The Golden Ratio And The Fine Structure Constant

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All electrons are identical fundamental particles having rest mass energy as well as energy in the field. This paper will present the Fibonacci growth rate number Φ as having a very fundamental connection to the fine structure constant which is the ratio of the electron free charge-field energy to its rest mass standing-wave energy at the compton radius of the electron. The Fibonacci number is also known as the Golden Ratio and the square root of the Fibonacci number is extremely close to $4/\pi$. This ratio is also expressed by the Height of the Great Pyramid at Giza to 1/2 of its base length. Further, the energy density in the standard electric field to the energy density in a closed toroid field at the same radius of the electron has the ratio expressed by $4/\pi$. This is shown in chapter 1 of my book, **"Electrogravitation As A Unified Field Theory".** [1]

It will be shown that the universal fine structure constant α is connected to the Fibonacci growth rate and that a surplus energy left over from establishing the rest mass energy of the electron leaves energy left over for establishing the charge-field at the zero crossing point. Therefore, charge is the result of energy being left over after establishing the rest mass energy of the electron and that surplus energy is the result of the spiral growth rate of the Fibonacci spiral not closing exactly on zero after a full rotation. The amount of energy left over is larger than the rest mass energy by an amount equal to the fine structure constant times the rest mass energy.

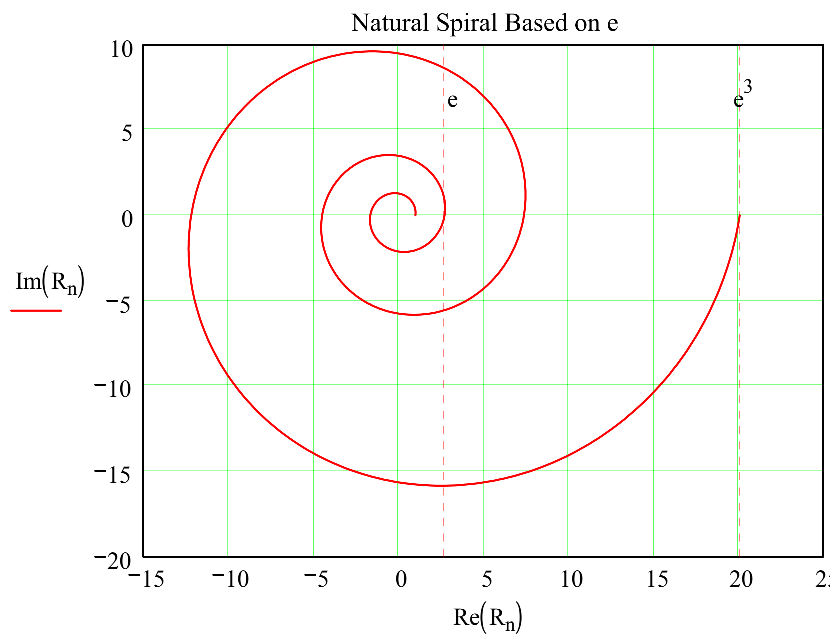
First, the spiral equation related to the growth rate represented by the natural number e will be presented and then the spiral related to the Fibonacci growth rate will also be presented for the sake of comparison. At first glance, it may appear that the Fibonacci number is obtained as 1/2 of a full 2π rotation but it will be shown that the Fibonacci spiral is also related to a correction in the exponent such that the denominator of the exponent has the form of $2\pi+(1/(2\pi))$ if we desire that the zero crossing point does indeed equal 1/2 of the rotation of the natural spiral.

The small correction in the denominator of the exponent of e of $2\pi+(1/(2\pi))$ is related to **eq. 233 on p. 121 of chapter 7 of reference 1 above.** [2] Therein, the electrogravitational force equation is expressed in terms of phase angle which can create huge forces based on small changes in phase between the quantum ohm and reactive terms related to quantum electrogravitational inductance and capacitance. Reference 2 above shows the relationship of the closed field similar to the resonant standing wave field inside of a waveguide being shifted to a free field at the Compton surface of the electron that suddenly must take into account capacitive and inductive reactance in terms of the same base quantum frequency.

When n = 360, a full revolution is the result which = 2π.

$n := 0, 1 .. 1080$ Equal to 3 full revolutions in degrees.

$\theta_n := 2\cdot\pi\cdot\dfrac{n}{360.0}$ Then: $R_n := e^{i\cdot\theta_n + \frac{\theta_n}{2\cdot\pi}}$ where, $e = 2.71828182846 \times 10^{0}$ 1)



$R_{360} = 2.71828182846 \times 10^{0} - 6.65765039722i \times 10^{-16}$ $e = 2.71828182846 \times 10^{0}$ 1 rev. 2)

$R_{720} = 7.38905609893 \times 10^{0} - 3.61947401900i \times 10^{-15}$ $e^2 = 7.38905609893 \times 10^{0}$ 2 rev. 3)

$R_{1080} = 2.00855369232 \times 10^{1} - 1.47581256816i \times 10^{-14}$ $e^3 = 2.00855369232 \times 10^{1}$ 3 rev. 4)

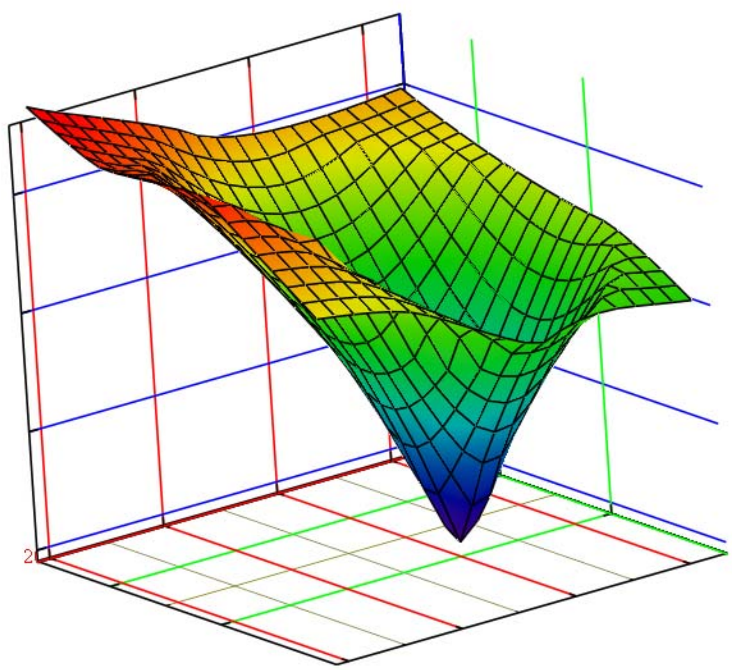
$\theta_{360} = 3.60000000000 \times 10^{2}\,\mathrm{deg}$

The results above show an exact correlation between the 2π multiples on the left and the constant growth constants related to multiples of the natural number e values on the right. This is in contrast to the results for the values related to Φ which will be shown in the pages to follow. It will be shown that a slight surplus difference related to 2π+1/(2π) occurs at the full circle crossing point.

Spiral growth set to equal the natural number e value for each complete revolution.

$X_n := \mathrm{Re}(R_n)$ $\quad$ $Y_n := \mathrm{Im}(R_n)$ $\quad$ $Z_n := \left| e^{i\cdot\theta_n + \frac{\theta_n}{2\cdot\pi\cdot(2)}} \right|$ Rate of vertical growth exponent is 1/2 of horizontal rate of growth. 5)

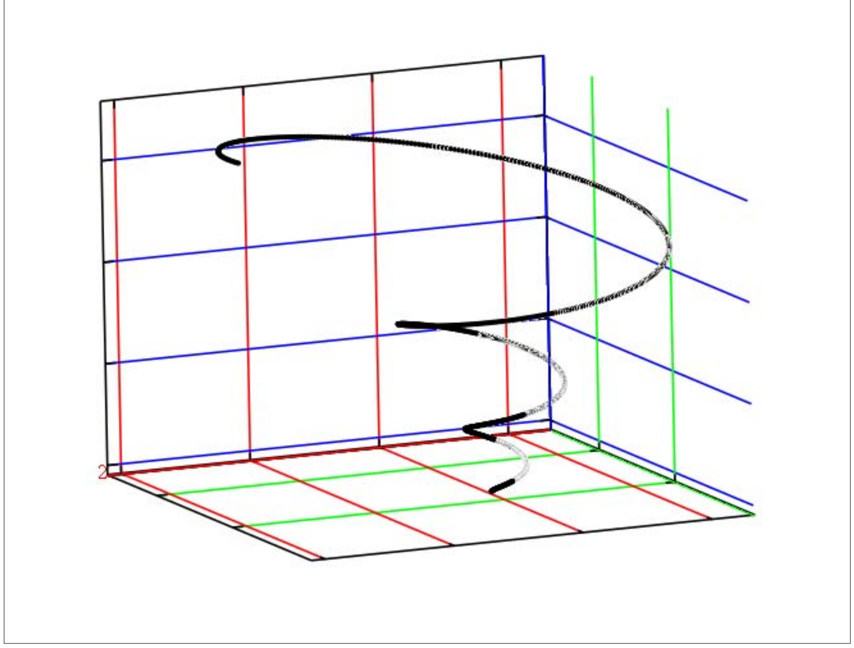
NATURAL NUMBER e TORNADO SURFACE PLOT



(X, Y, Z)

The charts above and below are based on the natural number e.

NATURAL NUMBER e TORNADO SCATTER PLOT



(X, Y, Z)

In the plot for the $\Phi = (4/\pi)^2$ growth rate, a full rotation has a magnitude slightly larger than expected at 360 degrees. The geometry related to the Great Pyramid at Giza has the ratio of $4/\pi$ as the height to 1/2 the base length as being equivalent to a number extremely close to the mathematically derived square root of Φ. Then $(4/\pi)$ squared is utilized as Φ.

$$\theta\Phi_n := 2\cdot\pi\cdot\frac{n}{360} \qquad f_{Cf} := 437.819808\cdot\mathrm{Hz} \qquad C_f := \frac{1}{f_{Cf}} \qquad \frac{1}{C_f} = 4.37819808000\times 10^{2}\,\mathrm{Hz} \tag{6}$$

$$R\Phi_n := e^{\left[i\cdot\theta\Phi_n + \frac{\theta\Phi_n}{\left(2\cdot\pi + \frac{1\cdot\sec + C_f}{2\cdot\pi\cdot\sec}\right)\cdot 2}\right]} \tag{7}$$

Golden Ratio Formula with correction C_f.

The f_{Cf} may be frequency related correction factor.

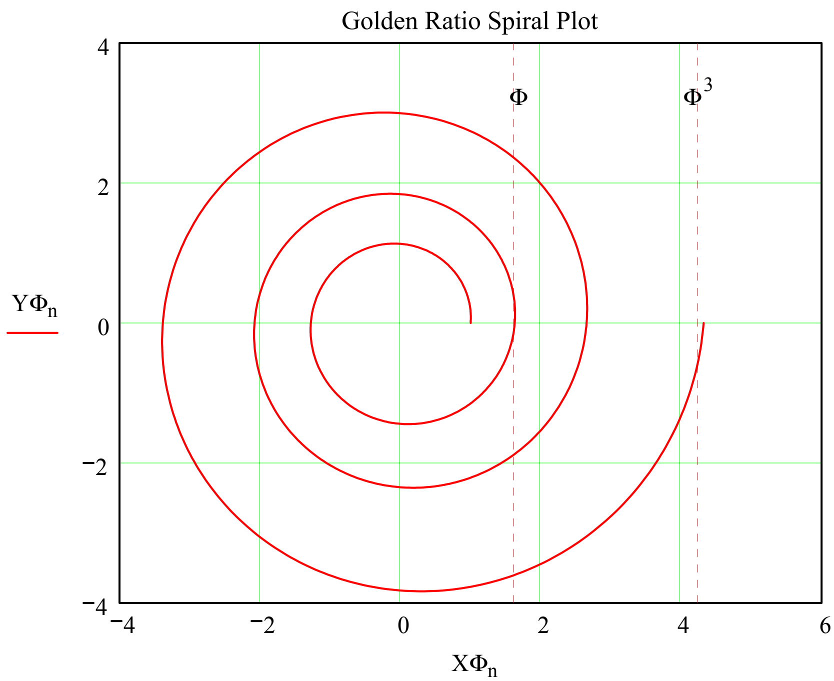
$$R\Phi_{360} = 1.62843629136\times 10^{0} - 3.98838685838i\times 10^{-16} \qquad \alpha := 7.297353080\cdot 10^{-03} \tag{8}$$

Note that: $\left|R\Phi_{360} - \left(\frac{4}{\pi}\right)^2\right|\cdot\alpha^{-1} = 9.99999999997\times 10^{-1}$

Spiral $(4/\pi)^2 = \Phi$ connection to α.

The below chart shows the spiral visibly exceeds the zero intercept at the Φ^3 point.

$$X\Phi_n := \mathrm{Re}(R\Phi_n) \qquad Y\Phi_n := \mathrm{Im}(R\Phi_n) \qquad \Phi := \left(\frac{4}{\pi}\right)^2 \qquad \Phi = 1.62113893828 \times 10^{0} \qquad 9)$$



$$R\Phi_{360} = 1.62843629136 \times 10^{0} - 3.98838685838i \times 10^{-16} \quad = 1.62113893828 \times 10^{0} \text{ 1 rev.} \qquad 10)$$

$$R\Phi_{720} = 2.65180475501 \times 10^{0} - 1.29896678083i \times 10^{-15} \quad {}^{2} = 2.62809145720 \times 10^{0} \text{ rev.} \qquad 11)$$

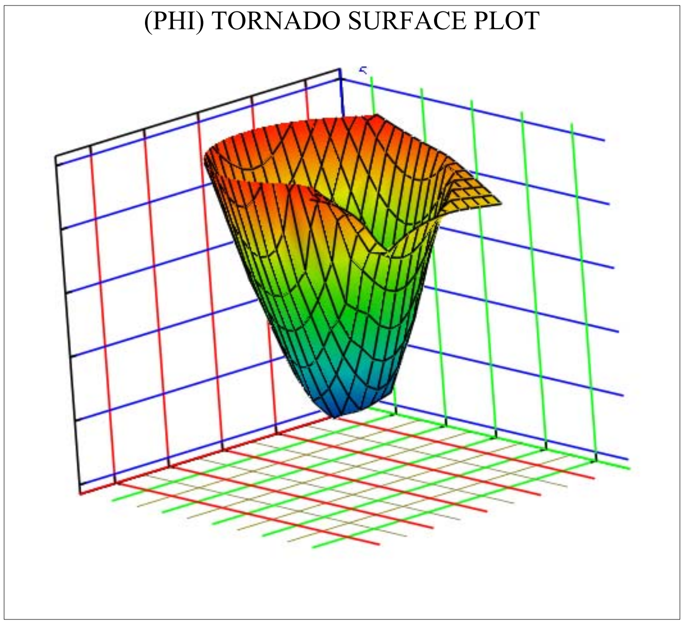
It is of extreme interest that if the Great Pyramid ratio of height to 1/2 the base length = $4/\pi$ is squared and then subtracted from the first golden ratio rotation magnitude, the difference is very close to the fine structure constant α.

$$\left|R\Phi_{360}\right| - \left(\frac{4}{\pi}\right)^2 = 7.29735307998 \times 10^{-3} \qquad \text{where,} \qquad \alpha := 7.297353080 \cdot 10^{-03} \qquad 12)$$

Next, spiral growth (vertically) set to equal to the square root of the absolute value of the golden ratio Φ for each complete revolution.

$$Z\Phi_n := \left[\left|\left[e^{\left[i\cdot\theta\Phi_n + \frac{\theta\Phi_n}{\left(2\cdot\pi + \frac{1\cdot\sec + C_f}{2\cdot\pi\cdot\sec}\right)\cdot 2} \right]} \right]\right|\right]^{\frac{4}{\pi}}$$

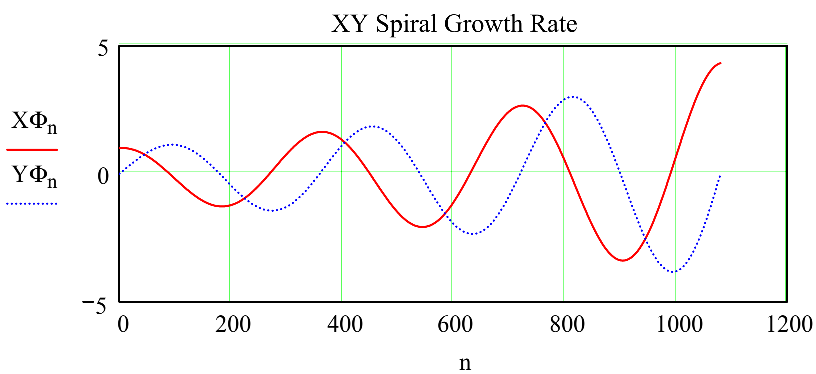
$4/\pi$ vertical growth equation. 13)



$(X\Phi, Y\Phi, Z\Phi)$

Axis Colors:
X = Red
Y = Green
Z = Blue

The chart below shows that the real and imaginary parts of $R\Phi_n$ are separated in phase by 90 degrees which provides circular rotation in the XY plane.



A B

$$R_n = e^{(i \cdot \theta_n) + \left[\frac{\theta_n}{2 \cdot \pi \cdot (2)}\right]}$$

The (A) part of the natural number (e) exponential provides the XY rotation due to the generation of both real and imaginary numbers as θ_n changes. The (B) part is the growth rate outwards and upwards. 14)

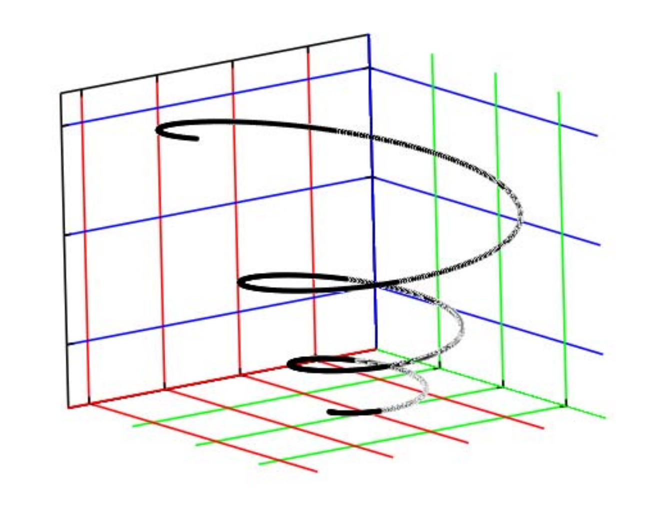
The below 2π expressions show the phase difference from 360 degrees which correspond to eq. 233 on p. 121 of chapter 7 of reference 1 above.

$$\left(2 \cdot \pi - \frac{1}{2 \cdot \pi}\right) = 3.50881093472 \times 10^{2}\,\text{deg} \qquad \frac{1}{2 \cdot \pi} = 9.11890652781 \times 10^{0}\,\text{deg} \qquad 15)$$

The XY diagram has the X axis as the + and - real number axis while the Y axis is the + and - imaginary number axis. Also, for the plot involving the golden ratio Φ, the X and Y axis are shifted clockwise by $-1/2\pi$ radians which corresponds to -9.1189065278 degrees. The spatial orientation of the axis is arbitrary in the XY plane and therefore the lagging $-1/2\pi$ radians may indicate a time lag per revolution. The correction factor C_f above brings the lagging $1/2\pi$ to exact zero on the X axis which again is the real number axis.

The below scatter plot closely resembles an actual tornado shape.

PHI TORNADO SCATTER PLOT



$(X\Phi, Y\Phi, Z\Phi)$

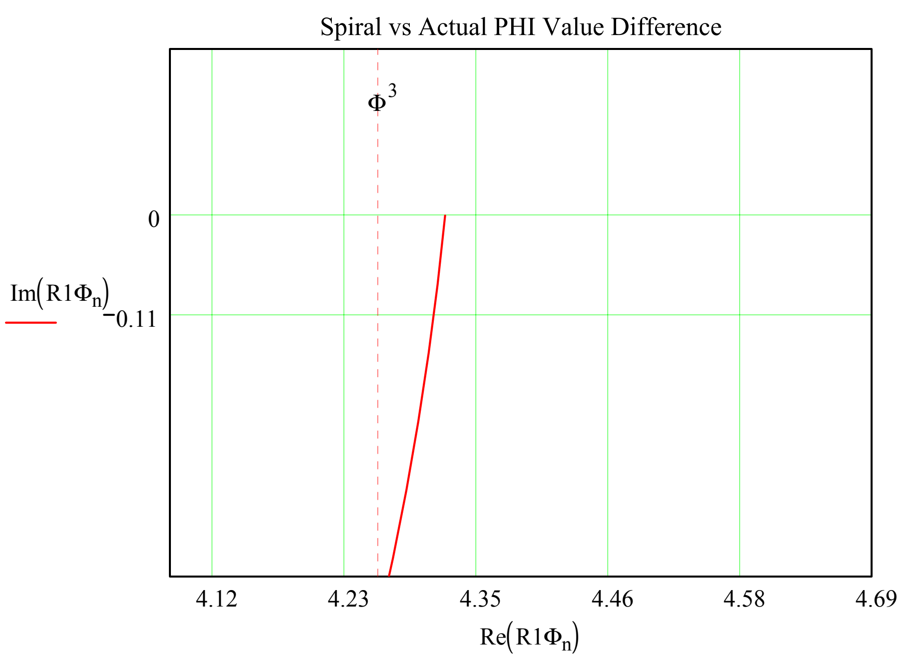
The following equation is used to allow for a magnified view of the spiral of Φ exceeding the expected value of and this may be interpreted as excess energy related to the fine structure constant in real energy magnitude.

$$R1\Phi_n := e^{\left[i\cdot\theta\Phi_n + \frac{\theta\Phi_n}{\left[2\cdot\pi + \frac{1\cdot sec + C_f}{(2\cdot\pi\cdot sec)}\right]\cdot 2} \right]} \qquad 16)$$

Check of $R1\Phi_{360}$ agreement to α:

$$\left[\left| R1\Phi_{360} \right| - \left(\frac{4}{\pi}\right)^2 \right]\cdot\alpha^{-1} = 9.99999999997 \times 10^{-1} \qquad 17)$$

A magnified chart of intersection of Φ^3 and golden spiral intersect at zero will show that spiral magnitude exceeds the Φ^3 reference. This represents left over energy from rest mass energy as explained above.



It is of important relevance that the frequency correction f_{Cf} and the below formulae are connected to eqs. 7A-04, 7A-05, 7A-06 and 7B-01 on p. 7A and 7B of a previous paper, **"A Proposed Test For Determining The Mechanics of Electrogravitation."** [3]

$$f1_{Cf} := \frac{2\cdot\pi}{1\cdot\text{sec} + C_f} \qquad f_{LM} := 1.003224805\cdot 10^{01}\cdot\text{Hz} \tag{18}$$

$$f1_{Cf} = 6.26886693505 \times 10^{0}\,\text{Hz} \qquad f_{LM} = 1.00322480500 \times 10^{1}\,\text{Hz} \tag{19}$$

$$f_S := \sqrt{\left(f_{LM}\right)^2 - \left(f1_{Cf}\right)^2} \tag{20}$$

$$f_S = 7.83245225248 \times 10^{0}\,\text{Hz} \quad = \text{Schumann Earth cavity resonant frequency.} \tag{21}$$

In the previous paper mentioned above, the f_{Cf} frequency was suggested as the real frequency and the Schumann frequency as the imaginary frequency.

The below ratios are in the range of $4/\pi$ and $4/\pi$ squared of the golden ratio.

$$\frac{f_S}{f1_{Cf}} = 1.24942072206 \times 10^{0} \quad \frac{f_{LM}}{f_S} = 1.28085658573 \times 10^{0} \quad \frac{f_{LM}}{f1_{Cf}} = 1.60032876019 \times 10^{0} \tag{22}$$

The ratio of $-4/\pi$ is negative on the spiral as shown on the $R\Phi_n$ spiral diagram above. It is of interest that 180 degrees is the negative crossing of $-4/\pi$ and we again see that the crossing is slightly more in negative magnitude than $-4/\pi$.

$$R1\Phi_{180} = -1.27610199097 \times 10^{0} + 1.56272260627i \times 10^{-16} \qquad \frac{-4}{\pi} = -1.27323954474 \times 10^{0} \quad 22)$$

$$R1\Phi_{180} - \frac{-4}{\pi} = -2.86244623475 \times 10^{-3} + 1.56272260627i \times 10^{-16} \quad = 7.29735308000 \times 10^{-3} \tag{23}$$

The sum of the real negative and positive values on the X axis is:

$$R1\Phi sum := \left[\left|R1\Phi_{360}\right| - \left(\frac{4}{\pi}\right)^2\right] + R1\Phi_{180} - \frac{-4}{\pi} \tag{24}$$

$$R1\Phi sum = 4.43490684522 \times 10^{-3} + 1.56272260627i \times 10^{-16} \tag{25}$$

It is of interest what the frequency may be when used as a correction factor relative to the result of $R1\Phi_{180}$ - $(-4/\pi)$ = zero or very nearly zero. This is also equal to zero degrees on the XY plane.

Let: Then: or,

$$f1_{Cf} := 2.6412990466278\cdot Hz \qquad C1_f := \frac{1}{f1_{Cf}} \qquad C1_f = 3.78601582913\times 10^{-1}\,s \tag{26)}$$

$$R1neg\Phi_n := e^{\left[i\cdot\theta\Phi_n + \frac{\theta\Phi_n}{\left[2\cdot\pi + \frac{1\cdot sec + C1_f}{(2\cdot\pi\cdot sec)}\right]\cdot 2}\right]} \tag{27)}$$

$$R1neg\Phi_{180} - \frac{-4}{\pi} = 1.55921723642i\times 10^{-16} \tag{28)}$$

It is seen that the frequency is in the extreme low frequency range and is equal to $f1_{Cf}$ above. This is a significant drop in frequency from f_{Cf} above considering that $R1\Phi_{180}$ was a small drop from $R1\Phi_{360}$ above.

$$R1\Phi_{360} - \left(\frac{4}{\pi}\right)^2 = 7.29735307998\times 10^{-3} - 3.98838685838i\times 10^{-16} \tag{29)}$$

$$R1\Phi_{180} - \frac{-4}{\pi} = -2.86244623475\times 10^{-3} + 1.56272260627i\times 10^{-16} \tag{30)}$$

Note: $\alpha = 7.29735308000\times 10^{-3}$

$$\left[\frac{R1\Phi_{360} - \left(\frac{4}{\pi}\right)^2 - \left(R1\Phi_{180} + \frac{4}{\pi}\right)}{R1\Phi_{180} + \frac{4}{\pi}}\right]^2 = 1.25978253371\times 10^{1} - 1.10932725105i\times 10^{-15} \tag{31)}$$

Where: $4\cdot\pi = 1.25663706144\times 10^{1}$

The sum of the real negative and positive values on the X axis may be evaluated as above to find the correction frequency related to bringing the difference between the expected and the actual to zero numerically.

Let: Then: or,

$$f2_{Cf} := 2.6412990466278 \cdot Hz \qquad C2_f := \frac{1}{f2_{Cf}} \qquad C2_f = 3.78601582913 \times 10^{-1} s \tag{32}$$

$$R1sum\Phi_n := e^{\left[i \cdot \theta\Phi_n + \frac{\theta\Phi_n}{\left[2 \cdot \pi + \frac{1 \cdot sec + C2_f}{(2 \cdot \pi \cdot sec)} \right] \cdot 2} \right]} \tag{33}$$

$$R2\Phi sum := \left[\left| R1sum\Phi_{360} \right| - \left(\frac{4}{\pi} \right)^2 \right] + R1sum\Phi_{180} - \frac{-4}{\pi} \tag{34}$$

$$R2\Phi sum = 2.22044604925 \times 10^{-16} + 1.55921723642i \times 10^{-16} \tag{35}$$

Where, with the time correction factor $C2_f$ above:

$$\left| R1sum\Phi_{360} \right| - \left(\frac{4}{\pi} \right)^2 = 2.22044604925 \times 10^{-16} \text{ and, } \quad R1sum\Phi_{180} - \frac{-4}{\pi} = 1.55921723642i \times 10^{-16}$$

The frequency is again infrasonic (below the range of human hearing) as the above $f2_{Cf}$ shows.

So far we have investigated only the real X axis of the Argand diagram. The Y axis is the imaginary axis and it may be of interest to investigate the magnitudes.

$$R1\Phi_{90} = 6.91686351047 \times 10^{-17} + 1.12964684347i \times 10^{0} \tag{36}$$

$$R1\Phi_{180} = -1.27610199097 \times 10^{0} + 1.56272260627i \times 10^{-16} \tag{37}$$

$$R1\Phi_{270} = -2.64798698909 \times 10^{-16} - 1.44154458605i \times 10^{0} \tag{38}$$

The result at 90 and 270 degrees is imaginary. A rotation from 1 to -4/π (180 degrees) is obtained by squaring the square root of -4/π. Then the points corresponding to 90 degrees, 180 degrees and 270 degrees are obtained by multiplying by the square root of -4/π as shown below.

90 degrees 180 degrees 270 degrees 39)

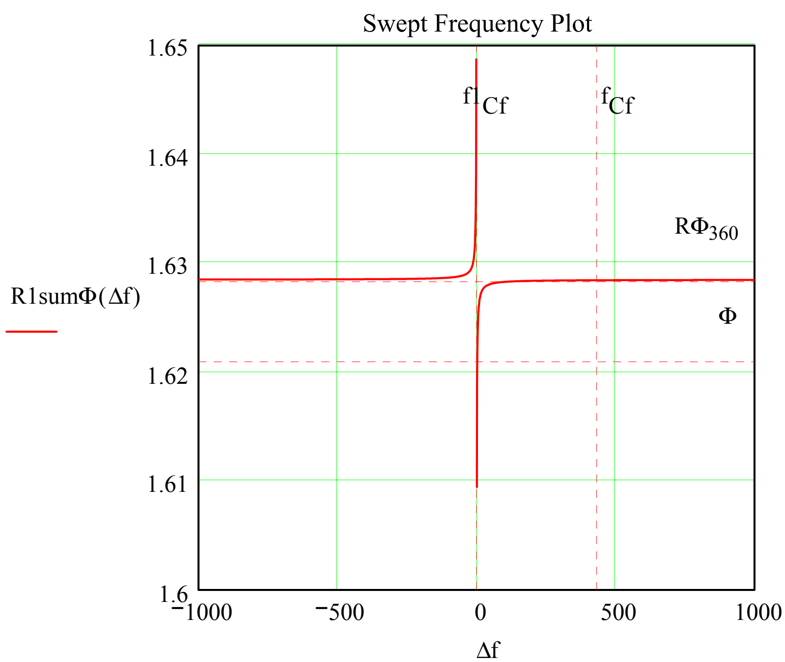
$$\sqrt{\frac{-4}{\pi}} = 1.12837916710i \times 10^{0} \quad \left(\sqrt{\frac{-4}{\pi}} \right)^2 = -1.27323954474 \times 10^{0} \quad \sqrt{\frac{-4}{\pi}} \cdot \left(\sqrt{\frac{-4}{\pi}} \right)^2 = -1.43669697700i \times 10^{0}$$

One more step in the above process will yield Φ which is the ending point at 360 degrees. It is verified that the spiral magnitudes are slightly larger than the 4/π magnitudes, even for the imaginary Y axis.

A plot relative to the 360 degree point on the spiral as a function of a variable correction frequency Δf is shown below.

Let: $\Delta f := 1000 \cdot Hz, 999 \cdot Hz .. -1000 \cdot Hz \qquad Cf(\Delta f) := \frac{1}{\Delta f}$

$$R1sum\Phi(\Delta f) := e^{\left[i \cdot \theta\Phi_{360} + \frac{\theta\Phi_{360}}{\left[2 \cdot \pi + \frac{1 \cdot sec + Cf(\Delta f)}{(2 \cdot \pi \cdot sec)} \right] \cdot 2} \right]} \qquad 40)$$



$f_{Cf} = 4.37819808000 \times 10^{2}\,Hz \quad f1_{Cf} = 2.64129904663 \times 10^{0}\,Hz \quad f2_{Cf} = 2.64129904663 \times 10^{0}\,Hz$ 41)

Note that the above plot is discontinuous between -1 and +1 Hz. Also, the significant vertical gap between RΦ360 and Φ is equal to the fine structure constant, α.

From the initial statement for magnitude difference between spiral growth magnitude and the golden ratio number Φ at 360 degrees:

$$R\Phi_{360} = 1.62843629136 \times 10^{0} - 3.98838685838i \times 10^{-16} \qquad \Phi = 1.62113893828 \times 10^{0} \qquad 42)$$

$$\alpha_{gap} := R\Phi_{360} - \Phi \quad \text{or,} \quad \alpha_{gap} = 7.29735307998 \times 10^{-3} - 3.98838685838i \times 10^{-16} \qquad 43)$$

The ratio between α_{gap} and the known S.I. units fine structure constant α is:

$$\frac{\alpha_{gap}}{\alpha} = 9.99999999997 \times 10^{-1} - 5.46552539621i \times 10^{-14} \qquad 44)$$

The result is effectively equal to unity in the real number domain.

The above result for is based on the time correction factor C_f of 1/437.819808 Hz as shown above. If there is no correction factor C_f at all, then the ratio of α_{gap} to α results in the number 1.00614008190 which is slightly larger than unity. This result suggests that α could possibly be slightly larger than is the standard α today by the ratio result stated as 1.00614008190. The maximum value related to α_{max} is therefore:

$$\alpha_{max} := \alpha \cdot 1.00614008190 \quad \text{or,} \quad \alpha_{max} = 7.34215942556 \times 10^{-3} \qquad 45)$$

Might the fine structure lines of the atomic spectrum be related to the above small discrepancy? If so, we could expect the lines to be slightly above the normal atomic energy band by an excess energy factor of 1.00614008190 which is also a frequency factor by E = hf.

In the discontinuous region of the above chart, as the frequency approaches zero, the time will approach infinity and so will the positive magnitude. This resonates with my previous work regarding reference 2. This also relates to the 1/f form of Nyquist noise wherein time approaches infinity as frequency nears zero and the result is enough to cause "jitter" in the orbits of the planets.

In conclusion, according to the above analysis, the energy that establishes the electric charge 'free-field' of the electron is surplus energy left over from the standing wave rest mass energy of that same electron. Further, there exists a little more energy left over for the establishment of other fields, namely the related magnetic and electrogravitational fields. This is due to the golden ratio spiral yeilding a magnitude greater than the expected amount predicted by $\Phi = (4/\pi)^2$. This may be the secret of the Great Pyramid.

--- Jerry E. Bayles ---

References:

1. Bayles, Jerry E., Electrogravity As A Unified Field Theory, http://www.electrogravity.com/gravbook/Egchap01.pdf, pp. 7-9, eqs. 7-15.

2. Ibid, http://www.electrogravity.com/gravbook/Egchap07.pdf, pp 121-124, eqs. 233-237.

3. Ibid, http://www.electrogravity.com/DISKTEST/AVecDisk.pdf, pp. 7A & 7B,eqs. 7A-04, 7A-05, 7A-06 and 7B-01.

Appendix 1: The Fibonacci Sequence J.E. Bayles

From:

http://mathforum.org/library/drmath/view/52677.html

http://mathforum.org/dr.math/faq/faq.golden.ratio.html

The standard formula for the Fibonacci numbers is due to a French mathematician named Binet. If F(n) represents the nth Fibonacci number, then: F(n) = (a^n - b^n)/(a - b) where a and b are the two roots of the quadratic equation x^2-x-1 = 0. It is not obvious how to derive this formula, but it is easy to prove that it satisfies F(0) = 0, F(1) = 1, and satisfies the same recursion as the Fibonacci numbers do. We can use the quadratic formula to see that a = (1 + Sqrt[5])/2 and b = (1 - Sqrt[5])/2, so a - b = Sqrt[5].

$$n := -10, -9.9 \,..\, 10 \qquad a := \left[\frac{1+\left(\sqrt{5}\right)}{2}\right] \qquad b := \left[\frac{1-\left(\sqrt{5}\right)}{2}\right] \qquad F(n) := \frac{a^n - b^n}{a-b}$$

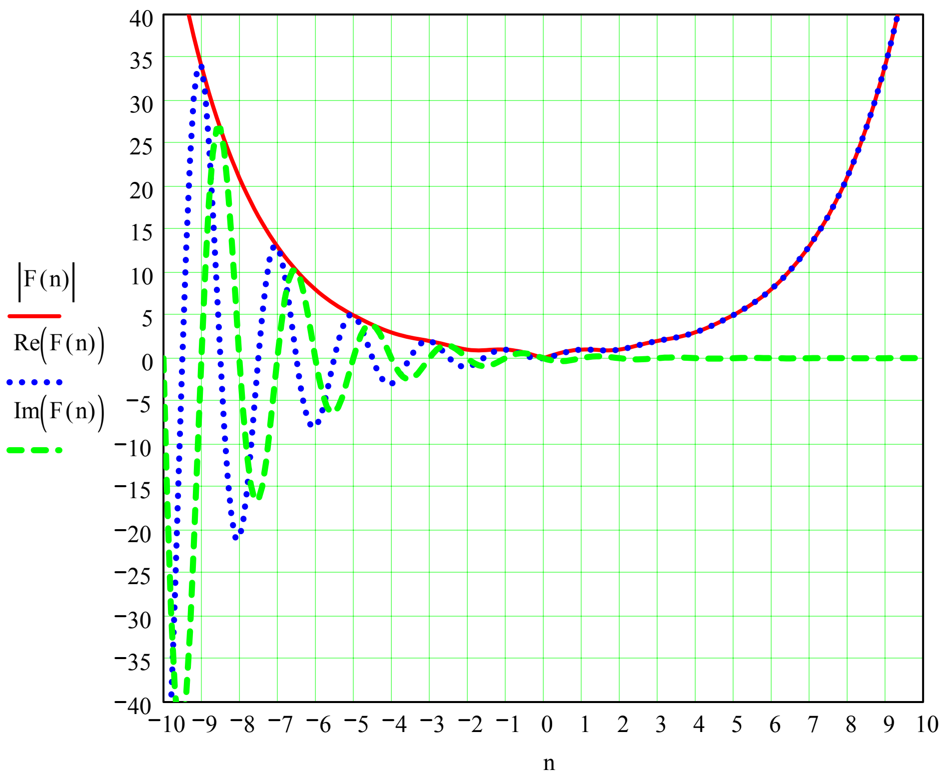
$F(n) =$

	0
0	$-5.50000000000\cdot10^{1}$
1	$-4.98500643782\cdot10^{1}-1.61985074658i\cdot10^{1}$
2	$-4.04118279068\cdot10^{1}-2.93638202969i\cdot10^{1}$
3	$-2.79800570068\cdot10^{1}-3.85170265414i\cdot10^{1}$
4	$-1.40165830089\cdot10^{1}-4.31521729551i\cdot10^{1}$
5	$4.62522021858\cdot10^{-3}-4.32411843200i\cdot10^{1}$
6	$1.27393321953\cdot10^{1}-3.91926962554i\cdot10^{1}$
7	$2.30895002698\cdot10^{1}-3.17729615168i\cdot10^{1}$
8	$3.02855570183\cdot10^{1}-2.19998628522i\cdot10^{1}$
9	$3.39297471821\cdot10^{1}-1.10226213359i\cdot10^{1}$
10	$3.40000000000\cdot10^{1}-3.24847619345i\cdot10^{-13}$
11	$3.08175655675\cdot10^{1}+1.00112281809i\cdot10^{1}$
12	$2.49848352156\cdot10^{1}+1.81478389830i\cdot10^{1}$

$n =$

	0
0	$-1.00000000000\cdot10^{1}$
1	$-9.90000000000\cdot10^{0}$
2	$-9.80000000000\cdot10^{0}$
3	$-9.70000000000\cdot10^{0}$
4	$-9.60000000000\cdot10^{0}$
5	$-9.50000000000\cdot10^{0}$
6	$-9.40000000000\cdot10^{0}$
7	$-9.30000000000\cdot10^{0}$
8	$-9.20000000000\cdot10^{0}$
9	$-9.10000000000\cdot10^{0}$
10	$-9.00000000000\cdot10^{0}$
11	$-8.90000000000\cdot10^{0}$
12	$-8.80000000000\cdot10^{0}$

Area 51 S-4 UFO Fibonacci Mass-Wave Generator?



Large energy fast rise pulse input at bottom of curve generates an increasing voltage corresponding to a traveling E field between the sides of the curve. A corresponding magnetic B field is developed around the E field the due to rotating A-vector around the increasing E field which is traveling towards the open end of the curve. This amounts to a moving mass field moving towards the open end of the curve.

The curve above is very similar to the 12 open curves on the upper surface of the S-4 craft as built by Testors Model Corporation, Kit #576. There are 6 microwave cavities that may be used to feed the electric field energy to the curves and they are located near the closed ends of the 12 curves. -- Jerry E. Bayles