Macro-Scale "Exotic Vacuum Object" Self-Oscillating within a High Q Factor Circuit Producing Nuclear Reactions with an Optimized Fuel Mixture

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The author of this document would like to give special thanks to George Egely. His research and papers are of extreme value in understanding the unique phenomena behind the QX and SK. In addition, this paper is dedicated to Alexander Chernetsky and Kenneth R. Shoulders.

Disclaimer:

There are numerous potential hazards in the replication of any experiment involving chemicals, electricity, and high temperatures, much less those that may induce cold fusion effects. Anyone who attempts a replication of the QX should utilize all safety equipment and procedures. The author(s) of this paper accept zero responsibility for any accidents, injuries, or property damage that could occur. Experiment at your own risk. Additionally, the E-Cat technology is the intellectual property of Andrea Rossi, and any experimentation that is performed should only be for the advancement of scientific knowledge. No for-profit or commercial research should be performed.

Abstract:

The E-Cat "Energy Catalyzer" technology developed by Andrea Rossi has evolved to the point of utilizing a nearly pure plasma environment with minimal non-ionized particulate matter. By utilizing the negative resistance regime of an electrical discharge between electrodes, the associated EVO "exotic vacuum object" (also known in literature as a fireball, spheromak, plasmoid, or complex space charge construct) self-organizes into a spinning vortex with an interior of positively charged ions and and an exterior of negatively charged electrons: the boundary between the two producing a vital "double layer." In addition to absorbing heat from the general plasma environment of the discharge tube and converting it to electrical current to sustain the negative resistance, the DL may also induce nuclear reactions through multiple possible mechanisms. High rates of nuclear reactions may be achieved with the use of optimized fuel mixtures and the construction and tuning of highly resonant external circuits allowing for high quality factors to maximize the amplitude of self-oscillations. The same conditions may also allow for modification of the active vacuum and the extraction of virtual particles which could provide an additional source of power. Testing and research to further understand the properties of the EVO at the heart of this technology may also lead to other applications such as

revolutionary propulsion technologies.

Introduction:

Andrea Rossi originally introduced the E-Cat or Energy Catalyzer to the world in late 2010 after a period of testing with Sergio Focardi, a pioneer of cold fusion well known for his work with nickel-hydrogen systems (1). The earliest E-Cat reactors were alleged to use hydrogen gas of the natural isotopic ratio (minimal deuterium) along with high surface area nickel powder and additional "catalytic" additives. Today, much more is thought to be known about these early "low temperature" systems such as extensive degassing to remove trapped contaminants in the metal lattice, the use of finely dispersed palladium as a potential spill-over catalyst, the application of abrupt high-voltage electrical discharges in the vicinity of the fuel charge, and various methods of generating atomic hydrogen to accelerate gas loading. But followers of the sometimes exhausting, ongoing saga had to pay close attention, because of the rapid evolution of the technology that transpired. In subsequent years, "hot cats" capable of higher exterior surface temperatures were revealed: first utilizing hydrogen from an external tank and later from metal hydrides - namely, $LiAlH_4$ or "lithium aluminum hydride." (2)

The use of lithium seemed highly significant as time went on, and a series of seemingly successful replications of the E-Cat using mixtures of carbonyl nickel powder and $LiAlH_4$ were reported, along with many failures. Certain individuals and teams have continued working on replications of the effect to this very day. Dr. Alexander Parkhomov is an excellent example of a researcher who achieved fascinating results and has continued to work in a steadfast manner. Many others replicators shared positive results only to stop their work for various reasons or to continue in secret due to commercial motivations.

The final phase of Andrea Rossi's involvement with powder based systems took place during work on a large conglomeration of reactors placed in a modified shipping container. While in Doral, Florida monitoring this now highly controversial "one megawatt" plant, he began to experiment with the earliest incarnations of his current plasma based technology. Giving successive designs names such as the Madam Curie, E-Cat X, Quark X, E-Cat QX, and now, finally, the E-Cat SK, he eventually achieved a state of performance that seems completely astounding. Andrea Rossi now claims - though without any third party verification or proof - that the minuscule reactor tube of an SK (only a few cubic centimeters in volume) can produce upwards of 27 kilowatts of thermal output with only a minimal input. (4) In actuality, in a statement made to Mats Lewan, a well respected engineer and journalist who has been reporting on the evolution of the E-Cat technology for several years, the output can be increased up to 60kW for a short time. In some modes of operation, it's claimed that direct electrical output can also be produced, although with lower efficiency.

The purpose of this paper is to convey what is known about this technology and the likely (or at least

plausible) mechanisms by which it produces anomalous energy - through cold fusion or LENR reactions with a possibility of virtual particle extraction from the vacuum. It's hoped that qualified individuals with access to laboratory facilities may be enticed to attempt replication of the technology solely for the expansion of scientific knowledge without any commercial intent to infringe upon Andrea Rossi's intellectual property or his Fluid Heater patent. (5) To get close to reproducing the performance characteristics that have been alleged may take significant effort and repeated modification of the apparatus being tested (external power supply circuit, electrode composition/size/geometry, and fuel composition), but a confirmation from a series of successful experiments could finally legitimize this field of exotic energy research - taking it from "snake oil" and "woo woo" to a discovery so paradigm shattering it could spark a new scientific revolution.

(As mentioned in the disclaimer near the top of this paper, all possible safety precautions should be taken when conducting replication attempts. In addition to the hazards from exposure to electrical shocks, chemicals, and high temperatures, conventional forms of radiation and yet to be fully understood "strange radiation" may be generated. All potential replicators should perform their own due diligence on these safety issues to minimize risk.)

A Brief Review of EVOs and Plasmoid Phenomena

Kenneth R. Shoulders, the widely accepted father of micro-electronics, coined the term EVO during his years of research experimenting with spark discharges. (6) He discovered that when an abrupt electrical pulse is applied to a sharpened cathode that the resulting cloud of ions and electrons would self-organize into a highly energy dense object which could produce an overwhelming number of anomalies. Typically, he would direct these "electron clusters" somehow overcoming their expected mutual electro-static repulsion down a narrow dielectric guide towards a target plate positioned near or atop the anode. The result upon impact could be mysterious non-thermal liquification of metals, transmutations of elements, isotopic shifts, small-scale EMPs (electromagnetic pulses), and at higher energies the production of x-rays. While observing these objects with an electron camera, he learned how to manipulate them in very precise ways: guiding them through obstacle courses, launching them over gaps, splitting them, and re-combining them. Oddly, he discovered that there were many variations of these small scale "plasmoids" (they were usually only a few microns in diameter) some of which could temporarily go into a "black mode", vanish into an unobservable state, and then re-appear at another location. Perhaps two of the most stunning observations were that they could be accelerated to high speed at very low energy cost apparently utilizing some sort of "warp drive" effect and they could effortlessly borrow through matter and deposit the substance at another location. He describes all of these discoveries in his very rare, self published book, "EV - A Tale of Discovery" and dozens of subsequent essays and articles published on the internet. Now, years after his death, his research and discoveries provide a solid foundation for anyone who wishes to study the mysteries and anomalies of similar self-organizing structures from the micro-scale to the macro-scale.

The most common theory as to the nature and composition of these EVOs is that they were micro-scopic toroidal vortexes of plasma - with internal positive ions and exterior electrons. To visualize this concept, imagine a donut shaped electronic inductor. Through the mass of the donut

positive ions would spin in a loop and wrapping around the exterior (like copper wire around a transformer) electrons would rotate in the opposite direction. He collected evidence of this through the markings produced both on the "launch" sites where EVOs would emerge from cathodes and where they impacted target plates: circular whirling marks were sometimes found. A full review of his work could fill a book, so a very few key points are as follows: he discovered EVOs are produced every time there is a spark discharge (even when you build up a static charge and touch a door knob), they seem to produce many different anomalies, and they form more readily and remain more stable in the presence of noble gases.

Winston Bostic is a famous American physicist who extensively studied plasmoid and vortex phenomena. (7) During his research of plasma filaments and other plasma structures, he observed many of the same anomalies as Kenneth Shoulders. In fact, these two pioneers began to communicate because they recognized the similarities between what they were observing. Perhaps a significant portion of Winston Bostic's research was not on micron sized EVOs but their larger cousins, spheromaks. (8) These plasmoid structures share nearly identical structure to EVOs, except they are much larger and, hence, far less energy dense. Hoping to utilize them as a method of achieving conventional fusion reactions, Winston Bostic studied everything about them. He learned the conditions by which they formed, the ways they could be manipulated, how they could be stabilized, and methods by which they could generate radiation of various kinds (x-rays and even neutrons). A key theme is that although spheromaks can be produced in pure hydrogen environments, even small quantities of noble gases could enhance their formation and stability. In one of his papers, he mentioned that the addition of five percent argon could increase x-ray production by ten fold. Moreover, he described how adding various gases of different weights (for example mixtures of noble gases in addition to hydrogen) could help further stabilize and "spin up" a spheromak via a whip like effect.

There are many terms that have been used to describe EVO like objects: complex space charge constructs, spheromaks, compact toroids, erzions, electron clusters, fireballs, pseudo-spark discharges, and a half dozen others. However, perhaps the most interesting is micro-ball lightning, because regular sized ball lightning seems to share many of the same properties and characteristics as EVOs. Papers speculating about the internal structure of natural ball lightning often describe them as spheromaks or plasma vortexes with internal positive charges and an exterior layer of electrons. (9) Most importantly, this double layer seems nearly identical in function to those of fireballs produced in direct current discharges. The double layer of ball lightning is a protective membrane that segregates the different regions of charge, absorbs matter and energy from the environment, uses a portion of it to self-sustain itself, and re-emits the remainder.

Description and Proposed Mechanisms

(The specific device described in this paper is the E-Cat QX, the predecessor to the E-Cat SK. Although the two systems seem to differ massively in terms of maximum power output (the QX being ran at lower output to avoid melting or damaging components), the core principles are considered to be the same even if there could be design differences.)

During the transition from a glow discharge to a true arc discharge, a transition zone is passed in which a negative resistance is experienced. In this negative resistance zone, the current rises while the voltage decreases - the opposite of ordinary resistance. (10) For such a negative resistance to exist, there must be a source of power for it. This comes from what is frequently described as a "fireball" or "complex space charge" that can appear on the cathode or anode, depending upon the properties of the circuit. For example, biasing the anode more positively can make the structure grow from it's surface. On the other hand, the same type of plasmoid with a double layer can emerge from a sharp tip on a cathode. Self-organizing from the chaotic mixture of positive ions and electrons, this structure develops a positively charged core and an outer covering of electrons: the same double layer that was previously mentioned. (11) The double layer produces an electrical gradient that can accelerate ions and electrons, absorbing and expelling matter and energy. To power the negative resistance, this "plasmoid" absorbs heat and converts it to electrical current. (12) Simultaneously, the highly non-linear properties of the fireball - a macro-scopic EVO - can produce self generating oscillations through the discharge tube. These "ion acoustic oscillations" or surges of ions and electrons only take place during a condition of negative resistance. (13) All of this can be seen on an oscilloscope. These oscillations are highly dependent on the properties of the exterior circuit. If undamped and attached to a high Q factor (highly resonant) circuit, the oscillations can grow in amplitude.

The QX is designed to take advantage of the same phenomena. As pictured in the Rossi Gullstrom paper, it consists of two nickel rods (high in manganese and speculated to be coated in platinum) positioned with their rounded faces separated by a gap of perhaps around a centimeter. (14) A small sharpened tip on the cathode, perhaps barely visible, would assist in the production of the fireball or EVO. Furthermore, if one studies the writings of Kenneth Shoulders, the idea of using a hollow cathode would seem potentially useful in generating a more powerful "pseudo-spark discharge." However, a more "natural" electrode tip produced by a conditioning period consisting of discharges at higher than ordinary currents could also produce a sharp tip. The two electrodes are within a transparent tube of an unspecified and allegedly custom-made material. Wires connect the two electrodes to a power supply.

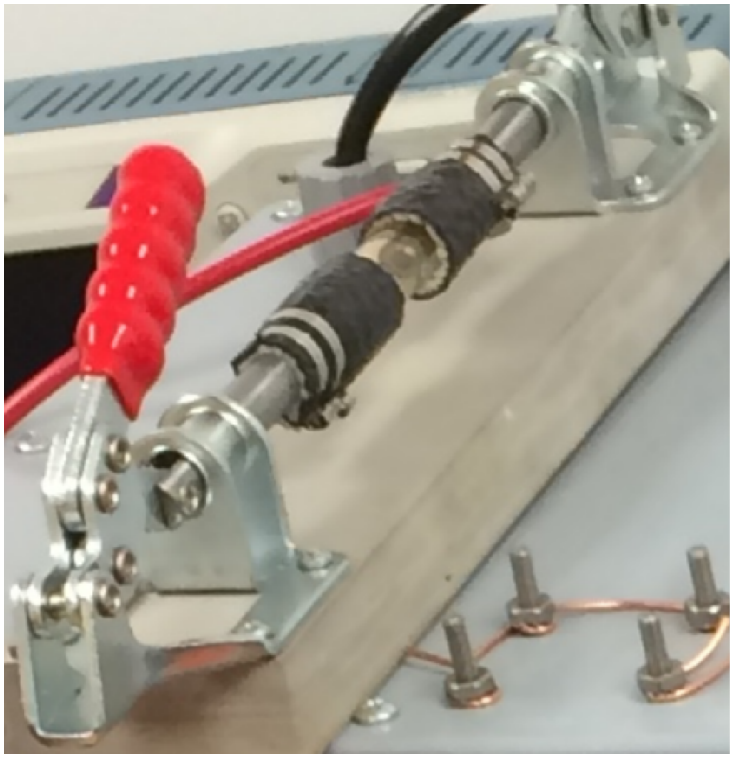

Image of the E-Cat QX from the Rossi Gullstrom paper. Please notice the visible electrode with a seemingly darker center portion where a tip would be positioned. Is this evidence of a hollow cathode, an area thermally damaged, or an illusion? If this is a hollow cathode, could it be filled with LiAlH4 or LiH?

From the video of the public demonstration of a QX unit in Stockholm, Sweden, we know that in typical operation a sudden discharge of seemingly high voltage and high current produces an ionization of the interior of the discharge tube - which was so bright that light from the plasma even escaped through the ends of the heat exchanger. After the initial jolt, the input power is reduced to extremely low levels and the self-generating oscillations can be seen on the screen of the oscilloscope along with a small positive DC bias voltage. These oscillations are the signature of excess heat production; they are literally electrical currents that have been produced by the double layer converting thermal energy from nuclear reactions into electricity. Although a continual input must be supplied to supply electrons to the meta-stable fireball, if the results of the Stockholm demonstration are accurate, it can be a tiny fraction of the thermal output. It's also likely that the extreme low level input is pulsed at a resonance frequency to match the ion-acoustic resonance taking place: thus sustaining the ongoing oscillations that are producing excess heat. A sophisticated control system may be needed in a highly optimized system to adjust the input as the plasma in the discharge cell heats up, the pressure in the tube increases, and the ion-acoustic oscillations change in frequency. This may not be required for basic setups.

The self sustaining oscillations apparent on the oscilloscope during the Stockholm demonstration of the QX. They appear after the initial higher powered pulse. Things to notice: 1) The positive DC bias that may be inherent to the plasma or may be applied by the power supply. 2) The frequency of these oscillations were said to be approximately one hundred kilohertz which is in the range that would be expected for a large gap between electrodes and near atmospheric pressure. 3) These oscillations are the signature of a negative resistance in a electrical plasma discharge. They represent thermal energy transformed into electrical current. 4) The input power during this period has been dramatically reduced and may consist of only a weak direct current or perhaps supporting frequencies.

An important factor that should not be overlooked is that different but related technologies using these principles have been developed in the past. Thomas Henry Moray, Paulo and Alexandria Correa, Paul Brown, and Alexander Chernetsky all built devices that utilized self generating resonant oscillations from the negative resistance regime. More specifically, Alexander Chernetsky's "Self Generating Discharge Tube" and Paulo Correa's "Pulsed Abnormal Glow Discharge" device both produced back-rushes of current to the power supply when the discharge was terminated or the circuit was opened. This can damage power supplies and produce overheating. Andrea Rossi's power supply for the QX consumed far more power than what was required to be sent to the discharge tube due to the need for active cooling. Most likely, he was experiencing these sudden spikes of current as well. These discharges can be very powerful: Chernetsky is reported to have destroyed a small electrical substation with a back spike from his device. The explanation for these surges have varied significantly; however, what's known beyond a doubt is that they are real and can take place.

What's also important to consider is the combination of fuel that Andrea Rossi is likely utilizing in the QX. In the Rossi-Gullstrom paper, the fuel is listed as $LiAlH_4$ and the presence of both hydrogen and lithium in the plasma are mentioned. (14) Moreover, in his power point presentation presented at the Stockholm demo, he indicates that the lithium to hydrogen ratio in the plasma is related to the output energy. (15) In this is so, probably only a tiny quantity of $LiAlH_4$ is placed in the reactor, because a

pressure much above atmospheric is probably not desirable. The initial high current and high voltage pulse would vaporize the LiAlH4 so that the elements mix in with whatever other gases are present. If a hollow cathode for a pseudo-spark discharge is utilized, a good location to place the LiAlH4 or LiH might be in the hole surrounding the needle like protrusion.

Argon and perhaps other noble gases are also probably used in the reactor. The only direct evidence we have for the presence of argon might be the bright blue light that emerged from the reactor during the Stockholm demonstration - high pressure argon plasma is bright blue in color. However, we have an abundance of indirect evidence because we know beyond a doubt that noble gases enhance the formation of plasmoids in general. Shoulders, Bostic, and Correa all utilized noble gases to enhance the formation of these self organizing structures. Another nugget of information in the support of Argon is that it's by far the cheapest and most available inert gas. Two series of articles written by George Egely expand on a range of devices that utilized the principles of the QX some of which used argon and other noble gases. (16) (17)

Yet another possibility is that Rossi adds a percentage of deuterium gas to the reactor. From a list of abandoned patent applications that he submitted, after reading the titles (the abstracts and body of the patent applications were not provided) we know that he utilized deuterium in some of his systems. The use of deuterium could increase the reaction rate due to the increased cross section.

Perhaps the final potential fuel components that should be mentioned are the nano-particles that would be sputtered off the electrodes. If they are coated with platinum, a metal that could be beneficial in many ways, then most of the nano-particles would be of that element. However, nickel and manganese nano-particles could also be present. But if Andrea Rossi has incorporated method of reducing erosion of his electrodes - which he claims is not a problem - then there would only be a small amount of sputtered nano-particles in the plasma. These nano-particles may not be a major source of fuel.

The utilization of a "magnetic mirror" or "magnetic cusp" effect may be utilized to keep the macro-EVO off the surface of the electrodes. In the Chernetsky and Correa devices, the erosion of the sharp tips on the electrodes was a huge problem. (18) Preventing this by placing permanent or electromagnets behind each electrode to produce a zone of weaker magnetic field lines in the exact center of the discharge tube that would trap the EVO there could solve this problem. By being placed at the far ends of the device away from the hot plasma, permanent magnets could plausibly retain their magnetic field instead of being demagnetized from the heat. However, using magnets to keep the EVO off the electrodes may not be required. A series of high frequency pulses after the initial pulse could help keep the plasma ball positioned away from the electrodes. Also, being in the center of the discharge tube could be a signature of maximized ion-acoustic resonance.

LENR and the Double Layer

There are many speculated methods by which the double layer of the EVO may produce nuclear reactions. One possibility is that protons traveling through the electron layer could be impacted with an electron with enough energy to form a neutron-like construct with a neutral charge. Once formed, this

neutron-like object (perhaps in theory the smallest imaginable EVO) could be captured by any of the elements present in the plasma and release a significant quantity of energy. Another possibility is that the dense layer of electrons could produce a powerful electric field that could screen the Coulomb barrier if two ions collided. Yet another possibility is that since lithium can undergo fusion reactions with hydrogen ions of very low energies (check out the work of Unified Gravity Corporation) the energy imparted by the double layer to the ions may be high enough to induce fusion between hydrogen and lithium. Experiments by Unified Gravity Corporation have verified extremely high reaction rates between hydrogen and lithium in plasma within a low energy window of around 200eV (much lower or higher the reaction rate drops). (19) Interestingly, they produce a plasma consisting of argon, lithium, and hydrogen and pulse it with alternating positive and negative electric fields induced by square waves. Doing so makes the lithium and protons collide and undergo fusion. This could be similar to what happens in the QX when the surges of ions from the double layer suddenly change direction. If this is a mechanism that produces excess energy in the QX, finding the precise amplitude of the oscillations that provides around 200eV of energy to the ions would be critical. Finally, another possibility is that the particulate matter such as nano-particles of platinum or nickel may be impacted by electrons which penetrate the surface and get stuck. Eventually, a massive electric charge could build up which might be capable of screening reactions between nearby positive ions that might crash into the particle.

Most likely, one or more of the above mechanisms are active to some degree in the double layer, but there is another possibility of what may be contributing to the heat produced. The abrupt motions and collisions of ions could polarize the active vacuum and extract either virtual photons or virtual particles from the active vacuum. (20) If electron-positron pairs are extracted, a percentage of the positrons may annihilate with electrons in the plasma producing energy. Andrea Rossi has already mysteriously commented that a test has been performed with a laser inferometer to determine if the vacuum is being manipulated by the device, but he refused to give any more information. Could he be holding evidence that the QX/SK is actively manipulating the vacuum?

Simon Brink and "Small Hydrogen"

Researcher Simon Brink on his "Subtle Atomics" website proposes a theory that proposes the orbit of an electron around a hydrogen atom can be reduced below the "ground state" so that it is closer to the nucelus. (21)According to his theory, the shrinking of the electron orbit would release an energy of a few hundred to perhaps closer to a thousand electron volts per reaction depending on the fractional state that is achieved. He claims that in addition to having hydrogen in the atomic state that catalytic elements are required, and he provides a list of several. Other parties have provided their own similar list of catalysts. Interestingly, lithium, argon, platinum, and nickel are all potential catalysts.

Perhaps what's more interesting about his theory compared to others is that he predicts these hydrogen atoms reduced in size could more easily fuse with other elements. This claim has been made before by another researcher in his patents but now seems to be dismissed. If the fuel mixture in the QX is highly optimized to produce small hydrogen, this could be yet another possibility as to how nuclear reactions are being generated. Could hydrogen atoms with reduced electron orbits more easily fuse with other

elements when passing through the double layers of the EVO?

What should also be pointed out is that the energy released by the reduction of the electron orbit cannot by any means be the only source of energy in the QX. Andrea Rossi claims that the reactor, a small cylinder of only a few centimeters in volume, only needs to be re-fueled every six months to a year. This is only possible if nuclear reactions are being produced that release millions of eV per reaction. If only a few hundred eV were generated per reaction, the fuel would be depleted in a very short period of time.

The formation of small hydrogen can only account for a small fraction of the energy produced by the QX. However, it could be part of how nuclear reactions are being induced. Please be aware that no one knows for certain what transformation takes place when a hydrogen atom is exposed to one of these catalytic elements. All that's known is that sub-nuclear, supra chemical energy seems to be released.

List of Components and Concepts

Here is a breakdown of the various components of the QX and the concepts behind them. Since there is probably a lot we do not know about the technology, this list should NOT be considered as complete. Some of the following are also guesses and should not be considered fact.

1) Nickel 212 alloy (high manganese) platinum plated electrodes - Platinum not only has a higher melting temperature than nickel, but it's also a poorer thermionic emitter, especially when undoped. This is a very good property, because it will help prevent the discharge from being pushed beyond the negative resistance zone to a true arc discharge with positive resistance. In a positive resistance arc discharge, the erosion rate would be high and the double layer would vanish. Additionally, it's possible that if Rossi desired to add deuterium to the plasma, he could easily load the the deuterium into the platinum in an electrolytic cell. When the platinum heated up, deuterium would be released. Also, the cell should be designed so the distance between the electrodes can be adjusted. The distance between the electrodes along with the gas pressure will alter the ion acoustic resonance frequency.

2) Hollow Cathode with Protrusion inside - A hollow cathode allows for a powerful electric field to build up inside and suddenly discharge in what is called a pseudo-spark. However, a hollow cathode may not be required. An extended period of high current firings might be enough to produce a small tip that might not even be visible without a magnifying glass. The tip will allow for the EVO to be formed at a much lower voltage as long as it is not damaged. If damaged, then the control system could send a series of powerful pulses to regenerate the tip. Hopefully, a magnetic mirror configuration or a state of perfect ion acoustic resonance would keep the EVO off the electrodes.

3) High temperature transparent tube - A high temperature fused silica or quartz tube may work. However, we don't know what custom modifications Andrea Rossi has made.

4) Backing Magnets for Mirror Effect - If optimizing the ion acoustic resonance or applying higher frequency impulses to the reactor tube doesn't move the plasma ball off the electrodes, then samarium

cobalt high temperature magnets could be placed at the rear of the nickel electrodes. In the image from the Rossi Gullstrom paper, the nickel electrodes appear very long. Magnets placed at their rear may not demagnetize. Additionally, a small coil of wire behind the nickel electrodes could produce a similar magnetic field.

5) Power Supply - The whole circuit should be made to have as high of a Q factor as possible. By optimizing the amplitude of the self generating oscillations, the production of excess heat will be increased and the input power can be decreased. The power supply should also be capable of applying high voltage, high current impulses with a fast rise time and be capable of immediately lowering the power when additional resonant frequencies are applied to the plasma. An intelligent circuit that would sense the electrical output from the plasma and adjust the input pulses as the resonant frequency changes would be very useful.

6) LiAlH4, LiH, Argon, Deuterium - LiAlH4 and LiH could be instantly vaporized by the high powered initial discharge. Combined with argon to help promote the formation and stabilization of the EVO, the deuterium could increase the reaction rate. However, experiments should be performed with the natural isotopic ratio of hydrogen and deuterium enriched hydrogen. Additional noble gases could be tested.

7) Safety Gear - A whole range of safety gear should be used during the construction and testing of the device. Obviously, standard safety protocols for dealing with electricity, potentially caustic chemicals, metal irritants, ultra-violet light, and high temperatures should be followed. However, due to the possibility of known and unknown forms of radiation emitted, additional measures should be taken. For example, the use of detectors for known types of radiation, using a protective barrier around the device, and staying away from the device while in operation. A remote camera system should be used to view the plasma.

8) Weak Ionizing Radioactive Element In Cathode - This is unlikely due to the fact Andrea Rossi has always declared that none of his systems include radioactive elements. However, if a weak radioactive substance was incorporated into the cathode, it could pre-ionize the environment and allow for a discharge to take place at a much lower voltage.

The Technology In a Nutshell

The transition of a plasma discharge to the negative resistance regime requires a complex space charge construct with a double layer to be produced. When connected to a highly resonant, fine tuned exterior circuit the amplitude of the ion acoustic waves generated by this "macro-scale EVO" can be increased to a highly significant degree. This self-organizing plasmoid while exchanging matter and energy with its environment may induce nuclear reactions in this state of resonance if an optimized fuel mixture is utilized: hydrogen, lithium, and argon being the most important. Although the dense electrons of the double layer may allow screening of Coulomb barrier or the modification of hydrogen into neutron-like structures, the oscillations in the plasma may allow lithium and protons to collide with a favorable window of energies around 200eV. Critically, the plasmoid must be kept off the surface of the

electrodes to prevent erosion of the very important sharp tips. Application of high frequency electric fields, magnetic mirror configurations, or finely tuned resonant conditions may allow for this.

Extreme Speculation

The United States Department of Defense announced in late 2017 the existence of the Advanced Aerospace Threat Identification Project (AATIP). For a period of several years, this project studied evidence in the form of gun camera footage, radar data, and visual accounts of encounters between the most sophisticated air craft and anomalous aerial vehicles. The former director of AATIP, Luis Elizondo, has went on the record to say that such unknown objects are indeed physically real craft from a non-terrestrial origin, exhibit performance characteristics which indicate non-newtonian propulsion systems capable of manipulating the active vacuum (warp drive), and are continuously being encountered by military aircraft. The author speculates that these objects are potentially manipulating the vacuum and producing warp-drive like effects by mimicking an extremely large scale, macro-EVO or complex space charge construct. Moreover, due to the admission by multiple individuals associated with AATIP that recoveries of such craft and de-engineering attempts have taken place, it's likely that highly compartmentalized Special Access Projects - perhaps embedded in aerospace corporations to avoid detection and oversight - have indeed constructed vehicles such as the Fluxliner Alien Reproduction Vehicle. (22) A better understanding of the EVO phenomenology could allow us to gain knowledge that could bring the **"core secret"** of the United States military-industrial complex into the light of day and out of secrecy.

Conclusion

The QX, if verified to perform as Andrea Rossi claims, represents a technological marvel that could hurtle mankind into a new age. However, proof or refutation of the existence of this technology is desperately needed.

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