Quantum chaos interpretation of LENR phenomena in conducting wires under transient electric pulses

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Quantum chaos interpretation of LENR phenomena in conducting wires under transient electric pulses

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Abstract: In this paper, I will present and interpret Low Energy Nuclear Reaction (LENR) phenomena that appear during experiments, where transient high voltage electric pulses are applied on conducting linear structures like metallic wires or sheets. This method of LENR generation can be used for the construction of proper LENR machines for low-cost energy generation.
Keywords: exploding wires, LENR, Stark effect, Quantum chaos, electron capture

I. Introduction

Signs of Low Energy Nuclear Reaction (LENR) phenomena have been observed in various experiments triggering new research. Low Energy Nuclear Reactions (LENRs) are related to the production of excess heat and other nuclear effects that occur at relatively low temperatures and pressures. Among them the most important to my mind are the following:

- Biological-, transmutations
  https://www.researchgate.net/publication/282984962_Biological_transmutations
  February 2015 Current Science 108(4):633-635 Jean-Paul Biberian
- Transmutations that occur in many experiments related to the so-called Cold Fusion https://blogs.scientificamerican.com/guest-blog/its-not-cold-fusion-but-its-something/
  December 7, 2016, Steven B. Krivit and Michael J. Ravnitzky
- Strong explosions of expired Lithium batteries, The explosive problem of 'zombie' batteries - BBC News 26 October 2020 https://www.bbc.com/news/business-54634802

However, Low Energy Nuclear Reaction (LENR) phenomena have been observed without the scientific community presenting a satisfactory explanation for them. The most important theories attempting to explain LENR that have been proposed are shortly presented as follows:

The Widom-Larsen theory proposes that the observed excess heat in LENR can be explained by the production of electron-capture phenomena, such as the generation of neutrons by protons [1]. According to this theory, new elements are produced by a weak interaction between electrons and protons in a metal lattice generating neutrons.

Another theory is the lattice-assisted nuclear reaction (LANR) model, which proposes that LENR occurs when hydrogen is absorbed into a metal lattice, leading to the formation of tightly packed hydrogen clusters. These clusters are believed to undergo fusion reactions that produce helium, with the release of excess energy. There is also the Holmlid model, which proposes that LENR can be explained by the formation of ultra-dense hydrogen (UDH) in metal hydrides. UDH is a highly compressed form of hydrogen that is believed to undergo fusion reactions with other hydrogen nuclei, leading to the production of excess energy. Other theories have been proposed to explain LENR, including the surface plasmon polariton model, the Bose-Einstein condensation model, and the nano-plasmonic model.

I believe that all the LENR phenomena have the same origin thus the most important thing is to reveal the mechanism by which the LENR phenomenon appears, because if we understand the mechanism, then we can make reproducible LENR experiments and relative applications.

The Widom-Larsen theory was developed by physicists Allan Widom and Lewis Larsen in the early 2000s, building on earlier work by Widom and Y. N. Srivastava [2]. In the paper, a possible explanation of the LENR phenomena was presented. Their assumption that is possible to be generated high-energy electrons that are capable to penetrate the rest electron shield of the ion atoms and enter to the nucleus was theoretically arbitrary. Thus, their explanation was deemed erroneous [3].

However, their argument that LENRs are caused by electron capture forcing nuclear reactions leading to transmutations can still be valid.

In the present paper, an alternative modification of the Widom-Larsen model will be proposed, explaining LENR phenomena in conducting wires or sheets under transient electric pulses.

The electron-capture elements produced in this way can then undergo nuclear reactions with other nuclei in the metal lattice, leading to the production of excess energy in the form of heat or light. The theory proposes that this process can occur at relatively low temperatures and pressures and that it does not require the extreme conditions that are typically associated with conventional nuclear reactions of fission or fusion.

According to my alternative proposed theory, Low Energy Nuclear Reactions (LENRs) also are not fission or fusion nuclear reactions and are generated when free electrons under special conditions overcome the screening barrier of the rest electrons of the atom ions in the metal lattice, enter its nucleus, and transform protons into neutrons.

From this point of view, the electron capture phenomenon is fundamental in order to understanding LENRs and their effects.

But as I will explain in the following text, electron capture occurs in extreme quantum chaos phenomena when electrons are guided to the middle of a conducting wire or sheet by a transient electric solid pulse.

In the following text, I will present my view of the LENR generation in linear conducting structures when a transient voltage pulse is applied to them. Also, I will present a possible path by which we can make a particular LENR machine that will generate more energy than its input electric energy.

II. Quantum chaos of free electrons in conducting wires or sheets under transient electric pulses

The behavior of free electrons in metals is an important topic in condensed matter physics and quantum chaos theory [4] has important implications for understanding the properties of these electrons.

In a metal, the outermost electrons of the atoms are not tightly bound to their individual atoms, and instead form a "sea" of free electrons that are shared among all of the atoms in the metal. These free electrons can move (almost) freely through the metal, and their behavior is described by quantum mechanics.

One of the key predictions of quantum chaos theory for free electrons in metals is that the energy levels of the electrons will be highly irregular and non-uniform. This means that the spacing between the energy levels will not be constant, but will instead vary in a way that is difficult to predict using standard quantum mechanics.

This irregular spacing of energy levels is known as "level repulsion," and is a hallmark of quantum chaos. It arises because of the complex interactions between the free electrons in the metal, which can lead to chaotic behavior.

The irregular energy level spacing has important implications for the electronic properties of metals, including their electrical conductivity and their response to external fields such as magnetic fields.

In the case of conducting wires or sheets under transient strong electric pulses the chaotic behavior of their trapped free electrons, that initially are obeying in Schrodinger equations, can have unexpected LENR phenomena that were noticed in many experiments and will be presented in the next chapters.

III. Experiments with linear conducting structures

In 2008, as part of my research, I came across a theory where the unexplained cut in the middle of a conductor when it receives a sudden electrical pulse, challenged Maxwell's theory and beyond, the special theory of relativitywhich is inseparably linked.

Having lectured on Maxwell's theory for years, I could not resist the temptation and proceeded with a series of relative experiments that led to a Maxwellian interpretation of this phenomenon [5]. According to this interpretation, there is a transient concentration of free electrons near the centers of said wires that create shear forces to them, which in effect is capable of even cutting the wire for strong enough voltage pulses.

Any conducting structure can be considered as a quantum trap of free electrons enclosed by the boundaries of the structure and obeying the Schrodinger equation. We focus on experiments when transient voltage pulses are applied on linear conducting structures of negligible thickness and length L. The free electrons inside a linear conducting structure will move, near its surface, under any external voltage excitation V and the system will behave as a quantum trap defined by the spatial Schrodinger equation. $\partial^2 Y(x)/\partial^2 x = -(\varepsilon - U) \cdot Y(x)$, Where: $(\varepsilon - U) = \frac{2m}{(h/2\pi)^2} * (E - V)$

The wave eigenfunctions of the free electrons inside the conducting structure can be defined by the respective wave Schrodinger equation considering V=0.

In the classic Bohr interpretation of the Schrodinger equation, the function $|Y(x)^2|$ defines the probability of an electron being in point x. Due to the extremely high number of free electrons, we can assume that $|Y(x)^2|$ is proportional to the number of electrons at x, thus this function defines the electric charge along the conducting linear structure.

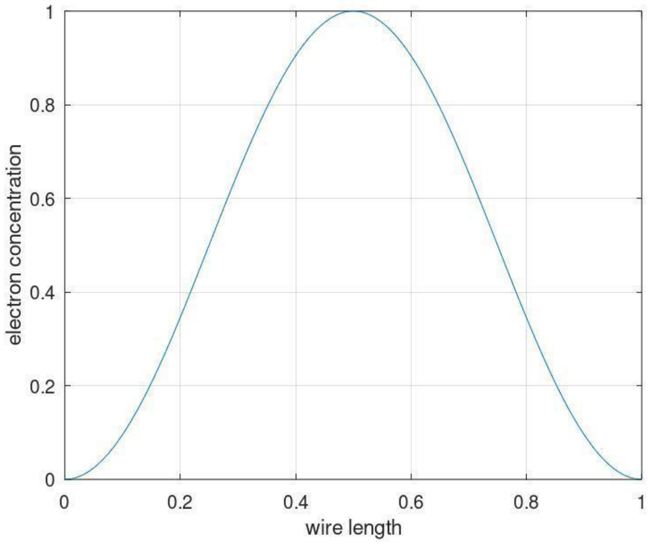
Due to the wave nature of the Schrodinger equation, the functions $Y(x)$ without any external voltage excitation should be a set of eigenstates $Yn(x)$ with respective eigenvaluesεn defined by the geometric boundaries of the structure where the wave function is considered zero.

Specifically, for a thin linear conducting structure of length L, obeying the Schrodinger equation, due to the boundary conditions Y(0)=0, Y(L)=0, can be defined as:

$$Yn(x) = A * sin\left(n\pi \frac{x}{L}\right), \qquad \varepsilon = (n\pi/L)^2$$

Thus, the fundamental $Y1(x)$, which has the minimum energy $\varepsilon 1 = (\pi/L)^2$, is given by $Y1(x)$=A*sin(π*x/L) and for this fundamental harmonic the electron concentration will be given by $|Y(x)^2|$ =A^2*[1-cos(2π*x/L)]/2 shown for A=1 in figure 1

FIGURE 1



Thus, the fundamental prevailing transient quantum harmonic, with a wavelength equal to half of the wire length, creates a transient electric current wave on the linear wire, that as a result leads to a transient concentration of free electrons in the center of the linear wire, which in several cases can cause the wire disintegrating in its middle. In pinch experiments with salted water in an open linear bottle, half of the water was ejected, as our model predicts [6].

Considering the experimentally proven (transient) free-electron concentration near the middle of the linear wire under a transient electrical pulse, besides other phenomena, the generation of LENR effects becomes possible. In order for a free electron to initiate a LENR effect, it should enter the nucleus of an ion in the metallic lattice. The arriving free electrons at the middle of the wire, by both directions, have a relatively low kinetic energy insufficient to overcome the screening barrier of the rest electrons of the lattice ions. However due to the strong collective electrostatic forces made up by the electron concentration in the middle and the occurring Stark effect, the screening barrier of lattice ions is weakened or eliminated, thus the penetration of free electrons in the nucleus of metal lattice ions becomes possible.The transmutation of a protons to neutrons, beyond other phenomena, will generate new chemical atoms and possibly excess heat.The necessary energy (>0.78 Mev) for the transmutation of a proton to a neutron is received by the electrostatic field of the positive proton and negative electron.

IV. Curvilinear conducting structures

Quantum phenomena in conducting curvilinear structures are related to the geometry of the structures. The general problem of calculating eigenvalues and eigenfunctions arising from Schrodinger dynamics in non-planar (non-Euclidean) two-dimensional structures is very complicated and can be tackled only numerically. However, the one-dimensional non-Euclidean case, i.e. as the case of curvilinear conducting structures can be tackled numerically more easily and in special cases, the wave characteristics of their trapped free electrons have analytic forms.

The Schrödinger wave equation for a one-dimensional (thin) curvilinear conducting structure developed along its parametric length *s* with can be proved [7] can be written as follows

$$\partial^2 Y(s)/\partial^2 s = -\left(\frac{\sigma^2(s)}{4} + \varepsilon\right) \cdot Y(s)$$

The standard curvature can be given by the local radius *R(s)* via the relation *σ(s)= 1/R(s).*
The curved linear conducting structures of constant curvature σ are in general three-dimensional helices given by the set of equations in Cartesian coordinates as follows:

$$x(t) = a * cos\, cos\,(t)\,, y(t) = a(t)\,, z(t) = b * t, 0 \le t \le T$$
$$and\ s(t) = t * sqrt(a^2 + b^2), thus\ L = T * sqrt(a^2 + b^2)$$

The constant curvature σ of this helical wire is given by:

$$\sigma = |a|/(a^2 + b^2)$$

As a result, for the boundary conditions *Y(0)=0, Y(L)=0,* the first harmonic of Y(s) will be given by:

$$Y(s) = A * sin\left(\pi * \frac{s}{L}\right), \quad where \ \frac{a^2}{4(a^2 + b^2)^2} + \varepsilon = \left(\frac{\pi}{L}\right)^2$$

Thus, the minimum energy for excitation of the first harmonic it will be given by the relation:

$$\varepsilon = \left(\frac{\pi}{L}\right)^2 - \frac{a^2}{4(a^2 + b^2)^2} > 0$$

Let us assume that T=2π, hence $L = 2\pi * sqrt(a^2 + b^2)$, $\varepsilon = 1/4(a^2 + b^2) - \frac{a^2}{4(a^2+b^2)^2} > 0$

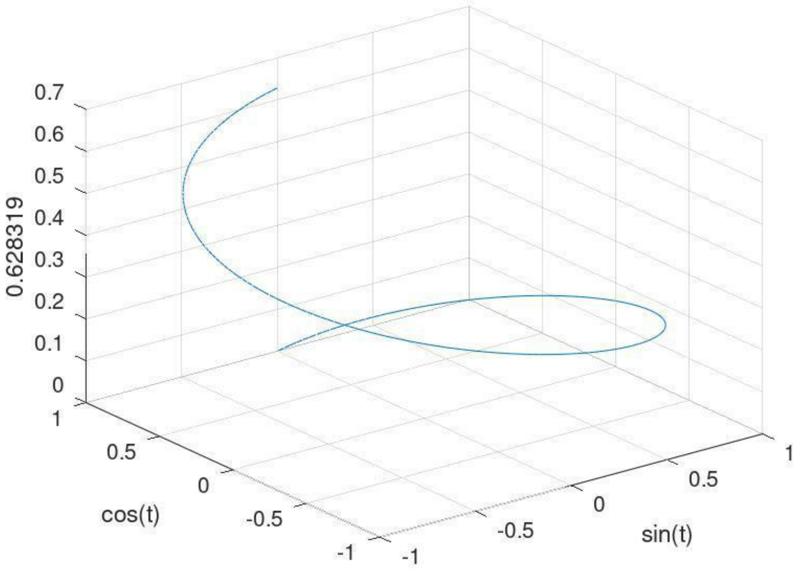
$$\varepsilon = \left[\frac{1}{4(a^2 + b^2)}\right] * \left[\frac{b^2}{(a^2 + b^2)}\right]$$

Thus, by simply taking b <<a the minimum energy of the fundamental eigenfunction can become negligible and the curved helical wire can be excited by a negligible voltage potential.

For T near the 2π, the minimum energy can become negligible for the appropriate relation of the constants a and b. In the author's opinion, this may also be one of the reasons for the self-explosion of "*zombie*" (expired) lithium batteries due to the accidental formation of helically shaped micro threads or "*dendrites*" of pure Lithium inside them.

A helical curved wire of a=1, b=0.1, and length approximately 2π is shown in figure 2

FIGURE 2 HELIX

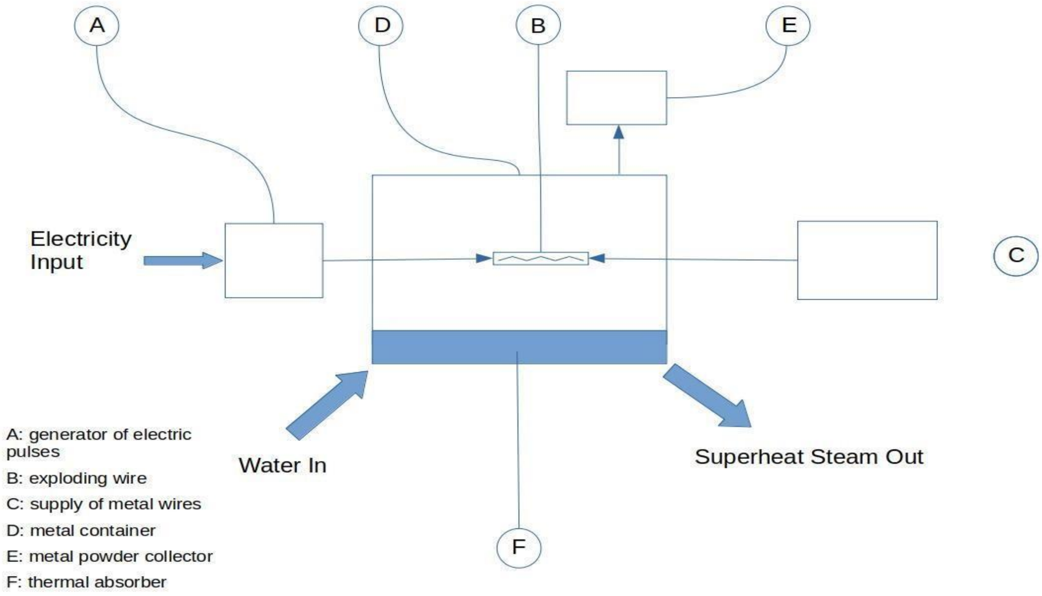


V. Provisional patent of a pap-lenr machine and LENR energy cost

Shortly our proposed LENR thermal machine will use as fuel small and thin conducting threads or sheets which we briefly refer to as LENR pellets. The conducting LENR pellets will be coated with a thin layer of an active material that can create LENR effects when the LENR pellets receive strong electric pulses

By the generated LENR effects we intend to produce thermal energy Q times higher than the electric energy of the electric pulse received, where Q should be for example greater than 10

Our company estimates that for thre first LENR thermal machine, the important thing is to achieve a high Q factor and not a high energy generation as in FUSION proposed machines.



Even a very small amount of active LENR material can generate a huge amount of thermal energy. For example, if we assume that the active material is Lithium, for every atom in a LENR, at least one million EVs could be generated.Let us say that the classical chemical reaction of burning carbon with oxygen generates only 4 EVs, thus the great advantage of LENRs is that they generate millions of times more energy than chemical reactions.

If we assume that a lithium atom transmuted to Helium during a LENR reaction approximately one million EVs of energy will be generated, it can easily be proven that one gram of lithium will produce 3,8 MWh. This amount of energy would demand 354 cubic meters of NG or 350 liters of diesel to be generated in combustion machines.

At current prices lithium costs approximately 400,000 USD/ton, thus one gram of lithium costs about 0.4 USD, by which we can generate 3.8 MWh, thus the fuel cost of any LENR machine, if and whenever they will be built, would be negligible.

The cost of the electricity produced by LENR technology will depend mainly on the cost of the LENR thermal machine which will produce superheated steam, by which a steam turbine will generate electricity. It should also be noted that lithium or similar LENR materials are in abundance and the quantities needed to meet the energy needs of our planet are for thousands to millions of years. LENRs alsoare not producing any radioactivity. Thus, the effective use of LENR technology could solve the threatening greenhouse effect on our planet.

VI. Conclusions

In the paper, a theory was presented regarding the possible appearance of LENR phenomena during the application of high-voltage transient electrical pulses (pinches) to linear or curved conductors. The LENR phenomena are created when free electrons manage to penetrate the screening barrier of the rest electrons of the ion atoms and enter the nucleus of the ion atoms transforming protons to neutrons.

This phenomenon in general is called electron capture and occurs naturally in several cases. In the spontaneous electron capture phenomena, free electrons enter the nucleus of atoms, join with nucleus protons, and turn them into neutrons. The forced electron capture induced by strong transient voltage pulses on conducting wires or sheets is due to the chaotic behavior of free electrons concentrating in the middle of wires or sheets and leads to Low Energy Nuclear Reactions (LENRs). The generated new elements by the occurring transmutations of the lattice atoms involved, are accompanied by the production of neutrons and heat, i.e. nuclear energy generation phenomena.

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