the units of the Bohr magneton resolve to be cubic meters per second – a volume flow rate.

$$\frac{J}{T} = \frac{kg\frac{m^2}{s^2}}{\frac{kg}{Cs}} = \frac{kg\frac{m^2}{s^2}}{\frac{kg}{(m)\,s}} = \frac{m^3}{s} \tag{3.3.1}$$

Bohr magneton units

Knowing the true units, Fig. 3.2 is updated to illustrate a transverse wave volume that is created from particle spin.

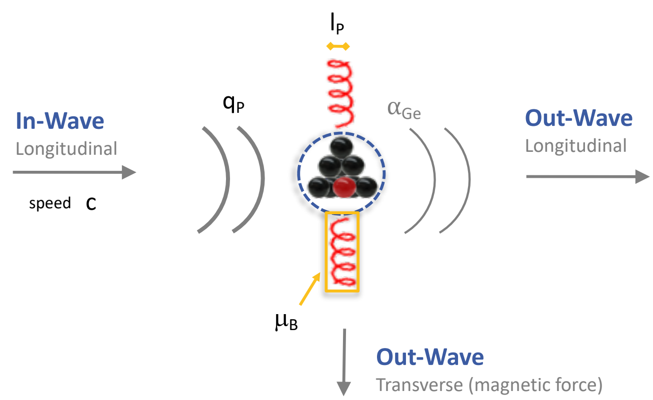


Fig. 3.3.1 – Bohr magneton transverse wave flow

The classical constants for wave speed (c), Planck charge (q_P) and Planck length (l_P) are used in Fig. 3.3.1 to describe the Bohr magneton. In these terms, the Bohr magneton can be expressed as follows in Eq. 3.3.1. Because Planck time (t_P) is the time that it takes to travel a distance of Planck length at the speed of light, Eq. 3.3.2 is also true after substitution. Eq. 3.3.1 can also be expressed in terms of wave constant amplitude, replacing Planck charge in Eq. 3.3.3. All three equations match in value to the Bohr magneton and have units of m^3/s.

$$\mu_B = \frac{l_P q_P c}{2}\sqrt{\frac{1}{\alpha_{Ge}}} \tag{3.3.1}$$

$$\mu_B = \frac{l_P l_P q_P}{2t_P}\sqrt{\frac{1}{\alpha_{Ge}}} \quad \textbf{(3.3.2)}$$

$$\mu_B = \frac{1}{4}(l_P K_e A_l)\,c\sqrt{\frac{1}{\alpha_{Ge}}}\cdot g_A^{-1} = 9.274\cdot 10^{-24}\left(\frac{m^3}{s}\right) \quad \textbf{(3.3.3)}$$

Using Eq. 3.3.2, the illustration in Fig. 3.3.1 can be described as the flow of the transverse wave through a cross section with sides of Planck length (l_P) in a time of Planck time (t_P). From Section 2, Planck charge (q_P) is the wave amplitude at the first wavelength at the particle core, which now goes through a transformation (square root of gravitational coupling constant). It is the inclusion of this gravitational coupling constant that is the first clue of the relationship between magnetism and gravity. The Planck length distance in this equation is also important.

Gravity and magnetism are linked due to a conservation of energy, so the starting point for the wave equation form to derive the Bohr magneton requires an energy equation. The complete form of the longitudinal energy equation was included in *Particle Energy and Interaction.* The in-wave and out-wave energy in complete form is:

$$E_{l(in)} = \frac{1}{2}\rho\left(\frac{4}{3}\pi(K_e\lambda_l)^3\right)\left(\frac{c}{\lambda_l\sqrt{\left(1+\frac{v}{c}\right)}}\frac{(K_eA_l)^3}{(K_e\lambda_l)^2}\right)\left(\frac{c}{\lambda_l\sqrt{\left(1-\frac{v}{c}\right)}}\frac{(K_eA_l)^3}{(K_e\lambda_l)^2}\right) \quad \textbf{(3.3.4)}$$

$$E_{l(out)} = \frac{1}{2}\rho\left(\frac{4}{3}\pi(K_e\lambda_l)^3\right)\left(\frac{c}{\lambda_l\sqrt{\left(1+\frac{v}{c}\right)}}\frac{(K_eA_l)^2K_e(A_l-A_l\sqrt{\alpha_{Ge}})}{(K_e\lambda_l)^2}\right)\left(\frac{c}{\lambda_l\sqrt{\left(1-\frac{v}{c}\right)}}\frac{(K_eA_l)^2K_e(A_l+A_l\sqrt{\alpha_{Ge}})}{(K_e\lambda_l)^2}\right) \quad \textbf{(3.3.5)}$$

There is a slight difference in energy between the in-wave and out-wave. It's negligible for calculating the energy of a single electron but must be considered for a cumulation of many particles. For a single electron, the ratio of the difference resolves to be the gravitational coupling constant for the electron.

$$\frac{E_{l(in)}-E_{l(out)}}{E_{l(in)}} = \alpha_{Ge} \quad \textbf{(3.3.6)}$$

The energy difference between the longitudinal in-wave and out-wave is 4.59E-57 joules. It is perfectly conserved as the new transverse wave energy is created (E_m).

$$E_m = E_{l(in)} - E_{l(out)} = 4.59\cdot 10^{-57}\left(\frac{kg\,(m^2)}{s^2}\right) \quad \textbf{(3.3.7)}$$

The magnetic energy of the transverse wave can be represented as the following, equal to the energy loss of the longitudinal waves at 4.59E-57 joules. Note that the volume is represented in classical terms of Planck length (l_P) to be consistent with Eq. 3.3.3. It can be derived in wave constant terms, but it is left in the equation to explain the Bohr magneton.

$$E_m = \frac{1}{\alpha_e}\rho l_P^3\left(\frac{(K_e A_l)^3 c}{(K_e^2\lambda_l)^3}\right)\left(\frac{(K_e A_l)^3 c}{(K_e^2\lambda_l)^3}\sqrt{\frac{1}{\alpha_{Ge}}}\right)g_\lambda g_A = 4.59\cdot 10^{-57}\left(\frac{kg\,(m^2)}{s^2}\right) \tag{3.3.8}$$

The previous equation is an energy equation. The Bohr magneton is a volume flow rate. Eq. 3.3.8 can be rearranged to show the components of the equation for the Bohr magneton.

$$E_m = \frac{1}{\alpha_e}\rho\left(\frac{(K_e A_l)^3 c}{(K_e^2\lambda_l)^3}\right)\left(\frac{(l_P K_e A_l)^2}{(K_e^2\lambda_l)^3}(l_P K_e A_l)\,c\sqrt{\frac{1}{\alpha_{Ge}}}\right)g_\lambda g_A \tag{3.3.9}$$

Comparing the equation for the Bohr magneton from Eq. 3.3.3 to the energy equation in Eq. 3.3.9, the highlighted component circled in red is the Bohr magneton. However, the difference is a factor of ¼. The proposed geometry of the electron is a tetrahedron (from Fig. 3.1). A tetrahedron has four faces (also four vertices). It is suggested that there are four transverse waves produced per wavelength, originating from each face or vertex and traveling in different directions, such that four Bohr magnetons would equal the value highlighted in Eq. 3.3.9. Yet, since they travel in different directions, only one is measured at a given point in space to be equal to the Bohr magneton. Finally, Eq. 3.3.3 is converted to true wave constants by replacing Planck length (from *Fundamental Physical Constants*) and the gravitational coupling constant for the electron (from Eq. 3.3). It yields the final derivation of the Bohr magneton.

$$\mu_B = \frac{\frac{1}{\sqrt{2}}\frac{\lambda_l^2}{12\pi K_e^{18}A_l}g_\lambda^2(2A_l g_A^{-1})\,c}{2}\sqrt{\frac{1}{\frac{K_e}{6\pi}\left(\frac{\lambda_l}{4K_e^{15}A_l}\right)^3 g_\lambda^2}} \tag{3.3.10}$$

$$\mu_B = 2K_e^4 c\sqrt{\frac{\lambda_l A_l^3}{3\pi}}\cdot g_\lambda g_A^{-1} = 9.274\cdot 10^{-24}\left(\frac{m^3}{s}\right) \tag{3.3.11}$$

Bohr magneton

4. Strong Force - Derived and Explained

The strong force is a similar wave transformation like gravity, but is a much stronger transfer of energy as longitudinal in-wave amplitude is significantly reduced and converted to a transverse wave that is recognized as a gluon between two particles. This section describes the strong force equation, and a later section (Section 4.2) addresses the structure of a proton and how its components may be arranged to create this force.

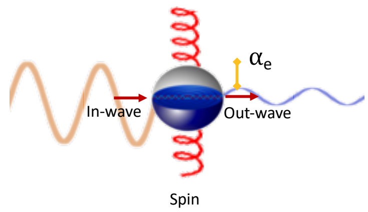


Fig. 4.1 – Strong force wave transformation

Strong Force

Measurements of the strong force have shown that it is about 137 times stronger than the electric force, which is the *inverse* of the fine structure constant (α_e).[6] The starting point for the derivation is once again the classical representation from the introduction in Fig. 3. The only difference with this force and the electric force is the addition of the fine structure constant in the denominator.

$$F_s = E_e \frac{Q_1 r_e}{\alpha_e r} \frac{Q_2}{r} \tag{4.1}$$

The classical terms for the electron mass, radius and fine structure constant can be replaced with wave constants from Eqs. 2.2, 2.3 and 2.2.3 respectively and simplified. It is the strong force in wave constant form.

$$F_s = \frac{4\pi\rho K_e^5 A_l^6 c^2 O_e}{3\lambda_l^3} K_e^2 \lambda_l g_\lambda \frac{4K_e^4}{3\pi} \left(\frac{A_l}{\lambda_l}\right)\left(\frac{Q_1 Q_2}{r^2}\right) \tag{4.2}$$

$$F_s = \frac{16\rho K_e^{11} A_l^7 c^2 O_e}{9\lambda_l^3} g_\lambda \left(\frac{Q_1 Q_2}{r^2}\right) \tag{4.3}$$

Strong force

Orbital Force

The strong force is known to apply only at short distances, less than 2.5 fm, or roughly the radius of the electron.[7] At distances less than the radius of the electron, longitudinal waves are standing in form. Standing waves have nodes of zero amplitude, creating a potential place for a particle to reside. But beyond this radius, waves are traveling in form. The strong force likely has a remnant effect, and one that causes an electron to stay in an orbital around a proton, as opposed to annihilate like it does with a positron (which has the same charge as the proton).

A proton is known to be a composite particle, including at least three quarks. As spherical longitudinal waves converge on these particles, each particle is transformed according to the strong force equation from Eq. 4.1. An axial wave that passes through two of these "quarks" in a proton will go through this transformation twice, and will continue to have a transverse wave along this axis. Figure 4.2 illustrates this transformation through two "quarks", creating the gluon (in red) and continuing as a transverse wave until reaching an orbital electron at a distance (r).

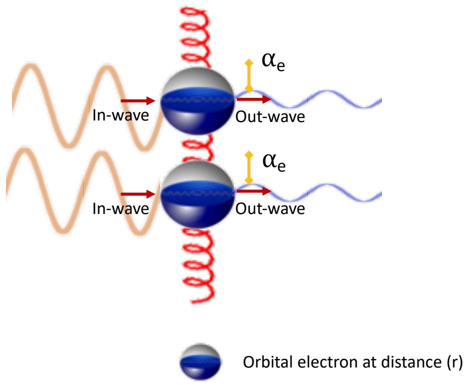


Fig. 4.2 – Orbital force wave transformation

In classical format, the wave along this axis that goes through two transformations is expressed as:

$$F_o = E_e \left(\frac{Q_1 r_e}{\alpha_e r} \right)^2 \frac{Q_2}{r} \quad \textbf{(4.4)}$$

The classical terms for the electron mass, radius and fine structure constant can be replaced with wave constants from Eqs. 2.2, 2.3 and 2.2.3 respectively and simplified.

$$F_o = \frac{4\pi\rho K_e^5 A_l^6 c^2 O_e}{3\lambda_l^3} \left(\frac{\dfrac{Q_1 K_e^2 \lambda_l g_\lambda}{3\pi\lambda_l}}{\dfrac{3\pi\lambda_l}{4K_e^4 A_l} r} \right)^2 \frac{Q_2}{r} \quad \textbf{(4.5)}$$

$$F_o = \frac{64\rho K_e^{17} A_l^8 c^2 O_e}{27\pi\lambda_l^3} g_\lambda^2 \left(\frac{Q_1^2 Q_2}{r^3} \right) \quad \textbf{(4.6)}$$

Orbital force

* In the *Atomic Orbitals paper,* additional particles in the proton are introduced and summarized as Q for reasons that are detailed in that paper. For the example in this paper, it is kept simple to compare to other forces and because the particle count for Q_1 in these examples is one (1).

4.1. Strong Force Examples

The strong force calculations in this section model the separation of particles at three electron wavelengths and four electron wavelengths. Section 4.2 provides a proposed geometry and the possible reason for these distances.

Example 1 – Quark Separation (Distance of 8.45E-16)

In this example, the strong force of two quarks in a proton is modeled as two electrons and a separation of one electron wavelength ($K_e\lambda_l$) between the edges of the two electron cores. Because the electron cores have a radius of $K_e\lambda_l$ each, the total distance (r) is 3 $K_e\lambda_l$ or 0.8454 fm. Q_1 and Q_2 are -1 and -1 each for two electrons. A strong force value of 4.424E4 newtons is obtained.

$$r = 3K_e\lambda_l g_\lambda = 0.8454fm \qquad \textbf{(4.1.1)}$$

The following variables are now used for the strong force equation (Eq. 4.3):

- $Q_1 = -1$
- $Q_2 = -1$
- $r = 8.454 \times 10^{-16}$ m

$$F_s = \frac{16\rho K_e^{11} A_l^7 c^2 O_e}{9\lambda_l^3} g_\lambda \left(\frac{(-1)\,(-1)}{(8.454 \cdot 10^{-16})^2} \right) = 44236 \left(\frac{kg\,(m)}{s^2} \right) \qquad \textbf{(4.1.2)}$$

Calculated Value: 4.424E4 newtons (kg m/s^2)

Example 2 – Nucleon Separation (Distance of 1.127E-15)

Example 2 is very similar to Example 1, using two electrons but now with a separation distance of two electron wavelengths ($2K_e\lambda_l$) to represent the separation distance of nucleons. Considering the radius of each electron core, the total distance between the two particle cores is four electron wavelengths (4 $K_e\lambda_l$) or 1.127 fm. At this distance, the calculated force is 2.489E4 newtons and is consistent with measurements for nucleon binding.

$$r = 4K_e\lambda_l g_\lambda = 1.127fm \qquad \textbf{(4.1.3)}$$

The following variables are now used for the strong force equation (Eq. 4.3):

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

$$F_s = \frac{16\rho K_e^{11} A_l^7 c^2 O_e}{9\lambda_l^3} g_\lambda \left(\frac{(1)\,(1)}{(1.127 \cdot 10^{-15})^2} \right) = 24891 \left(\frac{kg\,(m)}{s^2} \right) \qquad \textbf{(4.1.4)}$$

Calculated Value: 2.489E4 newtons (kg m/s^2)
Difference – Observation: 0.466%

Fig. 4.1.1 shows the separation force, in units of 10,000 newtons, for two nucleons at separation distances measured in femtometers. The force is at a maximum at slightly more than 1 femtometer (1E-15 meters), with a force of -2.5E4 newtons, consistent with the previous calculation.

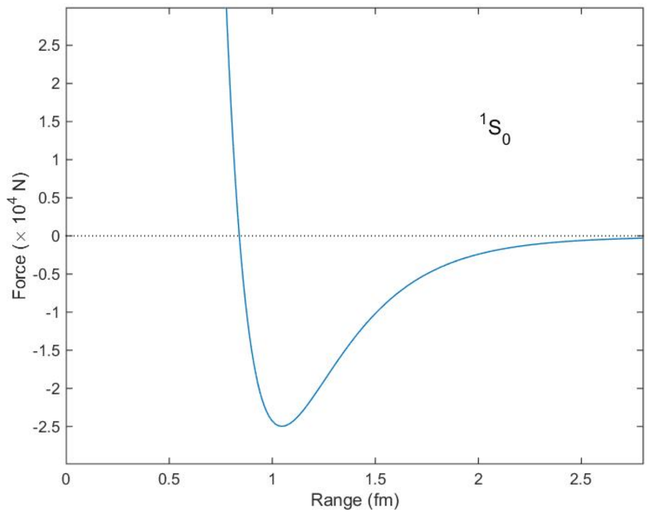


Fig 4.1.1 – Nuclear Force Error! Bookmark not defined.

Example 3 – Orbital Electron Separation (Distance of Bohr Radius)

A wave passing through a proton that coincides with the axis of two "quarks" in a proton goes through two transformations as it passes through particles. The orbital force equation (from Eq. 4.6) models the effect that it has on an orbital electron. This example uses hydrogen, where the orbital electron is known to have the best probable location at the Bohr radius (5.2918E-11 m).

The following variables are now used for the strong force equation (Eq. 4.3):

- Q_1 = -1
- Q_2 = -1
- r = 5.2918 x 10^{-11} m

$$F_o = \frac{64\rho K_e^{17} A_l^8 c^2 O_e}{27\pi\lambda_l^3} g_\lambda^2 \frac{(1)^2}{(5.2918\cdot 10^{-11})^3} = 8.239\cdot 10^{-8}\left(\frac{kg\,(m)}{s^2}\right) \quad \textbf{(4.1.5)}$$

Calculated Value: 8.239E-8 newtons (kg m/s²)
Difference – Coulomb Force: 0.000%

This orbital force matches the electric force at this distance (refer to Table 1.1), for a difference of 0.000% when compared to the Coulomb force. It is not a coincidence. The orbital force declines with the cube of distance. It is very strong at short distances and decreases in amplitude quickly. By declining at the cube of distance, it will eventually reach the same amplitude as the Coulomb force, which is spherical longitudinal waves declining at the square of distance. Particles move to minimize wave amplitude, so this is the position at which the electron has a stable orbit – but only when aligned on the axis of this transverse wave. At other times, it has a *probable* location, creating a strange orbit around the nucleus.

Over 450 orbitals distances are calculated for electrons in various atomic configurations in the *Atomic Orbitals* paper using this methodology of setting the orbital force equal to the Coulomb force to determine electron location. Further examples to calculate orbital distances and energies are provided in that paper.

4.2. Explaining the Quark and Nucleon Binding Process

This section theorizes possible structures for the proton and atomic nuclei binding, matching data from the strong force calculations in this paper 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 were addressed in *Fundamental Physical Constants*. Here, the proton structure related to gluons and the strong force is addressed.

As it was seen in *Particle Energy and Interaction*, standing waves have nodes where amplitude is zero, creating a position where a particle may reside. 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 could lock together and take a new form.

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

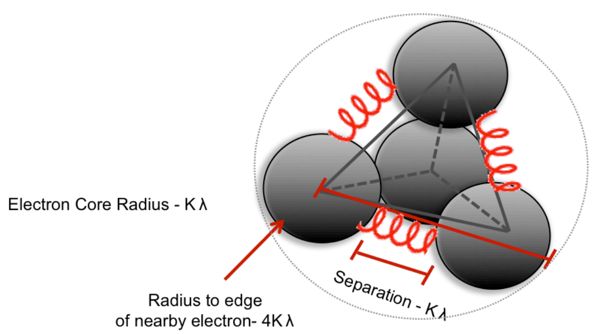


Fig 4.2.1 – Electron Gluons

Notes:

- The inside edges of the electron cores are separated by one electron wavelength, $K_e\lambda_l$.
- The radius of each electron core is $K_e\lambda_l$, thus the total distance between two electron centers is $3K_e\lambda_l$, or 0.845fm.
- The distance of the base of the tetrahedron, i.e. the edge of one electron to the far edge of the other electron, is $5K_e\lambda_l$. In the *Fundamental Physical Constants* paper, a tetrahedron with this base length is calculated to have a radius of 0.868fm to the circumsphere, in between recent measurements of the radius of the proton.[8]

In Example 2 of Section 4.1, it was found that two electrons (or two positrons) with a separation distance of two electron wavelengths had a force of 2.489E4 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.

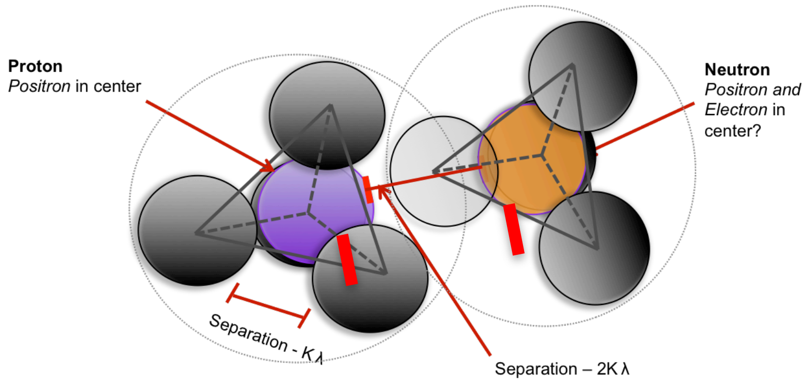


Fig 4.2.2 – Nucleon Binding

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).[9]
- The particle cores are separated by two electron wavelengths ($2K_e\lambda_l$), or from center-to-center of each of these cores, it is a separation of $4K_e\lambda_l$, or 1.127fm.

The explanation of electrons as quarks is contrary to the current understanding of electrons. Two electrons repel. In wave theory, it is possible to place two electrons at wavelengths if they are within the standing wave structure. This is due to the fact that at a standing wave node, amplitude is minimal, fitting the requirement for particle motion. However, to get two electrons to be within standing waves would take a significant amount of energy to overcome the constructive wave interference of traveling waves. In short, electrons strongly repel as they get closer, but once inside of the standing wave structure, it is possible to place electrons at nodes and maintain stability.

This section calculates the minimum velocity required for two electrons to collide to overcome the Coulomb force and bind at standing wave nodes.

Fig 4.2.3 – Two electrons moving toward each other with significant kinetic energy

In Fig. 4.2.3, two electrons travel at high speeds towards each other. With sufficient energy, they overcome the Coulomb (repelling force) and reach a standing wave node and stop. This kinetic energy is transferred to stored energy, referred to as a gluon. It is a transverse wave as the particles continue to spin, but it requires significant energy now to continue to spin (equal to the energy of the gluon).

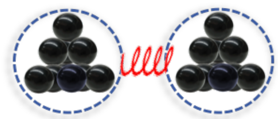


Fig 4.2.4 – Two electrons locked at a standing wave node with stored energy (transferred from kinetic)

Using the equations for kinetic energy from this paper, the minimum velocity of each electron can be determined. The total stored energy (E_s) for the gluon would be the kinetic energy of each electron (E_{e1} and E_{e2}), as described in Eq. 4.2.1.

$$E_s = E_{e_1} + E_{e_2} \tag{4.2.1}$$

Although it is very possible each electron could have a different velocity and still reach the same result, for simplicity of this calculation, assume that the velocity of electron 1 and electron 2 are the same. Therefore, $v_2 = v_1$. This is expressed as 2 times the energy of electron 1, using the complete form of Longitudinal Energy Equation (the sum of the in-wave and out-wave energies in Eqs. 3.3.4 and 3.3.5, ignoring the slight decrease in gravitational amplitude).

$$E_s = 2\left(\rho\left(\frac{4}{3}\pi(K_e\lambda_l)^3\right)\left(\frac{c}{\lambda_l\sqrt{\left(1+\frac{v_1}{c}\right)}}\frac{(K_eA_l)^3}{(K_e\lambda_l)^2}\right)\left(\frac{c}{\lambda_l\sqrt{\left(1-\frac{v_1}{c}\right)}}\frac{(K_eA_l)^3}{(K_e\lambda_l)^2}\right)O_e\right) \tag{4.2.2}$$

For the stored energy to be equal to the energy of the gluon, the electron's kinetic energy needs to be roughly 137 times larger than the electron rest energy. This is the value of the fine structure constant and the reason that the relative strength of the strong force compared to the electric force is 137 stronger. This can be represented in Eq. 4.2.3. Solving for v_1 in Eq. 4.2.2 when E_s is 137 yields the velocity in Eq. 4.2.4 when both velocities are assumed to be equal.

$$\frac{E_s}{E_e} = 137 \tag{4.2.3}$$

$$v_1 = v_2 = 2.99761\cdot 10^8 \tag{4.2.4}$$

This result means that the velocity of each electron must be at least 2.99761 x 10^8 meters per second to have a kinetic energy that will be stored as the gluon once the electrons reach the stable, standing node position. This is nearly the speed of light. When the position has been reached, kinetic energy becomes stored (potential) energy.

5. Magnetic Force – Derived and Explained

In Section 3 on gravity, magnetism was explained as a transverse wave created from particle spin. Gravity is the effect of longitudinal wave energy loss as a particle spins and transfers some energy to the transverse wave. The electron's magnetic moment, the Bohr magneton, was derived in that section.

In Section 4 on the strong force, another transverse wave due to spin was explained as the gluon of the strong force in the proton and neutron. It also extends beyond the proton to affect an orbital electron, declining in wave amplitude at the cube of distance.

Magnetic Moment (At Rest)

At rest, the electron and proton spin naturally and the magnetic wave is continually replenished by longitudinal in-waves. There is no motion (velocity) required for the particle to have a magnetic (transverse) wave. Magnetism is found in some materials and occurs naturally, even at rest. It occurs in materials that typically have particles aligned for spin to increase the effect of magnetism. A summary of the waves created from particle spin and explained in Sections 3 and 4 is shown below. No further derivations or calculations are done in this section for particles at rest.

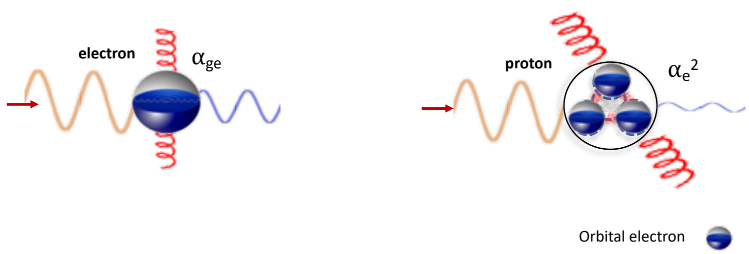


Fig 5.1 – Magnetic waves of electron and proton from spin

Electromagnetism (In Motion)

When in motion, velocity has an effect on the spin of a particle and the magnetic (transverse) wave that is created from spin. When a particle moves due to constructive or destructive longitudinal waves (electric force), it now has a speed and direction (velocity). The velocity of the particle causes it to spin faster – the individual wave centers reach incoming longitudinal waves faster, causing faster spin. Now, electrons that may have cancelled magnetic spin waves while at rest are no longer cancelled as one or more particles may be spinning faster. The additional energy is the magnetic energy as a result of motion.

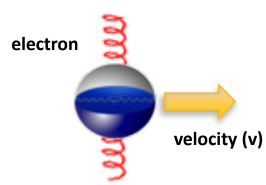


Fig 5.2 – Magnetic waves of electron in motion

The starting point for the derivation of the magnetic force for moving particles begins with Fig. 3 from the introduction. It is the electric force, but instead of the electron's rest energy (E_e), it is replaced by the kinetic energy of the electron.

$$F_m = m_e v^2 \frac{Q_1 r_e}{r} \frac{Q_2}{r} \tag{5.1}$$

After substituting wave constants for the electron's mass and radius (Eq. 2.2 without c^2 and Eq. 2.3), the equation simplifies to:

$$F_m = \frac{4\pi\rho K_e^7 A_l^6 O_e}{3\lambda_l^2} g_\lambda \left(\frac{Q_1 Q_2}{r^2} v^2 \right) \tag{5.2}$$

Magnetic Force (Electromagnetism)

The magnetic force will be compared to Distinti's New Magnetism. Distinti's equation considers electron groups at different velocities and vectors. The complete form of Eq. 5.2 is shown below, but it is not used in calculations in this paper.

$$F_m = \frac{4\pi\rho K_e^7 A_l^6 O_e}{3\lambda_l^2} g_\lambda \left(\frac{Q_1 Q_2}{r^2} \right) ((v_2 \cdot \hat{r}) v_1 - (v_1 \cdot \hat{r}) v_1 - (v_1 \cdot v_2) \hat{r}) \tag{5.3}$$

The equation for magnetic energy (electromagnetism) from Eq. 5.2 was compared to Distinti's New Magnetism for two electrons separated at various distances and at two different velocities. The results are placed in Table 1.1. The values from Eq. 5.2 and Distinti's point particle form for New Magnetism are identical. Distinti's equation for New Magnetism is used for calculations of the magnetic force in this paper because it is a simple method for determining the force of point particles, when given the velocity and distance of two groups of particles. Distinti's equation is as follows:[10]

$$F_m = K_M \frac{q_1 q_2}{r^2} ((v_2 \cdot \hat{r}) v_1 - (v_1 \cdot \hat{r}) v_1 - (v_1 \cdot v_2) \hat{r}) \tag{5.4}$$

Distinti New Magnetism

Distinti has a similar equation for the inductive force, which is based on acceleration, not velocity. In classical terms it can be expressed as:

$$F_i = m_e a \left(\frac{Q_1 r_e}{r} Q_2 \right) \tag{5.5}$$

Substitute wave constants for the electron's mass and radius (Eq. 2.2 without c^2) and Eq. 2.3:

$$F_i = \frac{4\pi\rho K_e^7 A_l^6 O_e}{3\lambda_l^2} g_\lambda \left(\frac{Q_1 Q_2}{r} \right) a \tag{5.6}$$

Inductive Force

It is compared to the Distinti New Induction equation:

$$F_i = K_M \frac{q_1 q_2}{r} a \tag{5.7}$$

Distinti New Induction

5.1. Magnetic Force Example

A single example is provided for the calculation of magnetism as a result of electron motion, using Eq. 5.2. The same methodology for this example is repeated for multiple configurations of electrons and distances and is placed in Table 1.1 and is compared to calculations using the equation for Distinti's New Magnetism.

Example – Two Electrons with a velocity difference of 2.5E-4 m/s at a distance of 1.4E-10 meters

In this example, two electrons traveling with a velocity difference of 2.5E-4 m/s are separated at a distance (r) of 1.4E-10 meters.

- $Q_1 = -1$
- $Q_2 = -1$
- $r = 1.4 \times 10^{-10}$ m
- $v = 2.5 \times 10^{-4}$ m/s

$$F_m = \frac{4\pi\rho K_e^7 A_l^6 O_e}{3\lambda_l^2} g_\lambda \left(\frac{(-1)\,(-1)}{(1.4\cdot 10^{-10})^2} (2.5\cdot 10^{-4})^2 \right) = 8.185\cdot 10^{-33} \left(\frac{kg\,(m)}{s^2} \right) \tag{5.1.1}$$

Calculated Value: 8.185E-33 newtons
Difference – Distinti's New Magnetism: 0.000%

5.2. Deriving Newton's 2nd Law of Motion

Newton's 2nd law of motion is often applied to large objects, determining the force an object exerts based on its mass and acceleration, expressed mathematically as F=ma. An object is made of particles, so at its most fundamental level, it is the electromagnetic interaction of many particles that describes the force of the object as a whole.

This section deals with the motion of particles like the electron and its magnetic and inductive forces. The inductive force is shown classically in Eq. 5.5. It is the force of an accelerating electron or a group of accelerating particles that are separated at a distance (r). However, a special case occurs when this force is measured at a distance that is equal to the electron's radius – explained as the maximum point where these particles can be separated. It becomes Newton's 2nd law of motion. To derive this law, Eq. 5.5 is set to a distance (r) that matches the electron's radius (r_e).

$$F_i = m_e a \left(\frac{Q_1 r_e}{r_e} Q_2 \right) \tag{5.2.1}$$

At this distance, the electron radius in the numerator and denominator cancels to become:

$$F = (Q_1 Q_2)\, m_e a \tag{5.2.2}$$

The variables preceding the electron mass is the numerical count of particles. From Section 3 on gravity, mass (m) is the sum of the masses of all particles (Q), as shown in the equation below (from Eq. 3.2.4 in the section on gravity).

$$Q_1 = \frac{m}{m_e} \tag{5.2.3}$$

In that same Section 3, Q_2 is set to one for the surface gravity acceleration equation, as all particles will experience the same acceleration. Since this is an acceleration equation, Q_2 is again set to one. Eq. 5.2.3 is substituted into Eq. 5.2.2. After being simplified, it resolves to Newton's 2nd law of motion.

$$F = \left(\frac{m}{m_e} (1) \right) m_e a \tag{5.2.4}$$

$$F = ma \tag{5.2.5}$$

Newton's 2nd Law of Motion

6. Weak Force

The weak force is not modeled mathematically in this paper as a standalone force. It may be potentially modeled as an aggregate of the strong force and electromagnetic force, 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.[11] 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.[12] 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 when a neutron is 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).

7. Conclusion

This paper concludes that there is one wave that is responsible for all of the known forces and it is also directly related to the energy of particles, such as the electron. In this paper, the electric force was derived from an equation representing traveling, longitudinal wave energy that was also found to calculate the electron's rest energy and mass in *Particle Energy and Interaction*. Then, this same wave was found to lose a small amount of longitudinal wave energy as a result of the electron's spin. The energy required for spin is then transferred to a new, transverse wave. This new wave becomes the magnetic force. The loss in longitudinal wave energy becomes the force of gravity as a result of a shading effect due to unequal longitudinal in-wave and out-wave amplitude. This was proven by relating the energy loss factor to both gravitational energy and the magnetic moment of the electron (Bohr magneton) in Section 3. Gravity and magnetism are a direct result of particle spin and the conservation of energy.

The calculations for the electric, gravitational and magnetic forces were proven in Sections 2, 3 and 5 - illustrated by a difference of 0.000% between the calculations using the wave equations for forces and the calculations using Coulomb's law, Newton's law of universal gravitation and Distinti's New Magnetism for various sizes of particle groups over varying distances. A derivation of Coulomb's constant (k) and the gravitational constant (G) was also provided. They are a representation of multiple wave constants in equations (density, amplitude, wavelength, wave speed and electron wave center count). Both the values and units for these constants match expected results. The derivations of these two constants, in addition to 23 other well-known constants, were calculated in *Fundamental Physical Constants*.

The strong force was derived and calculated in Section 4 using a different model of the proton which includes four electrons at tetrahedral vertices. In this arrangement, two electrons at separation distances that would be within a standing wave radius, would force electrons to be at nodes on the wave to be stable. Four electrons, equally spaced, would form a strong bond in a two-level tetrahedron. These strong bonds were calculated and derived to be similar to the strong force and nuclear force at distinct wavelengths which would be known standing wave nodes. The weak force would be a combination of strong and electromagnetic forces that hold the positron in the center of this tetrahedral structure to form a proton. A neutron would have an additional electron in the middle to form a neutral particle.

Lastly, Newton's 2nd law of motion was also explained and derived in the magnetism section. A similar equation for acceleration was included in the section on gravity, calculating the acceleration values of surface gravities of Earth and other planets in the solar system.

In conclusion, based on the equations and calculations in this paper, it is shown that there is indeed one fundamental reason for all of the known forces. Particles respond to waves as they attempt to minimize amplitude. The electric force is the effect of wave amplitude based on traveling, longitudinal waves that constructively or destructively interfere, and similarly, the magnetic force is the effect of traveling, transverse waves that constructively or destructively interfere. Gravity is a slight loss of longitudinal wave amplitude as particles reflect in-waves to out-waves as a result of particle spin. And the strong force is a modification of wave amplitude based on two particles in close proximity, within each other's standing wave structure. This has been modeled from one fundamental force, based on the longitudinal wave energy equation for particles from *Particle Energy and Interaction*, and extended to become a force equation here in this paper.

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[1] Yee, J., Particle Energy and Interaction, Vixra.org 1408.0224 (2019).

[2] Yee, J., Zhu, Y. and Zhou, G., Atomic Orbitals, Vixra.org 1708.0146 (2019).

[3] Yee, J., Fundamental Physical Constants, Vixra.org 1606.0113 (2019).

[4] Mohr, P., Newell, D. and Taylor, B., CODATA Recommended Values of the Fundamental Physical Constants 2014 Rev. Mod. Phys. 88, 035009 (2016).

[5] NASA, *Uranus Fact Sheet*, Online: http://nssdc.gsfc.nasa.gov/planetary/factsheet/uranusfact.html (Accessed July 14, 2017).

[6] Hyperphysics, *Coupling Constants for the Fundamental Forces,* Online: http://hyperphysics.phy-astr.gsu.edu/hbase/forces/couple.html (Accessed July 14, 2017).

[7] Reid, R.V., Local phenomenological nucleon–nucleon potentials, Annals of Physics **50** (1968).

[8] Emspak, J., *The Shrinking Proton: Particle is Smaller Than Thought*, Online: https://www.livescience.com/26563-shrinking-proton-smaller-measurement.html (January 2013).

[9] Konya, J. and Nagy, N. M. *Nuclear and Radio-chemistry* (Elsevier, London, 2012).

[10] Distinti, R., New Magnetism, Online: http://www.distinti.com/distinti/ne/ne.htm (Accessed May 3, 2018).

[11] Wogan, T., *Mystery of the Neutron Lifetime Discrepancy Deepens,* Online: http://physicsworld.com/cws/article/news/2013/dec/04/mystery-of-neutron-lifetime-discrepancy-deepens (December 2013).

[12] Cartwright, J., *The Mystery of the Varying Nuclear Decay*, Online: http://physicsworld.com/cws/article/news/2008/oct/02/the-mystery-of-the-varying-nuclear-decay (October 2008).