# A Unified Field Theory Derived from a Magnetic Confinement Method that Stimulates Curvature Upon Charged Particles Relative to a Solitary Location that Produces Energy from Particle Deviation

**Samuel P. Moss II[1]**

[1]Moog Inc. Aerospace and Defense Company, 400 Jamison Road, Elma, NY 14059; E-mail: smoss3@moog.com

**Abstract:** This work presents a novel patent pending method of inertial electrostatic confinement (IEC) fusion called the Nuclear Electromagnetic Shaping Accelerator Reactor (NESAR) that addresses all of the major failure problems with currently known methods of IEC fusion. A brief background of previous IEC methods that generate a negative potential well to accelerate ions for fusion will be reviewed and compared to the NESAR method of magnetic confinement. In addition, a direct comparison will be presented between the NESAR and the tokamak method of fusion. The NESAR method of fusion obtains the plasma oscillation and compression capabilities of a tokamak without producing the catastrophic magnetic reconnection disruptions that currently plague tokamaks. Since the NESAR can oscillate charged particles comparable to the tokamak, this work will briefly review the history of the tokamak, how sawtooth magnetic reconnection occurs, and how the NESAR precludes the occurrence of magnetic reconnection. This work will also review the beginnings of a novel theory that has obtained interest from the Defense Advanced Research Projects Agency (DARPA) which is currently interested in possibly supporting further research into the NESAR to explore this new theoretical concept. This novel theory is a unified field theory based upon the trajectory of charged particle movements within the NESAR. The NESAR is the only concept of magnetic confinement in the world that may have the capability to allow charge particles to collectively interact relatively to a solitary location. Due to this possible capability, there is a probability that the confined particles may experience curved trajectories that could allow them to experience the effects of curvature deviation. If curvature deviation occurs with these magnetically confined charged particles; then the deviated acceleration would allow for the electromagnet field to be propelled to a higher dimension that could influence spacetime. Finally, this work will review another theory that explains how pole reversals are observed by the National Aeronautics and Space Administration's (NASA) coiled magnetic field detectors. This theory requires little to no postulations to be framed and it is purely based upon the trajectory of charged particles within the NESAR, Michael Faraday's law of induction, and experimental observations of rotating plasmas.

**Keywords:** fusion; magnetic reconnection; quantum gravity; general relativity; unified field theory; field reversal

## 1. Introduction

The confinement of electrons or dense ionized gases (i.e., plasma) is a necessary step in several processes currently researched for nuclear fusion; especially in the field of inertial electrostatic confinement (IEC) fusion. The confinement of electrons or dense ionized gases is performed by a confinement device (also referred to as a confinement apparatus); which uses magnetic fields to manipulate the trajectories and confinement of electrons to form a negative potential well (i.e., virtual cathode). Once a negative potential well is established, ions are injected within the vacuum chamber and are accelerated towards the

negative potential well to fuse. Current methods in this field have major issues with electron losses, uniform plasma distribution, fusion rates, and electron recirculation/circulation which are critical failure issues that have restricted IEC methods in producing enough sustainable fusion reactions to surpass the breakeven point (i.e., the output energy produced by fusion reactions equaling the input energy needed for the system). To design an IEC fusion device that generates enough sustainable fusion reactions to surpass the breakeven point; it is essential to address these four failure issues to make further advancements in the field.

The Nuclear Electromagnetic Shaping Accelerator Reactor (NESAR) is a patent pending confinement method that is a simple approach that addresses almost all of the major failure issues that currently plague IEC methods towards sustainable fusion.[1] This paper will briefly cover previous IEC methods by Dr. William C. Elmore and Dr. Robert Bussard, and the failure issues that these previous methods of IEC fusion encountered.   This paper will then cover the major issues found with these currently known methods of IEC fusion and how they are amended by the NESAR focusing on the capabilities of confinement, ion distribution, and fusion rate. These three capability focuses are the greatest failure issues that are currently plaguing IEC methods of fusion.

In addition, the NESAR method of fusion will be directly compared to the tokamak; as the NESAR combines both of the major components of IEC and tokamak methods of confinement. Due to the unique design of the NESAR, it has the capability to oscillate and compress confined plasmas without producing the catastrophic magnetic reconnection disruptions that currently plague the tokamak. Due to these common features in both the NESAR and tokamak, this work will briefly review the history of the tokamak, how sawtooth magnetic reconnection occurs, and how the NESAR precludes the occurrence of magnetic reconnection.

This work will also present a novel unified field theory based on how charged particles oscillate within the NESAR that has obtained interest from the Defense Advanced Research Projects Agency (DARPA).[2] The NESAR has the potential to curve charged particles relative to this solitary relative location which may allow for these particles to generate extra accelerated energy from curvature deviation. Charged particles generating extra accelerated energy from curvature deviation may have the potential to accelerate the electromagnetic field to an extra dimension that may influence spacetime. This work will also review how this concept may be applied in producing an attractive force with this energy that may refute the existence of dark matter. Finally, this concept's potential to be applied in generating repulsive energy is elaborated upon; possibly providing a greater understanding of how dark energy is generated.

The last subject that this work will cover is a novel theory on magnetic pole reversal based upon the induced effects of altering plasma oscillations that are similar to the charge particle trajectories that occur within the NESAR. This pole reversal theory is purely based upon Faraday's law of induction, and how it affects observations recorded by the National Aeronautics and Space Administration's (NASA) coiled magnetic field detectors.

Similar to Michael Faraday's methods in developing theories, the approach in establishing the NESAR and the theories based on how it confines charged particles can be termed as a purist approach to modern theoretical physics; by having any theoretical explanation to provide a direct correlation between the account of a phenomenon and the phenomenon itself, without intervening conceptual abstractions or mathematical formulations.[3] This approach results in theories that can be physically conceptualized to be applied for experimentation; which allows for a less complicated conveying of developed theories because little to no postulation is needed. This approach to developing theoretical concepts allows for a logical exchange of transitions towards a   final developed theory. So in general, the presentation of this work should be understood by those who obtain a well-grounded understanding in the foundations of general physics.

## 2. Background (Review of Literature of IEC Method of Fusion)

Early work in this field by Dr. William C. Elmore is depicted in FIG. 1. This depiction demonstrates how emitted electrons from the inner surface of a spherical shell, 300, accelerate toward a grid of higher electric potential, 310. The electrons that accelerate towards the grid will pass through the grid and converge radially to a central region, 330, to form an electron cloud that is known as a negative potential well.[4]

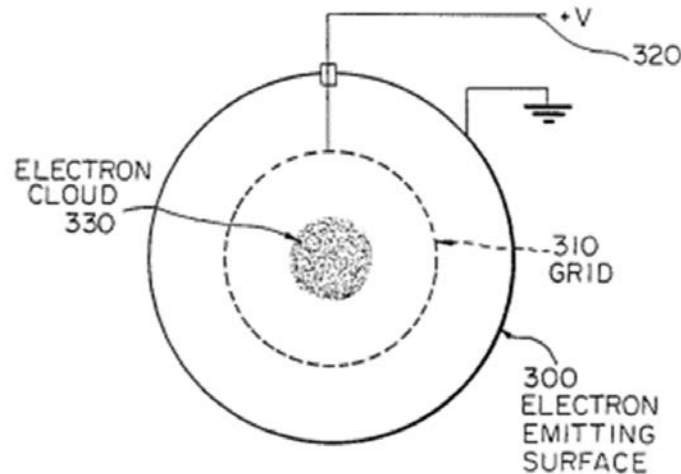



**Figure 1.** depiction of Dr. William C. Elmore's IEC that generates an electron cloud, negative potential well, within his patented method of IEC fusion.

Once a negative potential well is established, ions are injected into the chamber to accelerate towards the electron cloud 330 to perpetuate the fusion process. The Elmore design, however, provided no means of inhibiting electron loss at the sphere surface.

Building on this work, Dr. Robert W. Bussard proposed using a confinement apparatus made of a set of conductive coils arranged as a polyhedron generating set of magnetic fields to confine the electrons in the negative potential well, as shown in FIG. 2 from Bussard's patent, reproduced below:

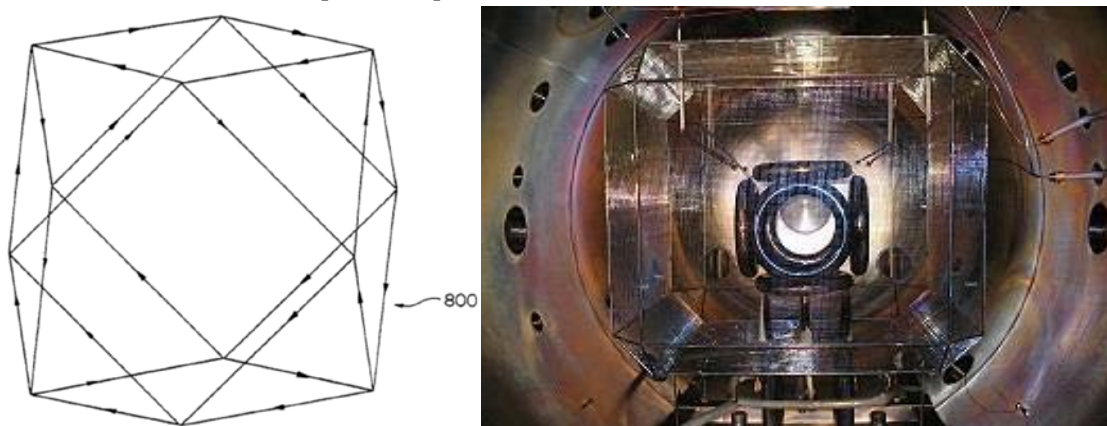



Figure 2. (left) depiction of Dr. Robert W. Bussard's method of fusion that shows the current flow used in his patented polyhedron configuration for magnetic confinement; (right) picture of Bussard's polywell prototype, WB-6.

In Bussard's design, electrons were injected through the "cusps" (i.e., boundaries between the magnetic fields) into the confinement apparatus where they were retained by the magnetic fields; creating a negative well potential. Ions then dropped into the confinement apparatus to accelerate towards the negative well potential to allow the fusion process to occur.

Research into the Polywell design, however, by Dr. Joel Rogers and Dr. Jaeyoung Park, revealed major electron losses at the cusps between the magnetic fields; which is the

primary failure issue for the Polywell. For example, the below patent image, FIG. 3, from Park, depicts the major areas where electrons escape from the confinement apparatus occurs. These areas of escape are highlighted in red.[5]

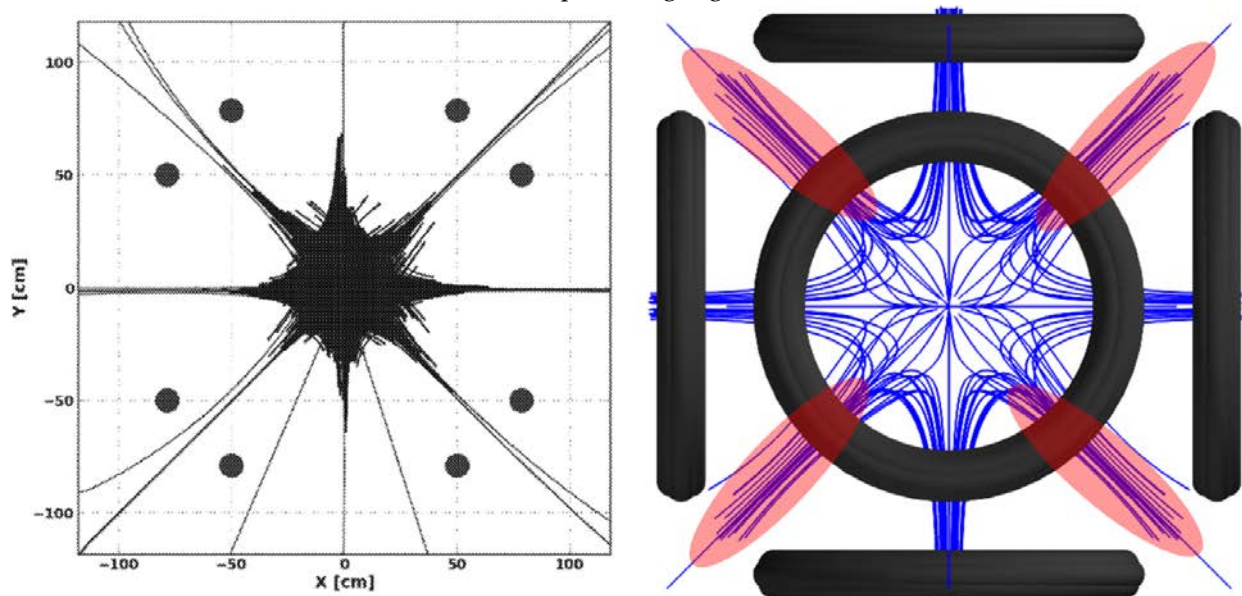



Figure 3. (left) shows numerically computed electron trajectories for the six coil cusp magnetic configuration from Dr. Park's patent application; (right) cross-section side view the of polyhedral coil mirroring what is depicted in the left image to present where electron loss occurs.

As previously stated, electrons escape from the confines of the polywell at the magnetic cusps. Depicted in FIG. 4 is a magnified view of a magnetic cusp showing how an electron, depicted by a red arrow, escapes the confines of the polywell. In this figure, the electron is depicted as a red arrow. When an electron's trajectory is parallel enough to the cusp it is able to easily escape. In addition, when the confinement pressure within the confines of the polywell are low, the magnetic cusps are more effective at redirecting the electrons back into the confines of the polywell; but as pressure builds within the confinement apparatus the system becomes less efficient at containing the electrons. When the pressure increases within the magnetic confines of the polywell, the magnetic cusps are forced to widen. It is this widening at the cusps that allows excess amounts of electrons to escape the system.

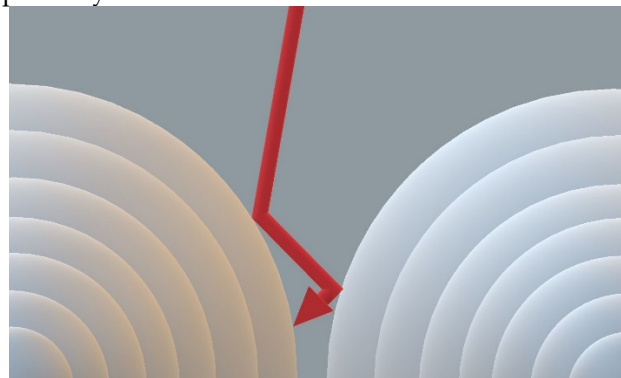



**Figure 4.** depiction of how an electron, red arrow trajectory, escapes from the polywell's magnetic cusps.

In addition, the polywell's lack of uniformity, by having the highest density of electrons located at the cusps, 106, greatly diminished the fusion rate of the polywell.[6] The polywell has 14 of these cusps, 106,   generating 14 separate locations where electrons are

concentrated. These electron filled cusps are depicted by the left image in FIG. 5.[6] These areas, where electrons are concentrated in the polywell, cause injected ions to accelerate in multiple locations, resulting in a low fusion rate and a lower density of confined ions, which is depicted by the right image in FIG. 5.[6] In addition, since all of the confined electrons have independent trajectories, the electrons within the confinement are not distributed uniformly, further contributing to a low rate of fusion by causing ions to accelerate to various locations.

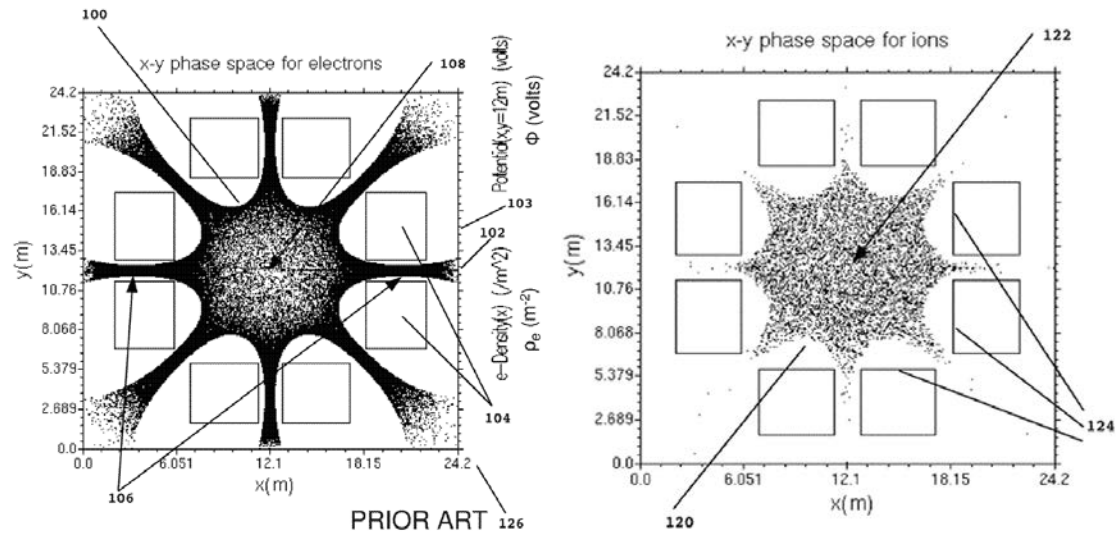



Figure 5. (left) image from Dr. Rogers patent presenting prior art from a computer simulation of polywell density distribution for electrons; (right) image from Dr. Rogers patent presenting prior art from a computer simulation of polywell density distribution for ions.

### 3. Analysis (Solution for IEC Method of Fusion)

The Nuclear Electromagnetic Shaping Accelerator Reactor (NESAR) introduces at least three separate innovations over the polywell to better confine, uniformly distribute, and circulate electrons within the confinement apparatus.[1] The first innovation has the confinement apparatus designed with more coils, in comparison to the polywell, to more evenly distribute the pressure created by the particles confined within the confinement apparatus. The magnetic coils are sized and arranged in a manner to closer resemble the shape of a rounded sphere. If all of the contiguous magnetic coils that make up the confinement apparatus are the same size, more dimension variances will be present in the distribution of the magnetic cusps needed for the effective confinement of electrons. To alleviate this issue a pentafoil pattern comprised of a set of five larger conductive coils that surround a smaller conductive coil is used to form the spherical shape of the confinement apparatus, as shown in FIG. 6. This type of configuration should more evenly distribute the pressure created by the particles confined within the confinement apparatus, reducing the escape of electrons.

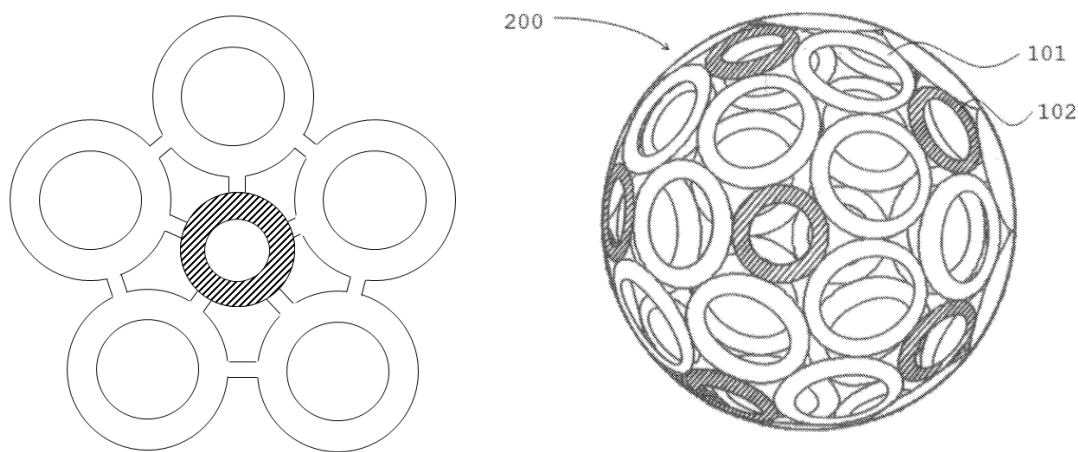



Figure 6. (left) Pentafoil arrangement, which comprises five larger coils surrounding a smaller coil;    (right) The more spherical shape of the confinement apparatus due to the pentafoil design.

The second and most important innovation, the NESAR obtains a set of magnetic coils angled off-center relative to a solitary location (i.e. single relative center point (SRCP) 601), which greatly improves the confinement capabilities of the system when compared to the previous methods of IEC fusion. Angling the magnetic coils in this manner allows for the magnetic fields that confine the electrons to overlap upon one another while the collective confinement of electrons within the confinement apparatus to spherically rotate relative to the SRCP; resulting in the improvement of the confinement apparatus' ability to magnetically confine electrons and accelerate injected ions more efficiently in improving the system's rate of fusion. The number of magnetic coils angled off-center and the degree of angle that they obtain can vary to optimize electron confinement and fusion rates. The left image in FIG. 7 is a general depiction of how angling the magnetic coils allow for confined electrons to rotate within the confinement apparatus.[1] The more evenly distributed confinement of electrons will resemble a rotating ball where the electron density decreases when approaching closer to the center as seen in the right diagram in FIG. 7.

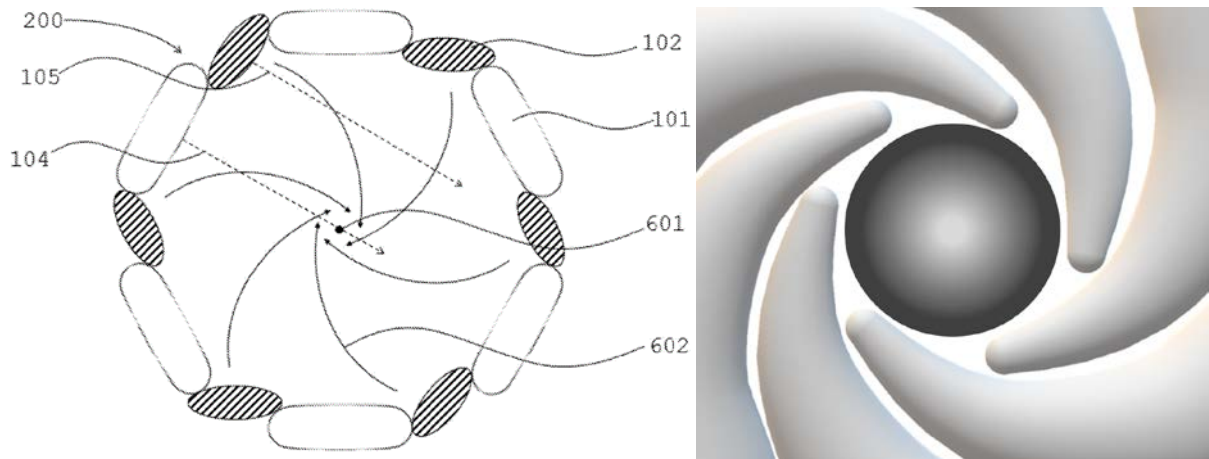



Figure 7. (left) Cross-section top view showing confinement coils angled to promote a rotation to the confined plasma; (right) Cross-section top view showing the angled magnetic fields overlapping to shield cusps from electron escape.

The effects of introducing a rotation to the negative potential well allow for the confinement of electrons to travel in a collective path that is more perpendicular to the magnetic cusps. This more perpendicular path reduces the possibility of electrons escaping through the magnetic cusps of the confinement apparatus. In addition, the overlapping of

the magnetic fields from the angled magnetic coils from the confinement apparatus restricts the escape of electrons that are part of the collective rotation. Essentially, the only way that electrons can escape the magnetic cusps of the confinement apparatus, if angled appropriately, is by obtaining a trajectory that would be inconsistent and contrary to the rotational collective; which would be minimal. Thus, rather than escaping in the manner shown in FIG. 4, the electrons traveling in this more perpendicular path are deflected away from the cusps as shown in FIG. 8.

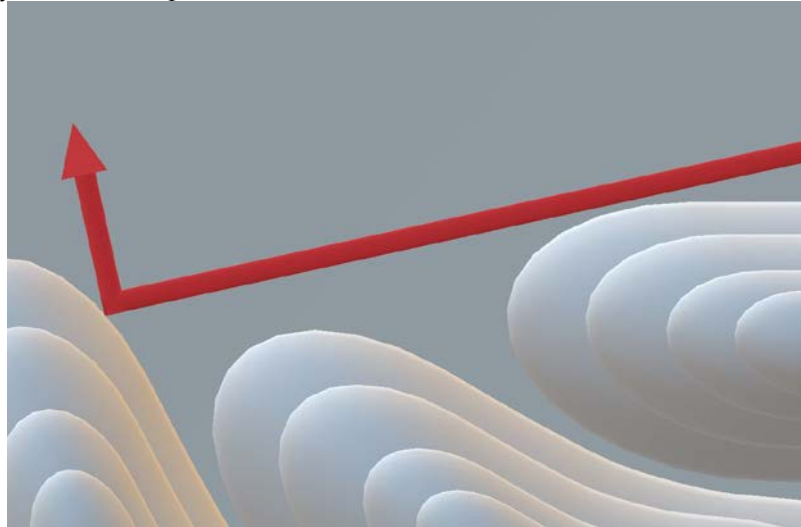



**Figure 8.** depiction of how an electron, red arrow trajectory, is redirected within the confines of the NESAR's magnetic fields.

In addition, the confined charged particles being pushed more perpendicular to the magnetic cusps and rotating within the confinement apparatus creates a dominant magnetic field within the confines by the rotating charged particles. Since magnetic fields do not cross each other, they merely push against one another and overlap. This means that the magnetic cusps of the angled toroidal magnetic fields that are layered upon each other while pushing a rotation upon the confined charged particles will reduce in size as the magnetic field of the confined charged particles increase. As the magnetic field of the confined particles increases it pushes outward and forces the layered magnetic cusps to close. Thus, increasing the confinement apparatus' capability in trapping charged particles. Generating a dominant magnetic field from the confined charged particles within the confinement apparatus, which is something the polywell was never capable of producing because the confinement of charged particles had no common relative trajectories. In the polywell, every confined electron obtained independent loop fields that would, for the most part, cancel each other out as a system. FIG. 9. Depicts how the increasing magnetic field of the confines pushes the cusps upon each other to improve confinement capability.

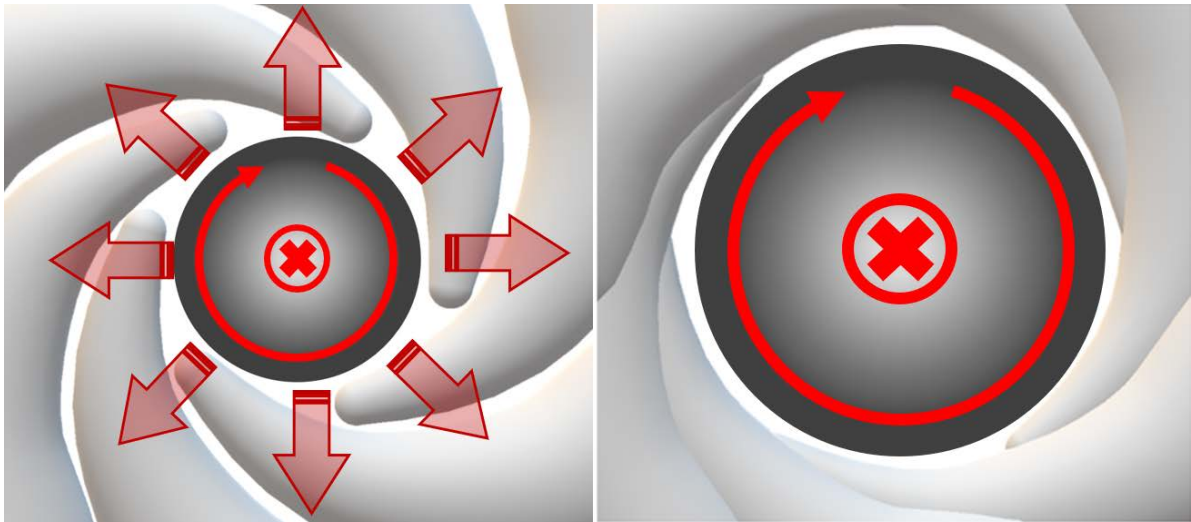



Figure 9. (left) cross-section top view showing the layering of magnetic cusps and rotation of the confined charged particles generating a magnetic field that increases as more charged particles become restricted within the NESAR; (right) cross-section top view showing how the efficiency of confining charged particles within the NESAR increases as the increasing magnetic field generated by the confined charged particles forces the magnetic cusps to reduce in size and possibly close.

This spherical circulation of electrons promotes a solitary location where the negative potential well is maximized due to the confined electrons electrostatically interacting at the SRCP; creating a solitary location where the majority of the injected ions will initially fuse. In addition, rotating the confinement of electrons in this manner also promotes a more even density distribution of the confined charged particles. Obtaining a more uniform confinement in this manner allows for a substantially improved yield in fusion rates in comparison to the polywell by allowing injected ions to accelerate to a more centralized location and permitting ions that do not initially fuse to be recirculated within the confinement apparatus to continue the fusion process. FIG. 10 is a depiction of a maximized negative well singularity being generated by rotating electrons relatively electrostatically interacting at a solitary location.

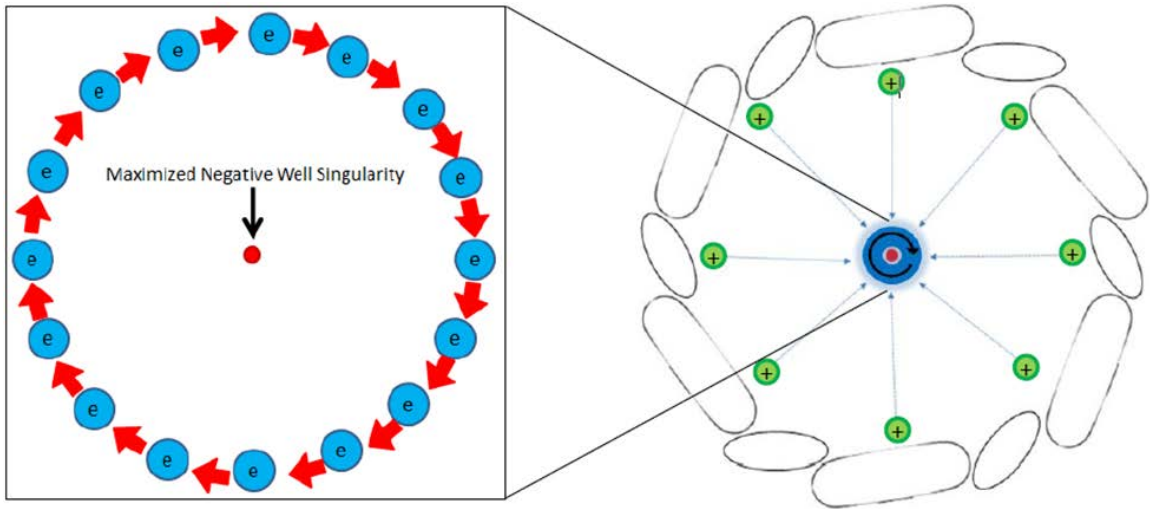



Figure 10. (left) cross-section top view depicting how a confinement of confined electrons electrostatically interact at the SRCP to generate a Maximized Negative Well Singularity.

The third innovation is the NESAR's ability to physically rotate the confinement apparatus in a direction opposite to the electrons that are in an initial rotational direction.

Even though the device should operate efficiently without the confinement apparatus rotating in an opposing second rotational direction; this added feature should, to some extent, increase the system's capabilities by improving the confinement apparatus' ability to shape a more spherical confinement that is also more evenly distributed in electron density over time.

The apparatus' ability to enable a physical rotation to the confinement apparatus is depicted in FIG. 11. The apparatus's ability to rotate is accomplished by affixing two hollow supports, 304 and 305, to the opposite ends of the confinement apparatus that obtain rotors, 301 and 307, at the end of them. The confinement apparatus is supported by two bearings, 303 and 306, that are coupled at the walls of the primary chamber that envelope the confinement apparatus and the two hollow supports that extend into two ancillary chambers. The two rotors at the ends of the hollow supports are then encapsulated within the same ancillary chambers that are encompassed within surrounding stators. These stators are then energized to induce movement upon the rotors. In the image below, the chambers are outlined in red to emphasize how the confinement apparatus is coupled to the system. In the second image, the rotation of the confinement apparatus opposing the rotation of the confined charged particles, 801, is depicted by the number 802.

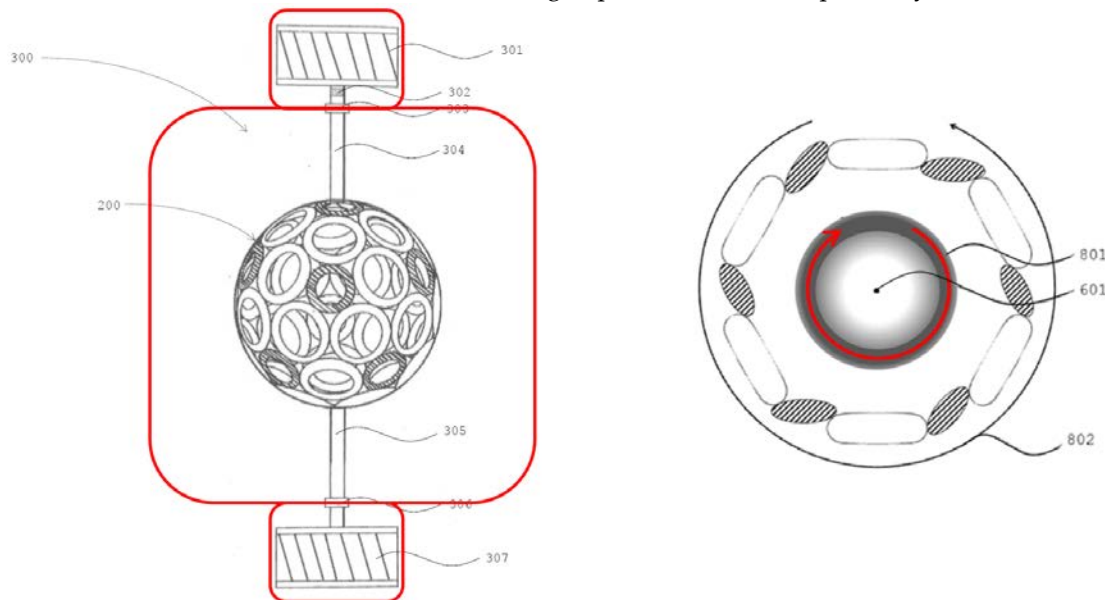



Figure 11. (left) cross-section side view showing the three different vacuum chambers that the NESAR obtains to emphasize how the confinement apparatus is energized and how the rotors within the ancillary vacuum chambers are rotated by stators that surround the ancillary vacuum chambers; (right) cross-section top view showing the confinement apparatus rotating opposite to that of the rotation of confined charged particles within the confinement apparatus.

As for energizing the confinement apparatus while it is in rotation, a novel method of having a direct current transferred throughout the confinement apparatus has also been implemented, if rotating the confinement apparatus is desired. A current is passed from one of two brushes that make contact with the commutator, 302, that is coupled to the hollow support, 304. The current is then fed to the conductive coils throughout the confinement apparatus from within the hollow support, and is then returned back to the commutator from within the same hollow support where the returning current exists through the second brush in contact with the same commutator.

To emphasize, the direct current transferring through the brushes, commutator, hollow support, and confinement apparatus is not what generates rotation upon the confinement apparatus; which are the common essential components that are normally used for generating movement in the rotor of a DC motor.   In the NESAR, these components are only used to energize the conductive coils of the confinement apparatus to generate the needed magnetic fields to confine charged particles.

In conclusion, the NESAR directly addresses all of the major concerns and issues that have plagued previous methods of IEC fusion.[7] If future simulations can validate even half of the possible improvements claimed by the NESAR method of confinement; the possibility exists for this method to surpass previous methods of IEC fusion and surpass the breakeven boundary.   In essence, this invention represents a positive step forward in at least confining electrons to generate a negative potential well in IEC devices.

### 4. Background (Review of Literature of Tokamak Method of Fusion)

Currently, the most researched and popular approach toward sustainable fusion is the tokamak method of magnetic confinement. The conception of this method of fusion has been around for almost seventy years. The first tokamaks were secretly developed by the Soviet Union in the late 1950s, and were declassified to the public by the mid-1960s. The same failure issues that we observe today with tokamaks were first documented in 1974, and these same failures were pretty much confirmed to be uncorrectable by the mid-1990s. The most well-known and largest tokamak research project is the International Thermonuclear Experimental Reactor (ITER).   To date the accumulated cost to fund ITER has come to more than 30 billion dollars; and will not be able to be fully tested until 2035, if it works.[8]

As previously alluded to in the prior paragraph, it has almost been fifty years since researchers were first aware of the greatest failure issue with tokamaks. The main failure issue is that tokamaks generate catastrophic magnetic reconnection events that are powerful enough to overwhelm and disrupt the confinement system. Magnetic reconnection is the physical process occurring in highly conducting plasmas in which the magnetic topology is rearranged and magnetic energy is converted to kinetic energy, thermal energy, and particle acceleration. FIG. 12 is a   Parker-Sweet reconnection diagram, that depicts plasmas with oppositely directed magnetic field lines in highly conductive plasmas flowing towards each other forming two newly connected field lines that have a plasma outflow.[9] The image is depicting a plasms magnetic field in red, from the top, being pushed towards an opposing plasma's magnetic field in blue, from the bottom. As these fields get closer to each other, they form newly connected field lines that expel massive disruptive energies perpendicularly outward from the inflow from the top and bottom. This plasma inflow and outflow relationship is emphasized by the yellow arrows. This is a very simple two-dimensional description of magnetic reconnection.

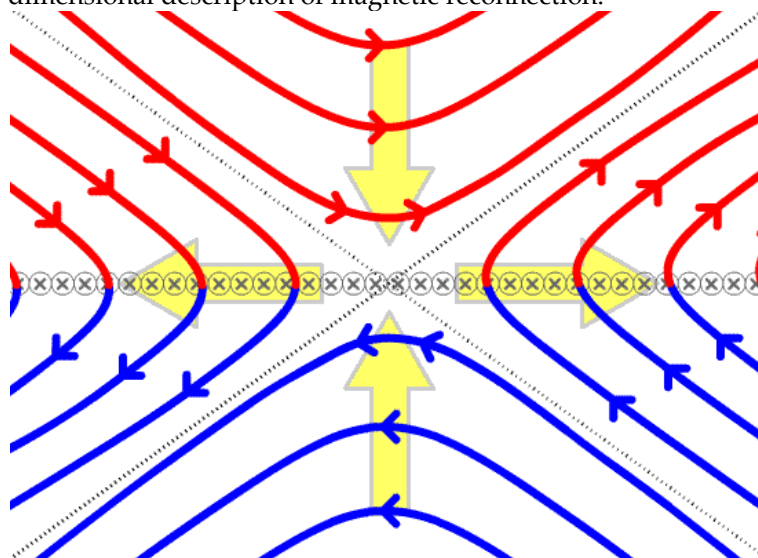



**Figure 12.** This view is a cross-section through four magnetic domains undergoing separator Parker-Sweet reconnection. Two separatrices (see text) divide space into four magnetic domains with a separator at the center of the figure. Field lines (and associated plasma) flow inward from above and below the separator, reconnect, and spring outward along the current sheet.

Even though tokamaks are unsuccessful due to magnetic reconnection failure; experts have a general idea of how reconnection events occur. The reconnection failure in tokamaks is called a sawtooth reconnection and it is mainly caused by the design of the tokamak incorporating poloidal fields. The purpose of the poloidal fields in tokamaks is to cause confined charged particles to twist in a helix pattern as it travels through the tokamak. This helix pattern from the poloidal fields compresses the particles toward the center of the main current of the charged particle confined. Sadly, incorporating the feature of a poloidal field seems like a sound enhancement, but this addition is the main cause for sawtooth reconnections in tokamaks.

Sawtooth reconnection originates from an induced field, called a magnetic island, being generated from varying energy states of the confined charged particles within the confines of the tokamak. The way sawtooth reconnection occurs is depicted in FIG. 13; the magnetic island is in yellow. This reconnection occurs when the opposing induced current's field, magnetic island, is pinched and severed in between the field of the main current of confined charged particles and the tokamaks poloidal fields. This happens because the tokamak's poloidal field currents run parallel to the main current of confined charged particles. Even though the poloidal fields are compressing the confinement of the charged particles to the center of the main current, the main current itself is being pulled towards the poloidal fields, as parallel currents attract towards one another. As a tokamak increases in its confinement of charged particles; the induced current's field gets pinched between the field of the main current of charged particles being pulled towards the fields of the poloidal currents that are affixed to the outside of the confinement apparatus. This pinching of the induced field causes an explosive surge of kinetic and thermal energy that causes massive disruptions in the tokamak confinement. FIG. 13 depicts this sawtooth failure.   The opposing induced current being created is depicted in FIG. 13 on the left in yellow. On the right of FIG. 13, the main current's field, in orange, is being pulled towards the parallel running poloidal currents, in green; pinching the induced current's field, in yellow.

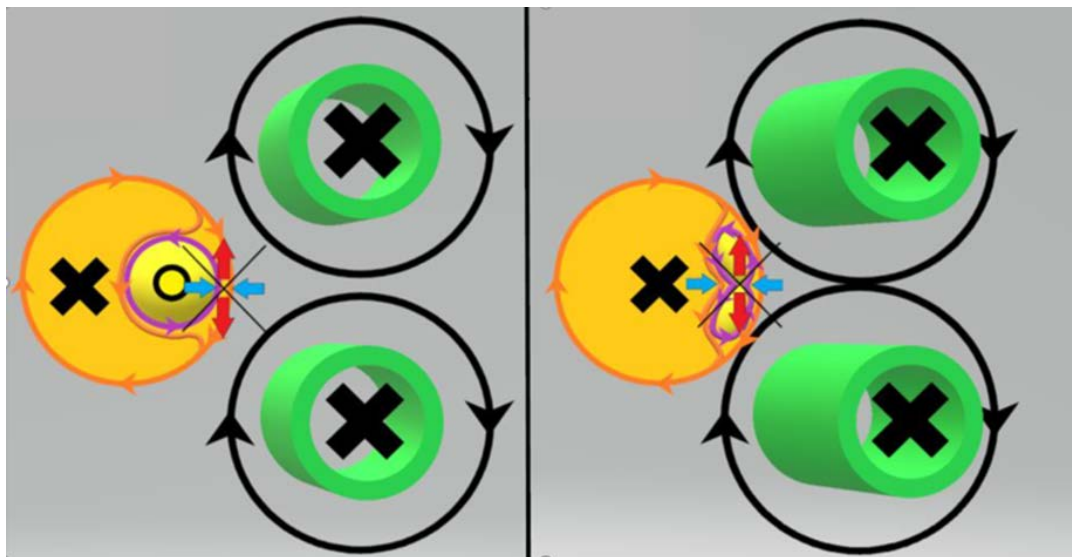



**Figure 13.** The progression of a sawtooth magnetic reconnection failure in a tokamak fusion reactor.

### 5. Analysis (Solution for Tokamak's Issues with   Magnetic Reconnection)

All magnetic fields are made of photons and every field line has a distinctive property that makes them different from each other. This distinctiveness for each field line is what keeps them from merging. Magnetic reconnection occurs when closed-loop fields are forced to collapse upon themselves, but more specifically by forcing a field line with the exact same density and characteristics to interact and merge upon itself. Magnetic field

lines will always seek the path of least resistance between opposite magnetic poles. So, when the conditions are met where a field line can interact with itself and shorten the closed-loop distance, it will. Three or more parallel running currents that are increasing in their field strengths are required to generate an increased attractive force amongst them, thus having the potential to pinch and sever a closed-loop field. FIG. 14 depicts this interaction, by depicting how these parallel currents force a closed-loop's most centralized field lines with the exact same density to interact with each other and reconnect. In the depiction in FIG. 14, the different densities of the field lines are depicted by different widths.

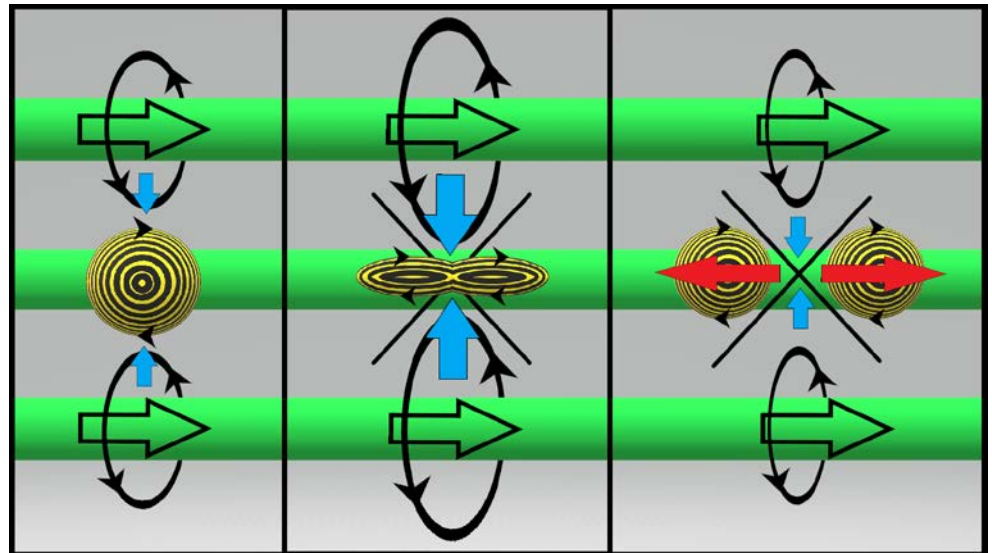



**Figure 14.** (left) depiction of a magnetic field within three paralleling currents; (middle) depiction of the three paralleling currents increasing in strength that result in the currents increasing in magnetic strength that add more pressure upon the magnetic field within the currents; (right) depiction of the three paralleling currents creating enough pressure to cause the magnetic field within them to compress upon itself and magnetically reconnect.

As a prideful West Virginian, it is easiest for me to explain magnetic reconnection by relating it to coal locomotives transiting on railroads.  I grew up about 150 yards away from the railroad tracks, and daily I would see powerful locomotives filled with coal rolling through our borough hills. Because of being raised in such close proximity to West Virginia's lifeblood, it is probably why it was natural for me to associate magnetic reconnection with transiting coal trains. Imagine that each field line is a flexible rubber train track. Each flexible track has a different width and is meant to represent an individual closed-loop. The wider and shorter tracks are closer to the dipole source than the thinner and longer tracks. This means that only a specific size locomotive can ride on each track. If each locomotive is pulling a line of hopper cars full of coal that is the length of their field lines, the amount of weight carried by each train would equal the same amount of weight on each track. This weight represents the field strength. Since each track is made specifically for each train they do not merge or cross, but when the same size track is forced upon itself; a train is able to fit on the newly found track and take the shortcut towards the dipole which is the path of less resistance. This new path breaks the track into two separate looped tracks that are carrying less weight than the other surrounding tracks. So, the lighter, weaker, track that is still attached to the perfectly balanced dipole system; must be compensated to operate within the law of conservation of energy. This means that a dipole system in plasma undergoing magnetic reconnection will rapidly shift and convert to balance for the loss of weight, magnetic strength, into an energy that is equivalent to the weight of the reconnected track that is detached from the dipole system. This converted energy then ejects the detached track away from the dipole system. Of course, this is a simple way to think about how magnetic reconnection is initiated, but reconnection is

not a simple two-dimension interaction, in reality, it is more like a photonic bubble being severed and reconnected, which is why there must be at least three areas of focused attraction to sever a closed-loop field at a given location.

In revisiting the Parker-Sweet reconnection diagram in FIG. 12, it depicts how plasma inflow and plasma outflow regions with the field directions produce magnetic reconnection occurrences. When this diagram is compared to the resulting diagram in FIG. 14, it is obvious to see how these two depictions align in depicting the same magnetic reconnection event.   Being able to align these depictions of magnetic reconnects by using attractive parallel running currents to illustrate this phenomenon; displays how this occurrence happens in tokamaks.

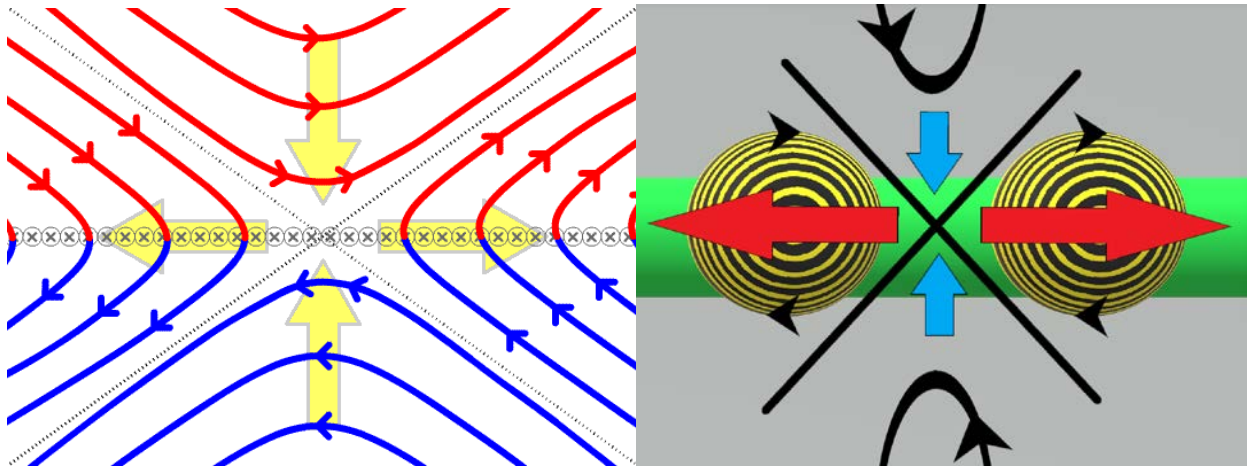



Figure 15. (left) This is the cross-section of the four magnetic domains undergoing Parker-Sweet reconnection from FIG. 12; (right) the right image in FIG. 14 depicting how it replicates the exact depiction of magnetic reconnection from the Parker-Sweet diagram.

Due to magnetic reconnection failures in the original designs of the tokamaks, it is no wonder that two extra magnetic systems have been added to tokamak systems, like ITER, in the hopes of possibly correcting the tokamak's natural tendency to magnetically reconnect mainly due to the system's poloidal fields. The two additional magnetic systems included in the tokamak system to address magnetic reconnection failures are the Correction Coils and Edge-Localization Modes (ELM) magnets.[10] These two systems require complicated sensors and analytical systems to monitor and control the confinement's efficiency. Even though these additional systems may improve the duration of time that plasmas within tokamaks are able to stabilize, many experts are very skeptical if Correction Coils and ELMs will be enough to allow tokamaks to be stable long enough to be used for fusion energy commercially. It is stated by those involved with ITER that Correction Coils are needed to compensate for field errors and ELM magnets are specifically used to massage the confined plasma. [10] To simplify it, the combined purpose of these two magnetic systems is to push the field of the confined toroidal plasma current away from the wall of the vacuum vessel, resisting the tokamak's natural tendency to pinch induced currents that cause magnetic reconnection. In FIG. 16, the Correction Coils are depicted in green, and the ELMs are depicted in blue.

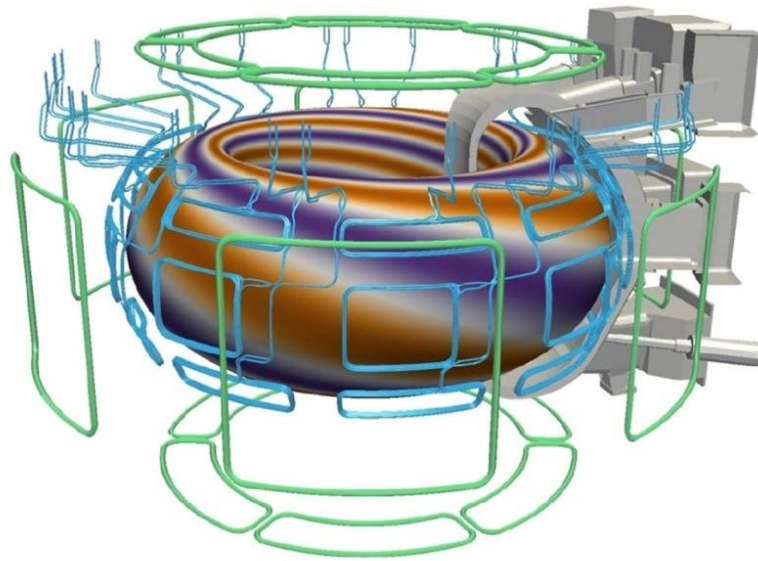



**Figure 16.** depiction of the tokamak's correction coils, in green, and ELMs, in blue.

The magnetic reconnection issue that hinders the tokamak concept should be alleviated by the NESAR magnetic confining method. The NESAR should be able to generate sustainable fusion reactions without the need for additional controls requiring complicated analytical systems to assist in correcting the tokamak's natural tendency to generate magnetic reconnection events by producing magnetic field alterations to counter these issues within the system. If the tokamak method is somehow able to be used as a sustainable method of fusion, it will be a much more evolved version in comparison to the original concept. In addition, if the tokamak is able to be used as a viable method of fusion, it will be more of a balancing act of inefficient fusion that will require to be massive in size and will require continual support, instead of a simple system that can be used commercially at a smaller size.

In conclusion, the NESAR is able to compress and rotate confined charged particles without the need for attractive parallel running currents like the tokamak's poloidal fields. Due to this, the confined plasma needed for the fusion process in the NESAR is denied the ability to be pulled towards the walls of the confinement apparatus. The NESAR is the first fusion concept with the ability to operate as a hybrid system; as It has the capability to circulate magnetically confined charged particles while restricting these particles' ability to escape through the magnetic cusps like a tokamak. While the NESAR circulates charged particles with minimal plasma loss; it obtains an IEC's ability to utilize a negative potential well to accelerate charged particles to assist in the fusion process. These improvements allow the NESAR to improve upon the rate of fusion in comparison to previous IECs methods of fusion without the magnetic reconnection issues that occur with tokamaks.

## 6. Background (Review of Literature of Unified field theory)

When two or more concepts in science are able to be connected; novel and unanticipated discoveries about fundamental philosophies are revealed. Possibly the best example of this is the coupling of the two rudiments of electricity and magnetism to develop our current understanding of electromagnetism. Though there are many scientists, like Andre-Marie Ampere and Michael Faraday,  who contributed enormously to progressing the understanding of electromagnetism; James Clerk Maxwell is possibly the most notable

physicist to substantiate that there is a direct relationship between electricity and magnetism by predicting the existence of electromagnetic waves. It would be decades later until Heinrich Hertz would validate Maxwell's predictions experimentally.

Maxwell's accomplishment of being able to unite multiple concepts to develop a better understanding of electromagnetism is why he is possibly the person who influenced Albert Einstein the most. Similar to Maxwell, Einstein developed his theory of special relativity which was able to establish an equivalence between mass and energy. Einstein once stated that "I stand not on the shoulders of Newton, but on the shoulders of James Clerk Maxwell".[11] This is possibly why after Einstein developed his theories of special and general relativity; he sought to unify the electromagnetic force to general relativity, which focuses on the effects of observed gravity based upon the properties of curvature and mass distorting spacetime.

Besides Issac Newton, Einstein is the greatest contributor to our current understanding of gravity. Einstein maintained the philosophy that gravity isn't a force at all. He described it as a curvature of time and space caused by mass and energy. Due to this theory, he expended more than thirty years in an attempt to prove that electromagnetism and gravity were different effects of the same field; combining them into a single physical and mathematical framework would have allowed for an achievement that would have surpassed his prior developments. This theory that Einstein hoped to develop is called a unified field theory.

For the first time, a unified field theory has been developed that rationally connects electromagnetism and gravity with almost no postulation needed. It would be remiss to not emphasize that a novel theory like the one that is about to be presented in this paper could have only been developed through a purist approach to understanding gravity, which is the method Faraday notably used to develop his theories.[3] Since the current approaches to developing gravitational theory exceedingly focus on developing a mathematical method for proving a postulation; the purist method, of building theory solely upon proven laws, has been trivialized as a means of developing gravitational theory over recent years. Due to applying a purist approach to developing a unified field theory; a device, similar to the NESAR, is conceivable to test out the theory.

## 7. Analysis (Relative Accelerated Energy (RAE), Possible Solution to Unified Field Theory)

For the first time, the early developments of a novel unified field theory that truly embodies both Einstein's and Maxwell's applied concepts of general relativity and electromagnetism have been established based upon the charged particle trajectories generated within the confines of the NESAR. Most importantly this is a theory that is testable by solely confining electrons within the NESAR's confinement apparatus. In addition, this initial concept has already obtained some interest from DARPA, who has asserted interest in possibly financially backing some initial research to further explore this innovative construct of a unified field theory.[2] One of the main reasons that DARPA has shown interest in this concept is because a clear pathway is provided for explaining how observed stronger-than-expected gravitational effects may be generated. In short, this unified field theory has the capability of disproving the existence of theorized dark matter.

The NESAR is the first and only magnetic confining concept that allows charged particles to spherically rotate relative to a solitary location, known as the single relative center point (SRCP), where the negative well potential is maximized due to electrostatic interactions relative to that location. This concept was covered previously in FIG. 10. The NESAR's probable ability to rotate charged particles on a curved path relative to a single location allows for confined particles to undergo relative accelerated interactions from curvature deviation also known as Converging Geodesic Deviation (CGD).[12] Generating relative acceleration from curvature deviation allows confined charged particles to obtain a trajectory that is in a third spatial dimension. This additional particle acceleration to a third spatial dimension is called Relative Accelerated Energy (RAE).

To better understand how RAE generates an extra accelerated spatial dimension to charged particles within the NESAR, one needs to understand CGD. In Einstein's Theory of General Relativity, CGD is an attractive effect between traveling objects upon a spherically shaped plane. This is a geometric effect that is depicted on the left in the following FIG. 17 that shows two travelers walking directly North from the Earth's Equator at the same speed from different locations. Since they are traveling on a curved surface, they will eventfully meet each other. The closing distance in-between these two travelers is the relative acceleration of CGD which is depicted by two red arrows pointing inward. This deviation from a directly northern path on a curved surface is a very basic example of CGD. Since CGD effects need to occur on a curved surface; all of the NESAR's confining magnetic coils of the confinement apparatus not on the axis of rotation need to be angled to create a Curved CGD Plane. The following image on the right side of FIG. 17 depicts this created plane that is formed by electrons being pushed in a curved trajectory against the created photon layer of the confining magnetic fields. This plane will be the primary location for generating RAE upon confined charged particles.

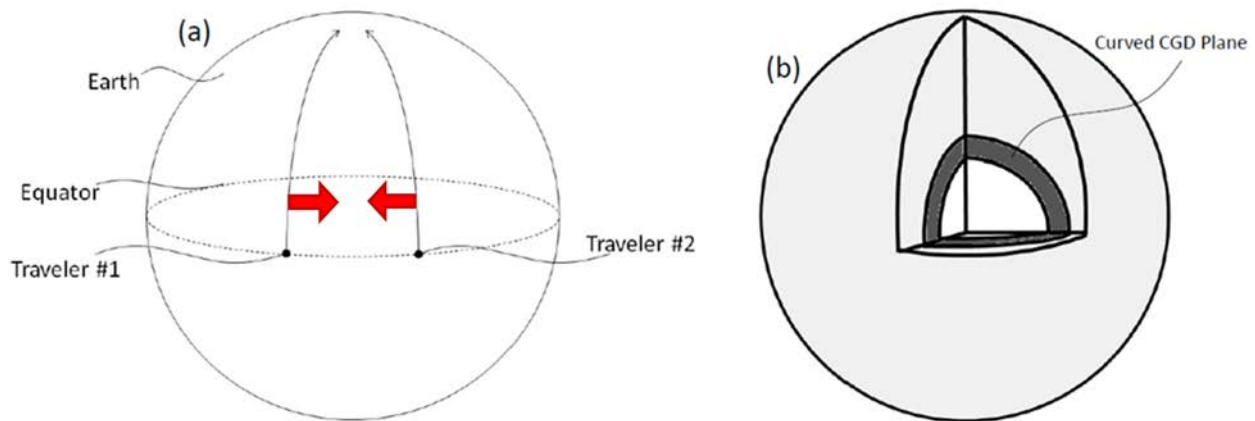



Figure 17. (left) simple depiction of the attractive effect of CGD by having two travelers heading north from the Earth's equator; (right) depiction of the plane where CGD effects would occur within the confines of the NESAR. This plane is where the the density of charged particles is the greatest and is depicted as the darkest region within the NESAR.

If the pattern of dimensional progression maintains, then RAE also drives an extra dimension into the magnetic field of accelerating charged particles. The spatial dimension of a generated magnetic field of a charged particle is always one dimension higher than the spatial dimension of the charged particle's physical trajectory. This means when a charged particle has a linear trajectory, which is one spatial dimension, it generates a loop magnetic field that is two spatial dimensions over time. When a charged particle has a loop trajectory in a coil, which is two spatial dimensions, it generates a magnetic field that is three spatial dimensions over time. Since two spatial dimensions is the highest physical dimension that has been placed upon charged particles experimentally, the highest spatial dimension that has been placed upon a magnetic field experimentally is three spatial dimensions of influence.

If RAE can manipulate a charged particle trajectory into a physical third spatial dimension, then there is a probability that the generated magnetic field from RAE influences can produce a magnetic field that has the potential to influence the fourth spatial dimension, spacetime. If this is true, the constant stellar observances of amassed charged particles rotating spherically make sense, because these systems would be areas of enormous RAE effects.

In FIG. 18, the spatial dimension generated from a charged particle's trajectory is compared to the corresponding spatial dimension of the magnetic field generated. On the far right of this chart, highlighted in yellow, the additional accelerated dimension is emphasized. If the NESAR has the capability to allow charged particles to undergo cur-

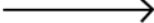
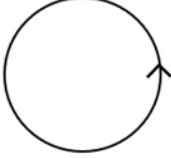
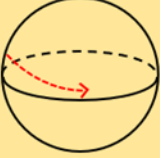
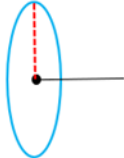
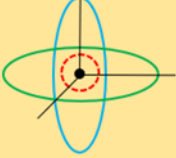
vature deviation; allowing charged particles to subtly accelerate in a third spatial dimension. This subtle acceleration into a third spatial dimension by charged particles has the potential to allow for generated magnetic fields tied to these RAE effects to influence the fourth spatial dimension we know as spacetime.

| | Stationary Charged Particle | Wire/Linear Current | Loop/Coil Current | NESAR Current |
|---|---|---|---|---|
| Charged Particle Trajectory | • | → | ◯ | (sphere) |
| Spatial Dimension of Charged Particle Trajectory | N/A | 1D | 2D | 3D, Addional Dimension From Curvature Divation |
| Magnetic Field Magnitude | N/A, Electric Field | (field diagram) | (field diagram) | (field diagram) |
| Spatial Dimension of Magnetic Field | N/A, Electric Field | 2D | 3D | Possible 4D Influence of Time and Gravity |

**Figure 18.** Depicts the relationship between the spatial dimensions of charged particle trajectories in comparison to their generated electromagnetic spatial dimensions. The red dotted line depicts the additional magnetic dimension resulting from charged particle trajectories.

The most astonishing possibility of this novel theory is its probable capacity to provide a rational justification for observed stronger-than-expected gravitational effects found with almost all formed galaxies. If spacetime influences are due to RAE upon charged particles, then observed gravity is no more than a closed or open system's acceleration of charged particles under curvature deviation relative to a solitary location. Since atoms like hydrogen, helium, oxygen, etc are in a constant exchange of both energy and matter, atoms like these should be categorized as open systems. Even though open systems like these atoms are in a constant exchange of energy and matter; they continue to maintain a balanced ratio of charged particles that obtain electrical neutrality by sustaining a charged particle composition ratio (CPCR) of 1 amongst its electrons and protons.

All stellar observances are depended upon the mechanism of generating photons by energizing electrons orbiting an atom's nucleus in which the atom maintains a charged particle CPCR of 1; it must be considered that this CPCR holds set energy transfers relative to the charge and mass of the electrons and protons that are continually electrostatically interacting within an atom. This possible established energy level depended upon baryonic matter for an atom's stability may be the limiting factor in all stellar observations (i.e. the speed of light).

If an open or closed system allows for confined charged particles influenced by RAE to obtain a CPCR greater than 1, would the system exceed baryonic limits and emit greater amounts of energy that can influence spacetime relative to systems with more baryonic mass? The NESAR is the only system in the world that has the possible capability of influencing spacetime without requiring the mass of baryonic matter to be stable, as it is the

only system that is able to rotate charged particles under RAE relative to a solitary location. If the NESAR maintains the sustainable confinement of charged particles that allows for a confinement system's quantity of electrons to exceed the number of confined protons; the CPCR would increase. When the CPCR is increased, a greater amount of energy influencing spacetime can be emitted at much lower masses relative to an open system, like atoms, that requires baryonic matter for a balanced CPCR of 1 to maintain a neutral charge for stability. Contrary to mainstream scientific understanding, allowing observed effects upon spacetime without the need for baryonic matter would generate stronger than expected influences upon spacetime if the generated energy is predominately from less massive electrons. In addition, systems that obtain higher CPCRs should emit lower levels of illumination, as fewer atoms, obtaining baryonic material, are present for fusion. Maintaining this assumption for stellar observations would explain how the Sun, which has a much lower observed gravity and magnetic presence, obtains a much higher level of relative luminosity in comparison to neutron stars and black holes. If this testable theory on RAE is correct, Einstien's calculations on gravity can be refined to express the gravitational force not originating from a singularity, but instead from charged particles under RAE collectively interacting about an SRCP where the energy is maximized.

If gravity is a product of RAE amongst charged particles driving another spatial dimension into the trajectory of the massless photon, then there may be a probability that RAE may be driving this extra spatial dimension upon the only other massless boson particle, the gluon, that acts as the exchange particle for the strong force between quarks. Even though this will have to be a tested theory with a prototype of the NESAR to confirm the existence of RAE, but if experiments exhibit promising results for RAE being the primary reason for observed gravity; then it would have to be considered that RAE interactions amongst up and down quarks, that obtains constant negative and positive charge interactions for stability, could possibly be at the source of generating the strong force. To simply state it, RAE upon photons to produce observed gravity could possibly provide a connection to better understand the strong force by gluons under RAE possibly producing observed strong forces about the atomic nucleus.

Finally, the last concept of this unified theory that interested DARPA, was how RAE could be applied to possibly produce observation of the repulsive force. There are two theorized pathways to how a NESAR-like device may be utilized to generate repulsive energy based upon Diverging Geodesic Deviation (DGD).[12] The first method would be by producing areas of confinement where the curvature can influence charged particles to diverge to a third spatial dimension, and the second method would be by generating repulsive energy from confining anti-matter, preferably positrons.

The first method of producing areas of divergence upon the confines within the NESAR can be accomplished by increasing the magnetic strength of certain confinement coils relative to the rest of the confinement apparatus in the areas where one would like to create diverging energy. In the following depictions in FIG. 19, there is a confinement of charged particles rotating clockwise. To place a repulsive force on the top and bottom areas of the confinement; the top and bottom conductive coils of the confinement apparatus have been increased in strength to push a diverging spatial dimension upon the charged particle confined within the NESAR. In doing so, diverging energy is generated at the top and bottom areas of the confines.

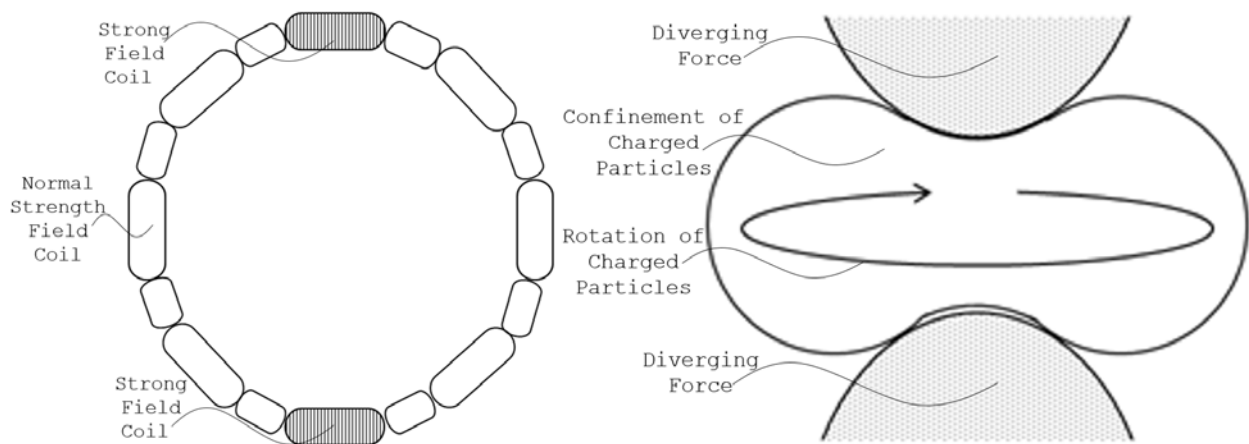



Figure 19. (left) cross-section side view showing stronger magnetic field coils on the top and bottom of the confinement apparatus depicted as stripped coils; (right) effect of these stronger magnetic field coils on a spherical rotating confinement of charged particles within the NESAR that produce a DGD effect.

The second probable method of producing a repulsive force would be accomplished by confining positrons instead of electrons. A confinement of positrons should confine exactly like electrons; which rises skepticism that this approach may yield a repulsive force. If by some chance a confinement of positrons is able to produce repulsive energy then there is a great probability that this type of confinement can demonstrate how dark energy is generated, and provide some assistance in understanding why there is little to no anti-matter in our universe. In addition, if the expansion of space is occurring due to a confinement that has a high CPCR of positrons,   then the expansion of space would be continual and exceed the speed of light without emitting great amounts of illumination, which is what is currently being observed in astronomical recordings. A confinement comprised of positrons is not reliant on the masses of antiprotons and antineutrons to generate repulsive energy. Lastly, if this theory of DGD proves to be correct, this understanding may be applied in demonstrating how gravitational waves may be a repulsive force that originates between two massive approaching gravitationally observed sources.

Einstein maintained the philosophy that gravity isn't a force at all. He described it as a curvature of time and space caused by mass and energy. For most of his life, he tried to form a unified field theory that would unify general relativity and the electromagnetic force. This unified field theory based upon a NESAR-like confinement method is the first concept that truly embodies Einstien's vision of unifying both of these concepts by impelling curvature deviation upon charged particle trajectories; resulting in an additional spatial dimension to the electromagnet field. In addition, this theory of RAE energy provides a logical approach to better understanding observed phenomena like dark energy, dark matter, and black holes that exceed the limits of gravity based upon closed or open systems that require baryonic matter. Finally, this theory is not based upon a postulation that can only be hypothesized mathematically with no aptitude to be validated experimentally. This is a theory that obtains a constructible device, that if built would eliminate debate or skepticism on if this unified field theory may be significant or not.   If this novel concept proves to be correct, again it should be emphasized that this theory extends from a purist approach similar to Faraday's method in developing theory.

## 8. Background (Review of Literature on Pole Reversal Theory)

This concept of fusion was originally designed to mimic the oscillations of the sun's core. The rotation of the outer layers of the sun, meaning roughly all radii greater than about half the radii of the photosphere, is directly observable via helioseismology. The observable plasmas in the Sun are effectively plasma due to very high collision rates, but

this is something that is not true for laboratory plasmas. For the most part, the structure of the Sun is very well understood, as compared to helioseismology observations, neutrino fluxes, and validation of stellar evolution via the population statistics of neighboring stars in the galaxy; but it is still unknown how the sun performs magnetic pole reversals, which happens within the unobservable portion of the Sun.

This theory focuses on how magnetic pole reversals occur in oscillating plasmas by applying Michael Faraday's law of induction within rotating plasmas to possibly provide an explanation for the unobservable portions of the sun. Introducing a novel concept like the NESAR may have profound implications for the internal structure of the sun, but will require more validation than what is currently in this paper. In general, if a phenomenon is unable to be directly observed, discouragement of forming theories about how the phenomenon occurs or operates is erroneous. Though this a theory based upon indirect observations, the NESAR is a device that is testable and should remove all skepticism if it operates as planned. At a minimum, this theory applies a novel approach to Faraday's concepts of induction to explain how rotating plasmas or magnets can reverse their magnetic polarities.

### 9. Analysis (Theoretical Solution to Pole Reversal)

The NESAR was developed in an attempt to reverse engineer the sun's core. So, the collective flow of plasma upon the NESAR curvature plane should be comparable to the sun's core. The NESAR obtains angled confining coils to generate a spherical oscillating curvature CGD plane, as seen in FIG. 17,   at an accelerated pace in comparison to how it evolves naturally in stars. Due to the NESAR's design feature, the curvature CGD plane is the only feature of the NESAR that is being used to provide some type of understanding in how the sun's core oscillates. Currently, no other physicist or cosmologist who studies helioseismology has developed a logical explanation that fully embodies how the sun's core reverses its magnetic poles while progressing through its solar cycles. This section of the paper will cover what is being observed as magnetic pole reversals from the sun, how observed magnetic pole reversals are being recorded with NASA's equipment, and how the sun is able to endlessly perpetuate through its solar cycles. Being able to provide a logical explanation for these questions should add validity in the NESAR method of confinement as being a process of fusion that is truly similar to the sun's core.

There are many layers to the sun that have a multitude of different features, but the sun's magnetic pole reversals originate from the core which is a solitary system that is continuously changing and evolving. If the sun's core is a confinement of plasma that is continuously changing, then the effects of inductance should be observed from the core. Due to these few but simple observable facts, it seems most logical to apply Faraday's law of induction to approach a better understanding of how the sun operates.

In studying Faraday's experiments, inductance is dependent upon the rate of changing magnitude of a magnetic field.[12] To apply Faraday's law of induction to how the NESAR or the Sun may reverse its direction in inductance, one cannot simply envision how Faraday conducted his experiments by moving a bar magnet in and out of a coil since the NESAR spherically circulates charged particles for constant utilization. In applying Faraday's law to better understand how the NESAR or sun-like confinements may reverse their magnetic poles, one must imagine and apply how a ring-shaped magnet rotating at variable speeds would affect the current flow in a surrounding magnetic coil. This relationship is depicted in FIG. 20.

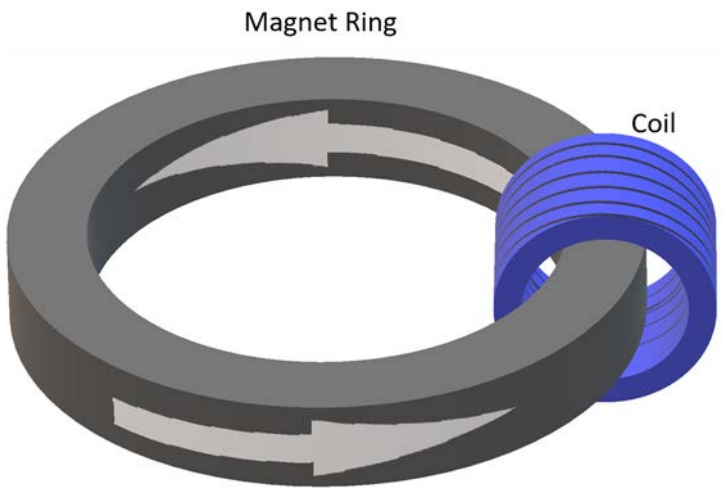



**Figure 20.** A depiction of this ring-shaped magnet rotating within a coil.

In analyzing the above rotating magnetic ring, the Faraday's las, depicted in FIG. 21, must be used to understand the generated electromotive force (EMF). Even though coils have a certain amount of turns, N, this factor is not important to get a general understanding of how EMF, ε, will be affected by a variable rotating magnetic ring. The most important factor to focus on is how the negative rate of magnetic flux, Φ, is changing.[12]

$$\varepsilon = -\frac{d\Phi_B}{dt}$$

**Figure 21.** Faraday's law of electromagnetic induction without number of coil loops, N.

In applying the Faraday's law, from FIG. 21, to the rotating magnetic ring, EMF is purely based upon the rate of a changing magnetic flux. So, if the magnetic ring is rotating at a stable rotational speed; there will be little to no change in the magnetic flux, so EMF will be zero. If the rotating magnetic ring increases in rotational speed, an opposing EMF will be created because the law of conservation of energy dictates that an effort must be made to maintain the system's original energy state. If the rotating magnetic ring decreases in rotational speed, a shift in the opposing EMF will again be created because of the law of conservation of energy. This relationship is depicted in FIG. 22.

| Rotational Speed | EMF |
|---|---|
| Constant Rotational Speed 1 | None |
| Increase in Rotational Speed 1 to Speed 2 | EMF in Opposite Direction of Main Field |
| Constant Rotational Speed at Higher 2 | None |
| Decrease in Rotational Speed 2 to Speed 1 | EMF in Supporting Direction of Main Field |
| Resume Constant Rotational Speed 1 | None |

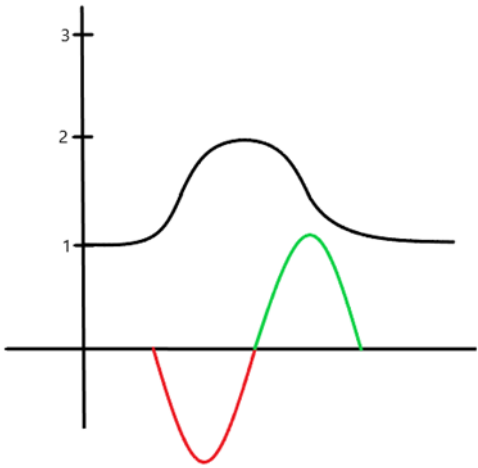



Figure 22. Graph of EMF as rotating magnetic ring increases its rotational speed from 1 to 2, and as it reduces its rotational speed from 2 to 1. The rotational speed is depicted by a black line, and the EMF is depicted by a red and green line.

The only way that magnetic flux could change in the NESAR confinement, and possibly the sun's core, without physically flipping or disrupting the integrity of the core is by altering the rotational speeds of the confined charged particles. Altering the rotational speeds of a stable confinement of charged particles will cause the main current's magnetic flux to change, which then results in producing an opposing EMF as shown in FIG. 21.

While revisiting Faraday's experiments, where inductance occurs in the surrounding coil, about a source changing its magnetic flux; the question of what is NASA's magnetic field detectors actually observing presented itself. Because of this uncertainty of what NASA is recording as the sun's magnetic field, researching the equipment used to record the sun's magnetic field was the next phase in developing this pole reversal theory. NASA uses Search Coil Magnetometers (SCM) to observe the sun's magnetic field. SCMs are copper coils wounded around a high magnetic permeability core. The magnetic cores of these SCMs concentrate magnetic field lines, and magnetic fluctuations.[13] Similar to Faraday's experiments with changing magnetic flux to cause inductance within wire coils, these coils are recording the inductance produced by the sun's varying main current at its core. Their SCMs not only observe one direction of the electromotive force (EMF), they also record the magnitude of EMF on the X, Y, and Z axes. In FIG. 23, these three axes of wounded coils are visible.

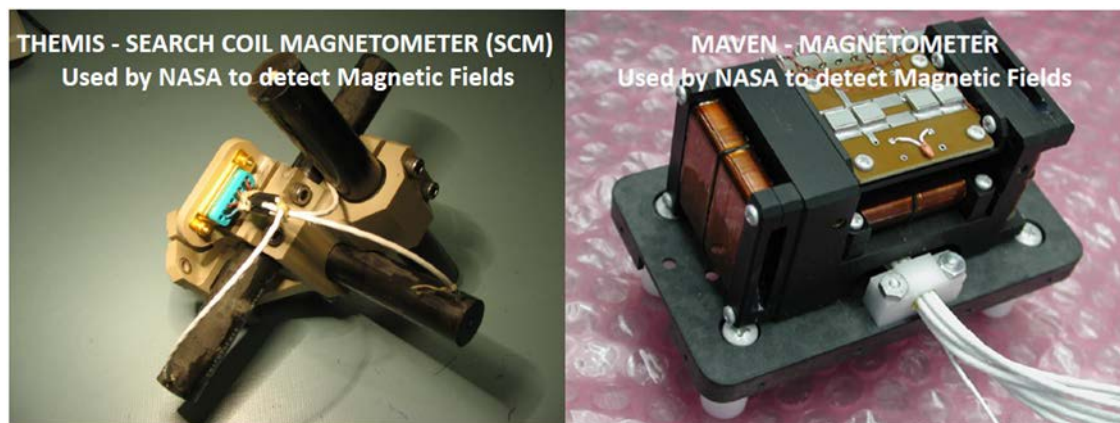



Figure 23. Picture of the two types of search coil magnetometers that are used in observing the sun's magnetic field.

Similar to the oscillating magnetic ring from FIG. 20, the main current of a stable oscillating plasma in a vacuum, like our sun, that has no controls to maintain a steady and unchanging rotational speed to sustain a constant energy level; will naturally pendulate in rotational speed to maintain stability. When the rotational speed of the main current begins to reduce in its rotational speed; an induced current flowing throughout the main current is generated that opposes the reduction in rotational speed. This induced current is similar to how the opposing current in sawtooth magnetic reconnection, from FIG. 13, occurs in tokamaks. This induced current will gradually slow down the rate that the main current's rotational speed reduces to a level where it eventually steadies at a minimum rotational speed. Since the minimum rotational speed of the main current is at its lowest energy state relative to its original energy state; the opposing induced current that is assisting in increasing the main current's rotation speed to return it to its original energy level is at a maximum level. Thus, increasing the rotational speed to and past its original energy state(i.e., original rotational speed). At this point where the main current starts to exceed its original energy state, the opposing induced current begins to work in slowing down the main current's rotation back to its original energy state where it will eventually return to and exceed to repeat the process over again. This process will continue to repeat itself, perpetuating different types of solar cycles in the process.

While the perpetuation of solar cycles is occurring; NASA's SCMs are recording the negative rate of magnetic flux over time as Faraday's law specifics. The rotational speed of the main current produces a magnetic flux that has a reciprocal relationship to the main current's changing rotational speed. So, the higher the rotational speed that the main current obtains, the higher the magnetic flux. The changing magnetic flux then generates an EMF. In order to graph the relationship between the sun's core magnetic flux and its generated EMF; Faraday's fundamentals serve as a succinct summary of the ways a voltage (or EMF) may be generated by a changing magnetic environment. As previously stated, the induced EMF in a coil is equal to the negative rate of change of the magnetic flux.

To graph how the sun's core cycles, a focus is placed on the rotational speed of the sun's main current, magnetic flux, and its generated EMF. As the main current of the sun's core changes in rotational speed producing an induced EMF; NASA's SCMs record how that EMF is changing which is being misunderstood as a physical flipping of its core. FIG. 24 depicts how the rotational speed of the sun's main current relates to its generated induced opposing current, and how these two factors produce and perpetuate the alternating EMF that is recorded by NASA's SCMs. In FIG. 24, the origination of the energy level that the sun is trying to maintain is not depicted. This energy would have been established before what is shown in this graph. More than likely the energy level trying to be maintained by the sun's core was established when the main current initially attained its maximum rate of change prior to the induced opposing exertions of the system were able gradually reduced the main current's rate of rotational speed to a level where the rotational speed rate was able to be steadied to a maximized rotational speed; initiating the perpetuation cycle of the sun's core.

The first portion to focus on for FIG. 24 is the top portion of the diagram. At the top left of the diagram, the established rotational direction of the main current of the sun's core is depicted by a clockwise open circle inside of a black box. This established rotation of the main current will never change, it will only change in its rotational speeds. The rotational speed (i.e., magnetic flux) of the sun's main current is depicted by a black dotted line. The opposing induced current that inversely affects the main current's rotational speed relative to the energy level the system is trying to maintain is depicted by a thin blue dotted line. At the top of the graph, it is depicted if the opposing induced current is assisting or opposing the established rotation of the main current by presenting a blue clockwise or counterclockwise open circle around the established rotation. The energy level (i.e., rotational speed) that the system is trying to maintain is depicted by a dark purple dotted line. The maximum and minimum rotational speeds achieved in each cycle are depicted by the black dotted line (i.e., magnetic flux) bounded by the light purple lines. The top portion of the graph, with the dotted black line, is only one of two portions of the graph to focus on; which is meant to depict how the main current of the sun's core pendulates about an established energy level attempting to be maintained.

The second portion of FIG. 24 is at the bottom of the diagram; where a brown dotted line (i.e., EMF) is generated from a changing magnetic environment generated by alternating rotational speeds of the main current depicted by the black dotted line. In accordance with Faraday's law of induction, this brown dotted EMF line expresses the negative rate of change in the main current's rotational speed. Again, this shift in EMF is what NASA's SCMs are observing.  In observing the EMF depicted in FIG. 24, EMF is at its greatest value when the main current is at its greatest rate of change. This occurs when the main current's rotational speed matches its maintained energy where it crosses the dotted dark purple line. When the main current reaches either its greatest or minimum rotation speeds, EMF is at its minimum level of zero. What is significant about EMF at a value of zero, it is at this moment when an observed magnetic reversal occurs; during solar maximums when the main current is at its maximum or minimum rotational speeds. Also, when the EMF is at zero, the opposing induced current, depicted by the thin blue dotted line, is maximized. The solar maximums, when pole reversals occur, are shown as

yellow triangles on the black dotted line (i.e., main current), and on the brown dotted line (i.e., EMF) the magnet pole reversals are shown as yellow squares.

Also in the second portion of FIG. 24, the diagram illustrates red and green portions within the boundaries of the brown dotted line (i.e., EMF). A generated EMF is not a negative or a positive value when it originates from an oscillating system like the main current of the sun's core. It is best to express the induced EMF as a rotation since the induced voltage traveling through NASA's SCM coils is merely a generated current that alternates its rotation to and from clockwise and counterclockwise when the system is at solar maximum. So, a green open circle in a clockwise direction is used to depict one of the EMF current directions, while a red open circle in a counterclockwise direction is used to depict the other direction. In addition, the magnitude of the EMF is depicted by how far away it is from the zero axis. The further away from the axis, the greater the magnitude.

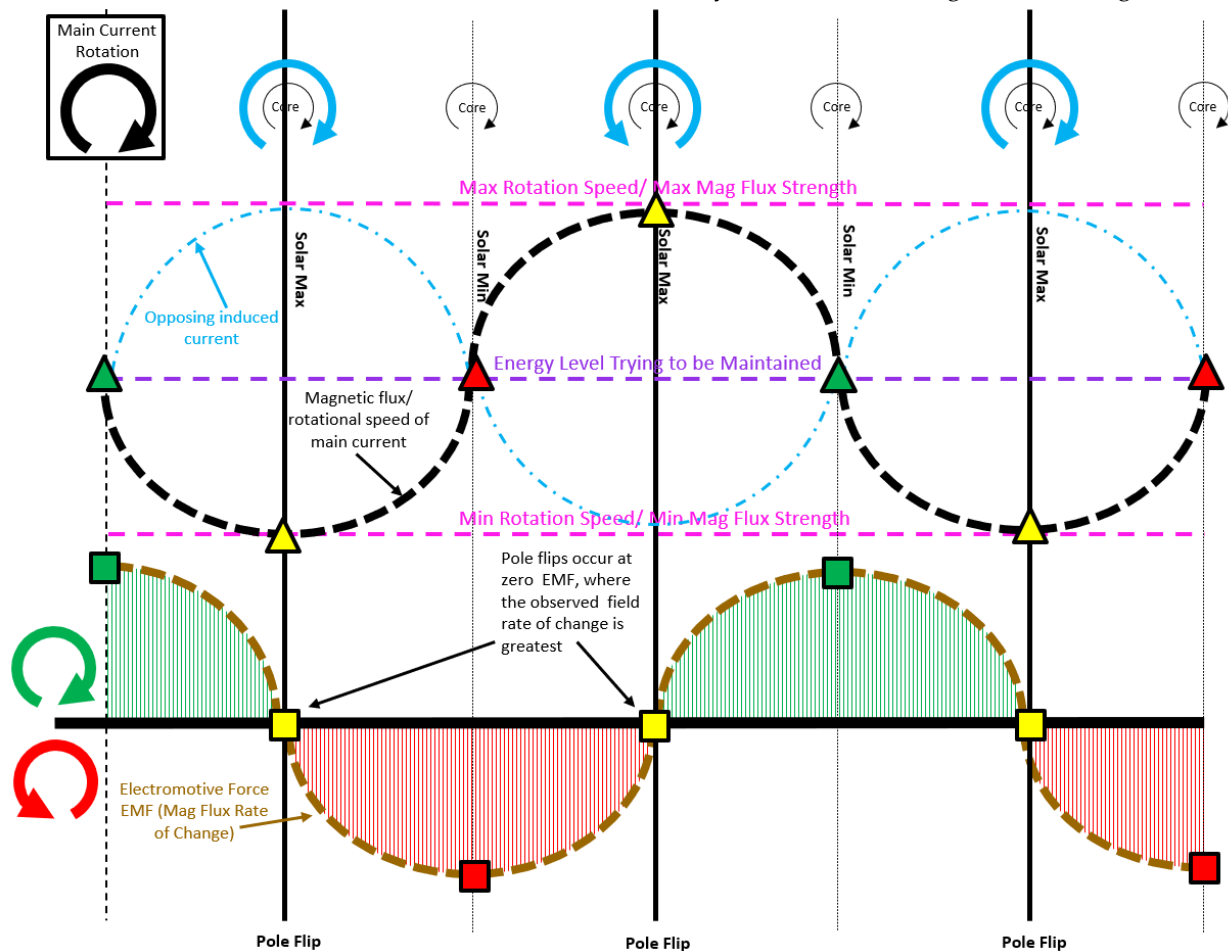



Figure 24. Depicts the relationship between the varying rotational speed of the system and its generated EMF.

If this magnetic pole reversal theory is correct about the sun, it may be possible to apply this concept to better understand Earth's much smaller and less active core. Due to Earth's much less active core, a pole reversal has never been observed. Earth's last pole reversal occurred almost 800,000 years ago, and it took thousands of years for the core to complete its full reversal. Possibly the greatest change that has been observed and recorded in Earth's core; is the evidence of Earth's poles drifting at its north and south axes. If the Earth's core operates similarly to the sun's core, then the simplest possible reason why the Earth's magnetic poles drift may be due to its core varying in rotational speed as well. As Earth's core slows in rotation, like a top, it starts to wobble; but once the core's induced current works towards aiding its rotational speed to increase in magnetic flux, it should become more stable and return close to its original axis.

This theory of magnetic pole reversal may be testable with the NESAR and is a logical approach for explaining recorded observations purely founded on Faraday's law of induction. Providing an explanation of how the sun's core can maintain its rotational direction without physically reversing or flipping its position is logical because the sun has a cycle that occurs in repetitive time sequences similar to that of a sine and cosine wave; which in essence is what this pole reversal theory is, using Faraday's proven laws of induction to explain this cycled relationship depended upon energy and mass exchanges.

## 10. Conclusion

The NESAR confinement method at a minimum has the potential to advance IEC fusion beyond its current capabilities by improving upon electron confinement, density distribution, and the rate of fusion. In addition, the NESAR's capability to compress confined plasmas without the need for a poloidal field allows the NESAR method of confinement to possibly alleviate the occurrence of major magnetic reconnection events in rotating plasmas. Even if the unified field theory and pole reversal theories, based upon how the NESAR confines charged particles, are neglected; the NESAR still provides a plurality of possible advances in the fields of magnetic confinement and IEC fusion. Due to these possible advancements in the confinement of charged particles, it is only logical to further explore this novel concept.

The NESAR magnetically confines a spherical-shaped constrainment of plasma that rotates about a single relative reference point, just like the sun. No other magnetic confinement concept or device in the world has a combination of these characteristics in a solitary device that obtains the most prominent features exhibited by the sun. Due to the NESAR obtaining these features, it should be no surprise that a unified field and pole reversal theory evolved from this novel confinement concept. These two theories are purely founded on the proven laws of physics and rely on little to no postulation. Since these theories are developed in a purist approach; complicated mathematics are not required to express the probability of the concept. The greatest advantage of the theories based upon the NESAR method of confinement compared to most; is that it is a lab testable theory. Instead of using intricate math to add validity to a postulation that is more than likely untestable, a prototype NESAR will either further validate these theories or disprove them. Either way, minimal time will be expended in entertaining the validity of this novel concept in comparison to other theories.

Similar to Einstein and Maxwell connecting multiple laws of physics to develop their theories and calculations; the NESAR mirrors their efforts with Faraday's approach to developing theory, which will hopefully become law dependent upon experimentation. If the NESAR method of magnetic confinement improves upon previous methods of fusion while being a device that can extend the electromagnetic field to a fourth dimension for possible utilization; the technological applications could eventually provide for ample clean energy worldwide, while utilizing the attractive and repulsive accelerated energies for continuous acceleration for space propulsion. Because the NESAR is a novel concept that extends from the countless hours of experimentation issues from previous IEC and magnetic confinement methods; any theories extending from the probable trajectories of charged particles within the confines of the NESAR are compelled to be founded upon the proven laws of physics because postulation rarely extents from the results of experimentation.

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