Theory of Electromagnetism and Gravity

Modeling Earth as a Rotating Solenoid Coil

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***Abstract*—The earth's magnetic field has not been well described, resulting in much trial and error over the millennia regarding the mechanism of planetary motion. By way of modeling the earth as a rotating solenoid coil a resolution to this problem is sought. Calculations using known parameters of the earth and measured field data has resulted in new understanding of the earths electrical system and gyroscopic rotation. The material makeup of the inner earth is better understood based on derived permeability and permittivity constants. The planet has been modeled as simple coils and then as a parallel impedance circuit which has led to fundamental insight into planetary speed control and RLC combination for Schumann Resonance of 7.83Hz. Torque and Voltage Constants and the inverse Speed Constant are calculated using three methods and all compare favorably with Newtons Gravitational Constant. A helical resonator is referenced and Schumann's Resonant ideal frequency calculated and compared with others idealism. A new theory of gravity based on particle velocity selector at the poles is postulated. Two equations are presented as the needed links between Faraday's electromagnetism and Newtonian physics. Acceleration and Speed Control of earth is explained as a centripetal governor. A new equation for planetary attraction and the attraction of atomic matter is theorized. Rotation of the earths electrical coil is explained in terms of the Richardson effect. Electric power transfer from the sun to the planets is proposed. The impact of this new science of electromagnetic modeling of planets will be magnified as the theory is proven; and found to be useful for future generations of engineers and scientists who seek to discover our world and other planets.**

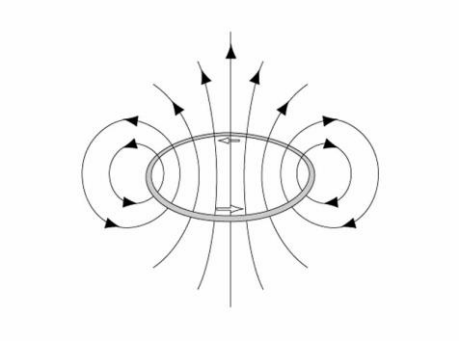
***Index Terms*— Ampere, Biot-Savart, Centripetal Acceleration, Centripetal Governor, Dynamo, Earth, Electric Field, Electromagnetism, Gravity, Newtons Gravitational Constant, Helical Resonator, Lenz Law, Lorentz, Lightning, Magnetic Field, Parallel Impedance, Planet, Speed Control, Schumann Resonance, Richardson Effect, Solenoid, Speed Constant, Torque Constant, Velocity Selector, Voltage Constant**

I. Introduction

The great problem of the earth's magnetic field is continually being addressed by scientist, and reported here-in are simple electrical models of the earth and applying well known laws of Faraday, Lorentz, Biot-Savart and others. Three alternative magnetic fields are considered – simple loop, toroid and stacked coils which are represented as a solenoid. Using measured data of the earth's magnetic field the loop coil equation derives the total earth current. These values are then inserted into the toroid and solenoid model for comparison and calculations of the relative permeability of the earth. Motational EMF calculations are generated for various latitudes to better understand the voltage gradient of the electric field that surrounds the earth. Torque, Voltage and Speed Constants are calculated and compared to Newtons Gravitational Constant. The earth's rotation due to the Richardson effect with rotating coils and DC commutation with the electric field at positive and negative poles is postulated. Using an RLC circuit the earth is modeled as a constant speed machine. Schumann Resonance is a known derivative of lightning and is calculated based on a permittivity of 1.1. It is then ideally calculated for a helical resonator model. The approximate electrical power of the earth is presented as well as other characteristics of the earth explained. The pole regions are a matter of keen interest as calculations suggest that deceleration through the electric field and magnetic field bending are the mechanism for particles and electromagnetic waves and its potential relationship to gravity. Like the RLC circuit which controls the speed of the earth, the electromagnetic field works as a velocity selector to filter out fast and slow particles and let through when $v = E / B = 7920$ m / s; which when moving in a circle equates to an acceleration of 9.8 m/s2. The electromagnetic circuit of the earth works hand in hand with the electromagnetic circuit of the atmosphere to maintain rotational speed at 465.1 m/s and provide centripetal governor, or what has historically been known as gravity.

II. Field At Center of Loop

Examining the direction of the magnetic field produced by a current-carrying segment of wire shows that all parts of the loop contribute magnetic field in the same direction inside the loop.



The form of the magnetic field from a current element in the Biot-Savart law becomes

$$dB = \frac{\mu_0 I d\vec{L} \times \hat{r}}{4\pi R^2} = \frac{\mu_0 I dL \sin\theta}{4\pi R^2}$$

which in this case simplifies greatly because the angle =90 ° for all points along the path and the distance to the field point is constant. The integral becomes

$$B = \frac{\mu_0 I}{4\pi R^2}\oint dL = \frac{\mu_0 I}{4\pi R^2} 2\pi R = \frac{\mu_0 I}{2R}$$

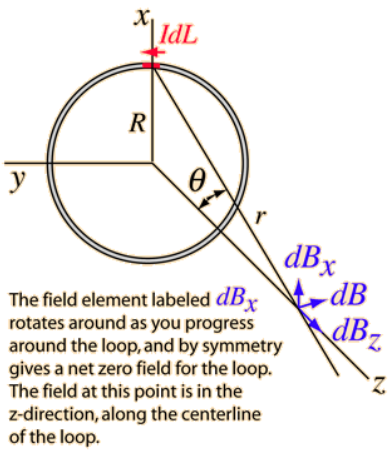
$$\mu_0 = 4\pi \ x \ 10^{-7} T \cdot m / A$$

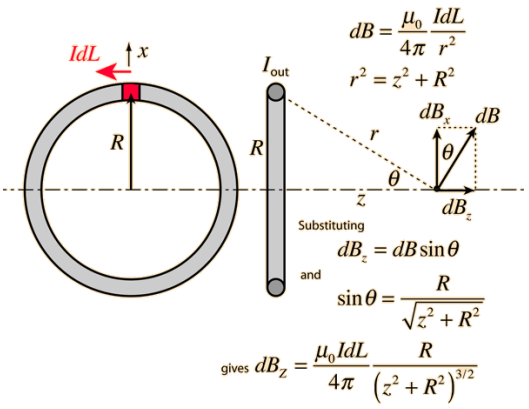
The application of the Biot-Savart law on the centerline of a current loop involves integrating the z-component.

$$dB_Z = \frac{\mu_0 I dL}{4\pi} \frac{R}{\left(z^2 + R^2\right)^{3/2}}$$

The symmetry is such that all the terms in this element are constant except the distance element dL, which when integrated just gives the circumference of the circle. The magnetic field is then

$$B_Z = \frac{\mu_0}{4\pi} \frac{2\pi R^2 I}{\left(z^2 + R^2\right)^{3/2}}$$





For a current I = 1730000000 Amperes and
loop radius **R** = 6378000 m, the magnetic field at the center of the loop is
B = 1.7042819977 x 10^ -4 Tesla = 1.704281997 Gauss.

At a distance z = 6378000 m out along the centerline of the loop, the axial magnetic field is

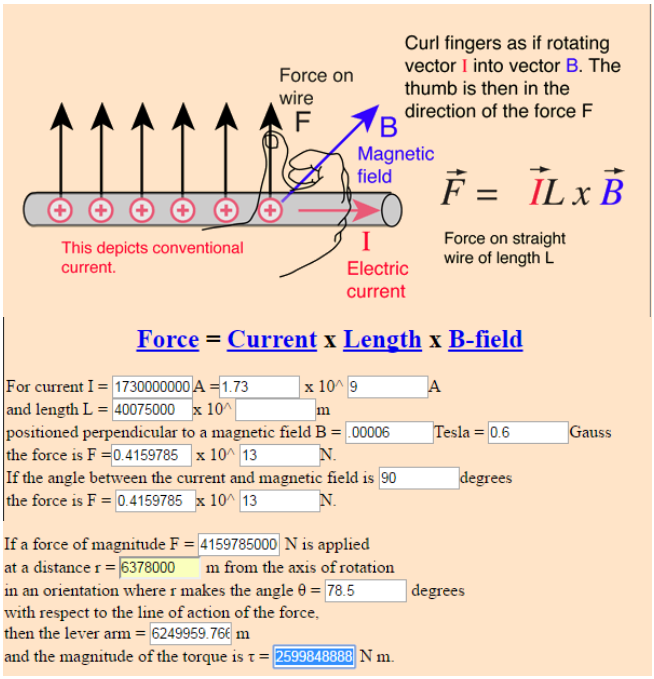
B = 0.6025546788 x 10^ -4 Tesla = 0.6025546788 Gauss.

The current used in the calculation above is the total current, so for a coil of N turns, the current used is Ni where i is the current supplied to the coil. We set N = 9.8 turns for our calculations.

An average lightning strike discharges about 30,000 amperes (20,000 amperes in the UK). NASA has recorded strikes of 100,000 amperes and there are other reports of strikes over 200,000 amperes. [1]

The magnetic field of the earth ranges from 1.7 Gauss at the center of the earth to .60 Gauss near the surface. These values compare favorably with measured values at the earth's surface of .25 to .65 Gauss.

III. Calculate Torque Constant



Torque = 25998488885508362000 Nm

Kt = Torque / Current

Kt = 25998488885508362000 Nm / 1730000000 Amps

Kt = 15028028257

Ks = 1 / Kt

Ks = 1 / 15028028257

Ks = 6.654 E-11

We can then compare to Newtons Gravitational Constant

G = 6.674 E-11

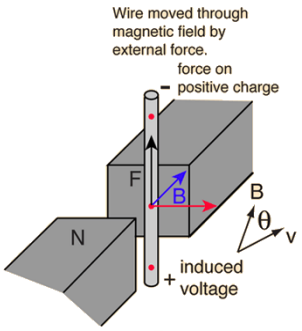
Percent error is less than 1%.

For confirmation, we will next calculate the Emf and Voltage Constant as we know that the Torque Constant is equal to the Voltage Constant and they both are equivalent to the inverse of the Speed Constant

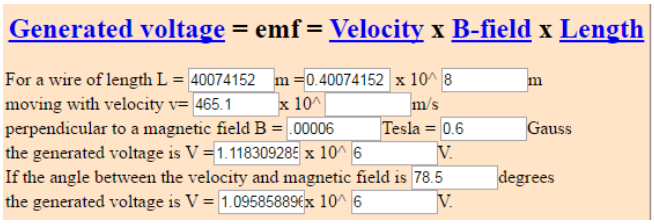
$$Ks = 1 / Ke = 1 / Kt$$

IV. Motational EMF

When a conductor moves through a magnetic field, there will be a generated motional emf. This is one example of Faraday's Law and it arises from the magnetic force. The voltage generated in a length of wire, presuming that the entire length moves through a uniform field, is given below:



The magnetic field is estimated to be .60 Gauss. The angle between rotation axis and magnetic field is approximately 11.5 degrees.



Changing latitude will reduce the length of L and increase the magnetic field B, thus for varying degrees and minutes we can show individual coil voltages at relative magnetic field strength:

Equator =	1,095,858 Volts	@ .60 Gauss
Capricorn =	752,875 Volts	@.45 Gauss
Cancer =	752,875 Volts	@.45 Gauss
Arctic Circle =	523,229 Volts	@.65 Gauss
Antarctic Circle =	523,229 Volts	@.65 Gauss

The average value of the five (5) voltages is approximately 730kv.

V. Calculate Voltage Constant

A voltage constant of *Ke* can be used to calculate a speed constant *Ks* of the earth and then compared to Newtons Gravitational Constant.

Ke = Voltage / Speed (rad/s)

Ke = 1095858V/ 7.292 E-5

Ke = 15028222709

Ks = *1 / Kv*

Ks = 1 / 15028222709

Ks = 6.654 E -11

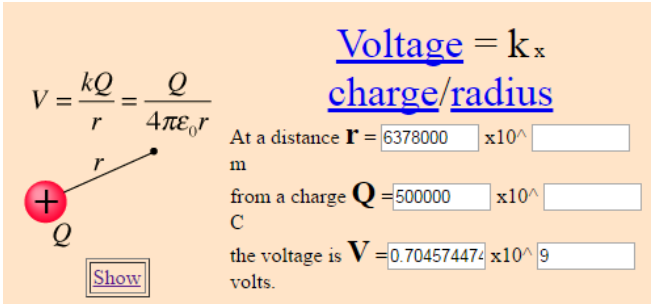
We compare to the Torque Constant and Newtons Gravitation Constant and find they again closely match.

G = 6.674 E-11

Again, percent is less than 1%, which suggest G = *Ks*. Put into words this implies that Newtons Gravitational Constant is derived from a planets motor speed constant, which is inversely related to torque and voltage.

VI. Point Charge Potential

The electric potential (voltage) at any point in space produced by a point charge Q is given by the expression below. It is the electric potential energy per unit charge and as such is a characteristic of the electric influence at that point in space. Since it is a scalar quantity, the potential from multiple point charges is just the sum of the point charge potentials of the individual charges and can be extended to calculate the potential from a continuous charge distribution. Based on 100V - 150 V/m, the charge of the earth has been calculated to be in the range of 400,000 to 600,000 Coulombs. [2]



The earth sphere act as an energy storage device with positive polarity at the north pole and negative polarity at the south pole. A burst of lightning of 704,574,474 Volts is theoretically possible and reports of 1 Billion may not be unreasonable. As a point of comparison Nicolai Tesla calculated the voltage of the sun at 18 Billion Volts. [3]

For the sphere, we can calculate Capacitance at surface based on an average value of Q (Coulombs).

C = Q / V

C = 500,000 C / 704,457,447 V

C = 710 microfarads

The theoretical Power of the earth is approximately

P = V x I

P = 700,000,000 Volts x 1,730,000,000 Amps

P = 1.211 E18 Watts

Power of Earth = 1.2 Exawatts

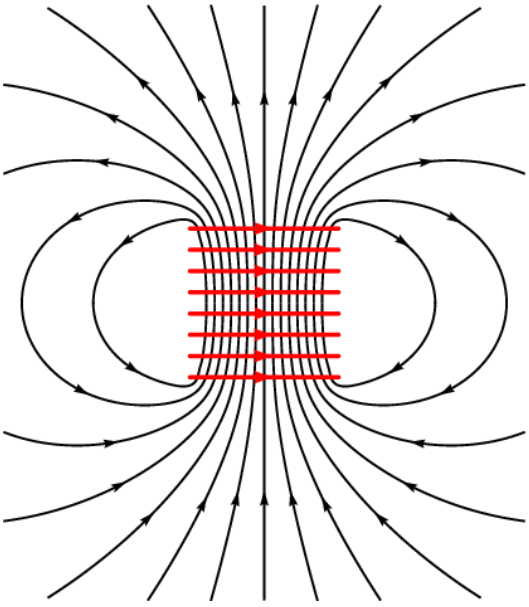
VII. Magnetic Field Solenoid Calculation

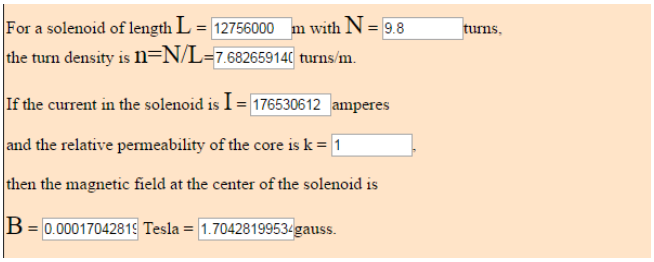
Electric current in a circular loop creates a magnetic field which is more concentrated in the center of the loop than outside the loop. Stacking multiple loops concentrates the field even more into what will resemble a solenoid.

Taking a rectangular path about which to evaluate Ampere's Law such that the length of the side parallel to the solenoid field is L gives a contribution BL inside the coil. The field is essentially perpendicular to the sides of the path, giving negligible contribution. If the end is taken so far from the coil that the field is negligible, then the length inside the coil is the dominant contribution.

$$B = k\mu_0 nI \text{ where } \mu = k\mu_0$$

and k is the relative permeability of the soil = 1, shows there is no magnifying effect of the core.

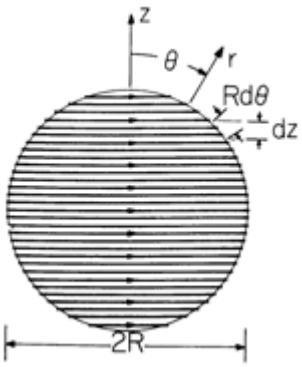




The magnetic intensity at the center of the core is 1.7 Gauss.

VIII. Inductance Of Sphere

The magnetic field intensity produced inside a spherical coil has the property that it is uniform. This should be contrasted with the field of a long solenoid that is uniform only to the extent that the fringing field can be neglected.



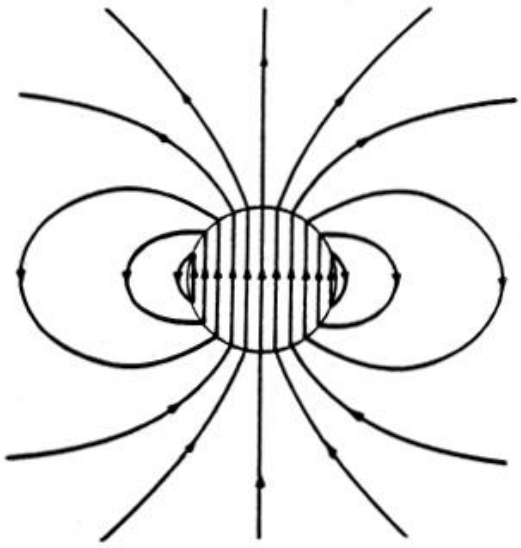
$$L \equiv \frac{2}{9}\pi N^2 \mu_o R \qquad (20)$$

N = 9.8 Turns

R = 6378,000 m (earth radius)

$\mu_0 = 1.2566370614\ldots\times10^{-6}$ H·m^{-1} or N·A^{-2}

For the earth L = 537 Henry



The exterior lines of magnetic field intensity are those of a dipole, while the interior field is uniform. Thus, the total picture, shown above is one of field lines circulating from south to north inside the sphere and back from north to south on the outside. [4]

The inductance of a coil of wire is given by

$$L = \frac{\mu N^2 A}{\ell}$$

ℓ = length of solenoid

A = cross-sectional area

Solenoid length 1275600 cm with N = 9.8 turns,

Coil radius r = 13442000 cm gives area A = 5676460953 cm^2.

Relative permeability of the core k = 1.

Then the inductance of the solenoid is

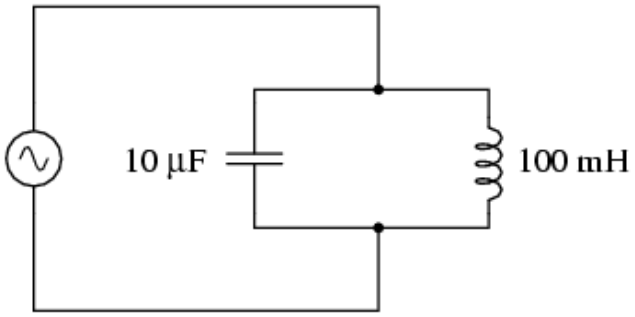
L = 537.0629087 Henry = ... mH.

The area of the coil is approximately 56,764,609,533 m2

IX. Parallel Impedance

A condition of resonance will be experienced in a tank circuit when the reactance's of the capacitor and inductor are equal. On a cosmic scale, it is theorized that the parallel impedance circuit is what maintains the earth, and perhaps other magnetic planets, at constant frequency and speed.

It is noteworthy that much of the earth's mantle is made up of quartz crystal. A quartz crystal behaves like an RLC circuit, composed of an inductor, capacitor and resistor, with a precise resonant frequency.



Defining the parallel resonant frequency as the frequency at which the voltage and current are in phase, unity power factor, gives the following expression for the resonant frequency:

$$\omega_0 = \frac{1}{\sqrt{LC}}\left[\frac{R_L^2 C - L}{R_C^2 C - L}\right]^{\frac{1}{2}}$$

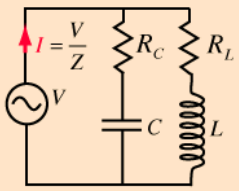
One of the ways to define resonance for a parallel RLC circuit is the frequency at which the impedance is maximum.

Different possible definitions of the resonant frequency for a parallel resonant circuit:

1. The frequency at which $\omega L = 1/\omega C$, i.e., the resonant frequency of the equivalent series RLC circuit. This is satisfactory if the resistances are small.
2. The frequency at which the parallel impedance is a maximum.
3. The frequency at which the current is in phase with the voltage, unity power factor.

Maximum impedance at resonant frequency

$$\omega_0 \approx \frac{1}{\sqrt{LC}}$$



Parallel Resonance

The initial RLC model assumes 465.1 m/s which is equal to the angular rotational value of 7.292 E-5 radians/second. L and C are inserted and solve for Rc and Rl.

For C = 0.71 x10^ -3 F = 710 µF = ... pF
and L = 0.537 x10^ 0 H = 537 mH = ... microHenries
at angular frequency ω = 7.2921159 x10^ -5 rad/s,
frequency = 1.16057629 x10^ -5 Hz = ... kHz = ... MHz
and series resistances:
R_C = 0.4 x10^ 1 ohms = 0.004 kohms = ... Megohms,
R_L = 0.4 x10^ 1 ohms = 0.004 kohms = ... Megohms,
the impedance is
Z = 0.40000000 x10^ 1 ohms = 0.00400000 kohms = ... Megohms
at phase φ = -0.00059650 degrees.

The resonant condition is

Using the series resonant frequency
Angular frequency ω = 0.51213408 x10^ 2 rad/s,
Frequency **f** = 0.81508671 x10^ 1 Hz
Z = 0.96542253 x10^ 2 ohms
Phase φ = 0 degrees.

C = 710 microfarad

L = 537 Henry

Z = 4 ohm

Angular Frequency = 7.2921159 E-5 rad/s

f =1.16 E-5 Hz

Phase Angle = 11 degree

I = V / Z

I = 704,574,474V / 4 ohm

I = 176,143,616 Amp

Calculate the Counter or Back Emf of Inductor:

Vemf = L di / dt

Vemf = 537 H x 176,143,616 A / 86,400s

Vemf = 1,094,781 Volts

Ke = 1,094,781 V / 7.292 E-5

Ke = 15013453099

Ks = 1 / 15013453099

Ks = 6.660E-11 (Newtons Gravitation Constant Calculated a third time.)

The watts loss is I2R = 1.24 E17 watts.

Note that the resonant condition for this RLC configuration is 8.15 Hz. This closely matches the 7.83 Hz Schumann Resonant frequency. Increasing C = 770 mF and keeping the inductance fixed will lower the resonant frequency to 7.83Hz. The difference in capacitance values is likely due to permittivity. C has been calculated based on the permittivity of free space = 8.85 E-12. Since the earth is a good conductor the relative permittivity is estimated to be 1.1 which then makes the following a closer electrical analogy of the earth which corresponds to the known Schumann Resonant frequency.

For C = 0.769299995 x10^ -3 F = 769.299999 µF = ... pF
and L = 0.537 x10^ 0 H = 537 mH = ... microHenries
at angular frequency ω = 7.2921159 x10^ -5 rad/s,
frequency = 1.16057629 x10^ -5 Hz = ... kHz = ... MHz
and series resistances:
R_C = 0.4 x10^ 1 ohms = 0.004 kohms = ... Megohms,
R_L = 0.4 x10^ 1 ohms = 0.004 kohms = ... Megohms,

the impedance is

Z = 0.400000000 x10^ 1 ohms = 0.004000000 kohms = ... Megohms

at phase φ = -0.00059947 degrees.

The resonant condition is

Using the series resonant frequency
Angular frequency ω = 0.491999873 x10^ 2 rad/s,
Frequency **f** = 0.783042118 x10^ 1 Hz
Z = 0.892546470 x10^ 2 ohms
Phase φ = 0 degrees.

X. RESONATOR FREQUENCY

A **helical resonator** is a passive electrical component that can be used as a filter resonator. Characterizing the earth's spherical inductor as a helical resonator the frequency is determined as follows:

Wavelength = 2 x Length / m m = 1, 2, 3, [5]

f = c / wavelength = c / 2 x L / m =1

f = 3E8 / 2 x 12,756,240 m

f = 11.75 Hz

This is a number for a self supporting Helical Coil in air or vacuum. However, our coil is buried in the earths mantle. The resonator frequency is a close approximation to Schumann Resonance of 7.83Hz.

In an ideal cavity, the Schumann Resonant frequency of the nth mode is determined by the radius of the earth and the speed of light.

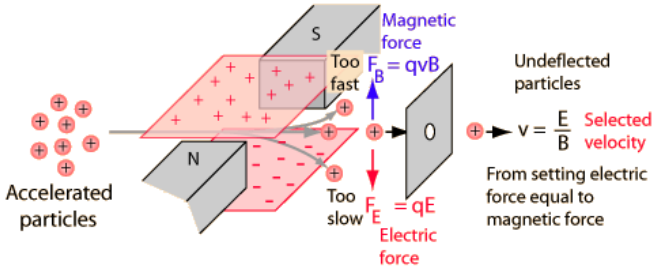
$$f_n = \frac{c}{2\pi a}\sqrt{n(n+1)} \qquad [6]$$

f = 10.5 Hz @ n = 1

We note that our frequency calculation for a Helical Resonator approximates the ideal Schuman Resonant frequency.

XI. ELECTRIC & MAGNETIC FIELDS AT POLES

Electromagnetic waves are produced whenever charged particles are accelerated, and these waves can subsequently interact with other charged particles. EM waves carry energy, momentum and angular momentum away from their source particle and can impart those quantities to matter with which they interact.



The concentration of magnetic field intensity at the North and South pole results in acceleration of particles into space. The Electric Field has been measured at 100 – 150 V/m at ground level and then dissipates to as low as .1 micro volt at 85km in the atmosphere. Particles are accelerated at ground level and then slow down as the Electric Field weakens and approaches zero in the upper atmosphere. The Magnetic Field meets the Electric Field and begins to equalize forces somewhere between 20-30km. There is a transition or handoff from one field to the other where the particles selected velocity equal the magnetic field divided by the magnetic field.

V = E / B.

The Forces become equal and terminal velocity of the particle is achieved. Particles that are moving too fast or too slow are rejected and filtered away. As a charge moves into a magnetic field with direction perpendicular to the field, it will follow a circular path. The magnetic force, being perpendicular to the velocity, provides the electrical force to bend the particles. A circular arc is made around the globe where they reenter at the south poles magnetic field and then accelerate back to earth. Billions of particles circumnavigate the globe at terminal velocity while being bent by the magnetic field.

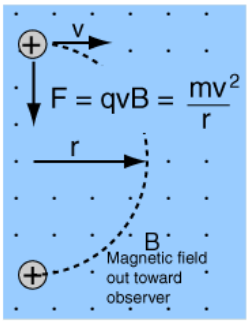
$$r = \frac{mv^2}{qvB} = \frac{mv}{qB}$$ Radius of path produced by magnetic field

If the velocity v is produced by an accelerating voltage V:

$$\frac{1}{2}mv^2 = qV \; ; \quad v = \sqrt{\frac{2qV}{m}}$$

Substitution gives:

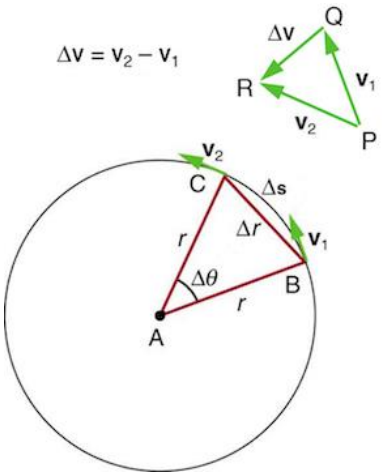
$$r = \frac{1}{B}\sqrt{\frac{2mV}{q}}$$



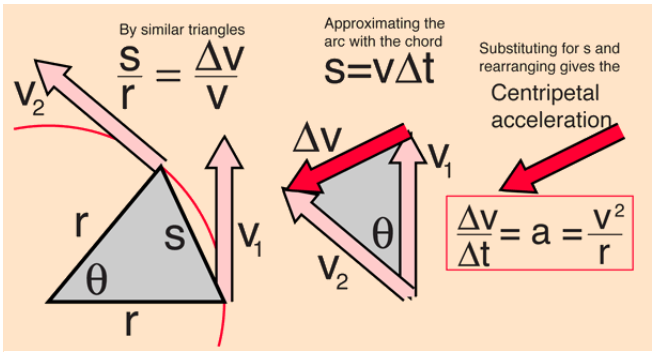
What is of interest is how the earth's natural velocity selector functions in the region of 20km to 30km and the average terminal velocity of particles as they turn and make their way through the strong magnetic field at the poles. The Magnetic Field weakens near the equator and then transitions as the charged particles makes it way to the South Pole.

XII. Centripetal Acceleration

Acceleration is a change in velocity, either in its **magnitude**—i.e., speed—or in its *direction*, or both. In uniform circular motion, the direction of the velocity changes constantly, so there is always an associated acceleration, even though the speed might be constant.



The figure above shows an object moving in a circular path at constant speed. The direction of the instantaneous velocity is shown at two points along the path. Acceleration is in the direction of the change in velocity, which points directly toward the center of rotation—the center of the circular path. This direction is shown with the vector diagram in the figure. We call the acceleration of an object moving in uniform circular motion—resulting from a net external force—the centripetal acceleration. Centripetal means "toward the center" or "center seeking".



It has long been asserted that acceleration and gravity are one in the same. We propose a theory of gravity based on the terminal velocity of particles generated from the earth entering the atmospheres magnetic field at 22km above the earth at 7920 m/s. This is the ideal selector velocity to achieve an acceleration of 9.8m/s2 towards the center of the earth. The radius of the earth at 22km is equal to 6,400,000 meters which generates the following centripetal calculations for speed and acceleration:

For a velocity of 7920 m/s and radius 6400000 m, the centripetal acceleration is 9.801 m/s².
Note that if the velocity is doubled to 15840 m/s at the same radius, the acceleration is

The magnitude of [the natural electric] field decreases with altitude; at 10 km, it has a value of about 3% of that at the surface, whereas at 30 km it is about 300 mV/m and 1 μV/m at about 85 km (Rakov and Uman, 2003). [7]

Implementing the equation v = E / B for various elevation:

10 km v = 150 V/m x .03 / .00005T = 90,000 m/s

22 km v = 150 V/m x .00264 /.00005T = 7920 m/s

30 km v = 150 V/m x .002 / .00005T = 6000 m/s

85 km v = 150V/m x .0000001/.00005T = 3 m/s

At 22 km, the hand off occurs whereby the Electric Field is equal to approximately 400 mV and the Magnetic Field is equal to an average of .00005 Tesla. The Electric Field continues to weaken rapidly and has no further effect on the speed of the particle. The particle begins its circular pattern around the globe due to the force of the Magnetic Field located above the Electric Field. Since the particle is travelling in a circle around the globe at 7920 m/s the acceleration pointing towards the center or towards earth is 9.8 m/s or gravity.

The equation for gravity equates Faraday's electro-magnetism with Newtonian physics. Electrical Acceleration and Kinetic Acceleration meet high in the atmosphere.

a = v2 / r

v = E/B

a = (E/B)2 / r

XIII. Centripetal governor

The purpose of the earths electromagnetic RLC resonant circuit is to set the desired speed of the planet, and the purpose of the atmospheric electromagnetic field is to maintain the speed of the planet through acceleration and deceleration. These two electrical systems work together to keep earth running as a constant speed planet. The speed of the earth is determined by the tuned circuit of the earths parallel inductor and capacitor. Centripetal acceleration or gravity is needed to accelerate or decelerate the earth to maintain the tuned speed of 465.1 m/s. Gravity does this by increasing or decreasing its inward acceleration thereby acting on the mass of the earth. By the equation F = m x a, we know that mass is constant so a change in acceleration will increase or decrease the force acting towards the center of the earth. Gravity is a centripetal governor that acts as a dynamic braking system on the earth. The brake lets off to speed up and pushes down on the earth to speed up. Fortunately for the inhabitants of the earth the RLC circuit is well designed and the force inward or outward is not perceptible. Gravity or centripetal acceleration does not have large swings so the tuned circuit is very stable and the servo control mechanism is tightly controlled.

The acceleration rate of the earth is controlled by terminal velocity or E/B.

The steady state force of the governor can be calculated using Lorentz equation:

F = QE + QvB

F = 500,000 C x .00264v/m + 500,000C x 465.1m/s x .00005T

F = 1320 N + 11627 N

F = 12,947 N

The atmospheric electromagnetic field is connected to the earth via commutation or lightning, thus it is a closed- loop control system. The speed with which a simple closed-loop control system moves to correct its output is described by its damping ratio and natural frequency. A system with a small damping ratio is characterized by overshooting the desired output before settling down. Systems with larger damping ratios do not overshoot the desired output, but respond more slowly. Monitoring of the Schumann frequency spectrum may show signature of acceleration or deceleration. Taken together these two equations are what control the speed and acceleration of planets like rotating machines here on the surface of earth.

1) Mechanical Velocity = Electrical Frequency

$$\omega_0 = \frac{1}{\sqrt{LC}}\left[\frac{R_L^2 C - L}{R_C^2 C - L}\right]^{\frac{1}{2}}$$

2) Mechanical Acceleration = Electromagnetic Field

a = (E/B)2 / r

XIV. Turns Ratio Calculation

V = L di / dt

V = (2 / 9 x Pi x N2 x μ_0 x R) x I / t

N2I = V x 9 x t / 2 x Pi x μ_0 x R

N x 1.73 Billion Amps = V x 9 x t / 2 x Pi x μ_0 x R

N x 1.73 B A = V x 9 x t / 2 x Pi x μ_0 x R

N x 1.73 B A = 1,095,858V x 86,400s / 2 x Pi x μ_0 x R

N x 1.73 B A = 852139180800 / 50.34

N x 1.73 B A = 16927675423

N = 16927675423 / 1,730,000,000

N = 9.78

XV. Calculate Forces between earth and Moon

Comparison of electrostatic force and kinetic force of attraction between planets.

F = Ke Q1 Q2 / R^2 and F = G M1 M2 / R^2

F = Ke Q1 Q2 / R^2
Q = 4 Pi $\varepsilon o r^2$ E
Ke = 8.99×E9 N m2 C−2
εo = 8.85418782 × 10-12 m-3 kg-1 s4 A2 (free space)
4 Pi εo = 1.1126501 E-10 F/m (earth)
4 Pi εo = 1.1126501 E-10 F/m (moon)
R = 3.844 E8 m (distance from earth to moon)
r = 6.378 E6 (earth)
r = 1.737 E6 (moon)
Mass earth = 5.974 E24 kg
Mass moon = 7.349 E22 kg
E earth = 100 V / m
E moon = 1 V / m (estimate)
Q earth = 1.1126501 E-10 F/m (6.378 E6 m)2×100 v/m = 453,613 Coulomb
Q moon = 1.1126501 E-10 F/m (1.737 E6m)2 x 1 v / m = 335 Coulomb
F = 8.99 E9 N m2 C−2 x 453,613 C x 335 C / (3.844 E8 m)2

F = 8.6 N

$F = GM1M2/R^2$
F = (6.674 E−11 N-m2/kg2) (5.974 E24 kg) (7.349 E22 kg)/ (3.844 E8 m)2
F = (2.930 E37 N-m2)/ (1.478 E17 m2)
F = 1.982 E20 N

The electrostatic force is far less than the kinetic force of attraction. Clearly there is a missing magnetic force of attraction. From such a long distance both planets are small enough to be represented as single points then they can be represented as point magnetic charges. Classically, the force between two magnetic poles is given by: [8]

$$F = \mu\, q_{m1}\, q_{m2\,/\,4\,Pi\,r2}$$

Where:

F is force (SI unit: newton)
q_{m1} and q_{m2} are the magnitudes of magnetic poles (SI unit: ampere-meter)
μ is the permeability of the intervening medium (SI unit: tesla meter per ampere, henry per meter or newton per ampere squared)
r is the separation (SI unit: meter).

The magnetic force produced by a bar magnet, at a given point in space, therefore depends on two factors: the strength *p* of its poles (**magnetic pole strength**), and the vector ***l*** separating them. The moment is related to the fictitious poles as: [9]

q_{m1} = magnetic moment / length

q_{m1} = 8E22 Am^2 / 1,756,000m [10]

q_{m1} = 6.27E15 A-m

A similar equation for the force between two wires carrying current I1 and I2 is as follows:

$$F = \mu_0\, I1xI2\, /2\, Pi\, r$$

It is readily discernible that the force of attraction due to the Lorentz force, the force between point charges, magnetizing force and force between wires is insufficient force to achieve that of Newtons Law of gravity using the mass of two planets.

XVI. New Equation for Planetary Attraction

The magnetic force of attraction of planets is most like two magnetic solenoid that are pulling towards each other. The magnetic force is like Lenz law for solenoids but instead of attraction to a piece of metal we have two spherical magnetic solenoids attracted to each other. The magnetic force is much larger in orders of magnitude then the electrostatic force, magnetizing force or the force between wires. Those forces are additive to the force of the spherical coils, and should be considered, but for the point of discussion are nearly inconsequential. What is proposed is a new theoretical equation for magnetic planets that more nearly matches Newtons Law.

Newtons Law = Electromagnetic Law

Force of attraction mass = Force of attraction solenoid

$F = Gm_1m_2 / r^2 = k\, F_{m1}F_{m2} / 4r^2$

$F = Gm_1m_2 / r^2 = k\, (n*i)^2\mu_0A\, (n*i)^2\mu_0A/4r^2$

Solving for k:

$Gm_1 = k\, (n*i)^2\mu_0A/4$ (earth)

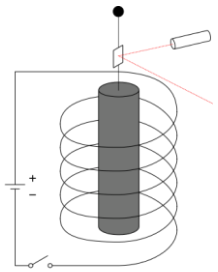
$k = Gm_1 / (n*i)^2\mu_0A/4$

$k = 6.674E\text{-}11 \times 5.974E24 / (1.73\ E9)^2 \times 1.2566E\text{-}6 \times 5.676E10 /4$

k = 7.4E-9

XVII. Richardson Effect

The **Richardson Effect** (after Nobel Laureate and Princeton Professor Owen Richardson), is a physical phenomenon delineated by way of experimentation by Albert Einstein and Wander Johannes de Haas in the mid-1910s that exposes a relationship between magnetism, angular momentum, and spin of elementary particles.

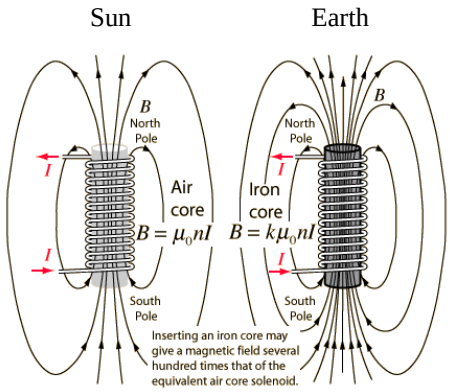


The effect corresponds to the mechanical rotation that is induced in a ferromagnetic material (of cylindrical shape and originally at rest), suspended with the aid of a thin string inside a coil, on driving an impulse of electric current through the coil. [11]

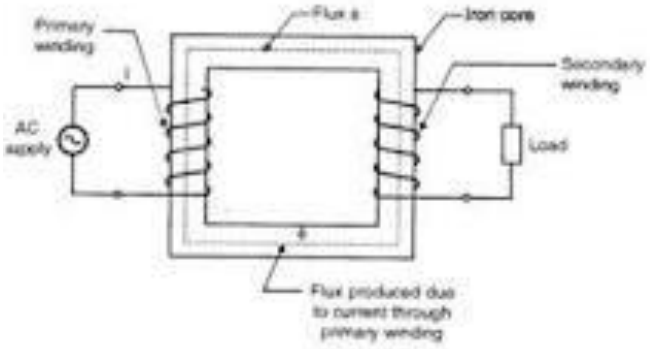
XVIII. Universal Power System

The sun and earth are electromagnetically connected just like a single-phase transformer with no iron. The flux transfer between the sun and planets occurs in the vacuum of space. Imagine the coil on the left being the sun and the coil on the right being the earth. The sun coil is many times larger than the earths coil, and there are numerous

planets that are also similarly connected. The sun acts as a multi tap single phase transformer with several tertiary winding or planets. Planets by being in a vacuum, and the Richardson Effect for coils, the planets all rotate. Orbits and positioning are a function of attraction to other like magnetic bodies. Thus, the sun is the power generator and the planets are motors all working much like a power system here on earth. Given the sun's immensity we have an inexhaustible supply of electromagnetic energy from which to draw clean reliable electric energy.



Sun Earth



"Electric power is everywhere present in unlimited quantities and can drive the world's machinery without the need of coal, oil, gas, or any other of the common fuels." - Nicola Tesla [12]

XIX. Conclusion

The earth has an inductive coil wrapped around it periphery of 9.8 turns. The rotation of the coil and the earth are attributed to the Richardson Effect. The Einstein-de Haas test results confirmed the Richardson Effect and provide explanation for earth rotation and helps to understand how the inner iron core spins in the opposite direction of the outer core, mantle and surface. Due to the tilt of the earth the rotating coils nearest the equator will cross from the positive electromagnetic field of the north pole to the negative field of the south pole. The direction of current flow in the wires will reverse and commutation occurs. This commutation of the earth shows up in the form of lightning from ground to the opposite poles electric field. The normal running current of the earth is very small, but the fault current of lightning is large. There are over 1.4 billion lighting strikes of various ampacity every year. The rotating strikes are believed to be what charges the atmospheric electromagnetic field and give the north and south poles their polarity. The Schumann Resonance of 7.83Hz is known to be related to lightning. The North and South Pole act as fixed magnetic fields. Lightning occurs near the equator and up into the regions of Tropics of Cancer and Capricorn. Above these latitudes the coils are too short in length and at such an angle that they cannot cross to opposite poles and as such commutation or lightning does not occur. The earth's parallel RLC circuit operates as a resonant circuit to precisely control frequency which ultimately fixes the rotational speed of the earth.

The magnetic coil that extends from the south pole to the north pole is shaped somewhat like a helical resonator. It acts as a particle accelerator and wave guide that generates the earth electromagnetic field at Schumann Resonant frequency, which is also correlated to the frequency of the earth's commutation circuit or lightning. The electric field in the near atmosphere decelerates the particles thru natures velocity selector and then transitions to the magnetic field when v = E/B. The earths electromagnetic field at the poles acts as filter for particles with a velocity of 7920 m/s. The magnetic field bends the particles around the earth. Experimentation is suggested with mass spectrometry to assess select and terminal velocity of particles at known atmospheric electric field values. Studying the relationship of particles and electromagnetic waves may be fruitful in further unlocking the secrets of gravity. The workings of the earth's governor control to maintain constant speed has been described. Research into the earth's servomechanism and relationship to Shuman Resonance would be of interest.

A new equation has been developed for electromagnetic planetary attraction that is equated to Newtons Law. It is conceivable under Ampere's hypothesis that all bodies are magnetic to some minute degree due to the circulating motion of electrons in the atom. The new equation, just like Newtons law, would apply to all atomic matter. Thus, determining the inductance and current of an apple may be the explanation, and the answer to Newtons questions, as to the unseen force pushing the apple to earth. We now know the turns ratio of the earth is 9.8.

Acknowledgment

The felicitation of all historical figures referenced would neither add nor detract to their contribution to the world of science. Names such as Copernicus, Galileo, Newton and Einstein are known monuments to science. But as curious young eyes begin to venture into the field of electromagnetic modeling of planets we hope they review the works of other

genius electrical minds that include Ampere, Gauss, Faraday, Lorentz, Lenz, Maxwell, and Tesla. Appreciation to David Gabriel, MSEE University of Hawaii for explanation of governor control and Dr. Tom Tonon, MSEE from Penn State and Doctorate of Philosophy from Princeton University for general information on centripetal acceleration. Heartfelt acknowledgment to authors nearly 90-year-old father Delbert M. Poole, BSEE retired from Bonneville Power Administration for relevance of quartz crystal to RLC resonant circuits and thoughts on interaction of electromagnetic fields between planets. Dick Reese, PE for review and support. Author made constant use of the online tool Hyperphysics for review and accuracy of calculations.

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Greg Poole was born in Auburn, Washington in 1959. He received the B.S. in electrical engineering from Washington State University in 1982. In 1984, he worked for Westinghouse Electric Corporation and spent much of his career working for their Engineering Service Division in the capacity of field engineer, sales and management. Mr. Poole was recipient of several awards at Westinghouse including the prestigious Eagle Award in 1994 for his efforts in renovating the NASA Unitary Wind Tunnel 200,000Hp motors and the commercialization of industrial substations. He also managed field service offices for General Electric, ABB and Square D prior to venturing into his own electrical engineering and testing company. At General Electric, he was involved in many AC drive upgrades of steel mills and paper plants in upstate New York. For the past ten years he has served as President and co-owner of Industrial Tests, Inc. in Sacramento, California. The company is a NETA certified electrical testing firm that has been servicing northern California for nearly four decades. Over the span of his career Mr. Poole has done work for research organizations such as SLAC, LLNL, and Sandia Labs.