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Radio & Superposition Considerations for Generating Hydrogen/Graphite/Silica Impermeable Plasma Barriers (IPBs) & Associated Space Survival Technologies – by Exploiting Existing Birkeland Filaments & the Atomic Hydrogen Spectral Line (1.42 Ghz)

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joabel1971@yahoo.com

Until otherwise noted, updates to this document – and associated signaling code can be found at: https://drive.google.com/drive/folders/1-3TDKlwpr2n6tQp0ypg-qxa6P_vOIytA

Brief Description:

This paper is meant as a primer for understanding and creating Impermeable Plasma Barriers, Hyper-accelerated Tubular Linear Induction Motors & associated technologies for peaceful, next-generation computers, space propulsion and space survival. It is mostly based on the prior research of Kristian Birkeland & Hannes Alfven. It is a short introduction to the needed Radio & Plasma generation principles. It is there to show how superpositioned EM emissions can meet the positive energy requirements of Impermeable Plasma Barriers (IPBs).

Impermeable Plasma Barriers & Hyper-accelerated Tubular Linear Induction Motors (IPBs & HATLIMs) use super-positioned signaling to function. Super-positioned EM emissions are created by combining 2 (or more) convoluted, superimposed AC signals, relatively low voltage electronics, a capable microcontroller (to generate signaling, duty & phasing), a series of interleaved wire wrappings, and spinning spheres (to modulate the path and relative speed of plasma filaments). LC tank circuits are described – using multilayer, interleaved cone & helical coils – meant to store the relative energy levels of separate frequencies. **1,420,405,751.768 Hz** is the highest frequency used (the H1 spectral line.) Below is a theoretical path of plasma around an IPB Generator.

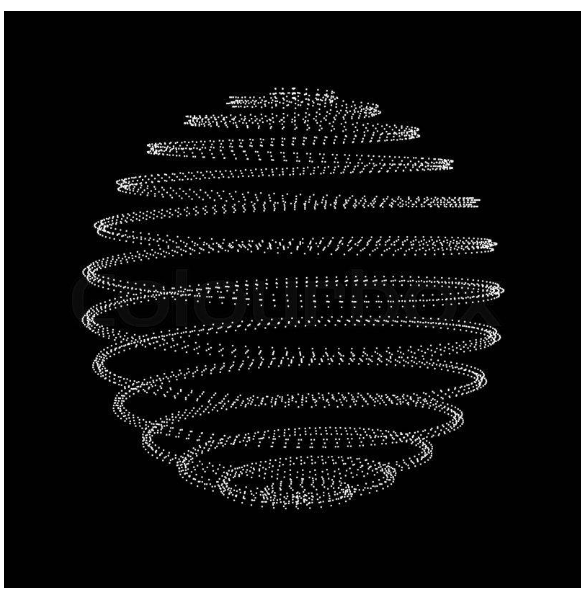

Figure 1 – Theoretical path of IPB plasma.

A Simplified Understanding of Generating & Exploiting Existing Hydrogen Plasma Filaments for Space Travel

Big Bang Cosmology describes various-sized local, galactic & intergalactic filaments. They are explained to be made from **dark matter** – which is an unknown substance. However, Plasma Cosmology describes these filaments as made from **hydrogen plasma**, which is a real, testable substance.

The largest filaments are connected - and form the largest known structure in the universe - called the Cosmic Web - or more generically – the Microwave Background Radiation.

Therefore, I chose hydrogen gas for testing – since Birkeland filaments are potentially made from hydrogen plasma. **I am attempting to test if buoyancy of the IPB occurs** – by operating it within an existing hydrogen plasma stream (a.k.a. local Birkeland filament).

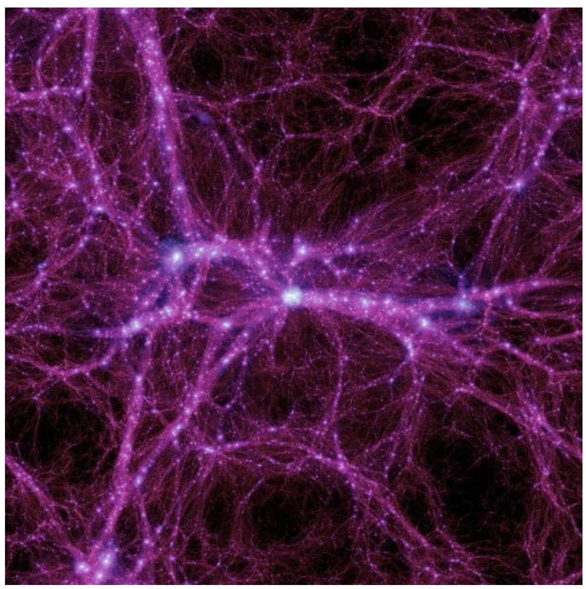

Figure 2 – Snapshot of the Millennium II - Computer simulation of the Cosmic Web.

To design & build such a device – an introductory understanding of hydrogen plasma is necessary. Plasma is considered the 4^{th} state of matter, and is naturally occurring in flames, lightning, and aurora. Larger plasma structures show up in Coronal Loops. It is also formed artificially for use in arc welding, fluorescent lamps, and plasma televisions. However, I will be generating a plasma at room-temperature.

I understand hydrogen plasma to be H2 gas that has been ionized. A definition of ionized hydrogen means that the protons and electrons of H2 – have been separated and are free-floating away from one another. Hydrogen H2 (if fully 100% ionized), is potentially NOT flammable.

Ionization also causes H2 plasma to become charged & conductive. More importantly – plasma has the ability to **cause self-organization of imbedded particles – by charging them to about 1-10 volts.**

1. Relatively cold or room-temperature plasma is called –non-thermal plasma.

2. Relatively hot plasma is called –thermal plasma.

3. When particles are added to a plasma – it becomes a –complex plasma, or –dusty plasma. These imbedded particles can move extremely quickly (kilometers per second range).

4. When charged plates are used to separate the gas into a plasma – it is called –Capacitively-Coupled Plasma or CCP.

5. When gas is passed through a helical- or cone-coil to separate the gas into a plasma – it is called –Inductively-Coupled Plasma or ICP. On the surface – ICP appears to be a more straight-forward way to create a stream of plasma from gas – than CCP.

6. A misconception is that ionized gas needs to be heated to become plasma – which is not true. Plasma can be generated at room temperature.

7. Another misconception is that 13.56 Mhz is the signaling frequency **needed** to turn any type of gas (O2, H2, N2, CO2, AR, etc.) into plasma. This is also not true. 13.56 Mhz was chosen by the scientific community as a standardized frequency used to generate plasma – AND not cause RF interference for other nearby RF devices. The truth is (RF interference aside) – any frequency can be used to make plasma.

8. To keep the plasma –non-thermal‖, the design questions then become:
   a. Which frequency can deliver ionization energy most efficiently for plasma generation and still mitigate heating? Is it the rest frequency of hydrogen gas – 1.42 Ghz?
   b. Will the 100% density of the gas (even at rest frequency) contribute to heating during ionization – due to particle collisions?
   c. Does hydrogen's high thermal conductivity help keep it cool during ionization?
   d. Does hydrogen's high electron affinity impede the gas's ability to stay cool during ionization?

9. Each and every gas in the universe has its own –rest frequency‖ – which is normally used by radio astronomers to tune their telescopes – and determine the composition of different cosmic objects.

10. The energy conversion efficiency during the ionization process – appears to determine how hot or cold the plasma will be – once the gas is ionized. Therefore, I am using the –rest frequency‖ of hydrogen for ionizing it – 1.42 Ghz. This is meant to keep the plasma at or near room temperature. I want to generate non-thermal plasma – for safety reasons.

11. Any other gases in or around the system (that aren't hydrogen) need to be either kept away from the coils – or ejected from the system rapidly. This is to avoid heating unneeded gases, and subsequently avoid heating up the device itself.

12. The H2 gas/plasma should never be ignited during operation of the device. If ionization is near 100% - hydrogen potentially becomes no-longer flammable. Regardless, Water Steam - is being added as a shield gas. It is also being used as a catalyst to bond the silica to the graphite.

    Water will be ionized/heated during operation – and therefore, must move from the bottom of the coils – directly through the outer or middle nozzle. The Steam will be used to isolate the H2 gas/plasma from making contact with any oxygen in the air (to avoid any potential ignition of any hydrogen gas that didn't ionize).

13. Ionizing the H2 gas – also is a means to an end. It is needed – to charge imbedded particles within the plasma – which causes SELF-ORGANIZATION of the particles into a ―dusty string‖ – which in turn – is used to synthesize a form of Graphene from charged graphite (or silacene from charged silica). Silica can hold 10 times the charge of graphite.

14. When there is any pressure, heat gradients between a gas and a plasmatic gas, this also can cause formation of an impermeable plasma barrier. Therefore, if I allow the Water Vapor to heat up somewhat, this may also increase the capability of the impermeable barrier.

    If I change the flow rate of the Water/Steam or Hydrogen gases – to achieve a <u>critical ionization velocity</u> (CIV) – this potentially will create any needed heat or pressure gradients.

15. The cones have a volume of 3.6 cubic feet each. The cones are not air-tight – and therefore, are filled with ambient air (78% N2 & 20% O2). The coils are not tuned for air – and therefore, any air must be ejected from the cones as fast as it enters – to avoid heating up. Large fans are being utilized to do this.

16. There is also the question of buoyancy. Will a hollow plasma sphere – made from hydrogen – become buoyant (counteract localized gravity) if located inside a Birkeland filament – or located near a star made mostly of hydrogen plasma?

<u>A Simplified Understanding of Fortifying a Hydrogen Plasma with graphite & silica particles.</u>

1. By adding small particles of silica & graphite (and potentially water vapor), a hydrogen plasma can be fortified – since the particles hold a charge & self-organize into an equidistant matrix.

2. Charged Graphite particles are stable in air - but charged Silica particles dissipate within air. Silica particles hold 10 times as much charge as graphite particles.
3. Since the ICP Torches are constructed of round tube – the flow properties of the plasma & particles will potentially allow the creation of a tube-within-a-tube of 2 streams of plasma. One stream will hold silica (inner nozzle), and one will hold graphite (outer nozzle).

4. A middle 3rd nozzle will separate the other 2 nozzles, and emit a shield/sheath substance (such as Water Vapor or Steam) – to keep the silica from touching the air. It's potential that shielding will not be needed for the hydrogen – since highly ionized hydrogen plasma is not flammable (as long as it remains ionized).

5. This dual-stream of plasma (potentially separated by water steam) will draw towards each other – and potentially be more stable in air than silica alone.

6. With the help of a catalyst (water vapor) – the graphite & silica will potentially bond with one another to create a durable hybrid material – not unlike a flexible Carborundum (silica carbide). It would have a high durability – yet be flexible like graphene or siloxane. The chemical bonding will take place as the plasma leaves the nozzles.

   This method will potentially show a new way to create graphene. It is different than:

   a. Epitaxy (including chemical vapor deposition) - spraying plasma onto a graphene precursor (located on a crystalline surface or substrate), which causes –growth‖ or self-assembly of nano-tubes.
   b. Liquid Phase Exfoliation – Shearing or Sonication from a graphite source
   c. Laser-induced graphene filaments
   d. Hydrothermal Self-Assembly
   e. Creating Molten Salts
   f. Electrochemical Synthesis

   Instead, the graphite is mixed/siphoned directly with the use of the plasma gas (hydrogen) – and then self-organizes <u>at the same time</u> that the gas is ionized.

7. The unified stream will then come in contact with a spinning (potentially conductive) sphere, and wrap multiple times around the sphere – and eventually spray outward.

8. My hypothesis is that the stream of hydrogen/graphite/silica plasma – will bond with adjacent layers of itself as it wraps around the aluminum sphere multiple times – and sprays out. This potentially will have the effect of creating a larger, hemi-spherical –macro-structure‖ of multiple windings of the plasma stream (bonded plasma spirals).

9. The –macro-stream‖ will eject at the equatorial region of the metal sphere (horizontally) – resembling a more uniform accretion disk – versus an independent plasma stream.

<u>Constructed Coils & Frames (vertical)</u>

A generalized Impermeable Plasma Barrier (IPB) design is shown below (several diagrams).

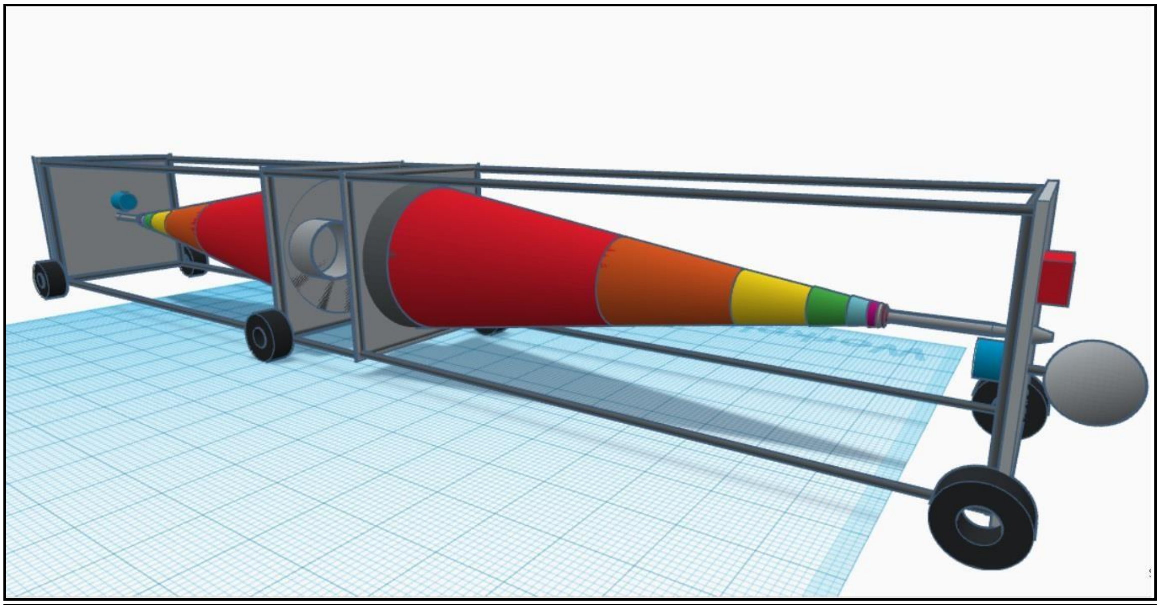

Figure 3 – Horizontal storage.

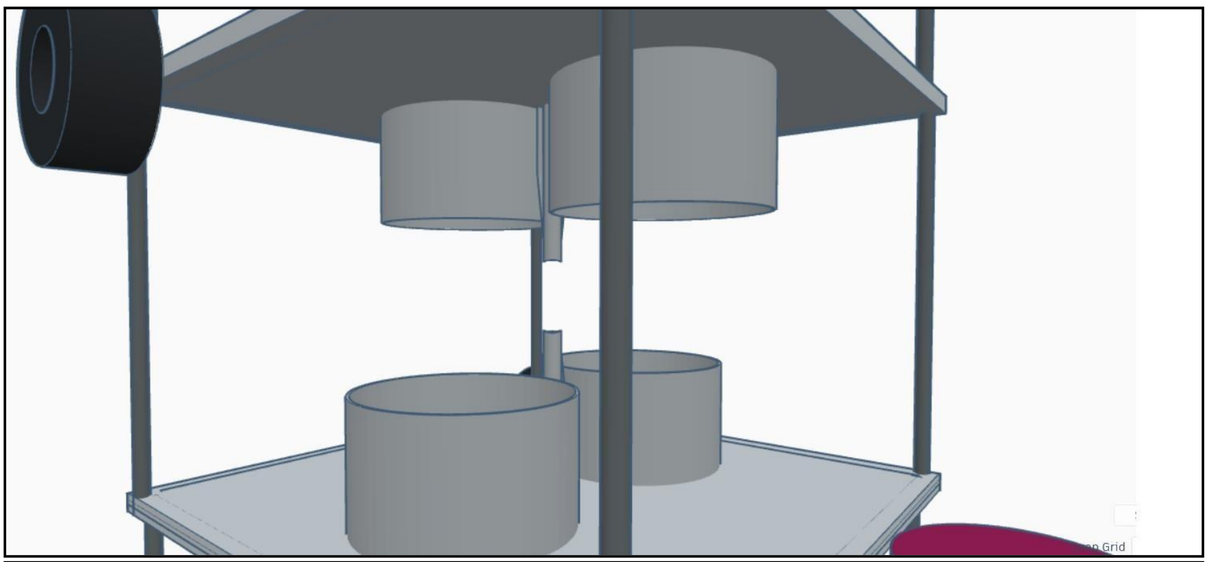

Figure 4 – Closeup of Fan Ducts & water/gas inlets.

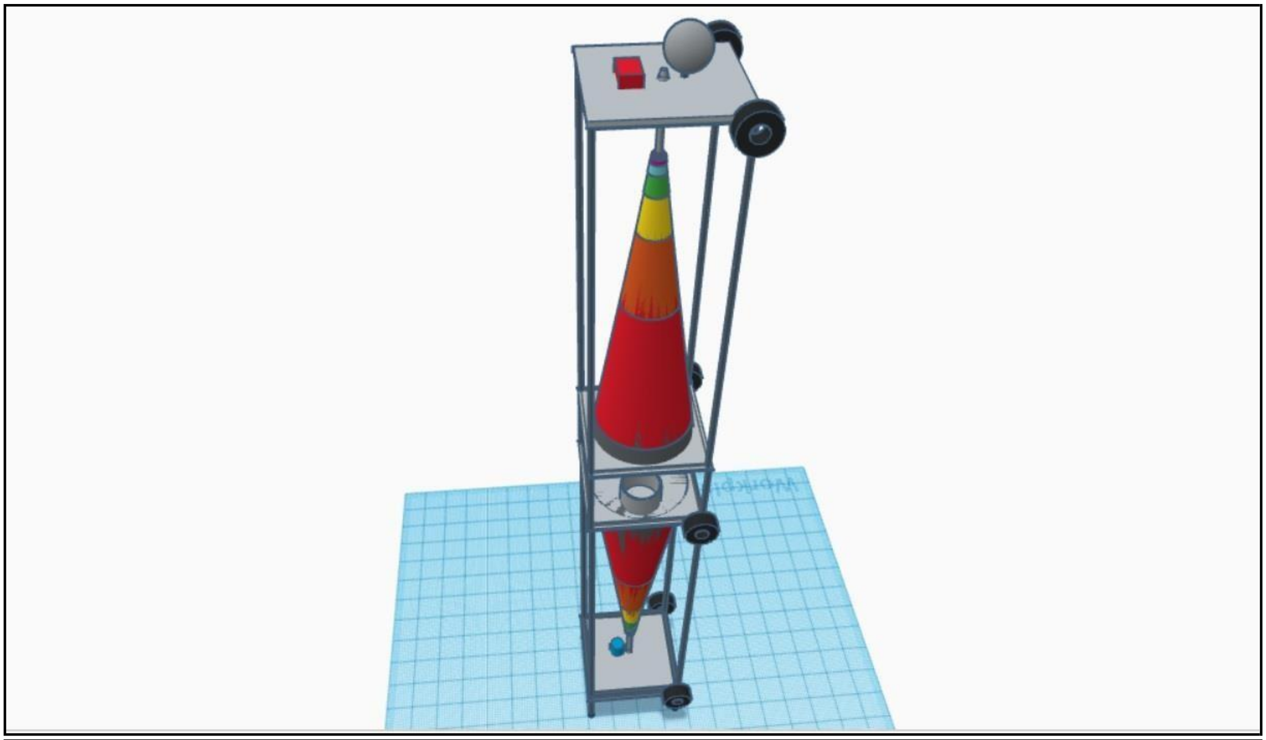

Figure 5 – Vertical position of test-bed.

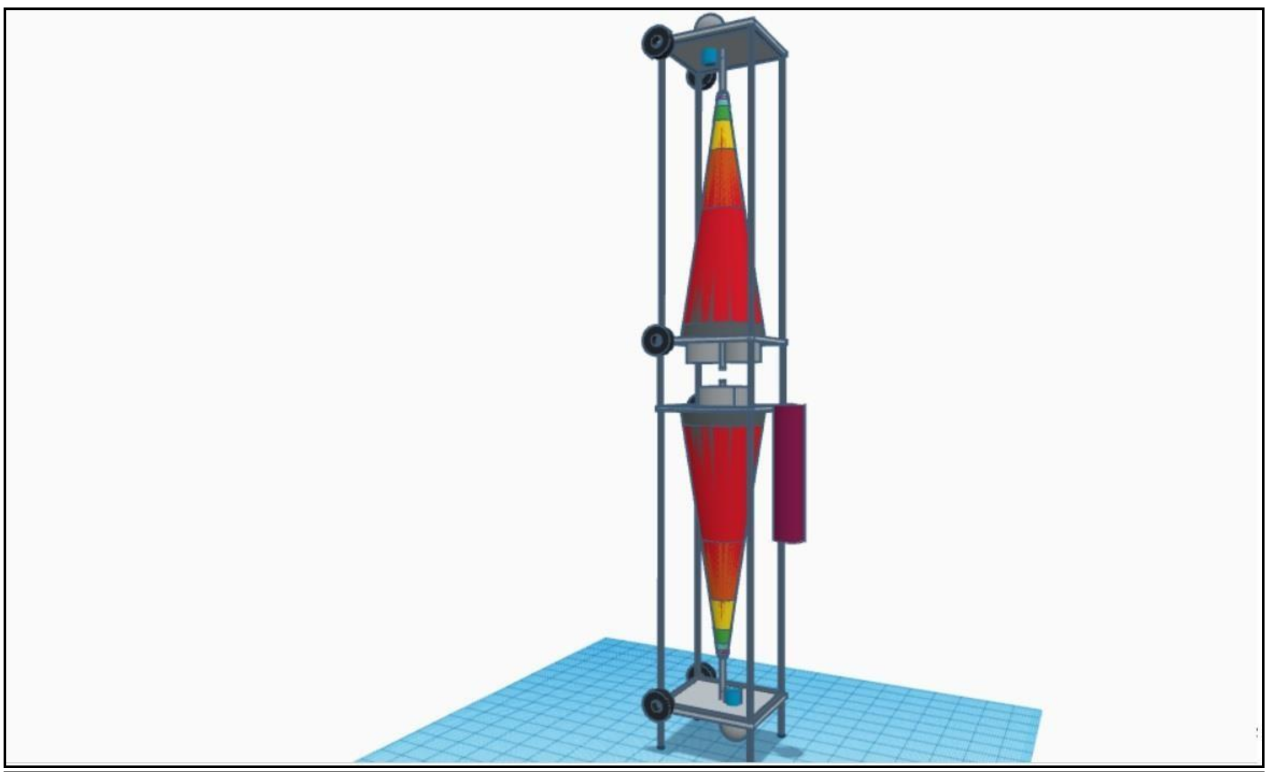

Figure 6 – Q-Sized hydrogen tank attached (80 cubic feet).

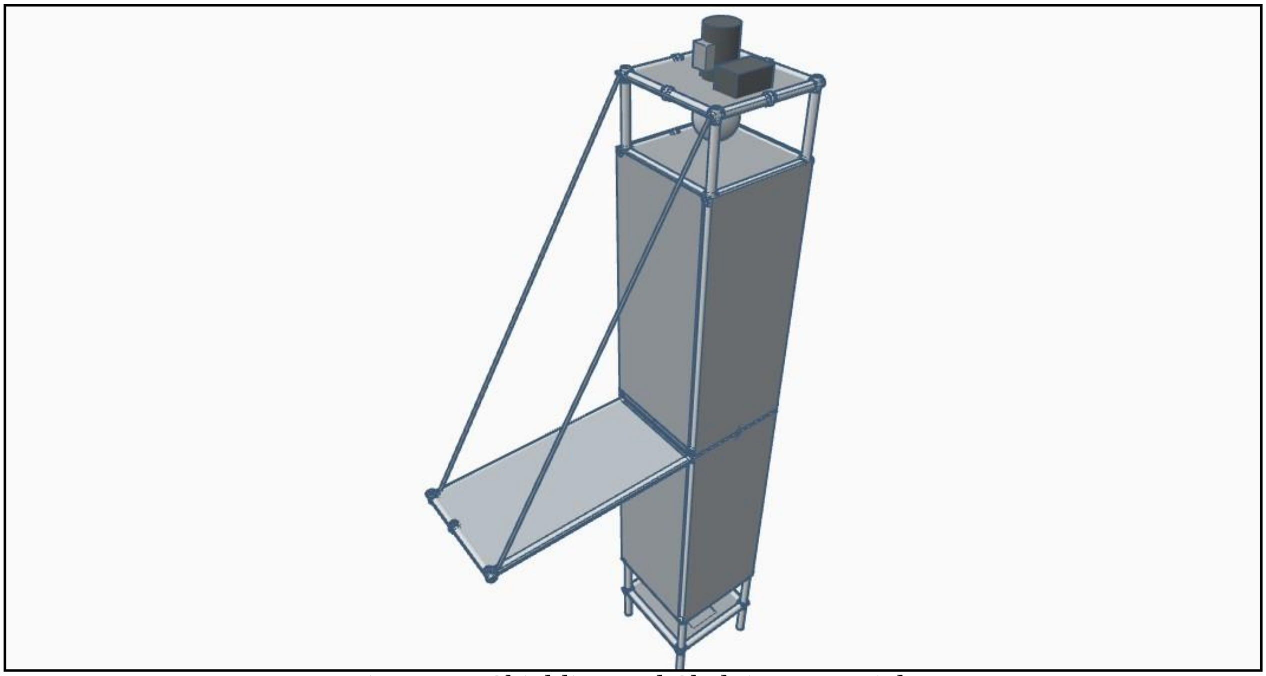

Figure 7 – Shielding and Shelving potential.

Constructed Jig for Wrapping Cones (horizontal)

Figure 8 – wooden jig used for wrapping any coils (cones or helical)

Figure 9 – Rear shot of flange and tube.

Multiple Coil Windings:

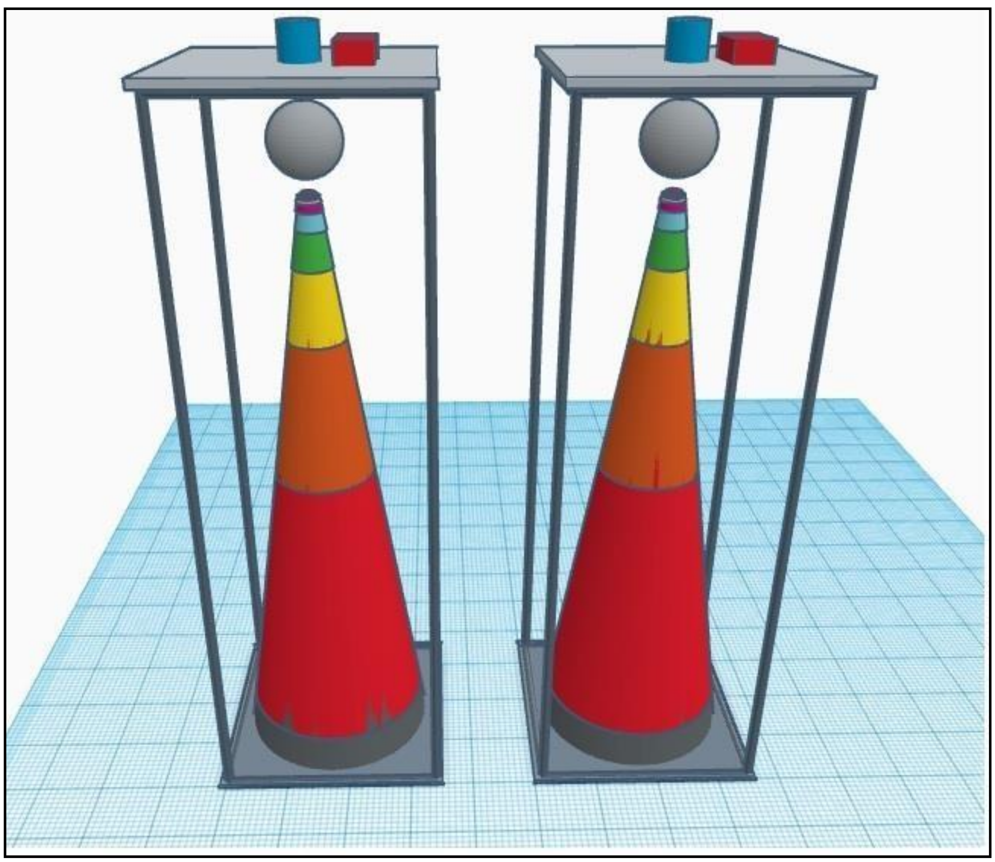

Figure 10 – Outer cone coils.

Cone Ductwork & Evacuation Fans - CAD & Construction:

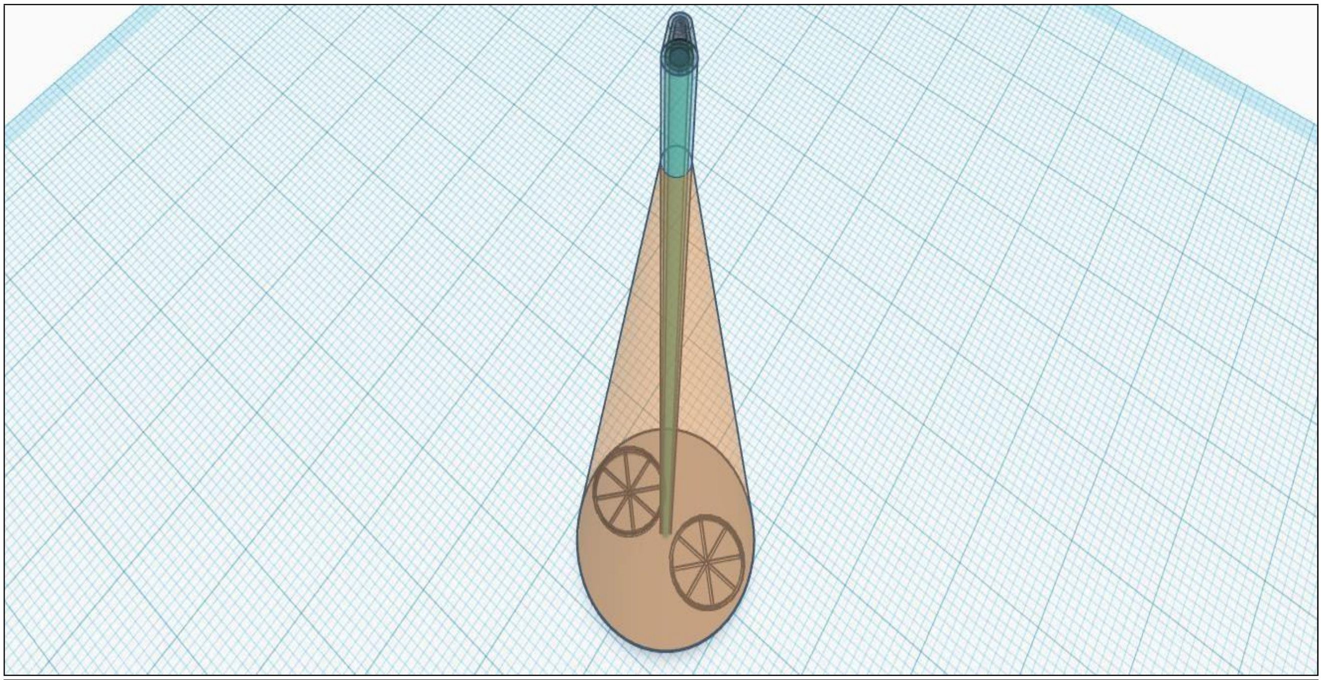

Figure 11 – CAD of inner helical nozzle/coil system, surrounded by cone coil.

Figure 12 – fan system used to evacuate any heated gases.

Figure 13 – bi-section of for inlet & outlet fans (air moves through a hole at the top of the bisection).

<u>Gas Inlets : CAD & Construction:</u>

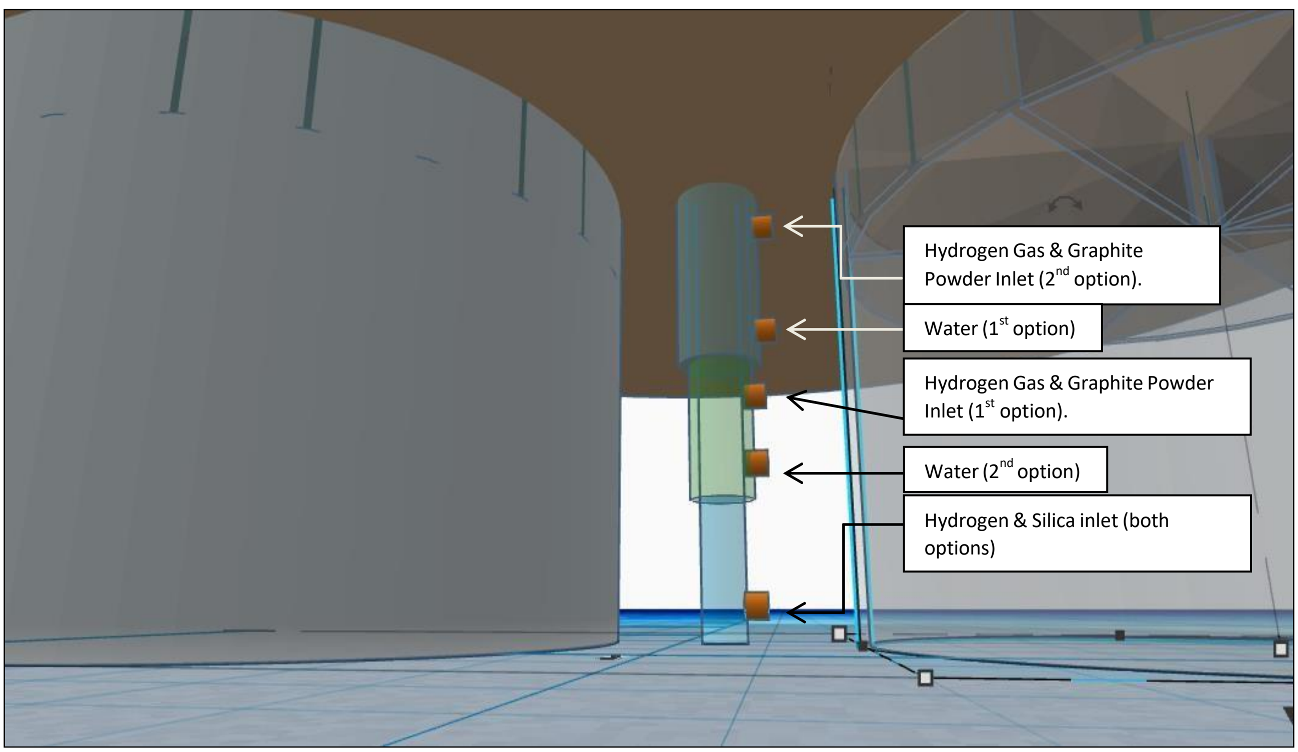

Figure 14 – CAD - Location of Gas and water inlets.

Placement of Split-shaft Collars, "O"-Ring Seals, and Gas & Water Connectors.

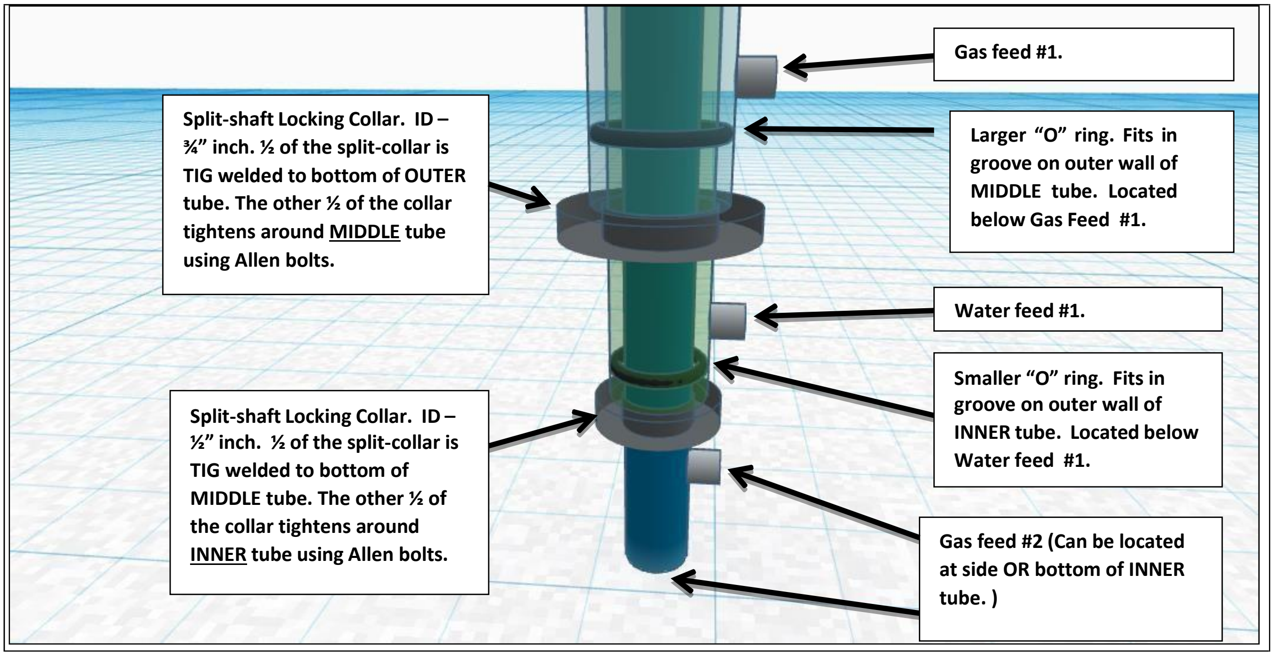

Figure 15 – Placement of Split-shaft Collars, ―O‖-Ring Seals, and Gas & Water Connectors.

Figure 16 – Cut 304 Stainless Steel tubes – for nested-nozzles.

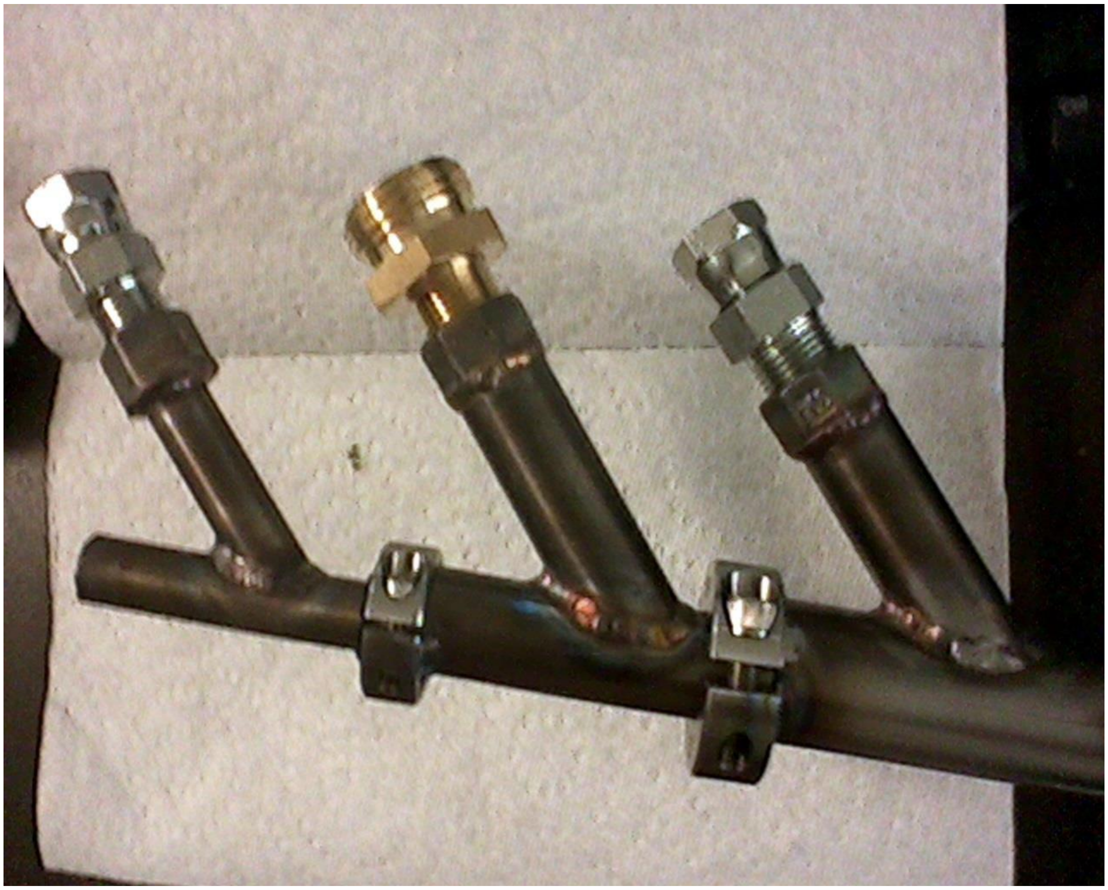

Figure 17 – TIG Welding completed for all water/gas inlets.

Nested Nozzles – CAD & Construction

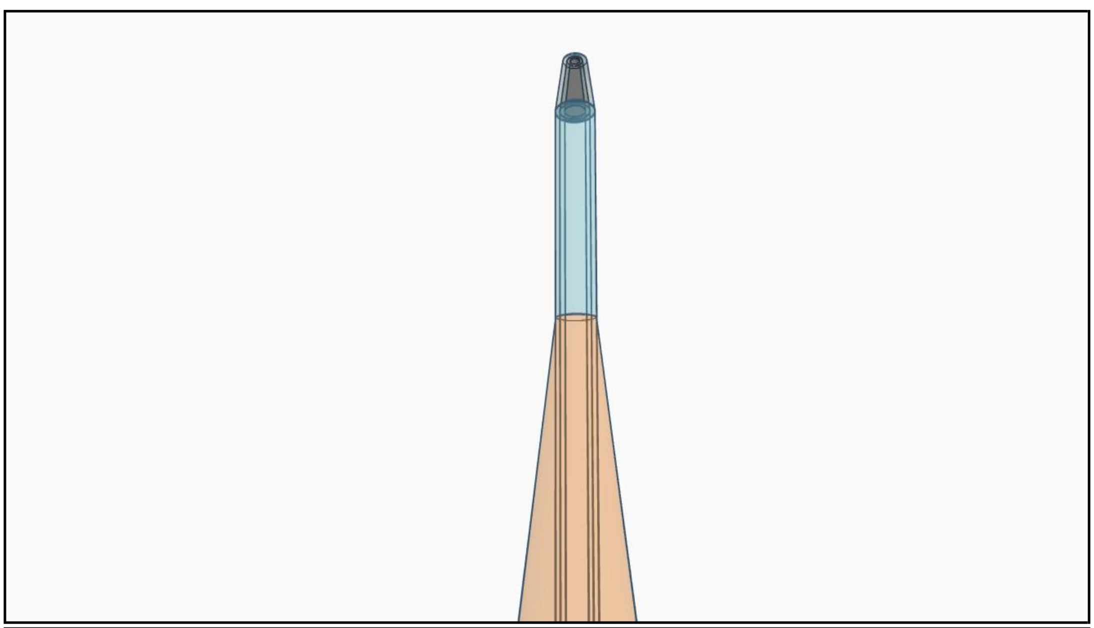

Figure 18 – Nested nozzles

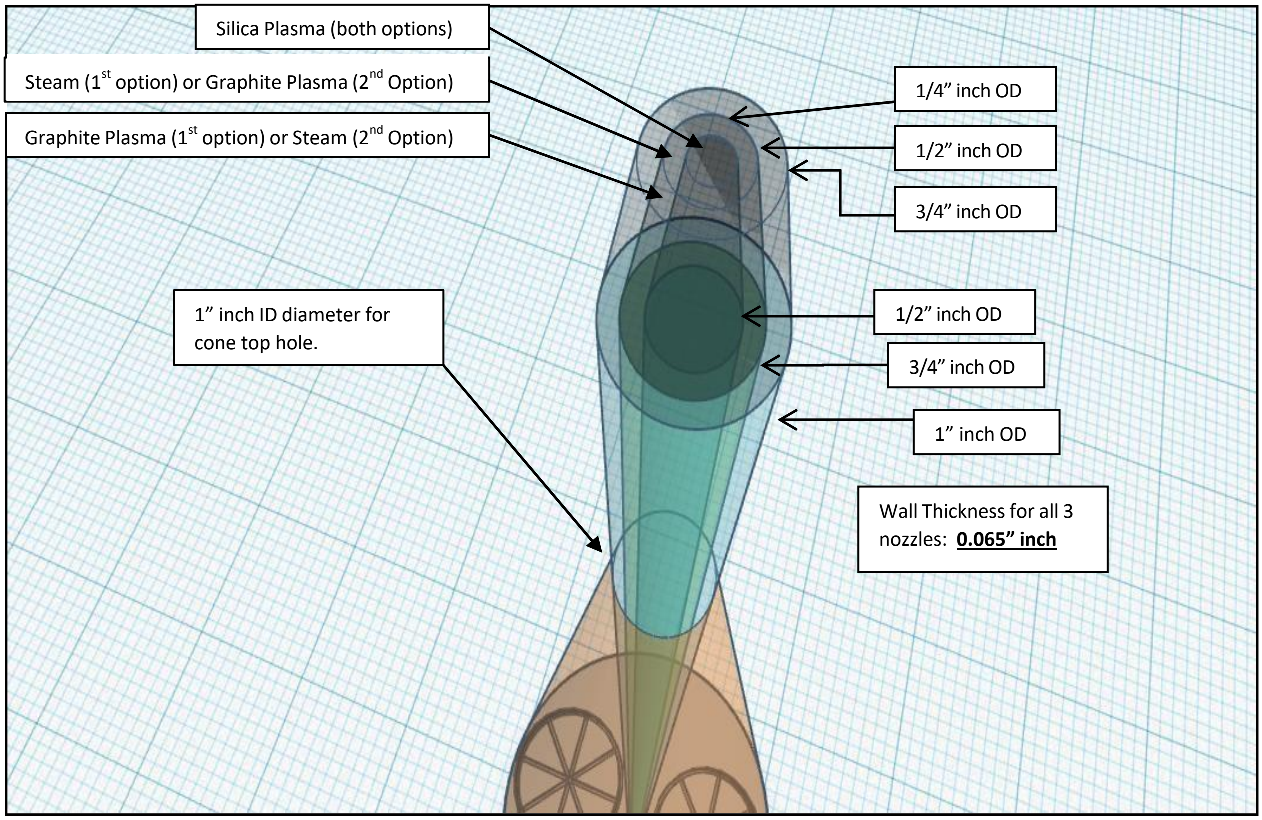

Figure 19 – Sizes of nozzles

Figure 20 – Assembled nozzle

Figure 21 – TIG welding of nozzles

Figure 22 – Powder coating receptacles to hold graphite & silica.

Wire Wrapping of Plasma Coil

Figure 23 (a-d)

Test Equipments

Vector Network Analyzers are used for finding the length of wires, and will be useful in measuring other aspects of the coil. They also have a built-in signal generator.

a. Length of wire
b. SWR (Standing Wave Ratio)
c. TDR (Time Domain Reflectometry)
d. Velocity Factor
e. Any potential faults in the wire.
f. Resonant Frequency

Spectrum Analyzers are used to measure the amplitude of signals within the frequency domain.

Both types of equipment typically come with built-in signal or tracking generators - which offer solutions for creating high-frequency RF signals. Handheld versions VNAs and SAs are available for much cheaper than desktop models. I found handheld models for about $150 each.

Rigol test equipment appears to offer the greatest functionality for the least price – so most of my desktop equipment is Rigol – including an Oscilloscope, Spectrum Analyzers, and Multimeter. However, Rigol PC software for each piece of equipment - is typically priced separately – and is relatively expensive.

Figure 23 – NanoVNA-F V2 (handheld vector network analyzer & signal generator)

Figure 24 – TinySA Ultra (handheld spectrum analyzer & signal generator)

Construction of Frames & Cones:

Figure 25 – Relative size of cone coils.

Protective Sleeve Construction:

Figure 26 – Outer shielding for cone coils.

Figure 27 – completed shielding

8” Aluminum or 304 Stainless Spheres & Shafts

Figure 28 – size of aluminum spheres.

Figure 29 – TIG welded aluminum spheres and shafts (w/ keyslot).

Design Calculations

1. Common Conversions & Constants

Pi (π)	=	**3.14159265359**
1 meter	=	**39.37007874 inches**
Degrees per rad = 360/(2π)	=	**57.29577951308**
Rad per Degree = (2π)/360	=	**0.01745329251**
30 AWG bare wire diameter =		**.01" in.**
Insulation thickness =		**2 x .0008" in. = .0016"**
Total 30 AWG wire diameter =		c**1 = .0116 in.**
Total 18 AWG wire diameter		***c2 = .0431 in.***
1 Hertz (Hz)	**=**	**60 rpms (cycles or revolutions per minute)**
Resistance of 30 AWG wire =		**338.6 milliohms per meter (.3386 ohms)**
		103.2 milliohms per foot (.1032 ohms)
Resistance of 18 AWG wire =		**20.95 milliohms per meter (.02095 ohms)**
		6.385 milliohms per foot (.006385 ohms)

The number of wraps per inch of 30 AWG wire (with insulation) is 1 / c1.

= **86.206897 wraps per inch (wpi)**[1]

The number of wraps per inch of 18 AWG wire (with insulation) is 1 / c2.

= 23.201856 wraps per inch (wpi)

2. Initial Example for Superpositioning of Frequencies

a. A Sine Wave Summation Sequence is used to describe Super-positioned frequencies & wire lengths to create the natural rectification of signals. It can be used to create the IPB, or drive a HATLIM

A simplified conditional summation of sine waves is below. Phasing & DC bias will cause a constructive interference of the convoluted EM waves across stacked coils.

$$f(x) = 3 + \sum_{n=1}^{n=3} \sin(4^{n} * x + 3/2\ \pi)$$

This simple function spans across 1 cycle & shows relative constructive interference along the top of the curve (compared to the bottom of the curve) through phasing of sine waves. It uses n=1 to 3 for visual simplicity.

b. The constant 3 in the summation equation represents 3 volts of DC bias (1 volt for each frequency). This bias causes the rectification. The bias voltage is meant to set a reference level.

c. The sequence of sine waves represents the convolution & superposition of 3 generated digital frequencies (by a microcontroller).

d. The phase is accomplished by programming the microcontroller to shift each subsequent frequency by 3/2 * π radians (or 270 degrees).

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[1] The number of wraps of 30 AWG wire was verified by counting 86 wraps to fill a 1 in. gap.

e. Real-life considerations - regarding capabilities, availability, and price are considered. Cylinder-shaped, helical coil templates have maximum sizes based on price & wire availability. Maximum lengths of the coil systems (that will fit in a workspace or construction area) are calculated below.

3. <u>Superposition Graph of qty. 3 – ¼ wave frequencies</u>

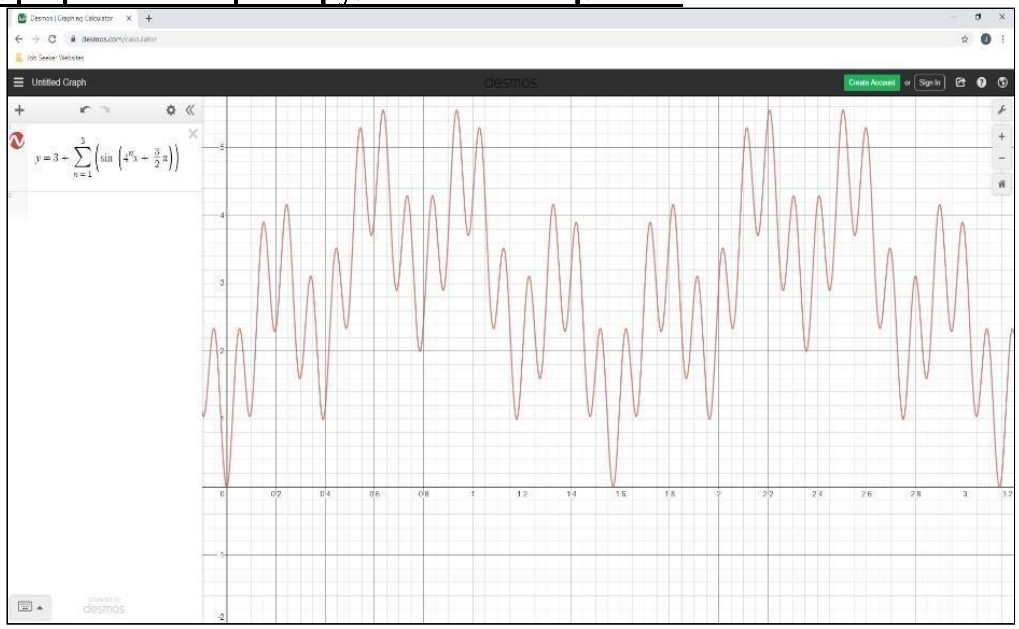


Figure 30 – Graph of 3 superpositioned frequencies.

a. The realistic maximum resonant frequency that the Propeller 2 Board can manipulate (through coded Phasing & Duty Cycle) is approximately 30 Mhz. The minimum frequency of the Board is not limited – however the price & length of the coil system, limits the value of n to 7 or 8. Higher frequencies can be achieved with P2 boards, but require external phasing electronics. VCO's (Voltage Controlled Oscillators) are being used for frequencies higher than 30 Mhz.

b. To find lengths of the wires & coil systems (based on n=7), changes to the equation need to be made. To build a realistic (workable device) - an increase in n, and a shift in the n-values of the summation function is needed:

$$f(x) = 9 + \sum_{n=7}^{n=14} \sin((5.291423766936 * 4^{n} * x) + 3/2\,\pi)$$

4. <u>Preliminary Frequency, Wire lengths & Resistance Calculations</u>

a. <u>Frequency calculations</u>

The maximum resonant frequency (f_R) should equal 1.42 Ghz (or the value **<u>5.291423766936 x 4^14</u>**). To keep the overall size of the cones manageable & prices –

<u>86,694 Hz</u> is potentially the lowest frequency that can be used – due to the length of the wire.
5.291423766936 x 4^n is assumed in this list.

F_R @ 4^14 =	**1,420,405,751. 766702882816 Hz**
F_R @ 4^13 =	**355,101,437. 941675720704 Hz**
F_R @ 4^12 =	**88,775,359. 485418930176 Hz**
F_R @ 4^11 =	**22,193,839. 87354732544 Hz**
F_R @ 4^10 =	**5,548,459. 967838683136 Hz**
F_R @ 4^9 =	**1,387,114. 991959670784 Hz**
F_R @ 4^8 =	**346,778. 747989917696 Hz**
F_R @ 4^7 =	**86,694. 686997479424 Hz**
F_R @ 4^6 =	**21,673. 671749369856 Hz**
F_R @ 4^5 =	**5,418. 417937342464 Hz**
F_R @ 4^4 =	**1,354. 604484335616 Hz**
F_R @ 4^3 =	**338. 651121083090 Hz**
F_R @ 4^2 =	**84. 662780270976 Hz**
F_R @ 4^1 =	**21. 16569506774 Hz**
F_R @ 4^0 =	**5. 291423766936 Hz**

b. <u>Design decisions, considerations & changes:</u>

1) One goal was to design a coil that works with a full range of 8 whole number ¼ -wave frequencies without causing sweeping issues from the microcontroller. A cone design allows 8 frequencies (down to 86.7 Khz).

2) Due to the difficulty in creating a pancake coil (without the use of adhesives, and unavailability of non-magnetic staples) – it became clear that a new shape was needed for the coil – and the patent diagrams were missing a side-view diagram.

3) A slant angle of of **9.1578495119 degrees** was calculated – **by setting the Slant Height equal to the Circumference <u>(of a full non-truncated cone)</u>**. This equality eases the calculation for Lateral Area of the truncated cone and other trigometric calculations.

Circumference*Slant Height = Circumference^2 = **<u>r^2 + h^2</u>**

This equality also allows an associated interleaved coil height of up to 70‖ and a highest frequency of 1.42 GHz to wrap around it (interleaved) a few times. **<u>I would not recommend cutting off very much of the tip</u>**, considering the wavelength of 1.42 Ghz is only 8.315244‖ in. An interleaved wrap needs to encircle the top of the cone – at least once.

Attempts at wrapping a 45 degree cone failed – due to low frictional forces causing wraps to slide to the narrow end of the cone.
The **<u>9.1578495119 degree angle (18-81-81 cone)</u>** was reached after studying patent US #5,255,863 & eventually matching the circumference with the slant height.

However, by changing the design from a helical coil structure – to a cone, the wrapped wire will no longer stay in place, regardless of the angle. A natural (non-radioactive, non- petroleum) adhesive was still needed to keep the wire from sliding to the narrow end of the cone. Tests were done by applying a pine-tar/graphite/sawdust/honey mixture to the cone, and then flaring the mixture. However, it did not produce the needed gummy viscosity needed for holding wire in place. Further testing revealed that melted & cooled **natural bee's wax** met this requirement.

4) **Wavelength-division multiplexing** was originally used for AM water-electrolysis experiments personally conducted in 2011-2014, and will potentially be needed for more complex signaling of this experiment. This can be accomplished by logically AND'ing multiple frequencies (pins) from the micro-controller. Wave-division multiplexing has been implemented within the signaling code - up to 22 Mhz.

However, implementing this function within AND logic gate IC chips is limited, since the clock cycle of the AND chips - is too slow.

A 2nd solution is to create AND gates with NPN BJT transistors (80 Mhz or higher, 10 Amp, 80 volt, 120 Watts) - to not only amplify the signal within the coils, BUT ALSO to build & test wavelength-division multiplexing (AND gate) circuitry. Transistor Model number **NJW44H11-D.**

5) Due to the Lenz force, all references to aluminum sheets & tubes are being changed to 3**00-grade stainless steel.** 300-grade Stainless Steel is poorly conductive & non-magnetic (austenitic) which removes the problem of Lenz forces. The 8‖ spheres are to remain aluminum (for now).

Due to the untested nature of super-positioned electromagnetic fields – there is the potential that the device can potentially attract even small particles of ferrous material trapped in the human body. Before this device is considered safe, testing to ascertain whether the human body can handle such electromagnetic reactions will need to take place.

A no-metal, no-radiation, high sulfur diet is potentially necessary to mitigate toxins in the body that potentially will interact with the superpositioned EM fields. Another solution is to remove ferrous material from the blood through donating blood – or attaching & operating an apheresis machine (with reversed functionality to reinsert blood plasma - instead of reinserting hemoglobin).

6) After doing some calculations, it appears possible to create an atypical ¼-wave transformer by sacrificing the longest wavelength of 86.7 Khz. The advantages are:

a) Eliminating impedance matching issues.
b) This transformation allows wavelengths down to 346,778 Khz – using common 30 volt, 10 amp power supplies – and still get approximately a 1 amp output.
c) Atypical DC power supplies of 300 volts won't be needed to overcome the real resistance of 300 ohms - at 1 amp.

A primary winding will be added - to create a voltage ratio of 1 : 9.29 (wraps) voltage transformer (wirelengths translate to 1 : 4).
This solution only requires a transformer wrap close to 10:1 - to get down to 1 amp at 300 volts.

This would allow me to use my existing variable 10 amp, 30 volt DC power supplies (I bought 4 of them so far). However, since the frame & cones have already been built to size - it may requiree a sacrifice of the lowest frequency (87.6 Khz) – due to too high a resistance.

d) Real-world Considerations:
If I only use 7 frequencies instead of 8, then the lowest frequency is 346.7 Khz, and the real impedance (resistance) is 292 ohms. I already own qty. 4 - DC power supplies that can deliver 30 volts at 10 amps.

346.7 Khz equates to 2329 wraps of 30 AWG wire - for the secondary coil.

NOTE: It was brought to my attention that impedance matching issues would also be a problem.

A solution to solve both the high coil resistance & impedence matching problems - would be to create a 1/4 –wave resonant transformer.

Conveniently, the ¼ wire length ratio of a primary-to-secondary transformer calculates to a 9.29 to 1 wrap ratio (which is close to 10:1.)

Therefore, I will need room for about 253.5 wraps of 18 AWG wire - which amounts to **10.927267**" inches worth of cone slant height.
This is possible, since the 7 frequency secondary winding will only be 27" inches long.

The primary coil (18 AWG wire) can handle 10-16 amps & is 4x the diameter of 30 AWG copper wire.

27" secondary winding + 10.927267" primary winding = 37.927267" inches of cone length.
If more bandwidth is needed, there is also room to add second ¼-wave primary.

c. Quarter-wave & resistance calculations for superpositioned secondaries & primaries

Resonant frequencies & wire lengths are calculated for each layer of the coil-sets. A range of powers is used to calculate the Resonant Frequencies. The workable subset of n = {15,14,13,12,11,10,9,8,7}. 30 AWG wire is assumed for resistances.[2]

$$\text{Length of wire (for n = 13 through 7)} = \frac{300,000,000}{(4^{(14-n)}) * \text{Resonant Frequency})}$$

Values of 5.291423766936 x 4^n

f_R = 1,420,405,751. 766702882816 Hz (for n=14): **2 x wire length = 0.2112072 m** (8.3152441 in.)
LA = 8.3152441‖ * c1 = **0.0964568 in^2:** Resistance **= .0715148 ohms**

f_R = 355,101,437. 941675720704 Hz (for n=13): **2 x wire length = 0.8448290 m** (33.2609842 in.)
LA = 33.2609842‖ * c1 = **0.3858274 in^2:** Resistance **= .2860591 ohms**

f_R = 88,775,359. 485418930176 Hz (for n=12): **2 x wire length = 3.37931608 m** (133.0439402 in.)
LA = 133.0439402‖ * c1 = **1.5433097 in^2:** Resistance **= 1.1442364 ohms**

f_R = 22,193,839. 87354732544 Hz (for n=11): **2 x wire length = 13.51726433 m** (532.1757610 in.)
LA = 532.1757610‖ * c1 = **6.1732388 in^2:** Resistance **= 4.5769457 ohms**

f_R = 5,548,459. 967838683136 Hz (for n=10): **2 x wire length = 54.0690573 m** (2128.7030433 in.)
LA = 2128.7030433‖ * c1 = **24.692955 in^2:** Resistance **= 18.30778280178 ohms**

f_R = 1,387,114. 991959670784 Hz (for n=9): **2 x wire length = 216.2762292 m** (8514.8121732 in.)
LA = 8514.8121732‖ * c1 = **98.7718212 in^2:** Resistance **= 73.2311312 ohms**

f_R = 346,778. 747989917696 Hz (for n=8): **2 x wire length = 865.1049170 m** (34059.2487007 in.)
LA = 34059.2487007‖ * c1 = **395.08728492812 in^2:** Resistance **= 292.9245249 ohms**

f_R = 86,694. 686997479424 Hz (for n=7): **2 x wire length = 3460.4196680 m** (136236.9948026 in.)
LA = 136236.9948026‖ * c1 = **1580.3491397 in^2:** Resistance **= 1171.6980996 ohms**

f_R = 21,673. 671749369856 Hz (for n=6): **2 x wire length = 13841.6786721 m** (544947.9792144 in.)
LA = 544947.9792144‖ * c1 = **6321.3965589 in^2:** Resistance **= 4686.7923984 ohms**

5. Cone Size (Truncated) Calculations

After realizing that there isn't a non-magnetic, non-adhesive way to fasten down a pancake coil - the design was redrawn & recalculated **using Truncated-Cone Coils as Primaries & Secondaries** (instead of Flat Pancake & Helical Coils). It is at that point, it occurred to me - the realization of missing information (particularly diagrams) in patent #512,340.

[2] Confirmation of the wire length - relies on measured resistance, capacitance and inductance.

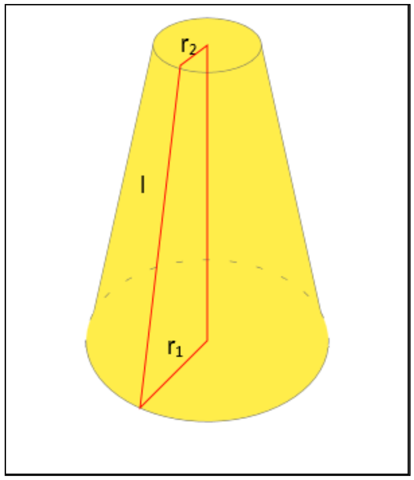


Figure 31 – cone with dimensions.

Slant height (sh) is equal to (l) in the picture. r1 is rb and r2 is rt.
Circumference is assumed equal to the slant height of a theoretical full cone (with the same base angle and rb.)

This sets the base angle = 80.842150 degrees:

Therefore, this causes the cos(base angle) to equal 1/(2*π)

There are 2 rb's and 2 rt's (1 each for primary & secondary coils) – so they are designated as follows: **rbp, rbs, rtp, rts.**

a. Formulas for cone-coil – with known top radius (rts = 0.125" inch):

Known formula for the LA & sh of a truncated-cone

LA = π * sh * (rbs + rts)
rbs = (LA / (π * sh)) - rts
sh = LA / (π * (rbs + rts))

(for known rb)
rts = (LA / (π * sh)) – rbs

(rb-rt) / sh = cos(80.84215048808) = 1 / 2π
sh = 2* π *(rbs - rts)

b. Find rbs – first, in terms of sh & rts – and then in terms of LA & rts:

Assume cos(base angle) = 1/(2*π)
(rbs-rts) / sh = cos(80.84215048808) = 1 / 2π
(rbs-rts) = sh / 2π
sh = (rbs - rts) * 2π
rbs = (sh / 2π) + rts

**** (for known rbs)**
rts = rbs – (sh / 2π)
Set the 2 **sh** equations equal:

$LA / (\pi * (rbs + rts)) = 2 * \pi * (rbs – rts)$
$2* \pi^2 *(rbs – rts)(rbs+rts) = LA$
$rbs^2 – rts^2 = LA / (2* \pi^2)$
$rbs^2 = LA / (2* \pi^2) + rts^2$
$\underline{rbs = SQRT(LA / (2* \pi^2) + rts^2) = 10.29598878083}$

<u> (For known rbs)</u>**
$LA / (\pi * (rbs + rts)) = 2* \pi *(rbs – rts)$
$2* \pi^2 *(rbs – rts)(rbs+rts) = LA$
$rbs^2 – rts^2 = LA / (2* \pi^2)$
$rts^2 = rbs^2 - LA / (2* \pi^2)$
$\underline{rts = SQRT (rbs^2 - LA / (2* \pi^2))}$

c. **<u>Find sh - in terms of LA & rt:</u>**
Given: **$sh = 2* \pi *(rbs - rts)$**
$\underline{sh = 62.72811383989}$

Substitute for rb:
$sh = 2* \pi *(SQRT(LA / (2* \pi^2) + rts^2) – rts)$
$sh = 2* \pi *(SQRT(2090.5742494844 / 19.73920880218 + .3125^2) - .3125)$
$\underline{sh = 62.72811002210}$

**** (For known rbs – substitute for rts)**
$sh = 2 * \pi * (rbs - SQRT (rbs^2 - LA / (2* \pi^2)))$

d. **<u>Find h (4 different ways):</u>**
1.) Pythagorean Theorem (known sh, rbs, rts):
$h^2 = sh^2 – (rbs - rts)^2$
$h = SQRT((sh^2 – (rbs – rts)^2)$
$\underline{h = 61.92855350085}$

2.) Tangent Calculation (known rbs, rts):
$h = \tan(80.84215048808) * (rbs – rts)$
$h = 6.203097420189 * (rbs – rts))$
$h = \underline{61.92855350085}$

3.) Replace the Slant Height with bottom Circumference (known rbs, rts):
$h^2 = sh^2 – (rbs – rts)^2$
$h^2 = (2\pi*rbs - 2\pi*rts)^2 – (rbs –rts)^2$
$h^2 = 4\pi^2*rbs^2 – 8\pi^2*rbs*rts + 4\pi^2rts^2 – (rbs - rts)^2$
$h^2 = 4\pi^2(rbs^2 – 2rbs*rts + rts^2) – (rbs – rts)^2$
$h^2 = 4\pi^2(rbs – rts)^2 – (rbs – rts)^2$
$h^2 = (4\pi^2 – 1)*(rbs - rts)^2$
$h = SQRT((4\pi^2 – 1)*(rbs - rts)^2)$
$h = (rbs – rts) * SQRT(4\pi^2 – 1)$

h = 61.92855350085

4.) Substitute for rbs (known LA, rts):

h = SQRT(4π^2 -1) * (SQRT(LA / (2*π^2) + rts^2) – rts)
h = 6.203097420189 * (SQRT(LA / (2*π^2) + rts^2) - rts)
h = 6.2030974202*(SQRT(2090.5742494844/19.73920880218+0.3125^2) - 0.3125)
h= 61.92855350085

**** (For known rbs & LA – substitute for rts)**
h = SQRT(4π^2 -1) * (SQRT(LA / (2* π^2) + rbs^2) + rbs)

6. **Coil Wire Calculations** - The cone coil is a truncated cone (with a small hole at the point).

Creation of a cone template can be made based on the bottom radius of the coil, and height of coil. The following template was created using an online cone calculator. The template may need to be split up into vertical or horizontal sections to be printed from a printer, and be cut from finite-sized 300-grade Stainless Steel sheeting.

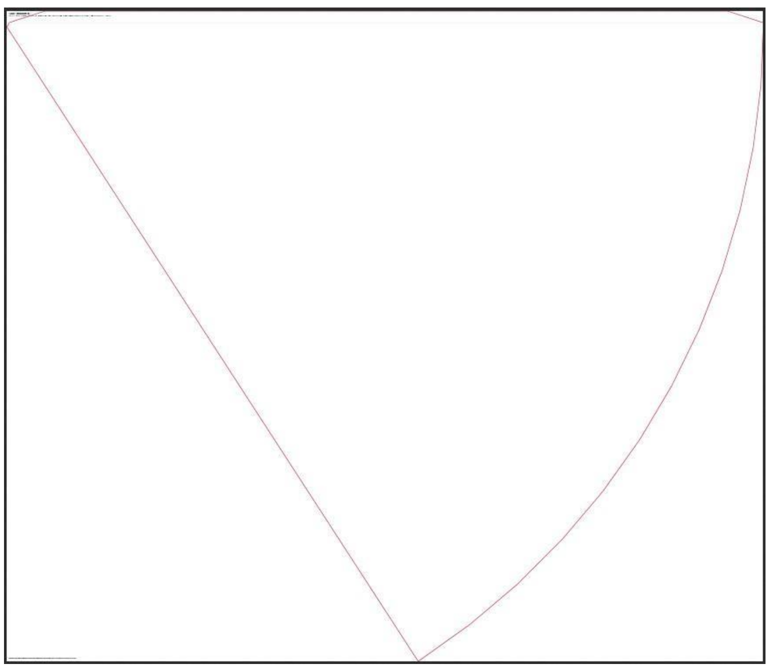


Figure 32 – 2D layout of cone.

a. Formulate a Lateral Area formula.

By finding the Lateral Area (LA) of a cone (Surface Area minus the Base Area), we can find the cone wire length (assuming a pointed cone):

LA of cone = π * rbs * slant height
LA of cone = π * rbs * SQRT(hc^2 + rbs^2)
Cone Wirelength = (π * rc * SQRT(hc^2 + rbs^2)) / c1

Cones of 45-45-90 degrees cannot be wrapped without wires sliding to the tip. A patent was helpful in deciding to choose narrower cone angles. In doing so, A simplified relationship was discovered – by choosing angles that allow the Circumference to match the Slant Height of the cone. Angles need to be **90 degrees, 80.8421504881 degrees, and 9.1578495119 degrees** to exploit this relationship.

Since the Cone Circumference equals the slant height (at any height), than:

LA = Wirelength * c1
LA = ½ * (Slant height)^2
LA = ½ * (Circumference) ^2
Slant height = Circumference = SQRT(2*LA)

b. Calculate a cone wire length formula – from the Lateral Area Formula:
The length of the cone wires = ¼ wave resonant wavelength:
rc = (Wirelength * c1) / (slant height * π))

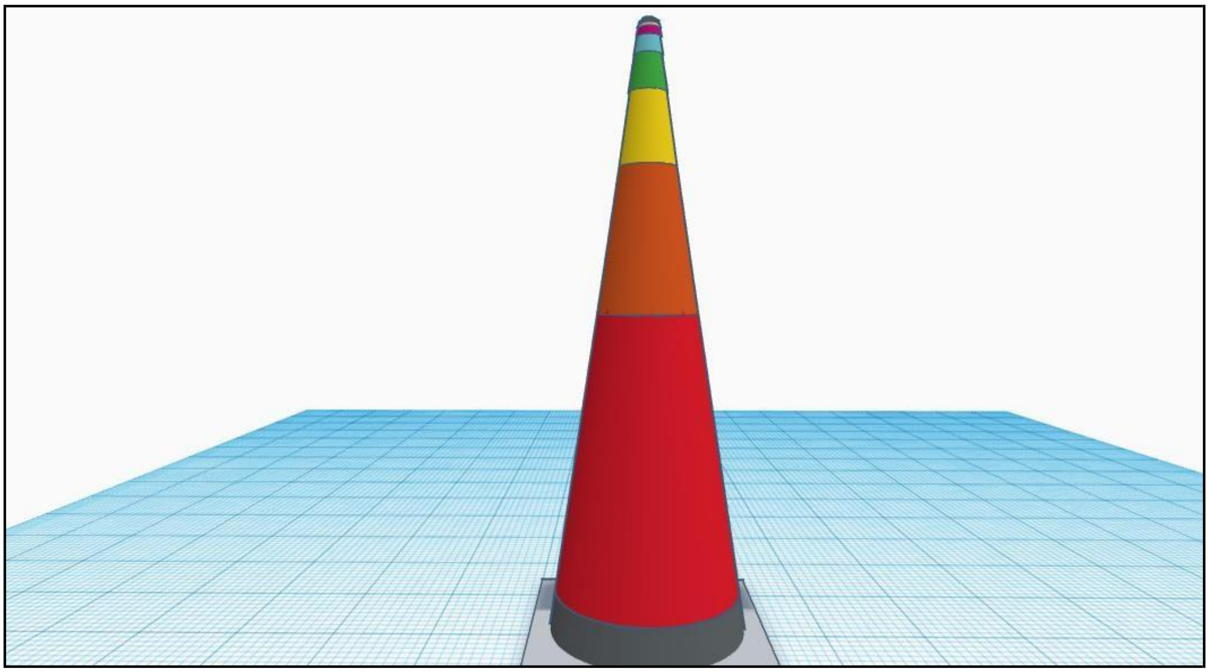


Figure 33 – Outer cone coils (8 layers).

Wire length = 0.2112072 m (8.3152441 in.)
f_R = 1,420,405,751. 766702882816 Hz (n = 14): LA = 8.3152441‖ * c1 = **0.0964568 in^2**
rbs= SQRT(LA / (2* π^2) + rts^2) =**0.14321856923"**
sh = 2π * (rbs - rts) = **0.11447064650"**
h = SQRT((4π^2 -1)) * (rbs – rts) = **0.11301155979"**: Resistance **= .0715148 ohms**

Wire length = 0.8448290 m (33.2609842 in.)
f_R = 355,101,437. 941675720704 Hz (for n=13): LA = 33.2609842‖ * c1 = **0.3858274 in^2**
rbs= SQRT(LA / (2* π^2) + rts^2) = **0.18753998087"**
sh = 2π * (rbs - rts) = **0.39295028891"**
h = SQRT((4π^2 -1)) * (rbs – rts) = **0.38794159399"**: Resistance **= .2860591 ohms**

Wire length = 3.37931608 m (133.0439402 in.)
f_R = 88,775,359. 485418930176 Hz (for n=12): LA = 133.0439402‖ * c1 = **1.5433097 in^2**
rbs= SQRT(LA / (2* π^2) + rts^2) = **0.30628415363"**
sh = 2π * (rbs - rts) = **1.13904193051"**
h = SQRT((4π^2 -1)) * (rbs – rts) = **1.12452326570"**: Resistance **= 1.1442364 ohms**

Wire length = 13.51726433 m (532.1757610 in.)
f_R = 22,193,839. 87354732544 Hz (for n=11): LA = 532.1757610‖ * c1 = **6.1732388 in^2**
rbs= SQRT(LA / (2* π^2) + rts^2) = **0.573031352599"**
sh = 2π * (rbs - rts) = **2.81506401181"**
h = SQRT((4π^2 -1)) * (rbs – rts) = **2.77918212747"**: Resistance **= 4.5769457 ohms**

Wire length = 54.0690573 m (2128.7030433 in.)
f_R = 5,548,459. 967838683136 Hz (for n=10): LA = 2128.7030433‖ * c1 = **24.692955 in^2**
rbs= SQRT(LA / (2* π^2) + rts^2) = **1.12542645878"**
sh = 2π * (rbs - rts) = **6.28586482672"**
h = SQRT((4π^2 -1)) * (rbs – rts) = **6.20574278555"**
Resistance of secondary **= (2128.703044 inches / 12) * 0.1032 ohms/ft = <u>18.30778 ohms</u>**
Resistance of primary = (**532.175761 inches / 12) x 0.006385 ohms/ft = <u>0.283162 ohms</u>**

Wire length = 216.2762292 m (8514.8121732 in.)
f_R = 1,387,114. 991959670784 Hz (for n=9): LA = 8514.8121732‖ * c1 = **98.7718212 in^2**
rbs= SQRT(LA / (2* π^2) + rts^2) = **2.240416014326"**
sh = 2π * (rbs - rts) = **13.291550819786"**
h = SQRT((4π^2 -1)) * (rbs – rts) = **13.12213162109"**
Resistance of secondary **= (8514.812175175 inches / 12) * 0.1032 ohms/ft = <u>73.2311312 ohms</u>**
Resistance of primary = (**2128.703044 inches / 12) x 0.006385 ohms/ft = <u>1.13265 ohms</u>**

Wire length = 865.1049170 m (34059.2487007 in.)
f_R = 346,778.747989917696 Hz (for n=8): LAs = 34059.2487007‖ *c1 = **395.087285 in^2**
rbs= SQRT(LA / (2* π^2) + rts^2)
rbs = SQRT(21.015355675) = **4.501705863"**
rbs –rts = 4.001705863"
sh = 2π * (rbs - rts) = **25.14345948"**
h = SQRT((4π^2 -1)) * (rbs – rts) = 6.2030974 *4.001705863 = **24.822971315"**
Resistance of secondary **= (34059.2487007 inches / 12) * 0.1032 ohms/ft = <u>292.9245249 ohms</u>**
Resistance of primary = (**8514.812175175 inches / 12) x 0.006385 ohms/ft = <u>4.53059 ohms</u>**

<u>Primary Turn & Wirelength Ratio Calculations :</u>

<u>slant height of secondary = (.0116 inches * # of turns) =</u>
<u>slant height of secondary / .0116 = 2167.5396 wraps</u>

===
<u>Multilayered (Tightly Coupled) Primary</u>

18 AWG wire. Nominal wire diameter (with enamel) = .0431 in. = c2

Top Radius of Primary = 0.5 in.
Wire length of secondary = 865.1049170 m (34059.2487007 in.)
Wire Length of primary = 865.1049170 m / 4 = 216.27622925 m (8514.812175175 in)

Top Radius of Primary = Top Radius of Secondary = rts = rtp = 0.5 in.
LAp of primary = 8514.812175175 * c2 = 366.9884047500425 in^2 (square inches)

Rtp, LA known. Find bottom radius of primary (rbp)
rbp= SQRT(LA / (2* π^2) + rtp^2) = SQRT(38.6228304‖) = **4.284778 in.**
h (height) = SQRT((4π^2 -1)) * (rbp – rtp) = 6.203097 * 1.7391285 = **23.4773466 in.**
sh (slant height) = 2π * (rbs - rts) = **23.780462 in.**

23.780462 in / .0431 = **551.751 turns.**
Turn Ratio of secondary to primary = **3.9285**

Adjacent (Loosely Coupled) Primary

rtp = 4.5017059" in.
LAp = wirelength * c2 = 8514.812175175 * .0431 = 366.98840475 in.
rbp = SQRT(LA / (2* π^2) + rtp^2) = SQRT (**366.98840475 / (2 * pi ^2) + 4.50171 ^2)**
rbp = 6.233558" in.

sh = 2* pi * (rbs – rts) = **10.8815479 inches**
h = 6.203097420189 * (rbs – rts) = **10.742847 inches**

wraps = sh / .0431 = 252.4721 wraps
Turn Ratio of secondary to primary = 2167.5396 / 252.4721 = **8.585264**

Wire length = 3460.4196680 m (136236.9948026 in.)
f_R = 86,694. 686997479424 Hz (for n=7): LA = 136236.9948026‖ * c1 = **1580.3491397 in^2**
rbs= SQRT(LA / (2* π^2) + rts^2) = **8.94857797090"**
sh = 2π * (rbs - rts) = **55.44017546351"**
h = SQRT((4π^2 -1)) * (rbs – rts) = **54.73351374813"**
Resistance of secondary **= (136236.9948 inches / 12) * 0.1032 ohms/ft = 1171.6980996 ohms**
Resiistance of primary = (**34059.2487007 inches / 12) x 0.006385 ohms/ft = 18.12236 ohms**

Wire length = 13841.6786721 m (544947.9792144 in.)
f_R = 21,673. 671749369856 Hz (for n=6): LA = 544947.9792144‖ * c1 = **6321.3965589 in^2**
rbs= SQRT(LA / (2* π^2) + rts^2) = **17.89584632841"**
sh = 2π * (rbs - rts) = **111.65752054681"**
h = SQRT((4π^2 -1)) * (rbs – rts) = **110.23429101434"**
Resistance of secondary **= (544947.9792 inches / 12) * 0.1032 ohms/ft = 4686.7923984 ohms**
Resistance of primary = (**136236.9948 inches / 12) x 0.006385 ohms/ft = 72.48943 ohms**

c. <u>The Skin Effect</u>

Below is a table which will be potentially helpful in combating any issues with the ―skin effect‖. Whether or not the skin effect is prevalent on interleaved coils – is unknown at this point. This speculation is due to the coil system's internal capacitance & auto-resonant behavior (along with using low voltages), which may offset the skin effect.

The ―Skin Effect‖ is the tendency of an alternating electric current (AC) to distribute itself within a conductor so that the current density near the surface of the conductor is greater than that at its core. The electric current tends to flow at the "skin" of the conductor. The skin effect causes the effective resistance of the conductor to increase with the frequency of the current. The maximum frequency show is for 100% skin depth (ie. no skin effects).

AWG	Diameter [inches]	Diameter [mm]	Area [mm^2]	Resistance [Ohms / 1000 ft]	Resistance [Ohms / km]	Max Current [Amperes]	Max Frequency for 100% skin depth
28	0.0126	0.32004	0.081	64.9	212.872	0.226	170 kHz
29	0.0113	0.28702	0.0642	81.83	268.4024	0.182	210 kHz
30	0.01	0.254	0.0509	103.2	338.496	0.142	270 kHz
31	0.0089	0.22606	0.0404	130.1	426.728	0.113	340 kHz
32	0.008	0.2032	0.032	164.1	538.248	0.091	430 kHz
33	0.0071	0.18034	0.0254	206.9	678.632	0.072	540 kHz
34	0.0063	0.16002	0.0201	260.9	855.752	0.056	690 kHz
35	0.0056	0.14224	0.016	329	1079.12	0.044	870 kHz
36	0.005	0.127	0.0127	414.8	1360	0.035	1100 kHz
37	0.0045	0.1143	0.01	523.1	1715	0.0289	1350 kHz
38	0.004	0.1016	0.00797	659.6	2163	0.0228	1750 kHz
39	0.0035	0.0889	0.00632	831.8	2728	0.0175	2250 kHz
40	0.0031	0.07874	0.00501	1049	3440	0.0137	2900 kHz

Figure 34 – Skin Effect graph.

7. <u>Pricing of Parts & Services</u>

30 AWG copper wire is sturdy enough to wrap by hand without breaking.
<u>Therefore, 10,000 meters of 30 AWG copper wire are needed for 8 interleaved layers (and frequencies), over 2 cone-coils & 12 TLIM coils.</u>
18 AWG copper wire is approximately 4 times the diameter of 30 AWG wire, and thus makes a good match for creating ¼ transformers.

<u>Stainless Steel Frame</u>
Qty 9 - Schedule 40 304 Stainless Steel Pipe seamless = 1.13 lbs. per foot. Wall thickness = 0.113‖ ID = ¾‖ OD = 1.05‖ inches & 21.9‖ inch length. Threaded both ends. ($280)
Qty. 40 - Schedule 40 304 Stainless Steel Pipe seamless = 1.13 lbs. per foot. Wall thickness = 0.113‖ ID = ¾‖ OD = 1.05‖ inches & 10.25‖ inch length. Threaded both ends. ($280)
Qty 8 – Schedule 40 304 Stainless Steel Seamless Pipe – 76‖ inch length. Threaded both ends. (Metal Supermarkets). ($400)
Qty. 2 – Schedule 40 304 Stainless Steel Pipe seamless – 48‖ inch length. Threaded both ends.
Qty. 32 – 5-way threaded pipe connectors – 304 SS. $12 each ($384 Alibaba.com)

Qty 30 – Union Nuts – 304 SS. $10 each ($300 – Menard's)

Fabrication
Qty. 2 - Cone construction ($1650 – Universal Climate Control)
Qty. 6 – Plate cutting & construction ($300 – UCC)
Qty. 8 – Shield cutting & construction. ($300 – UCC)
Qty. 2 – Fan & Duct Construction ($300 – UCC).
Qty. 1 – Winding Jig ($300 – UCC)
Qty. 6 - Re-cutting of Nozzle Holes ($100)
Qty. 8 – CNC boring of 5-way connectors ($300 – Hawkeye Welding).
Qty. 6 – TIG Welding of Nozzles ($400 Metal SuperMarkets)
Qty. 2 – TIG Welding of Aluminum Spheres & Shafts ($200 Metal Supermarkets)
Qty. 50 – Threading of Pipes ($300 Metal Supermarkets)
Qty. 6 – TIG Welding of gas & water inlets ($760 Metal Supermarkets)

Stainless Steel Sheeting
Qty. 1 – 2' x 3' x ¼‖ 300-grade Stainless Steel expanded sheeting – Metal Supermarkets ($220)
Qty. 2 – 10' x 4' sheets of 304 SS sheeting for cones ($650) (Metal Supermarkets)
Qty. 8 – 5' x 2' sheets of 304 SS shielding/sleeves. ($650) (Metal Supermarkets)
Qty. 1 – 11 GA SS 304 Plating 2' x 4' feet for supporting motors & cones ($400) (Metal Supermarkets)
Qty. 2 – 16 GA SS 304 Plating 2' x 2' feet shielding ($150) (Metal Supermarkets)
Qty. 1 - 40 gallon 300-grade stainless steel tank to hold water ($250)
Qty. 100 –300-grade stainless steel (non-magnetic) rivets 1/8‖ inch ($100).

Guy-wires
Qty. 100 ft – 316 SS aircraft cabling for guy-wires ($100)
Qty. 32 – wire rope connectors and cutter ($30 Amazon)

Aluminum Parts
Qty. 2 – Kings Metal 8" aluminum spheres ($400).
Qty. 2 – Aluminum shafts & connectors (to connect spheres to motors) (1/4"x12") ($20).
Qty. 4 – Aluminum SandBlaster Guns ($65 each, $260 total, Amazon)

Test Equipment & Electronics
Qty. 2 - 4 channel Rigol (DS1204Z-E) Oscilloscopes ($1600)
Qty. 2 - 2-sided Rigol Power Supplies – (832A) ($800)
Qty. 6 – Generic 2-sided Power Supplies – ($300)
Qty. 1 – Rigol 1.5 Ghz Spectrum Analyzer (DSA 815) ($1000)
Qty. 2 - Rigol Multimeters ($900)
Qty. 2 - Parallax Propeller 2 (model 64000) Signaling Microcontrollers ($300)
Qty. 3 – VCO's (Voltage Controlled Oscillators) and boards - at 88 Mhz, 355 Mhz, & 1.42 Ghz ($165).
Qty. 2 – 1/3 hp 220 Volt 3 phase AC Motors (Zoro.com $290)

Qty. 2 – Variable Frequency Drives 1 phase to 3 phase 220 volt (Amazon, $180)
Qty. 36 - non-boronated cylinder ALNICO magnets ½‖ diameter x ½‖ height ($200)
Qty. 1 - 0-240 volt Auto-transformers 5000 watt ($220)
Qty. 20 - Switches, transistors, diodes, variable Pot resistors for phasing, ultra-capacitors (5.5 v – 4F) & other electronic components ($200 DigiKey, Mouser, etc.).
Qty. 2 – 300-grade SS Shielding and Metal casings for electronics ($50 Digikey).
Qty. 1 – 220 volt 5 KW gas Generator for outdoor testing ($1000 Menard's)
Qty.1 – Windows desktop PC ($1000 - Dell)
Qty. 10 = USB & Power cables ($100)

Coil materials
Qty. 2 - Spools of wire - 30 AWG Copper ($280 Amazon) (10,000 meters total)
Qty. 2 - Spools of wire – 18 AWG Copper ($200 Amazon) (2500 meters total)
Qty. 6 pounds bee's wax (1 gallon) ($40 – local beekeepers)

Cost of parts & materials & test equipment= $14,005
Outsourced labor - $4275
Total cost of experiment = $18,440

8. Patents, Experimental Practices & Theories Considered

a. The first factor is a patent by Nikola Tesla from January 1894 – and was released to the public (republished) in 1995 – exactly 101 years after its inception. This is patent #512,340. It describes an interleaved coil system (2 wires wound next to each other).

This coil system is unique in the sense that it creates both induction & capacitance (between the two adjacent wires) at the same time (causing a self-resonant LC ―tank‖ circuit without the use of external capacitors). Interleaving adds the benefit of storing **250,000 times** the energy of a single wire coil.

Use of this patent is required – to achieve super-positioning of multiple frequencies - and is a way to eliminate external capacitors - to achieve multiple resonant conditions.

The first diagram is a birds-eye view of an interleaved truncated-cone coil. Multiple coils need to be layered (stacked) & positioned under their multi-layered windings (described next) – one set for each frequency used. The coil patent is nicknamed a flow capacitor – or ―flux capacitor‖. Note the side view is missing from the patent.

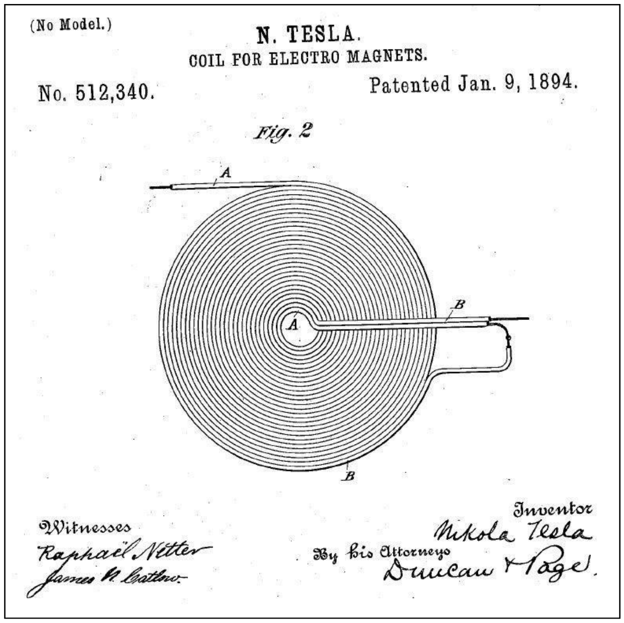


Figure 35 – Tesla Patent #512,340 (apparently modified).

The next diagram is a multi-layer, <u>interleaved helical</u> coil (also considered patent #512,340).Interleaved coils can be wrapped in ANY shape– this is just an example. Two spools of wire (of the same diameter) need to be used to create these coils, and the 2 wires need to be wrapped side-by-side, along the entire length of the coil. No skips, overlaps, or twists are allowed between the 2 wires – if it is to work correctly. The 2 adjacent wires create a capacitance, and again, holds **<u>250,000 times</u>** more energy <u>than single-wire helical coil.</u> There will be 4 wire connections (2 on each end) when completed – 2 of which will be coupled.

Multiple wrappings are made on a tube of cardboard (preferable) - one coil layer for each frequency used.

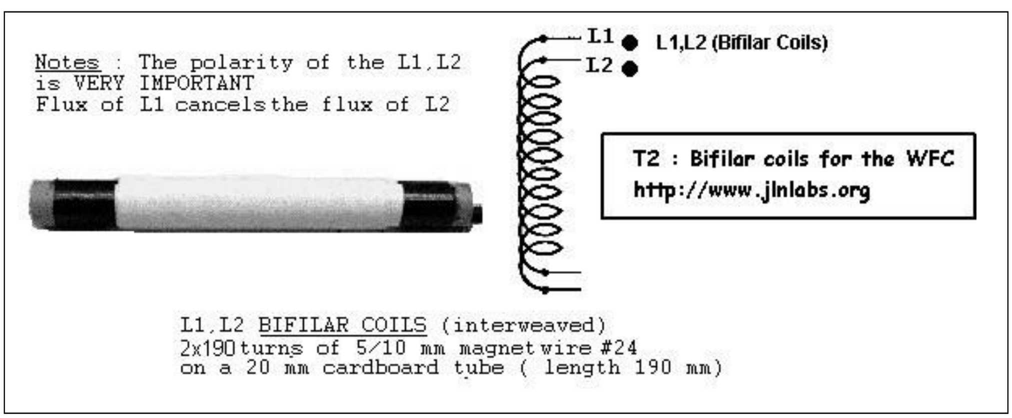


Figure 36 – Helical winding of patent #512,340.

b. The second factor is a patent showing how to improve the magnetic field of the entire coil system – by achieving dual-resonant ¼-wave conditions. US Patent #7,973,296-B2

c. The third factor is achieving a **triple-resonant condition.**

Wirelength resonance: The 1st condition is met by calculating the ¼ wave resonant frequency of all superpositioned interleaved coil wire-lengths. It is patent #US7973296-B2.

Wirelength resonant equation: F_R = 300,000,000 / (Length of wire)

1/4 – Wave Resonance: The 2nd condition is met by adding ¼ length primaries – positioned adjacent or layered to the secondaries. Current options are:

1. Layer the primary on the secondary (tightly coupled). Using 18 AWG wire over 30 AWG wire offers approximately a 4 : 1 Lateral Area – meaning that a ¼ wave primary will almost completely cover a secondary. Be sure to wind the secondary first.
2. Position the primary below the secondary (loosely coupled). This potentially might be required for some yet unknown purpose.

¼ Wave resonant equation: F_R = 300,000,000 / (4 * Length of wire)

Superposition: The 3rd condition is met by superpositioning of additional ¼ wirelength secondaries & primaries on top of the preceding wrappings. This also uses the **¼ - Wave resonant equation.**

LC resonant condition: This would be a potential 4th condition. This is met by tuning LC values to meet the same resonant frequency found above.

LC resonant equation : F_R = 1 / (2 * π * sqrt(LC)

In theory, interleaved coils are auto-resonating and will fulfill **both** equations – when the correct frequency condition is satisfied.

d. An interesting relationship exists when setting the 2 forms of resonant equations equal to each other.

Length of wire = 150,000,000 * pi *sqrt(LC)
LC = (Length of wire / (150,000,000 * π))^2

Equations for individual capacitance & inductance of interleaved, multilayer coils are difficult to find but can be assisted by the above equation.

However, as long as the coils for each cone are kept at 1/4-length ratios, patent #512,340 potentially will offer the same inductive reactance & capacitance reactance relationship (at resonant frequency) – regardless if **Cone- or Truncated-Cone shaped.**

e. The fourth factor is finding the relative coil size dimensions. This is to maintain the triple-resonant condition. All calculations have been made above.

NOTE: Capacitance measurements can become negative (depending on configuration) when measuring interleaved coils, which can be problematic.

f. The fifth factor is the Gravitational Magnus Effect - which can be used to wrap & extend the path of plasma around a spinning, conductive sphere – allowing slowing & modulation of the plasma propagation in a functional direction.

A published paper regarding the Magnus Gravitation Effect was released in July of 2018, giving a Newtonian explanation for Gravity which uses Magnus Effect equations - instead of the equation for Universal Gravitation – but calculates to the same results.

Magnus (Spin-Hall) Effects, potentially replace 2 difficult scientific concepts with 2 simpler ones (an example of fixing Occam's Razor) - by using Newtonian Pilot Wave Theory (De Broglie - Bohm Theory) & standing waves to explain deterministic outcomes (instead of the non-deterministic Copenhagen Interpretation of Quantum Theory) & the bending of Plasma instead of spacetime (Plasma Cosmology instead of Big Bang Cosmology).

Source: ***"Gravitational Magnus Effect",*** L.Filipe O. Costa, Rita Franco, Vitor Cardoso, published on May 3rd, 2018, revised & republished on July 25, 2018.

g. The sixth factor needed is use of the proper phase angle for super-position - of ($3/2 * \pi$) between all frequencies. Other phases don't properly create constructive interference. It's potentially possible that square-wave signaling by a micro-controller alleviates this requirement.

h. The seventh factor is building siphoning connectors which allow hydrogen gas to create a low-pressure condition – to suck particles of graphite or silica into the gas stream. This is an example of the Bernoulli Effect.

i. The eighth factor is to add electric variable frequency drives (1 VFD for each sphere) – to spin both conductive spheres - and slow the speed of flowing plasma along the N-S axis by extending & twisting its path along a perpendicular axis. These electric drives should have a maximum rotational speed of at least +/- 30 Hz (+/-1800 rpm). The horsepower should be based on the size & weight of the spheres, but a 1/4 HP motor is potentially sufficient for all spheres under 2 kg.

The rotational speed was estimated by researching –slow‖, –stopped‖ and –fast‖ light experiments at the University of Glasgow & their use of a +/- 1-30 Hz (60 – 1800 rpm) Variable Frequency Drive – used to spin a ruby window – thus slowing observed light by twisting & extending the path of light taken.

Source: Wisniewski-Barker, Emma (2015) ***–Slow light in ruby: a study in spatial and temporal domains".*** PhD thesis.

j. The ninth factor is how finely tuned to 1.42 Ghz a VCO can be adjusted. This can be controlled by purchasing DC power supplies that have a 1/1000 volt resolution.

9. **<u>Micro-controllers considered</u>**

a. Digital Signaling & Phasing of multiple frequencies cannot be accomplished with college-standardized Arduino micro-controllers. A newer, competing architecture from Parallax was first made available in 2008 – called the Propeller Board. The Propeller 2 board is now available from Parallax, Inc. for $150 and was released August. 2020.

b. The Propeller 1 & 2 boards are 8 core micro-controllers. They can produce up to 32 & 64 frequencies at the same time – along with duty cycles & limited phasing for superposition. The P2 allows clock frequency changes & Smart Pin technology to assist with sequencing & synchronizing the signals.

c. Extensive open-source code is available for the Propeller 1 Board – but is limited for the P2. However, there is enough information to achieve a Pulse Width & Phase Modulator – to operate a 6-8 frequency IPB or HATLIM. P1 Quickstart & P2 Evaluation versions are shown below.

d. Code for the Propeller Boards can be written in SPIN, SPIN2, Assembly, C, or Fortran. Tweaking & experimentation was necessary to find a range of 6 non-sweeping ¼ wave frequencies that match ¼ wave divisions of 1.42 Ghz. Screenshots are below of tested software.

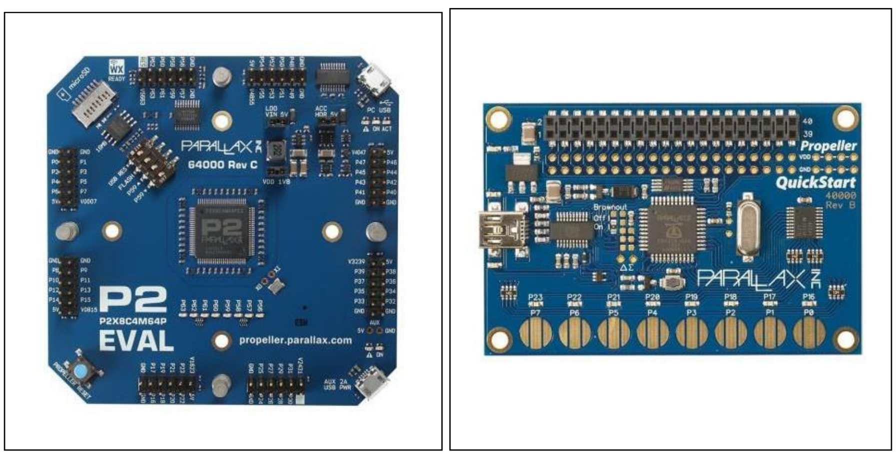


Figure 37 (a & b)– Propeller 2 (2020) & Propeller 1 (2008)

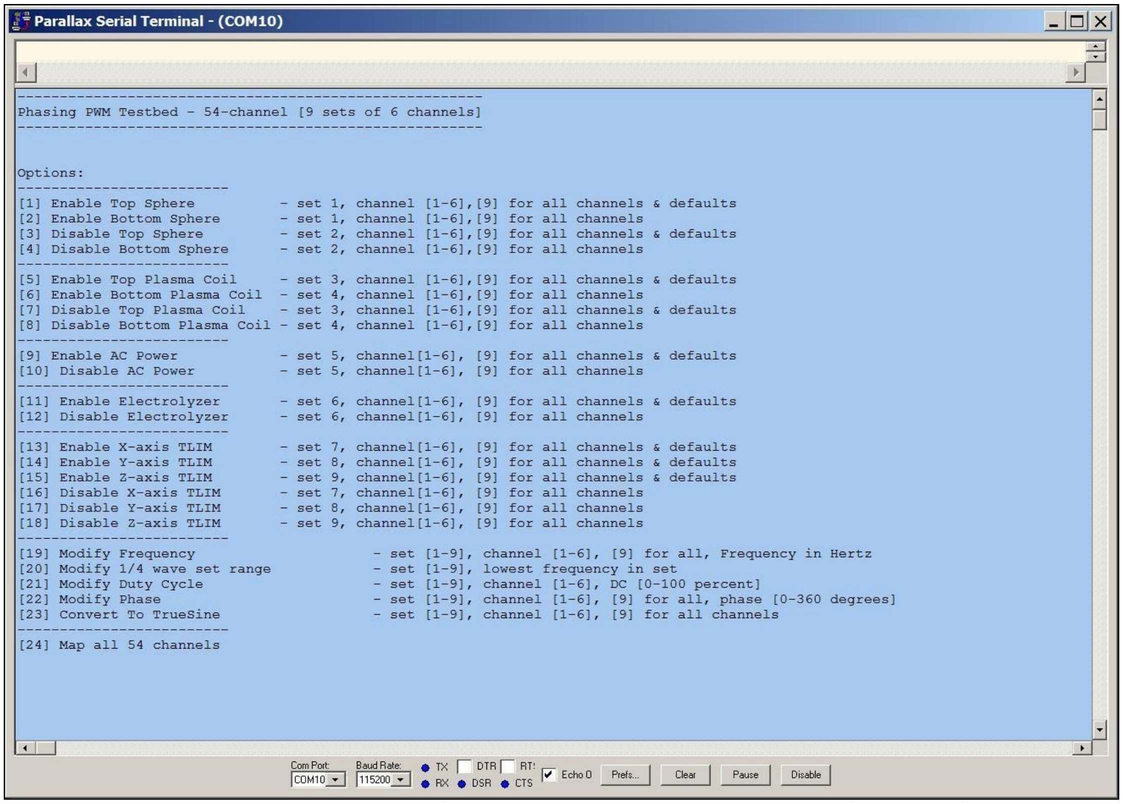
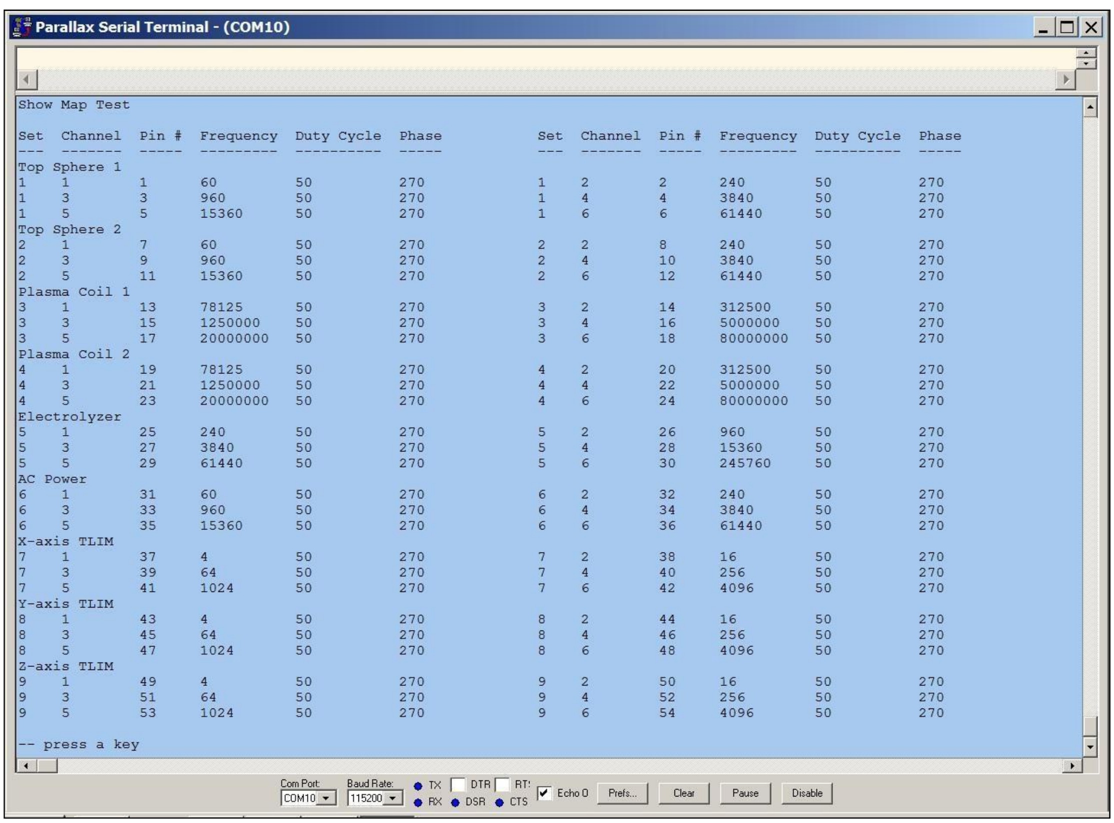


Figure 38 – Screenshot of signaling software Menu System “PWM-54”.



Set	Channel	Pin #	Frequency	Duty Cycle	Phase	Set	Channel	Pin #	Frequency	Duty Cycle	Phase
Top Sphere 1											
1	1	1	60	50	270	1	2	2	240	50	270
1	3	3	960	50	270	1	4	4	3840	50	270
1	5	5	15360	50	270	1	6	6	61440	50	270
Top Sphere 2											
2	1	7	60	50	270	2	2	8	240	50	270
2	3	9	960	50	270	2	4	10	3840	50	270
2	5	11	15360	50	270	2	6	12	61440	50	270
Plasma Coil 1											
3	1	13	78125	50	270	3	2	14	312500	50	270
3	3	15	1250000	50	270	3	4	16	5000000	50	270
3	5	17	20000000	50	270	3	6	18	80000000	50	270
Plasma Coil 2											
4	1	19	78125	50	270	4	2	20	312500	50	270
4	3	21	1250000	50	270	4	4	22	5000000	50	270
4	5	23	20000000	50	270	4	6	24	80000000	50	270
Electrolyzer											
5	1	25	240	50	270	5	2	26	960	50	270
5	3	27	3840	50	270	5	4	28	15360	50	270
5	5	29	61440	50	270	5	6	30	245760	50	270
AC Power											
6	1	31	60	50	270	6	2	32	240	50	270
6	3	33	960	50	270	6	4	34	3840	50	270
6	5	35	15360	50	270	6	6	36	61440	50	270
X-axis TLIM											
7	1	37	4	50	270	7	2	38	16	50	270
7	3	39	64	50	270	7	4	40	256	50	270
7	5	41	1024	50	270	7	6	42	4096	50	270
Y-axis TLIM											
8	1	43	4	50	270	8	2	44	16	50	270
8	3	45	64	50	270	8	4	46	256	50	270
8	5	47	1024	50	270	8	6	48	4096	50	270
Z-axis TLIM											
9	1	49	4	50	270	9	2	50	16	50	270
9	3	51	64	50	270	9	4	52	256	50	270
9	5	53	1024	50	270	9	6	54	4096	50	270

-- press a key

Figure 39 – Screenshot of signaling software frequency map.

10. Phasing Considerations

If the resonant frequency is too high for the microcontroller to phase, or shifting errors occur – which is seen above 20 Mhz - then external phasing electronics potentially need to be added. The formulas below describe the phase angle, with respect to external Resistance (R), Capacitance (C), and X_C (capacitive reactance).

Because of the high frequencies needed, the Propeller Board can only be used to generate synchronized frequencies – but not be able to make accurate phase changes. A variable RC circuit (a potentiometer & external capacitor) is capable of making phase changes.[3] Associated formulas follow:

$$X_C = 1 / (2 * \pi * f * C)$$
$$|Z| = SQRT(R^2 + (X_C)^2)$$
$$\tan(\text{Phase Angle}) = (X_C) / R$$
$$\text{Phase Angle} = \tan^{-1}(X_C / R)$$

More completely:

$$X_L = (2 * \pi * f * C)$$
$$|Z| - SQRT(R^2 + (X_L - X_C)^2)$$
$$\tan(\text{Phase Angle}) = (X_L - X_C) / R$$
$$\text{Phase Angle} = \tan^{-1}((X_L - X_C) / R)$$

11. Zener structures.

Zener diodes can be built using regular diodes – instead of buying Zener diodes. The following diagram is the equivalent of a Zener diode with a reverse voltage of 3 volts. The number of diodes used in the reverse direction will depend on the maximum voltage swings created.

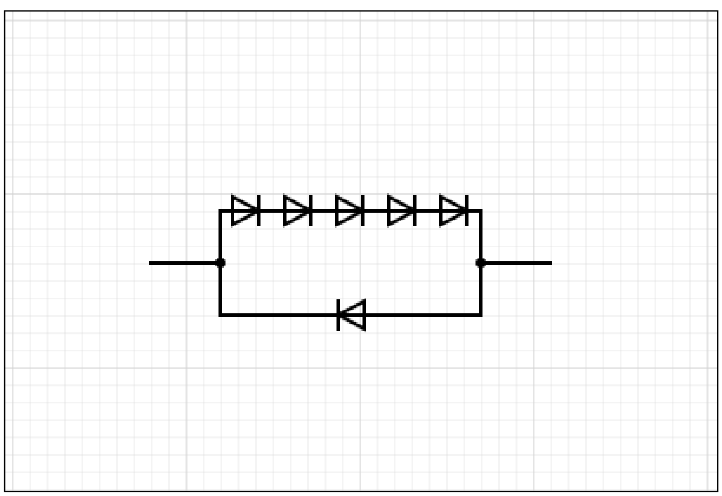


Figure 40 – Zener diode structure, using standard diodes.

[3] The Wein Bridge Oscillator is 1 example of a circuit that uses a resonant frequency for operation.

12. Construction of a Tubular Linear Induction Motor (TLIM)

a. The diagram below shows a 1-axis Tubular Linear Induction Motor (TLIM), to be placed inside an Impermeable Plasma Barrier along 3 different axis– which will potentially allow Hyper-accelerated propulsion in at least 6 directions. SS 304 tubes, pipes & connectors should be used instead of plastic or wood.

b. This design allows propulsion & guidance control of the entire plasma structure (when placed inside an IPB) – leading to controlled flight. Each tube contains pinned & floating magnets. The tubes are wrapped with multi-layer, interleaved helical coils (not shown).

c. If a IPB protects against acceleration, & superpositioned frequencies (and energy states) are used - then the TLIM can be renamed HATLIM (Hyper-Accelerated Tubular Linear Induction Motor)[4]

d. Below is a single TLIM (Tubular Linear Induction Motor). It shows the pinned & floating magnets. A simpler solution potentially uses only 2 magnets – 1 pinned on both ends and 1 pinned on one end.

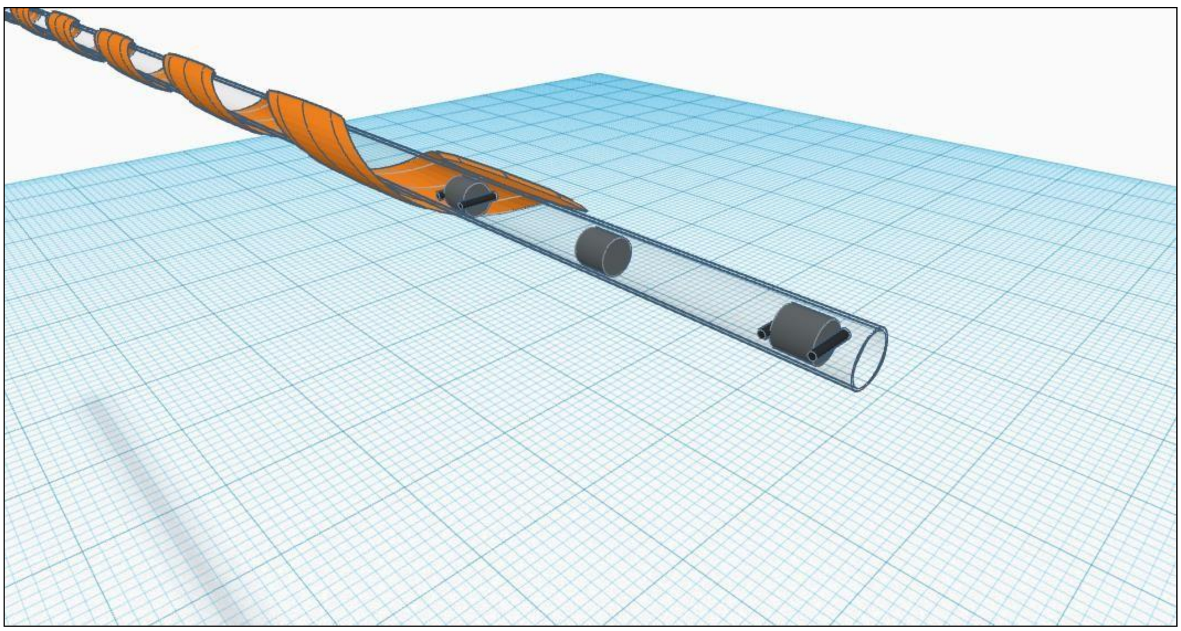


Figure 41 – Magnet closeup in TLIM.

[4] **NOTE:** A modification of the design will double the amount of magnets & wire (placing them at the far ends of the tubes.) This allows helical coils to be wrapped twice as long.

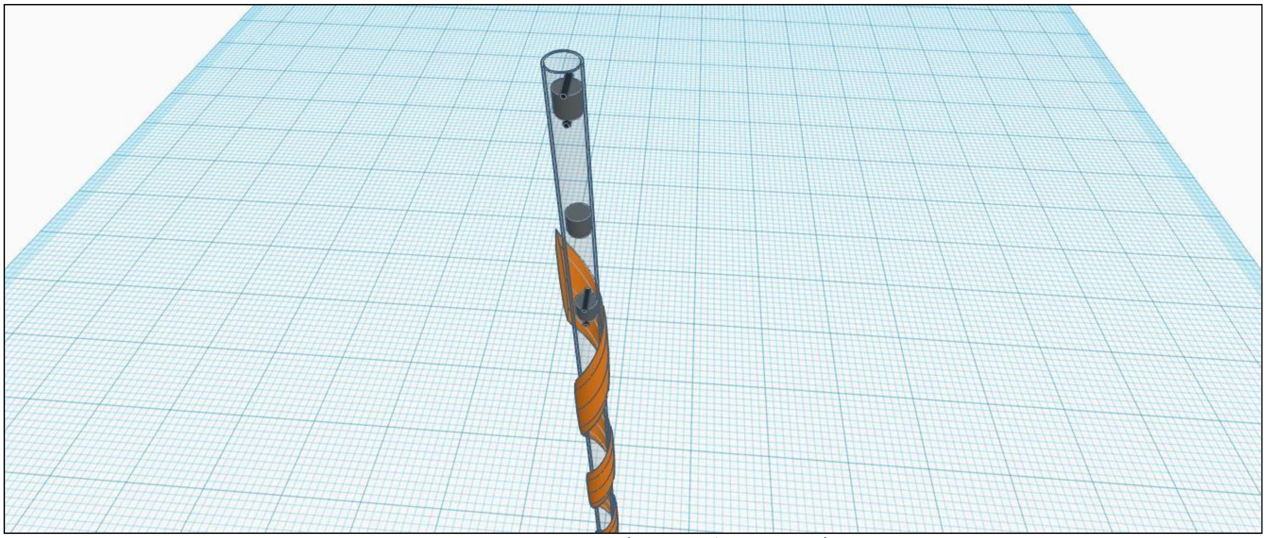


Figure 42 –TLIM (vertical position).

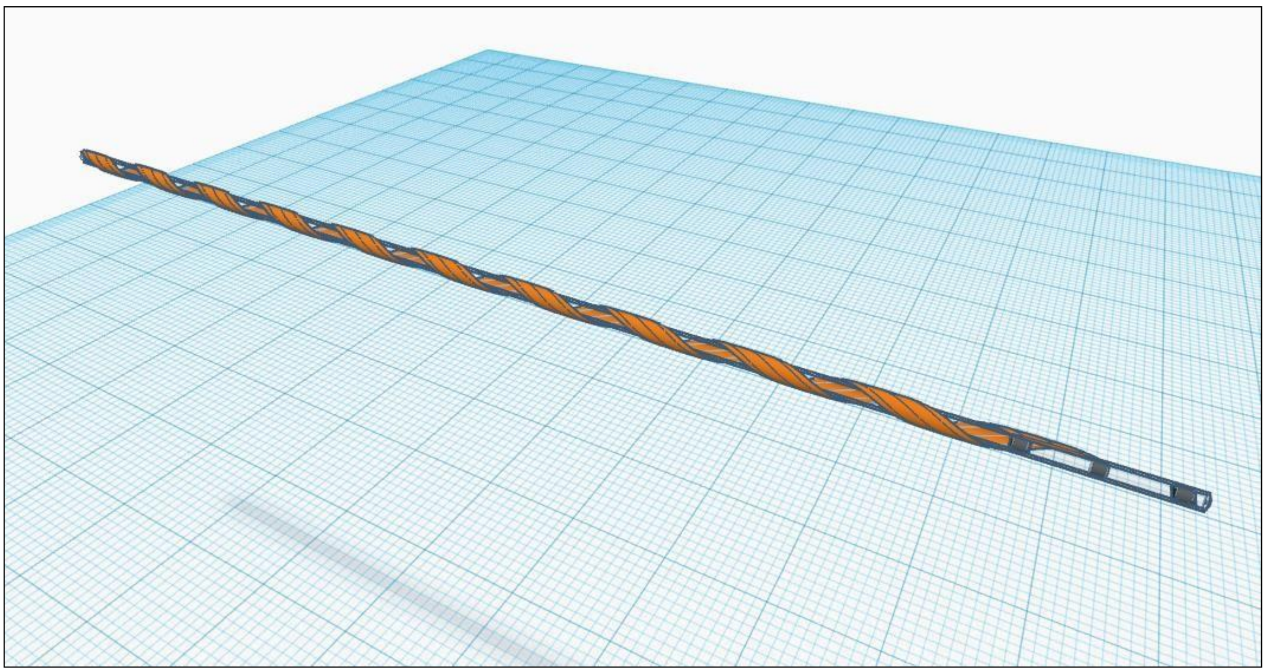


Figure 43 – Complete TLIM (horizontal position)

<u>Test Calculations:</u>

Total 30 AWG wire diameter = c**1 = .0116 in.**

Total 18 AWG wire diameter ***c2 = .0431 in.***

1 Hertz (Hz) **= 60 rpms (cycles or revolutions per minute)**

Resistance of 30 AWG wire = **338.6 milliohms per meter (.3386 ohms)**
103.2 milliohms per foot (.1032 ohms)

Resistance of 18 AWG wire = **20.95 milliohms per meter (.02095 ohms)**
6.385 milliohms per foot (.006385 ohms)

The number of wraps per inch of 30 AWG wire (with insulation) is 1 / c1.
= **<u>86.206897 wraps per inch (wpi)</u>**[5]
The number of wraps per inch of 18 AWG wire (with insulation) is 1 / c2.
= **<u>23.201856 wraps per inch (wpi)</u>**

Tube length – 6 feet.

<u>Tightly-coupled Calculations</u>
Diameter for secondary on bottom layer = 0.75" inches
Secondary coil length = 60 inches (5 feet).
Secondary wire length = 12187.2129 inches (1015.60108 feet)
Wraps = 5172.414 wraps
Resistance = 104.81 ohms

Diameter for primary on top layer = 0.7732" inches
Primary wire length = 12187.2129 / 4 = 3046.803225 (253.9003 feet)
Primary coil length = 54.060488 inches
Wraps = 1254.304
Resistance = 1.621153 ohms

Wrap ratio = 4.12533
Maximum Primary Power = 25.406 volts @ 4.125 amps

<u>Loosely-coupled Calculations</u>
Diameter for secondary on bottom layer = 0.75" inches
Secondary coil length = 26 inches (2.16667 feet).
Secondary wire length = 5281.12561 inches (440.0938 feet)
Wraps = 2241.379
Resistance = 45.41768 ohms

Diameter for primary on bottom layer = 0.75" inches
Primary wire length = 5281.12561 / 4 = 1320.2814025" inches (110.02345 ft.)
Primary coil length = 24.15086" inches
Wraps = 560.3448
Resistance = 0.7025 ohms

Wrap Ratio = 4.0
Maximum Primary Power = 11.354 volts @ 4 amps

13. <u>Peaceful, Practical Space Survival Applications</u>

a. **Warp Drive and Unconventional Flying Objects** – This technology is written about in several 2012 PIERS proceedings, including ***"Pulsed EM Propulsion of Unconventional***

[5] The number of wraps of 30 AWG wire was verified by counting 86 wraps to fill a 1 in. gap.

Flying Objects", A. Meessen, Institute of Physics, Catholic University of Louvain, Belgium.

This technology is meant for safe, buoyant, unconventional travel – by assuming a plasma-filled universe model (versus a spacetime model – or Copenhagen interpretation). Another function of Plasma-force fields (IPBs) – is to protect their contents (including HATLIMs – detailed above) from acceleration against external space plasma.
The plasma-filled universe is a published, competing model to the Einsteinian space-time model (Copenhagen Interpretation) – and is necessary to create a Newtonian design - to propel through space at unconventional speeds.

Source: ***"Plasma Universe"***, Hannes Alfven, April 1986, Department of Plasma Physics, S-100 44 Stockholm, Sweden. TRITA-EPP-86-03

b. **AM water electrolysis** (elemental separation of water - without recombination) – AM Water electrolysis can create pure, breathable oxygen (O2), and separate burnable Hydrogen (2H2) for gaseous fuel applications.

c. **AM water desalination & radioactive cleanup** (molecular separation & recombination). AM water electrolysis is more efficient that DC water electrolysis. It can be used with contaminated water, salinized water, or even distilled water to remove everything – including metal & radiation.
The molecules (2H2 & O2) can then be recombined to create clean, liquid water for drinking. This is done by attaching an oxy-hydrogen torch nozzle to the electrolysis machine. Burning the oxy-hydrogen recombines the gas into water.

d. **BINGO or AuqaFuel –** Oxy-hydrogen gas can also be recombined into something other than water. By using graphite during electrolysis – recombination potentially yields a burnable liquid similar to gasoline. Octane ratings would depend on the amount of graphite available for the recombination reaction.

e. **Atmospheric creation** – This technology is meant for holding breathable, oxygen-rich atmospheres. They are created by building a Impermeable Plasma Barrier which is safe for life, and large enough to fit lifeforms inside. Clean oxygen can be created & held inside the IPB. The oxygen can be produced from electrolyzed water – and hydrogen can be expelled.

f. **"Q-Bit" or "cubit" technology** – This technology is a 3-dimensional way to store digital information (instead of 2D memory arrays) – and would have layers (like an onion). Plasma waves can be combined to create standing waves & anti-nodes along an Impermeable Plasma Barrier, which would trap & spin small, metal particles. Then, an internal laser could determine the spin direction & allocate a ―0‖ or ―1‖ to the direction of the spin.

g. **Stealth Technology** – This technology is meant to improve the trap plasma emissions, by resonating the plasma that surrounds transmitted radio waves an an ICP coil – allowing for potential stealth applications.

h. **Autonomous Hoverboard technology** – This technology uses 3-4 relatively small Impermeable Plasma Barriers - mounted underneath a board. These IPBs would be an interface with the ground, and allow for semi-frictionless transportation across the ground. The smaller coils would require higher frequencies & better microcontrollers than the current design.

i. **Low power audio speaker –** By adding an audio signal to the input waveform, the plasma can be made to move at audio frequencies of 0 - 20,000 Hz.

j. **Healing & Growing environment** - Plasma is known for expediting healing of wounds. It may potentially also act as a better growing environment – since there won't be any Nitrogen in the environment.

k. **Improved Radio Telescopes**

14. Atmospheric Creation - using IPBs & AM Water Electrolysis

This technology involves creating an Impermeable Plasma Barrier (IPB) large enough to contain a water tank, electrolyzing equipment & a human being.

a. Creation of pure 100% oxygen can be efficiently accomplished by electrolyzing a supply of water with AM signaling (instead of DC). Then, venting of the Hydrogen gas can occur (with a tube) & leave Oxygen for breathing. Any backflow of hydrogen can be controlled with a valvular conduit. This is another Nikola Tesla patent – which functions as a valve, but with no moving parts. This is patent #1329559A

   With AM electrolysis – chemical electrolytes are not necessary (as with DC electrolysis) – keeping the inputs & outputs clean of impurities.
   A Hoffman ―voltameter‖ is a device meant to separate the Oxygen & Hydrogen gases during water electrolysis. The application of superpositioned AM signaling to the anode (instead of DC power) - is necessary to avoid using electrolytes (i.e. metal salts, sodium HCL or potassium HCL caustic bases) – and also use power efficiently.

b. To perform water electrolysis – add a power coil to collect energy from the main coil system from the IPB circuit above. Then connect the leads to the Anode & Cathode of the Hoffman voltameter and allow water to fill the middle tube.
   The diagram below shows the layout & functioning of a Hoffman voltameter – and allows separation & venting of hydrogen gas - **away from oxygen gas** - after AM electrolysis takes place. An air-tight IPB would then be able to hold the oxygen.

Hoffman Voltameter:

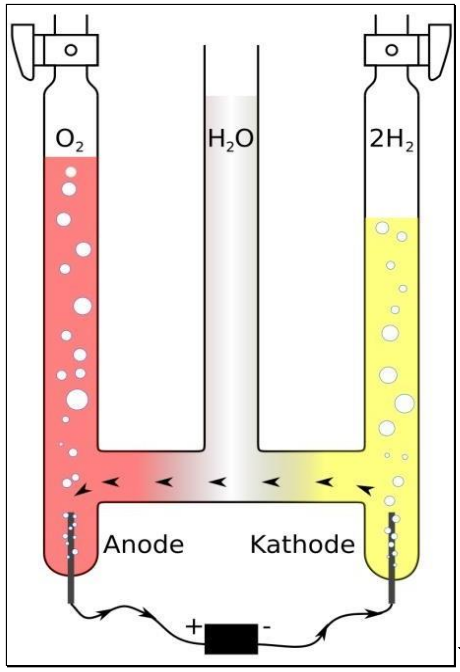


Figure 44 – Hoffman voltameter (water electrolyzer)

60 ml Hoffman voltameters are available online for about $115.00

Constants, Conversions & Calculations for Water Electrolysis:

Water contains a stechometric ratio of 1 mole of atomic Oxygen (O) & 2 moles of atomic Hydrogen (H).
The volume of 2 moles of liquid water can generate 1 moles of molecular, gaseous O2 & 2 Moles of molecular, gaseous H2 (3 moles of total oxy-hydrogen gas).
Therefore, O2 makes up 1/3 the volume of the separated gases.

The volume of 1 mole of liquid water (H2O) = 18 ml (.018 liters).
The volume of 2 moles of liquid water = 36 ml (.036 liters)

1 mole of <u>any ideal gas</u> (O2 or H2) occupies 22.4 liters of space at ambient temperature & pressure.
The volume of 1 mole of O2 plus 2 moles of H2 molecules (or 2 moles of equivalent water) = 3 moles of ideal gas (O2 + 2 H2) * 22.4 = 67.2 liters.
1 mole of water (18 ml) generates (½ * 67.2 liters) or 33.6 liters of Oxyhydrogen (O2 + 2H2) mixed ideal gases.

Furthermore, the Gaseous Expansion ratio of oxy-hydrogen gas (O2 + 2H2) from water = 33.6 / .018 = 1866.6666.
Therefore, after venting the H2 - the Gaseous Expansion ratio of just O2 from the same 1 mole of water is (1/3 * 1866.66666) = 622.22222

60 ml of water in the Hoffman voltameter contains 3 1/3 moles of water.

The volume of liberated oxygen from 60 ml (.06 liters) of water is 3.333333 moles (water) x (.018 liters/mole) x 622.222222 (expansion factor) which equals 37.333333 liters (9.862428 gallons or) of mol. oxygen (O_2).

The minimum size of the plasma barrier will potentially be a sphere with a diameter defined by the distance between the 2 spinning spheres. To make a 2' x 2' x 2' cube in the middle of the machine, involves a minimum separation distance of 14 feet between the equator of each sphere (seperated from the cone by up to 6 inches) – or a plasma radius of 7 feet.

Conversions used:

Liters per cubic foot **– 28.3168**

Liters per gallon **– 3.78541**

Gallons per cubic foot – **28.3168 / 3.78541 = 7.48052**

The volume of a sphere is calculated with the following formula:

Volume of sphere = $\mathbf{4/3 * \pi * radius^3}$

Therefore, the volume of the sphere is **1436.755040 cubic feet.**
Conversions yield a volume of **40684.305124 liters (10747.661448 gallons).**
The voltameter will need to be filled **1090 times** to fill the sphere with pure oxygen at atmospheric pressure (assuming the hydrogen is vented and no longer taking up space).

Therefore, to create a 100% oxygen environment of this volume – requires **65.385491 liters (17.273027 gallons) of water.**

NOTE:: To clean the existing air (nitrogen plus oxygen) – before adding more oxygen to the IPB, an air compressor & air conditioner are potentially needed to separate the Oxygen & Nitrogen gases, or a vacuum pump is needed to empty the space of **all** gases.

15. Ralated circuit diagrams (Currently being updated. **)**

Below is the circuit layout of the coil system used for AM electrolysis of water. The 2nd diagram (cone-coil) shows the circuit layout of one of plasma coils.

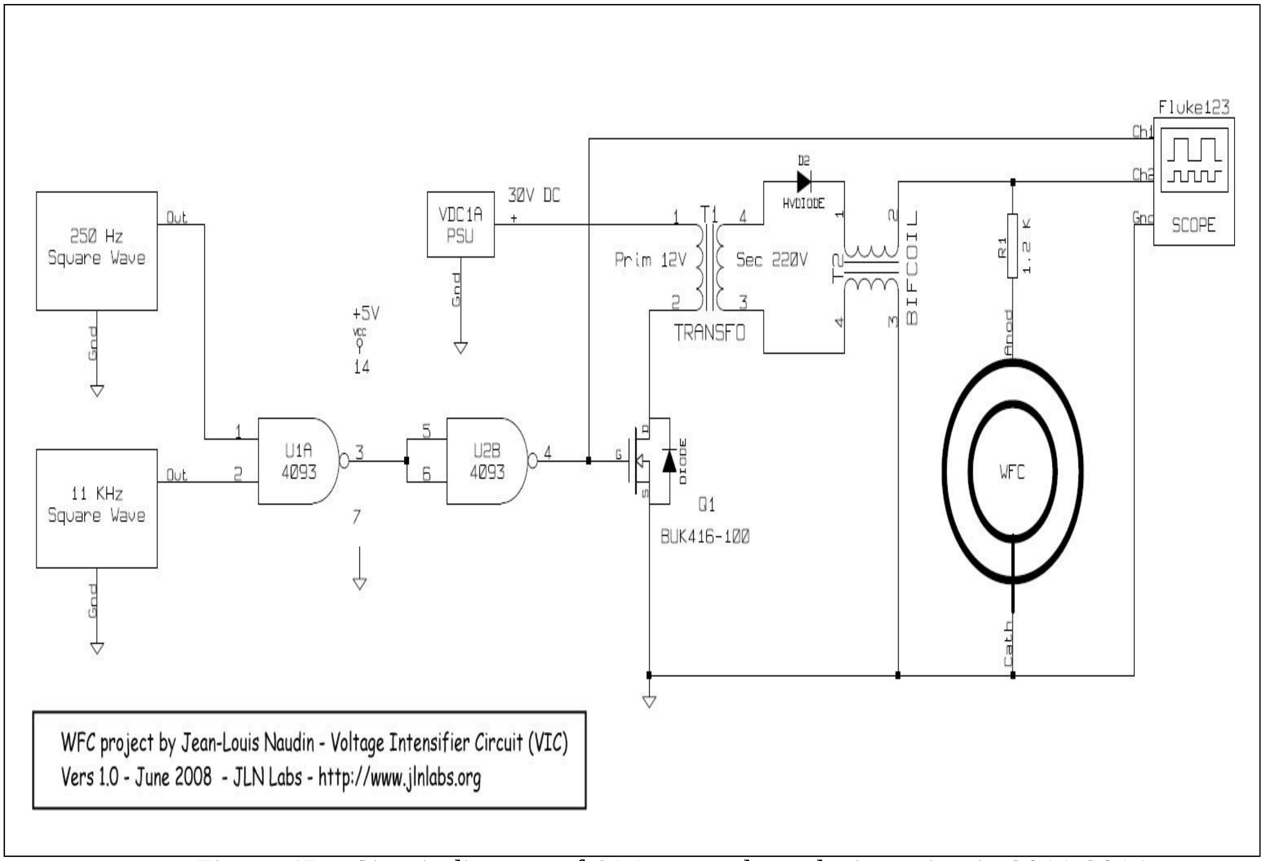


Figure 45 – Circuit diagram of AM water electrolysis testing in 2011-2014.

Primary Connections on Top Layer (Tightly Coupled to Secondaries)

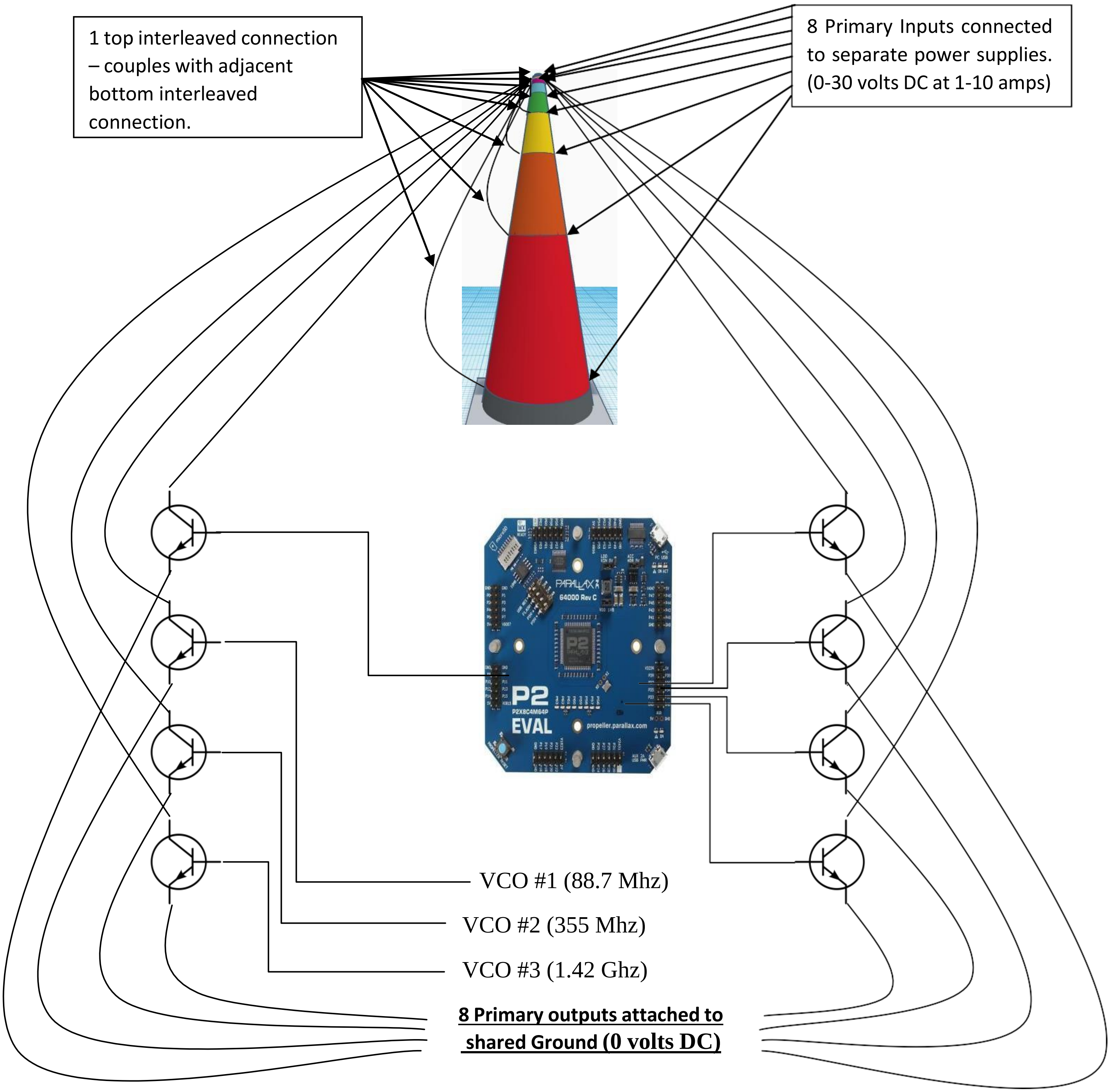


Figure 46 – Circuit diagram of Primary Coils

Secondary Connections on Bottom Layer (Tightly or Loosely Coupled)

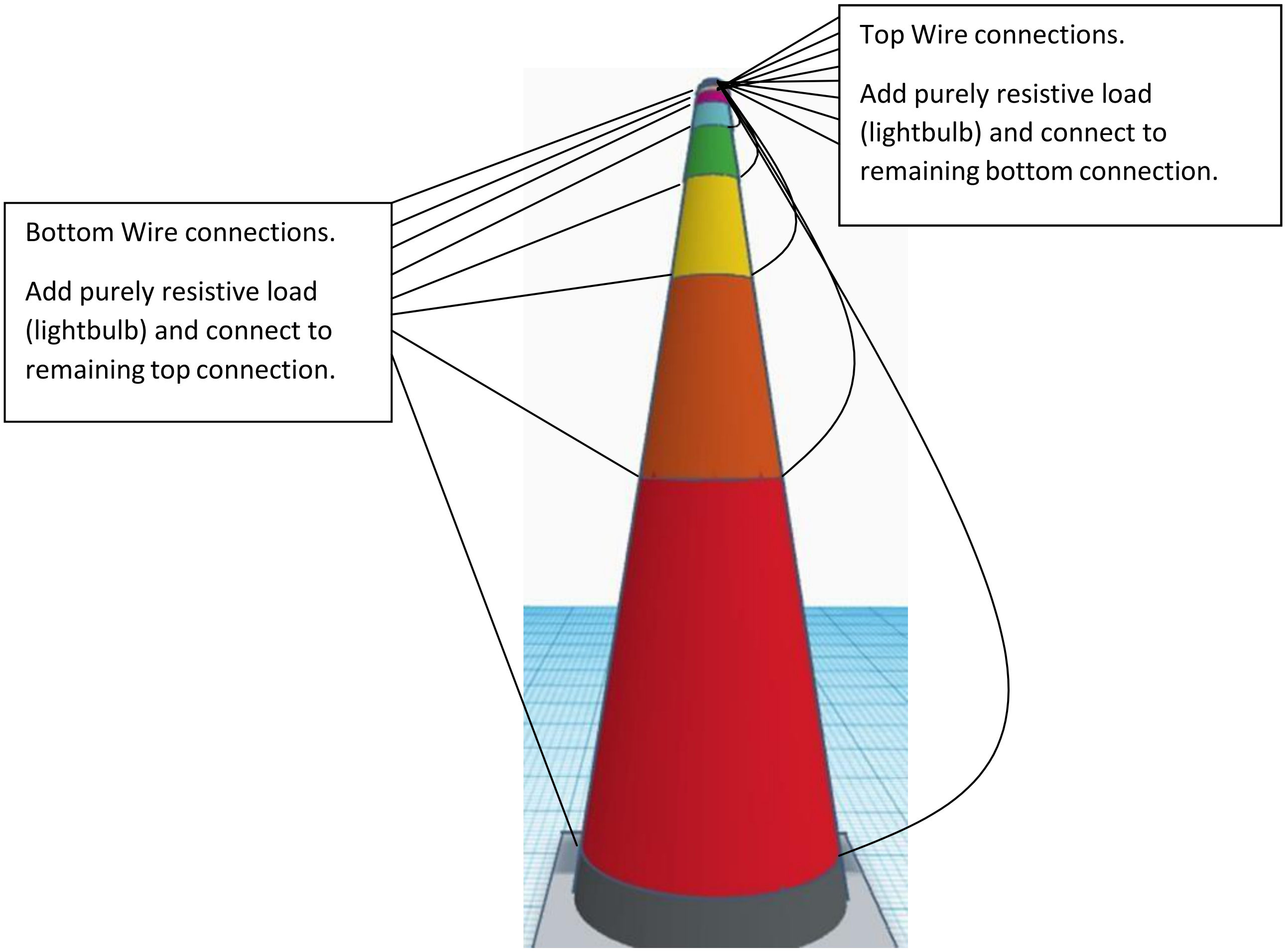


Figure 47 – Connection layout of Secondary Coils

16. Coil Shaping & Re-evaluating Cosmic Structures

Patent #512,340 can be twisted & wrapped in any shape necessary - for specific applications. It leads to an understanding of coil shaping & creating true, 3-dimensional antennas. This concept (combined with superposition techniques & plasma modulation) allows for an extrapolated understanding of how Birkeland filaments (currents) can potentially form – and guide the formation of larger cosmic structures. This idea gives better spatial understandings of said structures (such as cosmic jets & triaxial galaxies). 3-dimensional galaxies are considered more prevalent than first thought.

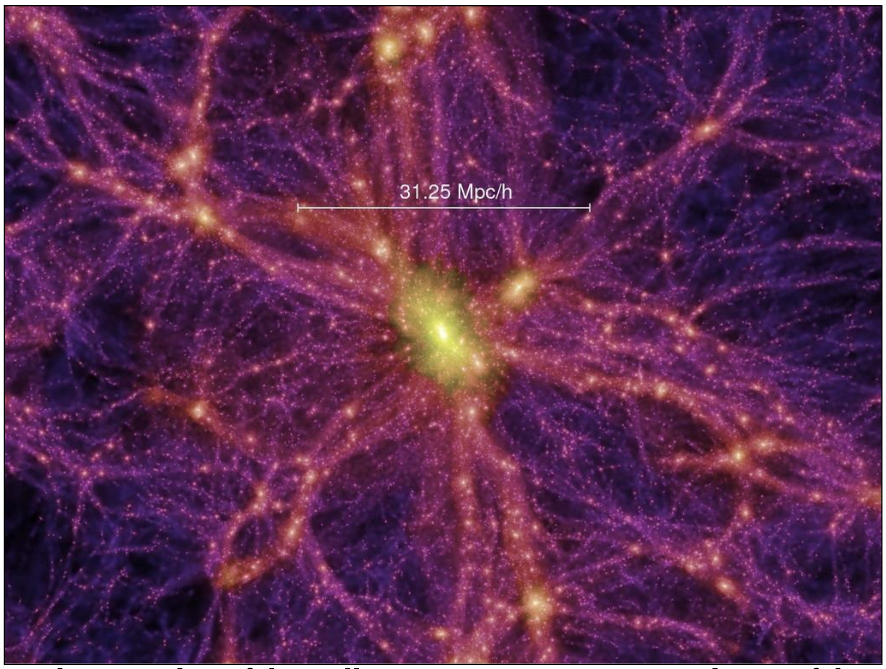


Figure 48 – Another snapshot of the Millennium II - Computer simulation of the Cosmic Web. The label of 31.25 Mpc/h corresponds to roughly 71.356 million lightyears across.

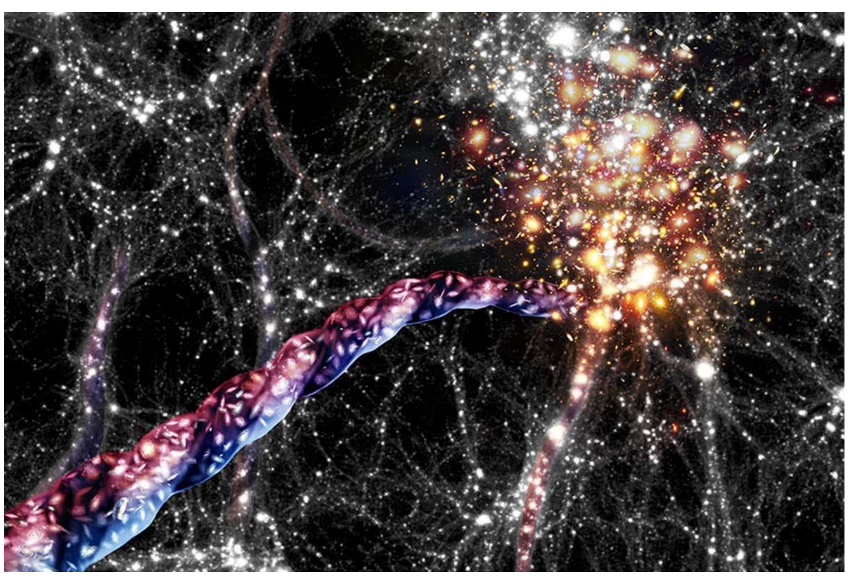


Figure 49 – Visualization of an intergalactic-scale braided Birkeland filament.

Newer research has determined that these filaments can braid together (twisted) and are rotating.

The following article explains how isophosic twisting occurs in galaxies – leading to an argument against dual-axial galaxies since 1982. Source: ***"Isophote Shapes"***, by R.I. Jedrzejewski at the Mount Wilson & Las Campanas Observatories in Pasadena, CA.

Filaments can twist together & have a ropey, braided characteristic. Newer research indicates that they are also rotating. These braids shows up in Coronal Loops, Galactic armatures, Nebula, and other cosmic structures.

Figure 50: Braided current sheets glow softly in visible and infrared light along the Cygnus Loop of the Veil Nebula. Image credit: W. P. Blair, R. Sankrit (Johns Hopkins University / NASA

More braided filament visualizations follow:

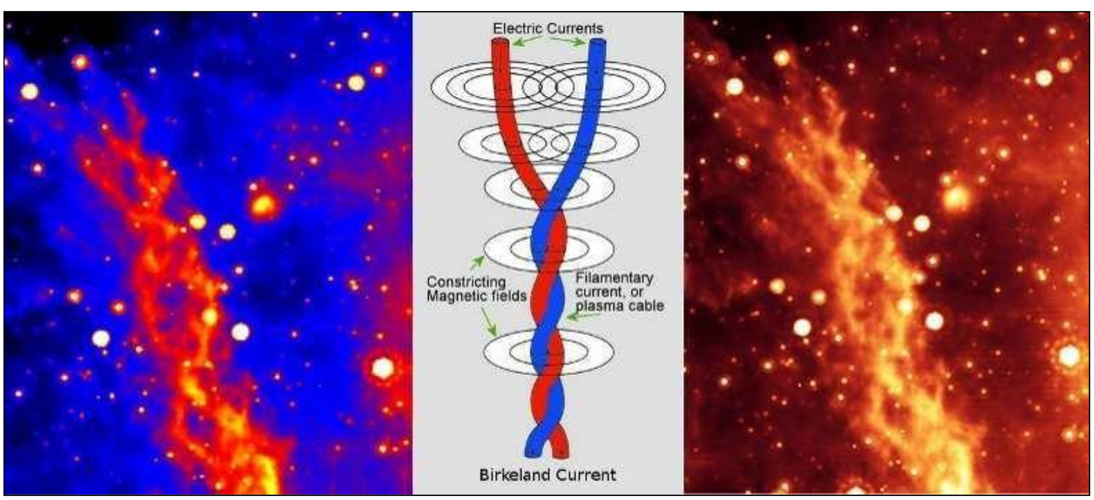


Figure 51 – Shape & Formation of Birkeland filament. Twisted current filaments in the Double Helix Nebula near the center of the Milky Way. Image credit: NASA/JPL – CalTech/UCLA

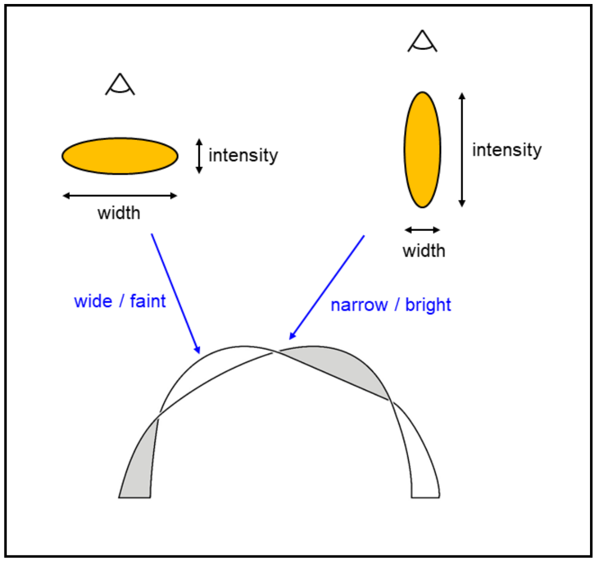


Figure 52 – Cross Section of a Solar Coranal Loop

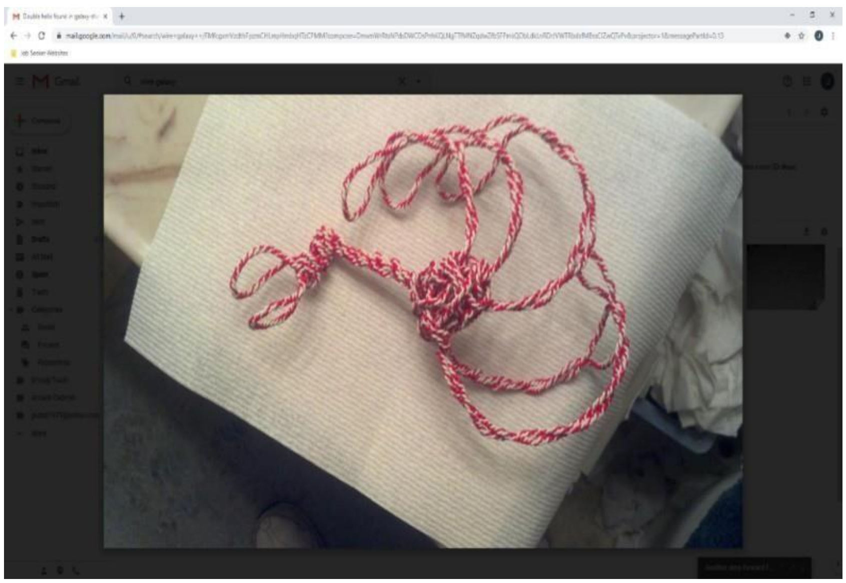


Figure 53 – Desktop simulation of twisting 2 current streams (doorbell wire) into a 3D galaxy shape.

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18. US Patent #1329559A – Valvular Conduit