Forces: Explained and Derived by Energy Wave Equations

Jeff Yee

jeffsyee@gmail.com

May 3, 2018

Summary

In 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. The electromagnetic force is separated into electric forces and magnetic forces, although it is covered under one section for electromagnetism.

Using energy 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 energy 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 or wave form based on constructive and destructive wave interference 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.

An Acceleration Equation can be derived from the Force Equation, linking Newton's definition of force (mass and acceleration) with Coulomb's force (charge and distance). Proof of the equation is provided by calculating the surface gravity of the planets in the solar system and the velocities of falling bodies attracted by the gravity of these planets.

Lastly, for further proof that the energy 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 electromagnetic force is further separated into an electric force and magnetic force. 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.

Explanation of Forces

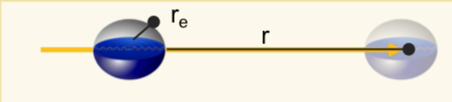
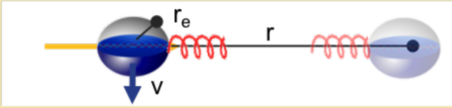
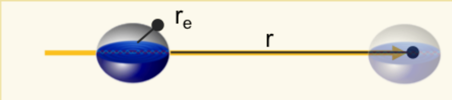
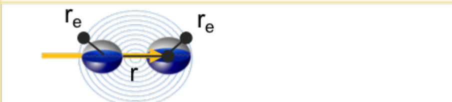
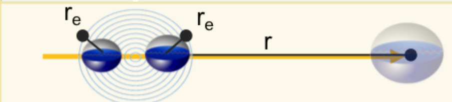
The Coulomb (electric) force is the fundamental force based on longitudinal waves. It will be shown in Section 1.2 to derive the Force Equation, which is the electric force. All other forces are a variation of this force. This electric force is based on the electron's energy (E_e), electron's radius (r_e), and particle counts (Q) separated at distance (r). The following is the relationship for the force.

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

The remaining 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 from the Coulomb (electric force), also found in visual format with simplified force equations in Fig. 1:

- **Magnetism** – change in energy from rest where c^2 is replaced by v^2 in E_e.
- **Gravitation** – change in longitudinal energy where α_{Ge} is applied to wave amplitude. The energy loss is due to particle spin and is converted to the 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 it 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 now squared because it passes through two particles before affecting the orbiting electron, now decreasing at the cube of distance. It is not covered in this paper but in a separate work. See *Atomic Orbitals* for the derivation and calculations.[2]

The equations in Fig. 1 will be explained in each of the upcoming sections detailing the forces.

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.	$F = E_e \left(\frac{Q_1 r_e}{\alpha_e r}\right)^2 \frac{Q_2}{r}$

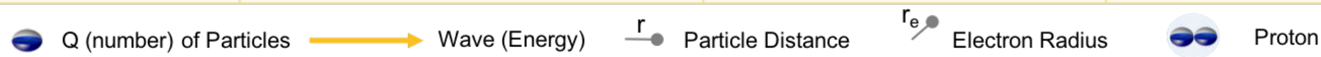


Fig 1 – Visual and simplified equation format of forces

Calculations of Forces

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 the electric force. Distinti's New Magnetism is used for the magnetic force calculations. The findings are 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 3.542E+22 newtons, which is a variation of 0.00% when using Newton's law. In the second to the last column, the gravitational force between the Earth and Moon is calculated at 1.976E+20 newtons, also a variation of 0.00% from the traditional calculation. 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 energy wave equations and constants. Further, the four forces (strong, electric, magnetic 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.

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. It is compared to the second calculation using Coulomb's Law (electric force), Distinti's New Magnetism (magnetic force), Newton's Law of Gravitation (gravity) and measured results (strong force).

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**	**2.463E-50**	**7.785E-50**	**1.853E-29**	**4.823E+10**	**1.060E+45**	**2.415E+55**
Two Electrons (Distinti)	1	2.463E-50	7.785E-50	1.853E-29	4.823E+10	1.060E+45	2.415E+55
% 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**						**3.542E+22**
Earth / Sun (Newton's Law)							3.542E+22
% Difference							*0.000%*
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)

Acceleration and force are related from Newton's Second Law, and later it is shown with a new acceleration equation that surface gravity (g), which is acceleration due to gravitation, can be calculated accurately with the same method for counting particles as was performed using the Force Equation in the calculations in Table 1.1. The known surface gravity values for the Sun, Earth, Moon and the remaining planets in the solar system are found in Table 1.2. They are compared to the calculated versions using the Acceleration Equation for Gravity in the "Calculated" column.

The source values of g are 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 1.2 –Surface Gravity using Acceleration Equation for Gravity (force calculated in m/s^2)

Notes about references for values in Table 1.2:

- Values for radius, mass and the surface gravity value (g) were obtained from Wikipedia pages for each of the planets.
- 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.
- The NASA fact sheet on Uranus was used for its surface gravity value.[3]

In Table 1.3, velocity was calculated for gravitational acceleration based on time, using the Velocity Equation for Gravity and compared to a non-relativistic value (velocity = acceleration * time).

Velocity (t)	Time (t)	Wavelength	Value (v=at)	Calculated	% Diff
Earth	1	2.8179E-17	9.81	**9.81**	*0.00%*
Earth	50	2.8179E-17	490.33	**490.33**	*0.00%*
Earth	1000	2.8178E-17	9806.65	**9806.38**	*0.00%*
Jupiter	1	2.8179E-17	24.79	**24.79**	*-0.01%*
Jupiter	50	2.8179E-17	1239.50	**1239.60**	*-0.01%*
Jupiter	1000	2.8177E-17	24790.00	**24789.99**	*0.00%*
Sun	1	2.8179E-17	274.00	**274.21**	*-0.08%*
Sun	50	2.8178E-17	13700.00	**13709.97**	*-0.07%*
Sun	1000	2.8154E-17	274000.00	**273961.26**	*0.01%*
Relativistic Velocity					
Sun	1.00E+14	3.0808E-25	N/A	**299,792,455**	
Sun	1.00E+15	3.0808E-26	N/A	**299,792,458**	
Sun	1.00E+16	3.0808E-27	N/A	**299,792,458**	

Table 1.3 – Velocity due to Gravity Using Velocity Equation

Notes about references for values in Table 1.3:

- Time is in seconds (s) and wavelength in meters (m). Therefore, the value and calculated columns are velocity expressed in meters per second (m/s).
- Calculations assume constant acceleration and zero initial velocity for simple comparison.

- The value column uses a non-relativistic calculation (v << c) of velocity where v=at.
- The difference between the traditional calculation (value column) and the energy wave theory calculation (calculated column) becomes larger as velocity increases, due to relativity. In the final three rows, the relativistic velocity of Sun's gravity at 1.00E14 seconds approaches the speed of light. At 1.00E15 and 1.00E16 seconds, velocity remains constant at the speed of light: 299,792,458 meters per second.

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 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 at different particle sizes (K) and wavelength counts (n), in addition to differentiating longitudinal and transverse waves.

Notation	Meaning
K_e	e – electron (wave center count)
λ_l λ_t	l – longitudinal wave, t – transverse wave
Δ_e Δ_{Ge} Δ_T	e – electron (orbital g-factor), Ge – gravity electron (spin g-factor), T – total (angular momentum g-factor)
F_g, F_m	g - gravitational force, m – magnetic force
$E_{(K)}$	Energy at particle with wave center count (K)

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, including a constant for the electron that is commonly used in this paper.

Symbol	Definition	Value (units)
	Wave Constants	
A_l	Amplitude (longitudinal)	$3.662796647 \times 10^{-10}$ (m)
λ_l	Wavelength (longitudinal)	$2.817940327 \times 10^{-17}$ (m)
ρ	Density (aether)	$9.422369691 \times 10^{-30}$ (kg/m^3)
c	Wave speed (speed of light)	299,792,458 (m/s)
	Variables	

δ	Amplitude factor	variable - (m^3)
K	Particle wave center count	variable - *dimensionless*
n	Wavelength count	variable - *dimensionless*
Q	Particle count (in a group)	variable - *dimensionless*
	Electron Constants	
K_e	Particle wave center count - electron	10 - *dimensionless*
	Derived Constants*	
O_e	Outer shell multiplier – electron	2.138743820 – *dimensionless*
Δ_e / δ_e	Orbital g-factor /amp. factor electron	0.993630199 – *dimensionless* / (m^3)
Δ_{Ge}/δ_{Ge}	Spin g-factor/amp. gravity electron	0.982746784 – *dimensionless* / (m^3)
Δ_T	Total angular momentum g-factor	0.976461436 – *dimensionless*
α_e	Fine structure constant	0.007297353 – *dimensionless*
α_{Ge}	Gravity coupling constant - electron	$2.400531449 \times 10^{-43}$ - *dimensionless*
α_{Gp}	Gravity coupling constant - proton	$8.093238772 \times 10^{-37}$ - *dimensionless*

Table 1.1.2 – Energy Wave Equation Constants and Variables

The derivations for the constants are:

The outer shell multiplier for the electron is a constant for readability, removing the summation from energy and force equations since it is constant for the electron. It is the addition of spherical wave amplitude for each wavelength shell (n).

$$O_e = \sum_{n=1}^{K_e} \frac{n^3 - (n-1)^3}{n^4} \tag{1.1.1}$$

The three modifiers (Δ) are similar to the g-factors in physics for spin, orbital and total angular momentum. These modifiers also appear in equations related to particle spin and orbitals, however the g-factor symbol is not used since their values are different. This is due to different wave constants and equations being used. In *Energy Wave Equations: Correction Factors,* a potential explanation for the values of these g-factors is presented as a relation of Earth's outward velocity and spin velocity against a rest frame for the universe.[4] A velocity of 3.3×10^7 m/s (11% of the speed of light) would reduce three g-factors to one based on relativity principles.

The value of Δ_{Ge} was adjusted slightly by 0.0000606 to match experimental data. Since Δ_T is derived from Δ_{Ge} it also required an adjustment, although slightly smaller at 0.0000255. This could be a result of the value of one or more input variables (such as the fine structure constant, electron radius or Planck constant) being incorrect at the fifth digit. The fine structure constant (α_e) is used in the derivation in Eq. 1.1.2 as the correction factor is set against a well-known value.

$$\Delta_e = \delta_e = \frac{3\pi\lambda_l K_e^4}{A_l \alpha_e} \tag{1.1.2}$$

$$\Delta_{Ge} = \delta_{Ge} = 2A_l^3 K_e^{28} \tag{1.1.3}$$

$$\Delta_T = \Delta_e \Delta_{Ge} \tag{1.1.4}$$

The electromagnetic coupling constant, better known as the fine structure constant (α), can also be derived. In this paper, it is also used with a sub-notation "e" for the electron (α_e).

$$\alpha_e = \frac{\pi K_e^4 A_l^6 O_e}{\lambda_l^3 \delta_e} \tag{1.1.5}$$

The gravitational coupling constant for the electron can also be derived. α_{Ge} is baselined to the electromagnetic force at the value of one, whereas some uses of this constant baseline it to the strong force with a value of one (α_G = 1.7 x 10^{-45}). The derivation matches known calculations as $\alpha_{Ge} = \alpha_G / \alpha_e = 2.40 \times 10^{-43}$.

$$\alpha_{Ge} = \frac{K_e^8 \lambda_l^7 \delta_e}{\pi A_l^7 O_e \delta_{Ge}} \tag{1.1.6}$$

The gravitational coupling constant for the proton is based on the gravitational coupling constant for the electron (above) and the proton to electron mass ratio (μ), where μ = 1836.152676.

$$\alpha_{Gp} = \alpha_{Ge}(\mu^2) \tag{1.1.7}$$

1.2. Force, Acceleration and Velocity Equations

In the *Particle Energy and Interaction* paper, it was shown that a single particle contains energy in the form of longitudinal traveling waves beyond the particle's radius ($r_{particle}$), which can be measured at a distance of r. The energy becomes the particle's energy, multiplied by a ratio of the particle radius over distance as represented by:

$$E = E_{particle} \frac{r_{particle}}{r} \tag{1.2.1}$$

First, the electron is considered as the particle for the force, so E_e and r_e replace the particle energy and particle radius respectively. Second, force is energy over distance, so Eq. 1.2.1 can be rewritten to include an additional distance, r, in the denominator. A force is the movement of a particle, or group of particles (Q_1) that are acted upon by another particle or group (Q_2). Q is represented in integers and is dimensionless. This particle count is used to determine the constructive or destructive wave amplitude interference between these particles. A particle will move to minimize amplitude. A force is a difference in amplitude that causes particle motion. The greater the amplitude difference, the greater the force. This is the simplified version of the electric force shown earlier in Fig. 1.

$$F = E_e \frac{Q_1 r_e}{r} \frac{Q_2}{r} \tag{1.2.2}$$

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. 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.

Also, from *Particle Energy and Interaction,* the energy of the electron and the electron's classical radius were derived in terms of wave constants. The force equation begins with the Coulomb force and is based upon the electron as the particle. The following derivations of the electron's energy and radius were found to match in numerical value and units in *Particle Energy and Interaction*:

$$E_e = \frac{4\pi\rho K_e^5 A_l^6 c^2 O_e}{3\lambda_l^3} \tag{1.2.3}$$

$$r_e = K_e^2 \lambda_l \tag{1.2.4}$$

Substituting Eqs. 1.2.3 and 1.2.4 into Eq. 1.2.2:

$$F = \frac{4\pi\rho K_e^5 A_l^6 c^2 O_e}{3\lambda_l^3} \left(\frac{K_e^2 \lambda_l}{r}\right) \frac{(Q_1)\ (Q_2)}{r} \tag{1.2.5}$$

Simplify Eq. 1.2.5 to become the Force Equation:

$$F = \frac{4\pi\boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2} \frac{Q_1 Q_2}{r^2} \tag{1.2.6}$$

Force Equation

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

The other key equations used for calculations in this paper are acceleration and velocity. They are derived later in Sections 6.1 and 6.3 respectively but placed here to summarize the three equations.

$$a_e = (K_e^2 \lambda_l)\, c^2 \frac{Q_1 Q_2}{r^2} \tag{1.2.7}$$

Acceleration Equation

$$v = c - \frac{c}{1 + (K_e^2 \lambda_l)\ (c) \left(\frac{Q_1 Q_2}{r^2}\right) (t)} \tag{1.2.8}$$

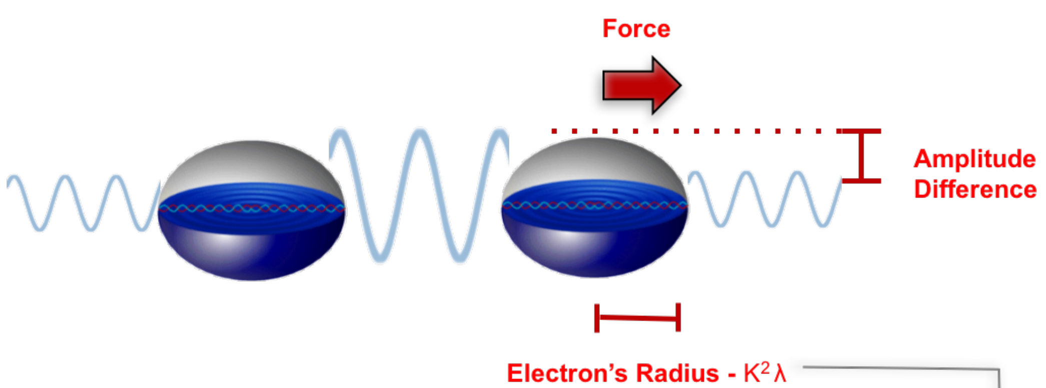
Velocity Equation

All three equations have a relationship between particle counts (Q) and distance (r), which is used to determine the amplitude difference based on constructive and destructive wave interference for electromagnetism. As it will be shown later, the strong force and gravity have modifications to the calculation of amplitude difference within these equations.

2. Electromagnetism - Derived and Explained

Electromagnetism consists of two forces: the electric and magnetic fields. The electric force for an electron is the Force Equation from the previous section. It is the longitudinal waves that flow through the universe and reflect off particles, constructively or destructively adding with other particles. 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 $$E_e = \frac{4\pi\rho K_e^5 A_l^6 c^2 O_e}{3\lambda_l^3} \qquad F_e = \frac{4\pi\rho K_e^5 A_l^6 c^2 O_e}{3\lambda_l^3} \frac{\boxed{(K_e^2 \lambda_l)}}{r^2}$$

Fig 2.1 – Electric force

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. 1.2.6).

2.1. Electric Force 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
$Q_1 = -1$
$Q_2 = -1$

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

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
$Q_1 = -1$
$Q_2 = -1$

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

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

<u>Example 3 – Electron and Positron at Distance 1.40E-10</u>

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.

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

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

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*[5] paper. It can be replaced in Eq. 2.2.6 to solve for Coulomb's constant.

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

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

As explained in the *Fundamental Physical Constants* paper, some of the constants require a modifier as a correction factor – believed to be a result of volume assumptions that were perfect spheres for particles and cylindrical shapes for photons. This is why the amplitude factor for the electron was not perfect at an integer of one (1). The correction factor used for Coulomb's constant is the product of spin and orbital momentum (total angular momentum). The total angular momentum modifier is:

$$\Delta_T = \Delta_e \Delta_{Ge} \tag{2.2.9}$$

When the modifier is accounted for, the calculated value of Coulomb's constant matches the known CODATA value. The units also match when considering that charge is measured in meters (see note below).

$$k_{e'} = \frac{16\boldsymbol{\rho} K_e^{19} \lambda_l c^2 \delta_e}{3A_l^2} (\Delta_T^2) \tag{2.2.10}$$

Calculated Value: 8.9876E+9
Difference from CODATA[6]: 0.000%
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 energy 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.

2.3. Magnetism

When longitudinal in-waves are reflected by wave centers in a particle's core, it introduces spin. The detailed explanation and accompanying visuals are upcoming in Section 3.4. The longitudinal out-wave energy is slightly reduced and a new, transverse wave is created as a result of spin. In most atoms, the effect of transverse (spin) energy is cancelled as a result of opposite spin particles, similar to how protons and electrons cancel the electric force. Particles move to minimize wave amplitude and thus cancel waves for stability.

Magnetic Moment

At rest, a single electron has a magnetic moment that can be calculated. The magnetic moment is known as the Bohr magneton, which is a fundamental physical constant. The Bohr magneton is accurately calculated using wave constants. It is included in Section 3.4 after particle spin and gravity are introduced, as they are related. Refer to that section for the explanation, derivation and calculation of the electron's magnetic moment – the Bohr magneton.

Electromagnetism

An electric field causes magnetism and vice versa. 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.

The simplified version of the magnetic force from Fig. 1 is shown again below in Eq. 2.3.1. Note that it is the same equation as the electric force with the exception of E_e being replaced by $m_e v^2$. Instead of $m_e c^2$, it is $m_e v^2$ for energy (E) because it will be the additional energy as a result of velocity (v). When the electron is at rest, the force is zero. As it increases velocity, the magnetic force increases.

$$F = m_e v^2 \left(\frac{Q_1 r_e}{r}\right)^2 \frac{Q_2}{r} \qquad \textbf{(2.3.1)}$$

After substituting wave constants for the electron's mass and radius, the equation simplifies to:

$$F_m = \frac{4\pi\rho K_e^7 \lambda_l^2 \delta_e}{A_l \Delta_e} \frac{Q_1 Q_2}{r^2} v^2 \qquad \textbf{(2.3.2)}$$

The force equation for magnetic energy (electromagnetism) from Eq. 2.3.2 was compared to Distinti's New Magnetism for two electrons separated at various distances and using two different velocities in Table 1.1. The values from Eq. 2.3.2 and Distinti's point particle form for New Magnetism are identical. Distinti's equation for New Magnetism is used as it is a simpler method for determining the force of point particles, knowing the velocity and distance of two electrons. Distinti's equation is as follows:[7]

$$F_m = K_M \frac{q_1 q_2}{r^2} v^2 \qquad \textbf{(2.3.3)}$$

Example – Two Electrons at Distance 1.00E0 and Velocity Difference of 2.40E-4

In this example, two electrons are placed at a distance (r) of 1 meter. The velocity difference is 2.4E-4 meters per second.

r = 1.0 m
v=2.4E-4 m/s
Q_1 = -1
Q_2 = -1

$$F_m = \frac{4\pi\rho K_e^7 \lambda_l^2 \delta_e}{A_l \Delta_e} \frac{Q_1 Q_2}{r^2} v^2 \tag{2.3.4}$$

Calculated Value: 1.604E-52 newtons
Difference – Distinti's New Magnetism: 0.000%

3. Gravity - Derived and Explained

Like electromagnetism, gravity is a force on particles 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. The difference in amplitude is modeled as a coupling constant in the Force Equation to be consistent with current physics and experiments.

First, this amplitude difference will be proven with calculations in Section 3.1. Then, in Section 3.2, the gravitational constant (G) will be derived by wave constants, and then the derivation and the importance of the proton-electron mass ratio and its relation to gravity will be shown in Section 3.3. Finally, in Section 3.4, it will be proven that the same amplitude difference for gravity is the cause of magnetism.

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. This amplitude loss is very weak compared to constructive and destructive wave interference that is the cause of electromagnetism. So, electromagnetism dominates wave center movement until the summation of amplitude loss in a collection of particles, e.g. large bodies like planets, 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 also affects the force of attraction.

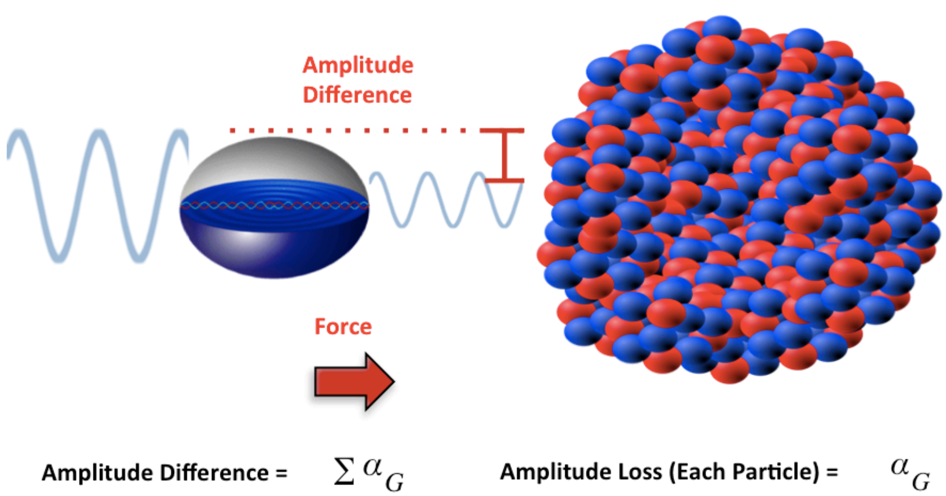


Fig 3.1 - Gravity

The first step is to calculate the amplitude loss for each particle. 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 (Kλ). 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 energy 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 electric force.

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

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

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 Electron – Coupling Constant – Alternative Derivation

Like many of the fundamental physical constants that are derived by energy wave constants, there are often two variations because these constants can be derived from either the Longitudinal Energy Equation or the Transverse Energy Equation. Eq. 3.8 shows an alternative derivation of the gravity of electron coupling constant. It has the same value of 2.4E-43, but it is derived from a separate method.

$$\alpha_{Ge} = \frac{\lambda_l^3}{6\pi K_e^{20} A_l^3}(\Delta_e) \tag{3.8}$$

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 mass of the proton and the electron (μ), as seen in Eq. 3.10. The strength of gravity for the proton is 8.1E-37 weaker when compared to the strength of the electric force.

$$\alpha_{Gp} = \alpha_{Ge}(\mu^2) \tag{3.9}$$

Gravity of Proton – Coupling Constant

Calculated Value: 8.0933E-37

Note: Most calculations involving gravity are based on large bodies, not single particles like the electron and proton. However, gravity is based on the total amplitude loss of particles in a large body, so the gravity coupling constant for the proton can be used to represent particles in a large body. Nucleons, including the proton and neutron, contain the greatest amplitude difference as the electron has a much smaller mass (the effect of the electron is negligible in calculations and the value is the same as the proton to at least five digits). Since the neutron is essentially the mass of the proton and an electron, and since the proton typically has an electron associated with it, this proton coupling constant can be used to calculate large bodies when used with the Group Particle Count equation below.

__Group Particle Count__

The Force Equation for gravity uses the proton coupling constant for each nucleon in a large body (group), so the number of nucleons 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 as shown in Eq. 3.10. This becomes the Group Particle Count equation to arrive at the number of nucleon particles (Q) that will be needed for the Force Equation.

$$Q_{group} = \frac{m_{group}}{m_p} \qquad \textbf{(3.10)}$$

Group Particle Count (Q)

Note: Eq. 3.10 provides a good estimation of the number of nucleons in a large body, using the mass of the proton to estimate nucleons. When using this estimate for nucleons, along with the gravity of proton coupling constant in the Force Equation (Eq. 3.10), there is no difference with calculated values and Newton's law to at least three digits.

__Gravitational Force__

The simplified version of the Gravitational Force from Fig. 1 is based on two groups of particles (Q) separated at distance (r) and includes the electron's energy and radius. It is identical to the Force Equation (electric force) with the exception of the loss of amplitude. For the electron, this is the gravitational coupling constant for the electron (α_{Ge}) as shown below in Eq. 3.11. It will be further derived in the next section. Gravity for large bodies will use the gravitational coupling constant for the proton instead of the electron.

$$F = E_e \frac{Q_1 r_e \alpha_{Ge}}{r} \frac{Q_2}{r} \qquad \textbf{(3.11)}$$

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 0.000%). When applied to larger bodies, the accuracy of the gravitational force of the Earth on the Moon and the Sun also show a difference of 0.000%.

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 = 1.4×10^{-10} m
$Q_1 = -1$
$Q_2 = -1$

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

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.

$$\frac{F_e}{F_{Ge}} = 4.1649E42 \qquad \textbf{(3.1.1.2)}$$

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 = 1.4×10^{-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.

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

<u>**Example 3 – Earth and Moon at Distance 3.85E8**</u>

In this example, the force of gravity of the Earth on the Moon is calculated. To do this, the Group Particle Count Equation (Eq. 3.10) is used to estimate the number of nucleon particles (Q) that will be used in the Force Equation. Eq. 3.1.3.1 calculates the nucleon particles in the Earth to be 3.570E51.

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

$$Q_{earth} = \frac{m_{earth}}{m_p} \tag{3.1.3.1}$$

Calculated Value (Q_{earth}): 3.570E51 particles

Using a similar method, the particles of the Moon are calculated in Eq. 3.1.3.2 to be 4.393E49 particles.

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

$$Q_{moon} = \frac{m_{moon}}{m_p} \tag{3.1.3.2}$$

Calculated Value (Q_{moon}): 4.393E49 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 1.976E20 newtons is obtained.

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

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

Calculated Value: 1.976E20 newtons
Difference – Newton's Gravitation Law: 0.000%

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. 3.10) is used to estimate the number of nucleon 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 nucleon particles. The Earth was calculated in the previous example to be 3.570E51.

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

$$Q_{sun} = \frac{m_{sun}}{m_p} \qquad \textbf{(3.1.4.1)}$$

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 3.542E22 newtons.

$r = 1.49598 \times 10^{11}$ m
$Q_1 = Q_{sun} = 1.189 \times 10^{57}$
$Q_2 = Q_{earth} = 3.570 \times 10^{51}$

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

Calculated Value: 3.542E22 newtons
Difference – Newton's Gravitation Law: 0.000%

3.2. Gravitational Constant (G)

The gravitational constant is derived from the Force Equation for gravity, described above in Section 3.1. 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 is the reduction of amplitude of each electron when it loses longitudinal wave energy as it spins and transfers this energy to transverse wave energy.

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

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 energy 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.

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

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.

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

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

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

<u>**Alternative Version of G**</u>

There is an alternative version of G that was proposed in *Fundamental Physical Constants,* which simplifies the constant even further (see Eq. 3.2.9). It is provided as an alternative solution because it introduces the modifier into this version. The derivation of O_e and explanation is also provided in *Fundamental Physical Constants*. In Eq. 3.2.8, δ_{Ge} and O_e are substituted for wave constants per their derivations and then simplified to become Eq. 3.2.9.

$$G = \frac{3K_e^5 \lambda_l^{11} c^2 \delta_e}{4\pi^2 \boldsymbol{\rho} A_l^{13}\left(\dfrac{3\lambda_l^4 \delta_e}{A_l^7}\,(\Delta_e^{-1})\right)^2 (2A_l^3 K_e^{28})} \qquad \textbf{(3.2.8)}$$

$$G = \frac{\lambda_l^3 c^2}{24\pi^2 \rho K_e^{23} A_l^2 \delta_e} (\Delta_e^2) \quad \textbf{(3.2.9)}$$

3.3. Simplified Gravitational Force Equation for Large Bodies

The Force Equation used in gravitational calculations for large bodies is based on the gravitational coupling constant of the proton, as illustrated in Section 3.1. However, this introduces an issue since this constant relies on the proton-electron mass ratio which was not derived in terms of energy wave constants. This constant can indeed be derived, but it requires a different correction factor to the spin g-factor, so instead, gravity calculations use the known proton-electron mass ratio.

This section highlights the derivation of a simplified gravitational force equation, without the need for the proton-electron mass ratio. It also highlights very interesting similarities with two other mass ratios, which leads to the belief that the proton-electron mass ratio is correct, despite the need for a different correction factor.

First, the difference in this correction factor. The gravity/spin g-factor used in the calculations of fundamental physical constants uses a slight correction of 0.00006062 to match experimental evidence. This leads to a value of 0.982746784.

$$\Delta_{Ge} = 2A_l^3 K_e^{28} - (0.00006062) \quad \textbf{(3.3.1)}$$

A modified version ($\Delta_{Ge'}$) of this constant requires a correction factor of 0.0010555 to match the known proton-electron mass ratio. The correction is still small, but it does result in a new value of 0.981751838. For this reason, the proton-electron mass ratio is not included in the fundamental physical constants derived by this theory.

$$\Delta_{Ge'} = 2A_l^3 K_e^{28} - (0.00105557) \quad \textbf{(3.3.2)}$$

Yet when this modified value is considered, 1) the proton-electron mass ratio matches the known CODATA value, 2) three ratios of the Planck mass, electron mass and proton mass are all variations of amplitude divided by wavelength, and 3) the gravitational force is greatly simplified.

Proton-Electron Mass Ratio (μ or m_p/m_e)

When the modified spin g-factor is used ($\Delta_{Ge'}$), the derivation of μ is precisely 1836.1527, which is the CODATA value for the proton-electron mass ratio. Since this was manufactured by adjusting the correction factor, the more important thing in this result is to notice the derivation of half the square root of amplitude and wavelength. It describes an important relationship between two particles and two fundamental properties of the wave that creates these particles.

$$\frac{m_p}{m_e} = \frac{1}{2}\sqrt{\frac{A_l}{\lambda_l}} \cdot (\Delta_{Ge'}^{-1}) \quad \textbf{(3.3.3)}$$

Planck-Electron Mass Ratio (m_P/m_e)

The ratio of the Planck mass to electron mass ratio was described in *Fundamental Physical Constants*, since both of these constants were derived by energy wave constants. The ratio matches the expected value at 2.389 x 10^{22}. Again, note the ratio of amplitude to wavelength ratio, but now squared.

$$\frac{m_P}{m_e} = \sqrt{2} \cdot K_e^8 \left(\frac{A_l^2}{\lambda_l^2} \right) \quad \textbf{(3.3.4)}$$

Planck-Electron Mass Ratio (m_P/m_p)

Given that the proton-electron and Planck-electron mass ratios are now solved, the Planck mass to proton mass ratio could also be solved. The ratio matches the expected value of 1.301 x 10^{19}. Once again, note the amplitude and wavelength ratio in this value.

$$\frac{m_P}{m_p} = 2\sqrt{2} \cdot K_e^8 \sqrt{\frac{A_l^3}{\lambda_l^3}} \cdot (\Delta_{Ge'}) \quad \textbf{(3.3.5)}$$

Simplified Gravitational Force Equation for Large Bodies

The derived form of the proton-electron mass ratio can now be used to simplify the Force Equation, so that it is dependent only on the five energy wave constants (and the remaining constants that can be derived from one of the five). The simplicity of the result provides even more evidence that the proton-electron mass ratio is indeed correct, despite having to use a different correction factor.

Eq. 3.3.6 is the Force Equation with the amplitude loss for the gravity of the proton coupling constant (α_{Gp}). This is the equation used to solve gravity for large bodies that consist of atoms: protons, neutrons and electrons. The reason for using the proton was described earlier in this section. Also, described earlier, is the relation of α_{Gp} to α_{Ge}. The coupling constant for the proton is the coupling constant for the electron multiplied by the proton-electron mass ratio (μ) squared, shown in Eq. 3.3.7.

$$F_{Gp} = \frac{4\pi\rho K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2} \frac{Q_1 Q_2}{r^2} (\alpha_{Gp}) \quad \textbf{(3.3.6)}$$

$$F_{Gp} = \frac{4\pi\rho K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2}\frac{Q_1 Q_2}{r^2}\left(\alpha_{Ge}\left(\mu^2\right)\right) \tag{3.3.7}$$

At this point, F_{Gp} will be replaced with F_g as the naming convention for the force of gravity because the proton is no longer in this equation. In Eq. 3.3.8, the proton-electron mass ratio from Eq. 3.3.3 is inserted into Eq. 3.3.7. In Eq. 3.3.9, the gravity of electron coupling constant is replaced with the value from Eq. 3.8.

$$F_g = \frac{4\pi\rho K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2}\frac{Q_1 Q_2}{r^2}\alpha_{Ge}\left(\frac{1}{2}\sqrt{\frac{A_l}{\lambda_l}}\cdot\left(\Delta_{Ge'}^{-1}\right)\right)^2 \tag{3.3.8}$$

$$F_g = \frac{\pi\rho K_e^7 c^2 A_l^7 O_e}{3\lambda_l^3}\frac{Q_1 Q_2}{r^2}\left(\frac{\lambda_l^3}{6\pi K_e^{20} A_l^3}\left(\Delta_e\right)\right)\left(\Delta_{Ge'}^{-2}\right) \tag{3.3.9}$$

After simplifying Eq. 3.3.9, the result is the Simplified Gravitational Force Equation. It can be used for the calculations of gravitational forces of large bodies with the same degree of accuracy shown in the examples in Section 3.1 *if* the modified version of the spin g-factor ($\Delta_{Ge'}$) is used.

$$F_g = \frac{\rho A_l^4 c^2 O_e}{18 K_e^{13}}\left(\frac{\Delta_e}{\Delta_{Ge'}^2}\right)\frac{Q_1 Q_2}{r^2} \tag{3.3.10}$$

Simplified Gravitational Force Equation

In Section 4, another force that is a result of a change in wave amplitude can also be simplified using a similar method.

3.4. Particle Spin – The Cause of Gravity and Magnetism

Energy is always conserved. When a particle spins, it takes energy, but this energy simply changes forms. Longitudinal in-waves reflect off wave centers, becoming longitudinal out-waves. The combination of these in-waves and out-waves creates the standing wave energy of particles such as the electron.

Fig 3.4.1 – Waves reflecting of particles. The resulting in-wave and out-wave forms a standing wave.
Despite the simplistic illustration of in-wave and out-waves, they are spherical and approach the particle from all directions in three-dimensional space.

A wave with properties of four universal constants (wave speed, amplitude, wavelength and density) and a constant property of the electron (the electron wave center count) results in the standing wave energy of the electron (8.1817 x 10^{-14} joules). This was derived in detail in *Particle Energy and Interaction.*

$$E_e = E_{l(10)} = \frac{4\pi\rho K_e^5 A_l^6 c^2 O_e}{3\lambda_l^3} = 8.1817 \cdot 10^{-14} J \qquad \textbf{(3.4.1)}$$

There is only one wave and it is responsible for particle mass and the forces, as it will be shown. Two of the forces are related to the spin of the particle.

Particle Spin

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 3.4.2 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.

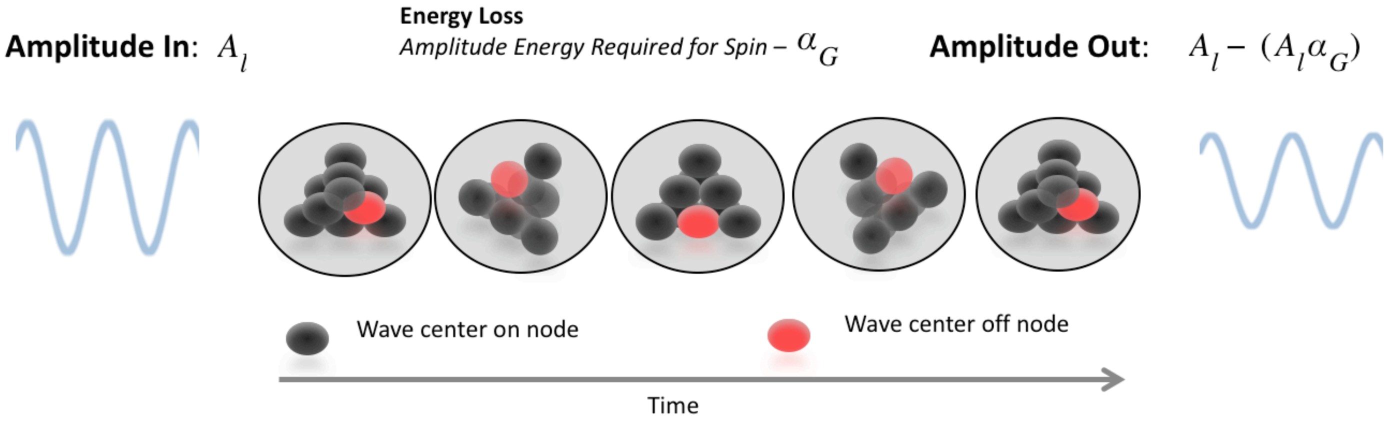


Fig 3.4.2 – Particle Spin and Amplitude Effect

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} and is calculated to be a loss of 2.40E-43 for amplitude loss for the electron's spin. It is a negligible loss when considering one electron, but when considering large bodies containing a significant number of particles, the loss becomes measurable and is the force known as gravity.

Due to the conservation of energy, the loss of longitudinal wave amplitude which becomes the force of gravity is converted to a new, transverse wave form that is the force of magnetism.

Electric and Gravitational Force

A new visual of gravity and its relation to the electric force is shown in Fig. 3.4.3. Both of these forces are based on the longitudinal wave amplitude between two or more particles.

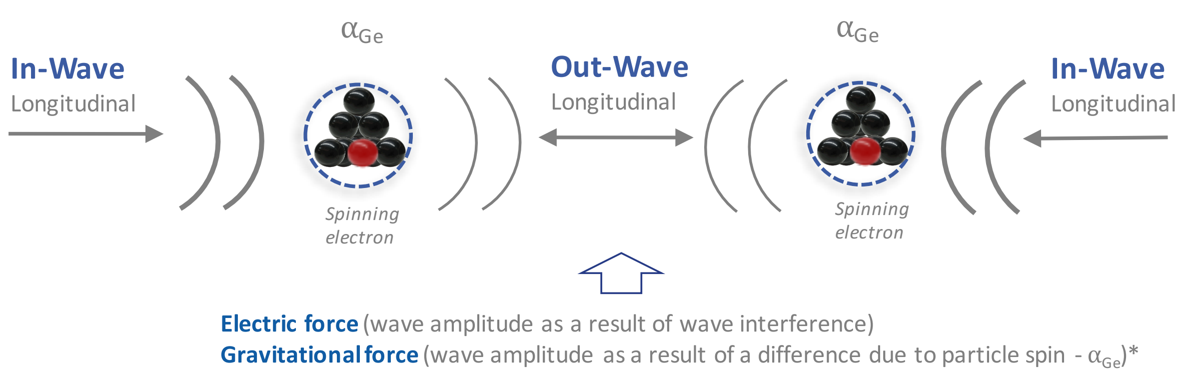


Fig 3.4.3 – Particle Spin and Amplitude Effect

** Gravitational force appears when the electric force cancels due to protons/electrons in atoms canceling wave interference. Then, wave amplitude difference begins to appear for a large collection of atoms - such as stars and planets – the force of gravity.*

The longitudinal out-wave is responsible for the electric force, as it was shown in Section 2. Two particles in proximity will experience constructive or destructive wave interference, depending on the phase of the waves, which results in an attractive or repelling force based on the resulting wave amplitude. The same properties of the wave that results in the electron's standing wave energy is expanded to include a collection of particles (Q_1 and Q_2) at distance (r). It was derived earlier in this paper, but again, note the similarity of Eq. 3.4.2 and 3.4.1 to prove this comes from the same wave. Eq. 3.4.2 is the **electric force (F_e)**, otherwise known as the Force Equation.

$$F_e = \frac{4\pi\rho K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2}\frac{Q_1 Q_2}{r^2} \tag{3.4.2}$$

Gravity was also derived and proven earlier in this section. It is the same longitudinal wave force, but with an amplitude difference α_{Ge} as a result of particle spin. Eq. 3.4.3 is the **gravitational force (F_g)**. It was further simplified in Eq. 3.3.10, but the expanded form is shown here as a comparison to magnetism. Now, compare Eqs. 3.4.3 to 3.4.2 to 3.4.1. All were proven to match experimental evidence of the electron's particle mass, Coulomb force and Newton's law of gravitation, including derivations of constants k and G.

$$F_g = \frac{4\pi\rho K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2}(\alpha_{Ge})\frac{Q_1 Q_2}{r^2} \tag{3.4.3}$$

Magnetism

Magnetism is the energy of a new wave that is created as the electron spins. It creates a new transverse wave, illustrated as red spirals in Fig. 3.4.4. Since energy is conserved, magnetism is the energy that is gained and released in a new wave form while gravity is the loss of longitudinal wave energy.

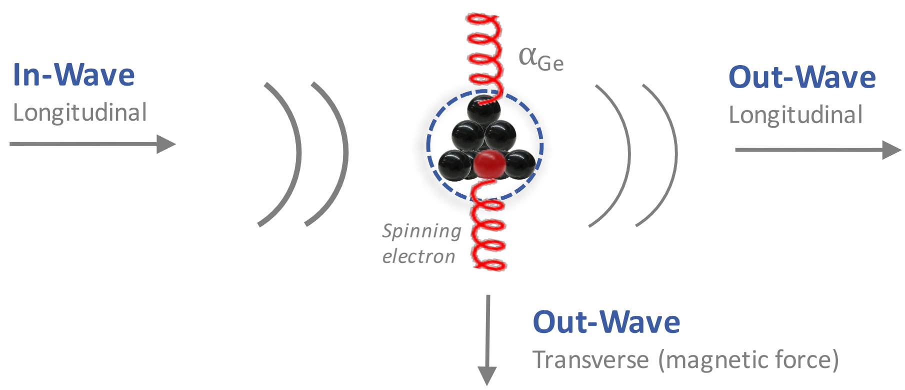


Fig 3.4.4 – As the electron spins, the wave centers that are off node absorb longitudinal wave amplitude and transfer it to a new transverse wave. This transverse wave becomes the magnetic force.

The proof that gravity and magnetism are linked is the derivation of the electron's magnetic moment, known as the Bohr magneton. Eq. 3.4.3 is rewritten to a form before it was simplified, where the in-wave and out-wave frequency and amplitude can be separated in the equation.

$$F_g = \left(\frac{4\pi K_e \rho O_e}{3\lambda_l}\right)\left(\left(\frac{c}{K_e\lambda_l}\right)_{in}(K_e A_l)^3_{in}\left(\frac{c}{K_e\lambda_l}\right)_{out}(K_e A_l)^3_{out}\alpha_{Ge}\right)\left((K_e^2\lambda_l)\frac{Q_1 Q_2}{r^2}\right) \tag{3.4.4}$$

In the expanded form of this Force Equation for gravity (Eq. 3.4.4), the focus is on the mid-section. The electron has an in-wave and an out-wave, with its frequency and amplitude based on the number of wave centers in the electron (K). Amplitude is cubed as it is spherical, in three dimensions. The out-wave experiences an amplitude loss (α_{Ge}) that will become magnetism. This is the mid-section:

$$\left(\frac{c}{K_e\lambda_l}\right)_{in}(K_eA_l)^3_{in}\left(\frac{c}{K_e\lambda_l}\right)_{out}(K_eA_l)^3_{out}\alpha_{Ge} \qquad \textbf{(3.4.5)}$$

To determine the resultant frequency and amplitude for magnetism, the geometric mean is used for the electron's in-wave and out-wave. One half (½) of the square of this mean is used because there are two axial waves that are created, each traveling in opposite directions from the electron.

$$\mu = \frac{1}{2}\sqrt{f_{in}A_{in}f_{out}A_{out}} \qquad \textbf{(3.4.6)}$$

The frequency and amplitude is apparent from the Force Equation. The in-wave and out-wave frequency, and the in-wave amplitude is shown in Eqs. 3.4.7. and 3.4.8 respectively. The out-wave amplitude is different. It is shown in Eq. 3.4.9. It has an amplitude loss (α_{Ge}) that matches the energy loss of gravity, although it is affected by half (½), because the particle's spin takes two rotations (1/2 spin). One of these rotational waves will become the natural unit of the electron's magnetic moment – known as the Bohr magneton.

$$f_{in} = \left(\frac{c}{K_e\lambda_l}\right)_{in} \qquad f_{out} = \left(\frac{c}{K_e\lambda_l}\right)_{out} \qquad \textbf{(3.4.7)}$$

$$A_{in} = (K_eA_l)^3_{in} \qquad \textbf{(3.4.8)}$$

$$A_{out} = (K_eA_l)^3_{out}\frac{\alpha_{Ge}}{2} \qquad \textbf{(3.4.9)}$$

Inserting Eqs. 3.4.7, 3.4.8 and 3.4.9 into Eq. 3.4.6 and simplifying, the equation resolves to be the **Bohr magneton (μ_B)** – the magnetic moment of the electron.

$$\mu_B = \frac{1}{2}\frac{K_e^2A_l^3c}{\lambda_l}\sqrt{\frac{\alpha_{Ge}}{2}} \qquad \textbf{(3.4.10)}$$

The Bohr magneton, like many of the fundamental constants calculated using wave constants, requires a g-factor (Δ_T) that is a correction factor. The use of the modifier is consistent with the g-factor in physics, which also has a correction factor, as it appears in equations for spin and orbitals and is derived and explained in *Fundamental Physical Constants*. The numerical value of the Bohr magneton matches the known CODATA value at 9.274 x 10^{-24}.

$$\mu_B = \frac{1}{2}\frac{K_e^2A_l^3c}{\lambda_l}\sqrt{\frac{\alpha_{Ge}}{2}}\cdot(\Delta_T^{-1}) = 9.274\cdot10^{-24} \qquad \textbf{(3.4.11)}$$

The units in Eq. 3.4.11 also match the Bohr magneton after considering that charge (coulombs – C) is measured as wave amplitude (m) in Energy Wave Theory. The Bohr magneton is measured in J/T (joules per Tesla).[8] In SI units, joules can also be expressed as kg * m^2/s^2. Similarly, Tesla can be expressed in SI units as kg / (C * s). Thus, when C is replaced with meters (m), the units align correctly. Eq. 3.4.12 has the derivation of J/T to m^3/s, proving that the units of the Bohr magneton are also correct.

$$BohrMagneton = \frac{J}{T} = \frac{kg\frac{m^2}{s^2}}{\frac{kg}{Cs}} = \frac{kg\frac{m^2}{s^2}}{\frac{kg}{(m)\,s}} = \frac{m^3}{s} \qquad \textbf{(3.4.12)}$$

4. Strong Force - Derived and Explained

Measurements of the strong force have shown that it is about 137 times stronger than electromagnetism, which is the inverse of the fine structure constant (137.036).[9] 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.[10] 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.

Strong Force

The simplified version of the Strong Force from Fig. 1 is based on two groups of particles (Q) separated at distance (r) and includes the electron's energy and radius. It is identical to the Force Equation (electric force) with the exception of the increased amplitude. The amplitude increase is converted from kinetic energy to stored energy, as explained later in this section (Section 4.3). The amplitude increase is the aforementioned fine structure constant (α_e) and is shown below in Eq. 4.2. It will be further derived in the next section in terms of wave constants.

$$F = E_e \frac{Q_1 r_e}{\alpha_e r} \frac{Q_2}{r} \tag{4.2}$$

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

$$F_{S1} = \frac{4\pi\boldsymbol{\rho} K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2}\frac{Q_1Q_2}{r_{S1}^2}(\alpha_S) \tag{4.1.2}$$

Calculated Value: 4.424E4 newtons

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.

$$F_{S'} = \frac{4\pi\boldsymbol{\rho} K_e^7 c^2 A_l^6 O_e}{3\lambda_l^2}\frac{Q_1Q_2}{r_S^2}\left(\frac{1}{\dfrac{\pi K_e^4 A_l^6 O_e}{\lambda_l^3\delta_e}}\right) \tag{4.1.3}$$

$$F_{S'} = \frac{4\boldsymbol{\rho} K_e^3 \lambda_l c^2 \delta_e}{3}\frac{Q_1Q_2}{r_S^2} \tag{4.1.4}$$

Example 2 – Particles Separated at Distance 1.13E-15

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. [10]

$$r_{S2} = 4K_e\lambda_l \qquad \textbf{(4.2.1)}$$

$r_{S2} = 1.127 \times 10^{-15}$ m
$Q_1 = -1$
$Q_2 = -1$

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

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

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 calculation.

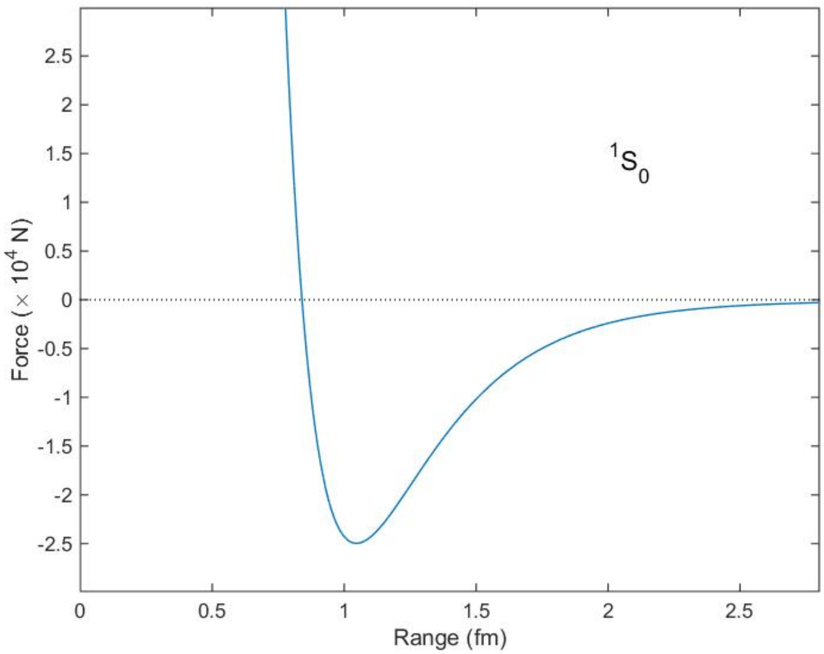


Fig 4.1.1 – Nuclear Force[10]

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 were 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.

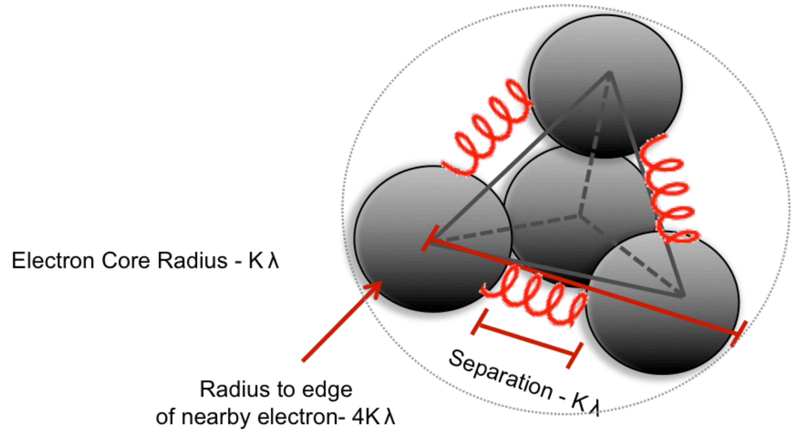


Fig 4.2.1 – Electron Gluons

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 compacted into 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.[11]

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 2.488E4 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.

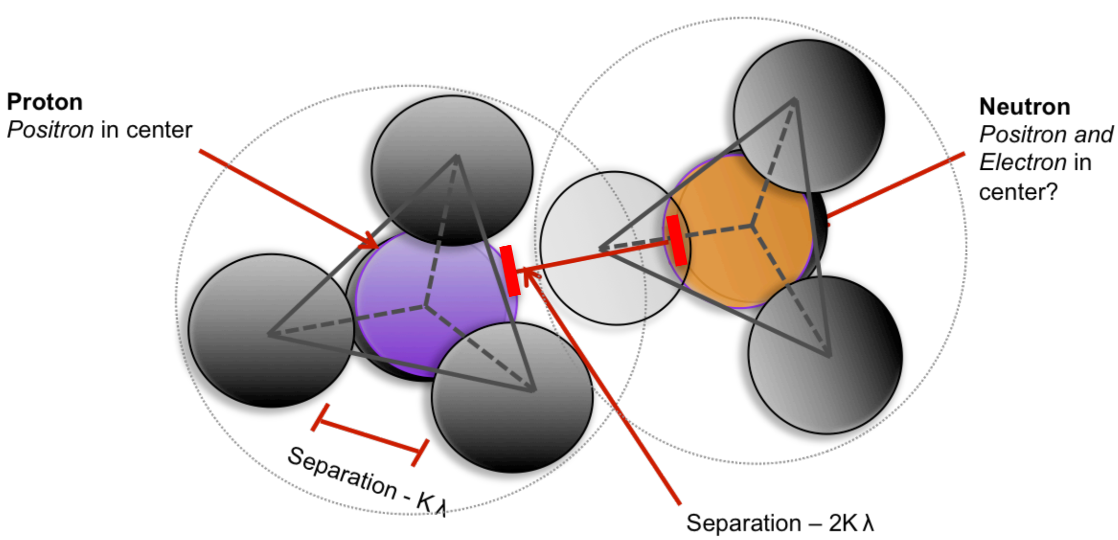


Fig 4.2.2 – Nucleon Binding

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).[12]
- 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.

<u>Strong Force Relation to the Fine Structure Constant</u>

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.

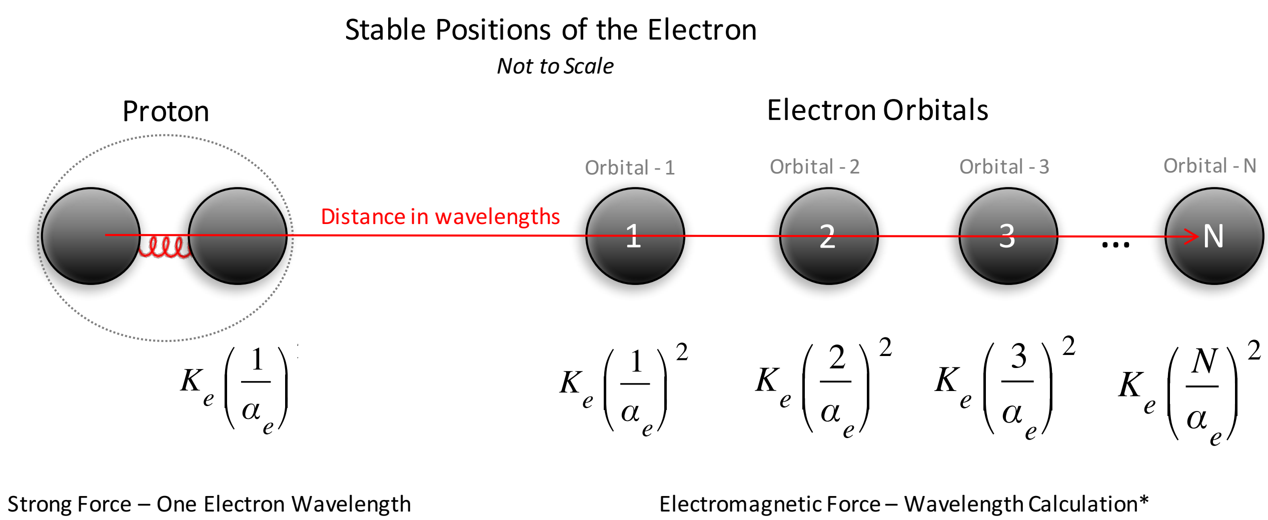


Fig 4.2.3 – Electron Placement Relation to Fine Structure Constant
**Wavelength Calculation – Orbital Equation (from Particle Energy and Interactions)*

4.3. Quark Binding Velocity

The explanation of electrons as quarks in Section 4.2 is contrary to the current understanding of electrons. Two electrons repel. Under 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 4.3.1 – Two Electrons Moving Toward Each Other with Significant Kinetic Energy

In Fig. 4.3.1, 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 spin (equal to the energy of the gluon).

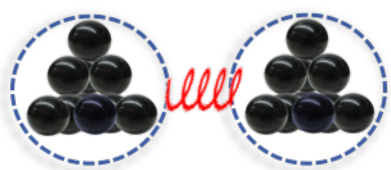


Fig 11 – Two Electrons Locked at Standing Wave Node with Stored Energy (transferred from kinetic)

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. 4.3.1.

$$E_s = E_{e_1} + E_{e_2} \tag{4.3.1}$$

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 the electron's energy (Longitudinal Energy Equation) from *Particle Energy and Interaction.*

$$E_s = 2\left(\rho\left(\frac{4}{3}\pi\,(K_e\lambda_l)^3\right)\left(\frac{c}{\lambda_l\sqrt{\left(1+\frac{v_1}{c}\right)}}\frac{(K_eA_l)^3}{(K_e\lambda_l)^2}\right)\left(\frac{c}{\lambda_l\sqrt{\left(1-\frac{v_1}{c}\right)}}\frac{(K_eA_l)^3}{(K_e\lambda_l)^2}\right)O_e\right) \tag{4.3.2}$$

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. 4.3.3. Solving for v_1 in Eq. 4.3.2 when E_s is 137 yields the velocity in Eq. 4.3.4 when both velocities are assumed to be equal.

$$\frac{E_s}{E_e} = 137 \tag{4.3.3}$$

$$v_1 = v_2 = 2.99761\cdot 10^8 \tag{4.3.4}$$

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. Weak Force

The weak force was not modeled as a separate force. It may be potentially 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.[13] 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.[14] 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).

6. Acceleration and Velocity

Isaac Newton laid the foundation of classical mechanics and proposed the relationship between force (F), mass (m) and acceleration (a) in Principia Mathematica with his second law of motion, F=ma. It was Newton's first law of motion that described velocity. Specifically, the first law states that a body remains at constant velocity or at rest if there is no force applied. In this section, Newton's first two laws of motion for acceleration and velocity are explained visually and derived mathematically.

The mathematical explanation of Newton's laws begins with the second law and acceleration in Section 6.1. Section 6.2 provides proof of the acceleration equation using energy wave theory, by calculating the surface gravity (acceleration due to gravity) of planets in the solar system. Finally, Section 6.3 provides proof of the velocity equation due to acceleration, calculating velocity as a difference in frequencies between a reference frame and a moving object.

Before deriving the equations and using them for calculations, they are first explained visually in this section and connected to Newton's first two laws of motion.

Newton's First Law of Motion

The first law of motion states that a body will remain at rest, or continue at a constant velocity, unless a force is applied. Essentially, velocity is always constant. At rest, velocity remains zero. While in motion, velocity remains the same until a force is applied.

At rest, a particle or body's acceleration (a) is zero and velocity (v) is zero. Fig. 6.1 describes a particle that has a particle core of one or more wave centers, a standing wave structure that extends to the particle's radius, and spherical, longitudinal traveling waves beyond this radius. Standing waves are generated by in-waves that are reflected to become out-waves. At rest, the wavelength of the standing waves (λ_{lead}) matches the wavelength of the in-waves (λ_l). There is no wavelength/frequency difference between the particle and its surrounding environment. The particle is at rest and will remain at rest.

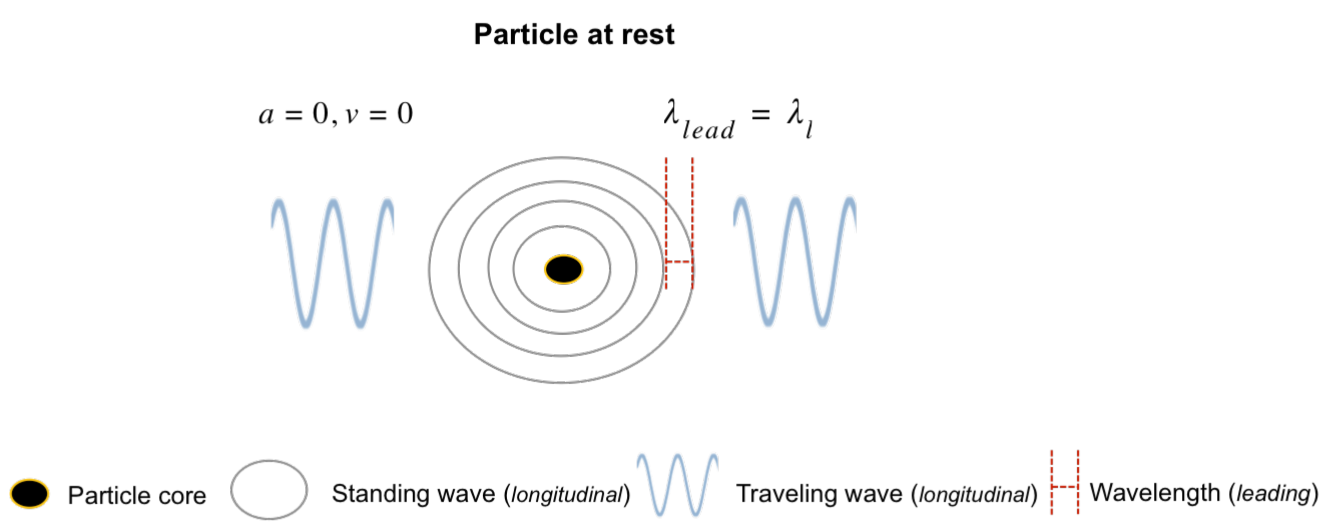


Fig. 6.1 - Particle at Rest

Note: The traveling wave is a spherical, longitudinal wave. Figure 6.1 illustrates a simple sine wave as this wave due to the difficulties describing a three-dimensional wave in a two-dimensional image. But it's important to note that it is a not the transverse wave associated with photon energy (described separately in *Particle Energy and Interaction*).

A particle in motion has a velocity greater than zero. With no acceleration (a=0), velocity remains constant according to Newton's first law of motion. To an observer, the wavelength on the leading edge (λ_{lead}) of the particle is compressed, in the direction of motion, relative to the longitudinal, traveling in-waves (λ_l). There is a wavelength or frequency difference with the external environment, which will be shown to follow Doppler equations in Section 6.3. This frequency difference is the basis of the calculation for velocity, as it will be shown mathematically. It is also the reason particles (and thus objects that are built upon particles) experience time dilation and length contraction in the direction of motion. The latter was explained in *Particle Energy and Interaction* and will not be replicated in this section.

Fig. 6.2 illustrates a particle in motion with no acceleration. Wave amplitude is constant and equal on all sides of the particle. The particle will maintain its standing wave frequency on both the leading and lagging edges of the standing wave structure, although it is different than its external environment. Wavelength on the leading edge is less than the wavelength of the in-waves ($\lambda_{lead} < \lambda_l$) and will remain constant. The smaller the leading edge wavelength, the greater the velocity. If the particle core reaches the edge of its standing wave radius, the leading edge wavelength is near zero, and its velocity is nearly the speed of light.

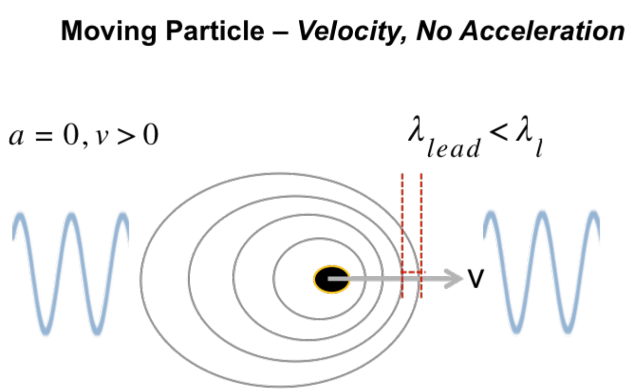


Fig. 6.2 - Particle at Constant Velocity

<u>Newton's Second Law of Motion</u>

Newton's second law of motion states that the sum of all forces is equal to mass multiplied by acceleration, or F=ma. In the first law of motion, when described in wave terms, wave amplitude is constant. A particle's leading edge wavelength may differ compared to the wavelength of in-waves, but in-wave amplitude is equal and constant on all sides of the particle.

In the second law, wave amplitude is not constant and is the reason for force and acceleration. Particles move to minimize amplitude, one of the laws of energy wave theory. Fig. 6.3 describes a particle, initially at rest (v_i=0), now accelerated (a>0). A particle will move in the direction of minimal amplitude, thus the leading edge in the equations described in Section 6.1 always refer to the direction in motion where wave amplitude is less than the amplitude in any other direction surrounding the particle. Similarly, the amplitude in the direction of motion is described using the same notation (A_{lead}). This amplitude difference leads to a force on the object and it is accelerated. The particle core will move from its resting position to a new frequency, similar to the illustration above in Fig. 6.2. In fact, it will continue to move and change frequency until either amplitude is once again equal (no force), or the particle core reaches its radius of standing waves (in which case it has reached the speed of light). In the two latter cases, velocity remains constant.

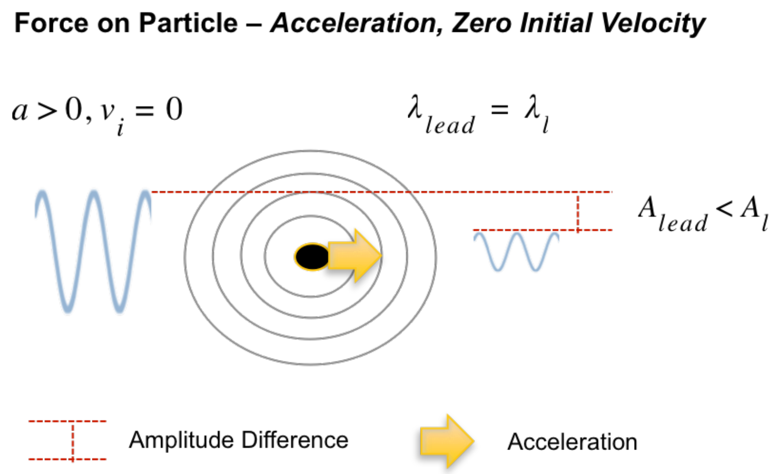


Fig. 6.3 - Force on Particle at Rest

Fig. 6.4 describes the change in position of the particle core due to acceleration, which is caused by amplitude difference. Acceleration is the change in the position of the particle core, affecting wavelength and frequency. A smaller acceleration value moves the particle core slower towards its edge, and a larger acceleration value moves the particle core faster towards its edge. This requires a measurement of time to define *slower* or *faster*. Time is based on wavelength cycles (which is frequency), thus acceleration is the movement of the particle core towards the edge of the radius based on the number of wavelength cycles. This will be seen in the Acceleration Equation in Section 6.1.

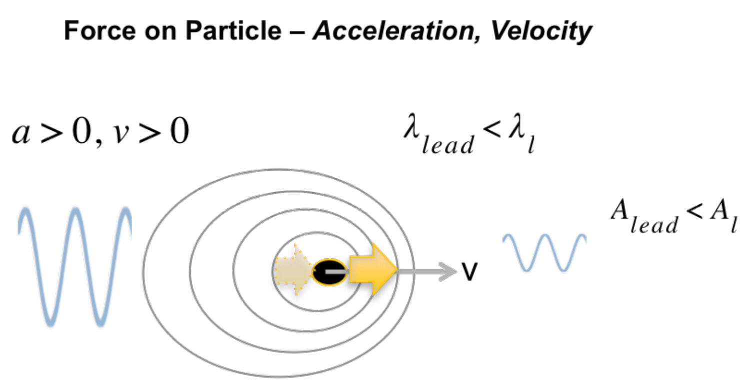


Fig. 6.4 - Force on Particle Moving at Velocity

The preceding visuals are intended to illustrate the equations that will be derived in Sections 6.1 to 6.3. Newton's first law of motion is based upon wavelength. The second law is based upon wave amplitude. And for the derivation and proof of these laws under energy wave theory, the starting point is acceleration, using the Force Equation.

6.1. Acceleration

Acceleration can be derived from the Force Equation. The derivation is also an opportunity to link Newton's force law with Coulomb's force law and explain the reason for acceleration. This is seen below in Eq. 6.1.1 where F (force) is equal to Newton's second law of motion, which is equal to Coulomb's force, which is then equal to the Force Equation from wave theory. They are all equal. In Eq. 6.1.2, Newton's and Coulomb's force equations are separated and will be solved for the mass and acceleration of an electron (a_e and m_e).

$$F = m_e a_e = \frac{kq_1q_2}{r^2} = \frac{4\pi\boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2}\frac{Q_1Q_2}{r^2} \qquad \textbf{(6.1.1)}$$

$$m_e a_e = \frac{kq_1q_2}{r^2} \qquad \textbf{(6.1.2)}$$

In the energy wave equations, the charge q is the number of particles (Q) multiplied by the elementary charge for the electron (e_e). This is consistent with the Force Equation. Thus Eq. 6.1.3 is inserted into Eq. 6.1.4.

$$q = Qe_e \qquad \textbf{(6.1.3)}$$

$$m_e a_e = \frac{k_e Q_1 e_e Q_2 e_e}{r^2} \qquad \textbf{(6.1.4)}$$

The equation above is rearranged in Eq. 6.1.5 to separate the variables to the right side of the equation, similar to the Force Equation. The elementary charge in the equation was derived in the *Fundamental Physical Constants* paper and is shown again in Eq. 6.1.6. The values for Coulomb's constant and elementary charge are substituted into Eq. 6.1.5 to become Eq. 6.1.7.

$$m_e a_e = (k_e e_e e_e)\frac{Q_1Q_2}{r^2} \qquad \textbf{(6.1.5)}$$

$$e_e = \frac{A_l^4}{2K_e^6}\sqrt{\left(\frac{\pi O_e}{\lambda_l^3 \delta_e}\right)} \qquad \textbf{(6.1.6)}$$

$$m_e a_e = \left(\frac{16\boldsymbol{\rho} K_e^{19} \lambda_l c^2 \delta_e}{3A_l^2}\right)\left(\frac{A_l^4}{2K_e^6}\sqrt{\left(\frac{\pi O_e}{\lambda_l^3 \delta_e}\right)}\right)\left(\frac{A_l^4}{2K_e^6}\sqrt{\left(\frac{\pi O_e}{\lambda_l^3 \delta_e}\right)}\right)\frac{Q_1 Q_2}{r^2} \qquad \textbf{(6.1.7)}$$

The right side of Eq. 6.1.7 simplifies to be the following in Eq. 6.1.8. At this point, it's not surprising. The right side of the equation has simplified to be the Force Equation. It's proof of Eq. 6.1.1 that Coulomb's force is equal to the Force Equation.

$$m_e a_e = \frac{4\pi\boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2}\frac{Q_1 Q_2}{r^2} \qquad \textbf{(6.1.8)}$$

However, when solving for acceleration, the meaning becomes clearer. Eq. 6.1.9 is divided by the mass of the electron (m_e). Since the electron mass is derived in *Particle Energy and Interaction*, it can be substituted into Eq. 6.1.10.

$$a_e = \frac{\dfrac{4\pi\boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2}\dfrac{Q_1 Q_2}{r^2}}{m_e} \qquad \textbf{(6.1.9)}$$

$$a_e = \frac{\dfrac{4\pi\boldsymbol{\rho} K_e^7 A_l^6 c^2 O_e}{3\lambda_l^2}\dfrac{Q_1 Q_2}{r^2}}{\dfrac{4\pi\boldsymbol{\rho} K_e^5 A_l^6}{3\lambda_l^3} O_e} \qquad \textbf{(6.1.10)}$$

After simplifying Eq. 6.1.10, acceleration is based on two particle groups (Q_1 and Q_2), separated by distance r. The constant in the equation is that movement is based on the square of the wave speed (c^2) multiplied by the radius of the electron (K_e^2 λ). Again, similar to the Force Equation, this radius is the point where standing waves (potential energy) transition to traveling waves (kinetic energy). The units resolve correctly to m/s^2 in Eq. 6.1.11.

$$a_e = (K_e^2 \lambda_l)\, c^2 \frac{Q_1 Q_2}{r^2} \qquad \textbf{(6.1.11)}$$

Acceleration Equation

Fig. 6.5 describes the Acceleration Equation in visual terms. As noted earlier, the particle has standing waves to its radius (K_e^2 λ). It also consists of two longitudinal waves (in-waves and out-waves), both traveling at the speed of light (c). This is reflected in Eq. 6.1.11, which is the Acceleration Equation.

Particle count (Q_1 and Q_2) divided by the distance (r) that separates these particles is also found in the equation. This was created for the Force Equation as the simplified method to calculate wave amplitude difference, as it is a method for calculating constructive and destructive wave interference between particles. It describes the wave amplitude difference (ΔA) between the leading edge and trailing edge. Thus, the Acceleration Equation can be thought of as the in-wave and out-wave, traveling through the amplitude difference within the particle radius.

Fig. 6.5 shows two examples. Example 1 has a smaller amplitude difference compared with Example 2. A smaller amplitude difference results in slower acceleration (illustrated in Example 1 as a smaller arrow). A larger amplitude difference results in faster acceleration (illustrated in Example 2 as a larger arrow). It defines how quickly the particle core will reach its radius (assuming constant amplitude difference).

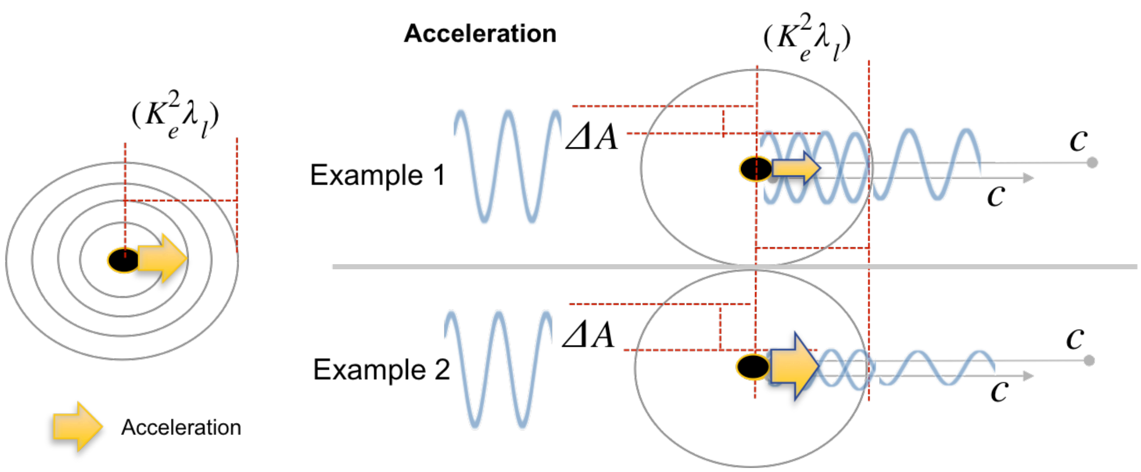


Fig. 6.5 - Acceleration Equation Explained

The Acceleration Equation is defined here and illustrated conceptually. In the next section, the equation is used to calculate well-known values of acceleration - gravitational acceleration of planets.

6.2. Surface Gravity (Gravitational Acceleration)

Gravitational acceleration uses the Acceleration Equation, but modified for the calculation of amplitude difference due to gravity. The slight variation in amplitude loss that is the cause of gravity needs to be accounted for. The proton is used again for the calculation using the gravity of the proton coupling constant, as shown below in Eq. 6.2.1.

$$a_p = (K_e^2 \lambda_l)\, c^2 \frac{Q_1 Q_2}{r^2} (\alpha_{Gp}) \tag{6.2.1}$$

To calculate surface gravity (acceleration due to gravity), assume a single proton on the surface of a large body. In this case, Q_1=1, as it is a proton. The gravity of proton coupling constant needs to be modified for a single group count Q, as Q was originally derived based on the mass of the proton. The ratio of the proton mass and electron mass (μ) is used here again as seen in Eq. 6.2.2. Finally, Q_2 becomes the nucleon particle count in the large body.

$$a_p = (K_e^2 \lambda_l)\, c^2 \left(\frac{Q_{group}}{r_{group}^2} \right) \left(\frac{\alpha_{Gp}}{\mu} \right) \tag{6.2.2}$$

Acceleration Equation for Gravity

The Acceleration Equation for Gravity in Eq. 6.2.2 was used to accurately calculate the surface gravity for each of the planets seen earlier in Table 1.2. The following is provided as an example calculation of Earth's surface gravity (g).

<u>Example 1 – Surface Gravity of Earth</u>

The number of nucleon particles for Earth was calculated earlier in Section 3.1 and is used as Q_{group}. The radius of the Earth, r_{group}, is 6,375,223 meters. The proton to electron mass ratio is μ = 1836.152676. The constant g replaces acceleration (a) to be consistent with the term used for surface gravity.

r_{earth} = 6,375,223 m
Q_{earth} = 3.570 x 10^{51}

$$g_{earth} = (K_e^2 \lambda_l)\, c^2 \left(\frac{Q_{earth}}{r_{earth}^2} \right) \left(\frac{\alpha_{Gp}}{\mu} \right) \tag{6.2.3}$$

Calculated Value: 9.807 m/s^2
Difference: 0.000%

Example 2 – Surface Gravity of Jupiter

A second example is provided to calculate the surface gravity for Jupiter. It is similar to the calculation for Earth, but has different values for nucleon count and planet radius.

$r_{jupiter}$ = 71,492,000 m
$Q_{jupiter}$ = 1.351 x 10^{54}

$$g_{jupiter} = (K_e^2 \lambda_l)\, c^2 \left(\frac{Q_{jupiter}}{r_{jupiter}^2}\right)\left(\frac{\alpha_{Gp}}{\mu}\right) \qquad \textbf{(6.2.4)}$$

Calculated Value: 24.792 m/s^2
Difference: 0.008%

The remaining planets in Table 1.2 were calculated the same way. The nucleon particle counts and radius for each planet are provided to reproduce each of the calculated values using the Acceleration Equation for Gravity.
Fig. 6.6, below, also details the reason why the nucleon count and planet radius are used in the equation. Each particle in a large body is responsible for a loss of amplitude. However, particles reside throughout the large body at varying distances from the object that is being affected by the gravitational force (falling object in this diagram). The wave amplitude difference from a single particle is negligible. However, when added as a result of multiple particles in a large body, Q_{group}, the wave amplitude difference becomes significant.

In a large body with particles spread uniformly throughout the body, the net sum of the amplitude loss from each of these particles will be equal to the amplitude loss if all of these particles were placed directly in the center of the large body. Force is a vector, thus when considering the cosine of particles throughout the body, the net result of each of these particles and their amplitude loss happens to be at the center. This is described in the top right of the diagram in Fig. 6.6.

The particle amplitude loss is α_{Gp}, which was defined earlier in this paper. However, when one mass is negligible in the gravity equations (such as the falling object attracted by the planet in Fig. 6.6), only one value Q is used to calculate nucleon count. In this case, the proton-to-electron mass ratio needs to be divided in the equation because a second value of Q is not used to estimate the nucleon count in the falling object.

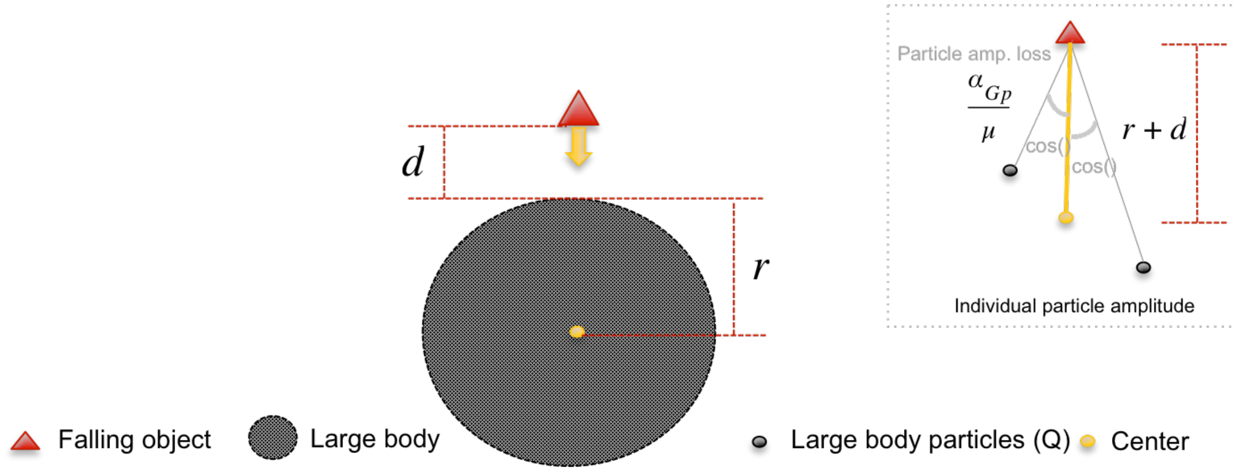


Fig. 6.6 - Large Body Gravity Explained

6.3. Velocity

In the beginning of Section 6, velocity was illustrated as a frequency difference in Fig. 6.1. The wavelengths of the standing wave structure of a particle are different than the wavelengths of its surroundings, which are the spherical, longitudinal waves that become the particle's in-waves. In this section, velocity is derived based on this frequency difference.

In a Classical Reconstruction of Relativity, Declan Traill explained the frequency difference in acceleration and mapped this same frequency difference to velocity.[15] The following derivation originated from this key observation, although the equations differ.

Earlier, in Fig. 6.5, an illustration was provided showing a wave at speed (c), traveling through the particle radius ($K_e^2\,\lambda$) with a change in amplitude (ΔA). A modified version of this is now found in the ratio of the frequency of the particle's leading edge waves compared to the frequency of the particle's surroundings. Eq. 6.3.1 shows this ratio in both frequency and wavelength, which are related. Time (t) is now introduced into the equation.

In a quick check of Eq. 6.3.1, if there is no change in amplitude, the equation resolves to 1. There is no difference in frequency or wavelength. When there is a change in amplitude, there is a difference in wavelength. The leading edge wavelength is compressed relative to its surrounding in-wave wavelengths as it was shown visually in Fig. 6.2.

The difference in amplitude (ΔA) is calculated by constructive and destructive wave interference, based on two groups of particles (Q) at a distance (r). This is shown in Eq. 6.3.2.

$$\frac{f_{lead}}{f_l} = \frac{\lambda_l}{\lambda_{lead}} = \frac{A_l^3 + (K_e^2\lambda_l)\,(c)\,(\Delta A)\,(t)}{A_l^3} \tag{6.3.1}$$

$$\Delta A = \frac{Q_1 Q_2}{r^2} (A_l^3) \tag{6.3.2}$$

Eq. 6.3.2 can be substituted into Eq. 6.3.1 to become the method of calculating the wavelength ratio based on two particle groups (Q) and distance (r). It is shown in Eq. 6.3.3, which is then simplified to Eq. 6.3.4 to show the ratio of wavelengths.

When solving for the particle's leading edge wavelength, Eq. 6.3.5 can be used. It will be shown that this wavelength is the velocity of the particle.

$$\frac{\lambda_l}{\lambda_{lead}} = \frac{A_l^3 + (K_e^2 \lambda_l)\,(c)\left(\frac{Q_1 Q_2}{r^2} A_l^3\right)(t)}{A_l^3} \tag{6.3.3}$$

$$\frac{\lambda_l}{\lambda_{lead}} = 1 + (K_e^2 \lambda_l)\,(c)\left(\frac{Q_1 Q_2}{r^2}\right)(t) \tag{6.3.4}$$

$$\lambda_{lead} = \frac{\lambda_l}{1 + (K_e^2 \lambda_l)\,(c)\left(\frac{Q_1 Q_2}{r^2}\right)(t)} \tag{6.3.5}$$

Acceleration Wavelength at Time (t)

Similar to acceleration, the variables used to determine amplitude difference for gravity can be substituted into the equation above to be a version used for calculations of gravity. Whereas Eq. 6.3.5 can be used for simple constructive and destructive wave interference of particles based on electromagnetism, Eq. 6.3.6 is used for the calculation of the leading edge wavelength for amplitude loss in a large body.

$$\lambda_{lead} = \frac{\lambda_l}{1 + (K_e^2 \lambda_l)\ (c) \left(\frac{Q_{group}}{r_{group}^2}\right) \left(\frac{\alpha_{Gp}}{\mu}\right) (t)} \tag{6.3.6}$$

Acceleration Wavelength at Time (t) for Gravity

At this point, only the wavelength at time (t) is known. To calculate velocity, the same wavelength ratio is applied to a known Doppler equation to solve for velocity (v). This equation is found in Eq. 6.3.7, where it is again expressed as the ratio of the longitudinal in-wave wavelength and the particle's leading edge wavelength.

Since the wavelength ratios are seen in acceleration and the Doppler equation, Eq. 6.3.4 and Eq. 6.3.7 are combined into Eq. 6.3.8.

$$\frac{\lambda_l}{\lambda_{lead}} = \frac{c}{c - v} \tag{6.3.7}$$

$$\frac{c}{c - v} = 1 + (K_e^2 \lambda_l)\ (c) \left(\frac{Q_1 Q_2}{r^2}\right) (t) \tag{6.3.8}$$

Now, the equation above can be solved for velocity. This becomes the Velocity Equation.

$$v = c - \frac{c}{1 + (K_e^2 \lambda_l)\ (c) \left(\frac{Q_1 Q_2}{r^2}\right) (t)} \tag{6.3.9}$$

Velocity Equation

Again, the same equation can be modified for amplitude loss based on gravity. It becomes the Velocity Equation for Gravity.

$$v = c - \frac{c}{1 + (K_e^2 \lambda_l)\ (c) \left(\frac{Q_{group}}{r_{group}^2}\right) \left(\frac{\alpha_{Gp}}{\mu}\right) (t)}$$ **(6.3.10)**

Velocity Equation for Gravity

Note: The velocity equations, Eqs. 6.3.9 and 6.3.10, assume initial velocity of zero and constant acceleration (constant amplitude difference).

When acceleration or time are non-relativistic (low values), Eq. 6.3.10 resolves to be the calculation for velocity based on time, v=at. This was shown in Table 1.3 where the calculated values (using Eq. 6.3.10) match the velocity values that use v=at.

Two example calculations are shown for velocity, using Eq. 6.3.10, although the remaining planets are calculated and shown in Table 1.3.

Example 1 – Velocity of Falling Body on Earth at 50 Seconds

Velocity is based on time, so the first calculation is based on a falling object on Earth, which starts at rest, and has a calculated velocity after 50 seconds (t). The particle count (Q) and radius of earth (r) are re-used from previous examples.

t = 50 s

r_{earth} = 6,375,223 m

Q_{earth} = 3.570 x 10^{51}

$$v = c - \frac{c}{1 + (K_e^2 \lambda_l)\ (c) \left(\frac{Q_{earth}}{r_{earth}^2}\right) \left(\frac{\alpha_{Gp}}{\mu}\right) (t)}$$ **(6.3.12)**

Calculated Value: 490.33 m/s
Difference: 0.000%

Example 2 – Velocity of Falling Body on Sun at 1.0E15 Seconds (Relativistic)

To demonstrate that the velocity equations also naturally support relativistic speeds, further examples were calculated using the Sun's gravitational force over a time of 1.0E15 seconds. The velocity hits a maximum of 299,792,458 meters per second, or the speed of light. A time of 1.0E16 seconds was also placed into Table 1.3, but it has the same value

– speed of light. This would happen to any object experience a force of that magnitude over that time period, not just the gravitational force of the Sun.

$t = 1.0 \times 10^{15}$ s

$r_{sun} = 695{,}700{,}000$ m

$Q_{sun} = 1.189 \times 10^{57}$

$$v = c - \frac{c}{1 + (K_e^2 \lambda_l)\,(c)\left(\frac{Q_{sun}}{r_{sun}^2}\right)\left(\frac{\alpha_{Gp}}{\mu}\right)(t)} \tag{6.3.13}$$

Calculated Value: 299,792,458 m/s*

** Speed of light*

<u>**General Relativity**</u>

One of the terms from General Relativity is apparent in the equations above. Eq. 6.3.4 is shown again in Eq. 6.3.14 as a function of wavelength ratios based on time. Time (t) can also be expressed as distance divided by wave speed. In other words, time is the distance (d) that it takes for light (c) to travel. This is shown in Eq. 6.3.15. Note that distance is sometimes found in gravity equations as height (h) instead of d.

$$\frac{\lambda_l}{\lambda_{lead}} = 1 + (K_e^2 \lambda_l)\,(c)\left(\frac{Q_1 Q_2}{r^2}\right)(t) \tag{6.3.14}$$

$$t = \frac{d}{c} \tag{6.3.15}$$

Replacing time with distance (d):

$$\frac{\lambda_l}{\lambda_{lead}} = 1 + (K_e^2 \lambda_l)\left(\frac{Q_1 Q_2}{r^2}\right)(d) \tag{6.3.16}$$

Acceleration (a) is nearly found in the above equation. It was derived and shown earlier in Eq. 6.1.11, but shown again in Eq. 6.3.17 to compare it to Eq. 6.3.16. However, a little algebra to add c^2 to the numerator and denominator allows acceleration to be added back to the equation (Eq. 6.3.18).

$$a_e = (K_e^2 \lambda_l)\, c^2 \frac{Q_1 Q_2}{r^2} \tag{6.3.17}$$

$$\frac{\lambda_l}{\lambda_{lead}} = 1 + \frac{(K_e^2 \lambda_l)\,(c^2)\left(\frac{Q_1 Q_2}{r^2}\right)(d)}{c^2} \tag{6.3.18}$$

Now, acceleration (a) can be substituted into Eq. 6.3.18. The result is an equation seen in General Relativity. It is expressed in both distance (Eq. 6.3.19) and also in time (Eq. 6.3.20).

$$\frac{\lambda_l}{\lambda_{lead}} = 1 + \frac{ad}{c^2} \tag{6.3.19}$$

$$\frac{\lambda_l}{\lambda_{lead}} = 1 + \frac{at}{c} \tag{6.20}$$

To summarize this section, acceleration is based on a difference in wave amplitude. This causes particle motion as it attempts to minimize amplitude. This causes a frequency shift (wavelength in particle's leading edge is compressed), which is velocity. Acceleration is based on wave amplitude; velocity based on wavelength. Both are relative to its surroundings and thus naturally incorporate relativistic speeds into the equations. These equations were used to calculate and match acceleration values (using surface gravity of planets as comparisons) and velocity values (using velocity at time intervals due to gravity).

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 also found to calculate the electron's rest energy and mass by calculating standing, longitudinal waves. 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 the Force Equation for gravity (F_g) and the magnetic moment of the electron (Bohr magneton) in Section 3.4. Gravity and magnetism are a direct result of particle spin and the conservation of energy.

The calculations for the electromagnetic and gravitational forces were proven in Sections 2 and 3 - illustrated by a difference of 0.000% between the calculations using the Force Equation and Coulomb's law, Distinti's New Magnetism and Newton's law respectively for electromagnetism and gravity 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 wave constants in the Force Equation (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 22 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 first and second laws of motion were also explained by deriving the Acceleration Equation and the Velocity Equation. Calculations using these equations match acceleration and velocity results of the gravitational pull of falling bodies on Earth and other planets in the solar system.

In conclusion, based on the equations and calculations, 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 strong force is a modification of wave amplitude based on two particles in close proximity, within each other's standing wave structure. 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 spin. 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. Its significance is important as it describes gravity, but hidden in the constant is the reason and meaning for gravity. This section attempts to break down the constant into its key parts to discover this meaning.

Separating the Gravitational Amplification Factor Components

During the gravity derivation, the gravity of electron 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 that the coupling constant is dimensionless, while the amplitude factor has units of meters cubed (m^3).

$$\alpha_{Ge} = \frac{K_e^{12} \lambda_l^4}{A_l \delta_{Ge} \alpha_e} \tag{A.1}$$

However, it can be modeled a second way, appearing as its true nature in the energy wave equations as an amplitude factor. The amplitude factor describes constructive and destructive waves responsible for changing the amplitude of the wave. Modeling the same equation above as an amplitude factor would appear as the following:

$$\delta_{Ge} = \frac{K_e^{12} \lambda_l^4}{A_l \alpha_{Ge} \alpha_e} \tag{A.2}$$

In Eq. A.2, the amplitude factor (δ_{Ge}) is now the value of 2.40E-43, and what was the former coupling constant for the gravity of electron (α_{Ge}) is the correction factor. In Eq. A.3, the modifier is substituted and the values are rearranged for the purpose of breaking down each of the components of the equation to understand its meaning.

$$\delta_{Ge} = \left(\frac{K_e^8}{A_l} \right) (K_e \lambda_l)^4 \left(\frac{1}{\alpha_e} \right) \left(\frac{1}{\Delta_{Ge}} \right) \tag{A.3}$$

In Eq. A.3, the Planck charge is now apparent ($A_l/2{*}K_e^8$). It was derived in *Fundamental Physical Constants.* In fact, it is the inverse of two Planck charges. The radius of the particle core is also seen in the equation ($K_e\lambda_l$). The particle core radius is further separated into parts for what is assumed to be three-dimensional space and time (measured by a wavelength cycle). Eq. A.4 is a rewritten form of Eq. A.3 with the changes noted above. The value remains 2.40E-43 at this point, just rewritten in a logical form.

$$\delta_{Ge} = \left(\frac{1}{2q_P}\right)(K_e\lambda_l)^3(K_e\lambda_l)\left(\frac{1}{\alpha_e}\right)\left(\frac{1}{\Delta_{Ge}}\right) \tag{A.4}$$

Now, Eq. A.4 can be shown visually, similar to how the fine structure constant was proposed visually in the *Fundamental Physical Constants* paper (Appendix section). The components of the equation are color coded for easier reading.

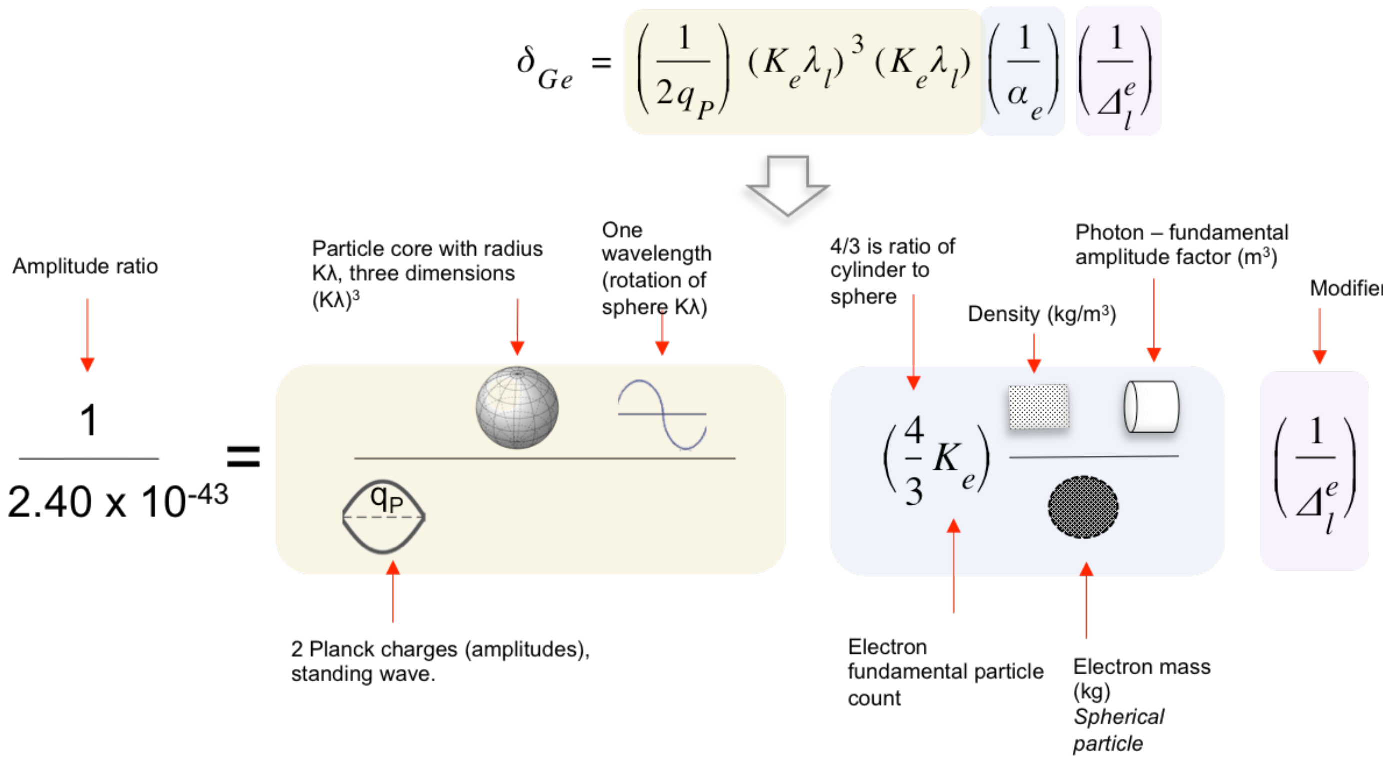


Fig A.1 – Gravitational Amplitude Factor – Visual Equation

Starting from right-to-left, the first component of the equation in light purple is the modifier that appears throughout the energy wave equations.

The second component in light blue is the inverse of the fine structure constant. This constant was proposed, visually in the *Fundamental Physical Constants* paper, to be resonance of the fundamental frequency for the electron. In short, it represents ~137 photon wavelengths at a fundamental amplitude, converting from cylindrical volume (photon) to match the spherical energy of the electron. Refer to the *Fundamental Physical Constants* paper for further details. The important point about the constant is that it appears where kinetic energy is transferred to potential energy and vice versa.

The third component is the focus of the explanation for gravity. The presence of the fine structure constant in the equation suggests that gravity is related to a conversion of energy from one form to another as the derivation of this constant is when longitudinal energy transfers to transverse energy or vice versa. Indeed, it was shown and proven that gravitational energy is lost longitudinal energy as it converts to be the transverse energy of magnetism due to particle spin.

In light yellow are the key components for gravity. The denominator includes the representation of two Planck charges, which is amplitude. In the standing wave in the core, there are two amplitudes, one for each wave. In the numerator, the particle core is shown. It's a spherical core with radius $K_e\lambda_l$, or in three dimensions it is $(K_e\lambda_l)^3$. Lastly, in the numerator, an additional $K_e\lambda_l$ appears as the electron wavelength.

One interpretation of this equation is that the electron particle core is losing two Planck charges (amplitudes) of energy for each wavelength. Since the fine structure is in the equation, it represents longitudinal wave energy being converted to spin energy.

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 C. 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] Yee, J., Particle Energy and Interaction, Vixra.org 1408.0224 (2018).

[2] Yee, J., Zhu, Y. and Zhou, G., Atomic Orbitals, Vixra.org 1708.0146 (2018).

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

[4] Yee, J., Energy Wave Equations: Correction Factors, Vixra.org 1803.0243 (2018).

[5] Yee, J., Fundamental Physical Constants, Vixra.org 1606.0113 (2018).

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

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

[8] L. Bennett, C. Page, L. Swartzendruber, "Comments on Units in Magnetism", Journal of Research of the National Bureau of Standards, Volume 83, No. 1 (1978)

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

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

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

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

[13] 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).

[14] 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).

[15] Traill, D., *A Classical Reconstruction of Relativity*, Online: http://fqxi.org/data/essay-contest-files/Traill_FQXi_Essay_Declan_Tr_1.pdf (July 2012).