Applying Faraday's Law of Induction to Explain How the Sun's Core Reverses Polarity and Oscillates

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Abstract

This is an introduction to the most plausible and logical theory of how the sun reverses its magnetic poles while simultaneously maintaining its continuity that is based upon a novel patent-pending magnetic confinement method that was designed to emulate how plasma at the sun's core rotates about a single common relative location. This theory of sun polarity reversal was developed to provide supplementary validity that this novel magnetic confinement method for fusion has similar properties with how our sun operates. By logically applying Michael Faraday's law of induction in analyzing the generated oscillating currents within the confines of this new sun like method of confinement; one is able to simply explain how magnetic pole reversals observed by NASA's magnetic field detectors occur without the sun's core physically flipping or reversing in direction.

Key words: Helioseismology, Pole Reversal, Geomagnetic, Sun, Faraday, Pole Flip, induction

Introduction

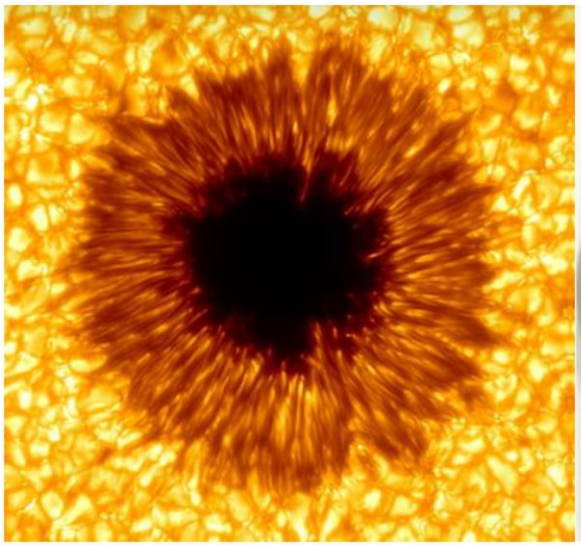
Originally, I developed the Nuclear Electromagnetic Shaping Accelerator Reactor (NESAR) [1] to be a logical approach to sustainable fusion by designing the first reactor that truly confines similarly to how our sun operates. In an effort to express the validity of this postulation, I attempted to supplement a logical method that would explain how the sun reverses its magnetic poles based upon how the NESAR confines charged particles. Astonishingly, I was able to develop a straightforward explanation on how the sun's core oscillates

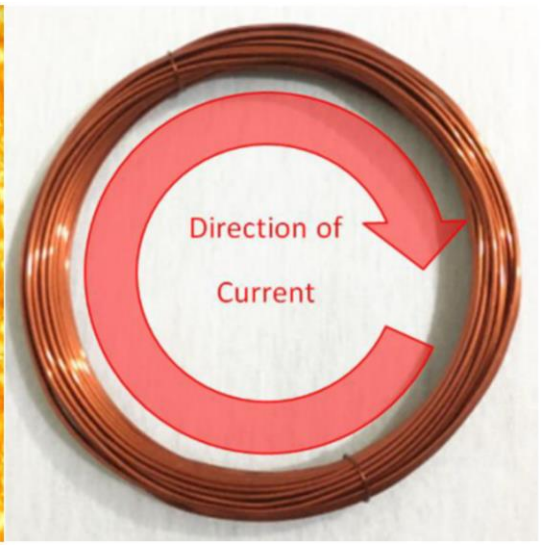
In this paper, I will review the general design and generated current flow within the NESAR. The induced effects of this generated current flow will then be analyzed against how it influences the magnetic field detectors used by NASA in assessing the magnetic fields of stellar bodies. Finally, I will review how the sun produces observations of magnetic pole reversals and perpetuates through its cycles.

The Logic in Designing A Reactor that is Supposed to Confine Like the Sun

The surface of the sun is full of plasma, which is one of the four states of matter which is formed at high temperatures and consists of freely moving protons, positively charged, and free electrons, negatively charged. Besides being able to observe its bright surface called the photosphere; probably the other most observable feature to the sun are its sunspots that form on its surface every 11 years when the sun is at its most active. These spots have a much stronger magnetic field strength than the other surface areas of the sun. In addition, these spots are also at a cooler temperature in comparison to the surrounding areas. Due to these spots being concentrations of magnetic strength, these are the areas that will have the greatest observable influences on the plasma, charged particles. Plasma can be manipulated by magnets and will travel in the direction of the magnetic fields.

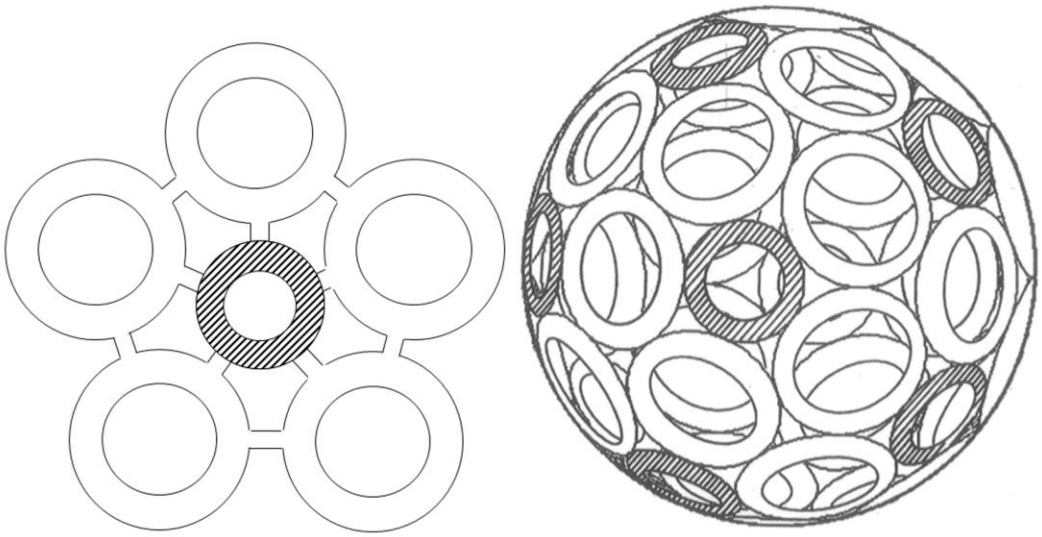
It is unknown if sunspots are formed due to inadequacies in the sun's confinement system, but the main thing to take away is that they are for the most part circular in shape and are gigantic magnetic fields that traverse through photosphere. In observing most sunspots, they look as if a collective of charged particles are being pulled into the confines of the sun. For this to happen, a good portion of these sunspots would have to be a gargantuan clockwise moving current; which results in creating the inward-directed magnetic field. If you are not familiar with electromagnets, the right-hand rule is used to determine the direction of the magnetic fields created in electromagnets and coils. The way this rule works is by making a big thumbs up with your right hand and have the curled finger go in the same direction as the current. When you do this, the thumb will be the direction of the magnetic field created. In the next picture below one can see the plasma from the photosphere being stretched and pulled into the sun's core. This same magnetic effect would occur if one were to place a clockwise current through a coil of wire.



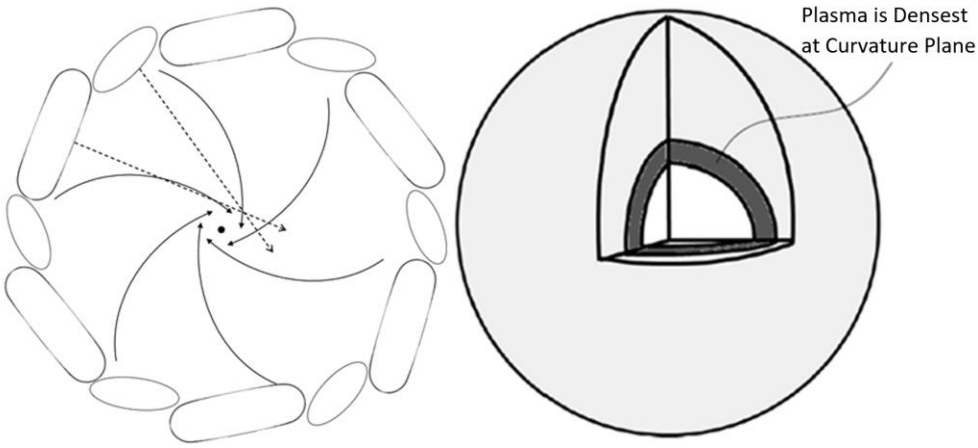


Our sun is not the most efficient star at fusion, which is a good thing. If the sun was too efficient at perpetuating fusion, it would burn out much faster. Sunspots are a reoccurring phenomenon in the sun's confinement system; but one of the most important things that can be assumed from the observation of sunspots is that there is a great probability that there is a current-carrying layer under the photosphere made of thousands to possibly millions of these weaker and less dynamic contiguous clockwise currents. This realization initialized me to design a spherical shaped magnetic confining apparatus that consisted of numerous toroidal magnetic coils that would have an inward directed magnetic field.

In designing the confinement apparatus, I used a multisided pentacoil design to evenly disperse the toroidal magnetic coils as the surface of a sphere. This pentacoil design for the confinement apparatus is not an essential feature. Below you can see the pentacoil design and how it collectively makes up the spherical confinement apparatus for fusion.

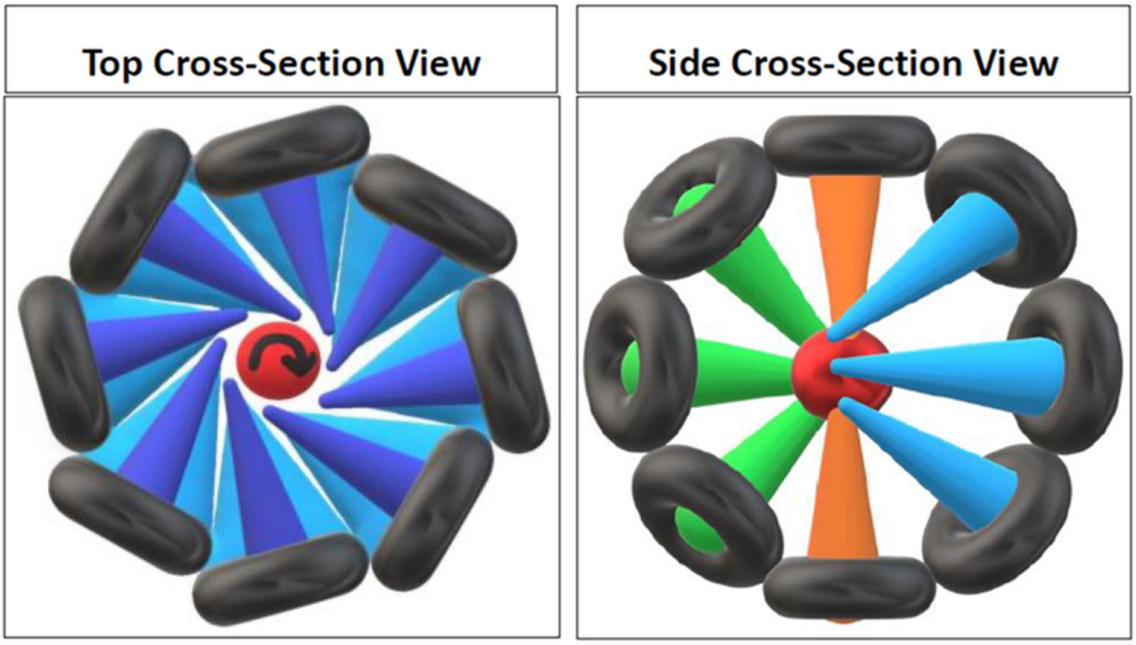


When looking at the spherical confinement apparatus that is supposed to operate within a vacuum chamber; one can falsely assume that the NESAR is supposed to simply confine charged particles to the center of the apparatus. If this were so, the most import feature of the NESAR is that every confinement coil, besides the vertical axis, is directed off center to promote a collective directional rotation to the confined charged particles within the confinement apparatus. Angling the magnetic confinement fields to spherically rotate charged particles; allows the NESAR to quickly perform what takes the sun thousands of years to do naturally through sheer size and induction from an increasing well potential at the center of its confinement. The natural evolution of the sun's rotating core will be covered later on in the paper. Being able to spherically rotate charged particles is vital to the Sun and the NESAR in having the capability to effectively confine and perpetuate without catastrophic magnetic reconnections that could disrupt the confinement. Depicted below on the left is a cross-section top view of how the confinement coils are collectively angled to promote a rotation to the confined plasma. On the right is a depiction of the created plane within the confines of the NESAR where the rotating plasma is the densest.



To better show how the magnetic fields of the NESAR will confine and rotate charged particles within the confinement apparatus, the following depiction has two 3D diagrams showing the cross-section of the confinement apparatus to highlight the angling of the toroidal magnetic coils. The diagram

on the left is a cross-section view from a top looking down on the NESAR confinement apparatus. From this diagram, one can observe the toroidal magnetic coils that are slightly directed off center to push a rotational pattern upon the confined charged particles. The angled toroidal magnetic coil fields on this plane are depicted in blue. The diagram on the right is a cross-section view from an upright perspective of NESAR confinement apparatus. In the diagram on the right, the angled toroidal magnetic coil fields directed to the background are green; while the toroidal magnetic coil fields directed to the foreground are blue. In this same diagram, the toroidal magnetic coil fields on the vertical axis directed to the center of the confinement apparatus are orange.



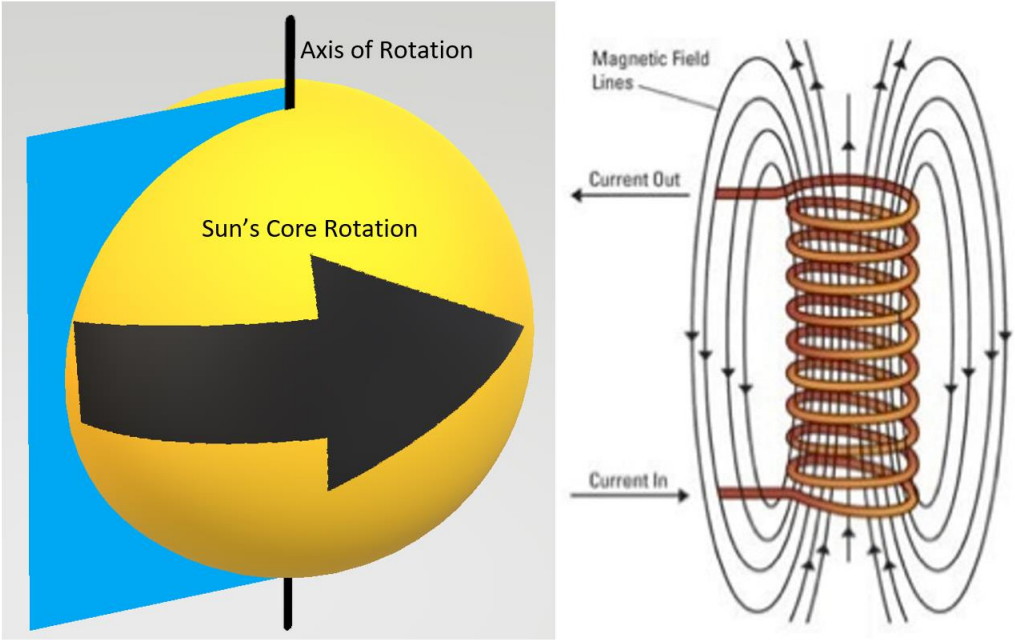
Magnetic fields will not cross each other, they merely push against one another. This means that the angled toroidal magnetic fields will layer upon each other while pushing the rotation of confined charged particles spherically. This increases the confinement's capability in trapping charged particles while at the same time driving charged particles to rotate collectively to create a dominate magnetic field within the NESAR confinement apparatus. In remembering that an electromagnet is only charged particles moving as a collective in a rotational direction, the confined charged particles within the NESAR will collectively exhibit the similar electromagnetic properties as charged particles flowing through a coil. Thus, creating an observable primary magnetic field for the system just like the sun.

Proving that the NESAR Confines Like the Sun By Explaining How the Sun Reverses Its Magnetic Field

The NESAR was developed in an attempt to reverse engineer our own sun. So, the collective flow of charged particles within the NESAR confines should provide some type of understanding in how the sun operates. In my research of the sun, I realized that no other physicist or cosmologist who studies helioseismology has come up with a logical explanation of how the sun reverses its magnetic poles while progressing through its solar cycles. Understanding this quandary, I knew if I were able to logically explain this phenomenon it would add validity to the NESAR confinement method.

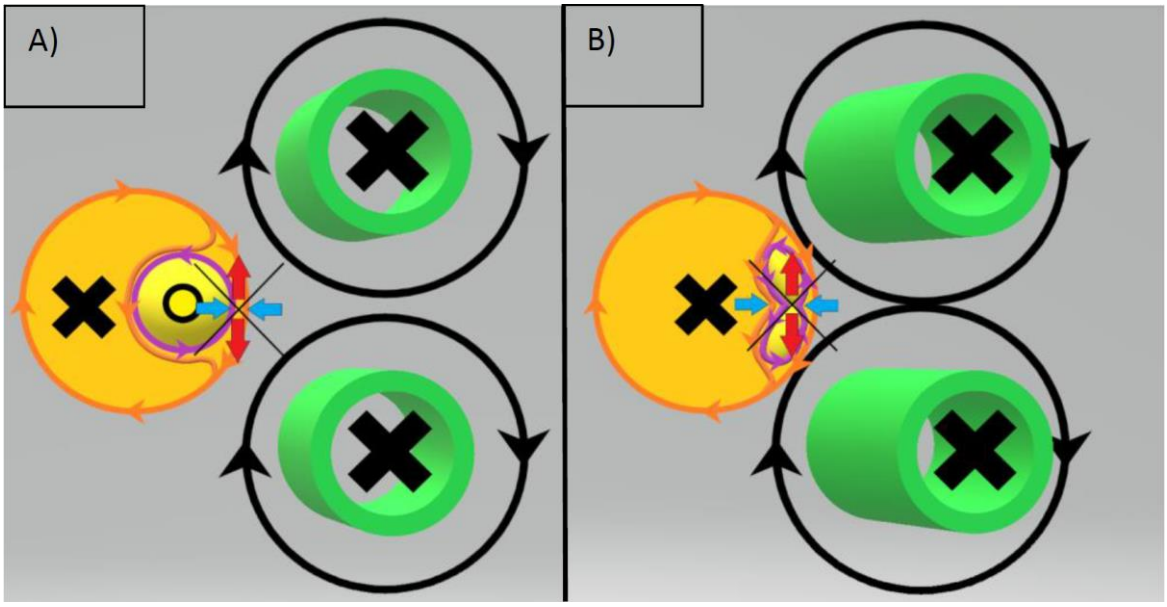
There are many layers to the sun that have a multitude of different features. Since I am trying to focus on magnetic pole reversals, it must be coming from one source and that source should be the sun's core. The sun is a continually changing environment, so it should be assumed that its core is doing the same. If this is true, then induced effects of the core should be very observable and constantly altering as well. Maybe it's because I am a huge fan of the self-taught English scientist Michael Faraday and the eccentric engineer Nikola Tesla; that I chose to approach better understanding how our sun operates in merging the general concepts of these two legends.

In studying Faraday's experiments [2], I remembered that the direction of inductance is not dependent upon the physical direction of the magnetic field of the source but is depended upon the change in magnitude of the magnetic field in a specific direction. So, applying this concept to how my NESAR confined, the system's magnetic field is generated from the confinement of charged rotating particles. Unlike the moving bar magnet used in Faraday's experiment as the magnetic field source, the only way that the magnetic flux could change in the NESAR confinement or the sun's core is by altering the rotational speeds of the confined charged particles. To get a better idea of this concept, look at the depiction below. In the diagram on the left, the created magnetic field will be directed downward. As the rotational speeds of the confined charged particles increase; the more charged particles will pass through the imaginary blue plane over time. This increase in rotational speed results in the NESAR or sun's core to increase in current, causing the system as a collective to increase in voltage.



Since the sun's core is a rotating ball of charged particles, plasma; it is logical to relate how the induced current generated within tokamaks may be similar to how it may occur within the sun's core. Even though tokamaks are extremely unsuccessful due to magnetic reconnection failure; experts know how the reconnection occurs. The reconnection failure in tokamaks is call a sawtooth reconnection. This reconnection occurs when the opposing induced current's field from the main confinement of charged particles is pinched and severed by the field of the main current of confined charged particles. This happens because the tokamak's poloidal field currents run parallel to the current of confined charged particles. So, 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. Below are a couple of diagrams that depict this sawtooth failure [3] . Please notice how the opposing induced current is created in diagram A, in yellow. In diagram B, the main current's field, in orange, is being pulled towards the parallel running poloidal currents, in green; pinching the induced current's field.

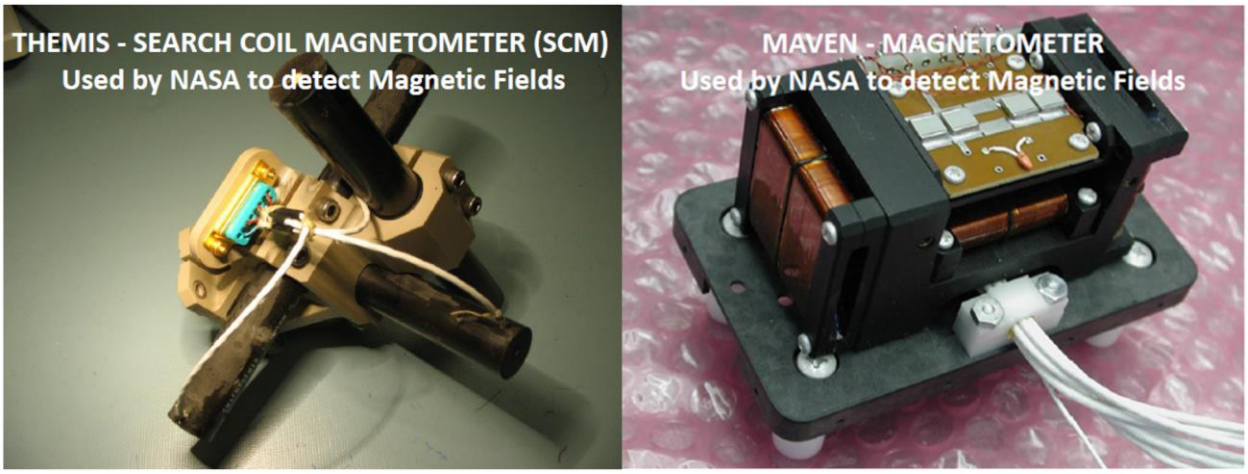


I will cover much more in dept how magnetic reconnection occurs in another paper and explain how the NESAR eliminates this catastrophic failure issue. The main reason that I am bringing up the tokamak sawtooth failure at this time in the paper is to provide a depiction of the type of induced current that is more than likely occurring in the sun's plasma core. This induced current plays an extremely important role in the perpetuation and existence of our own sun by driving the system to maintain a certain energy level.

Since the magnetic field of our sun's core is constantly changing then there must be the presence of inductance in the sun's surrounding environment. In Faraday's experiments, inductance occurs in the surrounding coils around the source of the changing magnetic flux. Thinking of his experiments made me wonder if the equipment that we are using to observe the sun's magnetic pole reversal are simply coils that are recording the sun's core change in magnetic flux instead of its actual magnetic field.

Because of this uncertainty of what NASA is recording as the sun's magnetic field, I started to research the equipment that is used to record the sun's magnetic field. NASA uses Search Coil Magnetometers (SCM) [4] to observe the sun's magnetic field. SCMs are basically copper coils wound around a high magnetic permeability core. This magnetic core concentrates magnetic field lines - and the magnetic fluctuations they carry - inside the coils. The fluctuations induce currents and electric voltage drops inside the core that can be measured and recorded by the instrument's electronics circuits. In general, these coils are recording the inductance given off by the sun's core. Their SCMs not only observe one direction, they record the magnitude of the induced electromotive force (EMF) on the

X,Y, and Z axes. Below are pictures of the two types of search coil magnetometers used to observe the sun's magnetic field. In the pictures you can physically see the coils wounded to obtain three axes.

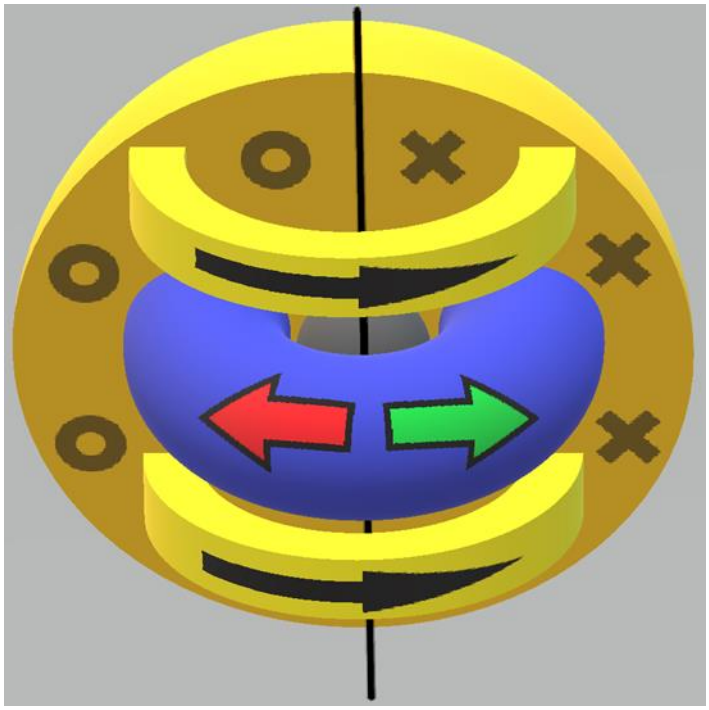


In researching NASA's SCMs, I was surprised that these recordings were not more publicly presented as recorded inductance readings instead of the actual magnetic field of the sun's core. Faraday discovered and clearly conveyed how inductance occurs in conducting coils almost over 200 years ago, I truly believe if the sun's pole reversal were presented as a shift in measured inductance, those who study helioseismology would have figured out much earlier that these sensors are not measuring actual flips in the magnetic field of the sun's core.

After researching the NESAR and NASAs SCMs in a Faradayan manner and realizing that the sun's core could obtain a same rotational direction of charged particles while presenting shifts in inductance; It was time to approach learning how the sun's magnetic pole reversals occur in a Teslan approach. So, if man is actually observing the sun's inductance, then the recordings that are being captured by NASA's SCMs are actually the sun's electromotive force (EMF).

In the study of electric motors, stators induce an EMF current upon the rotors to drive a rotation upon the motor's rotor. Any change in the magnetic environment of a coil of wire will cause a voltage (EMF) to be "induced" in the rotor coil. A rotating confinement of charged particles would create a dipole magnet field similar to a coil. No matter how the change is produced, the EMF voltage will be generated. The change could be produced by changing the magnetic field strength, moving a magnet toward or away from the coil, moving the coil into or out of the magnetic field, or rotating the coil relative to the magnet.

In the case of the sun's core or NESAR the constantly changing rotational speed is the variable that creates the EMF. To proceed further explaining this relationship I had to develop the below diagram to differentiate between the main current and the induced current.

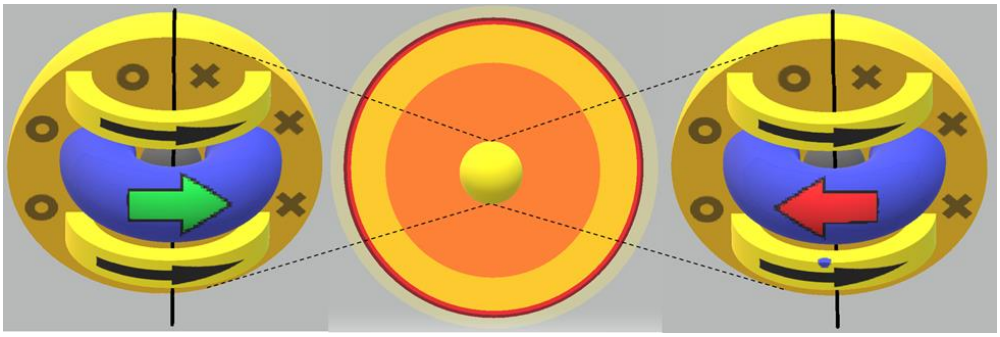


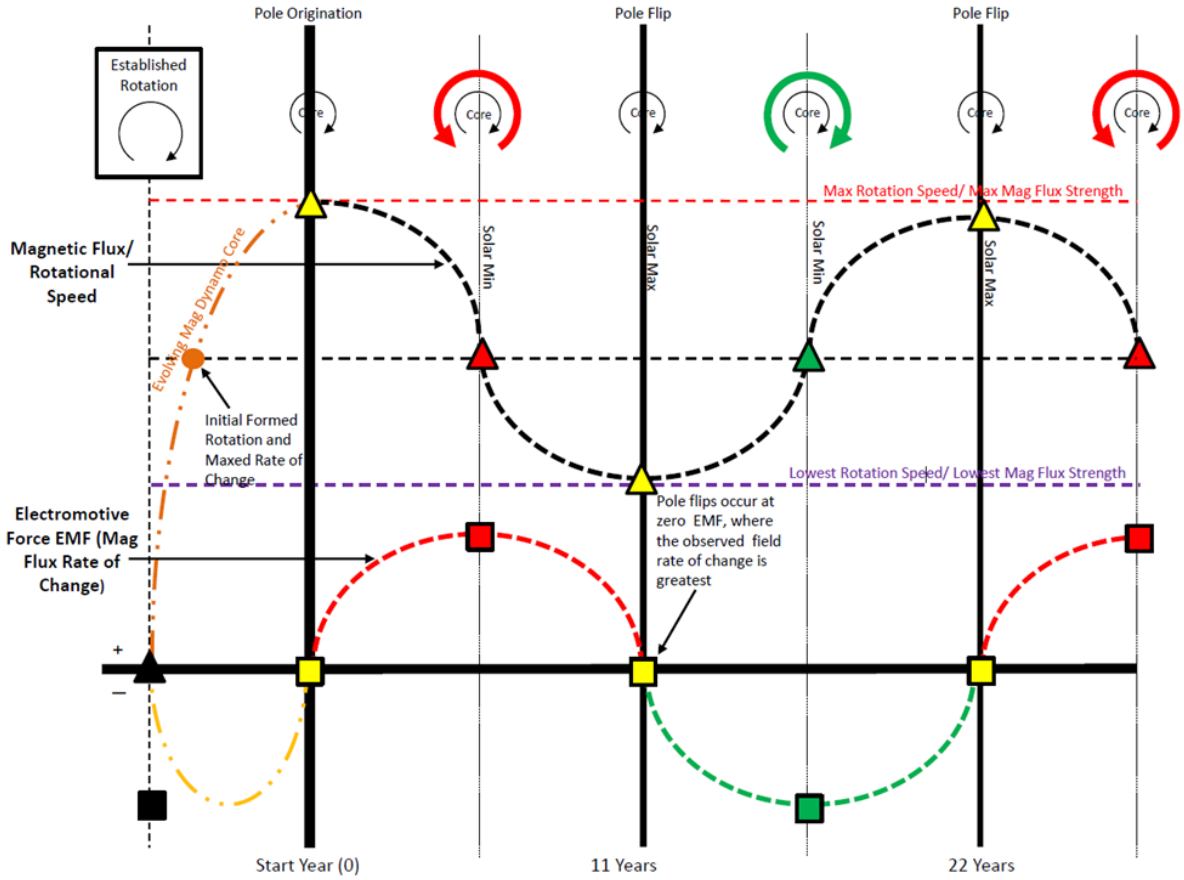
In the previous diagram, you can see the main current rotation of the sun's core is in yellow. The blue toroid is the induced current. There is a red and green arrow on this blue toroid to indicate that an induced current can either work to either increase or decrees the rotational speed of the system, as the system attempts to maintain its initial maximum rate of change where the induced current was at its greatest strength. In general, the sun's perpetuation is due to the law of conservation of energy; where the sun is attempting to maintain its maximum induced current by varying its rotational speed. To clarify, the sun's recorded EMF is being driven by the changing rotational speeds of the core's plasma in yellow. The sun's oscillation is driven by the induced current in blue. This induced current, in blue, is not what NASA's detection instruments are recording, because the main current's magnitude, in yellow, supersedes the induced current in blue.

In order to graph the relationship between the sun's core main current and EMF; Faraday's fundamentals serve as a succinct summary of the ways a voltage (or EMF) may be generated by a changing magnetic environment. The induced EMF in a coil is equal to the negative rate of change of magnetic flux times the number of turns in the coil. Main thing to focus on for graphing this relationship for our sun's core is that the sun's EMF is the negative rate of change of the magnetic flux, which would be the negative rate of change of the systems rotational speed.

The following diagram and graph was developed to show how this relationship between rotational speed of the system is directly tied to its induced forces. On the X-Axis, is the EMF. The reason that EMF is on the X-Axis is because it is the negative rate of change of the rotational speed of the system that emits a magnetic flux in relation to its rotational speed. The EMF will shift from an aiding or opposing force towards the systems rotational speed. Again, this shifting in EMF is due to the system trying to maintain its greatest initial rate of change; but the most important thing to take notice is when the EMF is zero, is when we have been observing the sun's magnetic pole reversals with NASA SCMs.

The following diagram is meant to be used in conjunction with the graph. It is meant to show how the induced current is supposed to increase or decrease the sun's core rotational speed. Notice that the green indicates that the induced current is working to increase the rotational speed; while the red is opposing the direction of cores rotation, slowing the system's rotation. The induced current's direction is depicted at the top of the graph in red or green. The EMF curve on the graph is color coated red and green as well to indicate when induced currents are working to increase or decrease the system's rotation. In the graph, notice that sun's rotational speed and magnetic flux is initially a dotted orange line. This is because logically there may be an instantaneous, not a gradual, maximum rate of magnetic flux that would have occurred when the system evolved to initially establish its rotation because the sun does not use angled confining magnets like the NESAR. If this is true, then there would not have been an established opposing induced current or EMF as well, which is why the corresponding EMF section of the graph is depicted with a dotted yellow line.





The main take-away from this graph, is to see how the induced currents within the sun's core act upon its rotational speed to create an alternating magnetic flux that produces the EMF that NASAs SCMs observe. This changing rotational speed is depicted by the black curve. Do recognize that the rotation of the sun's core never stops nor reverses. The main variable that influences our observations of the sun's core is its oscillating rotational speed, and because of this the magnetic pole reversals occur when the sun's core is at its fastest and slowest relative rotational speeds. The solar maximums and minimums occur when the rotational speed of the sun's core is at its greatest rates of change.

I know that I mentioned it before, but I want to emphasize that the EMF that NASAs SCMs are picking up is not from the induced field created within the sun's core, even though this field congruently shifts with the sun's emitted EMF, it is merely the driver for oscillation. The recorded EMF from the sun's core is from the changing rotational speeds of the plasmas at the sun's core; causing the environment's magnetic flux to vary. This varying magnetic flux is what NASA's SCMs are picking up as reversing magnetic fields.

I believe that the Earth's core may operate very similarly to the sun's; just much smaller and less active. If it does, the reason why the Earth's poles change location is due to its core varying in rotational speed. As Earth's core slows in rotation, like a top, it starts to wobble; but once an induced current works towards aiding its rotational speed it should become more stable. Most important thing to understand is that the Earth's core will never physically rotate or flip, so any equipment dependent upon Earth's magnetic fields should only need minor calibrations to account for the shift in Earth's inductance when the time comes for Earth's magnetic field to reverse.

Conclusion

All things considered; this is a straightforward, no frills, theory of how our sun perpetuates. Not only is it logical, but it is also simple. It is a law-based explanation that incorporates Faraday's law with already recorded induced occurrences that scientists have documented in rotating plasmas when observing tokamaks. Most importantly this theory provides clarity on what NASA's SCMs are actually recording from the sun's core. After researching countless theories on the sun's magnetic pole reversals, this explanation makes the most sense with the current knowledge that we have on the sun's core.

The main concern some may have, after reading this paper is that I previously stated that this theory of solar pole reversal is based upon a novel confinement method for fusion that is supposed to mimic how our own sun perpetuates fusion. Which may be initially off putting for some because everyone knows that gravity is the main driver for the fusion within our sun. Even though I have and will not cover the concept in this paper, I have developed a simple quantum theory of gravity based on this NESAR method of confinement that DARPA is currently interested in possibly pursuing further research on that I will cover in my next paper.

In developing a method of fusion that truly functions like our sun, I knew that I would have to address magnetic pole reversal, gravitational theory, and plasma theory; resulting in the production of multiple papers to properly express the full NESAR concept coherently. The reason that my initial paper on the NESAR confinement method is addressing magnetic pole reversals within the sun; is because it is the portion of the concept that has the least amount of postulation and should be the easiest to accept since it is almost purely based upon the proven laws of physics. In addition, I have found that most experts in physics are very hesitant to entertain reviewing any concept that involves multiple disciplines

in physics. So, focusing on Faraday's law of induction to explain how the sun's core oscillates is possibly the topic with the broadest interest to cross the most fields of physics.

The main takeaway from this paper is that the observed pole reversals from the sun's core are shifts in EMF, which means that the sun's pole flips don't have to be dependent upon physically flipping a magnetic pole like so many others believe. Basically, the observed pole flips in the sun's core are due to rotational speed changes in the densest confined plasmas. The universe is driven by the universal laws of energy conservation, and these laws are the driver to why the sun's core oscillates. So, every time the rotational speeds of the sun's core maximizes or minimizes, we observe a pole reversal as alternating EMF; which seems as if the sun's magnetic poles are flipping.

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