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EDITORIAL COMMENTS

NOT DISSIDENT BUT AUGMENTED

In Einstein's later years he questioned whether his life's work would prove of lasting value. With his wife's mathematical help, Einstein, the theoretical physicist, began with a false notion and achieved remarkable results. Today, the scientists in many countries have essentially moved forward from both Special Relativity and General Relativity into a more complete understanding of Nature.

No scientific breakthroughs have ever been credited to preservation of the status quo. There is virtue in erecting bulwarks against error. There is little virtue in defending the past by condemning progress. Neither a scientist nor a journal need be dissident. Progress can be made by correcting past errors, such as some of the errors made in SR. More progress can be made by augmenting our understanding of nature through new discoveries, new hypotheses to be tested, and new theories to be thoroughly evaluated by experiments.

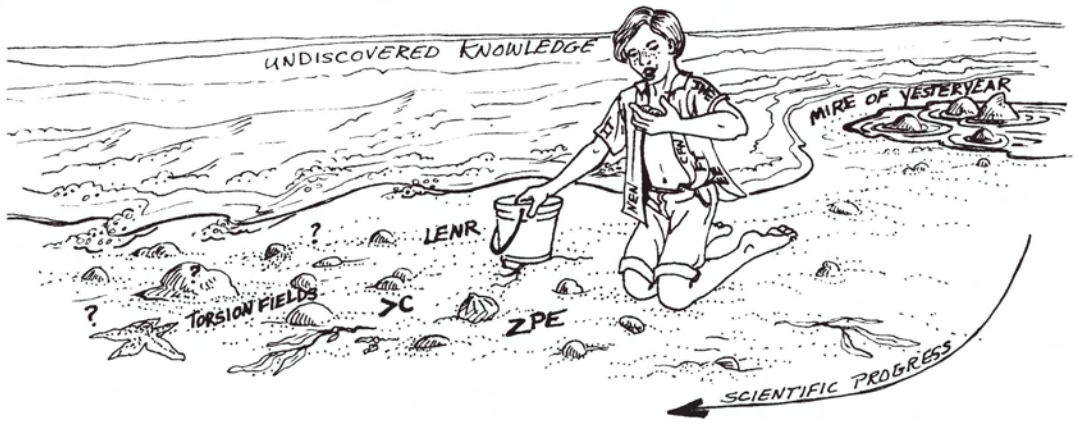
There is no question but that our electromagnetic equations have served to help advance many aspects of electricity and magnetism. However, they were simplified by Heaviside from the 20 equations developed by Maxwell. The simplification made the equations easier for engineers and scientist to understand and use. However, they also simplified out some of the meaningful aspects of electromagnetic reality as conceived by Maxwell.

Neither Einstein, Maxwell, nor Heaviside would ever claim to have encompassed all truth in a set of equations. Why then do some of today's "lesser lights" so dogmatically defend partial truths against the onslaught of new truths.

This Journal of New Energy is not a dissident journal. We do not seek to condemn nor correct past errors. "Let the dead past bury their dead.*" This journal seeks to explore new realms somewhat in theory, but more dedicated to experimental evidence. Here are some of our findings, (for which we have published articles): The speed of light is not constant. Torsion fields exhibit strong superluminal velocities. The aether didn't disappear with one failed experiment (Michelson-Morley). Low-energy nuclear reactions are a scientific fact (hundreds of successful experiments). There appear to be biological nuclear reactions. Electromagnetic phenomena have outgrown Heaviside's simplified equations.

This journal is not devoted to dissent but to augmenting scientific progress. In this editor's judgement, that is what a scientific journal should do. To paraphrase Newton: We stand on the shores of a great ocean of truth examining pebbles on the beach, some more beautiful than others, while the whole sea of unfound knowledge lies before us. It does not make sense to wallow in the mire of yesteryear when there are an abundance of gleaming pebbles on the beach to explore.

* from Henry Wadsworth Longfellow's "A Psalm of Life"



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THE NEED FOR ACCURATE REPORTING AND ARCHIVAL OF DATA FOR ADVANCED ENERGY CONVERSION DEVICES: THE INE DATA BASE

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ABSTRACT

A methodology is presented to collect, document, and summarize the finding of the various experiments, motors, generators, devices, and demonstrations in the innovative energy conversion areas that have been reported in the past several years to produce very high-efficiency or so-called over-unity operation. The concepts of free and over-unity devices are not new, and many examples of such devices have been built utilizing various forms of potential energy within the last 100 years, such as hydro-electric dams and nuclear reactors. As many such devices and experiments are currently being reported, it is important and necessary to collect the data available on each, cross-check the data with other researchers, and maintain an accurate and truthful accounting of the status of each device and experiment. The INE Database has become an internationally recognized summary of such data. This paper presents the description of this database, its location on the publicly available Internet, and provides instruction on how to add new devices and experiments to this database, and also how to modify and update the existing data. Selection criteria based upon technical interest, and also on commercialization interest, allow these data to be easily ranked for comparison and reference.

This information is being provided with the hope and trust that it will be used by each of the researchers in all of these advanced energy fields.

I. INTRODUCTION

'Energy' cannot be created or destroyed - it exists throughout space and within matter - and energy conversion allows the form that we perceive the energy to be in to change. 'Perpetual Motion' does not exist - and long lasting motion is easily observable, such as planetary spin and planetary orbits.

'Zero-Point Energy' (ZPE) is known theoretically as an energy that fills the fabric of all space. Theoretically, the ZPE is said to result from an electric flux that flows orthogonally to our perceived dimension or reality. The mass equivalence of this energy has been calculated by physicists to be on the order of 10^{93} gms/cm^3 . Henry T. Moray, Walter Russell, and Nikola Tesla all described the nature of the ZPE and designed and built equipment to engineer its properties. It may be possible to build devices to cohere this energy. If possible, this would result in a non-polluting, unlimited supply of virtually free energy [1, 2, 3].

'Free Energy' is a term that can have two meanings: either (1) the additional energy that can be obtained from a device at little or no additional cost, so the additional energy is essentially free; or (2) more output energy appears to be available than the input energy, so it looks like some energy is being created, such as in the case of the detonation of an atomic bomb.

'Over-Unity Devices' are those systems which appear to produce more energy than they use. In analyzing such systems, a box is drawn around the device and energy balances are formulated to measure the amounts of energy coming into and going out of that box. Whether or not the device is termed an 'over-unity' device will depend upon the size of the box as drawn. When the box is drawn large enough, all systems or devices will have a net energy transfer of zero. On the other hand, when the box is drawn just small enough, the device will seem to produce energy out of nothing, and can be said to be an 'over-unity' device - and any intelligent person or any physicist will

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know better. The additional energy will always form some "potential energy source," such as the batteries in a flashlight.

From this point of view, examples of existing so-called 'free-energy' and 'over-unity' devices abound: such as Hoover Dam! So then is any battery, generator, or any nuclear reactor: by way of a 'potential energy' source. More energy certainly comes out of a dam than went in to making it (by us, at least). And any dam engineer will tell you that it will produce more energy than it cost to build, and that it will last forever (or at least until his kids get out of college). So it is seen that these generators can be thought of as 'free-energy' or 'over-unity' devices, while they are really only energy conversion devices, and obviously not perpetual motion machines. People who insist that they actually are "perpetual motion machines," are either very ignorant or very devious. In such eases, it is important to examine the person's true motives. Another 'free-energy' system which has been carefully studied in refereed scientific journals is the radiation that emanates from a hydrogen atom [4, 5].

These technical concepts, with their advantages and limitations, and examples of such devices that have been said to demonstrate these concepts, have been reported in previous IECEC papers [1, 2]. Updated, revised, and expanded versions of these papers are also available on the public Internet at the URLs:

www.padrak.com/ine/BGH97_I.html and www.padrak.com/ine/BGH97_2.html.

II. THE NEED FOR ACCURATE DATA REPORTING

As in any scientific discipline, accurate data are required to be studied before any theory can be made, and before any conclusions can be drawn. The original classical "Scientific Method" first requires the data, then an examination of the data, then a conclusion from the data, and then independent validation by other researchers of the data, and then finally a mathematical theory is formally suggested to explain the data.

In any new or rapidly-growing technical field, newly reported data is commonly refused and ignored by scientists who may not be aware of all of the developments in that new field. This condition is best described by the oft-heard political conclusion:

"I will not review your data because it does not fit into my theory!"

Examples of this absurd conclusion abound, such as: "Voices cannot travel over wires"; "Heavier than air machines will never fly"; so- called 'Cold Fusion' experiments do not work"; 'There is no water on the moon"; and so on.

The data must come before the theory, of course – and, the data must be reviewed with an open mind, and not just casually rejected!

Thus we have an absolute need to collect accurate data from which to form any new conclusions and make any new or significant advances!

The Institute for New Energy (INE), a non-profit organization, was formed to build a bridge between the conventional scientific establishment, and the general technical community. The INE is interested in collecting and documenting the details and data from devices and experiments that would advance our current understanding of science, and that would lead us in breakthroughs into new sciences and new technologies [1,2].

This goal is the same for the NASA "Breakthrough Propulsion Physics Program," as NASA Lewis Research Center currently calls one of their current breakthrough efforts, whose objectives are to obtain fuel from "empty" space and also to travel at a speeds that appear to be faster than the speed of light [3].

Another large organization of interest with similar goals is the Society for Scientific Exploration, whose *Journal of Scientific Exploration*, edited by Bernhard Haisch , states: [5]

"As science has developed, it has become increasingly compartmentalized. This may make the operation of each discipline more efficient, but we run the risk that the profession may not be responding to challenges that do not fit neatly into the matrix of present-day mainstream science."

It is therefore important that the researchers and investigators in these new areas document and report their data for others to see and review. This will cause interest, investigation, and eventually support for those new technologies that will be developed. For those experiments and devices with a positive future, this is an absolutely necessary step in their development, review, maturity, and acceptance. For those experiments and devices that may not turn out, or that have a negative future, this is also a necessary step in order to document their status and the reasons that those investigations did not turn out as hoped.

By reporting and collecting these data, the successful results will be catapulted into the watchful eyes of the established scientific community, while the unsuccessful results will also be made available in order to avoid and not promote "overt fraudulent research" or so-called "pathetic science" [6, 7, 8].

It is the responsibility of the researcher to contribute his data to this quest. To the researcher, the benefits are very large, and the liability is very low.

Several active researchers have shown supportive interest in this INE Database. They have contributed several new innovative devices, experiments. and data for inclusion and review. More data is needed in these and other areas.

III. VALIDATION, CROSS-REFERENCING, AND RESPONSIBLE FEEDBACK

Efforts to validate the data are as equally important as the initial efforts to summarize and report the data.

Validation may occur in different phases or sequential steps: (1) Validation by a non-technical witness, such as a member of the press; (2) Validation by a technical witness who will affirm the data; (3) Validation by repeating the experiment again under the same or different conditions, without and with witnesses; (4) Validation by a completely separate and independent researcher; and (5) Validation by independent researchers.

All of those different levels of validation can and should be reported.

During such validation efforts, it must be remembered that the conditions of the experiment and the materials used in the experiment must be the same or as identical as possible to those used in the experiment that is being validated. A good example is trying to start a car engine when the spark is not tuned to a few degrees just before top-dead-center (of the pistons): unless the timing is adjusted to be very accurate, the car will not start, even though someone else's car does. Similar instances can be cited where one experiment appeared to be successful, while a repeat or another validation effort was unsuccessful - because something (that turned out to be of major importance) was changed in the latter experiment.

Cross-referencing and feedback provide the means to allow communications between the various researchers to resolve any and all differences of opinion or results that may occur during this research and reporting process. It is hoped that all differences in the experiments, materials, and the results can be resolved in this manner. However, in cases where research results differ, these data and comments should also be reported as feedback and made available to all other researchers to see and reference. Future discussions may then be able to resolve these differences.

IV. THE INE DATA BASE

The INE Database is being collected and maintained by volunteers who are members of the Institute for New Energy. Any person who becomes an INE member can assist in this effort.

The INE Database is being made completely available to the interested scientific community on the public Internet, through the use of website HTML files, at http://www.padrak.com/ine/DBGUIDE.html .

The Institute for New Energy has created the INE Database in the following three formats:

1. An Excel Spreadsheet with All of the Data for All of the Devices (one Excel file)
2. A Listing of all of the Data (one text file)
3. An HTML File for Each Device (many HTML text files)

The "Excel Spreadsheet" is a large spreadsheet with each experiment, device, or reported finding (hereafter called a "device") identified within one unique row of that spreadsheet. All of the data regarding that "device" is then contained in the various separate columns in the spreadsheet within that row, in a consistence format. Any new or modified data, as well as all comments and references, are also included in that particular row.

A "Listing" can be automatically made from the spreadsheet for any "device" of interest. This listing contains the label for each column in the spreadsheet, and the data that row contains for the "'device." The listing format is the same as that given for the database data, as shown below. The listing can be output as a text file for one device or for all of the devices contained in the database, and can be printed for reference.

An "HTML File" (HyperText Markup Language File) can also be automatically made from the spreadsheet for any or all of the "devices" of interest, containing the same data as the above listing. A large FORTRAN program has been written that processes each row of the database and creates a unique HTML file for each "device." Thus all of the data within the entire INE Database can be easily converted into many unique HTML files, uploaded and posted onto the Internet, and made available to the international community.

Currently, over 110 'devices' are stored within the INE Database, and an HTML file is now available on the Internet that shows the data that is available for each device. Although some of these files contain a great deal of data, other files contain very little data. More data is needed and requested in all of the files currently listed.

All of these HTML files are also available as links in other INE website summary files, that summarize all of the devices in one of the following four listing orders:
Device Name, Alphabetical;
Researcher Name, Alphabetical;
Interest Criteria, Highest to Lowest; and
Commercialization Criteria, Highest to Lowest.

These four file are also automatically created when the HTML device files are created, and each contains all of device files, just listed in a different order.

These summary files can be found at the following Internet locations (URLs):
Device Name: http://www.padrak.com/ine/db/DEVICES.html
Researchers Name: http://www.padrak.com/ine/db/DEVICES_N.html
Interest Criteria: http://www.padrak.com/ine/db/DEVICES_I.html
Commercialization Criteria: http://www.padrak.com/ine/db/DEVICES_C.html

V. CRITERIA FOR PERFORMING RANKING COMPARISONS

In order to rank each device against all the other devices in the database, various ranking criteria have been created to allow a fair and demonstrateable difference between all of the devices listed. These criteria and their results have been also reported in two previous IECEC papers [1, 2].

VI. RANKING BY TECHNOLOGY INTEREST

The criteria for performing the technical interest rankings has been published in the papers discussed above [1, 2]. An updated and expanded version of these criteria may be found at:
http://www.padrak.com/ ine/db/DBGUIDE.html
#Int_Criteria.

The objective of ranking by technical interest is to create an indication of how important each device or technology may be or would be (if the device is shown to be successful) to the general scientific community.

The current technology interest ranking criteria contains a 13-point ranking scale that is shown in Table 1.

VII. RANKING BY COMMERCIALIZATION POTENTIAL

The criteria for performing commercialization interest rankings has been published in the papers discussed above [1, 2] An updated and expanded version of these criteria may be found at: http://www.padrak.com/ine/db/DBGUIDE.html
#Com_Criteria.

The objective of ranking by commercialization interest is to create an indication of the current status for the commercialization, or the final development and distribution of each device.

The current commercialization interest ranking criteria contains a 13-point ranking scale that is shown in Table 2.

VIII. ADDING NEW DEVICES, UPDATING DATA, AND INCLUDING FEEDBACK (PRO AND CON)

Researchers, investigators, and critics are encouraged to add new devices, experiments, and research results to the INE Database at any time.

Table 1.
Technology Interest Ranking Criteria

N - No Information.
M - Incomplete: More Information is Needed.

LOWEST INTEREST
0 - Not Substantiated.
1 - Evidence That It May Not Be Substantiated
LOW INTEREST
2 - Being Researched By Only One Person.
3 - Something Unusual Was Demonstrated By One Person.
MEDIUM INTEREST
New Physics, Small Impact;
4 - That Something Was Again Demonstrated By One Person
5 - That Something Was Again Demonstrated And Witnessed By Others.
HIGH INTEREST -
New Physics, Large Impact;
6 - Something Was Replicated By Another.
7 - The Operational Techniques And Measurements Are Being Refined.
7 - The Phenomena Is Repeatable.
HIGHEST INTEREST -
New Physics, Great Impact; or:
9 - The Device Seems To Be Scalable To A Larger Size.
10 - A Larger Size Prototype Seems To Be Proven.

There is no cost for this service, and there is no requirement to join the INE non-profit organization. All the data and all serious comments with integrity that are received will be included into the database.

Researchers are also encouraged to update their data, and to provide positive, supportive, and validation data to the results of others - as well as to provide negative, non-supportive, and non-validation data - as they are found.

IX. THE INE DATA BASE INPUT TEMPLATE

The template to be used to communicate data to the INE Database is shown in Table 3. The template may be either in the form of a text file as shown below (with the colons) or as an Excel spreadsheet containing two columns. The items listed in this template form the column headings within the INE Database Excel Spreadsheet.

The items listed must not be changed, and must be in the order as listed in Table 3, as they are common throughout the entire INE Database.

This template is also available on the INE website at: www.padrak.com/ine/DBTEMPLATE.html

Completed templates with data can be emailed, either from the website or directly, to: < inedb@padrak.com>.

Table 2.
Commercialization Interest Ranking Criteria

N - No Information.
M - Incomplete: More Information is Needed.

0 - Found To Be Lies.
1 - Evidence That It May Be Lies.
2 - Being Researched By Only One Person.
3 - Something Unusual Was Demonstrated By One Person.
4 - That Something Was Again Demonstrated By One Person.
5 - That Something Was Again Demonstrated And Witnessed By Others.
6 - That Something Was Replicated By Another.
7 - The Operational Techniques And Measurements Are Being Refined.
8 - The Device Works; The Phenomena Is Repeatable.
9 - The Device Can Be Scaled To A Larger Size.
10 - Proven Prototype.
Commercialization Is Now Possible.

Table 3.
The INE Data Base Input Template

Device Name:
Device Category:
Device Type:
Inventor Name:
Inventor Address:
Date First Demo:
Watts Generated:
Date Last Demo:
Watts Generated:
% O/U Claimed:
% O/U Measured:
% Weight Loss:
Date Witnessed:
Witnesses Name:
Witness Address:
Date Tested:
Tester Name:
Tester Address:
Researcher Contact:
Researcher Address:
Ranking, Interest:
Ranking. Commercial:
References:
Last Ref, & Date:
File Name:
Date Last Modified:

The use of this data reporting procedure and this publicly available database should accelerate the arrival of new research and technology breakthroughs, as well as to identify, isolate, and publish any outright lies, failures, and near-misses. It also includes the ability to make known opposition and dissent, and offers the opportunity for those who feel they are under the threat of suppression to present their views - either personally or anonymously.

The INE will maintain this database with the utmost integrity possible, and will not include any data that is submitted marked as "proprietary", "confidential", or "secret". All of the data in this database is being made available for public dissemination and public use.

The authors feel that there is a much greater opportunity and a much greater probability of success for new breakthroughs when the researchers are working together – to share in the rewards of their success – than in working separately, apart, and under the restrictive covers of financial non-disclosure agreements. There are ways that such team-research groups can be formed and utilized. Such arrangements are outside of the scope of the INE or this paper.

We are also aware of major scientific breakthroughs that have been made by certain individuals, only to be lost in time because of organizational or financial constraints [9]. Examples of such works probably include: Nikola Tesla, T. T. Brown, Otis Carr, Hans Coler, Royal Rife, and T. Henry Moray. We would prefer to see such new technical breakthroughs emerge, rather than for the individual researchers to remain constrained, restricted, or suppressed [10]. There are several ways to organize team research efforts that can be effective and that will achieve important results. The INE Database will be an assistance to these efforts.

X. CONCLUSIONS

The INE Database allows researchers world-wide to collect, document, and summarize the findings of the various experiments, motors, generators, devices, and demonstrations that they feel are of interest to the general scientific community. This database is particularly useful in new, innovative, advanced, and breakthrough energy conversion experimental areas, where the data reported may appear to be in conflict with the currently accepted theories and simplistic views of physics. This database is available free to the international public on the Internet, and provides instruction on how to add new devices and experiments, and also how to modify and update the existing data. Selection criteria based upon technical interest, and also on commercialization interest, allow these device data to be easily ranked for comparison and reference. The review and modification process of the data reported will allow any new practical sciences and technologies to become easily identified and to emerge for possible commercialization in the international community.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the assistance of many other researchers, scientists, skeptics, and organizations that have contributed serious open research and documentation in these areas, including: the Institute for New Energy, *New Energy News*, the Fusion Information Center, the Society for Scientific Exploration, Hal Fox, Bernhard Haisch, Eugene Mallove, Ken MacNeil, and Tony Sutton.

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EM CORRECTIONS ENABLING A PRACTICAL UNIFIED FIELD THEORY WITH EMPHASIS ON TIME-CHARGING INTERACTIONS OF LONGITUDINAL EM WAVES

T.E. Bearden

ABSTRACT

This is a short digest of the author's paper, "Toward a Practical Unified Field Theory and a Deep Experimental Example," Proceedings of the INE Symposium, University of Utah, Aug. 14-15, 1998 (in publication), to be presented at the INE symposium in Utah in mid-August 1998. Additional material to clarify the time-charging interaction of longitudinal EM waves (Lws), as **time-density waves**, transduction of LWPs or fractions of them to transverse EM waves (TWs), mechanisms of LWP interaction detection, and vagaries of LW quasi-detectors has been included. In addition, important experimental evidence has been added.

Electrodynamics Is Seriously Flawed

As pointed out by Feynman, [1] there have been many past attempts to correct electrodynamics. Their failures have been largely responsible for the continuing inability of theorists to produce a practical, engineerable unified field theory (UFT). However, the main problem in all the EM corrections to date is that the major EM errors remained unsuspected. Consequently, no attempt has been made to correct them, and electrodynamics has not been successfully unified with general relativity. Table I shows some 32 errors and flaws in the present classical electrodynamics model. In this paper we discuss only a few.

In an attempt to rectify this problem, the author proposed [2] new corrections to electrodynamics at its very foundations [3]. These corrections appear to enable an engineerable UFT where general relativity (GR) is **infolded** (Bohm's term, different spelling) inside electrodynamics [4].

Electrodynamics Is Presently Defined Only in Matter

One key is that present Maxwellian electrodynamics has nothing at all to say about the form or action of its own electrodynamic entities as they exist in empty space devoid of mass [5]. Instead, it prescribes only **mass-to-mass transformations** (Fig. 1). It omits the necessary **mass-to-space-time transformation** in signal transmission and the subsequent **space-time-to-mass transformation** (Fig. 2) in signal reception. The latter two transformations **comprise** the present Maxwellian mass-to-mass transformation, hence are **infolded** in it. (Fig. 2)

Some Types of EM Waves and the Role of Phase Conjugate Wave Pairing

EM waves carry both energy and time; we will return to that below. See Fig. 9 and Fig. 10. In a transverse EM wave, the energy is carried as laterally oscillating 3-spatial energy density, and the time is carried without oscillation. The 3-spatial energy density is not oscillating along the line of motion of the wave. If a phase conjugate replica wave is produced and coupled to the transverse EM wave, the resulting wavepair - viewed as an entity - has its transverse X- and Y-degrees of freedom "frozen". Since its Z-degree of freedom in still available, the energy density oscillates in "surges to and fro" along the line of propagation of the wave. That comprises a longitudinal EM "surge" wave, or just longitudinal EM wave [6] as it is known in the literature. the direction of possible oscillation for an EM wave or photon are known as the "polarization" directions available for it.

If now the EM longitudinal surge wave is phase conjugated and its phase conjugate coupled to it, this new wave couplet freezes the remaining Z-direction degree of freedom. Consequently the 3-spacial energy density does not oscillate, and the oscillation is forced into the remaining degree of freedom, the time domain. The time-domain for any entity is conceived as being comprised of a very great number of dynamic time elements. So the new wave resulting from the LW wavepair couplet is an oscillation of the time-density of the time domain.

In the photon realm, photons oscillating (polarized in) the time-density domain are said to be **scalar photons**. Previously it has been argued by many theorists that these are inviolably non-observable, since all observation is

spatial in quantum mechanics. However, neither is an EM wave in the vacuum observable, even in theory. One always observes the effect of the interaction of that spatio-temporal EM entity with mass.

The interaction of scalar photons (and their time-density wave carriers) can result in a fractional **transduction** into transverse EM waves which affect matter observably. So we may regard the time-density waves as "quasi-observable". However, the time-density charge and time-density excitation existing upon the involved masses from their previous time-history will directly play a role. In short, "quasi-observation" experimental results depend very rigorously on the time-history of the measuring instruments and of the detecting matter.

The method of forming the "time-density" wave is provided automatically by an extension to nonlinear phase conjugate optics. When any mass is "pumped" by longitudinal EM suges waves, the mass acts as a phase conjugate mirror with a gain of 1.0, regardless of frequency. So a Newtonian third law reaction ensues for the longitudinal EM surge wave, producing its "anti-wave3" and coupling the two waves together. This forms the requisite phase conjugate pair of longitudinal EM surge waves, producing a **time-density wave**.

For simplicity, one can just deal with the pumping of the mass by longitudinal surge waves, because the consequent production of the EM time-density wave is automatic. Thus the interaction of longitudinal EM surge waves with matter produces (i) time-density EM waves, and (ii) time-charging of the absorbing mass not an excited time-density state. For linear situations, decay of the excited time-density state results in re-emission of longitudinal EM surge waves. In a nonlinear situation, a small fraction of the meitted LWs may be transduced into ordinary transverse EM waves measured by our instruments.

Electrodynamics Contains Hidden General Relativity and Space-Time Curvature Engines

Another key is that the two missing, hidden, infolded transformations inside EM field transformations are just Wheeler's principle of general relativity [7]. Hence incorporating them in electrodynamics produces a unified field theory (UFT) of EM and infolded general relativity. This **"EM carrier of GR"** theory is one of great power since

(i) EM is used to produce and transport space-time curvatures (space-time engines) comprised of multiple ST curvatures, and
(ii) the very strong EM force is used as the agent of space-time curvature (space-time perturbation) rather than the far weaker G-force.

Space-time curvature is made even more powerful when one uses longitudinal EM waves in phase conjugate pairs - which are **time-density** waves - to alter and structure the time density of space-time rather than altering and structuring the 3-spatial energy density. Such time-density ST curvatures may be some 10^{17} times stronger than ordinary spatial energy density ST curvatures afforded by ordinary transverse EM waves [8].

Some Experimental Support

Interestingly, at least one other researcher- Matsumoto [9] - has realized the basic implication in cold fusion processes of using the strong EM force as the agent of space-time curvature. He has shown consistency of the postulated EM-induced ST curvature approach with some important cold fusion results. However, Matsumoto has utilized the conventional interpretation of space-time curvature due to alteration of **3-spatial energy density** of space-time.

There are intriguing but still mysterious relationships to be noted between cold fusion and deep astrophysical mechanisms. Continuing reference is made to these similarities, including black holes and white holes. Black holes and white holes are space-time curvatures - extreme, but still just space-time curvatures. So one would suspect that the entire scale of space-time curvature - including black holes and white holes in the limit - should be of interest to cold fusion researchers.

In that respect, most nuclear scientists and even some relativists seem unaware of the much more powerful space-time curvature effects obtained by alteration of the **time density** of space-time rather than its energy density. Physicists have largely omitted **time density ST curvatures** because they have largely omitted the time components transported by photons and EM waves in their angular momenta.

Since longitudinal EM waves interact weakly with matter to produce **time density oscillations** rather than 3-spatial energy density oscillations, then longitudinal EM waves (the infolded inner domain of EM potentials, fields, and waves) can be utilized to obtain and use these extremely powerful space-time curvatures using alteration of time density as the curvature agent.

A New Time-Density Photon Interaction Presently Missing from Physics

Photon interaction as an energy collection or energy exchange process is well-known in physics. However, the interaction between the mass and the time component carried by the photon is ignored.

An atomic electron that absorbs a transverse photon increases its energy and changes into an excited energy state. When the electron subsequently "decays" from that excited energy state to a lower state, the energy differential between the two states is emitted as the energy component of an emitted photon. This is the energy-density and energy collection reaction of a transverse photon with an absorbing and emitting mass particle.

On the other hand, a **longitudinal** photon [10, 11] has a completely different interaction, regardless of how physics presently treats it. Any atomic electron at any energy level is continually receiving and emitting virtual photons - both transverse and longitudinal- in its virtual photon exchange with the energetic vacuum. Hence it is continually "connecting to" or "absorbing" time components, thereby changing its nature from mass to mass-time, back to mass, back to mass-time, etc. There thus is a violent "chatter' of the electron in the myriad levels of its time exchanges, giving it

(i) an average rate of time component exchange,
(ii) an average "'time-charge", and
(iii) a dynamically changing, specific structuring of its time components.

As opposed to **energy-charging** of the familiar transverse photon interaction, the longitudinal photon interaction is primarily a **time-charging** interaction because of the automatic addition of phase conjugate replica Lw anti-waves. In addition, even for an equilibrium time-charging state, the "mass-time" state of the interacting electron contains a specific structure of the time elements simultaneously (to the external observer) in the electron-time's time component. Each of these infolded time elements is also time-charging the electron.

So there exists a completely unsuspected "time-charge" set of excited states for an atomic electron and for any other particle.. There also exists a "time-structuring" of the time-charge excited time-state. Discovering this time-charging and time-structuring interaction has been one of the major results of this author's long effort to decipher the functioning of the healing (cellular regeneration) system of the body.

In summary: For longitudinal photon interaction, the atomic electron "absorbs" the longitudinal photon by time-charging to an excited time-state. This time-state then decays, emitting a longitudinal photon in the process. In the wave view, a material containing charged particles interacts (slightly) with LWs by time-charging to **excited time-states** (LW absorption), and the excited time-states then decay to emit **longitudinal EM waves**.

If all the absorbed time-charge of the excited electron is re-emitted as a longitudinal photon when the excited state decays, no energy-charging change occurs to the electron's energy state. Hence no "electron wiggle" will be created and our normal "electron wiggle" detectors performing such non-transducing longitudinal EM wave interactions will not exhibit an indication. In short, the "pure" time-charging EM LW interaction is unobservable to present instruments.

Transduction Between Time-Charging and Energy-Charging

In the absorber, a small fraction of the LW time-density absorbed will often change (transduce) into transverse photon energy effects [12], with something like a 10^{17} gain in energy compared to the time that actually transduces. In other words, 1 (one) second of time transducing into EM transverse wave energy will yield approximately 10^{17} joules. Just as one can change energy from one form to another, one can change **time into energy** and **energy into time**, the two being merely opposite sides of the same coin.

Indeed, the choice of units in physics is purely arbitrary. Everything can be expressed in a single fundamental unit, but its computational difficulty may be orders of magnitude greater. Jackson [13] expresses it thus:

"The desirable features of a system of units in any field are convenience and clarity. For example, theoretical physicists active in relativistic quantum field theory and the theory of elementary particles find it convenient to ***choose*** *the universal constants such as Planck's quantum of action and the velocity of light in vacuum to be dimensionless and of* ***unit magnitude****. The resulting system of units (called 'natural' units) has only* ***one*** *basic unit, customarily chosen to be length. All quantities, whether length or time or force or energy, etc., are expressed in terms of this one unit and have dimensions which are powers of its dimension. There is nothing contrived or less fundamental about such a system than one involving the meter, the kilogram, and the second as basic units. It is merely a matter of convenience."*

Anyway, part of the **time-charging** of the atomic electrons (or ions) often changes **into energy-charging**, resulting in the emission of some transverse photons accompanying the longitudinal photons. In short, some transduced transverse EM waves will often be emitted as companions to, and integral parts of, the predominant longitudinal wave emission. These TW emission components may then (and usually will) interact to produce anomalous excess heat - for example, as occurs in many cold fusion experiments.

Resolving the Energy Conservation Problem in Cold Fusion

When transduction is involved, standard "transverse EM waves only" computations will seemingly yield violation of energy conservation. That is an erroneous interpretation; energy overall is conserved, but some of the LW time flow is transduced into TW energy dissipation. Neither TW energy nor LW energy alone need be individually conserved; only the combined total energy of both is conserved. This resolves the present major "sticking point" between the cold fusion researchers and the conventional "transverse wave" nuclear and electrodynamic communities.

Ionization Detectors, Transduction Response, and EM LW Interferometry

Ionization processes obviously are processes where the partial transduction of LW time interaction into 'TW energy interaction would yield ordinary excited energy states of the affected electrons or ions. In turn, this would lead to ionization (e.g., of a gas, liquid, etc.). Hence ordinary ionization detectors such as Geiger Müller tubes have the innate capability of such transduction, and thereby the capability of serving as "quasi-detectors" of longitudinal EM wave interactions ongoing in the detector. In turn, this capability in an ionization detector can be used to provide an indication of LWs being emitted by a process (such as a cold fusion process) where some transduction from LW time-charging to TW energy-charging occurs.

The production of transduced TWs, however, must be a function of LW interferometry, since LW interferometry **creates** all TWs, as shown by Whittaker [14]. According to Whittaker superpotential theory, we may replace any EM field or wave as just two scalar potential functions. Any scalar potential is already composed of internal time-density EM waves (i.e., longitudinal EM phase conjugate wavepair), as also shown by Whittaker [15]. In such LW interferometry, the entire inner time-density wave structure of each TW in the interference also interacts. Potentials continually interact (e.g., superpose) and exchange inner time-density wave components in the process. Thus, scalar potential interferometry is extremely sensitive to the entire past time history of the involved potentials, and the fields and waves produced by the interference are also sensitive to the entire past time history track.

As a consequence, the ability of an ionization detector to transduce a specific set of LWs and give ionization detection will vary appreciably, according to the past history of the detector. The quasi-detection will vary for different variations in the instrument's original manufacturing process, and even for the specific past photon interaction history and experience of the individual detector itself. One detector's set of internal time-charges (and hence infolded time-density waves and space-time engines) may vary considerably from those of a second detector of exactly the same type. In general, two ionization detectors are unlikely to detect a given LW emission set in similar fashion.

Even for two detectors of the same brand, from the same manufacturing plant, and from the same batch of manufacture, it is likely that significant differences in LW detection of a specific LW set will occur because of the "past history" time-charge differences of the detectors. Indeed, a likely phenomenon is that one ionization detector will detect the LW emissions (transduce them) nicely, while the other will not detect them at all. In this "quasi-detection" one is dealing with additional hidden variables and hidden causes entering into the detection. This is one of the peculiarities of the new UFT area which must be overcome by further research in order to develop reliable, calibrated LW detectors. It is one of the primary problems - if not **the** primary problem - of cold fusion research to

resolve this **"time-charge experience history"** problem, so that LW detectors having calibrated, uniform responses to given longitudinal EM wavesets can be provided.

Experimental Longitudinal Wave Emission Phenomena in Electrolysis

Let us look at one set of ongoing scientific experiments where just such anomalous detector results have been obtained.

Researchers at the Naval Air Warfare Center at China Lake, and at the Department of Chemistry, University of Texas at Austin, have indeed detected precisely the kind of "anomalous" radiation to be expected from the **TW transduction from LW** phenomenon in ionization processes of multiple kinds [16].

According to a report by Miles and Bush [17] anomalous radiation at China Lake was first detected by the exposure of dental X-ray films in two experiments producing excess power (excess TW energy emission). Film used in a control study during these experiments showed no exposure. There was also no exposure of similar films in more than 20 experiments where no excess power was present. In other words, the presence of excess heat (excess TW energy emission) strongly indicates the presence of transduction. In turn, the presence of transduction implies the presence of LW wave interaction, where LW waves are absorbed and a mix of LW and transduced TW waves are emitted. Taken in reverse, the presence of TW wave absorption and emission with transduction directly indicates the emission of "anomalous" TW radiation, as detected by the resulting TW exposure of the X-ray film. So the "anomalous" radiation detections are consistent both forward and backward.

The film in manufacture is quite strongly quality-controlled. Also, it is used only once. So its past history has minimal variations between two samples of the film. Hence one would expect a fair degree of uniform film responses from film to film, to the same LW emission set.

We conclude that the behavior of the film in the combined China Lake experiments clearly shows the LW and LW-TW transduction nature of what is happening.

Geiger-Müller (GM) detectors and sodium iodide (NaI) detectors were also utilized when electrolysis experiments using heavy water were ongoing. We accent that a GM tube does not detect nuclear radiation per se; instead, it detects anything which will cause its internal gas to ionize. Sufficient LW-TW transduction in longitudinal wave absorption-emission interactions in a GM tube will cause the counter to indicate, because it ionizes the gas and produces an ionization discharge. However, both the specific LW and LW-TW transduction aspects of the ongoing experiment are involved, as well as the previous background history of the GM counter.

Several GM detectors gave anomalously high readings, reaching some 73 sigma above normal background counts. Most experiments, however, gave normal radiation counts, and no anomalous count rates were ever observed when the experiments were turned off. Our interpretation here is:

(i) that there was a variation in the presence of LW-TW transduction from experiment to experiment,
(ii) that the majority of the experiments did not produce sufficient transduction to cause detection (ionization discharge) on the GM tubes, and
(iii) that the transduction effects in the ongoing experimental process were mostly of the rapid variety, and not due to long-term "charge-up" effects conditioning the time-charge aspects and structuring of the experimental apparatus.

A direct correlation was also observed in the appearance of the anomalous radiation and the expected time periods required to load the palladium with deuterium. As reported by Miles and Bush:

> *"... the anomalous radiation would appear within a few hours in the co-deposition experiments where the palladium is loaded with deuterium as it deposits from solution. In contrast the appearance of anomalous radiation required days of electrolysis for the palladium rods that load much slower."*

Our interpretation is that the experiments show the time-charge rate effect to be expected in such LW interaction phenomena using collection of ions (in this case deuterium) that are much heavier than electrons. The faster the deuterium loaded, the greater the interaction of the deuterium in phase conjugating and self-targeting iterative interactions inside the palladium lattice. The production of an LW, e.g., can be as simple as the coupling of an

emitted transverse photon (particle view) or transverse wave (wave view) with its phase conjugate twin. Consequently the rate of LW production increases as some function (not necessarily linear!) of the rate of loading of the deuterium, because the rate of the wave/anti-wave coupling increases. As the rate of LW production increases, so does the rate of LW-TW transduction, and consequently the build-up of ionization effects by ordinary TW waves and energetic photons. [Could be related to the development of charge clusters by fracto-emission. Ed.]

A clinching observation is given by Miles and Bush as follows:

> *One GM-detector would measure anomalous radiation while another GM-detector would be "blind"to any anomalous effect. A few experiments, nevertheless, gave simultaneous anomalous effects from two different radiation detectors.*

Here our comment is that this precisely fits our expectations for demonstrating involvement of
(i) LW wave interactions,
(ii) consistency with LW-TW transduction expectations,
(iii) consistency with the fact that two different radiation detectors may or may not detect the LWs, depending upon the past history of the two detectors, and
(iv) variations in the individual experiments (loading time, specific geometry, ionization state of the chemical solution, internal time-charge state and structuring of the apparatuses and their parts, etc.) when LW-associated phenomena are considered. [Beaming of ejected energy could also be a factor. Ed]

In short, the anomalous radiation detected at China Lake, and the resulting peculiarities in the measurement apparatus functioning, strongly support the approach and the LW phenomena and mechanisms we present in this paper. We point out the decisive point that sometimes two detectors both indicated, and sometimes one indicated and the other would not. That immediately eliminates from consideration all purely TW wave phenomena, conditional only upon the premise that the instruments were properly functioning and calibrated.

Pseudo-Longitudinal EM Waves and Undistorted Progressive Waves (UPWs)

There is in fact a revolution in electrodynamics presently underway, due to the unique characteristics of **longitudinal** EM waves and **pseudo-longitudinal** EM waves. A summary by Rodrigues [18] and Lu is particularly revealing.

A pure longitudinal EM wave has infinite energy and infinite velocity, i.e., it appears everywhere at once. "Propagation through space" does not apply; instead, one has stumbled into that weird region where space-time is multiply connected. In the real world, one meets imperfect longitudinal waves, or **pseudo-longitudinal EM waves** that still retain a transverse energy density variation residue. These waves are called **Undistorted Progressive Waves (UPWs)**.

Such UPWs can move in space faster than the speed of light. As an example, Nimtz [19] and his colleagues have beamed Mozart's 40th Symphony down a waveguide at a speed of 4.7 c. So the old notion that information cannot be transported at superluminal velocities is passé. Again, summary papers by Rodrigues [20] *et al.* are revealing.

Energetics and the "Information Content of the Field"

The inner longitudinal multi-wave EM infolded inside all potentials, fields, and waves - the **information content of the field**, in Russian terms [21] - was shown by Stoney [22] and Whittaker [23] before general relativity (GR) was created, and was never recognized as an infolded general relativity hidden inside Maxwellian electrodynamics. Russian energetics weapon scientists refer to this EM-GR unified field theory as **energetics**. Previously this author has referred to it as **scalar electromagnetics**, after Whittaker's profound 1903 and 1904 papers showing that all EM potentials, fields, and waves are made by, and filled with, longitudinal EM wave-pairs. The Russians have weaponized the area for nearly 40 years. Coverage of the weaponization aspect has previously been crudely given by this author [24].

Longitudinal EM waves and longitudinal EM bi-waves comprise the organized space-time interior of the scalar potential and of all EM fields and waves. Further, space-time itself may be regarded as a giant scalar potential. Hence space-time is comprised of longitudinal EM waves, in our LW UFT model. It is known that longitudinal EM

waves **create** all "ordinary" EM fields and waves, as shown by Whittaker [25] in 1904. So longitudinal waves comprise (and "create") electrodynamics and space-time as well, including all structuring of either or both, including in 3-spatial structuring and in time-density structuring.

Accordingly, longitudinal EM waves can be used to engineer not only electrodynamics but also a powerful general relativity **since they already create and "engineer' both aspects**. Longitudinal EM waves thus become the key to engineering a very powerful unified field theory, in the laboratory and also in practical devices with radically extended capabilities. Further, **EM LWs can be applied to almost any present electrodynamics area or process, to thereby introduce full, general relativity effects into the area or process**. The implications of this capability upon all our present EM technology are revolutionary to say the least.

LWs Applied to Phase Conjugate Optics and Medical Therapy

As an example, in nonlinear phase conjugate optics, a very startling effect can be produced by pumping a mass with longitudinal EM waves instead of with transverse EM waves. When LWs are used, **the mass itself is time-reversed back to a previous physical state.**

This presents a revolution in the treatment of diseases. Diseased and/or damaged cells - **genetics and all** - can be time-reversed back to healthy cells with normal genetics, by this fairly straightforward methodology [26]. The implications for dread diseases such as cancer and AIDS are particularly revolutionary.

A second revolutionary aspect is that there **are now no resistant pathogen strains**, and there can be none. An emergent "resistant" pathogen strain infecting a patient, e.g., can itself be 'time-reversed" by LW-pumping it right back to its previous nonresistant strain [27]. **The entire evolutionary track of the organism is available as a path for dedifferentiation (time-reversal) by LW pumping.** (Fig. 3).

Proof of the New Medical Therapy Model

A specific experimental proof exists which has previously defied all scientific explanation. In laboratory animal testing in the 1960s and early 1970s, the Prioré device [28] in France produced revolutionary cures of terminal tumors, cured infectious diseases such as trypanosomiasis, reversed atherosclerosis, and restored suppressed immune systems [29]. Prioré and a team of prestigious French scientists [30] unwittingly applied the new unified field theory by creating longitudinal EM waves and pumping the body's cellular mass with them, to time-reverse the cellular mass instead of having the pumped mass produce time-reversed waves.

The Body's Cellular Regenerative System Uses LW-Pumping

It turns out that the Regenerative and Restorative (R&R) system of the body - as contrasted to the immune system - uses this LW pumping mechanism (both locally and globally in the body) to reverse cellular damage, within its more limited capabilities, and also to alter cells and their genetics to new forms. The **immune** system heals nothing, not even itself. It contains the fighters, the antibodies, the scavengers to dean up residues, etc. But it cannot **heal** and **restore** a single damaged cell, including one of its own. That is the task of the R&R system, which operates electromagnetically and is still very poorly understood.

One of the major results of the present author's 14-year effort in medical uses of EM has been the discovery that the body's own R&R system uses LW-pumping of cells as a means of

(i) reversing or partially reversing the cells' degeneration due to aging,
(ii) restoring damaged or infected cells back to normal healthy condition, and
(iii) reversing (within its capabilities) genetic damage in cells.

See Fig. 4. The R&R system also uses LW-pumping (both locally and globally in the body) to

(iv) coordinate needs of a local cellular damage site with distant cellular sites, so that the global delta causes distant cellular changes to support and fill local needs, and
(v) alter cells in either direction along the time-line (either time-reversing or time-forwarding, or in biological terms, either dedifferentiating or redifferentiating, or just differentiating).

See Fig. 5. Discovery of the extended mechanism used to differentiate and dedifferentiate off the time line - i.e., as in item (v) above - has been another of the major results of this long and arduous study effort. An overview of the functional operation (regenerative mode) of the R&R system is shown in Fig. 6.

Becker Unwittingly Used LW-Pumping

Cellular differentiation and dedifferentiation are directly enabled by this LW pumping process as shown initially in experiments by Becker [31]. However, Becker was unaware [32] of the LW-pumping process which **caused** the cellular dedifferentiation and redifferentiation. He knew it was the DC potential, but was unaware that the electrostatic scalar potential is just a group of bidirectional longitudinal EM waves - in short, EM pump waves in the time density domain rather than the 3-spatial energy domain. Nevertheless, Becker dearly demonstrated the dedifferentiation and redifferentiation of cells using small DC voltages with only pico-amperes of current. For his epochal work, Becker was twice-nominated for a Nobel Prize.

We have extended Becker's pioneering work to show a preliminary overall LW-pumping functioning of the R&R system (Fig. 6). A new paper [33] and a forthcoming book [34] will present the dramatic new extensions to Becker's work and to Prioré's work. They will also show the importance of the new mechanisms in cold fusion and particle physics.

In addition, the extended "steering" method we discovered (Fig. 5) can be applied to nonliving matter as well as living matter. In nonliving matter, it will enable engineering of the atom, the atomic nucleus, the quarks inside the nucleons, the material lattice, etc. That capability is beyond the scope of this present paper, although we have filed an Invention Disclosure with the U.S. Patent Office upon it, and will follow with a full patent application in the near future as soon as funds are available.

Proposal to Meet an Urgent Need and Save Millions of Americans

There exists a formidable threat of terrorist biological warfare attacks on U.S. cities. Such attack upon our population centers by weapons of mass destruction is now officially recognized as the greatest strategic threat to the United States [35]. As a single example, using general dispersion over Washington D.C. on a calm night, a single spray container of 100 kg. of anthrax could produce as many as three million casualties [36]. Presently almost all those stricken Americans would die. It is anyone's guess how decontamination could ever be effective.

In a formal letter [37] we have proposed to the U.S. Department of Defense an intense research program under Presidential Decision Directive authority to develop a suitcase-sized, computer-controlled, portable medical treatment unit (Fig. 7 and Fig. 8). The developed unit would be mass produced and apply the revolutionary new longitudinal EM wave medical technology for treating and curing mass casualties from terrorist biological warfare strikes (or clandestine nuclear attacks) upon our major population centers.

We believe that, with highest priority development, such inexpensive portable "cellular reversing" treatment devices could be available in quantity and distributed to emergency personnel, enabling the lives of perhaps 70% of those stricken Americans to be saved. With second-generation equipment, perhaps 90-95% could be saved. The program could pay for itself many times over in the first weapons of mass destruction strike in which such mass treatment was immediately available and quickly used. No such capability presently exists, and none can be obtained from any known conventional approach.

In Conclusion

The longitudinal EM wave technology is a unified field technology and a quantum leap of epic proportions, affecting all of science. Indeed, it is just now getting underway.

It will be the science of the 21st Century, and its impact upon humanity will be unparalleled.

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NOTES AND REFERENCES

1. Richard P. Feynman, Robert B. Leighton, and Matthew Sands, Lectures on Physics, Addison-Wesley, Reading, MA, Vol. 2, 1964, p. 28-6.
2. T.E. Bearden, "Toward a Practical Unified Field Theory and a Deep Experimental Example," Proc. of the INE Symposium, Univ. of Utah, Aug. 14-15, 1998 (in publication).
3. In doing so, we attempt to follow the consensus prerequisite laid down Einstein, de Broglie, Schrödinger and Dirac, who are among the principal architects of the fundamental theories on which unification has been attempted. They believed that the correct conceptual and theoretical structure has yet to be formulated, and that unification would be built-in naturally, given the proper formulation. E.g., see Reginald Irvan Gray, Unified Physics, Naval Surface Warfare Center, Dahlgren, VA, 1988, p. 7-44. We believe we have made at least a step in the right direction for the conceptual portion of a "naturally-arising" unified theory, although the new mathematical structure for it has yet to be laid down.
4. Note that Kaluza's unification of EM and GR added an additional spatial dimension to Minkowski's three spatial dimensions. Klein then treated such "extra" dimensions as "wrapped around" each point in 3-space. In a tortuous fashion, such "compactification" of extra dimensions either is, or approaches, the notion of infolding them inside 3-space. In our own case we have also infolded time structures inside the time stream itself (inside Minkowski's 4th dimension).
5. Specifically, EM potentials and fields are defined only upon assumed point unit charged masses assumed at every point in space. Waves, which are defined as dynamic field oscillations, therefore are defined only upon assumed point charged masses, and not at all in massless space.
6. For a simple analogy, we may think or the pseudo-longitudinal EM wave as a sort of velocity-modulated wave; i.e., it is rhythmically changing its volocity about some average value, where that value is not necessarily c (and usually is either less than or greater than c).
7. For a statement of Wheeler's principle, see W. Misner, K.S. Thorne, and J.A. Wheeler, Gravitation, W.H. Freeman and Co., San Francisco, 1973, p. 5.
8. This is because time may be regarded as compressed spatial length, where the L compression factor is c. Since the energy of a wave is proportional to L^2 (where L is the wave amplitude), then the release of ST time-density as ST energy density provides some 9×10^{16} times as much effect as simple energy density curvature alone. For convenience, we refer to this as the "10^{17} gain factor" one obtains by releasing the compressed length energy from its time-density ST curvature form.
9. T. Matsumoto, "Mechanisms of Electro-Nuclear Collapse," Proc. ICCF-7 (International Conf. on Cold Fusion, Vancouver, BC, Canada, April 1998, p. 98.
10. There are several types (polarizations) of photons utilized in physics. E.g., see Lewis H. Ryder, Quantum Field Theory, Cambridge University Press, 2nd edition, 1996. On p. 147+, Ryder discusses four polarization states of the photon. Two of these are "transverse", i.e., the well-known x- and y-polarizations of light, one is called "longitudinal," i.e., z-directed and related to Evans' B(3) field, and one is "scalar" or time-like.

    The longitudinal photon we are using in this paper consists of a coupled photon.anti-photon pair. It seems to be yet another brand, something like a cross between the Ryder's third and fourth classification, but producing his fourth classification with an internal substructure. That is, our "longitudinal" photon is named such because when it is imperfect it propagates (i.e., in the z direction) at finite speed. When perfect, it just appears instantly everywhere it will be, without propagation through space in the usual sense. Hence it can be at an infinite number of points simultaneously - very close to the notion of the pure Coulomb gauge or of Bohm's quantum potential - or it can be impure and propagate at subluminal or superluminal speeds.

    Our time-density photon is a coupled longitudinal photon/anti-photon pair. The reaction producing it occurs as a result of the interaction of a longitudinal photon and a mass. The main notion we intend in our use of the "longitudinal" photon interaction with mass is that the resulting oscillation is in the time domain and along the time axis. We use a model which produces the flow of time itself, and a time-component structuring of that flow

- something which is still absent from physics. So our longitudinal photon in one part resembles Ryder's discussion of the "scalar" photon, but is not just that alone.

A still deeper discussion of photon polarization is in F. Mandl and G. Shaw, Quantum Field Theory, Wiley, 1984, under the heading "covariant quantization of the photon propagator" in Chapter 5. My personal opinion is that none of these "modes" of photonic entities is entirely "fixed and fast". Mandl and Shaw argue that the longitudinal and scalar polarizations are not directly observable, but only in combination, where they manifest as the "instantaneous" Coulomb (electrostatic) potential. So by this route they arrive at a well-established mathematical theory that allows a hidden substructure within the photon itself. Mandl and Shaw include the photon's four polarization states as related to the four independent degrees of freedom available in the vector potential **A**. Suppression of the longitudinal and scalar polarizations is accomplished by "fixing the gauge". This reduces the independent degrees of freedom from 4 to 2, giving us the conventional electrodynamics. However, when one raises serious foundations flaws in that resulting conventional electrodynamics, it is obvious that the entire structure is still on somewhat shaky ground. An even better mode might be to consider the "fundamental" photon entity as existing in all degrees of freedom, and the various "kinds" of specific photons existing due to restrictions or partial restrictions placed on one or more of these degrees of freedom of the "fundamental" photon. This of course opens the stage to interactions which change one (restricted) type of photon into a different (restricted) type. That is essentially the basis for my use of the notion of "transduction". It also leads to the transposition of time into energy and vice versa, which I use in my own approach, but which is still missing from physics. Since the cold fusion phenomena seem to require that characteristic, I have retained it.

We are indebted for much of the preceding discussion to private correspondence from Bob Flower, a fine scientist and knowledgeable in this area. Flower has pointed out that the conventional photon theory outlined by the cited authors is missing the possibility that nonlinear phase-conjugate optics could make the photon's longitudinal and scalar polarizations manifest in an experiment. Or put another way, if the instantaneous Coulomb potential could be decomposed into a time-like component and a longitudinal component, it would allow the two hidden polarization states to be controlled directly. This would result in anomalous modifications of the EM vector potential, leading to measurable electromagnetic or quantum effects. Flower's observation seems to me to be the closest to my own view, stated more simply in the present paper.

11. So the end result of our yet-unfinished struggle in these **very** swampy photon waters is not entirely consistent with the conventional view. Nonetheless, the new approach does seem to fit and explain most of the anomalous cold fusion phenomena, as well as a wide variety of other phenomena previously deemed beyond the pale of physics itself. E.g., by noting that **mind is time-like in its operations**, that approach leads directly to a testable and engineerable theory of mind on all its levels (conscious, subconscious, unconscious, species unconscious, biospheric or all-species unconscious, and so on). But since the mind can interact with the body and produce at least the initial spatial forces carrying out intent in the physical world, it follows that some process must exist whereby the "time-like" photon interacts with and changes one or more of the other photons in the conventional view. Our use of **transduction** in fact encompasses that, and Whittaker's 1903 and 1904 papers strongly support this approach mathematically. So the approach used directly incorporates mind and matter interaction, again on multiple levels. Beyond the scope of this paper, it has become possible to begin the physics of living being - even of the entire living universe - and to foresee direct engineering of the various realms of mind itself. Indeed, Russian psycho-energetics - particularly the secret part of it - already is involved in just that capability in operational equipment of great portent. Since real results and real explanations of diverse metabiological phenomena have arisen from the approach as well as a very deep "more ordinary" physics including the necessary corrections to electrodynamics, we have continued to follow it to see where it eventually leads.

12. In conventional language, both the transverse and longitudinal field components always try to be born initially, whenever an EM wave is being generated. Generation of the transverse component produces a function which zeroes the longitudinal component. See Rod Donnelly and Richard Ziolkowski, "Electromagnetic field generated by a moving point charge: A fields-only approach," American Journal of Physics, vol 62, no 10, Oct. 1994, pp. 916-922. The function appears in the space-time representation of the transverse EM fields, obtained by Donnelly and Ziolkowski using special transforms. The phase conjugating and retroreflecting aspects of cold fusion experiments produce space-time curvatures, directly affecting the "canceling function." The altered function becomes an "LW-reduction function" which is postulated to determine the mix of transverse and longitudinal field components that emerge in the interactions.

13. J.D. Jackson, Classical Electrodynamics, 2nd Edition, Wiley, New York, NY, 1975, p. 811-812.
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21. Western scientists have misinterpreted the Russian meaning of this term as synonymous with TW spectral content. Russian energetics weapon scientists have been very content to let them continue in this erroneous interpretation. Accordingly, Western scientists still cannot comprehend Russian energetics weapons. For direct evidence of this continuing shortcoming in our scientific knowledge, see "Congressman Disturbed by Russian Military Research," *Washington Inquirer*, Feb. 9, 1998, p. 3. The Department of Energy - forced by Congressman Weldon to give a briefing to his subcommittee - admitted that the Russians are working in a technology that Western scientists do not even understand. Congressman Weldon was seriously concerned.
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23. E.T. Whittaker, 1903, *ibid.* See also E.T. Whittaker, 1904, *ibid.*
24. E.g., T.E. Bearden, Excalibur Briefing, Strawberry Hill Press, San Francisco, 1st edition 1980, 2nd edition 1988; Star Wars Now! The Bohm-Aharonov Effect, Scalar Interferometry, and Soviet Weaponization, Tesla Book Co., 1984; Solutions to Tesla's Secrets and the Soviet Tesla Weapons, Tesla Book Co., 1981; "USSR: New Beam Energy Possible?" *Defense & Foreign Affairs Daily*, vol. 53, no. 111, Tuesday, June 12, 1984; Soviet Weather Engineering Over North America, 1-hr. videotape, 1985; Fer-de-Lance: A Briefing on Soviet Scalar Electromagnetic Weapons, Tesla Book Co., Chula Vista, California, 1986; "Soviet Phase Conjugate Weapons: Weapons That use Time-Reversed Electromagnetic Waves," *Bulletin*, C.R.C., Jan. 1988, p. 1-6; "Dead Man Fuzing: The Real Meaning of the Reykjavic Summit," *Bulletin*, CRC, no. 295, Jan. 1987, p.-1-2; AIDS: Biological Warfare, Tesla Book Co., Chula Vista, California, 1988; "Glasnost: The Twenty-Ninth Move," *Bulletin*, CRC, May 1990, p. 1-4; Gravitobiology, Tesla Book Co., Chula Vista, CA, 1991; Analysis of Scalar/Electromagnetic Technology, Tesla Book Co., Chula Vista, CA, 1990; "What is Scalar Electromagnetics and What Can it be Used For?" CTEC, Inc. Fact Paper, Jan. 11, 1996.
25. Whittaker, 1904, *ibid.* initiated a branch of electrodynamics loosely referred to as super-potential theory. Other scientists adding to the super-potential theory included Hertz, Nisbet, McCrea, Debye, etc. For a summary, see Melba Phillips, "Classical Electrodynamics," vol. IV: "Principles of Electrodynamics and Relativity," in Encyclopedia of Physics, ed. S. Flugge, Springer-Verlag, Berlin, 1962, p. 1-108.
26. We have filed an Invention Disclosure with the U.S. Patent Office for this new kind of phase conjugate pumping and the results, as well as for a dramatic extension to the method whereby the mass can be transformed to a state and an internal structuring it never previously had in the past. Together, the two methods will eventually allow anything at all to be done with mass - transmutation, materialization, dematerialization, assembly of H+ ions (which are just protons) into elements, etc. E.G., is a very small local region with high phase conjugate

activity, a time-reversal zone may exist. In that zone, like charges attract and unlike charges repel. H+ ions will thus be attracted together, additional energy-balancing actions may occur, and a deuterium ion emerge or evcen a helium atom. A vast new set of possible nuclear reactions are thus made possible. These reactions seem to be what are generating or partially generating the anomalous nuclides in cold fusion experiments. We will shortly be filing a patent application on the first of the mechanisms included in the Invention Disclosure.

27. As an example, the Prioré LW pumping device did not kill the pathogens themselves. Instead, the pumping radiation reversed and eliminated all cellular damage. At the same time, the pathogens themselves were LW-pumped. This will produce a few pathogens that are (i) of a different strain and (ii) not susceptible to the immune system. Consequently, after that initial pumping to heal the cells, the restored immune system would destroy the original strain of the pathogen, but miss the small fraction of pathogens that are of the new strain. This surviving strain would then reinfect the laboratory animal and eventually kill it, if left alone. However, a simple short second radiation of reduced length and power would alter the immune system so it could recognize the new pathogen strain. The immune system would then make short work of the new strain. The secret here was that the short duration and low power reradiation was sufficient to enable the immune system to recognize and deal with the new pathogen strain, but was insufficient to create yet a third pathogen strain.
28. For a summary of the Prioré affair, see Christopher Bird, "The Case of Antoine Prioré and His Therapeutic Machine: A Scandal in the Politics of Science," Appendix I in T.E. Bearden, AIDS: Biological Warfare, Tesla Book Co., 1988. A book on the entire Prioré affair, together with technical expositions of the novel healing mechanism and the results achieved, is in process (T.E. Bearden, Revolution in Medical Science: Vacuum Engines and Prioré's "Hidden Variables" Methodology, in publication, to be available on site: < www.tarap ublishing:com/books>, 1998.) For a partial and less technical preview, see T.E, Bearden, Energetics of Free Energy Systems and Vacuum Engine Therapies, Tara Publishing, Internet node <www.tarapublishing. com/books> , July 1997.
29. A list of French literature citations of the papers reporting the detailed results achieved by Prioré, Pautrizel, and others working with the Prioré device, is included in "Revolution in Medical... ", *ibid.*
30. Such as Raymond Pautrizel, a world-renowned parasitologist of first rank, and Robert Courtier, Head of the Biology Section of the French Academy of Sciences and *Secretaire Perpetuel* of the Academy.
31. E.g., see Robert O. Becker, "A technique for producing regenerative healing in humans," *Frontier Perspectives*, vol 1, no 2, Fall/Winter 1990, p. 1-2. Becker reports producing dedifferentiation of human fibroblast cells, a common constituent of all soft tissue, by use of silver electrodes connected with tiny EM trickle currents. Previously dedifferentiation in humans had been thought limited to only the bone marrow cells. U.S. Patent No. 4,528,265 was issued for the treatment device on July 9, 1985. For Becker's work on the R&R system, e.g., see R.O. Becker, "The direct current field: A primitive control and communication system related to growth processes," Proceedings of the XVI International Congress of Zoology, Washington, D.C., vol. 3, 1963, p. 179-183. See particularly Robert O. Becker and David G. Murray, "A method for producing cellular dedifferentiation by means of very small electrical currents," *Transactions, New York Academy of Sciences*, vol 29, no 5, Mar. 1967, p. 606-615. The weak DC potential used by Becker decomposes into a set of bidirectional longitudinal EM wave-pairs, per Whittaker 1903. In each pair, there is a longitudinal EM wave and its phase conjugate. Such a pair represents a pair of pump waves diametrically opposed in the time dimension. So unwittingly, Becker was using the simplest possible case of longitudinal EM wave pumping of the cells, the body, and the damaged area.
32. Even normal transverse wave nonlinear phase conjugate optics was essentially unknown in this country when Becker did most of his work. See Robert A. Fisher, Optical Phase Conjugation, Academic Press, New York, 1983, p. xv. U.S. scientists only became aware of the time-reversed EM wave when two Soviet scientists from Moscow's P.N. Lebedev Physical Institute visited Lawrence Livermore Laboratory in 1972 and mentioned that a strange backwards-scattered EM wave that restored order after returning back through a disordering process in optical experiments had been observed in stimulated Brillouin back scattering. Several years passed before U.S. phase conjugate optics with pumped phase conjugate mirrors really got off the back burner. With only classical EM available to him, and with even ordinary phase conjugate optical pumping unavailable, it was not possible for Becker to decipher the full LW-pumping mechanism of his epochal discoveries.
33. Bearden, "Toward a Practical Unified Field Theory and a Deep Experimental Example," *ibid.*
34. Bearden, Revolution in Medical Science: Vacuum Engines and Prioré's "Hidden Variables" Methodology, *ibid.*
35. President Clinton issued a Presidential Executive Order declaring a national emergency in 1994, as a result of this threat. In November 1997 he extended it because the threat had increased even more. It is publicly known that terrorist strike teams are already in the United States, biding their time, and with BW agents already in hand. Recently Saudi terrorist Osama Bin Ladin, perhaps the greatest terrorist of all, in a secret interview with ABC News, declared that the U.S. would be struck within the next few weeks. The articles on the ABC interview

with Osama Bin Ladin can be downloaded from the <www.abcnews.com> web site, or simply search on his name from any web search engine. The July 1997 issue of *Reader's Digest* also contains a relevant article. For a scholarly article on the BW threat situation, see Richard K. Betts, "The New Threat of Mass Destruction," *Foreign Affairs*, vol 77, no 1, Jan./Feb. 1998, p. 26-41.

36. According to U.S. Congress, Office of Technology Assessment, Proliferation of Weapons of Mass Destruction: Assessing the Risks, Government Printing Office, Washington, 1993, p. 54. Such a spray attack would produce from 1-3 million casualties.
37. T.E. Bearden, Energetics: Extensions to Physics and Advanced Technology for Medical and Military Applications, CTEC Proprietary, May 1, 1998, 200+ page inclosure to CTEC letter, "Saving the Lives of Mass BW Casualties from Terrorist BW Strikes on U.S. Population Centers," to Major General Thomas H. Neary, Director of Nuclear and Counterproliferation, Office of the DCS, Air and Space Operations, HQ USAF, May 4, 1998.

TABLE I. SOME SERIOUS FLAWS AND ERRORS IN CLASSICAL EM THEORY.

1. Eliminates the Internal EM Inside the Scalar Potential.
2. No Definition of Electrical Charge or of Scalar Potential.
3. Equations Still Assume Material Aether Per Maxwell (Unchanged).
4. Use of Force Fields in Vacuum is False (and known to be so).
5. Treats Charge **q** as Unitary Instead of Coupled System $\mathbf{q = \phi(q)m(q)}$.
6. Confuses Massless Potential Gradients as Forces (See #3, #4).
7. Does Not Utilize Mass as a Component of Force (See #23).
8. Erroneously Assumes EM Force Fields as Primary Causes.
9. Topology of EM Model Has Been Substantially Reduced.
10. Does Not Include Quantum Potential or Action at a Distance.
11. Does Not Include Superluminal Velocity of Inner EM Components.
12. Does Not Utilize Extended Near-Field Coulomb Gauge Effects.
13. Does Not Include EM Generatrix Mechanism for Time Flow.
14. Does Not Unify Photon and Wave Aspects (Requires 7-D Model).
15. Does Not Include Electron Spin and Precession (See #19, #24).
16. Treats EM Energy As Existing In "Chunks," Instead of as Flow.
17. Confuses Energy and Energy Collection (See #16).
18. Discards Half of Every EM Wave in Vacuum (See #22)
19. Erroneously Uses Transverse Vacuum Wave; It's Longitudinal.
20. Arbitrarily Regauges Maxwell's Equations to Eliminate Over-Unity.
21. Omits Phase Conjugate Optics Effects (The **Rule** in Internal EM).
22. Does Not Include EM Cause of Newtonian Reaction Force.
23. Erroneously Assumes Separate Force Acting on Separate Mass.
24. Confuses Detected Electron Precession Waves as Proving Transverse EM Waves in Vacuum (Remnant of Old "EM Fluid" Concept).
25. Due to Error in String Wave, Omits the Ubiquitous Anti-wave.
26. **Assumes** Equilibrium; Not True Unless Include Vacuum Interactions.
27. Higher Topology Required, to Model Electromagnetic Reality.
28. Lorentz surface integration discards Poynting energy transport.
29. Has nothing at all to say about form of EM entities in massless space.
30. Eliminates the infolded general relativity using EM-force as curve agent.
31. Does not include longitudinal EM waves as time domain oscillations.
32. Does not include EM mechanism that generates time flow and flow rate.

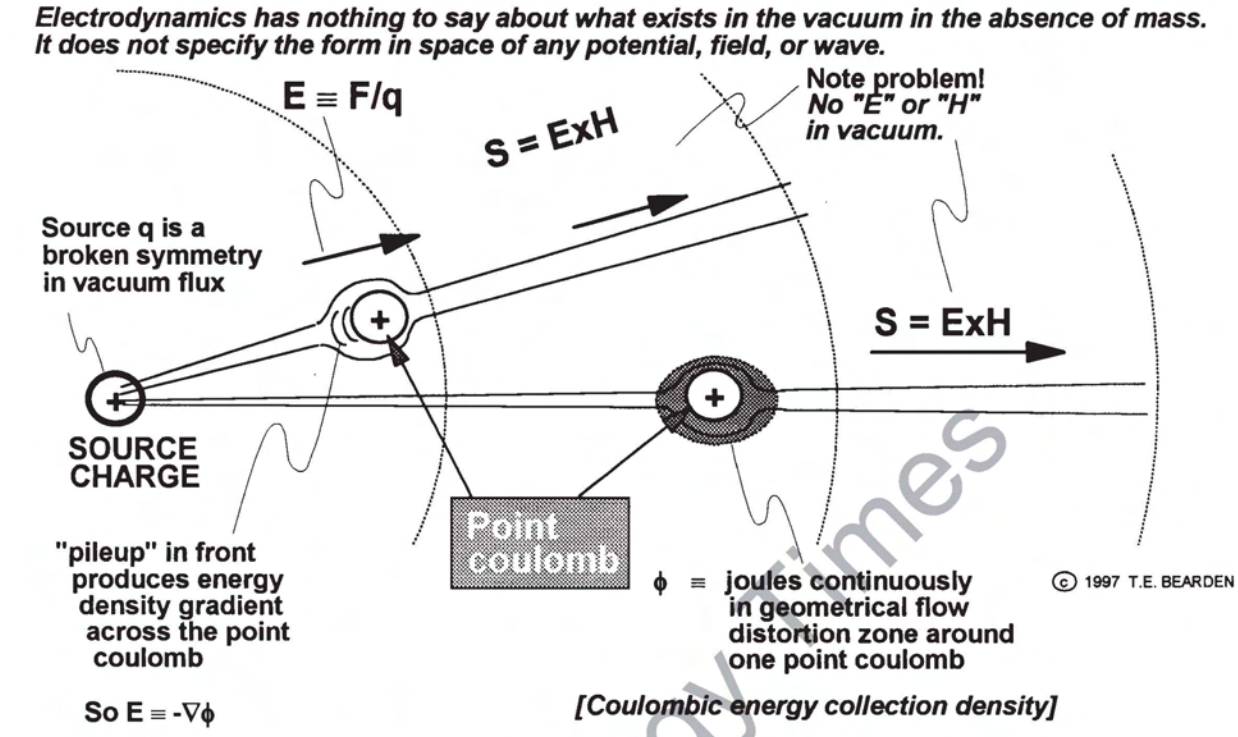

Figure 1. Fields and potentials are defined in terms of the disruption of the Poynting energy flow from the source charge, about an intercepting and "collecting" charge.

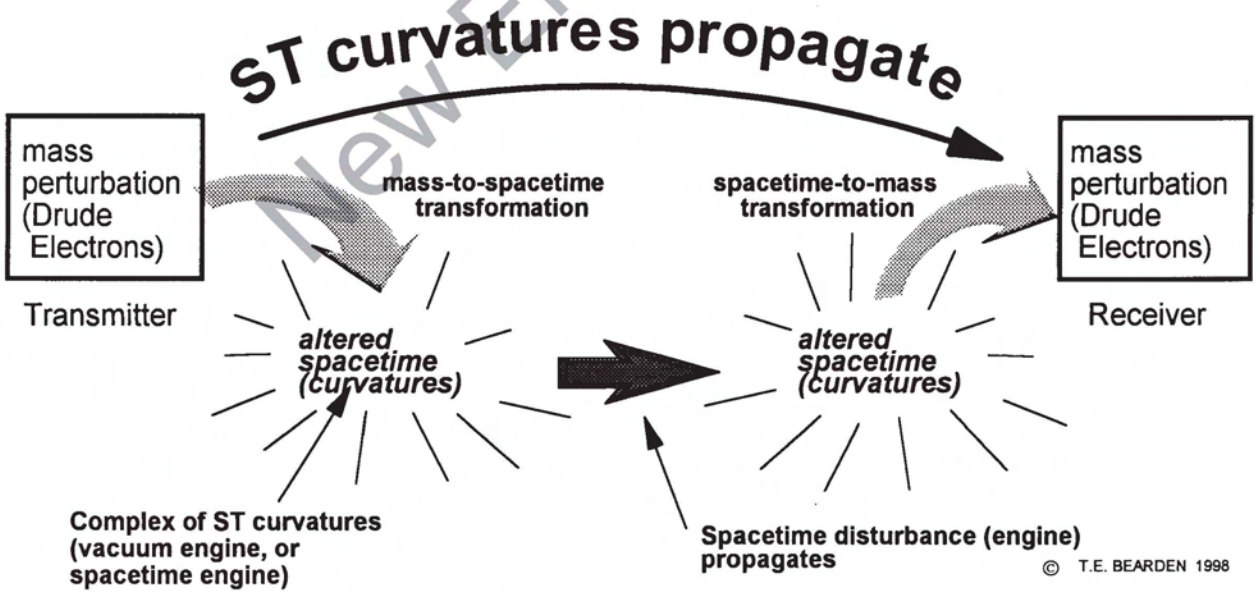

Figure 2. The mass-to-mass transform contains two hidden infolded transforms: (i) the mass-to-spacetime transform and (ii) the spacetime-to-mass transform.

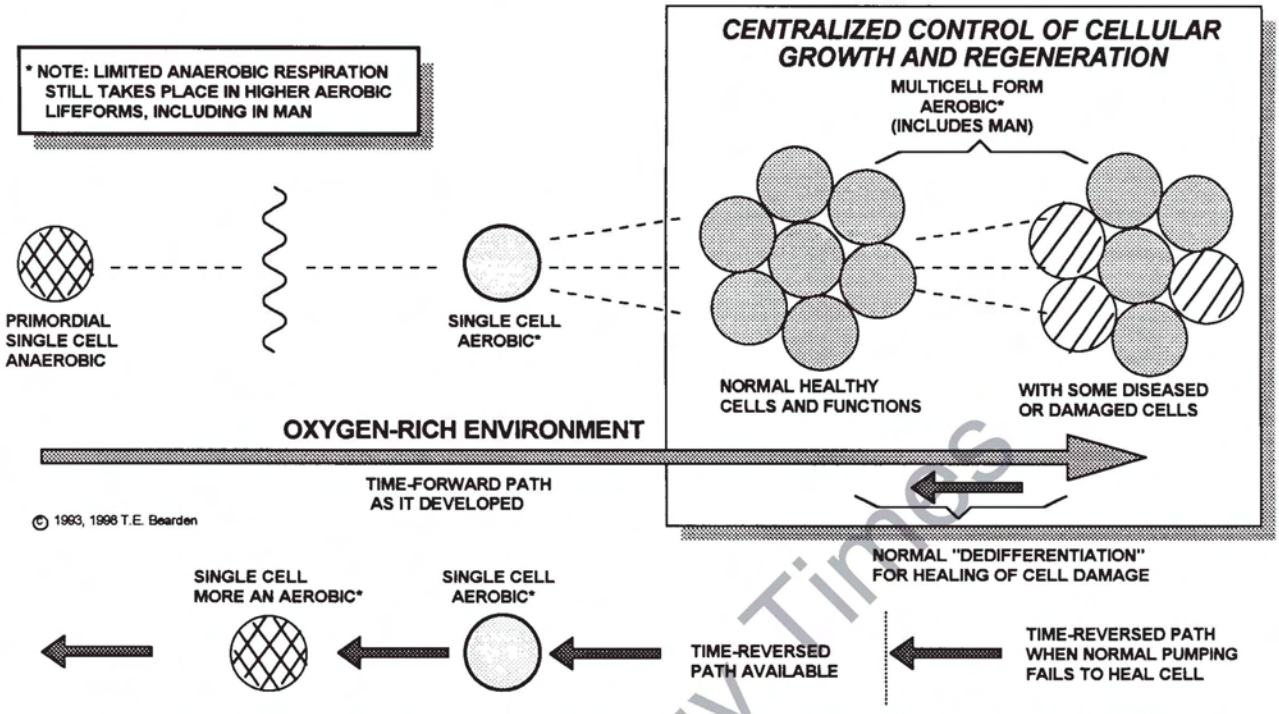

Figure 3. The entire evolutionary path of the organism is available as a path for dedifferentiation by LW pumping.

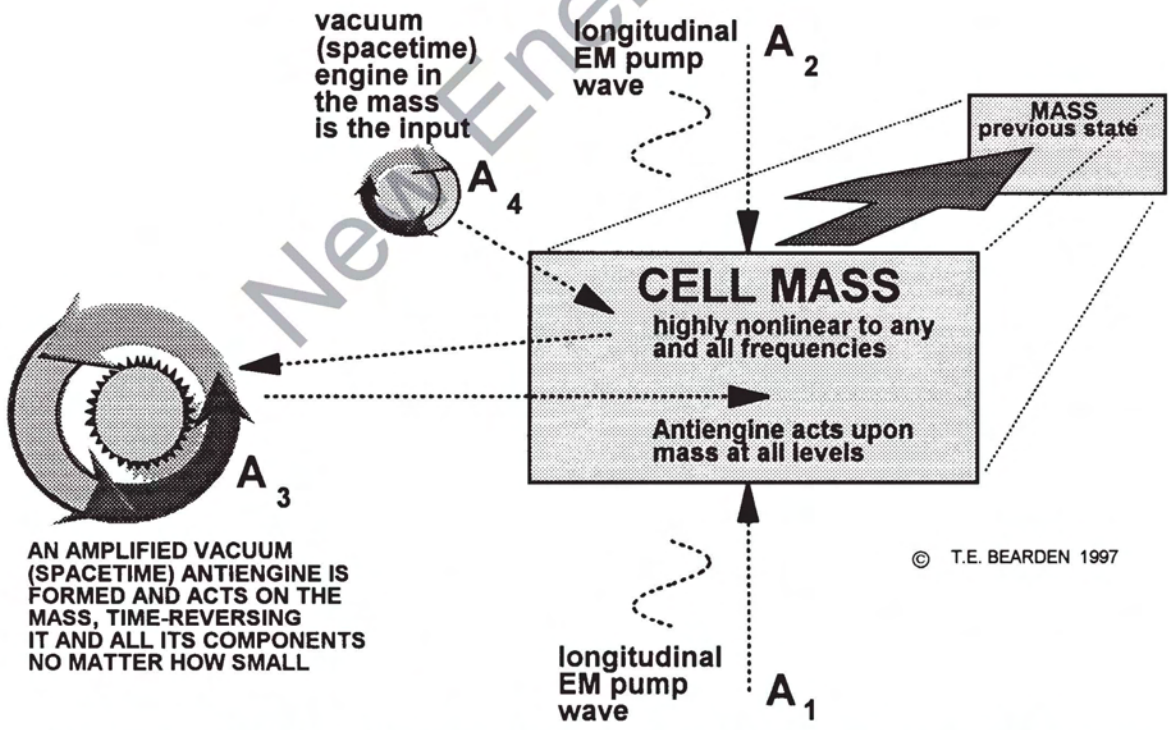

Figure 4. Pumping a cellular mass with longitudinal EM waves pumps it in the time domain, and time-reverses the cellular mass back to a previous state and physical condition -- genetics and all.

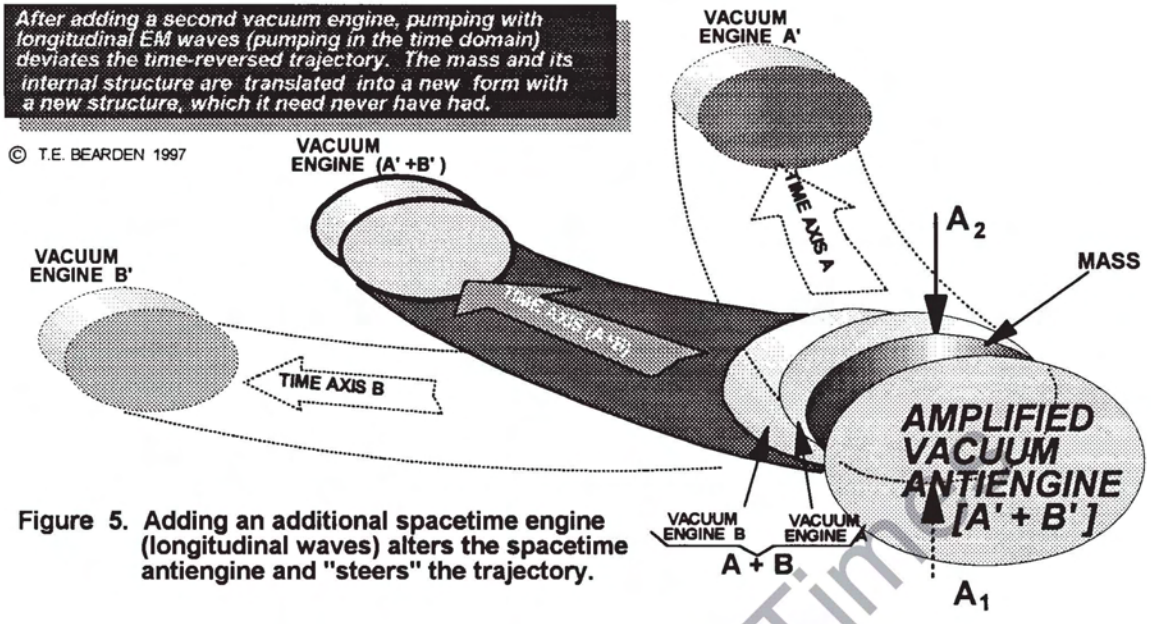

Figure 5. Adding an additional spacetime engine (longitudinal waves) alters the spacetime antiengine and "steers" the trajectory.

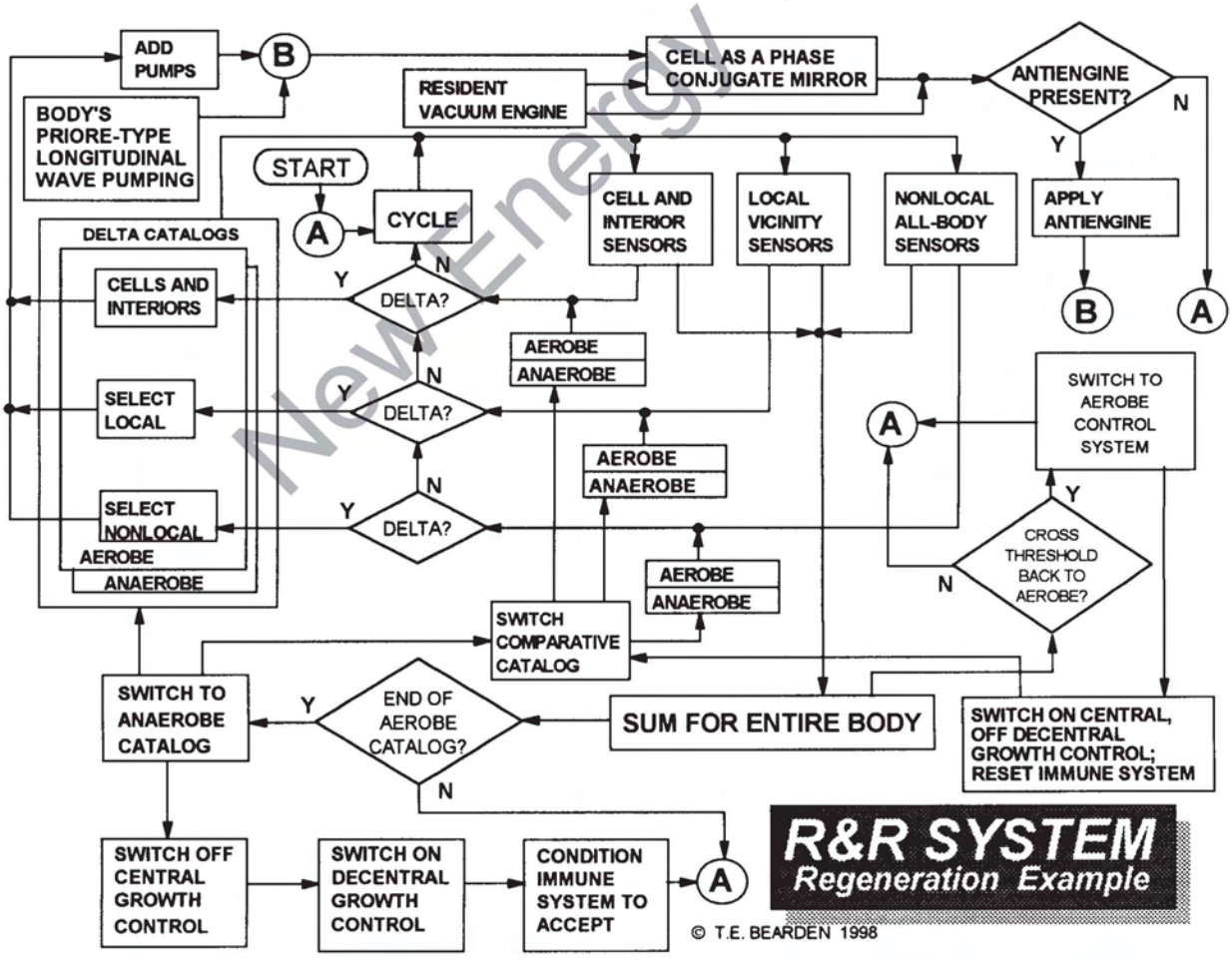

Figure 6. Overview of the new, extended functional model of the R&R system.

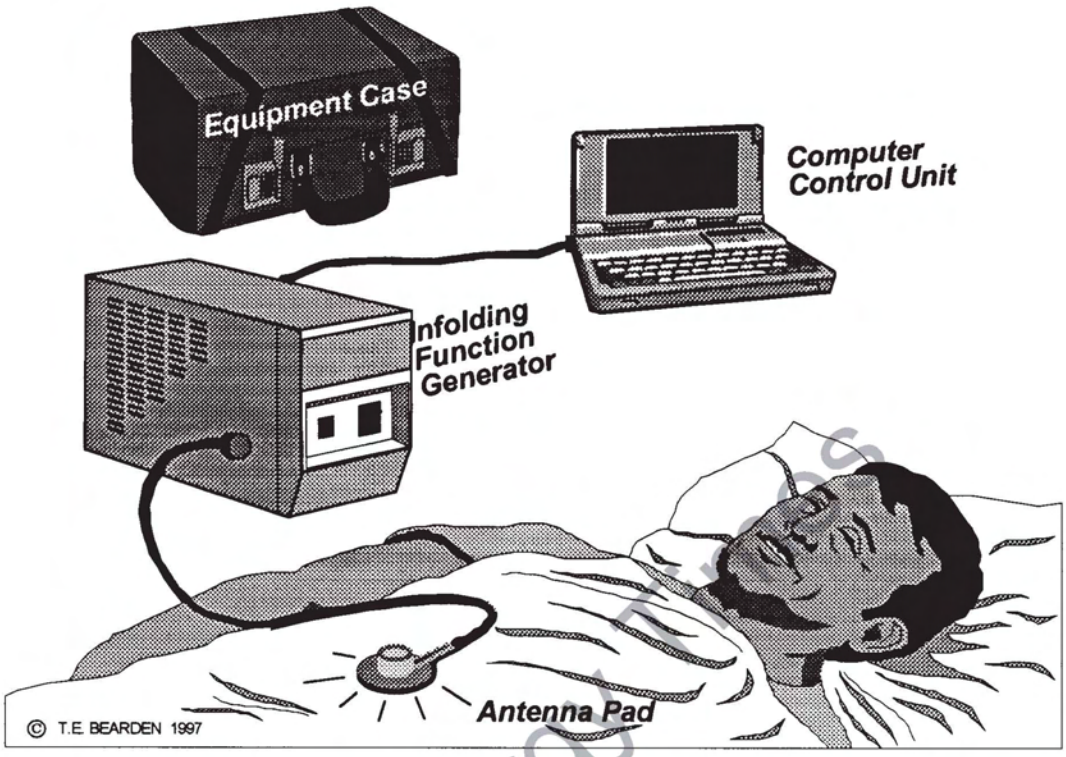

Figure 7. Portable first-method treatment unit proposed to the Department of Defense. For treating and curing mass casualties from terrorist BW attacks on U.S. population centers.

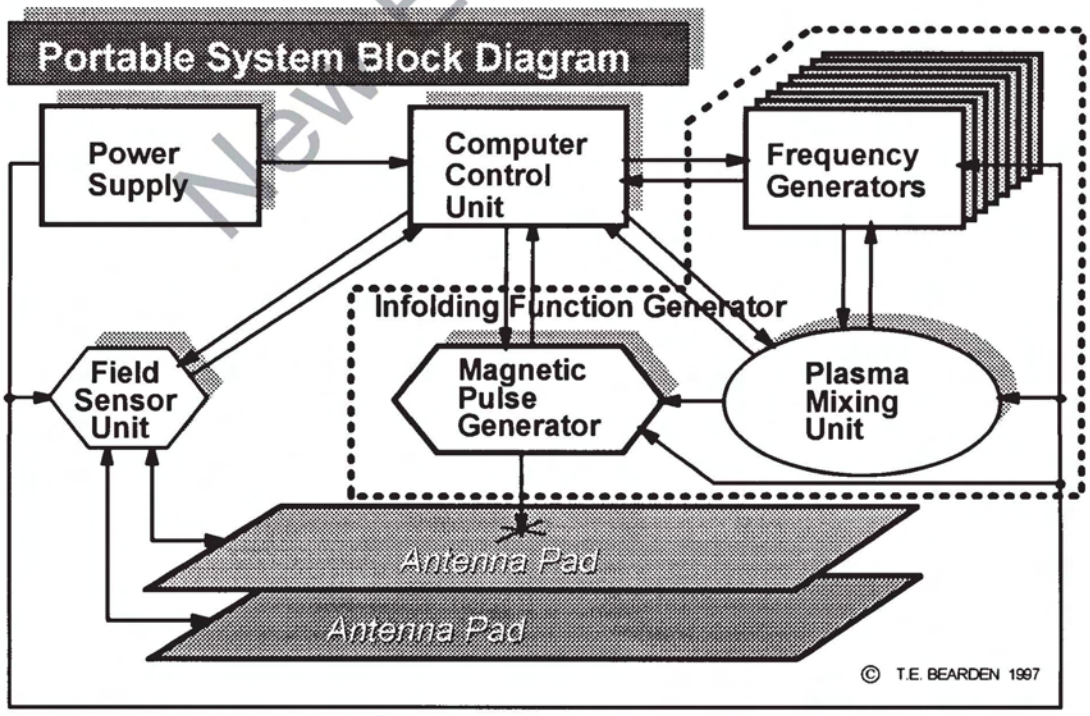

Figure 8. Block diagram of the proposed portable First Method treatment unit.

A SEA OF NEUTRINOS AS THE LUMINIFEROUS MEDIUM

Chuck Bennett [1]

ABSTRACT

The discovery of the neutrino with mass has provided a quantized agent enabling the resurrection of a luminiferous medium previously dispelled at the turn of the century by Albert Einstein as "superfluous." The neutrino medium replaces the abstract "mathematical medium of curvature" of general relativity with a real particle that has defined curvature in terms of a true helical spiral. The massive neutrino comprises photons, light wave, electrons, protons, and all other larger particles now known to exist. An approach to modeling light waves and photons is presented utilizing the helical spiral pattern of the neutrino with mass. The mass energy equivalence as well as Planck's law is derived from the model. In addition, the model can be extended to provide a premise for inertia and gravitation as well as a theory for matter production cycles within planets and stars.

DISCUSSION

New revelations from Japan have declared that the illusive neutrino has mass [1]. This discovery means that the universe has much more mass than previously thought [2]. A postulate is proposed, herein, that neutrinos with mass comprise the luminiferous medium that pervades all space in the universe. The neutrino with mass is equated to a particle called the "Q" particle (short for quanta) coined in a previous article describing the luminiferous medium as a sea of quantized particles [3]. There is no longer the need for the concept of a pure vacuum. Nor does the space between the particles consist of definable matter. Instead, the space is simply uncondensed primordial gradient fields created by a massive sea of neutrinos.

The basic postulate is extended to encompass neutrinos with mass as comprising photons, light waves, electrons, protons, and all other larger particles now known to exist. An approach to modeling light waves and photons is also set forth herein based on the premise than light is a helical spiral pattern of the motion template for the basic action of the neutrino with mass. The pattern is traced out in the luminiferous neutrino medium by a point mass consisting of a neutrino group. This particle starts as a condensed photon [4, 5]. Therefore, light can be thought of as "evaporated mass" and mass as "condensed light" according to the transformation equation, $E = mc^2$ [6].

Planck's law and the mass-energy equivalence can be derived from a combination of a spiral helical corkscrew motion template for the fundamental particles and the conservation of angular momentum. The particles travel in helical patterns where the tangential velocity and the forward velocity are both the speed of light, c [7]. This concept provides a connection between particle and wave behavior because the side view of this motion is a perfect sine wave. Yet, the neutrino group producing the pattern is a "virtual particle". One period of revolution is equal to a period of the sine wave. The frequency, f, is equal to the reciprocal of the period, 1/T. The circumference of the axial view of the spiral is equal to the wavelength of the sine wave because with the equal perpendicular velocities, one revolution is completed in the same time as one sine wave.

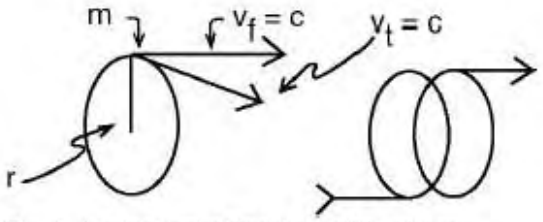

Fig. 1 Helical spiral "corkscrew" pattern.

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The conservation of angular momentum is applied to the circular motion about the axis of travel. If we have a mass of the light particle, m, and the radius, r, of the circle tangent to the forward motion, and the velocity, c, of light, then we have mvr = constant, or mcr = constant. Since 2πr is the circumference, C, which is also the wavelength, λ, of the forward motion, we have:

$$mcr = mc\lambda/2\pi = \text{constant}$$

$$mc\lambda = 2\pi = \text{constant}$$

If we recall that c = λf, and we set 2π •constant to 2πħ, or h as Planck's constant, we have:

$$mcc/f = h$$

$$mc^2 = hf$$

We recognize that mc^2 is the total energy so:

$$E = mc^2 = hf$$

The total relativistic energy is also the sum of the tangential component and the forward component:

$$½\ mc^2 + ½\ mc^2 = mc^2$$

When a stream of particles connect in the helical spiral pattern, a sinusoidal light wave results. Polarization occurs when the top dead center of the spiral is oriented in a synchronized pattern. Interference, diffraction and refraction can be modeled with the wave pattern scribed out by the underlying particles. This model provides a connection between the wave and the particle and no longer should they be considered as a "dichotomous" phenomena of nature [8].

At an early age, Albert Einstein asked himself the question, "What would happen if you were to ride on a beam of light?" In later years, this pondering lead to his publication of revolutionary theories about Maxwell's Electrodynamic equations and significant changes in our fundamental system of measurement [9]. A very powerful relationship between the property of mass and the release of light energy shortly followed [6].

We may ask the question, "What would happen if you were to take a quantum of electrodynamic light energy and wrap it up into a very small ball of stationary mass energy as a spherical shaped neutrino vortex?" Maxwell's original equations describe how light is propelled by a changing magnetic field that causes an electric field. The change in the electric field, in turn, causes the magnetic field. By circular reasoning, one causes the other and vice versa. A spherical vortex in the neutrino medium creates the same effect, but in a stationary inertial entity. Rotating magnetic fields change with a circular frequency thus causing a fight angle orthogonal electric field that also circulates thus causing the original magnetic field.

This view can be reversed to describe light as an "unraveled vortex" that travels in the helical spiral motion path. In addition to a more direct mechanism to explain mass energy, the theory offers a method to explain inertia and gravity. All matter can be modeled with the vortex approach. When electromagnetic gradients radiate from one body and impinge on another, a bias in the local field emerges. With various lines of reasoning, the mechanism for gravity results from this bias. Both the electromagnetic radiation from a body and the gravitational field follow the $1/R^2$ relation, but with different constants. A link between the two using the bias model offers a simple theory for the cause of gravitation.

When the direction of the flow of light is compared to the direction of the flow of mass that creates the light, it is generally observed that the two travel in opposite directions. Photon emission from a contracting electron is a prime example [5]. In terms of a duality of action, **when mass contracts inward, light is emitted outward, and when light emits outward, mass contracts inward.** This duality of action is analogous to the piezoelectric effect in polarized ceramics where a contraction of the material induces an electric voltage, conversely an electric voltage causes the contraction of the material. The extension of the analogy to the piezoelectric effect results in the coinage of the term, **"piezo-electromagnetism"** to describe the inverse relation between light emission and matter contraction as a new theory for gravitation.

A theory of energy generation is also proposed herein that postulates the cause of the source of energy that drives the output of light emission from any body with mass large enough to have a measurable amount of black body radiation. Molecular vibrations, internal friction and a general "grinding" action will generate a constant source of radiant heat from within the mass. The exchange of radiation with other masses is directly proportional to the gravitational attraction between the masses.

Naturally, larger bodies have more internal friction grinding, thus creating larger gravitational fields. The core and mantle within the Earth manifest a great amount of molten flow in circular motion. It is the purpose herein to introduce a concept of matter production cycles within planets and stars driven by mass energy reactions that can range from subtle reactions to the helium production system of fusion within the Sun.

Starting with hydrogen, there is an effect whereby hydrogen "rains" down into the star or planet. High density charge clusters can create nuclear reactions [10]. "High density charge clusters are produced with every lightning stroke and every crack of our crystalline rich earth produces many charge clusters - which in turn produces nuclear reactions" [11]. Then larger atoms are formed either by fusion to helium or molecules formed by chemical combination such as hydrogen into water. Then the heavier molecules experience cycles of heavier element production. Thus hydrogen can cycle down into the Earth's core until it becomes latticized within earthen materials and metals. The flow of molten material becomes solidified upon passage to the Earth's poles. Then the composite material is available for transmutation reactions that occur and generate higher elements in the process. This process provides the basis for energy and matter generation that allows the process to feed back upon itself to also generate its own energy to continually propel the cycle.

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Editor's Note: See Hal Fox's book review of Vladimir N. Larin (Russia), Hydridic Earth, The New Geology of Our Primordially Hydrogen-Rich Planet, c1993 by Polar Publishing, PO Box 4220, Station C, Calgary, Alberta, Canada T2T 5N1, 247 pages, illus., 263 refs. *New Energy News*, March 1995. This book suggests that enormous amounts of hydrogen were enfolded into the primodial earth.

TRITIATED AMORPHOUS SILICON POWER CELLS

Paul M. Brown, Ph.D.[1]

ABSTRACT

The application of tritiated amorphous silicon as an intrinsic energy conversion semiconductor for betavoltaic devices is presented. Analysis of the betavoltaic application shows an overall efficiency of *25%* for tritiated amorphous silicon. A betavoltaic battery is a nuclear battery that converts energy from beta particles released by a beta emitting radioactive source, such as tritium, into electrical power. Common semiconductor designs of betavoltaic batteries use a semiconductor p-n junction device that is either directly exposed to beta decay or is illuminated by photons created when betas strike a phosphor. These common betavoltaic batteries suffer from technical problems in that the directly irradiated cells suffer material degradation of the p-n junction limiting the operating life to days while the photo conversion systems are indirect and limited by efficiency to less than 1%. A limitation of the aforementioned betavoltaic batteries is the self-absorption of beta energy in the radioactive source itself. In order to reduce the self-absorption of beta energy the radioactive isotope must be incorporated into the lattice of a semiconductor. Details of this process are reported.

INTRODUCTION

Tritiated amorphous silicon is a novel, thin-film material where tritium, a radioactive isotope of hydrogen, is bonded with silicon in the amorphous network. Tritium has a half-life of 12.5 years, is overall a benign radiation hazard, and the pure beta decay of tritium produces a beta particle with a mean energy of *5.7* KeV. Thin-film, contact-potential, tritiated-amorphous, silicon cells have been built. These cells, called tritium batteries, have a specific power of 24 watts per kilogram, a full load operating life of 10 years, and an overall efficiency on the order of 25%. Cheap, long-life, high energy density, low-power batteries. I first disclosed this technology and the method of producing tritiated amorphous silicon January 1990 [1]. Today this technology is patented [2], with additional patents pending, verified and several institutions are now developing manufacturing techniques [3].

BACKGROUND

The betavoltaic effect may be defined, as shown in Fig. 1, in simple terms as the conversion of ionizing radiation to electrical energy by a material or combination of materials. Radiation that is absorbed in the vicinity of any potential barrier, say a p-n junction, a metal semiconductor contact or an electric field will give rise to separated electron-hole pairs which in turn flow as electricity due to the Volta effect. Of course, this occurs to a varying degree in different materials and geometries. So then, beta decay generates ions in the semiconductor and those ions migrate across the voltage barrier in much the same manner as in a solar cell with the radiant energy of the sun replaced by the emitted beta flux.

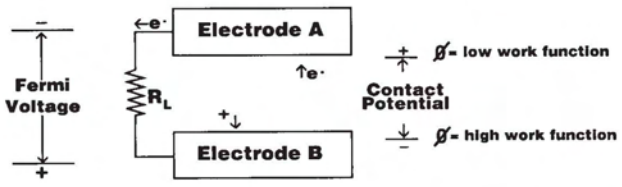

Fig. 1 Basic Beta Voltaic Effect

The emitted high energy beta particles from the radioactive source, traverse the cell material losing energy and creating electron-hole pairs. Those carriers within a diffusion length of the junction are swept across contributing a current. The highest device efficiencies are achieved by choosing a wide bandgap material capable of absorbing high energy beta particles without degradation. Further, it should be noted that device efficiency increases with increasing source energy and flux.

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D, the number density of electron-hole pairs generated per second in a tritiated amorphous silicon film is given by:

$$\mathbf{D} = \mathbf{k}\lambda\mathbf{n}\mathbf{E} / \epsilon \quad (1)$$

where λ is the decay constant of tritium (1.78×10^{-9} s^{-1}), **n** is the density of atomic tritium (0.5×1^{22} cm^{-3} assuming 10 atom % tritium atoms), **E** is the average energy of a beta particle from tritium (5.7 keV), ϵ is the energy needed to produce an electron-hole pair from an energetic particle (3.4 to 4.4 eV) and **k** is the fraction of betas that do not escape from the material [4].

In a tritium battery, electron-hole pairs are generated within the intrinsic layer and are separated by the electric field, as shown in Fig. 2. This device is analogous to a photovoltaic cell and the current-voltage equation can be written as

$$I = I_o (e^{qV/kNT}-I)-I_B \quad (2)$$

where I_o is the reverse saturation current, q is the electronic charge, V is the voltage, N is the ideality factor, K is Boltzmann's constant, T is the temperature, and I_B is the beta induced current. The beta induced current is related to the generation rate of electron-hole pairs, the size of the device, and the efficiency of the electric field in separating the charges. I_B may be expressed as

$$I_B = q\eta DtA \quad (3)$$

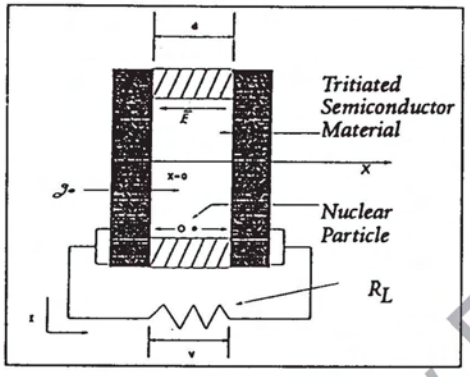


Fig. 2 Tritium Battery Detail

where η is the fraction of carriers that do not recombine in the intrinsic region, t is the thickness of the tritiated intrinsic layer, and A is the cross-sectional area of the device. The open circuit voltage is written as

$$V_{oc} = NkT/q\ 1n(I_B/I_o + 1). \quad (4)$$

The betas in a tritiated amorphous silicon film can also give rise to beta-conductivity that is of similar behavior to photo conductivity. Thus beta-conductivity can be written as

$$\sigma_B = q\eta D\ (\mu_e T_e + \mu_h T_h) \quad (5)$$

where μ_e and μ_h are the mobilities of the electrons and holes, respectively, and τ_e and τ_h are the lifetimes of the electrons and holes, respectively. Since the $\mu\tau$ product is larger for electrons than for holes in tritiated amorphous silicon, the beta-conductivity equation [5] may be written as

$$\sigma_B = q\eta D\mu_e T_e. \quad (6)$$

A tritium battery consists essentially of a tritiated amorphous semiconductor sandwiched between two dissimilar metals, that is metals with different work functions. The beta-induced electron-hole pairs are separated by the electric field present, thus giving rise to an intrinsic nuclear battery which is similar to a betavoltaic battery but is powered by tritium decay betas rather than external electrons.

Consider an intrinsic tritium battery wherein the *i* region, of thickness x, consists of tritiated amorphous semiconductor while the electro-positive and electro-negative regions consist of appropriate metal layers [6]. The maximum beta power per unit area produced within the intrinsic region can be expressed as

$$P_B = \lambda\mathbf{n}x\mathbf{E}. \quad (7)$$

The maximum areal current density within the tritium battery is given by

$$I_{max} = eP_B/\epsilon \quad (8)$$

Fig. 3 Ion Sputter Deposition Chamber

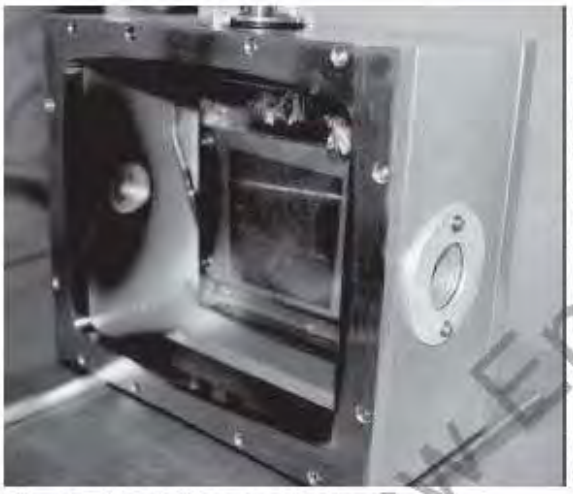


Fig. 4 The Substrate Heater

Fig. 5 The Target Holder and gas line.

where e is the elementary charge. Defining η_c as the current collection efficiency, the tritium battery short circuit current is simply

$$I_{sc} = \eta_c I_{max} . \quad (9)$$

The maximum power obtainable from such a cell [7] is then expressed as

$$P_{max} = I_{sc} V_{oc} F \quad (10)$$

Where V_{oc} is the open circuit voltage and F is the fill factor (0.74). Substituting for I_{sc} (9) in the preceding relation (10), the following expression for P_{max} is obtained

$$P_{max} = \eta_c (eV_{oc} / \epsilon) F P_B . \quad (11)$$

Finally, the overall efficiency η of the intrinsic tritium battery is

$$\eta = P_{max} / P_B = \eta_c (eV_{oc} / \epsilon) F = \eta_c \eta_s \quad (12)$$

where η_s is defined as the semiconductor efficiency [8].

The entrapment of tritium is particularly apt in this application as it is readily substituted for the hydrogen present in hydrogenated amorphous semiconductors with good intrinsic electronic properties. Radioisotopes other than tritium, may also be used as a source of energetic electrons as well as other forms of energetic nuclear radiation such as krypton-85 [9] for example.

This paper shall present a description of the properties and methods of preparation of amorphous semiconductors, concept and theory of tritiated amorphous semiconductor applications. All films were deposited using an ion-sputtering system.

Hydrogenation of amorphous silicon is essential as it serves to significantly reduce the defect nature of amorphous silicon by terminating a majority of the defective silicon bonds. Typically 10 to 25 atomic percent hydrogen is incorporated into amorphous silicon hydride to obtain a material with good semiconductor properties. The hydrogen is bonded to silicon and can be chemically stable to temperatures of 300°C. Tritiated amorphous silicon can be deposited in the form of small and large area thin films onto a wide variety of substrates, electrically conducting and insulating, using low temperature processing techniques. Various ion-sputtering plasma deposition techniques differ in the form of excitation used and in the resulting range of operating pressure.

The metal as well as the intrinsic layers were deposited using our ion sputter deposition system shown in Fig. 3. The system consists of a substrate holder at one end, shown in Fig. 4, and a target holder at the other end, Fig. 5. The substrate holder can be heated to 300°C and can be biased from floating to ground potential. Tritium was stored as a tritide on a depleted uranium bed and was released by heating the bed. The temperature of the bed was used to control the equilibrium partial pressure of tritium over the bed and a calibrated pinhole was used to introduce tritium into the chamber. The system was pumped with a turbo molecular pump backed by a vacuum pump. During the tritium depositions, the exhaust of the vacuum

system went to a tritium scrubber which traps tritium as tritiated water. The entire deposition system is housed in a nitrogen glovebox.

The tritium content of discharge-deposited amorphous silicon film can only be indirectly controlled via the discharge parameters and the substrate temperature. However, these parameters also affect other aspects of film growth. The relatively low pressure required to ignite a discharge allows co-evaporation of silicon to directly control the silicon-tritium ratio. In this design, silicon is evaporated by rf inductive heating of high purity silicon held in a fixture. This provides relatively uniform heating.

Our tritium scrubber is a design modeled after the tritium scrubber in use at Lawrence Livermore National Laboratory [10]. A tritium scrubber positioned after the two vacuum pumps, is used to strip tritium from the chamber effluent, by converting the tritium gas into tritiated water which is collected in desiccant. The scrubber consists of a stainless steel cracking chamber filled with catalyst (Engelhard #A16648) heated to a temperature of 1,000°F to ensure combustion of hydrocarbons over the catalyst including methane. The heat is provided by a tube furnace (Thermolyne Model F21125) which maintains a constant temperature to within 2° . From there the effluent passes through a gas-to-gas condenser consisting of 20 turns of stainless steel tubing, cooled by a fan. The cooled effluent and condensate then pass through two molecular sieves connected in series, each made of stainless steel and filled with desiccant (Linde #5A). A centrifugal blower is attached to the outlet port of the molecular sieve to draw gasses out and into the exhaust stack ventilation. A getter bed consisting of 800 grams of zirconium-manganese-iron (St 909) alloy [11], is positioned downstream of the centrifugal blower for the purpose of scavenging trace quantities of tritium before venting the chamber effluent.

The scrubber system is configured so that the deposition process can be carried out in a once flow-through mode or with the process system isolated. The latter is the preferred mode of operation where the chamber effluent gasses are continually processed yet the scrubber system volume is sufficiently large to ensure that the downstream pressure is below the required backing pressure for the turbo molecular pump.

The Lawrence Livermore scrubber has been operated for years without degradation of the catalyst. The molecular sieve will retain a water content of 15% of the dry weight of the desiccant prior to the breakthrough of tritium. Loaded drying flasks are then removed from the system, capped, and disposed of as tritiated water. This scrubber design reduces the tritium concentration in the effluent by one million times.

The intrinsic tritiated amorphous silicon layer was formed by initiating a discharge and introducing tritium gas into the reaction chamber. The structure of the tritium battery was nickel foil substrate, intrinsic layer of tritiated amorphous silicon, and zinc [12].

RESULTS

Fourier transform infrared measurements indicated that tritium atoms were bonded with silicon atoms. The bonded tritium concentrations were up to 25 atom %. Tritium out-gassing measurements were performed on the tritiated amorphous silicon films and it was found that tritium was stably bonded in the film at room temperature up to 300°C. The short circuit current and open circuit voltage are given in Fig. 6.

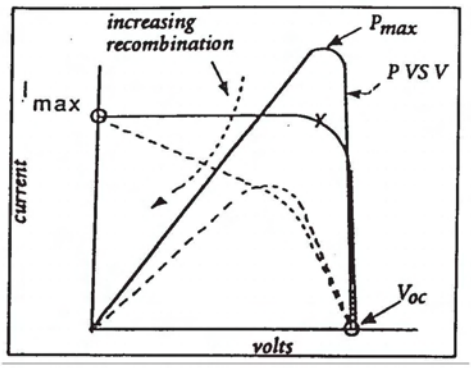
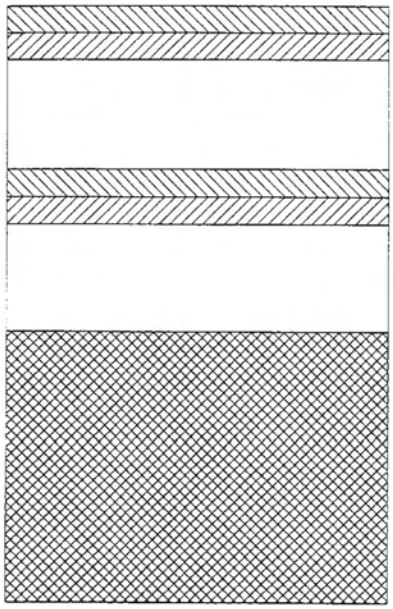


Fig. 6 Voltage-Current curve for Tritium battery.

Tritiated amorphous films are mechanically stable, free of flaking or blistering, with good adherence to the substrate and may be simultaneously deposited onto both conducting and insulating substrates using a discharge in tritium plasma. The silicon layer sputtered in a tritium/argon ambient at temperatures below 300° C results in a tritiated amorphous silicon film with the tritium concentration being variable from 5 to 30% depending upon deposition conditions.

The optimum tritiated amorphous silicon thickness is a tradeoff between capturing all the beta energy and collecting all the generated electron-hole pairs. Most of the beta energy is captured in a 2 μm thick film. Tritium batteries display a damage mechanism the same as the well known Staebler-Wronski degradation seen in all amorphous silicon photovoltaic devices. Staebler-Wronski degradation is driven by electron-hole recombination and manifests itself as a decrease in the cartier diffusion length. For hydrogenated amorphous silicon photovoltaic devices, the



highest initial efficiency occurs for device thicknesses around 800 nm, but because of the degradation in diffusion length the highest stable efficiency is obtained for 350 nm thick devices. From a stability viewpoint, the maximum allowable tritiated amorphous silicon film thickness falls in the 200-500 nm range.

The maximum useable thickness of tritiated amorphous silicon film is limited by the degraded carrier diffusion length, and is too thin to capture all of the beta energy. However, good device design allows most of the beta energy to be captured in the semiconductor. The basic concept is to use a multilayer stack with the intermediate pairs being thin enough to be transparent. The outermost metal layers are thick enough to act as electron reflectors.

The stack structure shown in Fig. 7, provides a monolithic series connection resulting in the addition of the voltages from the individual cell units. The films are typically grown at a substrate temperature of 200°C with 10-30 atomic percent tritium incorporated into the film. The tritium concentration may be increased by reducing the deposition temperature, but at a cost of a reduction of carrier diffusion length. Cadmium sulfide (CDs) is a wide bandgap semiconductor with a density of 4.8 g/cm^3, more than double the density of silicon. The higher density will result in more efficient energy capture from high energy betas. In general, wide bandgap semiconductors have been found to be more radiation hard than low bandgap semiconductors, so cadmium sulfide may also be more stable.

CONCLUSION

The concept of intrinsic power conversion is achievable in tritiated amorphous silicon semiconductors for the purpose of low power applications. Tritiated amorphous silicon was used to make a contact potential battery or tritium battery with a specific power of 24 watts/Kg and an efficiency of 25% [13]. Specific power is a function of the power density and the half-life of the isotope used. Measurements indicate that tritium was stabley bonded in the amorphous silicon network. Products based upon this technology are currently being developed.

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SOLVING THE NUCLEAR WASTE PROBLEM THROUGH APPLIED PHYSICS

Paul M. Brown, Ph.D.[1]

INTRODUCTION

Nuclear Solutions LLC has developed a process for neutralizing radioactive waste products whereby gamma radiation (x-rays) is used to induce nuclear transformations that change the normal half-life of radioisotopes, usually measured in thousands of years to a half-life measured in days, simply by using applied nuclear physics. This means that the radioactive waste products decay into non-radioactive stable elements in a matter of days. Patents are now pending.

NUCLEAR WASTE (FISSION PRODUCTS)

The two fission products of principal concern because of their substantial thermal impact on the repository as opposed to posing a health risk are Sr^{90} and Cs^{137}. These two radio-nuclides are dominant contributors to the heat released by spent fuel at least for the first several decades. Cs^{137} is also a major source of penetrating radiation emitted by spent fuel. The two fission products of principal concern because of their potential contribution to health risk are Tc^{99} and I^{129}. They are of principal concern because they are long-lived, produced in significant amounts in the fission process, generally soluble under geologic conditions, and migrate relatively quickly under common ground water conditions.

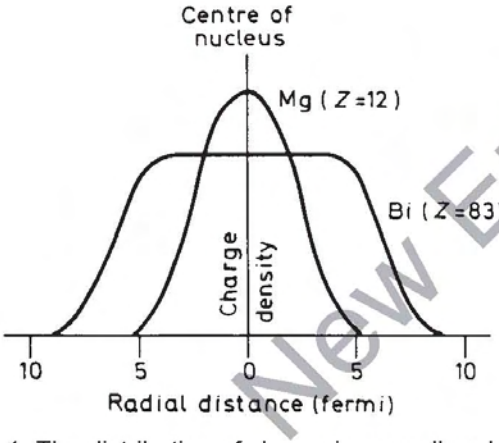

Fig. 1. The distribution of charge in a small and large nucleus. In the latter there is a central core of constant density and a diffuse outer region.

The long-term toxicity of spent fuel is dominated by the actinides such as Np^{237}, $U^{234,236}$, and $Pu^{239,240,242}$. However, the long-term risk is dominated in most scenarios by I^{129} and Tc^{99} because they are typically soluble and mobile in groundwater pathways. By being relatively insoluble under most conditions, the actinides are not mobile, so despite their high toxicity they contribute very little to the long-term exposure risk in scenarios where groundwater transport is important [1].

NUCLEAR PHYSICS

The nuclear charge is equal to +Ze, where Z is a whole number called the atomic number of the atom. The nuclear charge arises from the presence of Z protons in the nucleus. Atoms and nuclei are named according to their Z-values. For hydrogen, Z = 1; for helium, Z = 2; and so on. The mass number, A is equal to the total number of particles, of protons and neutrons (collectively called nucleons), in the nucleus. Of the A nucleons in the nucleus, Z are protons and the rest, N = A - Z, are neutrons. N is called the neutron number.

In much of physics and practically the whole of chemistry Z is far more significant than A (or N). This is because most of the ordinary properties of matter are due to the clouds of electrons outside the nuclei. In nuclear science, on the other hand, the situation is entirely different. A ranks equal in importance with Z, and its value must be added to the chemical symbol.

Just as nuclides having the same Z-value are classified together as isotopes, as are those with the same A-values (but different Z-values) classified together as **isobars**, and those with the same N-values as **isotones**. Thus Ar^{40}

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and Ca^{40} are isobars, and Si^{30}, P^{31} and S^{32} are isotones (with N = 16). Particles such as electrons and nucleons which obey the Pauli exclusion principle are called fermions and are said to follow Fermi-Dirac statistics. Those not so limited are called bosons and are said to follow Bose-Einstein statistics. Even-A nuclei are bosons and odd-A nuclei are fermions.

All attempts to form a picture of the nucleus today are based on the idea that it is composed of protons and neutrons. The nucleus is much smaller than the atom. Roughly, the ratio of their diameters is as $1:10^4$. The actual size is given sufficiently well by the formula $R = 1.4A^{1/3}$, where R is the radius in fermis (10^{-13} cm). All nuclei have the same average density, however, large they may be. In SI units the density has the enormous value of 2×10^{17} kg/cm^3.

Nuclei have a dense central core, which is nearly homogenous, surrounded by an outer layer in which the density tapers to zero. The outer layer is about 2.4 fermis thick.

RADIOACTIVE DECAY

In radioactive decay, nuclei change spontaneously in the direction of greater stability, losing energy in the process.

Types of Radioactive Decay:
1. α-decay, in which the nucleus emits an alpha particle, e.g., $U^{238} \rightarrow Th^{234} + He^4$.
2. β-decay, in which the nucleus emits an electron, e.g., $P^{32} \rightarrow S^{32} + \beta^-$. An electron emitted from the nucleus is known as a beta particle.
3. β^+-decay, in which the nucleus emits a positron, e.g., $F^{18} \rightarrow O^{18} + \beta^+$.
4. EC-decay (electron capture decay), in which the nucleus captures an electron from the electron cloud of the atom, e.g., $Mn^{54} + e^- \rightarrow Cr^{54}$.
5. Its (isomeric transitions), in which the nucleus undergoes a transition from an upper to a lower energy state, e.g., $Br^{80} \rightarrow Br^{80} + \gamma$.
6. SF (spontaneous fission), in which the nucleus divides into two roughly equal parts (fission fragments) plus about two neutrons, e.g., Cf^{254}.

β^-, β^+, and EC decay are often grouped together under the general heading of beta decay.

Each radioactive species undergoes decay at a characteristic rate, in the sense that a certain proportion of the nuclei in a large assemblage decay in a given time interval. If there are N atoms, the rate is $-dN/dt$, and this is proportional to N, such that $dN/dt = -\lambda N$. The constant λ is known as the disintegration constant. A convenient indication of the decay rate is the half-life T, which is the period of time during which one-half of the nuclei in a large assembly decay. T is related to λ by the equation $\lambda T = \ln 2 = 0.693$.

A **stability line** may be drawn through the middle of the band of stable nuclides and is represented by the following equation, $N - Z = ZA^{2/3} / 60$. No odd-Z element has more than two stable isotopes, whereas even-Z elements can have any number up to 10. An odd-A element may be either even Z, odd N or odd Z and even N. In odd-A nuclei, there is one unpaired nucleon. Many of the properties of odd-A nuclei are believed to stem from the single unpaired nucleon.

NUCLEAR MODELING

Throughout the central region of the nucleus a nucleon experiences on an average little change in the forces to which the other nucleons subject it, but towards the boundaries it experiences a net attractive force pulling it back towards the center. The same thing would happen if the nucleon moved inside a potential energy well, the potential energy being constant at the center of the well and rising at the walls.

For some purposes it is possible to assume that the nucleus can be represented by such a well, and it turns out that a well about 40 MeV deep and of about the same diameter as the nucleus itself has suitable properties.

For protons the well is surrounded by a rim. This is because a proton approaching the nucleus is repelled electrostatically, until the moment when it actually touches the nuclear surface. Once it makes contact, it is attracted and falls into the well. The rim is known as the Coulomb barrier. Its height is given by the energy required to bring the proton up to the nuclear surface, i.e., by Ze^2 / R (e = electronic charge, R = nuclear radius). For heavy nuclei

such as uranium the barrier is about 10 MeV high. In the general case of an ion of charge +ze and radius r incident on the nucleus the height of the barrier is $Zze^2 / (R + r)$.

The concept of the nuclear potential well can be applied both to particles entering or leaving the nucleus, as they do in nuclear reactions, and to nucleons inside the nucleus.

Consideration of the movement of nucleons inside the potential well leads to the shell model of the nucleus. It is assumed that the nucleons move independently inside the well and that their movements are quantized like those of the electrons in the atom. It proves remarkedly successful in accounting for properties of individual nuclei, in both their ground state and excited states. It is particularly successful with odd-A nuclides, in which there is a single unpaired nucleon.

The core excitation model of the nucleus is a model involving electromagnetic properties of the nucleus or the weak-coupling model. This is a model devised for the description of low lying states of odd-A nuclei, which tries to relate such properties to those of the odd particle and the even-even core. In other words, a state of an odd-A nucleus with an angular momentum J is written as

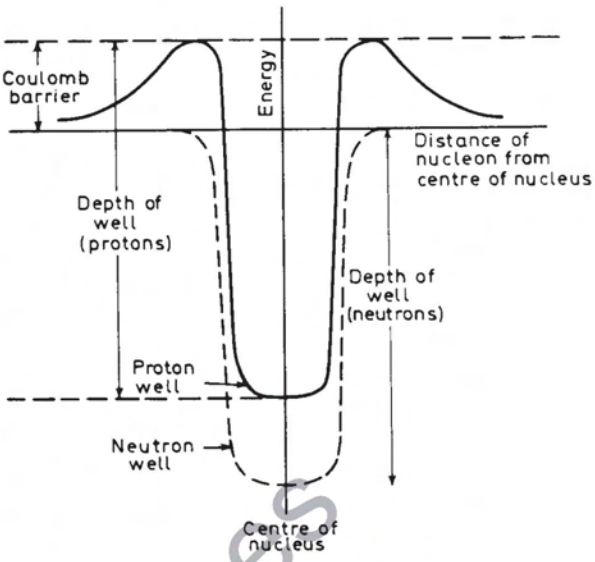


Fig. 2. The nuclear potential well and the Coulomb barrier.

	A−3	A−2	A−1	A	A+1	A+2	A+3
Z+2						α, 2n	α, n
Z+1				p, n d, 2n	p, γ d, n		α, p
Z			n, 2n γ, n	n, n p, p etc.	n, γ d, p		
Z−1	p, α	d, α	γ, p	n, p			
Z−2	n, α						

Fig. 3. The emission of single nucleons in (γ, n) and (γ, p) reactions requires an excitation energy of about 8 MeV. In this region the levels overlap and an exact energy match is not needed for absorption of the γ-ray.

$$\Psi (J) = \Sigma A_{Jcj} \phi (J_c, j; J)$$

Here $\phi (J_c, j; J)$ is a state in which the core carries an angular momentum J_c and the odd particle is in the state j.

It is important to note that, formulated in this way, there is no assumption about the **mechanism** which leads to the various core-states. These could be collective vibrations, or single particle excitations, or quasi-particle excitations, or anything else. The essential ingredient that goes into this model is the assumption of a weak coupling between the odd particle and the rest of the nucleus. Weak, that is, in comparison with the interactions involved in the core itself.

NUCLEAR REACTIONS (TRANSMUTATIONS THROUGH RADIOCHEMISTRY)

When neutrons, protons, γ-rays and other kinds of nuclear projectiles impinge on atomic nuclei, they may initiate processes of nuclear change. Such processes are called nuclear reactions. The reactions of γ-rays, known as photodisintegrations are restricted largely to scattering and the emission of single nucleons, i.e., (γ, γ), (γ, n) and (γ, p) reactions, owing to the limitations on the energies available. For the common low-energy reactions, the changes in Z and A for the target nucleus are as follows:

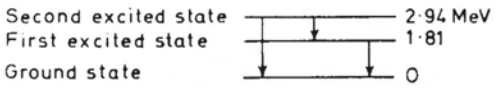
In a (γ, n) reaction neither the γ-ray nor the neutron has a Coulomb barrier to surmount, so reaction sets in sharply as soon as the threshold energy is reached. Beyond the maximum, competition from the (γ, 2n), (γ, 3n), etc., reactions becomes important; the total cross-section for all the (γ, xn) reactions falls to a few millibarns.

Over and above its binding energy in its lowest energy state (the ground state), a nucleus can acquire excitation energy. Like the atomic excitation energy absorbed by the electron clouds and familiar from the Bohr model of the atom, this energy can only be acquired in discrete amounts. The nucleus indeed, like the atom, can exist in a series of excited states, and it can undergo transitions from upper to lower energy levels emitting the surplus energy in the

form of electromagnetic radiation. The energy quanta emitted are of relatively high energy; the radiation is thus of very short wavelength, as short as that of X-rays, or shorter. It is called γ-radiation.

The energy levels of a nucleus, and the transitions between them, are often represented by a level diagram such as in Fig. 4, for Mg^{26}:

Fig. 4 level diagram



Aside from the lightest nuclei, nuclear binding energies are roughly proportional to nuclear masses. It is therefore convenient to consider the binding energy per nucleon [2].

It is rather important to note that radioactive nuclei tend to have lower binding energies per nucleon than stable nuclei.

The first nuclear reaction induced by photons was discovered by Chadwick and Goldhaber in 1934 [3]: the photodisintegration of the deuteron. They used the high energy γ's from a radiothorium source and were able to deduce a fairly accurate value for the neutron mass from their measurement of the energy of the protons produced. The only nuclide other than deuterium with low enough threshold (neutron-binding energy) to permit photodisintegration by naturally occurring gamma rays is Be^9.

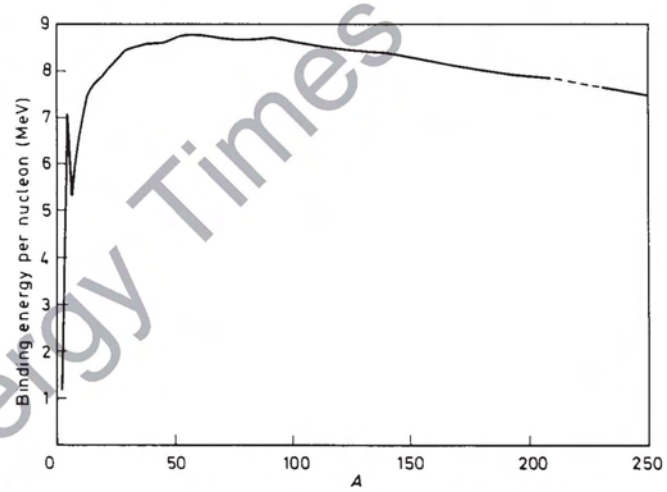


Fig. 5 Smoothed binding energy curve for stable nuclei. Binding energy per nucleon as a function of A.

GIANT RESONANCE

Reactions between nuclei and low- and medium-energy photons are dominated by what is known as a giant resonance: in all nuclei the excitation function for photon absorption (not just for a specific reaction) goes through a broad maximum a few million electron volts wide. The energy of the resonance peak varies smoothly with A, decreasing from about 24 MeV at O^{16} to about 13 MeV at Bi^{209}. Peak cross sections are 100-300 mb.

This giant-resonance absorption is ascribed to the excitation of dipole vibrations of all the protons against all the neutrons in the nucleus [4], the protons and neutrons separately behaving as compressible fluids. This model makes some fairly simple predictions about the magnitude and A-dependence of the resonance that are quite well borne out by the experimental data: the integrated cross sections under the resonance peaks are given to good approximation by 0.06 NZ / A MeV b, and the peak energies can be approximately represented by $aA^{-1/3}$ [5].

The energy of the dipole resonance is so low that mostly rather simple processes-such as (γ, n), (γ, p), (γ, 2n), and photo-fission reactions-take place in the giant-resonance region. The competition between these processes is governed by the usual statistical considerations of compound-nucleus de-excitation, so that neutron emission usually dominates.

Fig. 6. Different types of nuclear vibrations. The two extremes of the vibration are shown by solid curves, and the midpoint of the vibration, a spherical shape, is shown by the dashed line. All figures have rotational symmetry about a horizontal axis through the center. (a) (γ = 2 vibration (2^+ state); (b) γ = 3 vibration (3^- state); in (a) and (b) the neutrons and protons move together; (c) γ = 1 (1^- state), in which the neutrons and protons move in opposite directions. At one extreme of the vibration, the neutrons are displaced to the left and the protons are displaced to the right as shown, while at the other extreme of the vibration their positions are reversed.

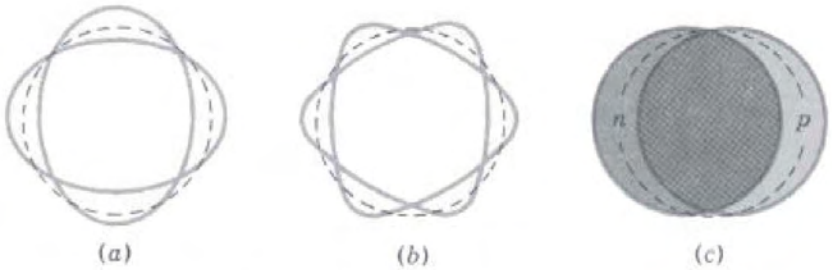


Fig. 6 Different types of nuclear vibrations

PHOTODISINTEGRATION

Atomic nuclei have been disintegrated by high energy photons. The process is called **photodisintegration**. These can be gamma rays of one energy (gamma rays are naturally occurring while X-rays are man made but both are photons) or gamma rays from a source which yields a continuous spectrum of energies, including a high-voltage X-ray tube as well as from a betatron.

The best known gamma reaction is the photodisintegration of the deuteron,

$$ {}_1H^2 + \gamma \rightarrow {}_1p^1 + {}_0n^1 $$

If the Q of a reaction is negative (A negative Q value means that kinetic energy must be brought into the nucleus to make the reaction proceed. This kinetic energy is converted to mass. Such a reaction is called endothermic), the reaction cannot proceed until the photon brings in enough energy to satisfy conservation of energy. This means that the cross section for a gamma reaction is 0 until the energy of the projectile is at least equal to Q. The energy of the projectile for which the reaction first has a nonzero cross section is called the **threshold** energy for the reaction. The threshold of the reaction is that energy of the gamma ray which is just sufficient to break the proton-neutron bond; i.e., the gamma ray must deliver an energy equal to or greater than the binding energy of the system.

Photodisintegration usually gives rise to neutron emission, i.e., to a (γ, n) reaction by the nuclei which have been raised to excited states by the absorption of these photons. The energy of the gamma ray for which neutrons are first observed to be ejected is the binding energy of the neutron. The (γ, n) cross section becomes very large for most nuclei, for gamma energies between 10 and 20 MeV. This effect, called the **giant resonance**, is responsible for much of the neutron background of high-energy gamma ray machines. The giant resonance occurs in all nuclei and is viewed as a general property of nuclei. Its width is 3-10 MeV and it is located between 13 and 18 MeV for medium and heavy elements and near 20 MeV for light elements.

Baldwin and Koch (1945) were able to determine the threshold for photodisintegration of several different nuclei in the range of atomic numbers Z = 6 to Z = 47. Sher, Halpern, and Mann determined the thresholds of many (γ, n) reactions. The threshold value of the (γ, n) reaction with any isotope of mass number A will give the binding energy of the neutron in the nucleus of the isotope of mass number A-1.

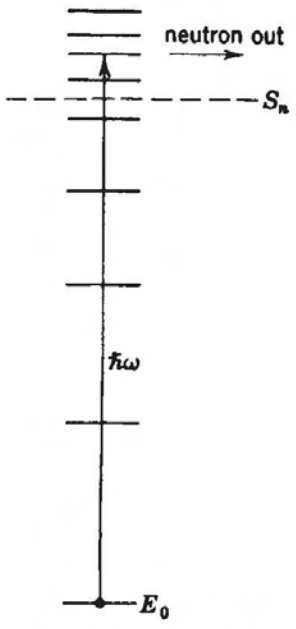
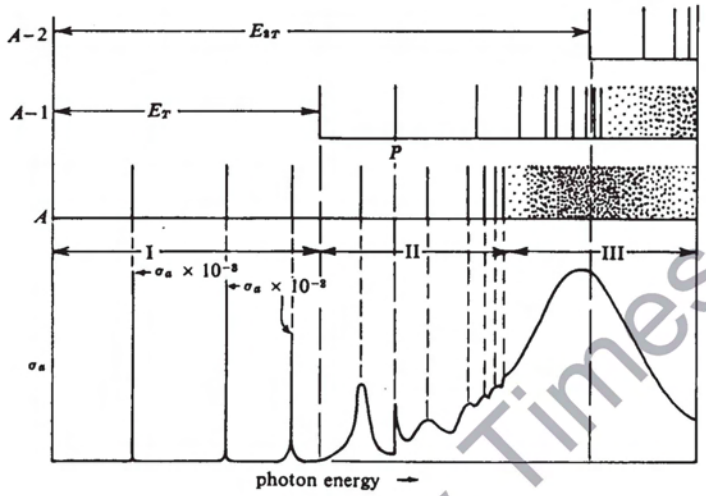


Fig. 7. Schematic picture of the photonuclear effect with Emission of a neutron [the (γ, n) reaction].

Fig. 8. The photon absorption cross-section for an idealized nucleus. Region I is that part of the energy scale below the particle thresholds where absorption is into discrete energy levels. Region II is the energy range above the binding energy where structure may still exist in the absorption cross-section. In region III the absorption cross section is smooth. The processes that can take place are indicated along abscissa; σ(γ, n) here stands for the cross section for nuclear emission. The energy levels in the nucleus *A*, *A*-1, and *A*-2 are illustrated at the top of the diagram. The binding energies for one and two particles are designated by E_T and E_{2T}. The level P_1 in *A*-1 represents a parent of the ground state of nucleus *A* [6].



Reaction	Threshold (MeV)
D(γ, n)	2·22
$Pt^{195}(\gamma, n)$	6·13
$Bi^{209}(\gamma, n)$	7·39
$Au^{197}(\gamma, n)$	8·05
$Cu^{63}(\gamma, n)$	10·8
$C^{12}(\gamma, \gamma)$	15·1

Fig. 9. The neutron binding energies are taken from V. Ashby and H. Catron, UCRL 5419.

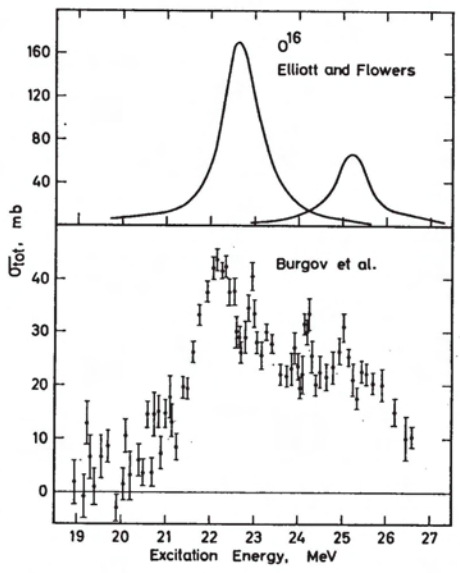


Fig. 10. A comparison between calculated values and measured values as calculated by Elliott and Flowers for O^{16}.

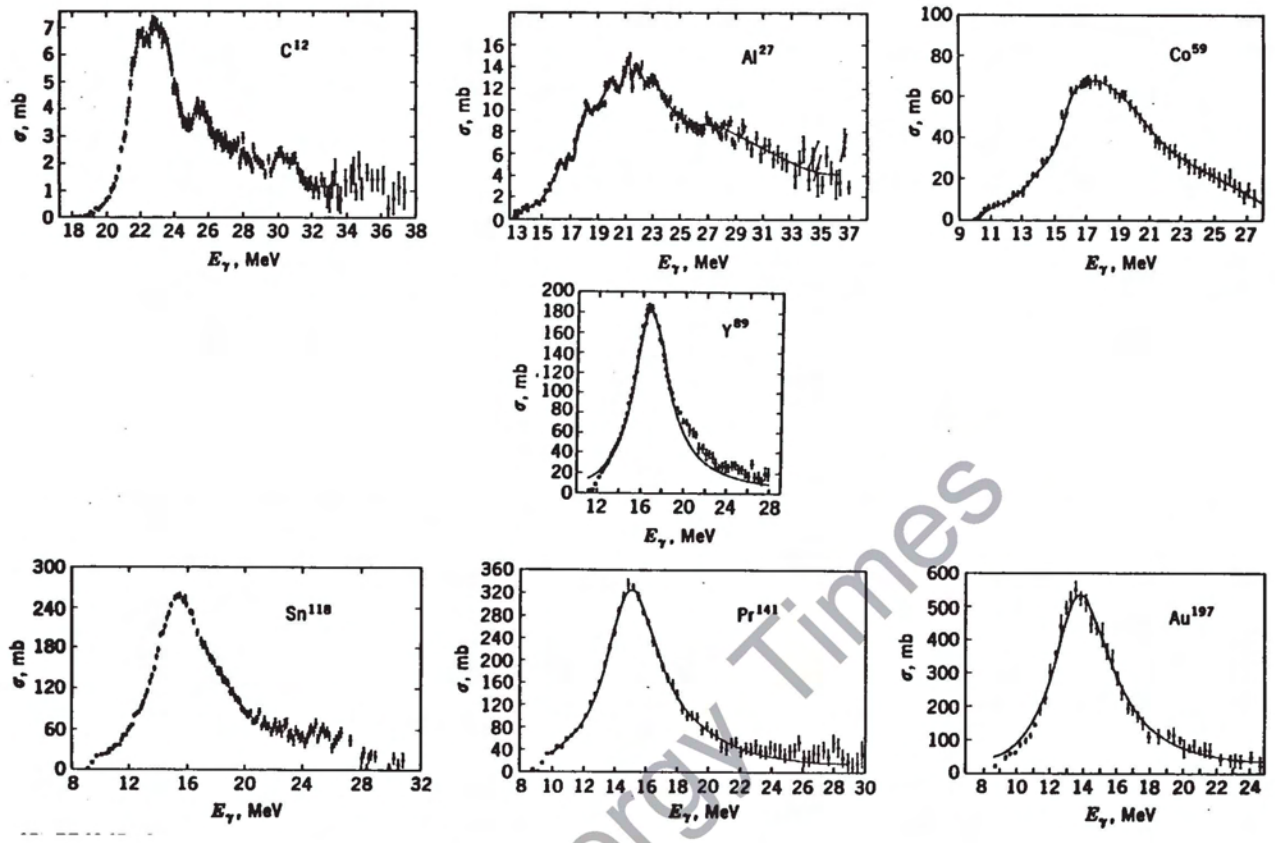


Fig. 11. Cross section for reactions induced by gamma rays vs. their energy E_γ in various nuclei. Actually these data include only reactions which neutrons are emitted, for example, (γ, n), (γ, 2n), (γ, pn), but these account for nearly all the reactions in most cases. Note that these cross sections are dominated by resonance due to the 1^- state vibration [7].

The energy necessary for photodisintegration of a nucleus is calculated from known nuclear masses. It is obviously easier to remove one particle than several from the nucleus. As a result we find that Eγ must be >5 MeV for photodisintegration of heavier nuclei. For 10 < Eγ <40 MeV the photon wavelength is comparable to the nuclear vibrational motions (so-called dipole vibrations, because the neutrons and protons are assumed to vibrate in separate groups). This is known as the giant resonance region, because the total cross-section for heavier nuclides goes up to hundreds of millibarns. For higher Eγ, nucleons may be expelled, the main reactions being (γ, n), (γ, 2n) and (γ, np) in descending importance [8].

FLUX AND CROSS-SECTION:

The number of photons per square centimeter per second incident on the target is called the **flux**. When a target is exposed to a flux of photons, the number of nuclei reacting is proportional to the flux, and to the number, N, of target atoms. Then $R = \sigma \phi N$, where R is the reaction yield and σ is a constant characteristic of the nuclear reaction in question. σ has the dimensions of an area, and is therefore usually called the cross-section of the reaction. We can picture each target atom as a disc of area σ, with reaction occurring every time an incident photon strikes the disc. In some circumstances σ is indeed equal to the physical cross-section of the nucleus. Tables and graphs of photonuclear cross-sections exist and may be used to calculate reaction yields. In such tables σ is usually expressed in barns or millibarns, one barn being 10^{-28} m^2.

Cross-sections vary with the energy of the incident photon, and the tables usually indicate this variation. Where there is a threshold energy, σ is zero below the threshold, and rises to positive values above the threshold. The relation between cross-section and energy is called the **excitation function** of the process.

REACTION RATE:
For a photonuclear reaction in which a species A is converted into a species B: A → B. If the cross-section of this reaction is σ, then nuclei of A are destroyed (burnt out) at a rate $\sigma \phi N_A$, while those of B are produced at this same rate:

$$R = -dN_A/dt = dN_B/dt = \sigma \phi N_A$$

This equation is of the same form as that for radioactive decay of A to B, but with $\sigma \phi$, in place of the disintegration constant λ. There is indeed an extensive analogy between the kinetics of radioactive decay, and kinetics in a constant flux of nuclear photons, and the equations concerned are closely similar.

If the target species A is radioactive, then both nuclear reaction and decay contribute to its disappearance. The rate of loss is the sum of the two terms:

$$-dN_A/dt = \sigma \phi N_A + \lambda_A N_A$$

$$= (\sigma \phi + \lambda_A) N_A$$

If ϕ is constant, there will be a corresponding effective half-life of $0.693 / (\sigma \phi + \lambda_A)$. Again, if the product B is radioactive it will be produced at a net rate:

$$dN_B/dt = \sigma \phi N_A - \lambda_B N_B$$

provided that we can neglect loss of B by further nuclear reaction.

WASTE MANAGEMENT

The goal of transmutation for waste management purposes is to convert a long-lived radionuclide that is potentially troublesome at a waste disposal site to a shorter-lived or stable nuclide by exposing the troublesome nuclide to a high flux for a sustained time. This has the effect of reducing the long-term toxicity of the waste because most of the waste constituents would then decay to a non-radioactive nuclide in a short time.

Chemical processes are an integral part of any transmutation scheme to separate the radioactive components of the wastes into high purity fractions that can then be made into transmutation targets. Such targets would be irradiated in a flux having sufficient intensity and energy such that the radionuclides in the targets would either be transmuted or fissioned into stable elements or isotopes with substantially shorter half-lives at an acceptable rate.

At present, there are only four industrially demonstrated separations processes applicable to reactor wastes meeting the needs of transmutation. These processes are designed primarily for the concentration and purification of plutonium, but only the PUREX process is well established in current worldwide use. In the past, the British have used a solvent extraction process called BUTEX, the French have used ion exchange, and there have been a number of ion exchange processes that have had limited production use in the isolation of minor actinides.

Several potentially applicable separations processes based on new solvents, such as the TRUEX-CMPO process, and new ion exchange materials are in various conceptual or laboratory scale development stages. Such advanced aqueous processes have been proposed to achieve high decontamination factors but have not been demonstrated at the full engineering pilot-plant level.

A commercial waste transmutation facility would require head-end treatment of spent reactor fuel to chop and dissolve the fuel, followed by separation of the transuranics and selected fission products. Either aqueous or nonaqueous processes may be used for the initial separations. The well-established PUREX process may be used for this separations step. This would be followed by an aqueous separations process using advanced technology such as the TRUEX process. A full scale separations system may be designed with high confidence for overall separations process losses of less than 0.1%.

Solid metals may be separated by pyrochemical process. Pyrochemical processes might require less capital expense than aqueous ones because the volume of shielded space can be smaller as well as the reduction in the size of the plant and equipment needed.

CONCLUSION

By introducing energy to the nucleus greater than the binding energy we can initiate a nuclear reaction that results in a radiochemical transmutation. By proper design, these reactions may be used to transmute long-lived radioactive waste products into short-lived and manageable products.

EXAMPLES OF TRANSMUTATION AFTER TREATMENT

Isotope	Normal Time Required To Become Stable	Time to Decay to Stable After Treatment
Strontium-90	291 years	IMMEDIATE
Iodine-129	1,700,000,000 years	IMMEDIATE
Technetium-99	2,120,000 years	43 days
Cesium-137	302 years	130 days

We have available to us a method for treating radioactive waste products in such a way that leaves the half-life manageable. This process is available to us now, without development of new technologies. The treated waste products, due to their inherently short half-lives, become heat sources. These heat sources may be utilized in conversion systems for producing electrical power, i.e., for powering the treatment equipment itself. There is also the neutron flux produced as a waste product of the treatment process. This neutron flux may be used for activation as well as neutron-transmutation of radioactive waste products, such as,

$$Tc^{99} + n \rightarrow Tc^{100}\ (16\ \text{second}) \rightarrow \beta + Ru^{100}\ (\text{stable})$$

$$I^{129} + n \rightarrow I^{130}\ (12.4\ \text{hr}) \rightarrow \beta + Xe^{130}\ (\text{stable})$$

$$I^{127} + n \rightarrow I^{128}\ (25\ \text{min}) \rightarrow \beta\ Xe^{128}\ (\text{stable})$$

Therefore, all that remains is to apply this technique. It should also be noted that application of this process should boost the nuclear power industry by providing a cheap, effective method for disposal of the reactor waste products.

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NEW-ENERGY ANOMALIES

Hal Fox [2]

ABSTRACT

Various anomalies (laboratory observations not consistent with current scientific models) have been detailed in the literature reporting on developments in the search for new-energy sources. The purpose of this paper is to provide a list of some of these anomalies and also to explore explanations in accord with classical physics. One of the more interesting anomalies is the frequent reports of low-energy, nuclear reactions, especially in many experiments with the hydrogen-loading of selected metals. The paper presents an explanation for this widely-reported anomaly and discusses others.

INTRODUCTION

One of the first observations of anomalous production of elements from deuterium-loading of palladium was reported at the first conference on cold fusion held in Salt Lake City, Utah [1]. It is of interest to note that following D. Rolison's presentation, she was immediately instructed by an MIT professor that such an anomalous production of elements was **impossible**.

In a recent article, Stoppini [2] explains the method by which some anomalous nuclear reactions may be produced. The explanation is consistent with known physical models. In summary, the flow of electrons through a metal lattice may result in the capture of electrons by metal nuclei. This capture results in an increase of the number of neutrons in the nucleus, an increase in the binding energy, an increase in the kinetic energy, and a decrease in the repulsive Coulomb barrier of this nucleus. Although such an event proceeds in a very short time (about 10^{-12} seconds), there is sufficient time for a nuclear reaction to occur. Such events should be capable of observation due to emission of gamma rays and soft X-rays (from the electron capture). Stoppini concludes with the observation that "other processes like the proton-proton chain for production of solar energy (standard solar model), but which requires energies that are not available here."

Subsequently, many experimenters have reported anomalous transmutation in a variety of experiments in which hydrogen (or deuterium) is loaded into various nickel (or palladium) and other metal electrodes [3, 4, 5, 6, 7]. The references 3 through 7 are all from the proceedings of the Second Conference on Low-Energy Nuclear Reactions (Sept. 13-14, 1996, College Station, Texas). Many other papers have reported similar results. (See the references in the articles cited.)

THE ROLE OF HIGH-DENSITY CHARGE CLUSTERS

One of the most perceptive explanations for many (but not all) of the transmutation observations has been made by Kenneth Shoulders [8]. For a better understanding of this explanation, an understanding of charge clusters is required, as follows:

High-density charge clusters are composed of several micron-sized toroids of electrons (about one billion electrons per micron). Twenty to forty of these micron-size entities form in a ring having a diameter of about 20 microns. Charge clusters are produced in a variety of ways: by lightning; in some liquids by field emission from specially-prepared electrodes; in low-pressure gases; and are often present in many sparks and arcs. Charge clusters can pick up and transport positive ions. The ratio of positive ions to electrons is about one in a million. Therefore, the positive ions can be carried by the charge clusters and move toward a positively-charged anode with

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about the same velocity as an electron. Five thousand volts will produce charge cluster velocities of about 0.1 the speed of light. IT IS CLASSICAL PHYSICS THAT POSITIVE IONS MOVING AT ONE-TENTH LIGHT SPEED WILL PRODUCE NUCLEAR REACTIONS ON MANY TARGET MATERIALS.

An understanding of the formation of charge clusters and their role in deuteron-loaded palladium can be explained, as follows:

The palladium is loaded with deuterons and becomes stressed and brittle (hydrogen embrittlement). At random times and places the palladium crystal lattice cracks. The separation of trillions of ionic bonds produces a large (several thousand volts) potential across the crack which lasts for pico-seconds before discharging through the conducting metal lattice. These are suitable conditions for the production of charge clusters from the cathode side of the crack by field emission (fracto-emission); the entrainment of deuterons by the charge cluster; the acceleration of the combined charge cluster to fractional light velocities; the impact of the combined charge cluster on the anode side; and the resulting nuclear reactions caused by the high velocity deuterons. A similar explanation can clarify the nuclear reactions in other hydrogen-loaded metals [8].

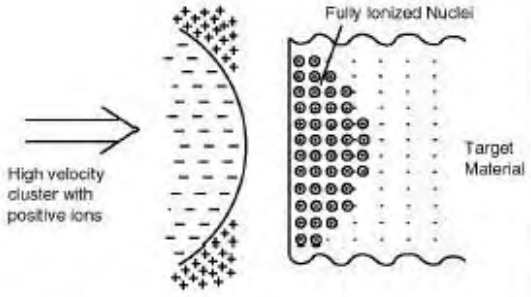

Fig. 1 Charge Cluster Impacting Target

Assume that we can produce and accelerate a charge cluster so that there is an impact of the charge cluster and a target metal (not necessarily loaded with hydrogen). As shown in Fig. 1, the charge cluster approaches a target, the very-high local charge will tend to repel the electrons away from the target nuclei and leave a plasma of highly-ionized nuclei. In addition, according to Stoppini [2], some of the billions of electrons that suddenly pulse into the target metal can produce nuclear changes in the metal lattice nuclei. Closely following the burst of electrons are the thousands of positive ions (usually protons, but can be deuterons, alpha particles, etc.) impacting the target metal. Nuclear events (transmutations) are not only possible but expected.

Once the role of charge clusters in low-energy-triggering of nuclear reactions is understood, there are many experimental anomalies that can be more readily explained by classical physics [9]. The more one becomes familiar with the nature of high-density charge clusters, the more prevalent these micro-miniature Tokamaks seem to be. S.X. Jin [10] provides an excellent preliminary analysis of high-density charge clusters and derives certain stability criteria.

There is a relatively simple method by which an experimenter can determine if charge clusters are being produced. When a high-density charge cluster impacts a target metal the billions of electrons react suddenly with the target and produce an electro-magnetic pulse. This pulse is easily heard on an AM radio tuned off of a station (to avoid the automatic volume control feature). Each disintegrating charge cluster will produce an audible crack on the radio. Also, examination of the electrodes after the experiments, may show evidence of numerous, small-diameter holes or pits in the electrode surface.

OTHER NEW-ENERGY ANOMALIES

Here are other experimentally-observed anomalies that challenge the standard scientific models:

1. In a deuterium-loaded palladium electrode, the transmuted elements were found below the surface [11]. In a thin cylindrical shell a few microns below the surface up to two-thirds of the palladium cathode had been transmuted. What type of forces prefer to work at a specific depth within a metal cathode?

2. An explosion produces hydrogen. This phenomena has been dubbed "The Rowe Effect" [12]. It appears that the energy of an explosion can produce hydrogen from the surrounding environment. As soon as we rediscover the aether, we may have an explanation.

3. The permanent-magnet rotor of an electric motor takes 3,000 Joules to spin up to rated speed. When stopped and spun up to rated speed immediately after stopping, the spin-up energy is only 300 Joules. After stopping for a few minutes, it again requires 3,000 Joules to spin up to rated speed. This discovery was made by Harold Aspden and is dubbed the "Aspden Effect". See [13] for a more complete description. The effect can be explained if there is an aether.

4. A special pump impeller is constructed and operated at rated rpm. As the pump is operated the water being pumped is heated. Measurements show that the thermal energy added to the water is more than the electrical energy provided to the motor [14]. An intense cavitation phenomena occurs in this pump. A scientific explanation has not be proposed and accepted. This pump is being manufactured and sold as an energy-saving, hot-water heater for offices and apartments.

5. Torsion fields (distinctive from the standard electro-magnetic and gravitation fields) have several anomalies. First, such a field is outside of standard scientific acceptance of energy fields. Second, these fields are associated with a variety of anomalous behaviors: traveling faster than light, affecting some organic materials, modulating laser frequency, traveling through barriers to electromagnetic radiation, etc. A paper by this author provides a summary of torsion fields with several references in English and Russian [15].

CONCLUSIONS

There are numerous anomalies that have been discovered in the search for new-energy sources. Because many of these anomalies are contrary to standard scientific models, there is too little effort to replicate and explain these discoveries. Science (as a body of knowledge) grows by the discovery of anomalies. To the extent that these anomalies are dismissed by skeptics without further scientific experiments, scientific advancement suffers. Small additions to scientific disciplines are often accepted and published in leading scientific journals. Major discoveries, especially those that require changes to well-accepted scientific models, are less acceptable **until the weight of evidence is overwhelming or until new products are marketed.** This author strongly supports the concept of minor funding to explore major discoveries. This funding activity would spur the advancement of scientific knowledge.

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GRAVITY WAVES & TORSION FIELDS: FASTER THAN LIGHT?

Hal Fox [1]

ABSTRACT

Based on Planck's **natural units**, equipment has been designed and used by Hodowanec and Ramsay to measure gravity-wave fluctuations. This work has been reported for several years. The experimental evidence is that gravity waves are affected by the sun's position; by other celestial bodies; and possibly by artificial means. Experimental evidence suggests that the speed of gravity waves are many times the speed of light. Several Russian groups have reported on experiments with **torsion fields** and claim that the speed of torsion fields is several orders of magnitude faster than the speed of light. These claims are explored in the paper. Experimental reports are cited that provide evidence in favor of superluminal speeds.

A. BACKGROUND OF GRAVITY WAVES

Beginning in 1959, Gregory Hodowanec became convinced that there was considerable merit in Max Plank's suggestion that experimentally-determined, universal constants could be used to "establish units of length, mass, time, and temperature, which are independent of special bodies or substances, which necessarily retain their significance for all times and for all environments, terrestrial and human or otherwise, and which may, therefore, be described as **natural units**" [1, 2]. This information and Hodowanec's later work to solve the observed problem of variations in weighing scales has resulted in a life-long search for a true understanding of cosmology [3]. While working with Henderson Industries, a company that manufactured weighing scales, it was noted that a balance-type of scale using both a reference weight and an unknown weight did not fluctuate. However, a scale using any kind of a spring or load cell would fluctuate daily over a small range and occasionally over a range as high as 10 percent (unusually high and seldom observed). Hodowanec wrote: "When I offered to solve their scale problems, ... their patent attorneys tried to get me to sign away all past and future rights to my research." Subsequently, Hodowanec developed a variety of devices to measure, observe, and study these dramatic changes or **gravity-wave fluctuations**.

Hodowanec's friend, Bill Ramsay, became a dedicated experimenter of gravity waves, has been in frequent communication with Hodowanec, and has shared much information with Hodowanec and others. During these experimental investigations, Ramsay discovered that by using a Rustrak strip-chart recorder, it was possible to record some of the frequent events where gravity waves appear to result from relatively brief changes in gravity-wave magnitudes [4]. Nick Anthony Fiorenza determined that one of the observed patterns was contemporaneous with the transit of the planet Pluto. A more detailed analysis was published by Fiorenza [5] showing that several planetary alignments showed in the chart output patterns. Alastair Couper also examined such timing events and has reported his findings on the Internet [6]. The most impressive experimental evidence is that the occurrence and measure of these celestial events (including the transit of the supposed "black hole" at the center of our galaxy) appear not to be limited by light speed.

One of the objectives of Trenergy, Inc. is to produce and market (using a specially-designed, printed-circuit board) an advanced version of the Hodowanec-Ramsay detectors of gravity-wave fluctuations.

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B. BACKGROUND ON TORSION FIELDS

Some Russian scientists report that as many as 25 groups of scientists in Russia have been investigating **torsion fields** [7-11]. These torsion fields are believed to be separate and distinct from the standard fields long recognized in physics. According to such reports, we must add torsion fields to the standard strong electric and magnetic fields, and the much weaker gravity field. The so-called strong nuclear force is also cited as one of the fundamental fields in nature. The Russian scientist, A. Akimov [11], describes three different "polarization states of Physical Vacuum". These are charge polarization (E-field), spin polarization (G-field), and transverse spin polarization (S-field). The S-field is described as the torsion field. Experiments with torsion field generators and receivers indicate that the torsion fields can penetrate matter, that they are very difficult to shield, and travel at superluminal velocities. (See references [7] to [11]).

According to Akimov [11], "...assuming that gravitational waves are longitudinal waves in elastic Physical Vacuum, V. Bunin [12] and V. Dubrovsky [13] demonstrated that these waves have speeds of the order of 10^9 **c**." The author does not, as yet, have English translations available for the work of Bunin and Dubrovsky and, therefore, cannot describe the method used to determine the speed of these waves. It is a current hypothesis of this paper that the torsion fields are responsible for the observed gravity-wave fluctuations and that these two fields of endeavor (one in the U.S. and the other in Russia) are closely linked. The reader will note that most of the currently-cited and most recent papers on torsion fields are written by Russian authors and published by the *Journal of New Energy (JONE)*. [The author is editor of the *JONE*]. That the *JONE* is one of the few journals that have published articles on torsion fields is a commentary on the state of acceptance of new science in the United States.

There is considerable Russian literature on torsion fields. It is noted that Akimov cites 177 references in his paper [11] and that 81 of these papers are in Russian. From Akimov [11], and from a few other sources [7-10], we have learned that the torsion field and its emanations are subtle energy fields. They are separate and distinct from **classical** Electric, Magnetic, and Gravity fields. Generators for torsion fields can be shielded against electro-magnetic fields and the torsion field will still manifest itself through such shielding. Torsion fields can be generated, detected, switched on and off (such as for communication purposes), and are a distinct type of energy field not included in today's classical physics. Torsion field emanations can travel at velocities at least as high as 10^9 times the speed of light according to Russian sources [12,13]. Torsion fields can interact with laser beams (change frequency); affect biological processes; are generated by melting or solidifying some materials; affect quartz crystals; affect some electronic components; can favorably change some beverages; and have been noted to affect gravity.

According to Akimov [11], torsion fields coupled with the standard electric, magnetic, and gravity fields should provide means for a unified field theory that will extend the realm of science to include the effects of consciousness. The concept of dowsing, for example, can now have a scientific basis of explanation for the phenomenon. If this suggestion by Akimov proves viable, then science has an opportunity to extend its borders more rapidly into the so-called psychic realms. That could be a multi-decade venture of considerable importance to the expansion of scientific knowledge.

In Russia, several types of torsion-field generators have been patented and some are available to purchase. The publisher of the monthly newsletter *New Energy News (NEN)* is expected to obtain additional information about the availability of torsion-field generators. Hopefully, such generators can be made available for purchase (or replication) here in the U.S. [As an advertising plug for *NEN*, it would appear to be worth the subscription price just to be kept up to date on the latest torsion-field developments].

C. PROPOSED EXPERIMENTS

It is proposed that experiments with torsion fields are now in the earliest days of discovery and development. For those who would like to be involved in the development of new technology, this may be a new technology of interest to experimenters, students, and even teachers and professors.

According to the literature on torsion fields, these fields can be created by spinning magnets, by Mobius-strip conductors, and by simple geometric forms of the proper materials. One can argue that the spinning magnet would

merely be broadcasting local fluctuating magnetic fields. Because it is well known how to shield magnetic fields, such a generator can be enclosed in a housing of magnetic material with the result that the magnetic fluctuations cannot be measured. If the literature is correct, torsion fields will be exiting from such a spinning magnet even though enclosed in a ferromagnetic shield.

Proposed Experiment 1.

Here is a proposed experiment: Drill a hole in the center of a long, rectangular, bar magnet having been magnetized end to end. Attach the magnet to a motor driven shaft. Enclose the entire structure in a iron box. Ensure that no oscillating magnetic fields are observable when spinning the magnet. According to some of the Russian scientists, you will now have a torsion field generator/transmitter.

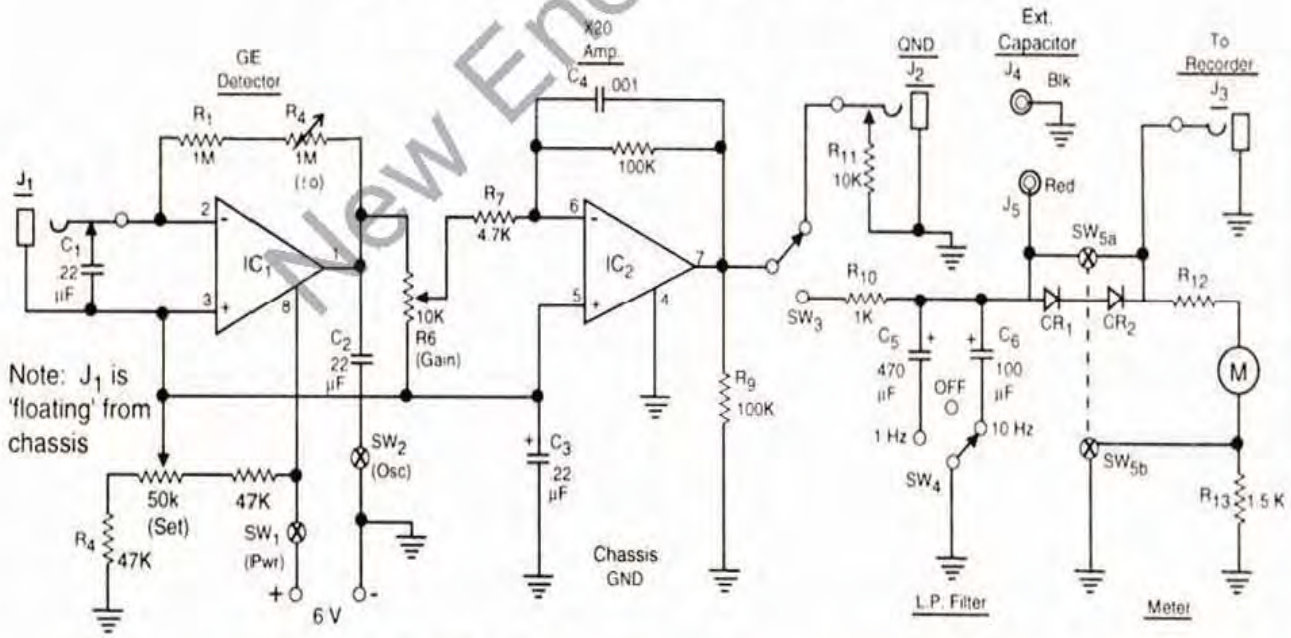
The next device needed is a means of sensing torsion fields. Fig. 1 is a circuit diagram of a standard **gravity-wave fluctuation** detector. This Hodowanec/Ramsay detector consists of a planar capacitor as the sensor which is coupled to a high-gain operational amplifier. The output of the detector will be, if this author's hypothesis is correct, able to detect the rotation of the spinning magnets. The output of the detector can be coupled to an dual-trace oscilloscope.

In operation, it would be appropriate to have a small coil inside the housing of the spinning magnet so that the magnetic field can induce a current in the coil. Using this coil as the input sensor for the spinning magnet, a comparison can be made between the speed of the input **torsion-field generator** and the signal picked up using the gravity-wave detector (torsion-field detector).

Proposed Experiment 2.

According to I.M. Shakhparonov [10], a torsion-field generator can affect (or modulate) the output of an optical laser. It is expected that the output of the torsion-field generator would modulate the frequency (the color) of the laser beam. For those experimenters who would like to try, it is proposed that a torsion-field generator be place adjacent

GW Signal Detection Demo Unit (Experimental Model A)



All resistors 1/4W, 5 %
All electrolytic capacitors can be 10V units.

IC_1 IC_2 : 1458 device
CR_1 CR_2 : IN914 Type diodes
M : 1 mA (0-15 scale)

Note: When SW5a is closed, SW5b is open and vise versa. This will switch between 1.5 V and 150mV scales. (DPDT switch used)

to a laser beam. It would seem appropriate to use an optical filter that had a strong cutoff frequency (color) at the output frequency of the laser. A change in the amount of light (by using a photo diode) passing through an appropriate filter could be a method of measuring the ability of the torsion-field generator to modulate the laser beam. There could be some problems. If the cutoff frequency of the optical filter is not within the degree of changes in frequency made by the torsion-field generator, there would be no change in the photo-diode output.

Other Experiments.
The author leaves it to you budding Faradays and Marconis to think up some clever experiments. One that is needed is an experiment to measure the speed of torsion field emanations as compared with the speed of light. In this high-tech age with computer chips operating a 400 megahertz, one should be able to make suitable measurements. The key component may be how best to make a torsion-field generator that has either a sharp pulse or a very high repetition rate. Perhaps the use of a sparking device (provided that the experimenter can show that a spark is both a source of torsion field and a source of optical energy) could be used.

D. IMPACT ON PHYSICS

The current dogma of Physics accepts the concept that nothing can travel faster than the speed of light; that a material particle would increase in relativistic mass as it approaches the speed of light; that the speed of light in a vacuum is constant, and that Einstein's Special Theory of Relativity (STR) is essentially correct. The discovery of field emanations that can travel much faster than the speed of light is expected to cause some significant changes in conventional physics. Alternatively, such an experimental announcement would be treated with considerable skepticism or even ignored.

There is expected to be a strong re-evaluation of some of the basic tenets of modern physics including STR and of the existence of an energetic structure of space (aether). The availability of low-cost means and years of experimental observations should lead to a wide-spread replication of both gravity-wave sensing equipment and torsion-field generators. If it can easily be shown that various celestial bodies (or events) can affect the gravity-wave fluctuations and that such events are replicable, the skeptics should ultimately be convinced.

The spinning of the earth on its axis and its revolution around the sun provides a means of scanning a portion of the heavens even using a fixed-to-the-laboratory instrument. Of course, the development of improved devices that can scan will be better. It would be helpful to have a personal computer program that would correlate the position and orientation of a gravity-wave sensor with respect to the actual (as contrasted with visual) position of cosmic structures (planets, suns, "black holes", novas, etc.) Eventually, it is expected that events being monitored at superluminal speeds will be correlated with later astronomical observations. This correlation will take some patience if the nearest star to the earth is several light years away. However, there are opportunities to make observations of planetary events in which the light travel time is in minutes. Perhaps a great experiment could be designed whereby an earth to asteroid ship provides an asteroid event (perhaps a nuclear explosion) to see if the gravity-wave fluctuation and the visual observation could be correlated.

E. CONCLUSIONS

Thanks to persons such as Greg Hodowanec, Bill Ramsay, Nick Anthony Fiorenza, Alastair Couper, and many Russian scientists [7-11], low-cost experimental equipment and significant instructional materials now exist to make it easy for dedicated experimenters of modest means to replicate some of the experiments on gravity-wave fluctuations and torsion-field measurements. It is highly important for the advancement of scientific understanding that such experiments be made and reported in the peer-reviewed journals. Perhaps the most important issue is to demonstrate and encourage the replication that gravity-wave fluctuations do occur at many times the speed of light. Perhaps you, the reader, will one of those to help usher in the Post-Einsteinian physics.

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LOW-ENERGY NUCLEAR REACTIONS AND HIGH-DENSITY CHARGE CLUSTERS

By Hal Fox and Shang Xian Jin [1]

ABSTRACT

High-density charge clusters, typically 1 to 20 micron with electron densities of 6.6 x 10^{29} electrons per cubic meter, plus attached positive ions (about one positive ion for one million electrons), can be produced in low-pressure gases, at atmospheric pressure, and (using special electrodes) in aqueous solutions. Experiments have been conducted using radioactive thorium nitrate as an electrolyte in a small reactor operating with less than 500 volts and at temperatures up to 500°F and pressures up to 50 atmospheres. The preliminary experimental results are that high-density charge clusters can be used to produce nuclear reactions in a relatively low-energy environment.

A. INTRODUCTION

The previously-published experimental protocols were used [1] in the experiments reported in this paper. A cylindrical zirconium electrode together with an axis-centered zirconium disk electrode were arranged so that the cylindrical electrode with Teflon T.M. end caps is a small pressure vessel. See Fig. 1. The reactor is partially filled using 25 ml. of a thorium nitrate {$Th(NO_2)_4$} solution. The two electrodes are connected to a variable, alternating current power supply for a period of thirty minutes or longer (depending on the amount of thorium nitrate used in the electrolyte). Thorium nitrate was chosen because the mildly radioactive thorium and its daughter elements allow for tracking changes in radioactivity without the necessity of using a "hot lab". Thorium $_{90}Th^{232}$ is one of the naturally-occurring radioactive nuclides and Table I shows its half life of 14 billion years and its decay series.

Table I.
Thorium Decay Daughter Elements

Element	Half-Life	α (MeV)	ß (MeV)	γ (KeV)
Thorium-232	1.4 x 10^{10}y	4.01, 3.95	--	59 (weak)
Radium-228	5.76 y	--	.039, .015	30 (weak)
Actinium-228	6.15 h	--	1.2, 2.1	911, 969, 338
Thorium-228	1.91 y	5.42, 5.34	--	84, 216, 132, 166
Radium-224	3.66 d	5.69, 5.45	--	241
Radon-220	55.6 s	6.29	--	550
Polonium-216	0.145 s	6.78	--	805 (weak)
Lead-212	10.6 h	--	.331, .569	239, 77, 75, 87, 300
Bismuth-212	60.6 m	6.05	2.25	727, 1621
Polonium-212	298 ns	8.78	--	--
or Thallium-208	3.05 m	--	1.8, 1.28, 1.52	2615, 583, 511, 860, 277
Lead-208	stable			

SOURCES: Lapp et al., [2], Hunt [3] plus updated values from other sources.

In the course of a few dozen experiments, similar, but not identical results were obtained. More than 50% of the thorium is typically removed from the electrolyte in 30 to 90 minutes of processing. The disk electrode (if removed immediately after the processing time) has shown an increase in radioactive emissions that peaks in two to ten hours. Emissions from the complete reactor, the disk electrode, the electrolyte, and the electrolyte plus precipitates have been measured variously by using a Geiger-Muller tube, a portable alpha detector, a gamma-ray spectroscope by using a two-inch long by two-inch diameter sodium iodide crystal gamma-ray detector (Ludlum Measurements,

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Model 44-10D), connected to an Aptec multi-channel analyzer installed in a IBM-compatible personal computer. The latest gamma-ray spectroscopy has been accomplished using an ORTEC T.M. (EG&G Instruments, Inc.) liquid-nitrogen-cooled, high-purity germanium, gamma-ray detector. The surfaces of both the disk electrode and the inner surface of the cylindrical electrode are pitted and cratered. The pitting/cratering is explained by small explosive-like nuclear reactions produced by the high-density charge clusters. The charge clusters are believed to be formed by an explosive electron emission initiated by field emission of electrons from the metal/metal-oxide layer of the zirconium electrodes [4].

Careful measurements of the gamma-emission radioactivity of the entire reactor shows a decrease in emissions after processing. Due to the weak gamma-ray emission from the thorium, the thick walls of the reactor, and the background radiation from cosmic rays, radioactive contaminants in the germanium crystal or nearby, and the particular source to be measured (via scattering, X-ray production, beta particles, or bremsstrahlung) most of the pre-processing gamma-rays are from the small amounts of thorium daughter elements. If the minute amounts of daughter elements do not participate in the nuclear reactions, there will be little change in the after-processing gamma-ray measurements. As discussed later, significant changes in pre- and post-gamma-ray emission occurs.

B. HISTORICAL BACKGROUND

The first person to discover and utilize high density charge clusters was Kenneth R. Shoulders [8,9]. Initially, Shoulders was primarily interested in charge clusters as the basis for high-speed computer components. Later, Shoulders discovered that the characteristic strikes of high-density charge clusters could produce nuclear reactions in certain target materials in micrometer-sized areas [5].

High-density charge clusters were discovered independently by A. Ilyanok, a scientist in Minsk, Republic of Belarus [10]. Ilyanok had also devised a method for flat-panel display using this charge cluster technology which was similar to one of Shoulders' embodiments in his patents. The third independent discovery of high-density charge clusters was reported by G. A. Mesyats [11] some ten years after Shoulders' discovery. Mesyats has named his charge clusters "Ectons".

Stan Gleeson and Rod Neal made a discovery that under certain conditions, using special cathodes, that nuclear reactions could be produced in an aqueous solution. The first published paper of this exciting discovery was presented at the second International Conference on Low-Energy Nuclear Reactions [12]. The methods by which certain metals could produce charge clusters in aqueous solutions was examined by Bhadkamkar and Fox [4]. The authors have conducted significant experiments using a variety of metals that demonstrate electroluminescence and charge cluster formation.

The production and control of high-density charge clusters carrying positive ions is expected to be developed into a system for the amelioration of high-level radioactive wastes. That such high-density charge clusters can be produced is an experimental fact also shown by others [5,6]. The stability of such charge clusters has been analytically treated and shown to be toroidal in form and to produce extremely high local electric and magnetic fields [7]. Due to the high electron to positive-ion ratio, a combined charge cluster can be accelerated to high impact energies using relatively low potentials. A 5,000 volt potential can provide such combined charge clusters with velocities of more than one-tenth the speed of light. It is standard physics that positive ions (such as protons) can produce nuclear reactions at such velocities. A proton particle accelerator would require about nine million volts to produce one-tenth light-speed velocities. Therefore, table-top particle accelerators, based on charge-cluster technology, are expected to be designed and used to produce nuclear reactions.

C. EXPERIMENTS AND RESULTS

A specially designed reactor is filled with 25 ml. of a thorium nitrate aqueous solution. The amount of elemental thorium placed into the reactor has ranged from 0.1 to 0.5 grams. The reactor is connected to the output of a power supply with the primary voltage of a 2 kVA transformer controlled using a variable transformer. The a.c. voltage to the reactor is gradually raised and the voltage, amperage, and temperature are recorded. Computations for the cell resistance shows that the resistance initially decreases as the temperature of the reactor increases. Further processing results in a gradual increase in cell resistance until the voltage is in the range of 300 to 500 volts and the

current is well below 0.5 amperes. Care is taken to increase the power input to the cell by small steps while monitoring the cell temperature. The cell temperature should not exceed 500° F due to the temperature limits of the Teflon™ used as end caps and seals for the reactor.

A typical experiment results in the removal of the thorium from the electrolytic solution; an erosion of both electrodes; and the formation of a small amount of precipitate. The precipitate is mainly a finely-divided metal oxide plus any elements formed during the experiment. The visual evidence on the electrodes is the formation of numerous small pitted areas where the charge clusters have formed or impacted.

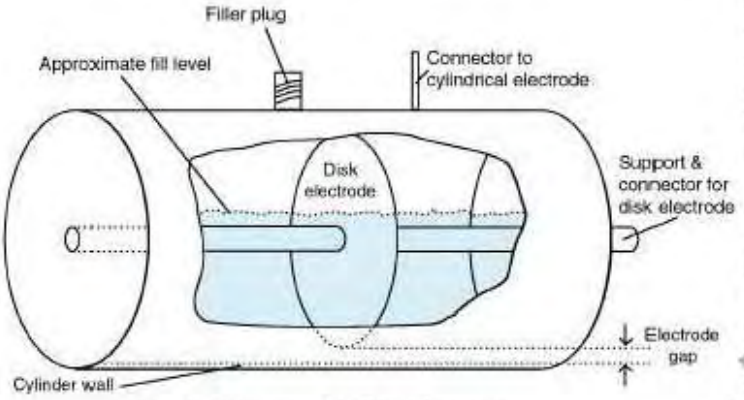

Fig. 1 Cut-away of LENT-1 Reactor

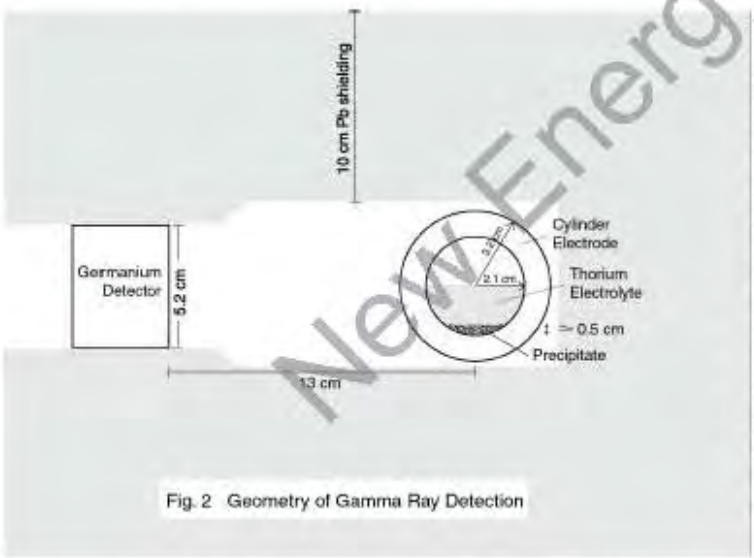

Fig. 2 Geometry of Gamma Ray Detection

A typical chemical analysis of the pre-processed electrolyte and the post-processed electrolyte shows a dramatic decrease in the amount of elemental thorium. In one of the earlier experiments the thorium was reduced from 4300 to 9.5 parts per million in thirty minutes of processing time.

GAMMA-RAY EMISSIONS BEFORE AND AFTER PROCESSING FROM COMPLETE REACTOR. As shown in Fig. 1, the reactor is composed of a cylindrical electrode with a central disk electrode. Fig. 2 shows how the entire sealed reactor has been placed in the lead-shielded chamber of the gamma-ray spectroscope in order to make accurate determinations by minimizing the geometry effect. As shown in Fig. 2, the radioactive solution fills the bottom half of the cylindrical reactor. After processing, there are precipitates that collect at the bottom of the cylinder. If the reactor were placed very close to the end of the germanium detector, it could be argued that the measured reduction in radioactivity was an artifact of the geometry. With the particular geometry used (locating the reactor 13 cm from the end of the germanium detector) the reduction in gamma-ray emission due to the possible change in location of the thorium (and daughter elements) is greatly reduced. Although somewhat difficult to calculate due to the fact that the distribution of the precipitates is not completely known, the authors claim that the geometry would not account for as much as ten percent change in the gamma-ray measurements.

In order to claim that the transmutation is not limited to just one elemental mass, such as thorium-232, data has been examined for elemental masses ranging from actinium-228 to thallium-212 as shown in Table II. Also by using other experimental data, the authors hypothesis is that from the range of lead to thorium the transmutation appears to be about the same for all elements within this range. Preliminary work done by others using uranium and also using cesium-137 promotes the hypothesis that the use of high-density charge clusters can provide for nuclear reactions across most, if not all, of the periodic table.

Table II.
GAMMA-RAY COUNTS FOR SOME THORIUM DAUGHTER ELEMENTS

Element (Isotope)	Gamma Energy (KeV)	Before Processing Net Counts/hr	After Processing Net Counts/hr
Actinium-228	911.07	127 ± 11	66 ± 8
Lead-212	238.63	421 ± 22	204 ± 16
Bismuth-212	727.17	40 ± 7	26 ± 6
Thallium-208	583.14	217 ± 15	105 ± 11

The above data was taken from one recent experiment in which 0.5 grams of thorium was added to the cell. The before and after spectra for entire cell are shown in Fig. 3a and Fig. 3b. These figures show the counts taken for 3600 seconds for the gamma-rays emitted by the lead-212 daughter element of the thorium. The overall reduction of gamma-ray emissions from the total reactor assembly (see Fig. 2) is about fifty percent. The importance of the data in Table II (as obtained from the analyses of the spectra shown in Fig. 1) is to demonstrate that the measure of gamma-ray emissions is reduced about the same for a range of elements. This data was taken without the cell being opened. All gamma-ray emissions had to penetrate the 1.1 cm. thick wall of the cylindrical electrode. The positioning of the closed reactor at 13 cm. from the germanium sensor was to minimize the effects of precipitate geometry. **The conclusions are that the observed reduction in gamma-ray emissions are the result of transmutation of thorium daughter elements and not an experimental artifact.**

TRACKING THE MOVEMENT OF THE THORIUM: Although the thorium is radioactive and continually produces a range of daughter elements (as shown in Table I) the thorium itself is very difficult to detect by measuring radioactivity. Although the thorium-232 emits a gamma photon of 59 KeV, the abundance of the photon is only about 0.2 percent and difficult to detect. **Therefore, we make measurements of the daughter elements of the thorium disintegration.** It is the authors' working hypothesis that the daughter elements from the natural radioactive decay of thorium will be treated in the reactor much the same way as the thorium nuclei. This hypothesis is based on data from previous commercial laboratory tests which measured the pre-and post-processing amounts of various daughter elements in both control and spent solutions.

Chemical measurements show that considerable thorium is removed from the electrolyte during processing. The initial evidence is the decrease in the conductivity of the electrolyte that is observed during the processing interval. If there is no transmutation of the thorium (and its daughter elements) then these elements must be found on the electrodes or in the precipitates. Specific data from micro-chemical or mass spectroscopy will be appended to this paper as soon as the commercial laboratory results are available.

MEASUREMENTS OF THORIUM IN THE SOLUTION AND PRECIPITATES

A new set of experiments were accomplished by using a new cylinder electrode. A new disk electrode is used with each experiment. The amount of thorium introduced into the electrolyte was 0.5 grams. After the experiment was completed the reactor was left intact (not opened) for several days (Friday until Monday). The reactor was opened and the precipitates decanted from the spent solution and measured for the degree of radioactivity. There is a significant amount of radioactivity in the precipitates caused by the presence of some of the thorium daughter elements. A comparison of the gamma-ray emissions from the original electrolyte (before processing) is compared with the **processed electrolyte plus the precipitates** in the following table III. Because the size of the containers used with the germanium detector, there can be only negligible effects from the geometry of the two samples.

TABLE III
COMPARISON OF GAMMA-RAY EMISSIONS FROM INITIAL SOLUTION & WITH PRECIPITATES
(After processing is solution plus precipitates. Count data is net counts per hour.)

Element (Isotope)	Gamma Energy (KeV)	Initial Solution	After Processing With Precipitates
Actinium-228	911.07	195 ± 14	75 ± 9
Lead-212	283.63	1849 ± 44	612 ± 25
Bismuth-212	727.17	76 ± 9	31 ± 6
Thallium-208	583.14	459 ± 22	147 ± 13

Note: The above data does not represent the maximum changes in gamma-ray reduction that has been achieved.

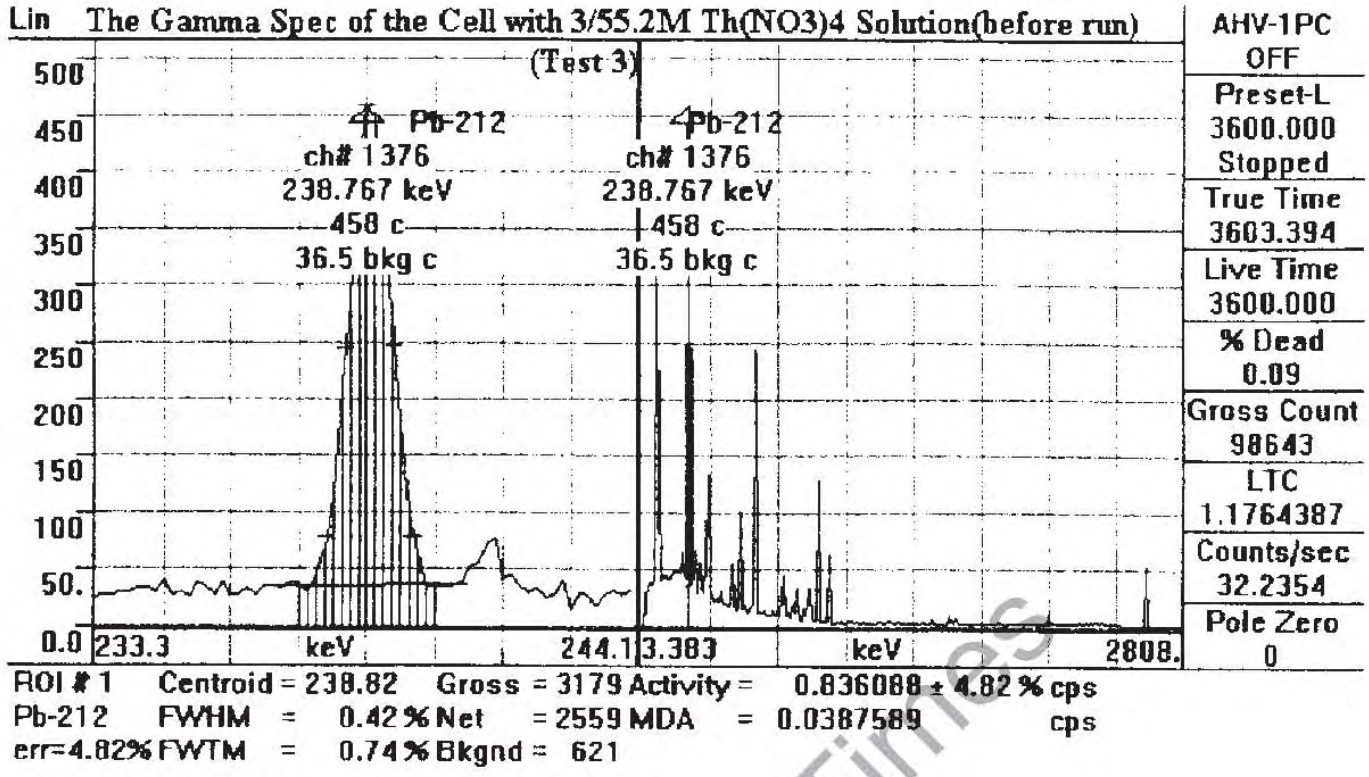

Fig. 3a Total Cell Count Before Processing

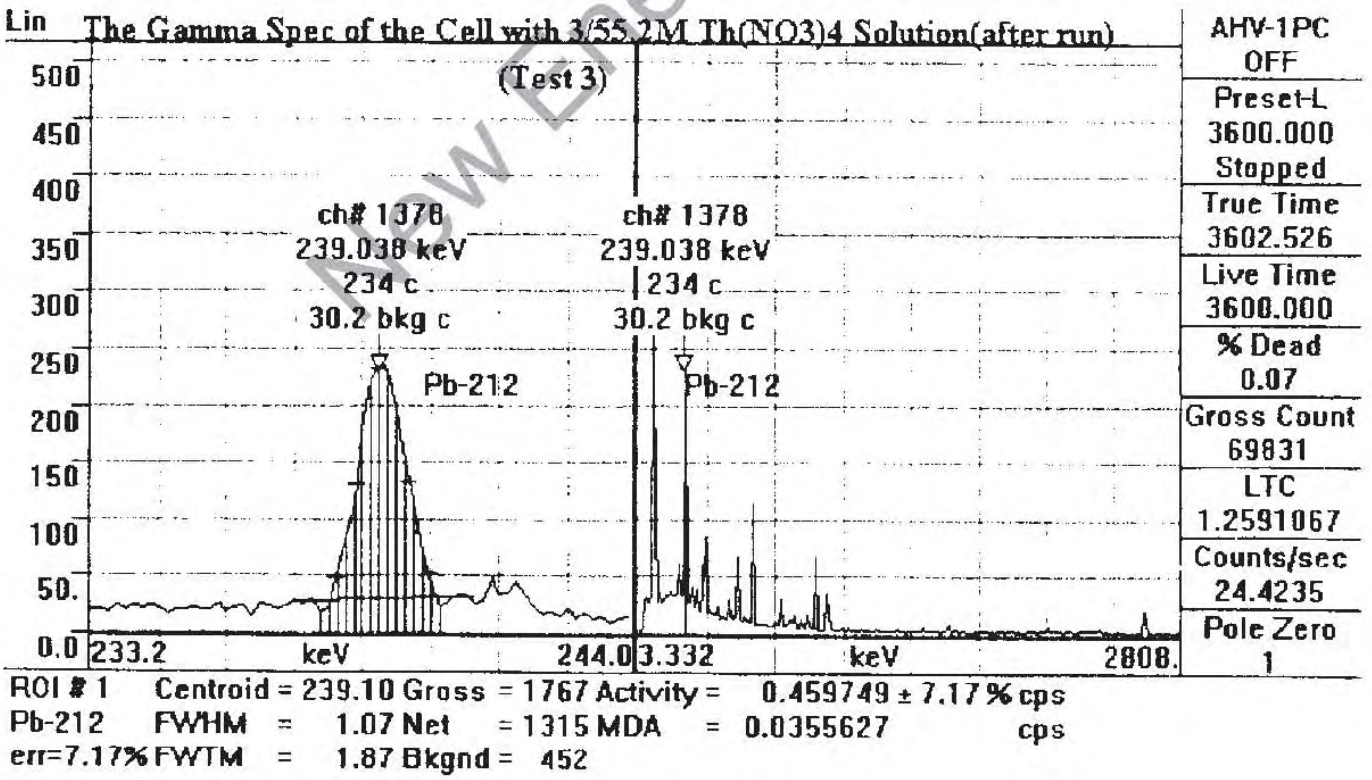

Fig 3b Total Cell Count After Processing

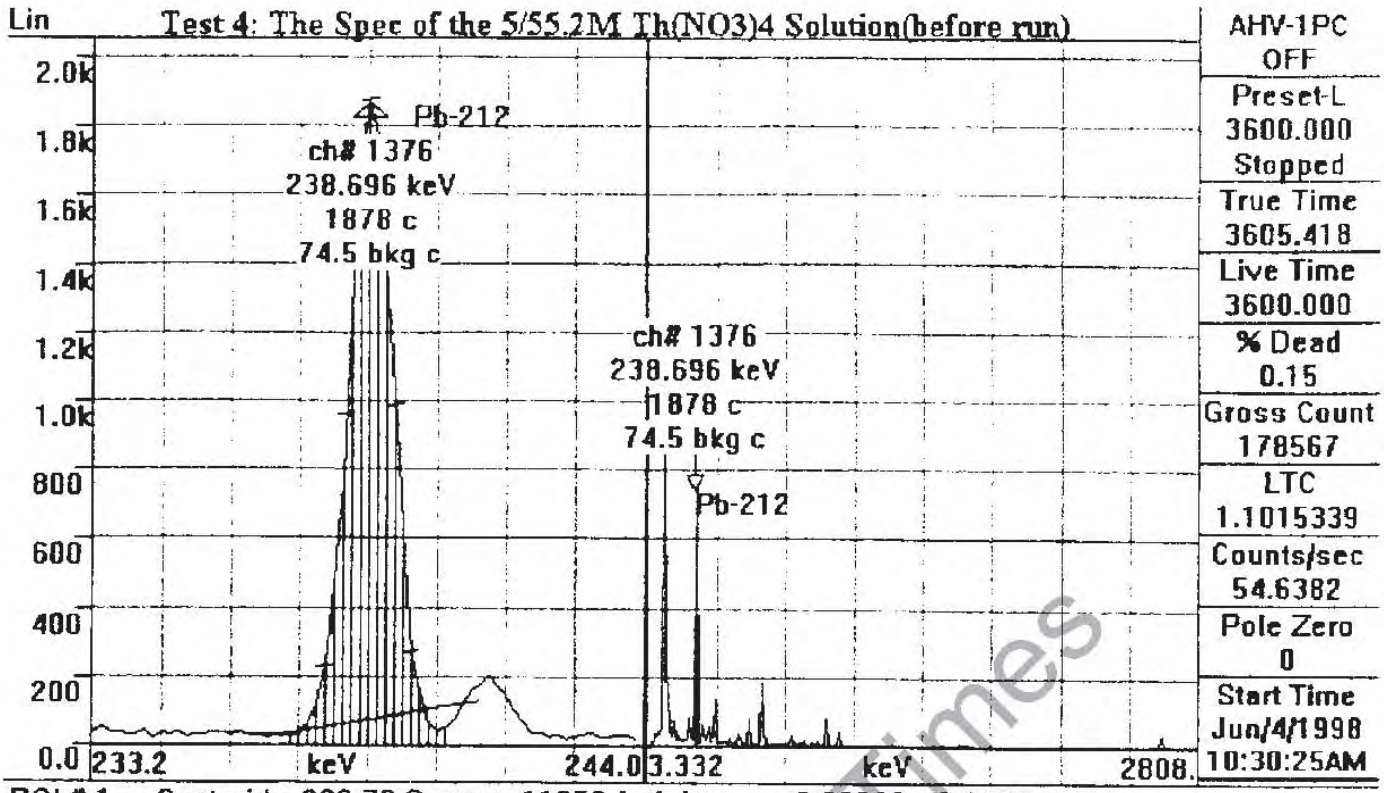

Fig. 4a Spectra of Electrolyte Before Processing

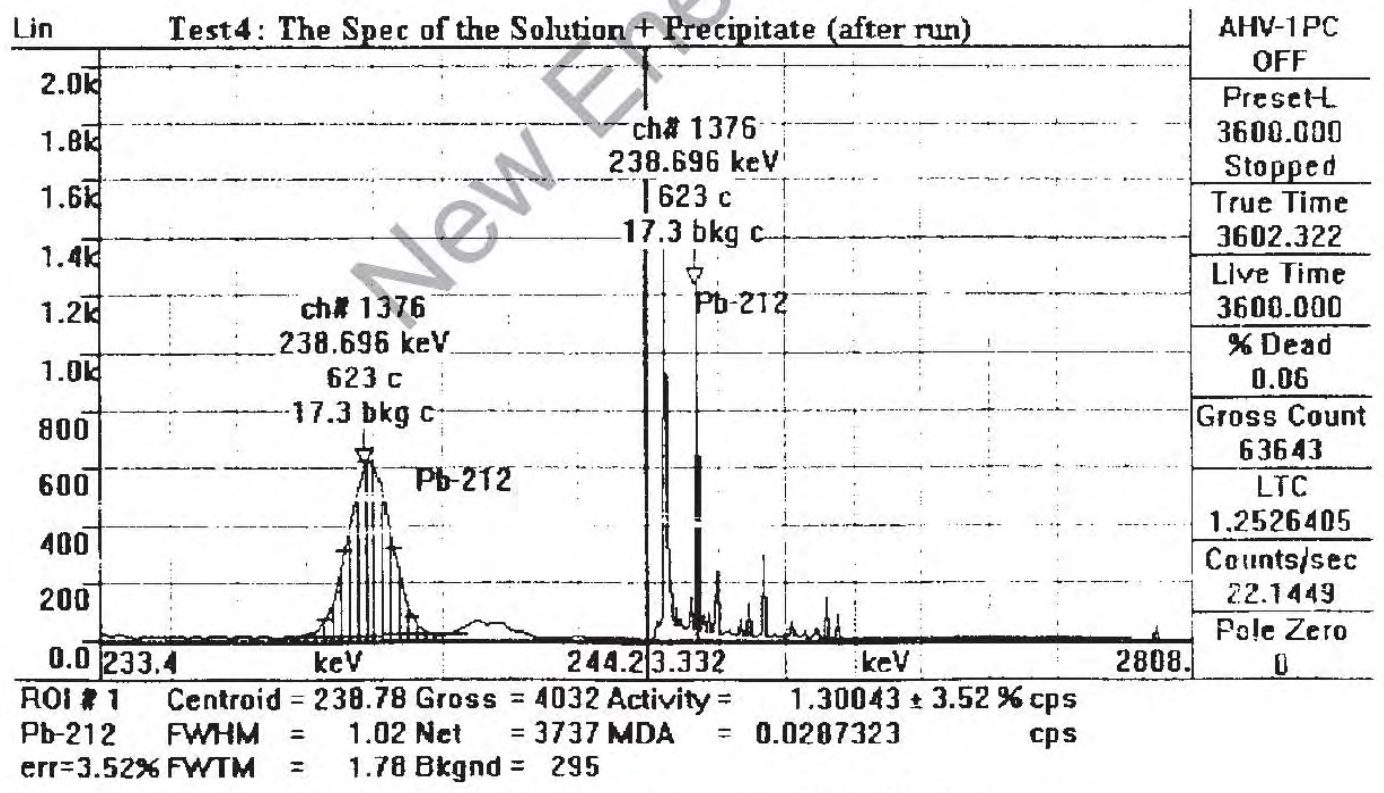

Fig. 4b Spectra of Electrolyte and Precipitates After Processing

The actual gamma-ray spectra of the electrolyte plus the precipitates and the gamma-ray spectra of the initial electrolytic solution are shown in Fig. 4a and Fig. 4b. The same size small containers were used and the position of the containers with respect to the germanium detector was the same.

The result of this particular experiment supports the concept that the amount of radioactivity in the initial solution was significantly decreased in the spent solution **and** precipitates. In this experiment, the lead-212 counts were reduced by 67 percent.

MEASUREMENTS OF THORIUM DAUGHTER ELEMENTS ON THE ELECTRODES: Because the electrodes are eroded during the processing time by the action of the highly-dynamic charge clusters, it is reasonable to assume that there would be little buildup (or plating) of the thorium (and daughter elements) on the electrodes. The following procedure has been used to determine the amount of thorium (and daughter elements) on the electrodes:

The disk or cylinder electrode is placed a precise distance from the detector in the lead-shielded gamma-ray spectroscope. The gamma-ray counts are stored by energy level in the 16,384-channel Aptec multi-channel analyzer. The gamma counts are continued for thirty or sixty minutes. The most predominant daughter element of the thorium on the gamma-ray spectrograph is the lead-212 having an energy of 239 keV (see Table I). See Fig. 5a where the net value of the counts for the lead-212 shows a net value (peak counts minus background counts) of 14 counts/hr for a typical disk electrode.

The next step was to place one percent of the original solution of thorium nitrate (from the control half of the pre-processed solution sample) onto the disk electrode. The disk electrode was then gently heated to evaporate the water. This process provides a disk electrode that has been **loaded** with one percent of the amount of thorium (and daughter elements) from the original solution. This disk was placed into the gamma-ray spectroscope in the same position as previously used. The results from the same counting period are shown in Fig. 5b. The net counts for the same channel (for the lead-212) measured 57 per hour. This careful measurements shows that the amount of thorium (or daughter elements) that are normally present on the disk electrode **after processing** amounts to less than one-fourth of one percent of the original amount of the thorium (or daughter elements). **Conclusion: there is a very small amount of thorium (or daughter elements) that is contained on the disk electrode.**

A similar procedure was used to measure the amount of thorium (or daughter elements) that may be found on the cylinder electrode. In this case the cylinder electrode used for measurements had been used for a total of over thirty similar experiments. Fig. 6a shows the results of the gamma-ray spectra with a net 26 counts for the lead-212 channel. After the addition of one percent of the original solution onto the center of the cylinder electrode the net counts as shown in Fig. 6b were 49 in 30 minutes. **Conclusion: after many experiments the total amount of thorium (or daughter elements) contained on the cylinder electrode is not more than one-half of one percent of the amount of thorium contained in the electrolyte in one experiment.**

D. THE USE OF HIGH-DENSITY CHARGE CLUSTERS

High-density charge clusters can be created in various fluids such as low-pressure gases, at atmospheric pressure, and in some liquids using specially-prepared electrodes. A single charge cluster, created from a specially-prepared electrode in liquids or from a cathode in gases is normally about one micron in diameter (see Fig. 7). With more energy several charge clusters ranging from about one-half to three microns form into a ring-shaped form with a diameter of about 20 microns and travel like a smoke ring (direction of travel perpendicular to the plane of the ring of clusters). As shown in Fig. 7, the high dynamics of the rotating electrons (considered to be spiraling around the outer surface of the toroid) create a very high internal magnetic field. According to the analytical model [7], the local strength of the magnetic and electric fields are much stronger than previously produced in laboratories.

The local strength of the electric field is strong enough to completely ionize the material of any dielectric that is in the path of the charge cluster. Therefore, a typical charge cluster can drill holes through aluminum oxide leaving evidence that this refractory material was vaporized [8]. Some preliminary calculations would indicate that the melting of such a small bore cylinder could require several times as much energy as used to create the charge cluster. A possible explanation is that some nuclear reactions occur in the aluminum oxide and provide energy to the charge cluster. Shoulders' experiments support this explanation [5].

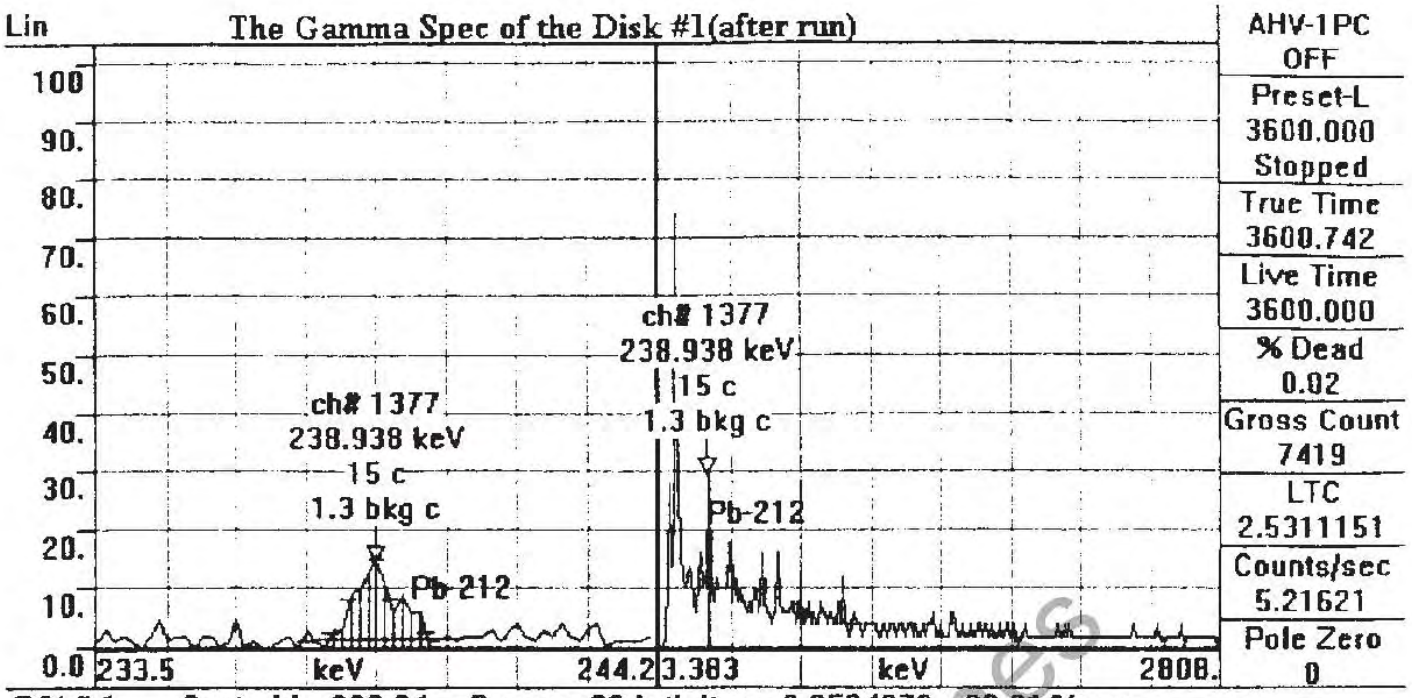

Fig. 5a Spectra of Disk Electrode

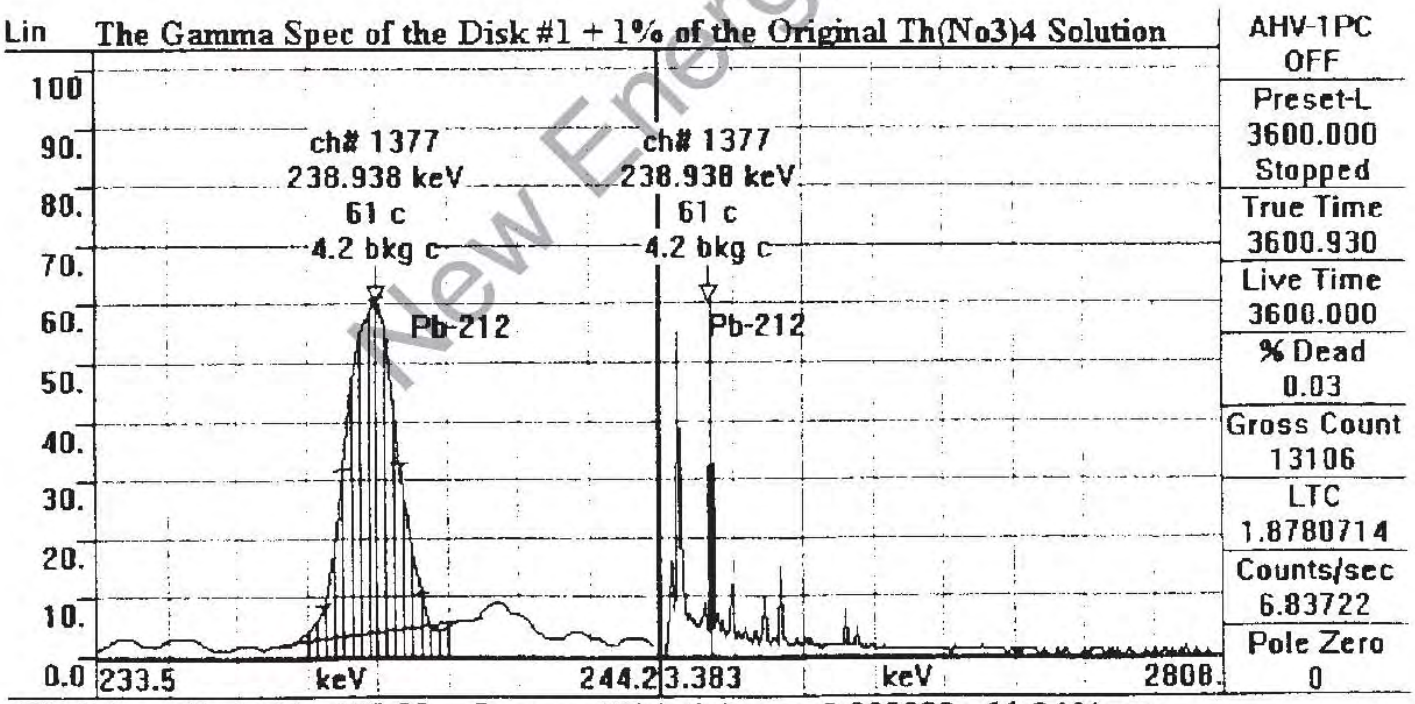

Fig. 5b Spectra of Disk Electrode Plus 1% of Added Thorium

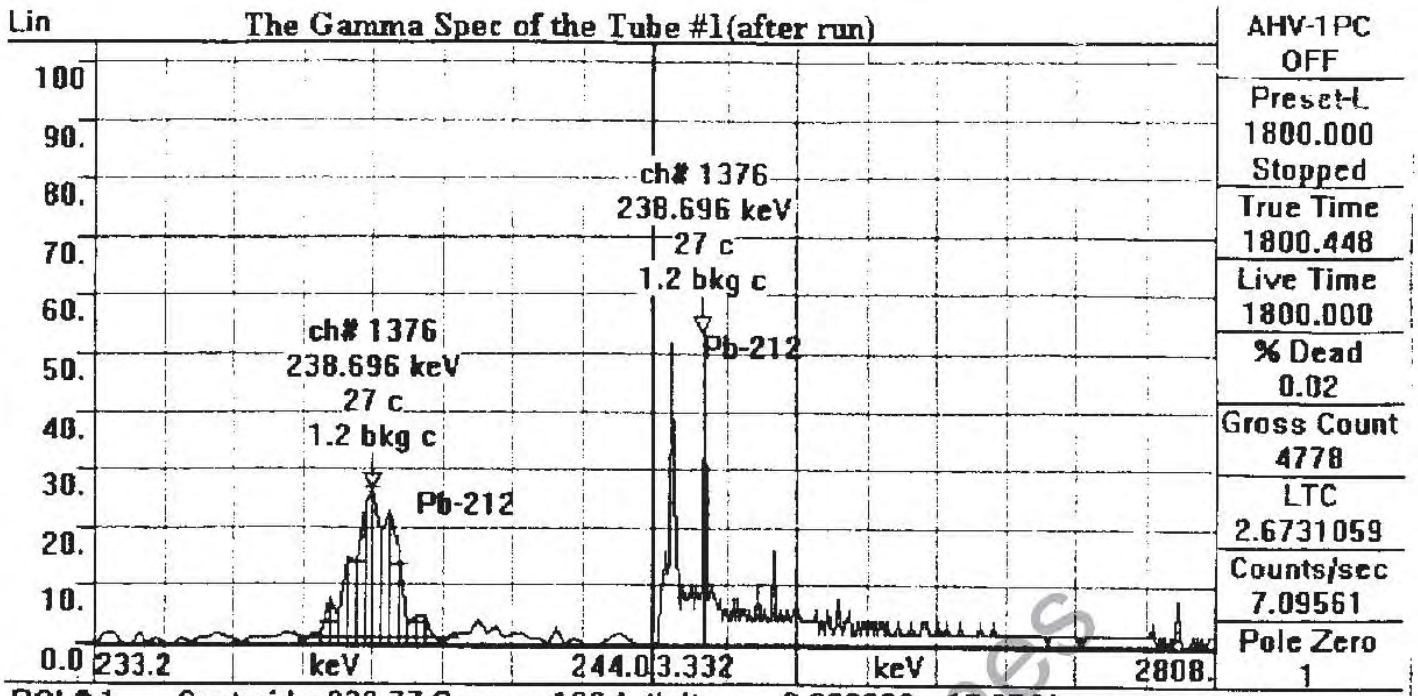

Fig. 6a Spectra of Cylinder Electrode

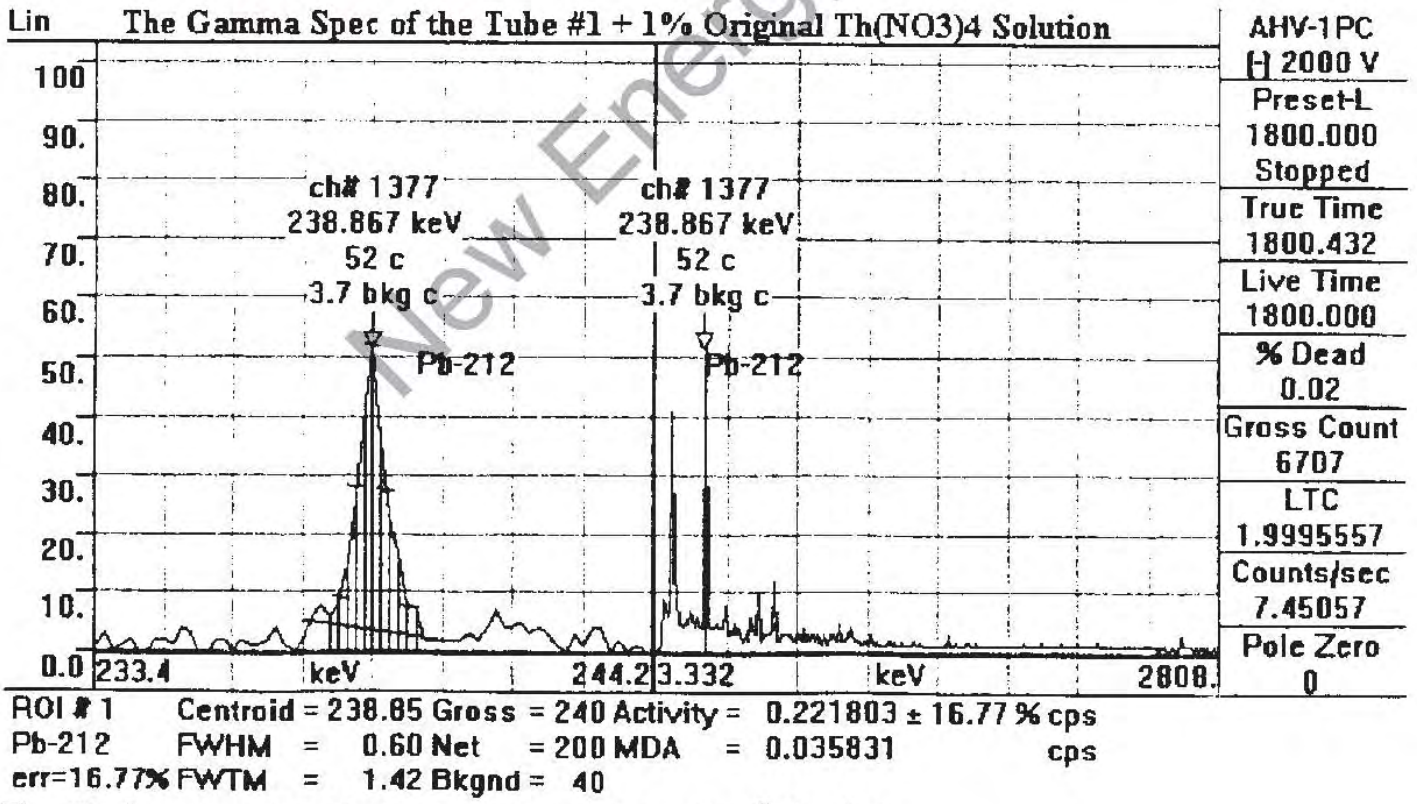

Fig. 6b Spectra of Cylinder Electrode Plus 1% of Thorium

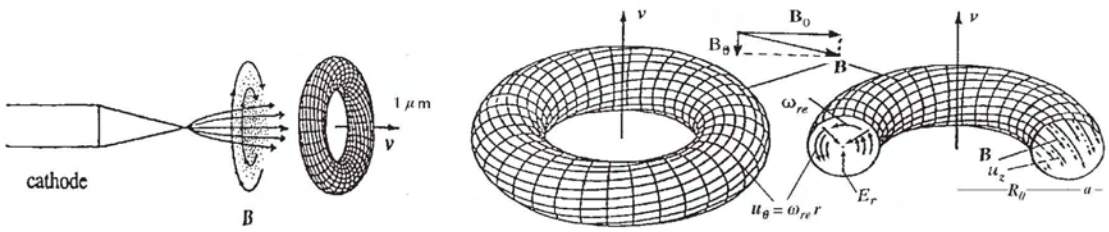

Fig. 7 Formation of charge clusters.

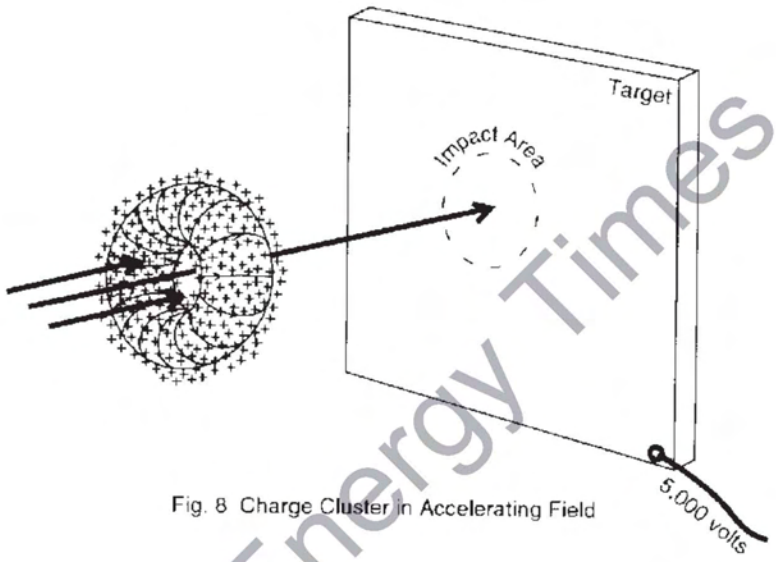

Fig. 8 Charge Cluster in Accelerating Field

When the charge cluster is created in an ionizable fluid, the charge cluster creates many positive ions and transports about one positive ion for each 100,000 to one million electrons in the charge cluster (see Fig. 8). Under the influence of an accelerating field the combined charge cluster can achieve velocities required to create nuclear reactions in a target material. The target material may be the anode in a low-pressure gas or an ion in a liquid.

With sufficient potential, the positive ions carried by charge clusters can create nuclear reactions (see Fig. 9). The positive ion velocity must be sufficient to penetrate the Coulomb barrier of a target nuclei. To explain some of the observed nuclear reaction products [1,5,6,16], the authors suggest that multiple-body reactions may be involved where two or more positive ions penetrate a target nuclei. A more complete discussion of this possibility will be the topic of a planned future paper.

It is important to note that the electron density in the high-density charge clusters is 10^{10} to 10^{12} times higher than the electron density in the Intense Relativistic Electron Beam (IREB). Therefore, the efficiency of collective ion acceleration of the charge cluster would be several orders of magnitude higher than previously achieved by IREB [13,14]. As a result, there will be many applications for the production and use of high-density charge clusters. New inventions are expected for many scientific and engineering applications. Among the more important applications are the use of such high-density charge cluster technology for the on-site stabilization of both liquid and solid (after reducing to small particles) high-level radioactive wastes.

E. EXPERIMENTAL CONCLUSIONS

The experimental evidence from the authors' work and from the cited work of others provides the following experimental facts:

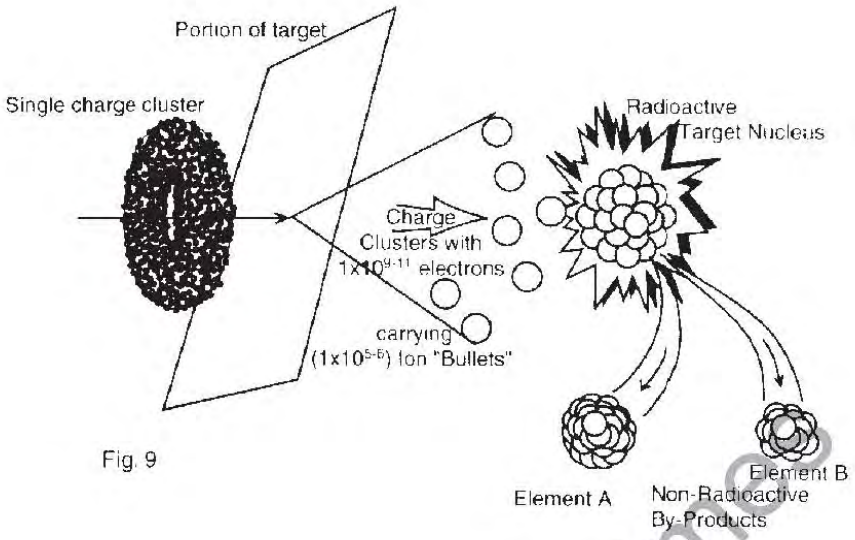

Fig. 9

1. High-density charge clusters can be produced in many fluids.
2. High-density charge clusters can ionize materials having sufficient resistivity.
3. Under some conditions high-density charge clusters can collectively accelerate ions and produce nuclear reactions.
4. Nuclear reactions can be produced using less than 5,000 volts.
5. Experiments with high-density charge clusters has proven that low-energy nuclear reactions are an experimental fact.

Qualified scientists working in various laboratories in several countries (including papers provided at two International Conferences on Low-Energy Nuclear Reactions [15]) have laid the groundwork for an important new technology. These new discoveries are important, first; to provide new insights into nuclear reactions and second; to provide new devices and systems for handling radioactive wastes, for creating clean energy, and for creating scarce elements from plentiful elements.

F. FUTURE EFFORTS

Further experimental work is planned using the germanium sensor in the gamma-ray spectroscope and mass spectrometer. The experiments will be designed to track the type of nuclear reactions that are being produced. It is hypothesized that protons are injected into the nuclei of heavy elements (such as thorium) and produce a nuclear instability resulting in fissioning of the heavy nuclei into smaller fragments. Due to the sparsity of neutrons produced from this type of reactor, it is further hypothesized that the nuclear fragments are neutron rich and decay by beta emission (where excess neutrons become protons). It is hypothesized that a part of the observed radioactive decay of the disk electrode is explained by the beta-emission processes where neutron-rich isotopes decay to stable elements over a period of a few hours to a few days after processing. Further experiments to determine the validity of this hypothesis are planned.

The complete elemental analysis of all components of the low-energy nuclear reactor currently being used will be accomplished and appended to this paper. Additional experiments will be conducted using naturally-radioactive uranium salts. Arrangements are being negotiated to have similar experiments accomplished in a laboratory suitable for working with high-level radioactive wastes.

ACKNOWLEDGEMENTS

The authors wish to thank the staff of Aptec Nuclear Inc. and the staff of the ORTEC division of EG&G Instruments, Inc. for their support and help in building and operating the gamma-ray spectroscope. In addition, the authors thank the management of Western Zirconium for their support. Most important, the authors are deeply indebted to the program managers of the American Nuclear Society for extending an invitation to present information about this important new technology at the 1998 annual meeting (June 7-11, 1998 in Nashville, Tennessee).

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THE SUPERLUMINAL VELOCITY OF GRAVITY WAVES

Hal Fox and Bill Ramsay [1]

ABSTRACT

Manufacturers of equipment to measure gravity, average the short-term fluctuations to obtain an acceptable result. Ramsay's study of these short-term fluctuations, or gravity waves, is accomplished by instrumentation based on a suggestion by Michael Faraday and instrumented extensively by Gregory Hodowanec. The experimental evidence is that gravity waves are affected by the sun's position; by other celestial bodies; and possibly by artificial means. Experimental evidence suggests that the speed of gravity waves are many times the speed of light. Several Russian groups have reported on experiments with torsion fields and claim that the speed of torsion fields is several orders of magnitude faster than the speed of light. These claims are explored in the paper. A demonstration of gravity wave detection equipment will be provided as a part of the presentation. The impact of this experimental discovery on the special theory of relativity will be presented.

A. BACKGROUND

Beginning in 1959, Gregory Hodowanec became convinced that there was considerable merit in Max Plank's suggestion that experimentally determined universal constants could be used to "establish units of length, mass, time, and temperature, which are independent of special bodies or substances, which necessarily retain their significance for all times and for all environments, terrestrial and human or otherwise, and which may, therefore, be described as natural units" [1, 2]. This information and Hodowanec's later work to solve the observed problem of variations in scales has resulted in a life-long search for a true understanding of cosmology [3]. While working with Henderson Industries, a company that manufactured weighing scales, it was noted that a balance-type of scale using both a reference weight and an unknown weight did not fluctuate. However, a scale using any kind of a spring or load cell would fluctuate over a range as high as 10 percent (unusually high and seldom noticed). Hodowanec developed a variety of devices to measure and observe these dramatic changes or "gravity-wave fluctuations".

One of the authors (Bill Ramsay) became a dedicated experimenter of gravity waves and has had frequent communication with and has shared much information with Hodowanec and others. During these experimental investigations, Ramsay discovered that by using a Rustrak strip-chart recorder, it was possible to record some of the frequent events where gravity waves appear to result from relatively brief changes in gravity-wave magnitudes [4]. Nick Anthony Fiorenza determined that one of the observed patterns corresponded in time to the planet Pluto's transit. A more detailed analysis was published by Fiorenza [5] showing that planetary alignments showed in the chart output patterns. Alastair Couper also examined such timing events and has reported his findings on the Internet [6]. The most impressive experimental evidence is that the occurrence and measure of these celestial events (including the transit of the "black hole" at the center of our galaxy) appear not to be limited by light speed.

B. TORSION FIELDS

Some Russian scientists report that as many as 25 groups of scientists in Russia have been investigating "torsion fields". These torsion fields are believed to be an additional "field". According to such reports, we must add torsion fields to the standard strong electric and magnetic fields, and the much weak gravity field. The so-called strong nuclear force is often cited as one of the fundamental fields in nature. The Russian scientist, A. Akimov [7], describes three different "polarization states of Physical Vacuum". These are charge polarization (E-field), spin polarization (G-field), and transverse spin polarization (S-field). The S-field is described as the torsion field. Experiments with torsion field generators and receivers indicate that the torsion fields can penetrate matter, that they are very difficult to shield, and travel at superluminal velocities.

[1] TRENERGY, Inc., P.O. Box 58639, Salt Lake City, Utah 84158

According to Akimov, "...assuming that gravitational waves are longitudinal waves in elastic Physical Vacuum, V. Bunin [8] and V. Dubrovsky [9] demonstrated that these waves have speeds of the order of 10^9 c." (The authors have not had English translations available, as yet, and cannot describe the method used to determine the speed of these waves.) It is a current hypothesis of this paper that the torsion fields are responsible for the observed gravity-wave fluctuations.

There is considerable Russian literature on torsion fields. It is noted that Akimov cites 177 references in his paper [7] and that 81 of these papers are in Russian. From Akimov [7], and from a few other sources, we have learned that the torsion field and its emanations are subtle energy fields. They are separate and distinct from **classical** Electric, Magnetic, and Gravity fields. Generators for torsion fields can be shielded against electro-magnetic fields and the torsion field still manifest itself through such shielding. Torsion fields can be generated, detected, switched on and off (such as for communication purposes), and are a distinct type of energy field not included in today's classical physics. Torsion field emanations can travel at velocities at least as high as 10^9 times the speed of light. Torsion fields can interact with laser beams (change frequency); affect biological processes; are generated by melting or solidifying some materials; affect quartz crystals; affect some electronic components; can favorably change some beverages; and have been noted to affect gravity.

According to Akimov, torsion fields coupled with the standard electric, magnetic, and gravity fields should provide means for a unified field theory that will extend the realm of science to include the effects of consciousness. The concept of dowsing, for example, can now have a scientific basis of explanation for the phenomenon. If this suggestion by Akimov proves viable, then science has an opportunity to extend its borders more rapidly into the so-called psychic realms. That could be a multi-decade venture of considerable importance to the expansion of scientific knowledge.

In Russia, several types of torsion-field generators have been patented and some are available to purchase. The publisher of the monthly newsletter *New Energy News (NEN)* is expected to obtain more information about the availability of torsion-field generators. Hopefully, such generators can be made available for purchase (or replication) here in the U.S. *NEN* is encouraging its readers to consider becoming involved in the development of low-power faster-than-light communication systems. Perhaps the next Mars Rover will be controlled by torsion-field communicator and not suffer the considerable delay now endured in controlling the Mars Rover over millions of miles using the slow, old-fashioned, radio waves.

C. IMPACT ON EINSTEIN'S STR & COSMOLOGY

The current dogma of Physics accepts the concept that nothing can travel faster than the speed of light; that a material particle would increase in relativistic mass as it approaches the speed of light; that the speed of light in a vacuum is constant, and that Einstein's Special Theory of Relativity is essentially correct. The discovery of field emanations that can travel much faster than the speed of light is expected to cause some significant changes in conventional physics.

There is expected to be a strong re-evaluation of some of the basic tenets of modern physics including STR and of the existence of an energetic structure of space (aether). The availability of low-cost means and years of experimental observations should lead to a wide-spread replication of the gravity-wave phenomena. When it can easily be shown that various celestial bodies (or events) can affect the gravity-wave fluctuations and that such events are replicable, the skeptics should ultimately be convinced.

The spinning of the earth on its axis and its revolution around the sun provides a means of scanning a portion of the heavens even using a laboratory fixed orientation of a gravity-wave sensor. It would be helpful to have a personal computer program that would correlate the position and orientation of a gravity-wave sensor with respect to the actual (as contrasted with visual) position of cosmic structures (planets, suns, "black holes", novas, etc.). Eventually, it is expected that events being monitored at superluminal speeds will be correlated with later astronomical observations. This correlation will take some patience if the nearest star to the earth is several light years away. However, there are opportunities to make observations of planetary events in which the light travel time is in minutes. Perhaps a great experiment could be designed whereby an earth to asteroid ship provides an asteroid event (perhaps a nuclear explosion) to see if the gravity-wave fluctuation and the visual observation could be correlated.

D. CONCLUSIONS

Thanks to persons such as Greg Hodowanec, Nick Anthony Fiorenza, Alastair Couper, the authors, and many others, low-cost experimental equipment and significant instructional materials now exist to make it easy for any person of modest means to replicate the experiments on gravity-wave fluctuations. It is highly important for the advancement of scientific understanding that such experiments be made and reported in the peer-reviewed journals. Perhaps the most important issue is to determine that gravity-wave fluctuations do occur at many times the speed of light.

Note: Together with the verbal presentation of this paper, Bill Ramsay demonstrated the real-time measurements of a typical gravity-wave fluctuation detector.

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WHAT IF THEY WERE CORRECT?

Roy E. Graham, Jr [1]

ABSTRACT

Different assumptions and mathematics are sometimes required for New Energy. The author presents: (a) Often overlooked, perhaps not widely noted, statements and work of Tesla, Einstein, Walter Russell, T.H. Moray, and other New Energy giants; (b) Historically significant practices and research in radio, RADAR, SONAR, television, and satellites; especially limits on energy transfer and conversion; (c) A portion of his own energy related research.

The author attempts to show that past practices and research may strongly suggest: (a) The noted results found in recent energy investigations could have different interpretations, and (b) Other investigations to do.

References are made to well known statements and to other sources presumed available to the readers.

DISCUSSION

Before submitting this paper for the 1998 International Symposium on New Energy I made a choice. I chose to raise questions in your mind and to prod you to think. That can help you more than a long paper about my work.

In 1998, among the people interested in New Energy, there are Giants bringing changes to energy use and to the types of energy we use. These people are actually accomplishing things. Their work can lead to less polluting forms of energy use in our world. They are Giants, not in the Biblical sense of Goliath. Instead they are more akin to Noah, Joseph, and Moses. They are cutting paths through unmapped territories and then showing us the way.

These Giants in New Energy aren't the first. In the past have been others. Some that come to mind immediately are Nikola Tesla, Waiter Russell, and T.H. Moray. In the future other Giants will become known. But, today's New Energy Giants aren't common followers; they are leaders. They are leaders in the sense that they do the correct things; while others are often just followers trying to do things correctly.

In this paper, I'll not try to mention all the New Energy Giants. They are at least 100 in USA. In other countries are hundreds more. Some are quietly doing important work. I can't tell you about the quiet Giants even if their work may be the most important. Others have previously spoken out; so I can mention them; their work may make you think. You'll find that some have cutting senses of humor. Most don't take themselves too seriously. Most of them often refer to the fine work of Giants who came before.

Also, there are many other fields where practices and research have dealt directly with the use of energy and energy conversion. The Navy gave me assignments that dealt with the use of energy and energy conversion for radio, RADAR, SONAR, television, satellites, internal combustion, and nuclear energy. These, of course, are not the only fields related to energy use and conversion.

Now retired from the Navy, I've been free to do my own investigations into energy use and conversion. Some of that will also be in this paper.

At the beginning all I had was: broad based engineering courses of the Naval Academy; day-to-day experience leading troops operating and repairing electronics and mechanical apparatus; and nuclear energy equipment;

[1] Inventor, Investor, Corporation Officer and Director for many years, retired Navy Officer. The author's education includes BS, U.S. Naval Acad., 1968 and MS, U. of Southern California, 1976. 40 Williams Dr., Annapolis, MD 21401.

celestial navigation; and MS studies in management of systems and R & D. What followed was not an event; it's been a journey; a trail of energy-related research conducted before and during actual experimentation while continuing to work 12+ hour days for America's Navy.

Now, in investigations of "new" things, only a fool would not look at all available information first. In addition, keep in mind that you can't break new ground if you only work in the areas where the "establishment" already is. Those establishment areas are often the well-worn, and perhaps worn out, trails that provide no energy advancements for our world. Along the trail that preceded my experiments I encountered: many concepts new to me; many old concepts perhaps wrongly discarded, probably because they were to difficult for lazy people; and some of the most brilliant minds the world has ever hosted. Some examples of the above: (but new to me) were the words used by Tom Bearden; old to me was the passive solar stable and home my grandparents built for their stagecoach station (now Castle Rock); introduced to me were Tesla, Moray, Bearden, Bailey, Grotz, and others.

Let's look first into the work of Pat Bailey and Toby Grotz, past Presidents of the organization that sponsored previous New Energy Symposiums. They still are hard at work in New Energy matters. Pat Bailey may have the overall broadest knowledge on New Energy progress (and problems). He's both a sounding board and a rebroadcaster for collected New Energy information. While Pat expends much time and love keeping us informed about New Energy matters, Toby parallels that effort.

With Tim Binder, Toby may be one of Earth's experts following up on the work of Walter Russell. New Energy papers of Toby and Pat in the Proceedings of 1993 and 1994 Symposiums are some of the most enlightening available. If you don't have those 1993 and 1994 Proceedings - buy them; study them.

Getting back to Toby, Tim, and Walter Russell--

It is very well documented that Russell did work directly related to today's "cold fusion." He applied magnetic (or more likely electromagnetic) fields to a container of gaseous elements, and: VOILA, other elements. If cold fusion today was as successful and as well documented as Russell's work there would be lots of money for cold fusion research and none for hot fusion research. But--Russell did it differently. As a trigger or as a catalyst, or both, Russell impinged energy fields on the gas mixture. Maybe Toby and Tom can determine and tell us whether the energy field impingement was the trigger; the catalyst; or both. Maybe they can confirm whether or not "oscillating fields" were used. Why haven't we read about energy field impingement being used in Cold Fusion research? Why haven't Cold Fusion research reports shown avoidance of accidental energy field impingement through use of Faraday shields? [Some cold fusion papers have explored the use of some types of energy fields, such as microwaves, and magnetic fields. Ed.]

Those above are the types of questions that lead to improvements. Think about it. There can be both accidental and intentional energy field impingement, AND -- the fields can be either static or oscillating. If the fields can't exist, and therefor can't have effects on energy research, then Tesla, Einstein, Walter Russell, T.H. Moray, and a host of others had to be wrong. Keep in mind that many of them were doing energy-related investigations, not necessarily together, at approximately the same time. Here's why they would have had to be wrong, in roughly chronological order.

Starting with Tesla--

Long ago, Tesla predicted the energy that is "the wheelwork of nature" will be put to use at a future time; approximately now. Moreover, he said it is oscillating, not static. Very much of his most trumpeted work was with "oscillating" energy in the Earth and Sky, and, according to him, beyond the atmosphere. If you don't think the energy Tesla used was "oscillating" (had a frequency) read about the St Elmo's fire seen on the lawn grass in Colorado Springs. St Elmo's fire is seen at night and an ionization cloud seen during the day when ionizing frequencies are resonating from natural antennas, like electric power company high voltage lines, the masts and yardarms of ships, or lots of blades of grass. Unless Tesla was clearly wrong, that means WE are to investigate frequency related energies and always be aware of those energies around us. Not only are we in Tesla's predicted time period; we're immersed in the energy. He often called the energy "Radiant Energy".

Another, perhaps clarifying, aspect of Tesla's writings was his classifying of energy into 2 categories: resistive and reactive. Edison's work was almost entirely with resistive energy. On the other hand, the work of Tesla, and his assistant Marconi, was mostly with reactive (oscillating) energy. Reactive energy has little resistance and can develop overwhelming power when brought to resonant conditions greatly avoided by electric power company engineers.

Then Einstein-

Einstein said that energy is found with mass OR without mass. That could be interpreted as: Mixed with atoms and molecules there is energy; AND there is energy between atoms and molecules and in the "void" of "space". This is another reason, unless Einstein also was wrong, we must look into and always be aware of energy in which we are immersed.

What about Tom Bearden's findings?

So far, I've found nothing in Tom Bearden's excellent work that conflicts with the fundamental work and statements of the most well known new energy investigators. This may be because, like Tom, those investigators looked "outside the box" to advance science beyond the limits (or mistakes) of others. They were willing to question generally accepted falsehoods of "establishment science", as does Tom Bearden. The only thing in Tom Bearden's work that ever bothered me was his attempt to convert Tesla's reactive (oscillating) energy around us to Edison's resistive energy by shuttling energy between 2 systems. Even then, Tom's work to expand the box has probably pointed us in the correct direction. Maybe we just aren't yet good at the conversion; maybe because the conversion was too difficult for both Tesla and Edison. In that area we still may be missing one or more pieces of the energy puzzle. Those pieces may also be outside the box. It's my opinion that Tom Bearden also has to be wrong if Tesla was wrong (and right if Tesla was right)..

Resuming the chronology with T. Henry Moray.

T.H. Moray's work was in multiple areas, like that of Tesla. He wrote the book: The Sea of Energy in Which the Earth Floats. After T. Henry Moray died, Tom Bearden helped his son(s) rewrite and edit the 4th edition and wrote the forword (June 4, 1977).

Moray developed apparatus to obtain "Radiant Energy" from our surroundings. His work was so valuable repeated attempts were made to steal the technology or to prevent its use. Attempts were even made to murder him. His apparatus made extensive use of oscillators and resonators. BINGO -- There was a field I knew something about. Navy RADAR and SONAR used resonation devices to increase the purity and power levels of their search beams. Other Navy electronics used oscillators and resonance. I was also aware of the possible physical effects of resonance. Movies had been made of bridges and other structures in resonant oscillations that led to destruction. Not only that, but Moray's apparatus had no conventional power input. It was an advancement on the Crystal radio I used years before to listen to the Denver Bears.

But that's not all -- Moray also developed methods and tools to obtain pure valuable metals. One method he used included oscillating field impingement. He apparently repeated the valuable metals production enough to attract the attention of Federal Agents. They seized the metals. Moray also worked extensively with radioactive materials. BINGO again. I had some knowledge of small nuclear energy equipment.

Could Moray's radiant energy equipment be recreated today and mass-produced to provide abundant inexpensive energy worldwide? Was Moray doing advanced Cold Fusion? Could his methods be used today with radioactive waste to stabilize the materials and quickly neutralize the radioactivity? How did Moray relate radiant energy work to nuclear materials work?

My Own Research.

The energy research trail became a dilemma. Which fork should I to take -- Radiant Energy through solid state electronics, or cold fusion? I took the one less traveled. Many better-financed people are doing Cold Fusion. I

decided to look into the "Radiant Energy." Before starting experiments I found many more writings on energy from the surroundings (including in the book of EXODUS, Chapter 25); participated in the 1993 New Energy Symposium, including a Brian O'Leary workshop on the energy fields within people; and worked energy apparatus designs with paper, pencil, and computer.

Some background: By 1993 I was retired from the Navy (on a small retainer for recall); financing 2 children in college, in great debt without sinking, a corporate officer of a small start-up company being viciously attacked from several directions. The company had proprietary rights to a patented major improvement of battery cases and was buying a bankrupt battery manufacturer.

A very useful Navy rule for increasing the chances of success in any endeavor, especially when you're already very busy, is: "Shoot your Biggest Gun at your Biggest Target First". For the building and experimentation on Moray type circuit apparatus the biggest target was NOT electrocuting myself. So, I made an intentionally weak Moray type apparatus. I kept it below 1 ampere out. It had enough "juice" to get readings on common multi meters and a frequency meter.

DESCRIPTION OF CIRCUITS

For people who weren't at the 1994 New Energy Symposium but are familiar with Moray's writings, a description follows. For power input the circuit had 3 loop antennas orthogonal to each other, with no conventional electrical input. The system did have capability to have added a single 1 ½ Volt DC battery for biasing transistor amplifiers. The device was tested both with and without the transistor biasing. For safety, I intentionally left out the Moray resonators.

Just for a moment this paper needs to discuss those resonators. In Moray's equipment they were in plain sight, no secret. Small cup shaped objects, they are used much like RADAR and SONAR resonators. That was the state of the art of solid state electronics before WWII. Cup resonators can physically confine key signals to a single frequency so well that all other frequencies are overwhelmed and, in effect, disappear. As other frequencies fade the intended frequency of the cup resonator is highly multiplied. The frequency of the resonators is most likely the frequency out of Moray's apparatus. The careful shaping of the cup resonators probably resulted in a frequency that the antenna length also received very well. In a well-designed circuit, resonators indicate electrocution power levels. Rarely are they found in passive receivers like Moray's. They are almost exclusive to high-power, radio transmitters and RADARs.

Although both my circuit and Moray's circuit were solid state electronics with no moving parts, there were more than just power levels differences. Moray's circuit only operated at high frequency; generally felt to be a single frequency and was always separated from the power of the local electric company. I wanted a circuit that could eventually connect to the power companies so their existing expensive infrastructure could be expanded worldwide and get its power without fuel. So my circuit had frequency cascading to step down the frequency from about 64.5 MHZ of the loop antennas to 60 Hz. Each cascade subcircuit was LC tuned to a lower frequency and had a K filter to eliminate higher frequencies.

In 1993, each time I measured the voltage, amperage and frequency at circuit test points in carefully run experiments on the modified Moray circuit, I got different results. When varying results occurs in science, some people collect data several times; calculate the averages, standard deviations and other mathematical contrivances of the results; then use the calculated numbers as if they meant more than the collected bad data. Sometimes they get Doctorate Degrees that way. I could have done those meaningless calculations. The only data that didn't change was the 60 HZ output through load to ground. I took all my data several times and then, while the meters were still connected to a test point, decided to go get coffee.

Walking away from my lab bench, I noticed the multi meter readings were changing. I stopped going for coffee. Walking all around the lab I watched the meters. The readouts kept changing. I started to think about this unexpected result and the meanings it had while I went for coffee.

It became apparent that my experiment and I were repeating the results of the Electromagnetic fields of any 2 people in Brian O'Leary's 1993 workshop. In effect, I had caused the varying results by my body, arms and legs being at different distances and directions from the experiment on the lab bench. The integrity of the experiment had been destroyed; loss of integrity being something I can't stomach. That result restarted and slowed my data collection considerably.

I didn't have and couldn't afford a Faraday cage. So, for each set of data I did the following. I set all the instruments; left the lab; read the experiment data instruments with binoculars through the door from a single long distance and azimuth; recorded the data; then reentered the lab. Then I reset for the next test. Then I did it all again and again...again...again .... Using these slower procedures I got repeatable results, except when the mouser cat entered the lab and jumped up on the lab bench.

The repeatable results, however, were all during good weather. I didn't want to go outside the lab during bad weather. I don't have results that show what changes rain, snow, or cold weather may cause to the experiments data. There were other results too. Neighbors asked why I was so blatant at being a Peeping Tom (and on my own house and with written notes to boot).

I also got results that at first I attributed to bad meters. I was wrong. I got AC voltage or AC amperage readings for several seconds on the digital multi-meters. The meters then "defaulted" to NOT AC. Eventually I called the manufacturer and talked with their head engineer. He said the meters were good but I had an unusual circuit or waveform. The meters always default to NOT AC whenever the measured signal waveform varies from a perfect sinewave by 3 percent or more, AND that the default is so fast you'll not get any reading first. He said the waveform I had must be very similar to a sinewave, but NOT a sinewave. The Manufacturer's Engineer's comments were confirmed by testing a RC circuit. The non-resonant RC circuit caused instantaneous meter defaults to NOT AC.

Other unusual results.

After I had finished taking a long series of voltage and amperage measurements, I started data readings on frequency. My frequency counter readout, after 1 to 3 seconds of steady readout on each frequency, kept jumping to another frequency readout for 1 to 3 seconds. I could see it, through the binoculars. Each time, however, the same sets of 4 to 6 different frequency readouts would repeat, not necessarily in the same order. After the problems getting voltage and amperage data, this frequency hopping was not welcomed.

A possible explanation, from current math, which wrongly teaches students to assume and deal with single frequencies in electric power circuits, is that the frequency switching indicated a bad frequency counter. After much thought I decided instead to believe my frequency counter. It was showing me that my circuit was sensitive to multiple frequencies of Earth's Electromagnetic field, that the relative strengths of the natural frequencies varied over time; that the strongest frequency at any specific time was showing on the frequency counter readout; that when a different frequency was stronger it would show on the meter.

The frequency hopping data readings of the frequency counter helped confirm the other meters were also OK. As previously mentioned, those meters had given voltage and amperage data readings that the waveforms in the circuit were at least 3 percent different than and therefor not sine waves. Since sine waves are related to circular wave formation and can only be formed with a single frequency, it was likely the 1993 experiment circuit had multiple frequencies of electricity flowing through it.

Months later I found an obscure text reference that engineers might have to deal with multiple frequencies and an additional secondary effect. The secondary effect is newly created frequencies in the circuits that are the sums and differences of those circuits' multiple primary frequencies. With the exception of dealing with harmonic and sub-harmonic frequencies, none of this multiple frequency information was in the power texts. Multiple frequencies was only discussed in the communications texts, and then only in discussion of Amplitude Modulation, not in discussion of FM (Frequency Modulation). So, apparently, there were 2 or 3 basic frequencies with additional sum and difference frequencies circulating through the circuitry. When possible that is avoided in all electric power company circuits and most communications circuits.

An implied result from my 1993 experiments is that older math better models New Energy. This is to be expected of the work of scientists who had nature to study but not man-made electrical apparatus to study. It adds more importance to the older math found and studied by Ben Iverson, Tesla, T.H. Moray, Tom Bearden, Stefan Marinov, and others.

It was apparent I needed to go back to the library. At Purdue University (IUPUI) Engineering Library, the Electrical Engineer's Databook had a hint by omission. It was in the chapter called Radio Noise. While that chapter's main purpose is to show the limits nature imposes on radio and television communications, it also has a relatively detailed description of God's Energy, the Radio Noise itself. The energy covers huge spectra at huge power levels. Radio and television signals have to "punch through" it. Oddly, no specific single frequency was mentioned, only bands of frequencies. Updated information on the same subject can be found in Chapter 12 of: Reference Manual for Telecommunications Engineering, Second Edition, by Roger L. Freeman, published by John Wiley and Sons, Inc., 1995.

The frequency information contains measurements of atmospheric and cosmic frequencies. Much of the information resulted from CCIR studies of the 1920s and 1960s that helped the developing radio, television and satellite communications industries. The Radio Noise chapter omitted any comment on whether the frequencies were AM or FM. By omission, the frequencies were probably not sine wave waveform. On the other hand, from experience tuning between AM radio stations, the radio noise waveform is similar enough to a sine wave that it's received well and causes a large amount of radio "static". The most reasonable inference is that nature's waveform is more "generic" than a man made sine wave. The more generic form of a circle, from which sine waves are developed, is the form of an ellipse. Then, of course, I couldn't find anything in the electronics and communications engineering textbooks on elliptical waveforms, much less 3 dimensional elliptical waveforms. The "bands" of frequencies rather than discrete frequencies found in the Radio Noise chapter also needed some explanation.

It would be after the 1994 New Energy Symposium before those results could be understood. Still, on the research trail, I was getting closer to the energy that Tesla talks of and Moray got from thin air. A key missing link was the math. Without the proper math there is little hope of proper circuit design to get Tesla's and Moray's energy out of thin air through the use of solid state electronics. And the math used by Tesla and Moray was far older than anything I'd been taught. I was not very interested in using the hit and miss Edison method of hundreds of failures for each success.

In 1994 the New Energy Symposium allowed me to exhibit my 1993 experiment circuit. Toby Grotz and others also graciously offered to test it at the Symposium for me, and at no cost. I declined for 3 reasons. First, it was intentionally designed for low power so people wouldn't get electrocuted, thus, not very exciting. Second, I was embarrassed that I had not made it more rugged. En route to the Symposium, it was damaged; repairs were needed before the results would be reliable. As best I knew, time, materials, tools, and equipment to make the repairs weren't available. I hadn't brought any from Indiana. Third, even if I could borrow everything to fix it, I didn't know how it could be tested without getting a Faraday cage or clearing the Symposium of all the people. I didn't have the gall to ask other researchers to get binoculars for the Peeping Tom trick. I didn't tell them that I knew it didn't produce sinewaves, but that I didn't yet know the wave shape. I offered to bring the experiment to them later (gently, after I repaired it).

Other results could be predicted from study of the results of Brian O'Leary's workshop. For example, because people are sensitive to Electromagnetic fields, when experiments involve actively generated frequencies, some biological effects could occur. In fact, when you read about New Energy you are likely to encounter researcher statements that they were sometimes unexplainably elated or made ill during their experiments. Maybe I was just lucky that my experiment was entirely passive. Another result you can expect, because you are surrounded by it, is 60Hz skewing all the frequency readings.

OTHER IMPORTANT CONCEPTS

There are other New Energy Giants having important new-energy concepts. These Giants review and correct mathematics and physics; math and physics that helps explain and model New Energy. They require careful,

sometimes boring, and always difficult review and updating. Some Giants in this area are Ben Iverson and Tom Bearden.

The math and physics used by Tesla and Moray predated much of what we teach today. There may be more than one thing wrong today, so let's discuss some of the areas delved into by these other New Energy Giants. Some of their work helped explain the non-sinewave and multiple frequency results of my 1993 experiments.

At the 1994 New Energy Symposium I met Ben Iverson. Ben has studied math back through history. He has spent 50+ years on his "hobby"--the history of math. He's found it. He can trace it back through different cultures. When a culture was destroyed Ben traced the math through alternate cultures. With Ben you can go way back. You keep going back, back even farther. With Ben Iverson you go all the way back to the days when Egypt ruled the known historical world. Those people had a simpler math, a math applicable to the real world, to the natural world. It didn't include calculus, geometry and algebra; not as we know them today. In some ways, perhaps all, the very old math was more accurate, perhaps far better than the math we use today. Since Ben writes about important topics in a clear understandable way, you should get all of his writings you can afford.

The key factor of importance in Ben Iverson's ancient math is that it applies to the real world, the natural world. It can apply to man-made rotating-machine electricity. More important, it does apply to Moray getting electricity out of thin air and to my experiments. The ancient math allows waveforms in nature that are similar to but not the same as sinewaves. The ancient math allows waveforms for multiple frequencies. The ancient math addresses harmonics that may be part and parcel of natural Radio Noise energy. The ancient math allows for longer wavelength energy bands of mixed frequencies resonating throughout our universe from the mixing of the wavelengths resonated from atoms and the harmonics and sub-harmonics of those short wavelengths.

The oldest math Ben found has some interesting characteristics. Although many of us alive today know of them and occasionally use them, the characteristics often aren't thought of as very important. Perhaps, our thinking is wrong. Perhaps the old thinking is better. For example, the old math uses no decimals; it uses only integers. More, it emphasizes and relies heavily on "Prime" number integers, right triangles, and male-female (positive-negative); yet this old math doesn't allow numbers less than zero.

The characteristics found by Ben Iverson in the ancient math are of critical importance. In the natural realm there are no decimal fractions; there are only integers; you can have no children or you can have 1 or more children. You can't have a fraction of a child. There are known natural realm progressions that can be "factored" using only prime numbers, there are many uses for the math of right triangles. An example of both combined is the compound interest curve, also called the farmer's curve or banker's curve. It also is the curve to describe the growth of a crop before harvest or the growth of numbers of persons of a family tree. The natural realm, because it has no circles and no fractions and no decimals, also has no sines, no cosines, no tangents, and no cotangents, it has heavy use of male-female, and no values less than nothing.

If you consider this for about a minute your mind may take you, like mine did me, back to 4th Grade. You may, like me, also want to know more about "quantum" math. You may begin to not like "averages," "standard deviations," and other contrived math in use today. You may find they aren't real.

Perhaps even more interesting about the ancient math Ben found is the minimal number of terms to remember to use the math and the apparent use of the same ancient math throughout all science and music. That is so different from today's math. Today's math has become so complex you need to know and remember the meanings of all the letters of several alphabets just to communicate, even in your own field.

Perhaps less interesting, but more important, is that today's common mathematics may not adequately address the needs in science. It seems that at less than one year intervals new types of energy or new types of particles are being "discovered" to fill "holes" in our understanding of the natural world, even though the "holes" may not exist, except in modern math.

Examples of Problems with Current Math.

By 9th Grade our children start learning the "sine" wave. We teach it as the most common example of a "wave form". It's not. Even so, the sine wave has assumed the status of "law" in much of today's science. It shouldn't be, yet we use it in Algebra, in Geometry, in Physics, in Calculus, in College Engineering courses. In fact, the sine wave is entirely synthetic, for an entirely synthetic mathematics. The sine wave is only a 2-dimensional representation of a side view of a 4 dimensional concept. It describes the path of a single point on the circumference of a wheel as the wheel revolves through a circle with steady sideways (along the wheel's axle) displacement. To see sine waves in physical form buy and play with a slinky.

Because the sine wave is a synthetic contrivance for synthetic math, for man made machines, it can have little usefulness in New Energy investigations. The natural world doesn't have circles, so it doesn't have sine waves. Instead, the natural world has ellipses. The man made circle is a synthetic mathematics "special case" of the ellipse. It's an ellipse with the long axis reduced to the same length as the shorter (perpendicular) axis, while the loci are superimposed. In the Spring of 1998 I found a single exception. I found a multiple sine waves can result and become output when you spin an ellipse around its axis between the ends of a dipole antenna device. In this case the sine waves have 4 dimensions, not 2.

The most spectacular examples of ellipses are the movements of the planets and Comets around the Sun, the moon around Earth. A common visible form of the ellipse in 3-dimensions is the rope when girls (or boxers) are doing "jump rope". Far more numerous, not easily visible forms of 3-dimensions ellipses are in music; they are the motions of piano wires, the motions of violin, harp, and guitar strings and the motions in the wood of those instruments. It's reasonable to presume and research other ellipses in nature; such as Earth's Electromagnetic field frequencies and the movements of atomic particles. There are implications for communications, transportation, medical treatment without drugs, and chemistry.

In 1994 I met Ben Iverson at the Symposium. We talked several times. Iverson's writings had an answer that explained my anomalous experiment results of 1993. In the natural world the ellipse is natural and common. Not just that. Elliptical forms in 3-dimensions are a natural progression from 2-dimensional ellipses. Moreover, sine waves are rare in the natural world. Sine waves are derived from circles, which are a "special case" ellipse with the foci superimposed. The circle, needed for sine waves, is man-made. It doesn't exist in the natural world. Natural world sinewaves can only result from spinning an ellipse on one of its 2 axes.

But Ben's answer also brought me dismay. It meant the mathematics of today and today's assumptions in the field of Electricity don't help describe and understand the natural energy in Earth's Electromagnetic field and "space". It meant I couldn't use today's math to help you understand my investigative research.

Ben Iverson's finding of the ancient math has other implications that match real world natural phenomena but don't match today's assumptions in physics. While the ancient math allows for elliptical waveforms it does not allow DC electricity. Instead, the ancient math implies we can see lightning and electrical sparks because of their wavelengths (approximately Angstrom) until their waveforms arrive at a physical location with diode type electrical characteristics. The same ancient math implies the current from a chemical battery is of atom diameter wavelength throughout the circuit until it reaches the end of the battery that receives the electrons (which has the electrical characteristics of a both a voltage difference **and** a diode). This may help explain why a capacitor, when circuited to ground or back to a battery, even through a fast opening switch, can't be effectively charged by the battery for use in a Voltage Squared DC-to-DC or DC-to-AC power circuit.

Ben is not alone. If he were alone Ben's writings would be considered pure fiction instead of the clear seeing view of a reliable researcher of math. If he were alone Ben's writings wouldn't sell.

Tom Bearden's Work.

Unraveling today's corrupted science so everyone can have good models and understand New Energy is part of the work of Tom Bearden. Tom is one of those guys who can disassemble science to find out what's wrong with it on the inside. Then Tom can describe and explain New Energy matters in terms of the science he's researched. More

than once Tom went back into history to find out when and why our science became unsuitable. You should review all his writings you can buy.

When you read the writings of Tom Bearden, prepare for some serious logic. Be prepared for wiping away many assumptions in physics that were incorrectly made for synthetic reasons. Here is a gentleman who has published papers that discuss oversimplifications of science for easier (but wrong) understanding by students. Bearden then follows up by being involved in practical applications of the research.

Perhaps the most interesting comments written by Tom Bearden deal with the need to junk some of today's long used equations and mathematics. Bearden's alternatives better fit studies of the natural realm. In our schools we have dropped portions of the older science and math when it got too complicated to easily teach. We copped out.

CONCLUSIONS

You should know that there are some true Giants in New Energy. Some of the Giants are those mentioned in this paper. They are not alone. There are hundreds more. The New Energy Giants care enough that they learn about and tell others the truth. They have found and have written about important scientific matters, about major technology improvements, about errors in the math and assumptions of physics which less discerning scientists and engineers haven't researched.

You should know that we are getting very close to Tesla's prediction of putting to work the oscillating energy that is the wheelwork of nature. That energy might exist in fields; it might have and probably does have multiple frequencies in elliptical waveforms. Researchers in Science and New Energy are just starting to fully study and gain full understanding of fields of energy and the interactions of energy fields. These researchers have much to learn.

In any paper on common use energy, such as non-renewable fossil fuels or nuclear energy, or in New Energy, there may be errors. Writers may have assumed that man-made sine waves and other man-made assumptions can be included in the science of the natural world when that is an error. You should carefully consider the assumptions and math to verify that errors of commission or errors of omission are not part of the information. You should remember that writers might not state all their assumptions. A good time to start questioning "scientific" information about the natural world is whenever the author uses man-made math or assumptions like single frequency, averages, percentages, or standard deviations.

You should enjoy the natural world. Enjoy children; enjoy grandchildren. Have fun.

For Further Study -

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The writings of Ben Iverson

The writings of Tom Bearden.

PRELIMINARY RESULTS OF ELECTRON MICROSCOPY AND ELECTRON DIFFRACTION SPECTROSCOPY OF CARBON-CARBON ARC EXPERIMENTS

Toby Grotz, Don Rapp [1]

ABSTRACT

Recent experiments [1] have failed to verify transmutation of carbon (C) to iron (Fe) in carbon arc discharges using carbon rods and carbon powder. Because microgram quantities were reported by J. Sundaresan and J.O'M. Bockris [2] during arcing over a much longer time (24 Hrs) than used in our experiments (10 min.) we decided to pursue examination of the results of are discharging in air using scanning electron microscopy (SEM) and electron diffraction spectroscopy (EDS).

EXPERIMENT AND RESULTS

Using the SEM to identify particles of interest, EDS is then used to zero in on small sections of a microscopic article and X-ray scattering is used to identify the elemental composition of the particle. The carbon powder used during this test was graciously provided by Kenjin Sasaki of Nagaiki Company. Ltd., Tokyo, Japan.

Several samples of carbon subjected to carbon arc discharge were analyzed in the laboratory of Professor John Dash at Portland State University. The photos of two types of particles found in the carbon and the elemental analysis accompany this text.

During the course of this investigation, we noticed that extremely powerful 2" x 2" x l/2" neodymium magnets were able to remove very fine particles of magnetic material from the carbon before the arcing process was begun. These particles resemble the type in the photograph and graph labeled as "Japanese Carbon after reaction." Because these particles also appear in the material after processing in addition to the type in the photograph labeled "Japanese Carbon discharge sample", we formed the following hypothesis.

1. During the grinding process used to pulverize and produce powdered carbon, contaminants in the form of small particles of steel are added to the carbon powder. These contaminants have a characteristic shape and composition. The source of these contaminants is probably the grinding surface of the machines used to produces the powder, e.g. the balls in a ball mill. These particles have the form, shape and composition of the material detailed on the graph labeled "Japanese carbon discharge sample".

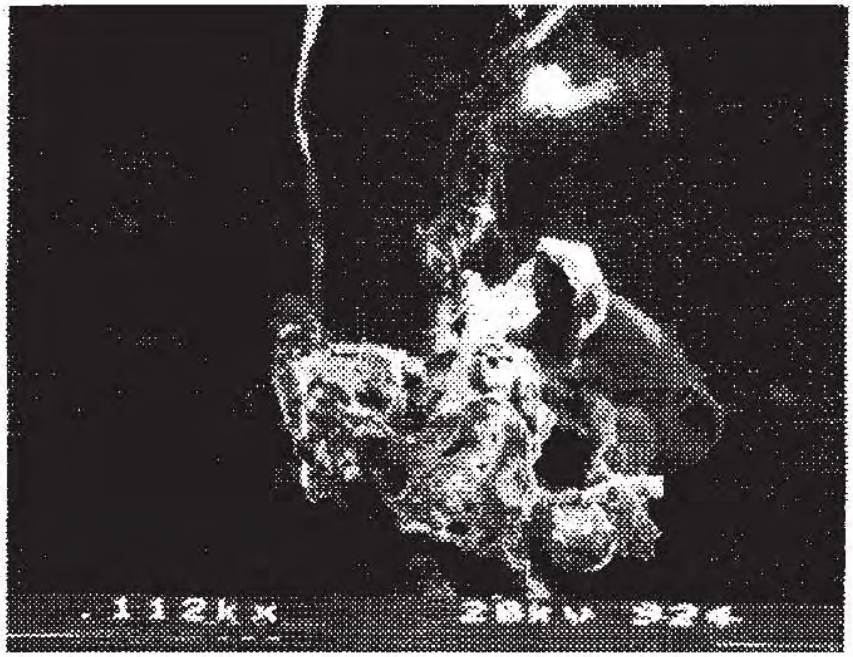
2. Once these contaminants are removed, another type of particle can be extracted from the carbon powder after carbon arc discharges. The composition of these particles differs from the former in the lack of silicon (Si), but have Aluminum (Al), Chromium (Cr) and a much higher ratio of iron to calcium (Fe/Ca).

CONCLUSIONS

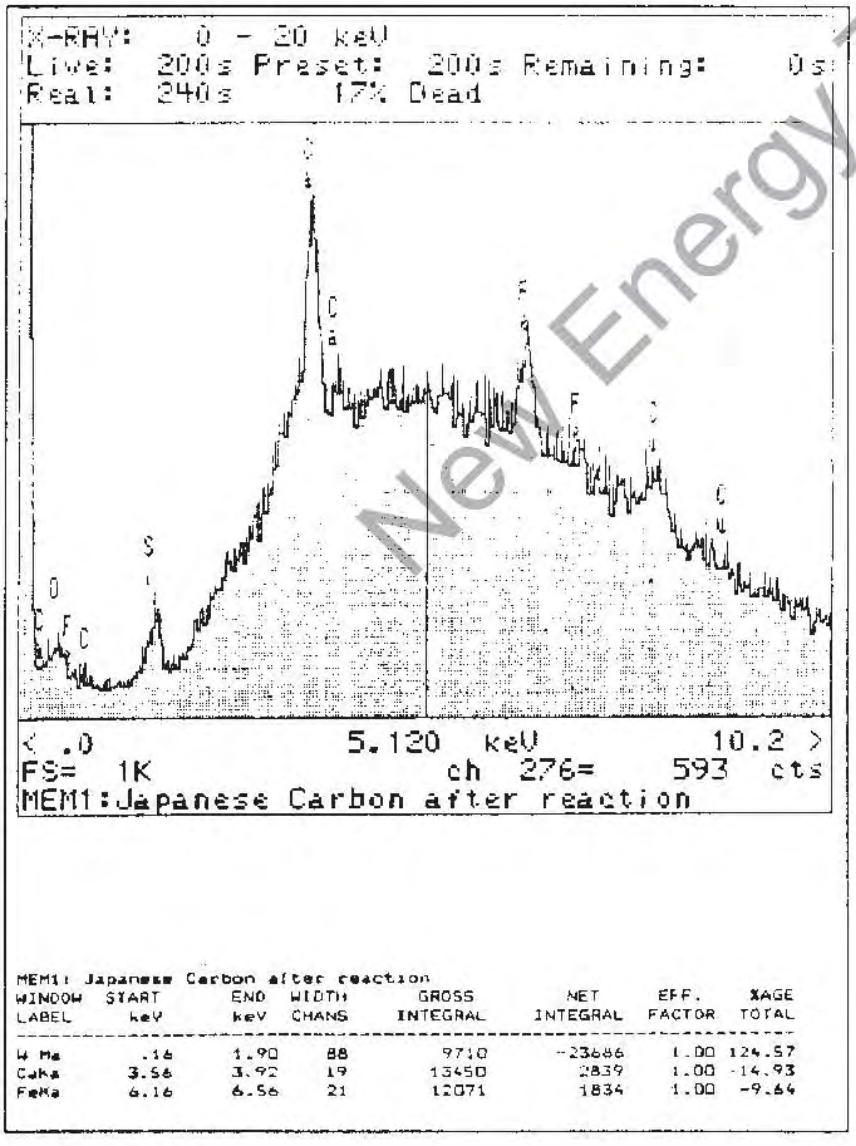
Although much more analysis needs to be done to determine if low energy nuclear changes (transmutation) are occurring in carbon arc discharges in air, it appears that there may be transmutations that are producing iron, chromium, and aluminum. More testing is needed before decisive conclusions can be made.

There is some difficulty in obtaining measurable quantities of a transmutation product in this experiment and others that seek to find iron in the carbon arc discharge. Further experiments by Michio Kushi and George Ohsawa were

[1] 760 Prairie Ave., Craig, CO 81625.



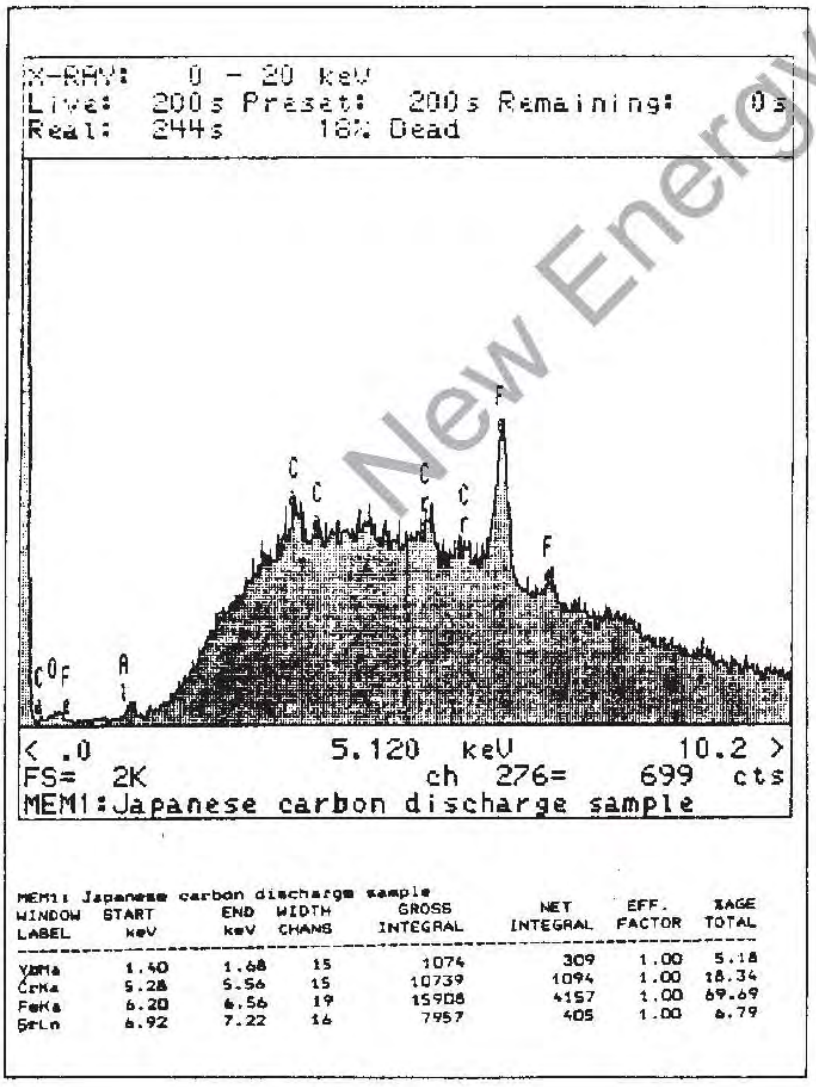
Contaminants melted during the discharge process



MEM1: Japanese Carbon after reaction

WINDOW LABEL	START keV	END keV	WIDTH CHANS	GROSS INTEGRAL	NET INTEGRAL	EFF. FACTOR	%AGE TOTAL
W Ma	.16	1.90	88	9710	-23686	1.00	124.57
CaKa	3.56	3.92	19	13450	2839	1.00	-14.93
FeKa	6.16	6.56	21	12071	1834	1.00	-9.64

Magnetic particle removed from discharge sample after removal of contaminants prior to discharge process.



MEM1: Japanese carbon discharge sample

WINDOW LABEL	START keV	END keV	WIDTH CHANS	GROSS INTEGRAL	NET INTEGRAL	EFF. FACTOR	%AGE TOTAL
YbMa	1.40	1.68	15	1074	309	1.00	5.18
CrKa	5.28	5.56	15	10739	1094	1.00	18.34
FeKa	6.20	6.56	19	15908	4157	1.00	69.69
SrLn	6.92	7.22	16	7957	405	1.00	6.79

claimed to have produced sodium from potassium, and gold from oxygen, copper, iron, sodium and potassium. These experiments were apparently done in the early 1960's. It has not been possible for later researcher to find any of the scientists, scholars, businessmen or students who supposedly took part in these experiments in Tokyo and France, in order to verify or replicate the phenomenon.

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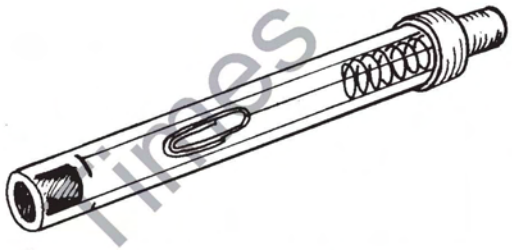

CHANNELING EFFECTS AND NUCLEAR REACTIONS IN ELECTROCHEMICAL SYSTEMS

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ABSTRACT

Growing body of evidence suggests that the so-called cold fusion effect (low energy nuclear transmutations – LENT) has a number of physical similarities with other effects, such as pitting corrosion, pinch plasma discharge, channeling and energy focusing, and few other effects. Experimental data show that the products of nuclear reaction appear strong anisotropic behavior, high directional charged particle beams have been observed by CR-39 solid detectors, photo-films and other detectors. Likewise, channeling for crystalline materials is effective for energetic particles entering the crystal or particles originating within the solid which are approaching the surface. An enhancement of several orders of magnitude in total apparent cross section of nuclear reactions due to the effects of focusing, collimation and others can be expected. These effects exhibit features of transient processes.

Considering the pitting corrosion with electrochemical noise, high energy concentration in a tiny area temporally and spatially under nonlinear electrochemical conditions can be inferred. Localized surface melting with volcano-like crates can be easily understood by using the model of lightning-cloud-land to describe the evolution of electrochemical double layer. According to the analysis of nuclei stability for the elements with different numbers of neutrons and protons, some medium-range heavy elements, such as Pd with 6 "stable" isotopes, could be the candidate subjects for beta decay under the condition of localized strong electro-magnetic fluctuation.

For nuclei greater than A = 40, the Coulomb force drives the stability line in nuclei table away from N = Z line towards neutron-rich nuclei. It is reasonable to expect higher rate of nuclear reactions from heavier nuclei. From point of view of reaction dynamics, most of anomalous nuclear phenomena are found in the energy range of chemical kinetics, the term of chemico-nuclear effect could be used in recent so-called cold fusion research. In this paper we summarize some of our recent observations and inferences on the topic.

INTRODUCTION

Despite a harsh reception by the research community, the idea of low energy chemically induced nuclear transmutations ("cold fusion") refuses to die out [1]. Growing body of evidence suggests that the so called cold fusion effect (low energy nuclear transmutations --LENT) has a number of physical similarities with other effects, such as pitting corrosion, pinch plasma discharge, channelling and energy focusing, and few other effects. In this paper we summarize some of our recent observations [2-6] and inferences on the topic. These effects exhibit features of transient processes.

Considering pitting corrosion with electrochemical noise, high energy concentration in a tiny area, which is temporally and/or spatially under nonlinear condition, can be inferred. Localized surface melting with volcano-like craters [5] can be easily understood by using the model of lightning-cloud-land to describe the evolution of electrochemical double layer. High rate of nuclear reactions along crystal channel of cathode metals due to focusing and collimating effects has been observed experimentally [4].

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According to the analysis of nuclei stability for the elements with different numbers of neutrons and protons, some medium-range heavy elements, such as Pd with 6 "stable" isotopes [7], could be the candidate subjects for beta decay under the condition of localized strong electro-magnetic fluctuation.

For nuclei greater than A = 40, the Coulomb force drives the stability line in nuclei table away from N = Z line towards neutron-rich nuclei [8]. It is reasonable to expect higher rate of nuclear reactions from heavier nuclei. From point of view of reaction dynamics, most of anomalous nuclear phenomena are found in the energy range of chemical kinetics, the term of chemico-nuclear effect could be used in recent so-called cold fusion research [9-11]. In this paper we summarize some of our recent observations and inferences on the topic.

In its opposition to the idea of purposefully induced low energy nuclear transmutations many members of the research community point the lack of physically believable mechanisms for such reactions, despite that there was no shortage of hypotheses suggested in connection with cold fusion, e.g. [12-16]. These papers is only a small fraction of possible speculations concerning the cold fusion effect.

Most of the proposed mechanisms aim at showing that there is a variety of physical effects which can, in principle, account for the nuclear reactions at relatively low energies. The suggestions, roughly, fall into two (sometime overlapping) categories: (1) models of energy concentration (such that a particular nuclear species acquire enough energy to initiate LENT), and (2) tunneling enhancement (mechanisms which can increase the probability of neutron tunneling by several orders of magnitude). It should be noted that due to the fact that quantum tunneling is an exponentially-controlled process (exponential barrier factor), change of tunneling rates by many orders of magnitude can often be attained by a relatively small variations of key parameters of the process.

In view of the above claim of a lack of plausible mechanisms is, in our opinion, an area of a somewhat arbitrary judgement. We believe that the discussion of possible physical effects which potentially can deliver reasonably high rates for low energy transmutation is useful, even if the proposed mechanisms are still highly speculative. In this paper we do no attempt to revise all the mechanism proposed earlier. Instead we provide our own tentative "package" of the effects and concentrate on those analogies which are, in our view, so far were underappreciated.

INSTABILITY OF ISOTOPICALLY MIXED SYSTEM

Since the original claims of Pons and Fleischmann made public in March 1989 [17] the crux of the objections to the idea of cold fusion was centered around the fact that the effect apparently contradicted the known rules of nuclear reactions. Of a particular concern was the lack of a detectable level of neutrons and gamma ray emission which are thought to be standard attributes of "normal" nuclear reactions.

This apparent departure on "cold fusion", and low energy nuclear transmutations (LENT) in general, from the traditional laws of nuclear physics has triggered the development of alternative explanations [6, 10]. Some of these explanations circumvented the necessity of neutron and gamma emission pointing that the process of exothermic nuclear transmutation does not, in principle, require the above emission.

Thermodynamically, the isotopically mixed system is almost always a non-equilibrium system. Therefore, the resulting situation can be commonly classified as a spatially extended non-equilibrium non-linear system.

For example, it is energetically possible that the reaction of isotopic rearrangement, like

$$^{17}O + {}^{17}O \rightarrow {}^{16}O + {}^{18}O \qquad (1)$$

goes spontaneously through a tunneling of neutron from one ^{17}O atom to another ^{17}O. On the basis of total binding energy of these nuclei it is easy to show that such a reaction is exothermic. The excess of energy released in this reaction can, in principle, dissipate to low grade forms (such as crystal lattice vibrations) instead of being emitted as a high energy gamma photon. Similar acts of neutron tunneling can be responsible for the effects of nuclear transmutation is palladium-based systems (like Pd-D) which were used in the majority of claims related to cold fusion.

The above reaction (1) is just one of many possible reactions of this kind. In fact, many isotopically mixed materials have similar potential energy instability. If a chemical element have several stable isotopes (as many elements do), than there is always a "lowest energy" combination which can (at least in principle) be reached through neutron hopping from one nucleus to another. Such a possibility exists for any element with at least three stable isotopes with consecutive atomic numbers (e.g. O, Mg, Si, etc). For example, for Mg (stable isotopes ^{24}Mg, ^{25}Mg, ^{26}Mg), isotopic pairs like (^{24}Mg, ^{26}Mg) and (^{25}Mg, ^{25}Mg) are mutually convertible into each other through a single neutron tunneling jump. Depending of which of two pairs have lower total energy the reaction

$$(^{24}\text{Mg}, ^{26}\text{Mg}) \leftrightarrow (^{25}\text{Mg}, ^{25}\text{Mg}) \qquad (2)$$

is exothermic in either right or left direction. In either of these cases the reaction can be sufficed by a single neutron tunneling (either from ^{26}Mg, to ^{24}Mg, or from one ^{25}Mg to another ^{25}Mg).

FROM ELECTROCHEMISTRY TO NUCLEAR REACTIONS

Experimental results of anomalous nuclear reactions in glow discharges have been reported by several laboratories [18-20]. Comparing a range of the effects, such as electrolysis processes, the pitting corrosion processes with electrochemical noise and volcano-like crates, and the glow discharge processes, one can observe some underlying similarities in physical behavior. The evolutions of both electrochemical double layer and plasma Debye sheath are very sensitive to electrode geometry and surface conditions, such as protrusions, inclusions, and roughness.

These effects happening in electrochemical solutions are sensitive to the concentrations, similar to gas pressure sensitivity for the effects happening in gas discharge. Surface melting and the formation of volcano-like crates are observed on the electrode surfaces in both cases [6, 21]. Such phenomena can be explained by temporal and/or spatial energy or particle concentration in a tiny area where the effect occurs.

It is well known that high density state of matter can be created by plasma self-pinch [22], high energy charged particles can be produced by plasma wake field acceleration [23-25]. Transient of triple junction of gas, liquid, solid around the protrusions and inclusions of cathode surface creates the sharp density gradient. Energetic particles can be produced
in this case.

Channeling in crystal structures is equally effective for energetic particles entering the crystal or particles originating within the solid which are approaching the surface [26]. An enhancement of several orders of total apparent cross section of nuclear reactions due to the effects of focusing, collimating and others can be expected [27].

The ellipsoidal deformation of the entering nucleus and the nucleus of channeling wall occurs due to the overlap of wave function radically. The rate of electron capture reaction increases under the condition of electron environment changing at nucleus [28].

Anisotropic emission of nuclear products has been observed by several laboratories [18, 29]. Bright spots with highly directional orientation have been detected. Depending on the initial conditions, namely, the electrolysis potential, the concentration of electrolyte, the crystalline structure of electrode metals, the geometry of electrodes etc. a variety of nuclear reactions could take place.

The effect of electron environment at nuclear reactions has been studied for many years, experimental results of the effect of the chemical state on the lifetime of isomers were reported by Cooper at al in 1965 [30].

According to the analysis of nuclei stability for the elements with different numbers of neutrons and protons, some medium heavy elements, such as Pd with 6 "stable" isotopes could be the candidate subject for beta decay under the condition of localized strong electro-magnetic fluctuation. For nuclei greater than A = 40, the Coulomb force drives the stability line in nuclei table away from N = Z toward neutron-rich nuclei. It is reasonable to get higher rate of nuclear reactions from heavier nuclei.

The main objection to the above neutron tunneling mechanism is that according the known principles, the rate of such tunneling should be prohibitively low. In the ordinary quantum mechanical picture the escape of the neutron from a nucleus is associated with its overcoming a potential barrier of several MeV high. This results in a fantastical smallness of a neutron tunneling factor to a distance of few Angstroms (needed to reach the next nucleus). Thus, the such nuclear reactions, though possible theoretically, are, for all practical purposes, do not occur.

Building a conter-objection to this argument calls for an analysis of possible effects which can enhance the rate of neutron transfer by exponentially large factors. One lead in this direction is provided by the reactions of charge and energy transfer in ionized plasma and in systems of crystal defects. For example, in 3-body reactions it is possible that the excitation energy of one atom migrates to the second atom, and excites the electron of the second atom above the ionization threshold. As a result, the excited electron (now at the ionization continuum) can migrate to the third atom without a need to tunnel through the classically forbidden barrier.

The latter mechanism is, in fact, above-the-barrier excitation rather than the tunneling in a proper sense. The question now, if the same (or similar) mechanisms can be operational for the neutron tunneling and if so, what are the conditions which favor the occurrence of such mechanisms. The main condition for such (or similar) mechanism(s) to work is the possibility that a sufficient amount of energy be simultaneously cumulated on a particular site (nucleus) to give a neutron a "boost" to overcome the potential barrier of nuclear forces.

This energy, which is probably about several MeV per neutron, should not necessarily be of nuclear origin. It can be a result of cumulation (focusing) of numerous low-energy contributions.

Consider, for example, electrochemical cell in a typical working condition. For an estimate, let us assume (an average) current density of 1 Amp/cm^2 and potential drop of 10 V/cm. Energy dissipation in such a cell is 10 W/cm^3, which is (about) 6 x10^{11} MeV/cm^3/sec. Assuming that "triggering" of each neutron escape takes 10 MeV, we arrive to some 6000 reaction per cm^3 per second, provided, of course, that there is an efficient energy cumulation mechanism.

Furthermore, in such a scenario, the external energy input (current x voltage) acts as, essentially, a catalyzer. Neutron which is trapped by another nucleus (different from the one at the escape site) releases more energy that was spend on its release. As a result the overall energy balance remains positive (exothermic).

ENERGY CUMULATION AND TUNNELING ENHANCEMENT PROCESSES

In what follows we discuss several physical effects which may provide some base for the analogy with LENT effects. We do not expect to arrive here to any final conclusions if all (or some) of these mechanisms are, in fact, relevant to the cold fusion and/or LENT. Nonetheless, we think it is useful to summarize them for the purpose of further investigations.

RESONANCE TUNNELING

Enhancement of quantum tunneling can be related to resonance tunneling [31]. The process of the resonance tunneling involves an intermediate energy level produced by the potential well "inside" the potential barrier (quasi-stationary level).

The effect, in principle, exists for electrons, neutrons and other quantum particles. It has a close similarity with the effect of resonance transmission of electromagnetic waves (including light). The tunneling enhancement by the intermediate quasi-stationary level can be explained in the following, somewhat imprecise, way. When the energy of a moving electron (neutron) is coincidental with an energy level which lies within the "inner" potential well (this level is called virtual or quasi-stationary due to a finite lifetime of a localized state of a particle trapped on this level), the amplitude of the reflected wave is negligible and the barrier significantly "improves" its quantum transparency. For electron energies out of the resonance the tunneling coefficient (quantum transparency) is decreased because of the destructive quantum interference of opposite waves within the barrier [31]. This effect has some similarity with an anti-reflecting coating in optical instruments.

SONOLUMINESCENCE

Processes of quantum energy cumulation are widely known in laser physics. Another example is a phenomenon of sonoluminescence where the energy cumulation leading to the emission of visible photons results from the cavitation processes in liquids [32].

Sonoluminescence is an example of the effect when the diffused energy form (the acoustic wave) shows the ability of a spontaneous focusing of energy on the isolated atoms and atomic or molecular complexes. The latter are excited to optical energies and deactivate through the luminescence. The significance of such processes of energy cumulation for corrosion and for nuclear transmutations can be likely related to the initiation stage. Energy transfer and Auger processes [33] can be accountable for the rupture of the passivating films of oxides due to the effects of energy "focusing" ("lensing"), similar to the above mentioned sonoluminescence case.

SPONTANEOUS QUANTUM REDUCTIONS

The effect of spontaneous localization of the wave function can contribute to the corrosion initiation as well as energy cumulation which activates neutron tunneling in cold fusion and/or LENTs. This effect was suggested and discussed for single-particle systems as well as for systems of many interacting particles [34-36].

The act of an elementary quantum collapse in a single particle system is a seemingly spontaneous (triggered stochastically) process in which the wave function of a particle experiences a sudden shrinkage of its size (more precisely: its wave function). Imagine that prior to the collapse the particle had a wave function Ψ. At the act of a collapse it instantly gets multiplied by a squared exponential (Gaussian) factor of the form [36]:

$$\Psi \rightarrow \Psi \cdot \exp [- | \mathbf{r} - \mathbf{r}_0 |^2 / 2W^2] \qquad (3)$$

Eq.(3) $\mathbf{r}_0$ is a random (stochastic) variable indicating the center about which a given quantum collapse occurs. The width of the Gaussian W is of an order of 10^{-5} cm (i.e. about 1000 Angstroms) and the probability of a such jump-wise collapse per particle per second is about 10^{-16}. The latter means that for a single particle collapse happens as an average only once every 300 million years (!) and, consequently, the process of elementary quantum collapse for a single particle system for all practical purposes can be neglected. Such spontaneous quantum collapse has a distant analogy with weak radioactivity of some (almost) stable isotopes with lifetimes of cosmic scales, i.e. millions of years (e.g., ^{238}U).

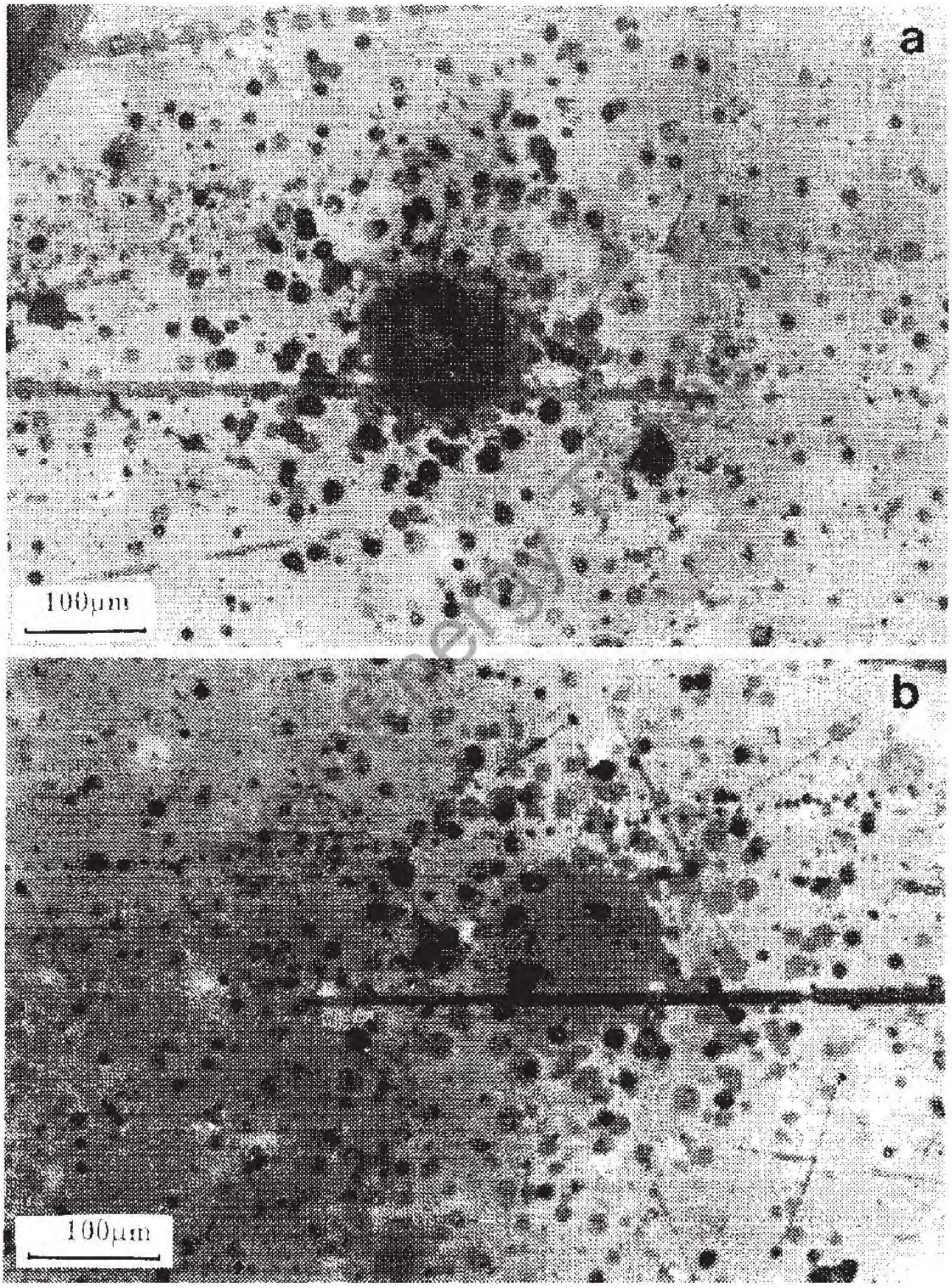
The effect of spontaneous collapse is, however, not that slow for a system of a "normal" (microscopic) size which contains many billions atoms. A peculiar feature of quantum collapse is that for a system of interacting particles (such systems have nonfactorable wave functions and form entangled quantum states) elementary quantum collapse for any single particle results in a multiplication of the entire wave function of the whole system by the above written Gaussian factor. This goes, so to say, in analogy with an automobile engine operation when the local (point-wise) ignition of an air-fuel mixture leads to a practically instant chemical explosion of the whole combustible mass in the interior of a given cylinder.

Therefore, the rate of quantum reductions for macroscopic bodies is quite significant. In a typical corrosion or LENT situation with, say, about 10^{23} participating atoms the resulting frequency of quantum collapse is about 10^7 reductions per second.

EXPERIMENTAL OBSERVATION

The CR-39 solid detectors have been use to record the charged particles produced on the protrusions of palladium cathodes (Fig. 1). The tracks of high directional particles indicate the nuclear products are emitted from crystal channels with focusing and columniation effects. According the shapes and the depths of the tracks and the etching duration of CR-39, particles generating tracks are protons and alpha particles with energies about the range of one to several MeV.

Fig. 1 –
Tracks of nuclear reaction products on the CR-39 detector; (a) distribution of energetic particles which caused tracks. (b) back side of the track cluster in the same region as shown in (a). The thickness of CR-39 sheet is 300 μm.



A palladium cathode after electrolysis over 200 hrs. with heavy water NaOH solution, and deposition in a dry air tube for 1.5 years, was exposed auto-radiography for 100 hrs., some clear traces with highly directional beams can be seen on the black-white film. Considering the trace lengths and their sensitivity to electromagnetic effect, it is supposed to be the tracks of beta particles with energies about several keV (Fig. 2).

With light water NaOH electrolyte, nuclear active sites on the protrusions of palladium cathode after long period electrolysis and high electrolysis voltage about 30 Volts and deposition for as long as 2 years, can also be formed. Fig. 3 shows the images of Pd cathode with nuclear active sites on the protrusions. The cathode was removed three times on the same KODAK color film of 27 Din with about same exposure times 100 hrs. Six rows of beam spots corresponding the widths of cathode metal plates can be seen on the film.

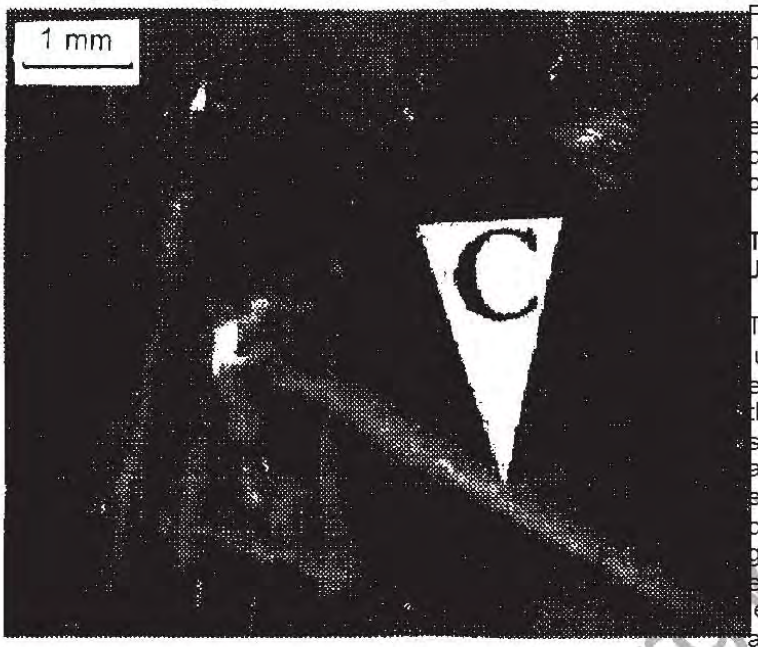


Fig. 2 Autoradiography of charged particles tracks of beta decay isotopes in air. C indicates a typical trace paralleling the surface.

TRANSIENT PROCESSES ON THE TRIPLE JUNCTIONS

There exist transient processes on the triple junction zones on the protrusions and inclusions of electrode surfaces. The term triple junction means the overlap zone of gas, liquid (electrolyte) and solid (electrode and its attaches). The stronger anomalous effects associated with the larger electrolysis current (or higher potential) have been claimed by many laboratories. Sharp density gradient and field gradient due to rapid electromagnetic perturbation on the protrusions lead to the energy concentration and particle acceleration by wake field [24,25].

CONCLUSION

The relationship between corrosion process and isotope physics was mentioned earlier [37]. The transition from the electrochemistry to the nuclear reaction is supposed to pass following stages: energy concentration in the electrochemical double layer, transient processes on the protrusions of electrodes, channeling effect in the metal crystal, quantum tunneling effect etc. For high reproducibility of LENT, we should consider following factors:

1. Higher electrolysis potential and concentration of electrolyte are favorable to low energy nuclear reaction.

2. The most of nuclear active sites are related to the protrusions, inclusions and surface roughness.

3. Intensive study of transient processes of triple junction of protrusions to cause sharp density gradient and wake field acceleration of particles is of important.

4. Quantum tunneling and reduction.

5. Anomalies behaviors of liquid water, such as high susceptibility to the perturbation of electromagnetic fields, high dielectric constants etc on the LENT should be investigated.

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Fig. 3 – Autoradiography of Pd cathode with nuclear active sites on the protrusions after 2 year deposition.

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REQUIREMENTS FOR BRINGING A NEW-ENERGY GENERATOR TO MARKET

Gary L. Johnson [1]

ABSTRACT

What is required to bring a generator that extracts power from the aether or vacuum to commercial production? This paper explores several aspects of this question, including generator sizes, development timetables, ownership, funding sources, patents, rewards to inventors, and possible research activities. It is recommended that work proceed on both a home sized unit (2-50 kW) and a substation sized unit (100-10,000 kW). Based on a comparison with wind turbines, it is projected that it will take at least 20 years and half a billion dollars before break-even is reached. Several reasons are given that suggest the original inventor will not be the long term owner of the invention. A system of rewards to the inventor and associates is proposed. It is recommended that several laboratories be established or identified across the country where lone inventors can go and test their devices.

INTRODUCTION

Many people believe that there is yet another source of energy to be discovered, and that power can be extracted from the vacuum or Æther around us. If true, this source would be both abundant and widespread. It would make present methods of electrical generation obsolete. We would no longer need to build nuclear power plants or to burn coal, oil, or natural gas to make electricity. The cost of electricity would be substantially less than what we now pay, and there would be essentially no pollution.

But what about the details? What should be done to encourage the discovery and development of this energy source? Some thoughts on this topic will follow.

GENERATOR SIZES

First we need to discuss the possible sizes of equipment and make some back-of-the envelope estimates on costs. In very general terms there are three distinct sizes or size ranges for new-energy devices that are capable of generating 60-Hz electricity.

1. Home size, 2-50 kW.
2. Substation size, 100-10,000 kW.
3. Central generator size, 100,000-1,000,000 kW (100-1000 MW).

The home-size unit would be located on the customer side of the utility distribution transformer. The substation-size unit would be located at a substation where high voltages from the utility are transformed down to distribution voltages for distribution to homes and businesses. A substation may supply from several hundred to several thousand homes. A central generating plant is usually in a remote location, and supplies power to a large geographical area at voltages from 115,000 V to 345,000 V or more.

It is quite possible, even probable, that the characteristics of the new-energy source will favor some sizes over others. The effect may only be a laboratory curiosity until some threshold size is reached, effectively eliminating the household sized unit, for example. On the other hand, the aether might be able to give up a few kW at a home without any noticeable side effects, but have unacceptable consequences in larger sizes. For example, there might be an associated vortex in the surrounding air, with the vortex size and speed proportional to the power extracted. This could be a minor nuisance in small sizes but could spawn destructive tornados in larger sizes. Or if power extraction from the aether is accompanied by a temperature drop in the surrounding air, a central plant may

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continually experience cloud cover and rain or snow. We should therefore not plan on mass production of a particular size until considerably more research is done.

If we assume that new-energy generators can be built in any size, then some general comments can be made about the advantages and disadvantages of each size, from both a home owner and a utility perspective. There are two disadvantages to the home-size unit, cost and safety. Then there are two aspects of the safety issue. One is that we will not know of any long term negative health effects of new-energy generators for possibly many years. A prudent course of action would be to not install a new-energy generator within, say, 30 m of a dwelling, which would obviously favor substation, central plant, or farm installations.

The other safety concern is that of utility personnel. When a tree limb falls on a distribution line and a utility truck shows up for repairs, the first course of action by the crew is to open the utility switch to the line, so the line can be repaired without danger of electrocution. If there are new-energy generators scattered around the neighborhood, they may be able to supply the load when the switch is opened (perhaps at voltages high or low enough to damage connected equipment if protective circuits are not properly designed). The lineman may then be surprised by an energized line.

There are technical solutions to this problem, of course. New-energy generators can be built so. they stop operation when the utility is not connected, or when line frequency or voltage stray outside the proper range. Such protective circuits increase the cost and can be expected to occasionally fail, which again puts the lineman in danger . Reasonable safety is assured if the lineman performs the extra task of installing a temporary shorting strap between conductors on both sides of the repair section.

The cost of electrical equipment on a dollars per unit of rating basis decreases significantly with size. For example, the electrical portion of a 10-kW wind turbine may cost $500/kW while the same section of a 1-MW wind turbine may cost only $200/kW. If we use these numbers for illustrations on new-energy generators, a 10-kW generator would cost $5000 installed in a home while a 1-MW generator would cost $200,000 installed at a substation. I suspect that the size and complexity of the home-sized unit will at least equal that of a high-efficiency furnace and air conditioning unit, so it is difficult for me to imagine an installed cost of significantly less than $5000.

To continue this illustration, assume that the $5000 is borrowed from a bank for a 10 year period at 10% interest. The yearly mortgage payment using standard equations [2, Page 336] is $813.81. If the yearly electrical energy consumption of the house is 10,000 kWh, the effective cost of electricity produced by the new-energy generator is about 8 cents/kWh plus any maintenance costs plus the fees charged by the utility to maintain power lines to the house and to provide emergency backup. The total cost would probably exceed 10 cents/kWh. This is somewhat greater than the present average retail cost of electricity in the United States, hence there is little economic incentive to install home sized units at this price. If the home electrical consumption is well above average, at say 20,000 kWh/year, or if the cost of utility supplied electricity is above 10 cents/kWh, then a different conclusion might be reached.

The mortgage payment for the substation-sized unit for the same terms of 10 years and 10% interest would be $32,550 per year. If the generator operated at a plant factor of 50%, equivalent to producing full power during the day when demand is high and being turned off at night when demand is lower, the yearly energy produced would be 4,380,000 kWh. The cost of these kWh would be about 0.74 cents/kWh. The cost of electricity produced substation-sized generator is an order of magnitude smaller than the cost produced by home-sized unit. The utility can make a handsome profit by charging 5 cents/kWh and the home owner pays only half (5 instead of 10 cents/kWh) of what he would otherwise pay if he owned and maintained a small new-energy generator.

A similar economic argument explains why one rarely sees an operating home-sized wind electric generator in windy Kansas. The economies of scale of capital costs, operation, and maintenance are such that the utility can always provide electricity to the home at less cost and with less hassle than the home owner can provide his own electricity. This rule applies where the utility distribution lines are nearby and the utility has adequate generation. Situations like a remote vacation home or a third world village may easily yield a different economic decision.

I do not mean to imply that all decisions will (or even should) be made only on the basis of economics. I have pointed out to people inquiring about the feasibility of installing wind turbines that there are at least four human desires that affect our decision making:

1. The desire to make (or save) money.
2. The desire to be the first kid on the block with a new toy, such as a motor boat, a camper, or a four-wheel drive vehicle. If such items were purchased only on the basis of economics, their sales would be greatly reduced.
3. The desire to be independent of the utility. I have met one farmer who never connected to the utility grid, instead using three wind turbine electric generators and a battery bank.
4. The desire to save the world by recycling, reducing pollution, and the like.

Except for the rare individual like the farmer mentioned above, wind turbine owners in the United States would always be connected to the utility grid for backup during those times when the wind would not blow. The energy source being discussed here would presumably be available all the time, so we have the real possibility of actually being disconnected from the utility. There may need to be some minor adjustments to our lifestyles, such as not running the air conditioner, the electric stove, and the clothes dryer all at the same time in order to stay within the power rating of our home generator. We may also have to make plans for emergency backup in case our generator fails, but these can be handled in a rational fashion. This capability for true independence may increase the U.S. domestic market to a significant level.

Returning to the economic argument, I would note that the net cost of energy to society is minimized by taking advantage of economies of scale. Fewer total dollars invested in electrical generation equipment means that more dollars are available for investment in factories, highways, hospitals, churches, etc. Even if significant numbers of people are willing to pay extra for electricity in order to have energy independence, it does not necessarily follow that all of society should do likewise.

The cost difference between a substation and a central-generation sized unit is not nearly as pronounced. A 100-MW unit would be only slightly less expensive than a l-MW unit, in dollars per kWh. The central plant requires large transmission lines to get the power out to the surrounding region. These lines are expensive to install and have significant opposition because no one wants a power line in their back yard. At approximately the same overall cost, most utilities would strongly prefer the substation-sized generator.

Therefore, even if any size is technically feasible, I would expect only two sizes to actually be developed. A 10-kW size will be sold to a relatively small U.S. domestic market and to a potentially large export market, while a 1000-kW unit will be developed for sale to the utilities. The development timetable should be shorter for the smaller unit. In fact, sales of the smaller unit should help with the cash flow while the 1000-kW size is being developed.

DEVELOPMENT TIMETABLES

How long will it take to do the engineering development work and have 10-kW and 1000-kW generators ready for market? An honest answer would be something like "A long time if all goes well, even longer otherwise". I hope we can beat the nuclear fusion industry who started off by asking for 40 years and a few billion dollars. Forty years later they came back asking for another 40 years and even more money, and we still have not seen the first net kWh of electrical production.

A development timetable with which I am more familiar is that of wind-electric generators. We started learning about and building these generators at the turn of the century. There was a large market for home-sized units in rural America. Over 6 million water pumping wind turbines had been installed on American farms starting about 1880, so there was considerable experience with wind technology, and an active sales and maintenance infrastructure. The small wind-electric generator was perfected by the 1930s and many thousands installed. With proper maintenance some of these machines lasted more than half a century.

There were two disadvantages of these small machines. The economies of scale mentioned in the previous section meant that the effective cost of the generated electricity was higher than the electricity generated by the local utility. And there was the 'hassle' factor, the problem of dealing with installation, maintenance, and outages. The Rural

Electrification Act of 1936 made it possible for almost every farm in America to be connected to a central utility by 1955. Lower cost electricity supplied with less hassle quickly drove the small wind-electric wind turbines into extinction.

The development timetable for these small machines was not extensive. From the time that electrical generators and batteries were available, and centrally generated electricity was in common use in the homes of the city cousins, it was only a decade or so before small wind-electric generators were in wide use. Of course, very few new theories or new materials were needed.

The technological success of the small machines encouraged engineers to build utility scale wind turbines, with the hope of breaking the economic barriers. The first large generator of this class, the Smith-Putnam turbine, was installed in Vermont in 1941. It was rated at 1250 kW, was designed with slide rules, and was built with pre-war technology. It lasted four years before a blade broke off and the turbine was scraped as being economically uncompetitive.

The wind turbine industry was then dormant until the oil embargo of 1973. By then we had powerful computers, better materials, and considerable experience in designing and fabricating large metal structures like jet aircraft. It appeared to be a simple matter to hire the best aerospace firms and develop commercial (utility scale) wind turbines in a short time, perhaps 4-6 years. We sent our best into battle and they returned wounded and bleeding. The results would have been funny if they were not so pathetic. The time to the first major failure of the first turbine, the MOD-O, was closer to four weeks than to the four years of the Smith-Putnam machine. Large aerospace firms built a single MOD-O (100 kW), four MOD-OAs (200 kW), a MOD-I (2000 kW), and five MOD-2s (2500 kW). None showed any promise of being reliable and economic producers of electricity and all were sent to the scrap heap as soon as possible. If it were not for all the things we learned that would not work, the whole operation would have to be considered a miserable failure.

In the meantime, a number of under funded small companies were patiently learning how to build smaller wind turbines (50-100 kW). It took them 10 to 15 years to learn to build a respectable turbine. Even after development times of 20 years or more, significant changes are still being made in an effort to further improve reliability and reduce costs. Sizes are being increased to take advantages of economies of scale, so turbines presently available are in the range of 300-1000 kW. These changes in size and technology sometimes result in short-lived components, which then require (typically expensive) field modifications.

Based on these observations, it is safe to say that the business of designing and manufacturing new-energy generators is not for the 'Get Rich Quick' people. It has taken more than 20 years to develop a **good** 1000-kW wind turbine, starting with substantial government funding and a world view where everyone knew that it could be done with only incremental advances in materials and computer codes for blades and towers. Relatively speaking, much more needs to be done to extract power from the energetic aether. A workable theory needs to be developed, which will help swing the majority world view into believing that it can be done. This may require substantial basic research, something not essential to developing large wind turbines. We could easily be looking at time periods of 20 to 40 years before 1000-kW new-energy generators are being routinely installed at utility substations.

Sometimes it is helpful to think through the steps that will be involved in developing a new-energy electrical generator. This allows us to estimate the time and money that will be required. There are claims of such generators operating [1, Page 22]. I have personally not seen such units, but let us assume that a unit has been produced in a crude or breadboard model, perhaps in the 2-10 kW range. This original unit needs to be preserved as an eventual museum piece, and also to allow comparisons with new versions. Several new units need to be fabricated, differing slightly in some feature, and tested in an effort to find out what materials or design features are critical.

Parallel work needs to proceed in developing a theory or hypothesis of why and how the unit works. This step should not be underestimated. It could easily take decades for the best theoreticians to put together a comprehensive theory of the energetic aether.

Once a reasonably robust working unit has been developed at the 2-10 kW power level, work can start on larger units. Until we know what the thresholds are for any new effects, the steps should be small. That is, once a 5-kW

unit is working, the next size might be 10 kW, followed by 20 kW, then 50 kW, and so on. The time required to get from the first breadboard version to a robust 5-kW unit that one would consider building an assembly line to manufacture could easily be five years. The time from a robust 5-kW unit to the first breadboard version of a 1000-kW generator is probably a minimum of five more years. After proof-of-concept on this breadboard version, we design what we hope is the final product, and build several by hand. These are placed at substations of cooperative utilities and monitored closely. New problems are always discovered at this stage. Components such as cooling fans and lightning protection will be redesigned. A manufacturing plant is then built and tooling acquired to fabricate these 1000-kW generators. They are built at a relatively slow rate at first to allow time for new problems to surface, that need to be repaired under warranty. Under ideal conditions, the factory should be operating to capacity at the end of the third 5-year period.

The first 5-year period requires a relatively small staff, with staff and facility requirements increasing with time. An order of magnitude guess on the finances required would be 5 million dollars for the first 5 years, 50 million for the second 5 years, and 500 million for the third 5 years. Break-even, when sales of equipment and electricity equal the total accumulative investment, will probably not occur before 20 years have elapsed after the first working breadboard unit was built. One large wind turbine manufacturer with which I am somewhat familiar, Kenetech, formerly known as U.S. Windpower, spent more money than the above, over a similar time period, and ran out of money before turning the financial corner. The need is for very committed and very deep pockets.

Is it worthwhile to spend this much time and money on a new-energy source? I really believe mankind has no choice. Billions of people on this earth are living in misery because of inadequate energy at an acceptable price. The only way to relieve their misery (and make the world a nicer place for all of us) is to develop this energy source which is available everywhere 24 hours a day, creates no pollution, and poses no balance-of-payments problems.

OWNERSHIP

A scientific principle cannot be patented, any more than a river can be patented. However, it is likely that some of the equipment that will be developed to capture this energy will be patentable. Such patents could be extremely valuable, worth many millions of dollars. It is therefore of interest to consider the question of ownership of the patents, and the related question of appropriate rewards to the inventors involved.

Who should own these valuable patents? The inventor? The investors? The public? The answer will depend on a person's world view. I will list some of the advantages and disadvantages of several possibilities.

1. THE INVENTOR. It is unlikely that the lone inventor will have the necessary business skills to guide a large manufacturing company. It may therefore be unwise for the inventor to maintain ownership for any extended period of time. The inventor should be rewarded handsomely and established in a nice laboratory for making additional discoveries, but should not be expected to be a long term leader in the manufacturing business.

2. THE INVESTOR. A philosophical and ethical question is whether we should allow any person or group to develop great personal wealth from this discovery, just because they happened to have money that they were willing to invest. The past decade reveals that many investors would have little or no commitment to the global benefits of low-cost, low-pollution electricity, but would immediately and continually be thinking about leveraged buy outs and golden parachutes. I believe that the owners should have a long-term commitment, with other motives operating in addition to basic greed.

If the investors are not the owners, this means that investments are regarded as debt rather than equity. The owners could issue bonds at an attractive interest rate, with principle and interest to be paid from royalties on the sale of electricity. This would provide incentive to bring the discovery to market, with minimal impact on cash flows in the early critical years.

3. THE U.S. GOVERNMENT. Our government already owns a large fraction of the Western United States, which is administered supposedly for the good of the whole. There is a question about how effective that administration has actually been in recent years. Also, the oil industry has had considerable influence on government actions, and the discovery of a new-energy source would be viewed as a threat by the oil

companies. Therefore, at best, there would be a question of competence and a possible conflict of interest with government ownership.

Government ownership could also lead to effective nationalization of the utility industry. The sale of electricity could be a very attractive revenue source for a government with a big deficit and an appetite for spending. We could have the equivalent of another Post Office, not exactly well known for efficient operation. Other reasons could be given, but I think it is obvious to most people that the government would not be the optimum owner of such a discovery.

4. A FOUNDATION. A charitable foundation would be one way of assuring that the benefits of long-term ownership would go to benefit mankind, rather than go to taxes and the establishment of a financial dynasty. This worked rather well for Hughes Aircraft after Howard Hughes died, until a judge decided the foundation was not giving away enough money, and forced it to convert Hughes into a publicly owned corporation. This idea is certainly worthy of more discussion. We must recognize that a new foundation does not have the money or expertise to bring a new-energy source to the market, and an old, wealthy foundation may not have the interest or the flexibility to do it.

5. A CHURCH. Why has the new-energy source not been developed in the last century? Tesla was close to the discovery. Moray apparently had a working system. A number of people have worked on the problem in the past 20 or 30 years, without success. It would seem that someone would have done it by now. Greed is certainly a factor, causing people to keep secrets in the hope of future reward, and then the people die before the secrets are transmitted to others.

But it seems that more than greed is involved. There seems to be a sort of blindness, where engineers will look at some new effect but not see the implications. It seems quite possible that the reason for the lack of discovery is that it is just not God's timing yet. Surely God wants the new-energy source to be used for His glory and the welfare of His creation. Perhaps He has not found a man or organization that He can trust with the discovery.

If God is looking for the right organization, then a church would be logical for ownership. Two possibilities come to mind, the Roman Catholic and the Latter Day Saints (LDS or Mormon). Both have a large membership (although the Roman Catholic is by far the largest), a large investment portfolio, and the centralized leadership that might be able to accomplish the task.

Both churches experience considerable jealousy and animosity from the remainder of Christianity. This would only get worse if one of them became owners of this discovery and used the resulting power and money to pursue their own agenda. Even if a church was selected that everybody liked (Mennonites?), the increased influence could easily destroy the character of the church. A church should be careful to consider such hazards before seeking ownership of this discovery. Rumor has it that the Mormons have already rejected the opportunity once, when they turned down Moray's offer of his discovery. Perhaps they were showing true wisdom at that time.

At the other extreme of size would be a very small church denomination, or even a commune, with a new-energy focus. A commune called Methernitha was established near Linden, Switzerland about 1960 which had a strong interest in alternative-energy technology [3, Page 146]. They have apparently developed a new-energy generator called the Thesta-Distatika which supplies part of the power requirements of the commune. They stopped receiving visitors and giving out information on the generator about a decade ago, saying they were afraid of the possibility of misuse from the 'weapon-industry', and that the world was not yet ready for the discovery. If Methernitha has been doing engineering development work for this entire time period, they would be in a good position to manufacture and market a home-sized unit when (or if) God tells them to do so. Other communes might be established around new-energy inventors to provide them with the necessary support and security.

6. ISRAEL. Israel has always had a place in God's plan. Who knows but what the plan incudes ownership of the new-energy source? It is possible that some construction details of the generators could be maintained as a trade secret, which would extend the useful life of ownership indefinitely, rather than the 17-year life of a

patent. The Israeli Army is among the best in the world at maintaining security around any key manufacturing sites. This idea is worthy of careful consideration.

7. EPRI. The Electric Power Research Institute would be an obvious candidate for ownership. They understand the concept of supplying reliable and inexpensive electricity. They have the engineers and the licensing experience necessary to bringing these new generators to the marketplace. The question is whether they have the will to overcome the political opposition that they would experience. A related question is whether they would be able to extract adequate funding from their utility supporters in the face of the upcoming utility deregulation.

8. A LARGE CORPORATION. Companies like General Electric, Westinghouse, or Boeing have the engineers, the manufacturing plants, and the financial resources to develop new-energy generators. The question is whether they have the vision that is required. It seems that most large companies of today have vision that extends only to the bottom line of the next quarterly report. Anything that is guaranteed to reduce that bottom line for the next 20 years is likely to be rejected, regardless of the potential income after that time.

9. A SMALL CORPORATION. The dream of most inventors is to form a small corporation that will grow to become a Hughes Aircraft, with the inventor remaining as sole shareholder. Vision is not a problem and development costs might be lower in a small, lean operation than in a typical large corporation. The small corporation would grow to become large. One problem is in finding investors who are willing to provide debt rather than equity financing.

10. THE EMPLOYEES. Many companies are moving toward employee ownership, partly because it makes good sense and partly as protection against leveraged buy outs. This spreads out the wealth and prevents the formation of financial empires. That is, the original owner (perhaps the inventor) guides the company for a few years and then sells it to his employees. Again, this arrangement would be possible only if investors could be found that would supply debt money rather than equity.

There may be other possibilities besides these ten. The options seem almost limitless Pt the present time. The primary requirement is to have or be able to raise half a billion dollars. Whoever is willing to invest this much money over the next 15 years is very likely to own a large fraction of the new-energy business.

FUNDING SOURCES

Where will the money come from that is necessary to do the required research and development for the desired new-energy source, assuming that some very deep pocket investor does not appear soon? At some point the lone inventor working in his garage will simply not have the resources necessary to do the essential construction and testing. Where does he go?

One obvious suggestion is the federal government, which has a long history of funding research and development activities. The National Science Foundation, Department of Energy, and Department of Defense all come to mind. Even small amounts of funding would send the message that the search for a new-energy source is a legitimate scholarly activity. This would relieve some of the burden of young researchers that must 'publish or perish'. Also the government does not demand ownership, especially while basic research is being done.

Government funding is strongly controlled by a peer-review system, i.e., 'Truth is determined by majority vote'. As long as the majority of engineers and scientists believe new-energy source is impossible, we should not expect substantial government funding. Of course, the people who control funding often have small amounts in the budget for discretionary purposes. That is, they can grant, say, $10,000 to a project on their own authority, without going through a peer-review process. These funds are usually used for travel grants, conference support, or preliminary research into very high risk areas. Free energy researchers who need amounts less than $50,000 should be alert to this possibility.

My own experience with government funding in another emerging energy area (wind energy) has not been very good, so I would urge caution in looking to the government savior in this area. Unlike the new-energy source being proposed in this book, wind energy has a long history of usefulness to mankind. No one doubts that one can get

mechanical or electrical power from the wind. But research and development funding was needed to produce prototypes with acceptable reliability and costs. The .energy source (wind) is free, but the equipment to extract power from the wind is not. The mortgage payment for the equipment and salaries for operating personnel must come from the sale of energy. These costs must be less than the equivalent costs of competing energy sources (e.g. photovoltaic) or there is no incentive to invest.

The government had a choice of research groups to fund. They could fund large corporations or small start-up companies. The large corporations had large engineering staffs, big computers, manufacturing capability, strong lobby groups, and proposal writers and accountants familiar with government funding requirements. The small companies had the good ideas and the 'fire in the belly'. That is, they were led by people enthusiastic about wind power, and who had no competing research activities.

The government systematically chose the large corporations, which then built large wind turbines with very short lifetimes and the equivalent of very high mortgage payments. When government funding dried up, these large corporations moved on to other topics for which funding was available, forgetting about wind power. In the meantime, the small companies struggled along with inadequate funding, eventually producing a number of respectable turbines. Government funding of the large corporations was nonproductive, and even counterproductive because of the wasted investment of the small companies in writing proposals that were doomed to failure.

Another factor in receiving government funding is the intimidating amount of paperwork involved. The lone inventor and his technician will probably need to hire someone, at least part-time, to make sure that accounting standards, safety standards, employment standards, etc., are met.

A non-trivial concern is that the government typically demands a non-exclusive license to use patents or other results of the research. This is certainly reasonable in cases like hot fusion where the government has invested many billions of dollars over a forty year period. However, a license to use technology of a new-energy system could be worth billions to the government, and granting of such a license for a one-time grant of a few thousand dollars to a new-energy researcher hardly seems fair. The government needs to waive this requirement for small grants, or perhaps to limit the requirement in some way. For example, the researcher might give the government license to use, without royalty, one kW of installed new-energy equipment for some given amount of grant money.

Of course, there are other governments besides the United States, some of which appear to be much more open to the idea of a new source of energy. Manning [3] mentions Japan, China, and India as examples of such governments.

Another possibility for a funding source is the Electric Power Research Institute (EPRI). EPRI was established by the electric utilities to solve existing technology problems and to develop new technologies for generating, transmitting, and distributing electricity. They certainly have the size, the engineering talent, and the mandate for carefully investigating a new-energy source. As mentioned earlier, however, the utility industry is now in the process of deregulation, somewhat similar to that experienced by the airlines and the Bell Telephone System some years ago. This has shifted the focus of many utilities and EPRI from long-term planning to short-term survival. Even if EPRI management could be convinced of the importance of new-energy research, the prospects for stable, long-term funding from this source have to be considered poor.

Foundations can also be considered as funding sources. There are thousands of foundations in the United States, many of which can give money to scientific research. Finding the right foundation and convincing the right people will be the problem.

Venture capitalists are an obvious source of funding. They usually do not get involved in basic research, preferring to come in when a prototype is working, hopefully after a patent has been granted. They typically ask for a large fraction of the rewards in return for a smaller fraction of investment. One has the question of ownership discussed in an earlier section. And one also has the question of their staying power and the depth of their pockets in bringing a new-energy device to widespread use. The attitude of 'make a quick buck and get out' is **not** what is best in getting this clean energy source deployed.

Churches or para-church groups would be an interesting source of funds. The selling concept might be that the new-energy device would help provide pure water and refrigeration in third world villages, thus relieving much preventable human misery. Why build a hospital to treat water-borne diseases when a pump and water treatment plant could be built, perhaps for less cost, but certainly with less sickness in the first place? These new energy devices could raise the standard of living in these third world villages, helping to slow the exodus to the over-crowded cities. The churches could be granted a non-exclusive license for the new-energy devices, at the rate of one kW for some amount of dollars, or could even receive part of the ownership of the technology.

Selling stock is a traditional source of funds. Many people are willing to believe in new-energy technology that has been described here, and are willing to invest a few thousand dollars. The emphasis in selling is usually greed, with investors being told they will receive a many-fold return. When the research and development takes longer and costs more than originally planned, the investors are usually disappointed. The inventor's friends and neighbors that have invested in the project become angry. I would suggest that potential investors be warned about the very real possibility that all investments will be lost, and that stocks not be sold to anyone that cannot afford to lose the investment.

A slightly different way of raising money is to sell dealerships. For $10,000, a person gets the right to sell new-energy devices in a given geographical territory. This assumes that the devices will be sized and priced to fit in a home, and that problems such as noise, vibration, and health hazards are of no consequence. In one case of my knowledge where dealerships were sold, the inventor has spent some time in jail, and many of his dealers wish they had their money back.

One can see that there is no perfect source of funding. Spending money to develop a new energy device, whether one's own or someone else's money, should be considered a sacred trust. Mistakes and resultant losses are inevitable, but promises and research activities should be made with the highest integrity. Greed should be de-emphasized, replaced by a goal to help mankind and improve the environment.

PATENTS

An integral part of the question of ownership and funding is the matter of patents. The patent system has been very important to the technological development of the United States. An inventor can have ownership of his invention for a period of at least 17 years, in return for publishing the details of the invention. This gives him time to receive a reward for his creativeness, and his company incentive to invest in production equipment, knowing that they have protection against competitors. The alternative of placing the information in the public domain means that the inventor is unlikely to receive any significant reward, thereby removing his incentive. It also makes it less attractive for companies to invest in manufacturing equipment since many other companies may be doing likewise. The competition may make it difficult or impossible to get a fair return on one's investment.

Even though the patent system has worked well in most cases, there are some significant hurdles to the lone inventor getting a patent on a free-energy machine and receiving an appropriate reward:

1. The inventor must hire a patent lawyer and spend several thousand dollars in order to make application. As a practical matter, application for and maintenance of a single patent will be a financial challenge to most individual inventors.

2. The Patent Office has guidelines which prevent it from issuing patents which even appear to violate the Law of Conservation of Energy. Perpetual-motion machines, cold-fusion devices, and free-energy equipment are all rejected out-of-hand, even if they appear to work (e.g. Moray and Newman).

3. A patent application can be declared to be in the interests of national security, classified, and the inventor warned to be quiet about the invention under threat of jail or worse. Manning mentions Adam Trombly as one example [3, Page 161].

4. Being granted a patent does not guarantee long term ownership. Other people can file challenging lawsuits, with or without justification. The real ownership is then determined by the courts. These cases can drag on for

years and cost enormous amounts of money. A classic case is the original patents for radio granted to Marconi. The Supreme Court decided in 1943 that Tesla had actually preceded Marconi in some key ideas, and that radio was actually invented by Tesla. This was, of course, many years after the original patents were issued, and both Marconi and Tesla were dead.

5. A patent does not guarantee that all users will pay for the use of the ideas. Other companies will often pirate the concepts, and pay a fair royalty only if the inventor catches them, sues them, and wins the lawsuit. Or a company may sign a royalty agreement and then not pay, requiring more lawsuits. A lone inventor without a deep pocket is definitely a lamb among wolves in this environment.

There are many pitfalls for the patent owner. I was once asked to serve as an expert witness in a lawsuit which shows yet another possible problem. A young engineer (a former student of mine) invented and patented a device for use in the medical industry. He formed corporation, raised venture capital, and did the development work on the device. Rather than build his own manufacturing facility, he entered into a joint venture with a company in another city to build the device. This other company did not build the device on schedule, but instead sued this young engineer for thirty million dollars, claiming that the development work and engineering manuals were inadequate and that the other company would have to invest considerable effort to produce a properly engineered device. The young engineer told me that the other company's plan was to take his corporation's assets, including the patent, if the other company won the suit, since the young engineer obviously did not have even a small fraction of thirty million dollars. In the meantime, he was involved in very expensive litigation, with the introduction of his product into the marketplace on hold.

The lone inventor has almost zero chance of keeping his patent in such an environment. It will eventually be owned by someone with deep pockets.

One alternative to this depressing situation is to maintain some critical aspect of the technology as a trade secret. The inventor and a circle of trusted associates would then have full control as long as the secret was held. For continuity past the death of the inventor, there would need to be a religious commune or perhaps a large family. The inventor would need worry only about two problems: reverse-engineering and theft. The technology may be so advanced that reverse-engineering is simply not feasible. For example, if Moray had developed a working transistor in the 1930s, competitors would have had great difficulty in replicating the device just by physical testing. They would have quickly found that the primary ingredient was germanium or silicon, for example, but would not have realized (without a detailed theory) that impurities at levels of less than one part in a thousand were critical to its operation. Theft would seem to be the more difficult problem, but probably not insurmountable.

REWARDS TO INVENTORS

Regardless of ownership or funding source, it is only fair to reward the inventors for developing this discovery. The discovery is worth many millions of dollars, but having this much money could easily cause more problems than it is worth for most inventors. I would propose, as a minimum, a comfortable retirement income, adequate to leave a modest inheritance to the inventor's children. This should be set in terms of some readily obtained benchmark rather than a specific dollar amount at the time of discovery, to allow for inflation and other factors. Possibilities include paying the same retirement pay as received by a Colonel in the U.S. Military retiring with 25 years experience, or the average retirement pay of a full professor from the College of Engineering of a Land Grant University, or the median engineering salary as published by the National Society of Professional Engineers. This should be for the life of the inventor and spouse, perhaps even for the life of their children.

I would suggest this retirement be paid from a royalty on each kWh produced by the new energy source. A royalty of 0.3 cents/kWh would be a reasonable amount at the beginning. The percentage could be lowered after all the retirement benefits are fully funded. The inventor would hopefully be salaried from other sources at least until energy sales were adequate to fund his retirement. This method of funding retirement provides incentive to the inventor to keep making improvements to his system until it is commercially available, and also prevents cash flow problems during the critical early years.

Should only the final inventor receive this reward, or should earlier or contemporary workers be rewarded also? We have a 'winner take all' mentality in regard to inventions, which may not be fair in this case, and may also be counterproductive. We are more likely to make the discovery as a team, but we are not inclined to share all our data openly if it might reduce our chances of receiving a reward. A classic example is that of Henry Moray, who apparently had a working free energy system in the 1930s. He and his sons have invested a fortune and much of their lives in this search, and their book has encouraged many others to start the search. They deserve some kind of return on their investment. Also, if Henry's sons, John and Richard, were convinced that they would receive a fair reward by joining a group or team of researchers, they might share some key piece of data that would send the remainder of the team in the right direction.

But how do we develop or encourage such teamwork? There is already considerable informal networking that is taking place, but perhaps even more could be done with a more formal system. One possibility would be for two inventors to sign a formal agreement including the following clauses:

1. Neither inventor will disclose any proprietary information made available by the other inventor.
2. Each inventor is allowed to visit the laboratory and library of the other.
3. Each inventor will make available specialized equipment as time and resources allow.
4. Each inventor will attempt to replicate experiments of the other.
5. If one inventor is successful in bringing a new-energy device to the marketplace, then after his retirement is fully funded from royalty payments, he will use the royalty payments to fund the retirement of the other inventor.

Agreements similar to this could be used to put together teams of researchers. A team might include theoretical physicists, engineers, and technicians. It would be nice if all the team members lived within a days drive of each other so that face-to-face sessions could be conducted periodically. Such teams should have a better chance of success than the lone inventor trying to be theoretician, engineer, **and** technician.

RESEARCH ACTIVITIES

If we assume that a new-energy source exists, whether it be called the aether or the vacuum, then we must decide how to characterize and develop this source. A theoretical understanding needs to be developed. Devices that use this source must be brought to the market. What are some rational research activities that have promise in fulfilling these needs?

This energy may be available in at least three ways: heat, mechanical rotation, and direct electrical output. Those performing successful cold-fusion experiments may have tapped into the aether. Certainly, a large fraction of our energy requirements are used for heating household space and water so the cold fusion activity needs to be encouraged.

Until the source is fully characterized, we should assume that any or all of the following parameters may affect performance of a new-energy device:

1. Location on the earth (latitude and longitude)
2. Elevation above mean sea level
3. Air temperature
4. Air pressure
5. Humidity
6. Solar storms
7. Time of day
8. Time of year
9. Weather conditions
10. Immediate environment of new-energy device (open air, wood-frame building, metal-skin building, etc.)
11. Electrical grounding features
12. Purity of materials
13. Composition of materials
14. Techniques of circuit construction
15. Orientation of device with respect to vertical, magnetic north, etc.

16. Frequency of oscillation or speed of rotation
17. Presence of harmonics or pulses
18. Presence of high electric and/or high magnetic fields, not necessarily inside the device.

There have been a number of experimenters who have assembled coils, transformers, Tesla coils, batteries, and capacitors on an intuitive basis and have observed anomalous effects. In many cases these experimenters are not scientifically trained and are unable to write detailed technical documents that would allow replication of their results. One research activity that may have great value would be to send one or more engineers into the workshops of these experimenters to hopefully observe the effects, and to document the experimental apparatus along with the other items on the list above.

There are several engineers in the new-energy area that have been very productive with very limited resources. A large corporation with vision would be wise to retain one of these people as a full-time consultant with a minimum of a five-year contract, give him a reasonable budget for travel and components, and let him do his own thing. That was one of the better decisions that General Electric made around the turn of the century, when they hired Steinmetz, put him in a nice laboratory, hired the best engineers as his assistants, and gave him free rein in his research interests. GE then owned the patents to his inventions which allowed it to become one of the largest corporations in the world.

A large corporation hiring a consultant could afford to apply for patents, and would have a reasonable chance of protecting the patents against lawsuits. It would be only fair to reward the consultant with a percentage of the royalties from his patents.

Many of the reported new-energy devices have permanent magnets, coils (often in unusual configurations), batteries, and rotating components. There may be resonance involved, often reported to be in the range of 30 to 500 kHz. High voltages or high currents might be involved. Large transients are common. It is likely that a component that is linear under normal operating conditions becomes nonlinear under these unusual operating conditions. There may be entirely new phenomena waiting to be discovered under the right conditions of voltage, current, frequency, and materials, similar to the discovery of superconductivity. This will be another case of theory following experimental discovery.

Without getting more specific, we need to be looking for new phenomena in situations involving high voltages and/or high currents in the frequency range of 30 to 500 kHz, in circuits including inductors and permanent magnets. The preferred place to start is in the workshops of the researchers reporting strange phenomena.

Certainly the several flaws or paradoxes in electromagnetic theory need additional experimental and theoretical work. Ampere's original force law between current elements needs more experimental verification to make sure the constants and the angular variation are indeed as he said. The similarity between Faraday's law for a coil around an iron core, and the Aharonov-Bohm effect, needs to be theoretically explored. Theorists need to consider why magnetic flux, supposedly produced by electron spin in an atom, does not appear to rotate with the bulk material of a permanent magnet.

It would be nice to have several well-equipped laboratories scattered across the country that would be available to experimenters operating on a nearly zero budget. One should be at high elevation, at least as high as Colorado Springs and perhaps as high as Leadville, Colorado (10,000 ft). The others would be at convenient locations, say East Coast, Midwest, and West Coast. An experimenter would write a proposal to the funding agency. Upon acceptance, the experimenter would be paid travel expenses and perhaps a consulting fee to take his apparatus to the laboratory. The experimenter and laboratory personnel would work together to characterize and test the apparatus, and write appropriate reports and technical papers. Publication can always be delayed for a year or two if there is any possibility of applying for a patent. Several of the Tesla coil and new-energy researchers have personal laboratories that would be adequate to the task, and would probably be made available for a reasonable consulting fee. Such an open laboratory would eliminate some of the measurement errors being reported and also improve communication among researchers that tend to be isolated.

Many other activities could be listed, but these give some idea of what could and should be done.

WHAT NEXT?

I have outlined many of the difficulties facing the development of new-energy generators. In the present climate, it appears that the lone inventor does not have the resources to do the necessary engineering development and bring a generator into full commercial production. It also appears that the people with the resources do not have the vision, leaving us at an impasse.

There are many people working on the discovery of a new-energy source (with limited resources) so it is conceivable some theoretical and experimental progress will be made without adequate funding. I believe this source will eventually be discovered, even without extramural research funding, but it may take another century. Adequate research funding could speed up the process considerably, however.

In the meantime, we need to do our homework and be ready for a major paradigm shift. Experimenters need to carefully document anomalous results and encourage others to replicate them. Theoreticians need to develop mathematical models for the unexplained observations in this book.

When we consider that over a billion people around the earth do not have access to electricity in their villages, we should sense some urgency about this research process. Villages lie in poverty and hopelessness. City slums are perceived to be a better place to live, with massive migrations of people. The third-world country becomes more unstable and ripe for revolution as this process continues. It can be argued [4] that the real costs to developing country and even to the world community of nations is greater if these basic energy needs are not met than if they are met. An improving standard of living in the rural areas would relieve a great deal of human misery and also improve the political stability of the world. As I.H. Usmani, Senior Energy Advisor, United Nations Environmental Programme, once said: "These villagers must have energy, not at a price, but at any price."

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VORTEX FILAMENTS, TORSION FIELDS AND THE ZERO-POINT ENERGY

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ABSTRACT

An hypothesis is proposed that plasma vortex filaments induce corresponding torsion in the physical vacuum which coheres the zero-point energy. Large energetic effects are expected when the filament is closed into a vortex ring plasmoid (like ball lightning), which can be created by subjecting a glow plasma to an abrupt discharge, bucking electromagnetic (EM) fields, and counter-rotating EM fields.

INTRODUCTION

What is the nature of pure vacuum, the "fabric" of empty space? Historically scientists believed space was comprised of a material ether capable of supporting the propagation of light waves. Such a view lead to immediate contradictions: It would have to be stiff as a dense solid to manifest the high velocity of light, yet be tenuous to allow matter to travel through it unperturbed. Failure to detect an ether wind from the earth's relative motion convinced the scientific community to accept the theory of relativity. Here the appealing concept of Lorentz invariance, where all inertial observers (moving at constant velocity) would observe the same laws of physics (including a constant speed of light), yielded a seemingly elegant simplicity: The ether was an unnecessary artifact and could be assumed not to exist. Thus in the early 1900's the scientific community believed empty space to be a void, and today's text books typically support that view.

However, in the 1930's quantum mechanics became accepted because it so accurately described atomic phenomena. The equations of quantum mechanics include a term that describes an ever present, underlying energetic jitter to all phenomena whose source is from the fabric of space itself. The jitter is called "zero-point fluctuations" (ZPF) or "zero-point energy" (ZPE) since the fluctuations are not from thermal radiation, but are present even at absolute zero degrees Kelvin. Quantum electrodynamics (QED) [1] has the ZPE at its basis where the vacuum can manifest pairs of oppositely charged, virtual (short lived) particles. The Heisenburg uncertainty principle is often invoked to allow "borrowing" the ZPE for short time periods in order to explain atomic events and particle interactions. This is a peculiar use of the uncertainty principle since it was originally intended as an inequality expression that limits the accuracy of a quantum measurement, yet in this case it is treated like an equality expression to limit how much energy can be borrowed for how long. Such an approach rationalizes a small "loop-hole" in the law of energy conservation, which is often cited as the actual reason why the vacuum energy cannot be tapped for large amounts of energy. However, if the ZPE truly physically exists, then real energy is present and its conservation is not the issue.

ZERO-POINT ENERGY PARADIGM

At the heart of the issue is a paradigm conflict. Most scientists were taught that the vacuum is an empty void, yet quantum theory concludes it's an energetic plenum. It can't be both ways. The conflict has given rise to many paradigm "camps" each with its own characteristic belief regarding the vacuum energy:

Paradigm Camps Regarding ZPE:

1. Quantum physics is wrong. Quantum events can be explained classically using self-fields. ZPE does not exist.
2. Relativity is wrong. A material-like ether exists.
3. Quantum physics is correct, but the ZPE is a theoretical artifact; it is not real.
4. The ZPE physically exists, but its magnitude is too small to be an appreciable energy source.
5. The ZPE physically manifests large energetic fluctuations, but they cannot be tapped because of entropy; they are random and ubiquitous like a uniform heat bath.

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6. The ZPE is a manifestation of chaos in an open nonlinear system. Under certain conditions it can exhibit self-organization and therefore become available as a source.
7. The ZPE is a 3-space manifestation of electric flux from a physically real, fourth dimension of space. It can be twisted into our 3-space yielding alterations in the space-time metric. It can be tapped as a source, and doing so locally alters gravity, inertia and the pace of time.

Western academia is dominated by beliefs 3, 4 and 5. Camps 1 and 2 try to model all physical phenomena purely at the classical level. Probably the toughest for them to explain is the EPR [2] nonlocal connection between two separate elementary particles (that originated from a common quantum event). Sophisticated ether models [3] are sometimes proposed, which ironically have similarities to belief 7 whenever the flexible space-time manifold is viewed akin to the ether. The Soviet Union has a large academic interest in beliefs 6 and 7. In addition they have contributed abundantly to the literature involving both theoretical and experimental investigations of torsion fields, a helical spinning coherence in the fabric of space associated with all spinning bodies (including elementary particles). Recently translated articles [4-6] show that many ideas regarding the ZPE considered esoteric and speculative in the West have been taken seriously, theoretically developed, and experimentally investigated by Russian scientists.

There is another major paradigm division across the scientific community regarding hyperspace. Do more physical spatial dimensions exist than the commonly perceived three dimensions of space? (The time dimension does not qualify unless it is considered to be a true spatial dimension as well). No doubt the majority believes not. Physicists often model higher dimensions mathematically, but typically do not believe it represents a real physical hyperspace. Some "compact" the higher dimensions topologically into microscopic tubes so as not to manifest them as spatial dimensions [7]. The philosophical bias is basically "if we can't perceive it, it can't exist." However, the scientific community has always had a minority camp that believes hyperspatial dimensions physically exist [8] and that it is human perception that limits us (like "flat landers") from seeing them. The principle of Occam's razor (simplest theory explaining all) is often cited as the reason hyperspace should not exist. However, if the strange observations of quantum mechanics (e.g., quantum logic, wave particle duality, nonlocal connectivity, etc.) as well as space-time curvature of general relativity are to be physically modeled, then utilizing a physical hyperspace might beget the simplest theory after all. Moreover, such modeling when applied to the ZPE could produce fruitful suggestions for experiments that might tap it for large output power.

GEOMETRODYNAMICS

Perhaps the most powerful of the ZPE descriptions is Wheeler's geometrodynamics [9] where the (mass equivalent) energy density of a single vacuum fluctuation is on the order of 10^{95} g/cm^3. Wheeler derives this value by inserting the ZPE's spectral energy density expression from quantum mechanics into the stress-energy tensor of general relativity. The high frequency modes of the ZPE yield such a huge energy density that space-time warps (like a black-hole) into microscopic hyperspatial filaments called "wormholes" that can channel electric flux between separate regions of 3-space or possibly to alternate parallel universes embedded in a "super space." The mouths of these wormholes are on the order of the Planck length, 10^{-33} cm (that is twenty orders of magnitude smaller than the electron). In 3-space they manifest like primitive charged particles or "mini holes" whose polarity is set by the direction of electric flux. The electric flux normally passes orthogonally through our 3-space from a fourth dimension with small residual (vectorial) components aligned in 3-space to manifest the ZPE jitter. Thus the flux appears to enter through "mini white holes" and exiting through "mini black holes," and this action creates the foundational basis of charge pair production. The mini hole pairs are constantly being created and annihilated in a fluctuating state of chaotic turbulence called the "quantum foam." On a large scale the quantum foam averages to yield the familiar flat space-time metric, and it provides an ideal substrate to model QED's virtual charge activity. By combining quantum mechanics' ZPE spectrum and general relativity without any extra assumptions, Wheeler created an "already unified" field theory that ironically yields a specific model for the ether when viewed from a 3-space perspective: It appears like a turbulent plasma.

The wormhole model of charged particle pairs offers the prospect of geometric descriptions of the real elementary particles. Such modeling is intuitively appealing especially in view of a similar manifestation that can occur in hydrodynamics, the Falaco soliton [10]. The Falaco soliton is a vortex filament that can be created in a quiescent swimming pool. If a frisbee is stroked across the pool's surface, it will create two oppositely rotating, surface

circulations in its wake, which can persist for minutes. An arcing, underwater, thin vortex filament connects the two circulations. If ink drops are poured into one vortex, the ink will flow helically along the arc toward its paired counterpart and highlight the connecting thread vortex filament. If the filament is cut, the Falaco soliton will instantly disappear with an audible pop. In an analogous view, wormhole filaments may provide a way to model nonlocal EPR connectivity where oppositely moving particles born from a quantum pair production event are still connected through the higher spatial dimensions. The vortex filament is an archetype that appears at all levels of nature. It not only plays a role in modeling torsion fields and elementary particles, but it also might well provide the key for abundantly tapping the zero-point energy.

The goal of geometrodynamics is to ultimately model the real elementary particles. Since the ZPE flux flows orthogonally to 3-space, some type of vortex action in this flux, perhaps manifesting as a toroidal vortex ring, is required for the particle's persistence in 3-space. The ZPE flux continuously feeds the vortex in order to maintain it, much as the flow of a river maintains a whirlpool. Geometrodynamics was successful in modeling spin-1 bosons as three dimensional topological entities called "3-geons," but was unable to model the spin ½ fermions in a like manner [11]. The problem with spin ½ particles is that their isotopic spin description exhibits a quantum two valueness that cannot be modeled geometrically in 3-space. After one 360 degree rotation the fermion does not return to its original state, but instead it alternates between an "up" and "down" state, requiring two full rotations to return to the original state. Thus the electron cannot be modeled as a three dimensional geometric entity. Geometric modeling will require invoking higher dimensions where the electron's space-time manifold becomes "disconnected" from 3-space to allow a fourth dimensional rotation, yet it asymptotically appears to connect to the global space-time metric [12]. From a 3-space perspective the electron would be classed as a "non-orientable" topological entity, like a Klien bottle. (The mouth of a four dimensional Klien bottle appears as a toroid when intersecting 3-space [6,13]. Thus could the Dirac virtual fermion vacuum appear as a sea of toroidal forms? [14]) Hadley [15] has recently proposed a "4-geon" model for the electron using only general relativity, and was able to show that his model yields the strange, non-distributive, quantum logic where the quantum particle seems to somehow nonlocally "sense" its experimental environment to manifest the appropriate conjugate state. The model utilizes a peculiar solution of general relativity call "closed time-like curves" (CTC). The solution involves hyperspatial wormholes (filaments) that can allow a self interaction across the time dimension. This presets the stage for a probabilistic outcome consistent with the environment, even for the "delayed choice" experiments [16]. It is surprising that the strange behavior typical of quantum mechanics can be derived from the classical-like equations of general relativity. The behavior essentially arose from topological vortex filaments spanning across the time dimension.

PLASMA VORTEX FILAMENTS

Vortex filaments naturally arise in turbulent plasmas. Bostick [17] shows that filaments tend to form in counter rotating pairs. The vortex filament exhibits a force-free, natural flow where the electric (E field) vector and magnetic (B-field) vector can both be aligned with the particle velocity vector in an ever-tightening spiral. Moreover, such spiral field behavior can also occur in pure vacuum as well. Kiehn [18] shows that dynamic structures with non transverse E and B fields can occur in vacuum as solutions to Maxwell's equations. They exhibit topological torsion and have spin qualities like the photon. Rodrigues [19] has also derived non-dispersive, solitary wave solutions to Maxwell's equations that can even manifest speeds exceeding light. The Russian literature on torsion fields also describe solutions along the torsion filaments exceeding light speed [4]. (Since light is typically used to "define" the 3-space portion of the metric, such faster than light solutions would seem to propagate on filaments in the hyperspace). There appears to be an archetypal pattern here [20]: Just as turbulent plasmas exhibit a tendency to form into force-free vortex filaments, the virtual plasma comprising the quantum foam can exhibit a like tendency. This suggests a hypothesis: A highly energetic plasma filament induces a corresponding vacuum torsion filament. The coherent tandem of vortex filaments couples to the orthogonal ZPE flux and twists more of it into our 3-space. Since the force-free vortex filament exhibits self-tightening tendency [21,22], a plasma filament which closes onto itself (forming a helical vortex ring plasmoid [23-25]) would experience a positive feed back loop of increasing energy density [26] which ultimately would bring the ZPE effects into play. Once the quantum foam's virtual plasma couples to the vortex ring, the feeding ZPE flux would manifest a "non-orientable" entity akin to a "macroscopic charge." This might be the energy source feeding ball lightning as well as Shoulders' "electrum validum" (EV)[27]. Such vortex phenomena also arises from a plasma's anomalous glow discharge as evidence by the experiments of Correa [28], who appears to have rediscovered the operating principle of the plasma tubes of Moray [29]. Thus the vortex filament manifests in

both the virtual plasma of the quantum foam to produce the elementary particles as well as in turbulent plasmas to produce plasmoids, ball lightning and EV's. It appears to be an engineering key for tapping the vacuum energy.

The vortex filament is at the heart of modeling torsion fields where filaments can intertwine and potentially grow as large braids [30]. Shpilman [31] uses this theme to describe the electron as possessing a plethora of vortex filaments flowing from the charge and interacting with its environment. Such a model could likewise be applied to ball lightning or the EV where a dynamic polarization interaction with the dielectric environment [32] seems necessary for its stability. In a description like Shpilman's, an EV sprouts vortex filaments whose negative end is braided around the EV's internal toroid and whose positive end strikes the dielectric substrate, sucking electrons from before it while depositing them in its wake as it travels. Rather than exist as a collection of electrons, the EV could be thought of as a braided cluster of vortex filaments which manifests as a kind of "macroscopic charge." Torsion filaments can be thought of as braids starting with microscopic wormhole filaments and recursively building up in the physical vacuum, even to a macroscopic level.

MODELS OF THE VACUUM

The existence of braided torsion filaments in the vacuum requires a rather exotic model for the physical vacuum. The literature contains a variety of proposals for modeling the physical vacuum. Some would support the potential existence of rich set of organized, "subtle" structures, while others would rule them out. In the next century as experimental evidence accumulates, it would not be surprising to see the scientific community divide into paradigm camps regarding how to best model the physical vacuum:

Models of the Physical Vacuum
1. Void
2. Fluid ether
3. Spectral fluctuations
4. Orthogonal electric flux
5. Turbulent plasma
6. Virtual elementary particles
7. Toroids
8. Feynman lattice
9. Phyton lattice

The void model would have to explain action at a distance while a fluid ether would have to explain the observations of physics in a local mechanical way. The zero-point energy density spectrum is popular in the field of stochastic electrodynamics [33] where quantum effects are explained classically by matter's interaction with the all pervading zero-point energy density spectrum. EPR nonlocal connectivity remains unexplained however. Wheeler's geometrodynamics is essentially the orthogonal flux model which manifests a turbulent plasma model in 3-space. Dirac's virtual particle sea [34] was perhaps the first proposal for modern QED with the toroidal vacuum [14] as an attempt to avoid using point particles. The Feynman lattice [35] is a model that tries to explain the manifestations of the wide variety of elementary particles. The phyton lattice features spin and torsion. Since the hypothesis is that vortex filamentation can induce a large ZPE interaction, the phyton lattice model might inspire some effective experimental suggestions.

Akimov [4] is a leading researcher who has proposed the phyton lattice model for the physical vacuum, and this model is popular in Russia. Akimov hypothesizes that the basis of the vacuum is a quasi-particle called the "phyton" which is sized at the Planck length and exhibits two counter-rotating spins as if it were a pair of particles superimposed one within the other. Obviously for this to be physically modeled, space must contain a higher dimensionality. Thus even though not stated explicitly, Akimov's model is fundamentally hyperspatial in its nature. Phytons proliferate all of space, and for simplicity can be thought of as forming a lattice when in the vicinity of matter. The phyton can polarize in various ways to manifest the fields of nature. It can separate into opposite charge to manifest the electric field and support QED vacuum polarization. The gravitational field is modeled by the phyton separating longitudinally (where the spin axes still remain opposite) in an oscillatory fashion and is called "longitudinal spin polarization." In response to a spinning body one of the phyton spin axis can flip so that both become aligned, resulting in what is called a "spin transverse polarization." Such a polarization is used to model

torsion fields and torsion propagation. Akimov's diagrams illustrate how the phyton lattice polarizes in response to a spinning body (including the elementary particles). If the body's spin axis points up, the phytons above the body point up; those below point down. Why that particular polarization? Further discussion is required since that selection relates spin to the higher geometric construct of torsion and chirality. A right hand rule was used to define the spin axis; a left hand rule can have been chosen just as well. By picking this particular spin transverse polarization, Akimov is selecting a preferred chirality for the fabric of space. Chirality refers to spin becoming associated with a helix having either right-handed threads or left-handed threads. Is there a preferred chirality to the fabric of space? Kiehn [36] has described how a chiral vacuum could be topologically modeled in a curved space-time manifold. It would yield subtle electromagnetic and torsional effects. Could this be the basis for preferred molecular chirality observed in living systems? The question is not yet answered, but in Russia there is biological research interest and active experiments exploring the interaction of torsion fields with living systems and possible medical applications [5]. The activation of powerful torsion fields via plasma filaments might produce dramatic effects in the biological arena. Years of Soviet research has garnered experimental support for Akimov's model despite the many still outstanding, theoretical questions. Our understanding of vacuum physics is still at an early enough stage that the science must be explored empirically. Perhaps the most valuable contribution would be an experiment that produces such a large energetic effect, that a free running energy machine would be trivial to construct.

PLASMA STIMULATION

The primary hypothesis for tapping the ZPE is that stimulating a plasma into a self-organized coherent form induces a like coherence in the virtual plasma of the quantum foam. This would suggest that a glow plasma be subjected to one or more of the following stimulations to induce a coherent nonlinear self-organization:

1. Abrupt EM pulse
2. Bucking EM fields
3. Counter-rotating EM fields

There are "free energy" inventions associated with each stimulation. For example Correa [28], Moray [29], Papp [37], Shoulders [27], and Graneau [38] all utilize the abrupt discharge in their inventions to manifest a plasmoid form as well as excess energy [39]. Correa, Moray and Papp apply the discharge directly to a glow plasma. Shoulders pulses a liquid metal electrode and Graneau pulses a small cylinder of water. Shoulders, Correa and Graneau have observed plasmoid formations via photographic methods. Shoulders, Correa and Moray tapped the excess energy via rectifying an output pulse, while Papp and Graneau have focused on tapping the anomalously large mechanical reaction force via a piston. It is noteworthy that an abrupt discharge in a glow plasma or liquid also produces a characteristic bucking field compression. Mesyats [40] has described in detail the behavior of a liquid surface in response to an electric discharge. It forms a stalk protruding from the surface, which is symmetrically surrounded by a polarized glow plasma. The tip of the stalk explodes into the glow plasma yielding a perfectly symmetrical compression by two ion layers. It is the symmetry that guides the emitted electron plasma to form into a closed helical toroidal filament, producing the EV or plasmoid [39].

A number of inventors have used radioactive materials to help create the glow plasma. Moray [29] is perhaps the most famous where his "Swedish stone" cathode contained a mixture of luminescent and radioactive compounds pressed into a germanium pellet to make a "radioactive transistor" with sufficient gain to drive a small loud speaker. Papp [37] also used radium and luminescent materials in his electrodes to help ionize his inert gas mixture. Brown [41] used this principle in a simplified fashion to make his nuclear battery where a weak radioactive source creates a glow plasma which interacts resonantly with an LC circuit to produce anomalously excessive energy output. The simplicity of Brown's invention makes it a good candidate for replication.

The use of bucking EM fields to produce a scalar excitation in the vacuum energy has been emphasized by Bearden [42]. Abruptly opposing EM fields produce a stress on the fabric of space and increase the electric potential, yet since the fields are in opposition, they sum into a net zero field vector. Nonetheless the abrupt stress and release can cause an orthorotation of the ZPE flux [43], and can couple vacuum energy into the glow plasma being so stimulated. Caduceus coils [44] or Mobius coils [45] have been suggested for such excitation. Recent Soviet experiments [6] with Mobius coils have claimed to launch "non-orientable entities" akin to ball lightning, as well as produce negative

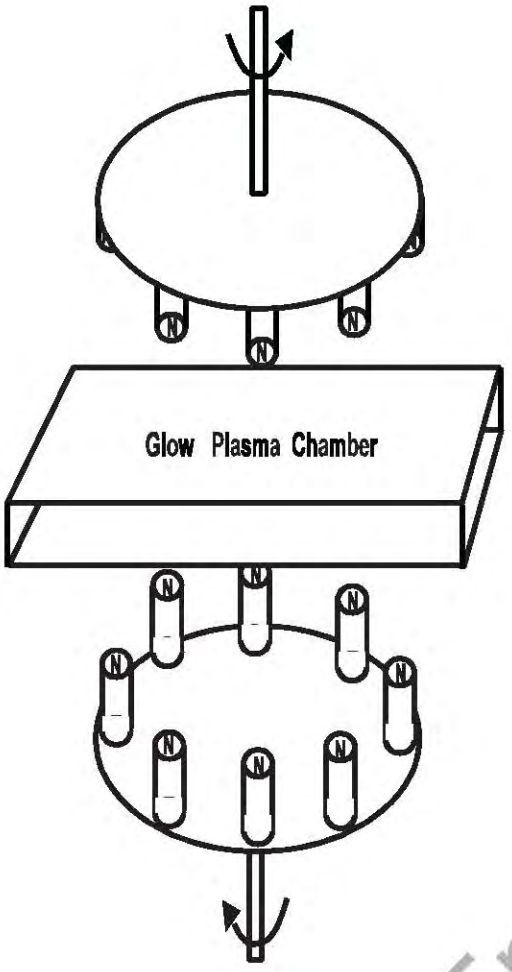

Fig. 1 Stimulate a glow plasma with counter rotating, bucking magnetic fields as well as an abrupt electric discharge from a pulsing circuit (not shown).

energy formations described as "magnetic monopoles." Subjecting a glow plasma to abruptly bucking magnetic fields might produce some large ZPE effects.

Bedini [46] used the bucking field principle in his "modified Kromrey, G-field" generator from which experimenters [47] claimed to have observed an output of "cold current," i.e. the ability to conduct appreciable power along thin wires without heating them. Bedini's generator consisted of two steel core coils that are spun through the two air gaps of two aligned horse-shoe magnets. Bedini's plans show ordinary coil windings, but he mentioned using "proprietary windings" as well. Were the windings caduceus, bifilar, or perhaps both? The windings appear balanced and slip rings are used to extract the output which should be combined in parallel such that current would not flow from one coil directly to the other (because of perfect phase opposition). The simplicity of Bedini's invention make it an attractive project for the hobbyist.

Akimov's phyton model motivates using a counter rotation stimulus. If a glow plasma is stimulated with two charged, counter rotating disks, it may activate a significant ZPE coupling. It seems this approach was used for the Swiss ML converter [48,49]. Further excitation could be provided by using the bucking field motif: If magnets are mounted on the surface of each counter rotating disks aligned for repulsion (Fig. 1), the glow plasma would be excited by both counter rotation and magnetic field opposition. Gray's motor [50] utilized pulsed opposing magnetic fields along with sparking discharges across the rotor-stator gap. Sweet [51] may have excited a fractoemission plasma by a counter-rotating, pivoting grain motion within his conditioned barium ferrite [52], thus providing stimulation by both techniques. Perhaps an invention that subjects a glow plasma to all three stimulations might produce the largest effects of all.

SUMMARY

Nature appears to operate recursively through levels of self-organization to produce what seems to be an archetypal "quantization" pattern: A plethora of "particles" combine to manifest as a flux or continuous flow at a macroscopic level relative to the size of the individual particle. Nonlinear behavior in the flow can then produce "topological defects" (i.e. solitons, vortices, discontinuities, filaments, vortex rings, etc.), which then can be viewed as if they were "quantized particles" at a new macroscopic level. If similarly gathered as a plethora, they would form the basis for the next higher level flux or continuous flow, which could then repeat the pattern. Turbulent plasmas exhibit the behavior when they form plasmoids. Geometrodynamics proposes analogous behavior to form pairs of charged elementary particles from the quantum foam. Kiehn [53] shows that Cartan's topological methods can abstractly model the archetypal process of evolution of continuous flux to quantized "defects," regardless of the dimensionality. Thus in principle Cartan's methods can apply to hyperspatial models of the ZPE and could someday yield a practical engineering theory for the vacuum energy. When the concept is applied to the substantive models of the physical vacuum, torsion fields become described. Descriptions of wormholes, strings, braids, fiber bundles, vortex rings, etc. appear in the literature, and in a sense could be modeled from a topological foundation of the vortex filament. A primary hypothesis is proposed that triggering a vortical self-organization in a plasma could exhibit a torsional coherence in the zero-point energy especially at the large energy densities that occur as the vortex tightens. The ZPE coupling is maximized when the vortex filament closes into a vortex ring, and the experimental production of

excessive energy from ball lightning and EV's may be the evidence. The largest effects might be produced by subjecting a glow plasma to an abrupt discharge combined with a counter-rotating, bucking electromagnetic field stimulation. If such experiments indeed produce large energetic effects, then it would be easy for the scientific community to replicate a self-running device that directly taps the zero-point energy.

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MEASUREMENTS AND RESULTS IN THE WIN METHOD

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ABSTRACT

Data are presented showing a yield of 148 percent and 154 watts collected from the vacuum continuum. Circuit diagrams are shown with pictures of the equipment used in the energy collection process. The goal of this research has been to prove that energy can be collected from the vacuum using electron acceleration. That has been accomplished even though stability problems have been identified. Development and testing of commercial prototypes has to be part of the next step.

INTRODUCTION

The purpose of this paper is to show how energy is collected from the vacuum, zero-point energy or ZPE, in the WIN Method and how it is measured. The WIN Method is a solid state method with no moving parts. ZPE is collected through electron acceleration which is enhanced through the use of E-dams. E-dams is a name coined after the functioning of hydroelectric dams and consists of a crystalline mixture mounted between ferroelectric plates.

The entire thermodynamic system includes the vacuum which cannot be measured. It has to be treated as an open system such as a heat pump. Electric power is used as the input in the collection process and is easily measured. The output used in this research is in the form of heat and light which may also be easily measured. Collecting the output as electric power is something which will be done in the product development cycle of this invention.

The entire thrust of this research has been to show that energy can be collected and measured from the vacuum using the basic idea of electron acceleration.

CIRCUIT

Electric power is taken from the line in the form of 60 cycle 240 volt power. Fig. 1 is a block diagram of the total circuit. The power supply consists of a 240 volt by 35 ampere autotransformer shown in Fig. 2. This is used to control the power input. Power goes from the autotransformer to three high voltage transformers mounted in parallel and shown in Fig. 3. These are capable of delivering up to 1.0 amperes at voltages up to 5,000. High voltage power goes to a bridge rectifier capable of 2.5 amperes up to 17,000 volts. It is shown on the right of Fig. 4. A voltage divider is mounted in the center and used to measure the direct current voltage into the entire circuit. The digital voltage meter used is at the top center.

Output goes to ground and returns through the front load, shown in Fig. 5, through the tank circuit and line's chokes to the power supply. The power supply is positive to the tank circuit. The front load, as shown in this picture, is 554 ohms. This is one of the research variables and is used to control the current surge from the power supply into the tank circuit. In a production unit, it will be replaced with a choke.

The tank circuit, as presently being studied, consists of three energy collection modules as shown schematically in Fig. 6. A picture of the tank circuit is shown in Fig. 7. It shows three lamps as loads, two E-dams and two chokes. A schematic drawing of one module is shown in Fig. 8 with a picture in Fig. 9. The tank capacitor is mounted on the floor and is shown in Fig. 10. This is a research variable. As shown, it consists of 21 microfarads by 4,000 volts.

The electrical charge moves from the tank circuit through line chokes mounted in series for a total of 6.2 henries and 16 8 microfarad by 4,000 capacitors. A picture of it is shown in Fig. 11.

The switching system was provided by Bruce Vicknair and may be varied from 500 to 5,000 Hertz and from 110 to 40 microseconds on-time. A picture of the present system is shown in Fig. 12 and shows two Fuji IMBI200-N-120

IGBTs mounted in series. This provides a capability of 2400 volts and 200 amperes. Energy loss in the switching system is negligible and is ignored.

POWER INPUT

Input current into the tank circuit is measured using a 0.100 ohm precision resistor located between the circuit chokes and the voltage divider. Fig. 13 shows the digital multimeter used in the upper left side. A 0.01 precision shunt is located on the positive side of the tank capacitor and the meter used is located on the upper right of Fig. 13. This is accurate as long as the capability of the meter is not exceeded. It becomes obvious when that happens because of the high meter readings. Direct tank voltage is measured using a multimeter across the tank and is shown in the foreground of Fig. 13. It shows a voltage drop of 281.8 volts across the tank. Input power is calculated from P = EI, where P is the power in watts, E is the voltage and I is the current in amperes.

POWER OUTPUT

Power is lost in the three E-dams and three lamps. A photograph of an E-dam is shown in Fig. 14 and shows a thermistor on the back side of the E-dam. This thermistor is calibrated using a known direct current power source with a watts versus resistance calibration curve plotted. Three calibration curves were used in this paper as the three E-dams were different. The curves are shown in Figs. 15-A, B and C. In each experiment the three thermistor resistances are recorded and the energy lost is taken from the calibration curve. Fig. 16 shows a digital resistance meter and a voltage meter for section one, an ambient temperature meter, a voltage meter for segment two and a switch meter on the bottom. The switching system is shown in the upper right of Fig. 16.

A light box is placed around one of the three lamp loads as was shown in Fig. 9. Twelve photocells are mounted in series around the inside perimeter of the light box and used to monitor the light brightness of one lamp. The other two lamps are left exposed in order to see the shape of the lamp arcs. Fig. 17 is a picture taken looking down into the light box through a mirror and shows two of the 12 photocells. The white area at the top is the ceiling. The lamp in the light box was calibrated using a D.C. source and calibration curves are drawn of watts versus ohms as shown in Fig. 18-A. D.C. resistance of the laps is plotted in Fig. 18-B. The alternating current is the same through the tank circuit. It is assumed that the resistance versus power of the three lamps is the same and the calibrated lamp results are multiplied by three to get the total lamp power loss.

E-dam and lamp power loss are added to get the tank output power loss. Output power divided by input power times 100 gives the yield in percent.

RESULTS

Results of experiment 6/3/98-1A, 1B, 1C are shown in Table 1. The major variable of the three experiments was the frequency. This shows the highest gain of 148.43 percent at 3,346 Hertz.

At the top frequency of 5,000 Hertz, the total watts collected went up a little to 158.27 but the input power went up more to drop the yield a small amount.

At the lowest frequency of 2,266 Hertz, the input power went up even more and dropped the watts collected to 87.55.

The highest alternating current of 3.581 amperes was at 2,560 Hertz and the lowest of 2.625 amperes was at 5,000 Hertz. The input current was held close to 1.0 amperes in all three experiments.

The three E-dams were from the 161 series. They were made different on purpose as part of my research program. E-dam 161-A had the highest wattage loss and the highest A.C. volts. A.C. voltage and resistance are calculated from the measured alternating current and E-dam wattage.

It has been found that a high E-dam cold resistance is desirable but that instability problems are magnified as the resistance is increased. It is desirable to increase the E-dam inductance which normally increases with resistance. The three E-dams did not follow this theory so there are additional factors which enter into inductance.

It is desirable to minimize E-dam power loss and this is going to require an improved switching system which will be part of a follow-on program. Power lost in the E-dams results from their impedance which acts to slow down electron acceleration rather than enhancing it. Acceleration results from voltage which comes from both the power supply and the magnetic field. The resistance versus current curves are developed for the E-dams using direct current. Fig. 19 shows the data plot for E-dam 161-B. As the voltage data were being recorded, the digital multimeter was showing a switching from high to low and back to high again in a rapid fashion. Switching from a high resistance to a low resistance is easily accomplished by switching from a low to high resistance was happening as the measurements were being taken. This did not happen in the other two E-dams and indicate that this was the best of the three.

GENERAL COMMENTS

The research goal has been to prove that energy can be collected from the vacuum using electron acceleration. That has been accomplished. Developing and testing commercial prototypes needs to be the next step. Increasing E-dam yields and efficiency should be a part of that effort.

TABLE 1. EXPERIMENTAL DATA RECORD

Experimental Number	6.3.98-1A	6.3.98-1B	6.3.98-1C
Tank Input	0		
DC Volts	347	311	318.4
DC Amps	1.027	1.057	1.041
DC Watts	356.4	328.7	331.5
Tank Cap -uF	56.94	56.94	56.94
Frequency -hz	3346	5000	2560
Duty Cycle - uS	40	40	40
Photocell - ohms	1343	1314	1879
Tank Output			
Watts / lamp	125	128	105
Lamps watts	375	384	315
A.C. current	2.982	2.625	3.581
Lamps volts	125.8	146.3	88.0
Lamps ohms	42.2	55.7	24.6
Lamps DC ohms	103.20	101.4	101.4
% difference	59.14	45.0	75.8
E-dam cold resistance	13,407	13,407	13,407
E-dam watts	98.50	103.00	104.00
D.C. E-dam volts	71.50	87.60	77.20
E-dam ohms	8.20	14.95	8.11
E-dam AC volts	21.60	29.24	29.04
Calculations			
Watts in	319.00	328.73	331.45
Watts out	473.5	487	419
% Yield	148.43	148.15	126.41
W = ½ QV	0.6182	0.9799	0.3898
Watts collected	154.50	158.27	87.55
Per cycle	0.04617	0.03165	0.03420
Changes Made	E-dams	E-dams	E-dams, caps

Experiment Number	6.3.98-1A	6.3.98-1B	5.21.98-2A
E-dam #1	161-B	161-B	161-B
Cold R	5800	5800	5800
Cold mH	50	50	50
Thermistor R	2471	2375	2266
Watts	33	36	37.5
D.C. volts	29	28.5	26.7
A.C. volts	11.07	13.71	10.47
A.C. R	3.71	5.22	2.92
E-dam #2	161-A	161-A	161-A
Cold R	6,360	6,360	6,360
Cold mH	0	0	0
Thermistor R	626	567	654
Watts	47	48	46.5
D.C. volts	44	44	36.5
A.C. volts	15.76	18.29	12.99
A.C. ohms	5.29	6.97	3.63
E-dam #3	160-C	161-C	161-C
Cold R	1247	1247	1247
Cold mH	150.2	150.2	150.2
Thermistor R	2140	2060	1960
Watts	18.5	19	20
D.C. volts	14.9	15.1	14
A.C. volts	6.20	7.24	5.59
A.C. R	2.08	2.76	1.56
Totals			
Ohms - cold	13,407	13,407	13,407
Ohms - A.C.	11.08	14.95	8.11
Watts	98.50	103.00	104.00
D.C. volts	87.9	87.6	77.2
A.C. volts	33.03	39.24	29.04
Inductance	200.20	200.20	200.20

GEOMETRIC ENERGY FIELDS

Guy McCarthy [1]

ABSTRACT

A number of so-called ordinary devices may be considered to exhibit over-unity operation. Capacitors, coils, antennas, and organ pipes (to name just a few) produce a gain or enhanced response to external stimulus which is dependant on geometry. We may generalize the enhanced response of these devices as "Geometric Energy Fields" which are spacial phenomena associated with our modern concept of the aether. Certain optimal geometries and materials may be used to construct devices which exhibit enhanced response under ambient conditions, that is, with no external stimulus. Construction details are presented for two simple devices which generate tangible, linear force effects with absolutely no input power. The value of these educational devices are two-fold: (1) they prove that aetheric grades of matter exist and can be sensed by the average person, and (2) they demonstrate reliable methods of aetheric activation which may be utilized in new energy applications.

OVERVIEW OF GEOMETRIC DEVICES

George Wiseman has demonstrated that condensers and coils exhibit over-unity operation by storing and releasing energy which is over and above the input current [1]. The quantity of energy produced depends primarily on the geometry of the device.

See for example, Fig. 1. Plate condensers (a) and (b) are each connected to identical sources of electric current for a finite time (t). Even though the magnitude of electric current is precisely the same at all points in the circuit, a build up of charge occurs across the plates of each condenser. If (t) is sufficiently long, capacitor (b) will store four times the amount of static charge as compared to capacitor (a).

In Fig. 2, the condensers are replaced with primary coils (a,b) and secondary coils (c,d). Both primary circuits are connected to identical sources of electric current for a finite time (t). When the electric sources are disconnected, voltage spikes are induced across coils (c) and (d) in opposition to the collapsing flux around the primaries. The voltage induced across coil (d) will be twice as great as compared to coil (c).

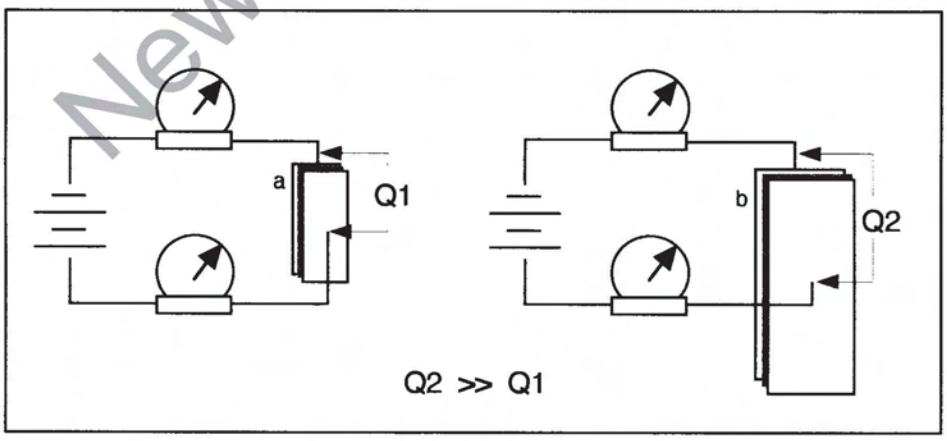

Fig. 1 Condenser Circuits of Unequal Geometry

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With condensers and coils the magnitude of energy response depends primarily on the geometry of the device, not on the input current. Materials selection can also affect response - in a given condenser design, certain insulator materials will yield a greater response.

Other examples of over-unity devices include the venerable organ pipe and the electromagnetic radio antenna. These devices operate on the principle of resonance, in which a relatively low amplitude oscillation is reflected back upon itself. The response signal can be many times greater than the input, depending upon the exact dimensions of the device. The most efficient resonator measures exactly one quarter of the original wavelength. Resonance

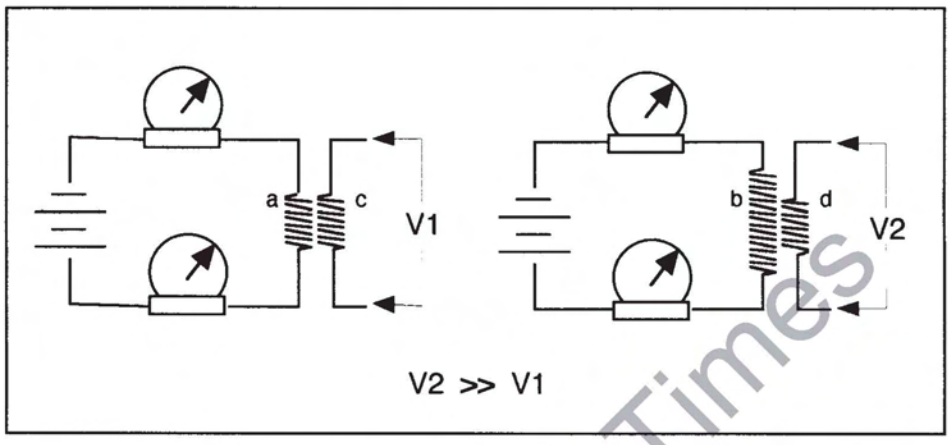

Fig. 2 Inductor Circuits of Unequal Geometry

will also occur at lengths which are any odd multiple of quarter wavelengths.

In such cases we find that the geometry of a particular device is of primary significance. When the geometry is optimized for input conditions, a maximum gain or enhanced response can be achieved.

We may generalize the over-unity characteristics of these devices as "Geometric Energy Fields" because the intensity or total energy of the response can be made to vary solely as a function of size, shape, and position in space. With this in mind, we speculate that certain highly optimized geometries might achieve an enhanced response without any input signal whatsoever. Such a device might induce a useful response by amplifying extremely subtle vibrations at the quantum level that fall well below the threshold of our ability to measure them.

MODERN AETHER TECHNOLOGY

Although research into nature's finer forces has been underway for thousands of years, one could argue that the modern era began in 1844. In that year Baron Karl von Reichenbach of Stuttgart published a series of letters describing his investigations into aether, which he termed "OD." Reichenbach found that a percentage of the general population could visually sense emanations from the tips of crystals and magnets if they were first properly conditioned in complete darkness. He termed these people "sensitives" [2].

Over time Reichenbach determined that aether could be conducted through materials such as silk, glass, and metal. According to his subjects aether seemed to permeate all things in various concentrations. Particularly large quantities could be found in sunlight and in the flame of a candle.

By the turn of the century the Austrian-born philosopher Rudolf Steiner was investigating the unseen world of aetheric forces with clairvoyant gifts. His close associate and biographer, Guenther Wachsmith, continued this work after Steiner's death and published a masterwork entitled The *Etheric Formative Forces in Cosmos, Earth, and Man* [3].

In Wachsmith's model, aetheric forces circulate through and about the earth as if it were a living organism. Aether is composed of four grades of rarefied matter, corresponding to the archetypal elements intuited by ancient

philosophers: earth, water, air, and fire. Together with solids, liquids, and gases, they comprise a seven-layered model of the physical world (Fig. 3). Various interactions among the four aethers' give rise to all the terrestrial and atmospheric phenomena observed on earth [4].
The first true engineer of aetheric forces was Wilhelm Reich, who discovered what he termed "orgone energy" in 1939. Like Reichenbach a century before, Reich found that metals tended to conduct aether. His real breakthrough, however, was the realization that organic materials tended to absorb aether. By layering the two types of materials together, Reich caused a directional flow of aether to occur (Fig. 4).

Reich developed the first useful apparatus for collecting and concentrating aether. The "orgone accumulator" was a six-sided box with alternating layers of metal and organic material. Under controlled conditions, the device generated an unexplained rise in temperature on the inside. This was sufficient to engage the interest of Albert Einstein, who met with Reich in January, 1941 [5]. Reich also experimented with the "cloudbuster," a turret-like device which seemed to direct a flow of aether through the atmosphere.

Perhaps the greatest contribution of aetheric engineering technology was made by Trevor James Constable. A student of Steiner, Wachsmith, Reich, and others, Constable has spent over 40 years perfecting the application of aether technology to weather engineering [6]. He discovered that certain geometric shapes seemed to exhibit greater aetheric response. Over many years he refined his techniques to the point where a device the size of a coffee mug, suitably mounted deep within an ocean-going vessel, could modify weather patterns for miles [7].

Constable's discovery of resonant aetheric structures has profound implications for the new energy researcher. With

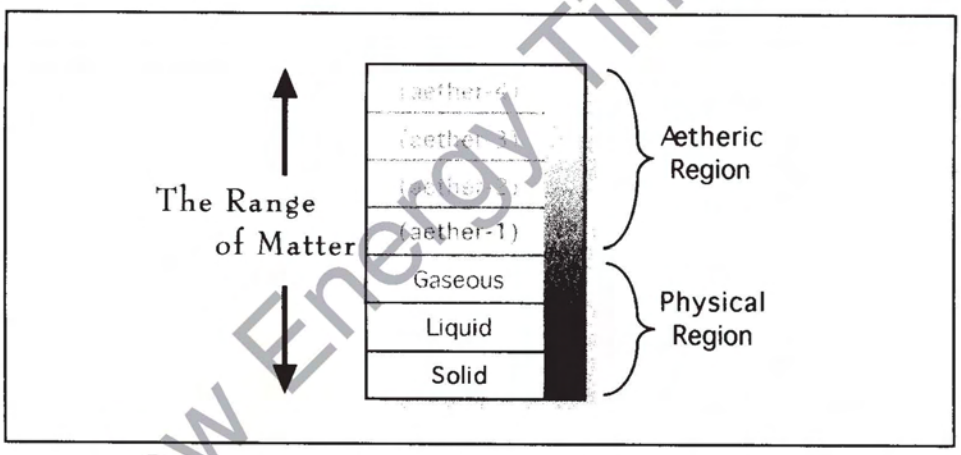

Fig. 3 Seven-fold Model of the Physical World (Steiner, Wachsmith)

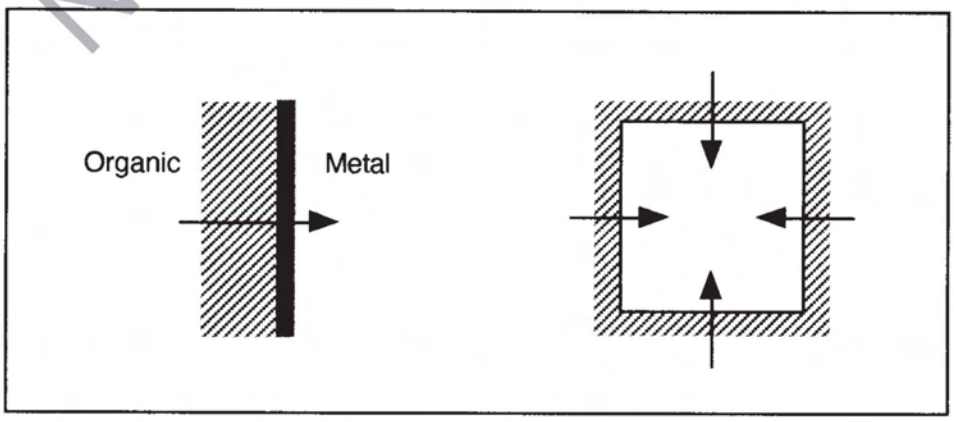

Fig. 4 Stimulating a Directional Flow of Aether (Reich)

nothing more than a simple geometric device, it is now possible to direct a concentrated beam of aetheric force through any type of apparatus with great accuracy. In fact, the degree of aetheric concentration is so great that the resulting pressure may be sensed directly by human touch.

AETHERIC ENERGY TOOLS

Thanks to the pioneering work of the natural scientists mentioned above, it will be possible to describe the construction of two resonant aetheric devices, which the author has named "Chi Pencils." Both devices are constructed around a central, resonant cavity. The formula for calculating the dimensions of the resonant cavity was derived from the research of ballistics expert Gerald Bull, Phd. [8].

The "emitting" device is basically a cylindrical, metallic cavity with a non-metallic outer layer. By means of the boundary phenomenon discovered by Reich, aether is drawn from the space around its sides and emitted from both ends. (In principle this is similar to a laser.) The geometric energy field around the emitting device is pictured in Fig. 5.

The "vacuum" device is simply the inverse: a non-metallic cylindrical cavity with a metallic outer layer. Aether is drawn into one end and dispersed through the sides. The geometric energy field around the vacuum device is pictured in Fig. 6.

HOW TO BUILD THE EMITTING DEVICE

The following supplies are required:
a length of 5/32 inch brass tubing
1/8 inch soft cotton cord
metal tubing cutter
metric ruler, sharp knife, hot glue gun.

1. Cut a piece of brass tubing that is exactly 18.1 cm long.
2. Apply a small bead of hot glue to the outside of one end and affix the cotton cord.
3. Working 2 cm at a time, apply a bead of hot glue and wrap the cord snugly around the tubing.
4. Trim away the excess cord.

HOW TO BUILD THE VACUUM DEVICE

The following supplies are required:
a length of 5/32 inch ID vinyl tubing
a length of 5/16 inch brass tubing
metal tubing cutter
metric ruler, sharp knife, electrical tape.

1. Cut a piece of brass tubing that is exactly 18.1 cm long.
2. Wrap electrical tape around the vinyl tubing in a few places so that it fits snugly inside.
3. Slide the vinyl tubing into the brass tubing until the ends are flush.
4. Trim away the excess vinyl tubing.

SENSORY EXERCISES

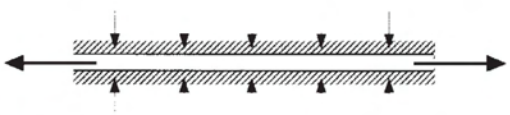

Fig. 5 Geometric Energy Field of the Emitting Device

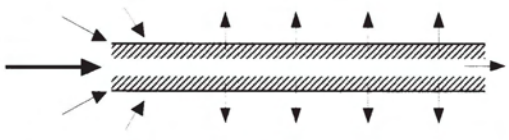

Fig. 6 Geometric Energy Field of the Vacuum Device

To date the aetheric force streams generated by the resonant devices described above have defied detection by ordinary instruments. This is not surprising, since aether is believed by many to be a "living" energy, while ordinary instruments are most certainly "dead." However, detection of the aetheric forces by a living organism (such as the human body) is quite straight forward.

Experiment #1: Hold the emitting Chi Pencil lightly in one hand. Breathe deeply, and relax. Now bring the tip close to the palm of your other hand. Hold it still for several seconds and mentally picture a thin fluid flowing between the tip and your palm. Try moving the tip in a slow, small circle around your palm. Most people readily experience a sensation of pressure or "heaviness" from the etheric stream. Shake your hand vigorously a few times to clear it.

Experiment #2: Hold the vacuum Chi Pencil about four inches from your palm. Breathe deeply and relax as before. One end will invoke a distinctive sensation at this distance. Be patient, it may take several seconds. Many people experience a "prickly" or "granular" sensation from one end only. This sensation is more subtle than with the emitting device. Try other sensitive spots, such as the inside of your wrist. When you determine which end is active, mark it with a small piece of tape.

Experiment #3: Repeat experiments 1 and 2 while holding a thin piece of paper in your palm. Notice if the sensation feels different as the aetheric stream passes through the paper (organic materials tend to accumulate aetheric energy).

Experiment #4: Take a length of copper wire and strip the insulation from both ends. Make a small loop in the bare wire at one end. Point each type of Chi Pencil at the loop while holding the other end in your fingertips. See if you can detect a sensation as the aetheric stream is transmitted through the wire (metals tend to conduct aetheric energy).

Experiment #5: Bring the active end of the Vacuum Chi Pencil close to either end of the Emitting device and then gently push them together. See if you can detect a certain "resistance" which feels like the force between similar magnetic poles. This may be due to interference between opposite rotations of the two etheric streams.

With these tools in hand, you may begin to experience the world of aetheric forces directly. Allow this intimacy with Nature to guide you in the design of new experiments. Do not underestimate the value of clarity and highest intent in this work.

CONCLUSION: THE COOPERATIVE FUTURE

Interest in the aesthetic value of geometric structures has waned since the days of ancient Greece. Yet new evidence points to geometry as the key to clean energy in the post-modern age. Who will grasp this concept and build the dynamos of tomorrow?

Perhaps that responsibility is too great for any one person or group. The doctrine of knowledge as property has failed to advance the human condition, promoting instead the lesser qualities of greed and aggression. The time for such folly has passed. Share your knowledge freely, and let cooperation be the engine of innovation.

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ENERGY FROM TRASH, NOT BY BURNING IT

Dr. Hans J. Petermann

ABSTRACT

This article describes what happens when you take house trash, mix it with old batteries and old oil remains, plug it into a thermally insulated container, close it airtight in a vacuum and leave electrical bulbs burning inside it? It becomes warm in the container and the pressure rises inside. Combustion can't take place due to lack of oxygen. As simple as it sounds, this experimental arrangement is theoretically unique in demonstrating what really occurs in the reactor container.

This article describes the work of Jürgen Mundt from Germany, the construction of his reactor and the sequence of many years of rational thinking. His reactor works with various types of trash and has been operational since 1995, for the past 3 years.

A UNIQUE DEMONSTRATION

Gottfried Hilscher is standing in the empty room of a Westphalian industrial complex. Stored on a structure rests a 1 meter long container (80 cm diameter) in horizontal position. It has 2 walls, insulated with the inside of the container with circulating water hooked up to the house water heater. The heat is removed from the reactor-container in this way. Electric cables run into the container to supply 14 light-bulbs with a total output of 2 kilowatts. The used trash contains many plastic materials, trashed video tapes, etc., and a heating rod which is connected to the switching mains. This should not be much for the connection of the light-bulbs and heating rod. The most surprising thing is that it produces electricity. It supplies the power for a 1.5 kw electric motor connected to a 9 kw-generator. Measuring devices allow the determination of temperatures inside the reactor chamber and the connecting pipes; the water flow and the electric current were also measured. The view through a viewing glass into the reaction chamber shows what's going on inside.

Eleven kg. of trash are stored inside the reactor, which is closed in a gas-tight manner. After 8 days of operation it's resupplied with additional trash. About 80% of the 11 kg. of materials have somehow dematerialized during these 8 days. We can't explain it more precisely, as to what really happens here. 2100 liters of water circulated per hour between the reactor and hot water heater in the presence of myself and a second witness. The temperature difference between the 2 cycles amounted to 4° C. For this we figured out the hourly thermal output of 9.6 kw. Compared with the electrical output of 2 kw, which is produced by the heat-bulbs inside the reaction chamber, the heat output is 10 times larger than the input in electrical energy. But that's not all folks! Once the 1.5 kw electric motor is hooked on to "the system" and runs the 9 kw-generator, the input power meter barely moves!! The consumed electric energy (beside the heat) is provided by the reactor, where a lower pressure reigns inside apparently. The current must be removed via the electric cables which lead to the heat-bulbs. There are no other electrical connections between the reactor-container and the switching mains. Jürgen Mundt wanted to understand how the cosmos functions. What he recognized, he finally realized in the micro cosmos of his reactor.

TEST AND MEASURING RESULTS CONFIRMED VIA NEUTRAL SIDES

These where the observations according to my best knowledge, consciously reproduced here in writing. Jürgen Mundt really does not wonder anymore about the phenomena which are offered by his reactor. For example, that the reactor produces more energy output, when the consumer wants more output! Apparently, a magnetic field is created which deflects the needle of a compass which was placed on top of the reactor housing, deflecting it from the north-pole. This is only one of the strange phenomena which Mundt knows about!

In recent times several reactors of different sizes have been independently tested. In the beginning of 1994 'DEKRA' confirmed in a report that there were no gas vapors exiting from the reactor chamber and that the only energy supply

was from the 2 - 150-watt-halogen bulbs inside the chamber. Between the water recycling runs a temperature difference of about 10 degrees was observed. A much more detailed test protocol was performed by the 'Center for Experimental Society Formation' (ZEGG) in Belzig (Brandenburg), where one device was tested in great detail. It basically confirmed the results which have been reported here. During the U.N.-climate conference in 1995 in Berlin, Germany, there was a meeting of Jürgen Mundt and Prof. Joachim Leuschner of the Berlin 'Nature-Technical' Institute. The energy currents were measured again. By comparison of the used halogen-bulbs energy, which was given off in the form of heat and high frequency electrical energy, the 'excess factor' of 2.89 was the energy produced. For the first time mention is made of measured radio-activity in the experiment report. This can only indicate that we have here the process of 'cold fusion' taking place in the reactor. All of the 'cold fusion' effects have been confirmed by Mundt and others now, so that Leuschner has recommended the systematic, continued development of the reactor to a mass-produced product.

To Finally realize this undertaking is of the utmost concern for many people involved here for our future energy supplies and environmental protection concerns on a worldwide basis! The patent concerning the reactor is protected under the number DE 4326 632 C2, effective as of 11 May 1996. This 'cold fusion' reactor by Jürgen Mundt indicates that these phenomena being observed by people in Germany are real indeed and Jürgen Mundt has been operating his reactor now for 3+ years in his own house in the Siegerland of Germany! His 'cold fusion' reactor proves that it produces heat output in excess of the energy input! Furthermore, it is stated in his patent that this 'cold fusion' process permits the very effective reduction of toxic and/or radioactive materials.

In conclusion, the consequences which can be seen concerning 'chemically induced low-temperature nuclear reactions' which have been repeatedly and successfully verified by independent tests. Tests were performed by Institute experts in Germany. The successful work being continued by Stanley Pons presently can be summarized by this Professor in the following way: The phenomena in 'cold fusion' have been successfully demonstrated and repeated! The ultimate question remains; When can these 'over-unity' output nuclear reactions be successfully demonstrated on a larger, mass-produced technical scale? Once these different projects have proven to be successful, which takes a substantial amount of funding in Germany, and for the continued work of Stanley Pons and others, including this author, then these new sources of 'cold fusion' energy projects can be phased in on a worldwide bases! Germany and Switzerland are now the leaders in this area!

EXCITATION AND EXTRACTION OF VACUUM ENERGY VIA EM - TORSION FIELD COUPLING - THEORETICAL MODEL

Don Reed

ABSTRACT

A historical survey of torsion field research is given. One particular theory is singled out and described that offers promise for direct coupling to the vacuum via electromagnetic means, for the extraction of vacuum energy. Experimental protocols are suggested in the context of this theoretical model in order to achieve this goal.

INTRODUCTION

The author has spent some time researching the historical theoretical under-pinnings as well as empirical exhibits of torsion fields, with an aim to determining the proper requirements that would allow artificial manipulation of vacuum energy by electromagnetic means. Part of this process has involved cataloguing the various anomalous energy signatures which have accompanied key electromagnetic research, such as the Zinsser kinetobaric effect which has been treated elsewhere [1]. Preliminary results from the analyses in the foregoing areas show some progress has been made towards this end. In the following, key developments along these lines will be explored in order to outline a theoretical model and to suggest preliminary experimental protocols for implementation of this knowledge.

HISTORICAL PERSPECTIVE ON TORSION FIELDS

Unlike other research results implying phenomena of an anomalous nature, the field of torsion research has an objective origin in formal theoretical physics with the history of gravitation theory. It is here that we will gain the best insight on how torsion fields and electromagnetic fields are linked.

Current notions of gravity are based upon a space-time geometrical description of the gravitational interaction. In the well-known general relativity theory, introduced by Einstein in the early 20th century, the space-time geometry is assumed to be that developed by Riemann. Here, gravitation is described by the metric tensor field (g_{uv}). A main conclusion of general relativity theory is that space-time is curved or distorted, in response to a classical energy-momentum tensor due to the presence of mass [2].

It was noticed that one of the ways to generalize general relativity is to consider non-Riemannian space-times. One of the interesting theories developed along these lines describes the gravitational field by **two** independent geometric objects, the metric tensor field (g_{uv}) and the torsion field (q_{uv}^{λ}). The torsion field tensor is defined as the anti-symmetric component of the non-symmetric affine connection (Γ_{uv}^{λ}), where $Q_{uv}^{\lambda} = \frac{1}{2}(\Gamma_{uv}^{\lambda} - \Gamma_{uv}^{\lambda})$. This so-called Einstein-Cartan Theory (ECT) or Riemann-Cartan Theory, went further than the Einstein theory in describing dynamic effects in space-time. It posited the existence of a physical object called the torsion of space-time, which occurred in response to the classical spin-angular momentum density of a rotating mass [3]. In geometric terms, the torsion of space-time expresses the axial polarization of intrinsic angular momentum of matter particles.

However, in the early development of the torsion theories, considerable psychological prejudice prevented an ongoing search for empirical exhibits of a torsion field. This was primarily due to ECT findings that if torsion existed, the theoretical constant of spin-torsion interaction would be proportional to the product of $G\hbar$ (G = gravitational constant, $\hbar$ = Planck's constant). This value is almost 30 orders of magnitude weaker than gravitational interactions (the weakest of known physical forces), and thus would not be expected to contribute noticeably to observed phenomena [4]. Another barrier to examining empirical exhibits of torsion under the ECT theories, was that torsion equations allowed only for an algebraic linkage between torsion and its spin source. In other words, in ECT torsion is static, non-propagating and is directly connected to the source. Thus, a torsion potential which is necessary for a dynamic description of physical forces, is not permitted in ECT theories.

If torsion theory continued to exhibit such dubious contact with experiment, having been burdened with a static nature and corresponding predictably infinitesimal coupling constants, it is unlikely that it would have had any significant impact on the advancement of science. However, numerous anomalies continued to surface in connection with both the quantum spin properties of elementary particles [5], as well as with the macroscopic exhibits of angular momentum (polarization) aspects of electromagnetic waves [6], that argued for a possible explanation in terms of a torsion field concept.

Finally, in the 70's and 80's two new developments occurred in connection with torsion research that were responsible for a new resurgence in the field and a return to a study of torsion concepts in earnest by orthodox science. The first development was the consideration of a torsion field which was not rigidly attached to its spin source as in ECT, but one which could freely propagate through space. An exciting consequence of the application of this new model to astrophysical situations, was the prediction of a non-stationary cosmology in which gravitational singularities could be avoided [7]. The second development was the serious investigation and ultimate validation of experimental exhibits of torsion fields by several groups in the former Soviet Union. An outgrowth of this study was the development of torsion generators [8], as well as the evolution of a new model of the vacuum. This vacuum structure provided for interaction of particle-antiparticle pairs, producing different states of dynamic vacuum polarization which, on the macroscopic level results in known physical forces [9].

TORSION FIELD MODEL FOR ELECTROMAGNETIC VACUUM EXCITATION

Since the introduction of general relativity with spin and torsion into the physics literature in the early 70's [10], many attempts have been made to construct a gauge-invariant theory of electromagnetism with torsion [11]. The main difficulty in this construction comes from the fact that the torsion of spacetime, if one considers a minimal coupling between gravitation and electromagnetism, breaks the gauge-invariance of the theory. Another way of expressing this fact is the popular notion that standard EM waves (e.g., photons), normally do not generate nor react to (e.g., "feel") torsion [10]. One solution to this problem proposed modifying the gauge-invariance in order to allow for propagation of torsion [12]. However, this theory failed to strictly uphold the equivalence principle of general relativity which has been established beyond doubt. Instead, this torsion theory predicted that different size masses would fall at different rates in the Earth's gravitational field. Then, in the early 80's, a propagating torsion model was advanced that both preserved gauge-invariance and also did not violate the equivalence principle. Instead, proposing a semi-minimal interaction between torsion and the electromagnetic field, this theory allowed for a minimal coupling between torsion and the virtual particle-antiparticle fermion pairs produced by a physical photon, according to the vacuum-polarization effect [13]. Thus, in this theory, which also agrees substantially with the proposed Russian vacuum structure [8], photons are indirectly coupled to torsion preserving the necessary gauge-invariance. This theory, devised by De Sabbata and Gasperini, is the one that we will focus on in this report. Not only do its elements and conclusions tend to offer theoretical corroboration for the anomalous energy signatures recorded in various electromagnetic field research, but it will be seen to possess a mathematical structure which outlines a prescription for the generation of an electro-magnetic field configuration which might possibly provide for actual artificial excitation and extraction of vacuum energy.

The structure of this theory presupposes a torsion potential (φ), whose gradient is the axial vector torsion (Q_μ). On the grounds of a semi-minimal coupling of the electromagnetic field tensor ($F_{\mu\nu}$) to the vacuum polarization tensor (details given in [14]), the following interaction Lagrangian is introduced,

$$\mathfrak{L}_I = \frac{\sqrt{-g}}{16\pi}\,\alpha\,\eta^{\mu\nu\alpha\beta}A_\mu F_{\nu\alpha}Q_\beta\,, \qquad (\alpha = e^2/4\pi\hbar c,\; Q_\mu = \frac{1}{3!}\eta_{\mu\nu\alpha\beta}Q^{\nu\alpha\beta})\,. \tag{1}$$

The total Lagrangian, involving spinor (e.g., fermion) sources as well as the EM-vacuum interaction (1) is,

$$\mathfrak{L}_T = \frac{\sqrt{-9}}{16\eta}\left\{\frac{R}{G} + \frac{3}{2G}\partial_\mu\varphi\,\partial^\mu\varphi - F_{\mu\nu}F^{\mu\nu} + \eta\,\alpha^{\mu\nu\alpha\beta}A_\mu F_{\nu\alpha}\partial_\beta\varphi - \right.$$
$$\left. - 16\pi\left[\frac{1}{2}(\bar\psi\,\gamma^\mu\psi_{|\mu} - \bar\psi_{|\mu}\gamma^\mu\psi) + m\bar\psi\psi - ieA_\mu J^\mu - i\frac{3}{4}\partial_\mu\varphi\,J_5^\mu\right]\right\} \tag{2}$$

where $F_{\mu\nu} = \partial_\nu A_\mu - \partial_\mu A_\nu$, $J^\mu = \bar\psi\,\gamma^\mu\psi$, $J_5^\mu = \bar\psi\,\gamma^\mu\gamma_5\psi$ and $\gamma_5\gamma_\nu = (i/3!)\,\eta_{\mu\alpha\beta\nu}\gamma^\mu\gamma^\alpha\gamma^\beta$.

This Lagrangian is invariant under the local gauge transformations,

$$A_\mu \to A'_\mu = A_\mu + \partial_\mu \Lambda(x). \tag{3}$$

$$\psi_{|\mu} \to \psi_{|\mu} + ieA_\mu \psi\,, \quad \bar{\psi}_{|\mu} \to \bar{\psi}_{|\mu} + ieA_\mu \bar{\psi} \tag{4}$$

The torsion potential (φ) is coupled in a minimal way to the spinor field (ψ) and in a semi-minimal way to the electromagnetic field.

From independent variation of ψ, $\bar{\psi}$, A_μ, and φ, we obtain the field equation for the charged-matter field, the electromagnetic field and the torsion potential,

$$\gamma^\mu \psi_{|\mu} - ieA_\mu \gamma^\mu \psi - i\frac{3}{4}\partial_\mu \varphi \gamma^\mu \gamma_5 \psi + m\psi - 0 \tag{5}$$

$$\bar{\psi}_{|\mu} \gamma^\mu + ieA_\mu \bar{\psi} \gamma^\mu + i\frac{3}{4}\partial_\mu \varphi \bar{\psi} \gamma^\mu \gamma_5 - m\bar{\psi} - 0 \tag{6}$$

$$F^{\mu\nu}{}_{|\nu} = 4\pi ieJ^\mu + \frac{\alpha}{2}\eta^{\mu\nu\alpha\beta} F_{\nu\alpha} \partial_\beta \varphi \tag{7}$$

$$\varphi^{|\mu}{}_{|\mu} = \frac{Gx}{6}\eta^{\mu\nu\alpha\beta} F_{\mu\nu} F_{\alpha\beta} - 4\pi iGJ^{\mu 5}{}_{|\mu} \tag{8}$$

Therefore torsion is a propagating field since its potential obeys a wave equation (8). This equation can be simplified in the flat space approximation and in the absence of spinning matter to become,

$$\Box \varphi = \frac{Gx}{6c^4}\varepsilon^{\mu\nu\alpha\beta} F_{\mu\nu} F_{\alpha\beta} \tag{9}$$

Electromagnetic production of torsion is allowed, then, even in the absence of other torsionic sources like spinning particles or polarized macroscopical bodies. Now, taking the static limit of (9), we arrive at the following important result, where **E** = Electric field intensity, **B** = Magnetic field intensity,

$$\nabla^2 \varphi = -\frac{4}{3}\frac{Gx}{c^4} \boldsymbol{E} \cdot \boldsymbol{B} \tag{10}$$

This is the key equation that we will need, showing that any electromagnetic field with the property $\mathbf{E} \bullet \mathbf{B} \neq 0$, apparently can serve as a source of torsion potential. Thus, from theoretical considerations, torsion waves can be generated using polarized electromagnetic radiation.

However, a single plane wave cannot be a torsionic source according to eq. (10), since it satisfies $\mathbf{E} \bullet \mathbf{B} = 0$. This is in agreement with the fact that the photon-torsion coupling is due to the vacuum polarization effect, and there is no linear vacuum polarization for a traveling EM wave in empty space. Therefore, an EM wave must propagate through another EM medium in order to produce torsion.

We will now show that two intersecting polarized plane EM waves can produce a scalar torsion potential, in much the same way that Bearden proposed with the process he termed "scalar interferometry" , where a scalar wave form can result from the coupling of two standard EM waves. We consider the highly idealized situation in which two electro-magnetic plane waves are propagating at a right angle. The first wave is linearly polarized along the x-axis and it is propagating along the z-axis with a frequency ω_1. The EM field is then,

$$\mathbf{E}_1 = (A_1, 0, 0) \exp[i(k_1 z - \omega_1 t)]\,, \qquad \mathbf{B}_1 = (0, A_1, 0) \exp[i(k_1 z - \omega_1 t)]\,. \tag{11}$$

The second wave is polarized along the z-axis and it propagates along the y-axis with a frequency ω_2,

$$\mathbf{E}_2 = (0, 0, A_2) \exp[i(k_2 y - \omega_2 t)] \tag{12}$$

$$\mathbf{B}_2 = (A_2, 0, 0) \exp [i(k_2 y - \omega_2 t)]$$

where A_1 and A_2 are the amplitudes of the waves, and k_1 and k_2 are related to the frequencies by,

$$k_1 = \left(0, 0, \frac{\omega_1}{c} \right), \quad k_2 = \left(0, \frac{\omega_2}{c}, 0 \right) \tag{13}$$

Note that we have neglected, in first approximation, the deviation from unity of the refractive index of the vacuum due to presence of an EM field.

The total density of "torsionic charge", ($\mathbf{E} \bullet \mathbf{B}$) is then,

$$(\mathbf{E}_1 + \mathbf{E}_2) \bullet (\mathbf{B}_1 + \mathbf{B}_2) = A_1 A_2 \exp [i (k_2 y + k_1 z - \omega_1 t - \omega_2 t)]. \tag{14}$$

(notice that the polarization mode is crucial for the possibility of torsion production). The standard procedure of Fourier transform provides the following solution of eq. (10):

$$\varphi (x, t) = - \frac{2}{3} \frac{G\alpha}{c^2} \frac{A_1 A_2}{\omega_1 \omega_2} \exp [i (k_2 y + k_2 z - \omega_1 t - \omega_2 t)] . \tag{15}$$

The torsion potential is then a monochromatic scalar wave,

$$\varphi = A \exp [i(\mathbf{k} \bullet \mathbf{x} - \omega t)] \tag{16}$$

with a frequency $\omega = \omega_1, + \omega_2$, a propagation vector $\mathbf{k} = (0, k_1, k_2)$, and an amplitude $A = (2G\alpha A_1 A_2 / 3c^2 \omega_1 \omega_2)$. The torsion wave propagates then in the (y, z)-plane at an angle δ with the y-axis,

$$\delta = \text{arctg } k_1 / k_2 = \text{arctg } \omega_1 \omega_2 \tag{17}$$

and the space filled with EM radiation behaves like a dispersive medium for the propagation of torsion, according to the following dispersion relation,

$$\omega(k) = ck(1 + 2\omega_1 \omega_2 / c^2 k^2)^{1/2} . \tag{18}$$

CONSIDERATIONS FOR REALIZATION OF THE MODEL

With the above theoretical model, it would appear that the generation of a classical electromagnetic wave with the property, $\mathbf{E} \bullet \mathbf{B} \neq 0$, can provide a coupling to torsion fields. However, the realization of this proposed model, utilizing 2 laser beams at right angles, for instance, in a laboratory setting is problematical chiefly because the model described is ideal. We have failed to consider the factor of the refractive index of the medium which must be taken into account whenever we have a linearly polarized EM radiation propagating through another EM medium. A more realistic situation is to replace the 2nd plane wave with a static electric or magnetic field, which is different from zero and constant only in a restricted region [15]. The fact that Russian findings have established that any electrostatic field possesses two chiral torsion field components, justifies this proposition [9]. Just such a similar EM field configuration was a feature with the Hutchison lift and disruption effect, where inexplicable levitation and/or catastrophic fracturing occurred to various masses placed within the target area [16]. Here, the EM milieu included both RF effects from Tesla Coils, oscillators, radioactive sources, as well as electrostatic fields from Van de Graaff generators with toroidal/spherical capacitor terminals [16].

Perhaps it might be possible to obtain the torsion-coupling effect more readily with a single EM source. In this regard, similar unaccountable inertial anomalies occurred in conjunction with the Zinsser "kinetobaric effect", in which sharply pulsed microwave EM energy was applied to electrodes immersed in water [1]. According to our theoretical model, this would entail the generation of a field configuration in which $\mathbf{E} \bullet \mathbf{B} \neq 0$. While such a field relation is

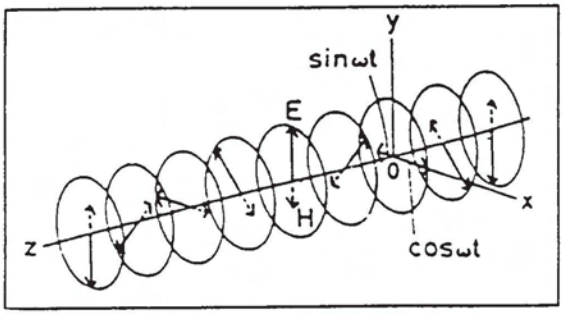

Figure 1a. Helical distribution of linearly oscillating parallel electric and magnetic fields shown by solid and broken arrows, respectively.

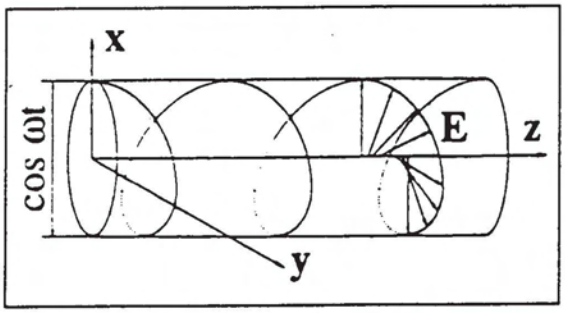

Figure 1b. Electric field distribution of a helicoidally polarized standing wave. The magnetic field B (not shown) is parallel to E and oscillates in time in quadrature with E.

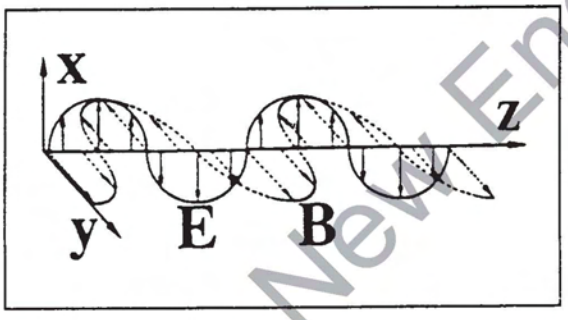

Figure 1c. Electric (solid line) and magnetic (dashed line) field distributions of a linearly polarized standing wave.

counter to all standard single transverse EM waves (TEM) in which **E** • **B** = 0, nevertheless recently classical TEM waves in which the **E** and **B** vectors are parallel (**E** • **B** ≠ 0), have been theoretically predicted [17], disputed [18], and subsequently shown to exist [19]. These waves are quite unique in structure. First of all it was found for one representation of this wave type, the magnetic vector potential (**A**) satisfies a so-called Beltrami vector field equation (e.g., curl**A** = k**A**, where k is a pseudo-scalar). Such vortical type vector fields are fascinating in their own right and are currently being studied for novel applications in many areas of science [20]. At any rate, besides this geometric feature, or possibly because of it, **E** and **B** waves possess a specialized topology which describes a helical standing (or more accurately - stationary) wave. Consequently, every plane wave solution corresponds to two circularly polarized waves propagating opposite to each other and combining to form the helical stationary wave. It is appropriately termed "stationary" since this wave does not possess the standard non-zero Poynting power flow feature of standard TEM waves with **E** • **B**, but propagates magnetic helicity. Magnetic helicity is purely a topological feature of fluid-like systems and appears often associated with non-linear aspects of high-density plasmas [21], and turbulent fluid motion [22]. The geometry of this wave is shown in Fig. 1a, b. In comparison Fig 1c is a depiction of a linearly-polarized standing wave with perpendicular **E** and **B** vectors. Notice that the helically-polarized stationary wave is composed of electric and magnetic fields distributed along a spatially constant amplitude helix. Also, unlike the linearly-polarized wave the TEM wave with **E** // **B** exhibits no nodes. In this regard, the latter wave traces out in space and time a configuration which is identical to the plane surface of minimal area known as the helicoid. See Fig. 2 for a picture of this surface. This unique field configuration has been experimentally realized in the "twisted mode" technique for obtaining uniform energy density in a laser cavity [23, 24]. Figs. 3, 4, 5, 6 show different experimental arrangements to produce the **E** // **B** stationary wave. Those with such apparatus are urged to experiment further.

TOPOLOGICAL CONSIDERATIONS FOR EM WAVES WITH E • B ≠ 0

Artificial electromagnetic coupling to torsion fields, with accompanying excitation of the vacuum and extraction of useful energy in the process, can thus possibly only be accomplished by the generation of specially crafted EM waves exhibiting multiply-connected soliton-like topology and possessing the key relation, **E** • **B** ≠ 0.

Although they have been little studied, empirical classical electromagnetic structures displaying the features of closed, finite-energy wave-packets have appeared in recent history dating from Tesla's research. Particularly, in the waning years of the 20th century, with the development of high-power plasma generating devices in conjunction with fusion research, and high-intensity lasers whose operation can only be described with the aid of vacuum

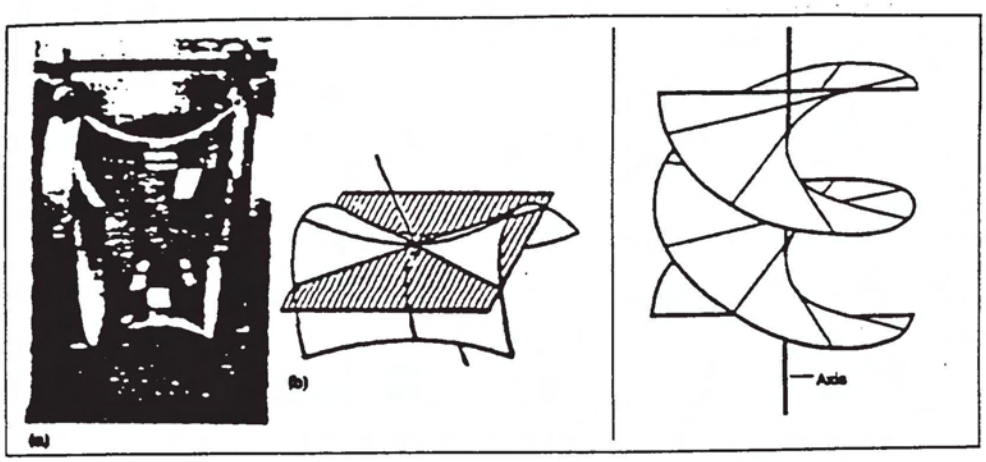

Figure 2a. Soap films as minimal surfaces

Figure 2b. Generation of helicoid

polarization phenomena predicted by quantum field theory, evidence continues to surface which clearly demonstrates inaccuracies from the linear Maxwell theory in the classical arena when extremely high energy intensities are involved. As case in point, the existence of EM soliton singularities has been demonstrated in recent years with Shoulders' discovery of condensed charge-cluster EV units [25], and the important but overlooked observation of closed spark loops in high-voltage electrostatic discharges at the Holifield Heavy Ion Research Facility at Oak Ridge National Laboratory [26, 27, 28]. In the latter case, below 10 MV (mega-volts) the discharges resemble those of normal forked lightning. However, above this threshold, the discharges topology changes dramatically. Here, at peak machine voltage (@20 MV), these structures have been ascertained as genuine multiply-connected closed-loop configurations, and not the accidental visual superposition of simply-connected spiral discharges [26]. Traditionally, Maxwell's linear theory is supposed to subsume all exhibits of classical electrodynamics, regardless of the level of energy- or charge-density of the field. However, the new spark discharge evidence and the Shoulders' research both indicate that there may actually exist, hitherto unsuspected, separate regimes of classical electrodynamics in high energy-density plasmas, demarcated by a voltage phase transition [28]. Above this barrier of potential, finite closed energy wave-structures may exist which cannot be codified by the linear Maxwell-field theory. Theoretical justification for the existence of classical EM wave packets has been examined in the key research by Barrett in which higher symmetry groups utilizing non-Abelian quaternion algebra (SU(2) Yang-Mills fields) are invoked, implying a non-Abelian extension of Maxwell's equations [29]. This topic has been treated by the present author elsewhere where a toroidal model is speculated on for both the Shoulders' charge-cluster units and the closed spark loops [30].

However, for purposes in the present exposition the author wishes to emphasize that the EM field structure obeying the relation $\mathbf{E} \bullet \mathbf{B} \neq 0$, in contrast to the latter experiments, can be generated with relatively small energy input [24]. Moreover, Kiehn has shown that the proper description of the characteristics and dynamics of classical EM waves with $\mathbf{E} \bullet \mathbf{B} \neq 0$ satisfying Maxwell's equations, require the use of the topological postulates expressed in terms of Cartan's theory of differential forms [31]. We will explore the major implications of his key conclusions for our needs here, and refer the reader to [32] for the details.

According to the Cartan exterior differential system, several topological equivalence classes can be constructed, starting with the covariant 1-form (A):

TOPOLOGICAL ACTION	$A =$	$A_\mu DX^\mu$	
TOPOLOGICAL VORTICITY	$F = dA$	$= F_{\mu\nu}\, dx^\mu \wedge dx^\nu$	
TOPOLOGICAL TORSION	$H = A^{dA}$	$= H_{\mu\nu\rho}\, dx^\mu \wedge dx^\nu \wedge dx^\rho$	(19)
TOPOLOGICAL PARITY	$K = dA^{dA}$	$= K_{\mu\nu\rho\sigma}\, dx^\mu \wedge dx^\nu \wedge dx^\rho \wedge dx^\sigma$	

One should not that these classes can be applied to any continuous smooth vector field such as those in classical hydrodynamics and electrodynamics. For the system of classical electrodynamics we have;

$$A = A_x dx + A_y dy + A_z dz - \Phi dt = A \bullet dr - \Phi dt\,. \qquad (20)$$

where A is the magnetic vector potential, and Φ is the scalar potential. The exterior derivative of this 1-form (A) generates the 2-form (F) of electromagnetic field intensities (**E, B**) :

$$F = dA = \mathbf{B}_z\, dx^{dy} + \mathbf{B}_x\, dy^{dz} + \mathbf{B}_y\, dz^{dx} + \mathbf{E}_x\, dx^{dt} + \mathbf{E}_y\, dy^{dt} + \mathbf{E}_z\, dz^{dt}\,, \tag{21}$$

The exterior derivative of (F) vanishes if the potential functions are C^2 differentiable: dd A = dF = 0, which implies in standard engineering notation:

$$curl\, \mathbf{E} + \partial \mathbf{B} / \partial t = 0\,, \quad div\, \mathbf{B} = 0 \tag{22}$$

Note that this derivation of two of the four Maxwell vectorial equations is based upon a topological statement about limit points [33], and does not depend upon geometrical considerations of metric or connection on a vector bundle.

Now, on the domain {x, y, z, t}, the 3-form of topological torsion (A^{dA}) has the general representation of an axial current four-vector ($H_{\mu\nu\rho}$) - a covariant tensor field of 3rd rank, whose 4 components have a vector part (**T**), the torsion current, and a pseudo scalar helicity density (h). In engineering language:

$$\mathbf{T} = \mathbf{E} \times \mathbf{A} + \Phi \mathbf{B}, \quad h = \mathbf{A} \bullet \mathbf{B}. \tag{23}$$

Finally, the 4-form of topological parity in an electromagnetic context, is constructed through taking the exterior derivative (total divergence) of the torsion current 3-form,

$$dA^{dA} = -2\,(\mathbf{E} \bullet \mathbf{B})\, dx^{dy \wedge dz \wedge dt} = (div\, \mathbf{T} + \partial h / \partial t)\, dx^{dy \wedge dz \wedge dt}. \tag{24}$$

A major result of this system dynamics, with important physical consequences in describing evolutionary processes in any context (hydrodynamics or electrodynamics), is the demonstration that the Cartan topology is not necessarily a connected topology unless the property of the topological torsion 3-form (A^{dA}) vanishes. In the specific application of electrodynamics, if the induced Cartan topology is connected ($A^{dA} = 0$), then the associated gauge theories involve flux quanta. However, if the induced Cartan topology is not connected, then the gauge theories involve torsion and helicity as well as flux quanta. Accordingly, when the potential 1-form has domains of {x, y, z, t} where $\mathbf{E} \bullet \mathbf{B} \neq = 0$, Pfaff dimension is 4, and the space supports a symplectic non-compact irreducibly 4-dimensional manifold. On this 4-D manifold the 4-divergence of the torsion (eq. 24) does not vanish. On domains where the Pfaff dimension if 3 (and not 4) there exists a 3-dimensional period integral related tot he Hopf index: $\int\int\int A^{dA}$. If the domain has Pfaff dimension 3, then evolutionary processes in the direction of the electromagnetic charge-current four-vector (J) leave the integral of topological torsion over a 3-D boundary as an evolutionary invariant. Moreover, if the Pfaff dimension is irreducibly of 3 or more, there can exist electromagnetic domains for which the magnetic field (**B**) is also irreducibly 3-dimensional. Consequently, there can exist propagation modes for such fields in which the magnetic field must have a longitudinal component.

In these domains energy transport also has a topological significance. For a standard Lorentz vacuum, the rate of energy flow in an EM field is the speed of light. However, as Keihn shows using Cartan's topological system, for a wave with $\mathbf{E} \bullet \mathbf{B} \neq 0$, the topology is not connected (e.g., there are soliton solutions) and the speed of energy flow can be less than light speed. In this case, the normal 4-fold degeneracy characteristic of the Lorentz vacuum is lifted. In fact, due to non-vanishing helicity-torsion transport for the EM field with $\mathbf{E} \bullet \mathbf{B} \neq 0$, the four-vector potential cannot be described by less than 4 linearly independent functions over the space-time domain. Much like the Barrett findings [29] (quaternion) functions. This can be put into correspondence with 4 different helical solutions to Maxwell's equations, two right-handed modes propagating with different phase velocities in opposite directions, and two lift-handed modes propagating in opposite directions with two other distinctly different phase velocities. These four-modes solutions have been observed empirically in ring-laser experiments by Sanders in 1977 [34]. Moreover, unlike customary plane EM waves, these solution violate both time-reversal and parity invariance.

In 1915 Bateman also introduced a number of interesting solutions to Maxwell's equation that, much like Kiehn's 4-mode field structures, emulate propagating singular filamentary strings (not plane waves) [35]. Also, it was Bateman who determined in 1910 that the Maxwell equations were invariant with respect to the conformal group, a much wider

group than the Lorentz transformations. Bateman also recognized the relationship of his work to the tensor calculus Ricci and Live-Cevita, several years before the development of general relativity.

An even more astounding conclusion of Kiehn follows from introducing the constitutive relations between the electromagnetic field intensities (**E, B**) and the field excitations (**D, H**) of the vacuum:

where ϵ_0 and μ_0 are constant and γ can be complex.

Unfortunately, space prevents further development of these fascinating ideas. Nevertheless, the following points can be made which have pertinence to the current exposition. When $\gamma = 0$, the Lorentz vacuum dominates and the propagation velocity in singular, of 4-fold degenerate light speed. However, if $\gamma \neq 0$ we then have the ability of the aforementioned 4-mode waves to couple to a chiral vacuum structure, forming soliton fields exhibiting a non-connected Cartan topology [36].

In general vector fields, where the parity 4-form coefficient $\mathbf{K}_{\mu\rho\sigma} \neq 0$ (eq. 19), there exist important topological 3-dimensional period integrals of the 3-form torsion current, representing global objects which are invariants of the evolutionary process, whatever its source. These cyclic 3-dimensional integrals which are non-zero, have values proportional to the integers, and possibly represent the basis for a topological quantum theory that is independent of scale. Theoretically, these vortices appear only in discontinuous jumps like a formation of holes in a piece of paper by a puncture process. In terms of a general manifold of arbitrary dimension, they could be considered as 3-dimensional soliton "punctures" in space-time. Thus, these unique waves most likely have a higher dimensional origin, supporting the observations made recently by King [37].

As Kiehn points out, these unique field dynamics in an electromagnetic context also entail a variation in free-space vacuum impedance. Thus, perhaps there is a key hitherto unnoticed connection between electromagnetism, the vacuum impedance of free space, and the inherently chiral (possibly higher dimensional) torsion field structure [8]. Certainly, the significance of the non-zero value of $\mathbf{E} \bullet \mathbf{B}$, which we have repeatedly observed as a continuing thread in both the contexts of torsion fields and in higher topological electromagnetic structures that have been empirically demonstrated, may provide a clue towards the certification of this link. In the next section we examine established torsion field characteristics, as well as other speculated ones, that might indicate signatures of EM-torsion field coupling.

POSSIBLE EFFECTS OF TORSION WAVE COUPLING

One major characteristic of torsion fields is their unique ability to leave a "ghost-field" imprint on the polarized vacuum of space once the original excitation has been removed [9]. Experimenters should check for this property with $\mathbf{E} \,//\, \mathbf{B}$ waves. Secondly, it is speculated that torsion fields from the polarized vacuum can interact with the inertial fields of masses [4]. Recently, support for this hypothesis has been given by Puthoff et al., demonstrating theoretically that the property of inertia might not be an inherent property of matter, but a derivative property of the fluctuating zero-point EM energy vacuum fields of nature [35]. If proven, this thesis could provide an explanation for the Zinsser kinetobaric effect and Hutchison's lift and disruption phenomena as well. Also, since the torsion potential of our model is a function of the gravitational constant (eq. (10)), one could, in addition, possibly expect to observe a distortion in either gravitational potential or pace of time in the proximity of a torsion ray or beam. A similar effect was noted by W. Smith as an adjunct to the energy production in his caduceus-wound coils [39]. A noticeable change in the half-life of a radioactive substance or alteration in the mass of an object could provide such a test. Since the torsion field produces the attraction of like charged fields [4], this unique property could provide an explanation for the formation and persistence of Shoulders' charge-cluster units in which the Coulomb barrier is broached [40]. Moreover, if the charge-cluster units are a solitonic product of torsion coupling, then torsion fields represent a quantized vacuum impedance having a definite speed, direction, and spin (chirality), which

$$\left| \begin{matrix} \mathbf{D} \\ \mathbf{H} \end{matrix} \right\rangle = \begin{bmatrix} \epsilon_0 & 0 & 0 & \gamma & 0 & 0 \\ 0 & \epsilon_0 & 0 & 0 & \gamma & 0 \\ 0 & 0 & \epsilon_0 & 0 & 0 & \gamma \\ \gamma^\dagger & 0 & 0 & 1/\mu_0 & 0 & 0 \\ 0 & \gamma^\dagger & 0 & 0 & 1/\mu_0 & 0 \\ 0 & 0 & \gamma^\dagger & 0 & 0 & 1/\mu_0 \end{bmatrix} \circ \left| \begin{matrix} \mathbf{E} \\ \mathbf{B} \end{matrix} \right\rangle$$

can be topologically structured by specific electromagnetic geometries [29], or high-intensity, abrupt, spark discharges [26].

CONCLUSION

The recent Russian research findings on torsion fields holds promise for providing the connecting link between different modes of microscopic vacuum polarization and the known macroscopic physical forces of nature. For instance, there is preliminary evidence to suggest that a more comprehensive understanding might be forthcoming regarding the dynamics of electromagnetic fields at a more fundamental level of nature and their mode of interaction with the vacuum, which obviates the necessity for a quantum mechanical treatment. However, such research is merely in its infancy. Consequently, the associated ideas examined in this paper should be taken as preliminary and far from definitive. Perhaps with appropriate future experimental corroboration, amplification, clarification, and refinement, these ideas can then be integrated formally into theoretical and empirical science.

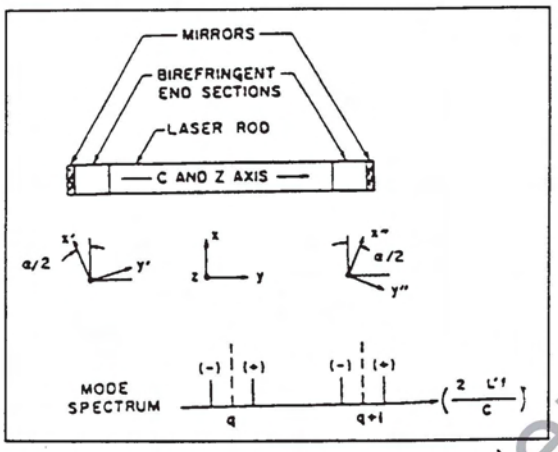

Figure 3. Consttruction and mode spectrum of a "twisted-mode" laser resonator

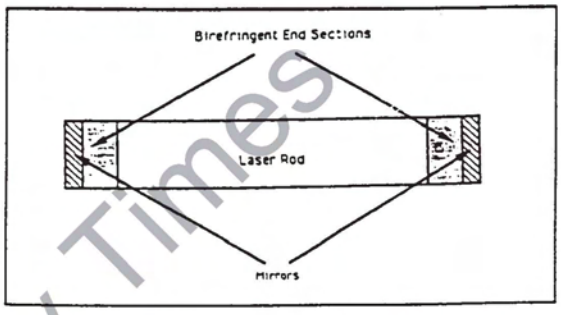

Figure 4. The configuration of aruby laser proposed by Evtuhov and Siegman [1965] which realizes *E//B* TEMSW

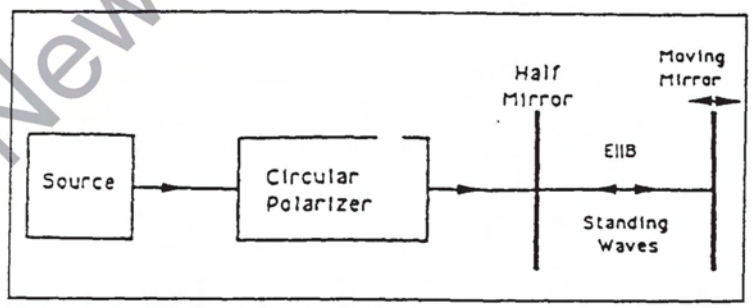

Figure 5. Schematic diagram of an experimental configuration that generates and E//B TEM standing wave pattern

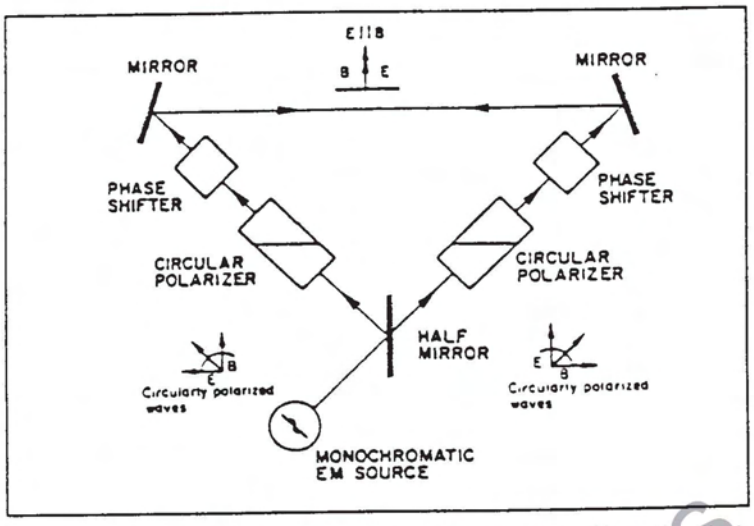

Figure 6. Schematic diagram of an experimental configuration that generates an E//B TEM standing-wave pattern

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METANALYSIS OF RESEARCH AND DEVELOPMENT IN COLD FUSION

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Since the announcement of the discovery of cold fusion (CF) in March 1989, we have reported on CF, nuclear science and engineering, as it has been replicated and demonstrated, and expanded, in laboratories in over thirty countries [1,2]. This considerable effort by the scientific community has resulted in a massive and developing volume of cold fusion papers; many published in peer-reviewed journals, and others presented at technical conferences or published in technical publications (Fig. 1). Much discussion has been made about the quantity and quality of the scientific CF literature. A number of reports cite a good, but limited, set of selected papers [5], of which skeptics of this new science often use to incorrectly claim the publication rate is decreasing because of an alleged failure to reproduce the CF effects. Previously we reviewed this matter and demonstrated that this is more complicated based upon our metanalysis of the CF literature which comes closer to the entire CF data base [4,5]. We now continue our metanalysis of the literature by focusing on scientific research and developments in cold fusion.

We have analyzed aspects of this steady increase in scientific papers output in this field, and have analyzed the CF efforts, selected for scientific (experimental or theoretical papers) basis, and sorted by country, and state[4]. The annual rate of published articles in CF continues unabated in this field (mean 227 papers/year; range 100-400). The main countries contributing to cold fusion scientific effort are Japan (110,343), United States (86,930), Russia (52,198), India (28,71), Italy (13,108), France (11,41) and China (10,81), where the numbers indicate the CF experimental paper output in 1995-1996 and the cumulative scientific CF paper output from 1989 through 1996 including theoretical and peripheral papers. Although the United States leads with more than 900 articles published, Japan with a third of this amount has a greater number of experimental articles published (110 vs. 86 in the 1995-1996 time period). Most of the recent experimental efforts in the United States has occurred in California (30,108), Texas (17,61), Massachusetts (6,28), New Mexico (6,33), Pennsylvania (4,9), Florida (3,6), Minnesota (3,7) and Utah (3,64).

In summary, despite an unprecedented reluctance on the part of many peer-reviewed journals to publish cold fusion articles, the appearance of peer-reviewed publications in the field continues, although it is down from the 1989-1990 peak, there may be a second peak since '95. However, we have shown the appearance of time delays in this data which is an alternate interpretation at this time [4].

One important result of this analysis is that it appears that although the severe skepticism in the US has severely decreased the scientific publication rate in the CF field, the worldwide publication rate has taken up the slack and continues unabated, possibly increased in '95-96 compared with previous years (Fig. 1). Another result is that this study corroborates the previous reports4,5 which heralded that the some interpretations of the CF data set based upon subsets of the published CF papers[3] (and those papers citing that data) may have errors, including the claim that there is an "exponential decrease" in the number of CF papers.

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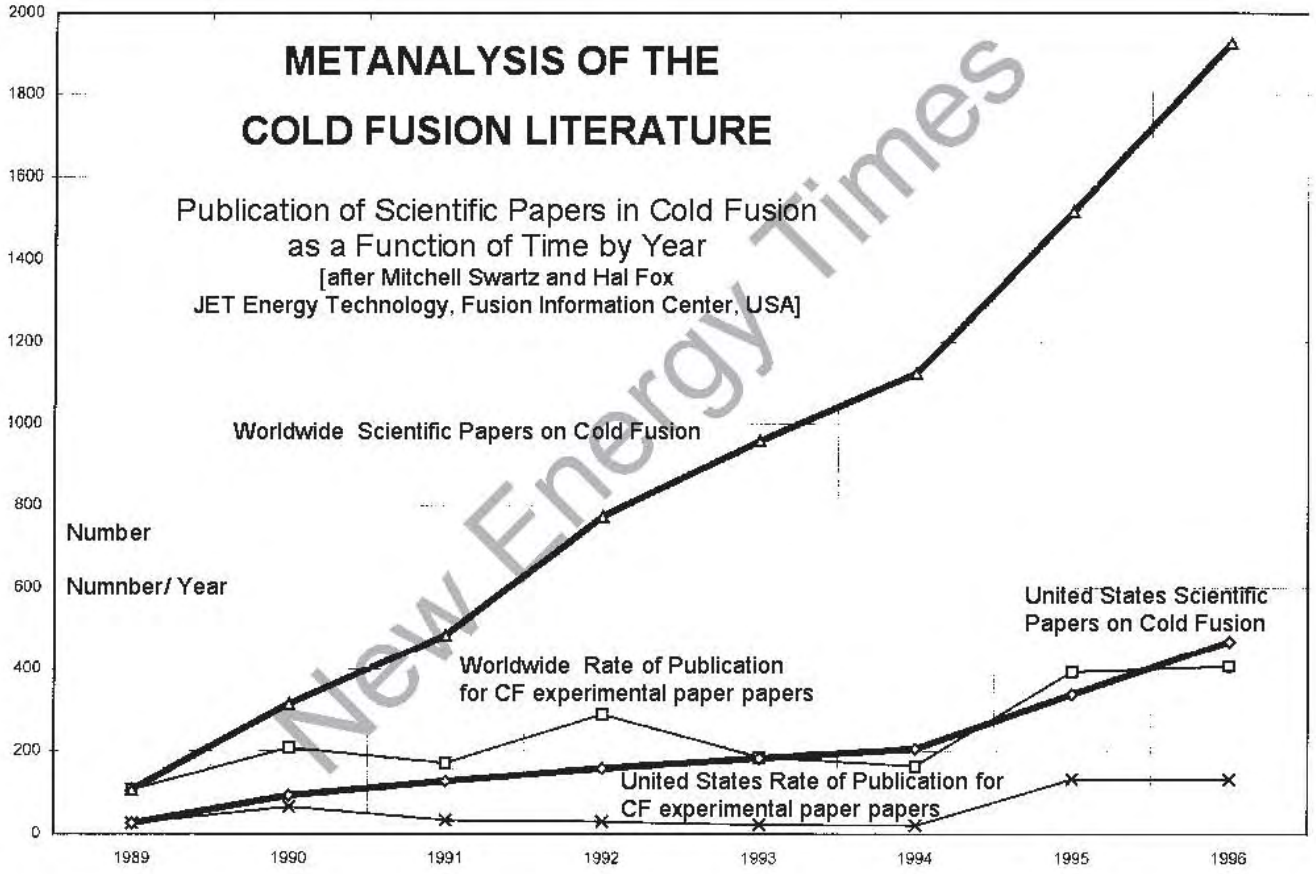

EDITOR'S CHOICE

ON PLANETARY MOTION CAUSED BY SOLAR SPACE-VORTEX

Paramahamsa Tewari, B.Sc.Engg. [1]

INTRODUCTION

René Descartes, in the 17th century (before the formulation of mechanics by Newton), had postulated Vortex Theory, which explained motion of the planets in elliptical orbits around the Sun due to the eternal existence in space of a fluid matter, aether, that as a vortex with the Sun at its center, moved the planets. He also proposed, on similar lines, that the satellites were propelled around their parent planets, which too have *aether circulation* around them; and the aether surrounding the Sun and the planets had no *relative motion* with respect to these cosmic bodies.

Near the end of the seventeenth century (1689), Leibniz too believed that the planets are moved by their aethers, and had proved that such a motion will lead to Kepler's third law, as per which, the area swept by the radius drawn from the center of circulation to the planet will be proportional to the time elapsed. In 1673, Huygens stated that a body, in uniform circular motion, will experience a central force (centrifugal force) which is directly proportional to the square of the speed and inversely proportional to the radius of the circle. With the discovery of the electron by the close of the nineteenth century; knowledge on its *annihilation* with positron in the thirties of this century; quantitative values of mass and charge of electron; and the postulate of Einstein, at the start of this century, that speed of light is the *highest possible speed* in the universe; it had been possible (mid seventies) for the author to postulate *space vortex structure* for the electron, which shows further in this article that Huygens' *centrifugal force* is produced only when there is *relative motion* between the space and a body in circular motion. Therefore, the question arises whaether such a force will be exerted on the planets even if they have no *relative motion* with their surrounding space. And if the radial and outward centrifugal force on the planets does not exist, the centripetal force as gravitational attraction postulated by Newton becomes redundant in celestial mechanics. The following analysis shows that such, indeed, is the case for the motion of the planets and the satellites of the solar system and, therefore, will be generally applicable for all the cosmic bodies in the universe. Brief description that follows on the *nature of space, mass, charge* and *inertia* of electron will aid in providing proof to the above conclusion.

NATURE OF MASS

Taking the case of electron, which shows the property of *mass* as applied in Newtonian mechanics, it has been explained elsewhere [1,2,3] as to why the electron possesses *mass* and *inertia*. The structure of electron, Fig. 1, shows that it is neither a *point-mass* nor a *point-charge*, as presently believed. It has a *spherical-void* at its center, where *void* is defined as a *fieldless* and *energyless* zone, enclosed within a *spinning vortex of space*. The *space (absolute vacuum)* is postulated to be an *incompressible, homogeneous (continuous), non-viscous*, and *massless fluid* that has a limiting speed of flow at speed of light (c). The maximum speed of rotation of *space*, as shown in Fig. 1a, is at speed of light. The space-vortex, which itself is electron, has *dynamic stability* [1,2]. During the translation of electron *relative to space*, it is the *combined action of the void and the fluid space* that endows it with the property of momentum and inertia (discussed further). The electron, due to its central void, is subjected to an *inward pressure* from space (Fig. 1a) , which determines the gravitational field [1,2,3]. The equation for the *rest mass* of electron has been derived as:

$$m_e = (\text{volume of spherical void})\, c = (4\pi/3)\, r_e^3\, c \qquad (1)$$

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where m_e is the rest-mass of electron; r_e is the radius of the spherical void, and c is the speed of light relative to the medium of space. In CGSE system of units, it is shown [2,3] that a new unit or mass, mu, with cm^4/sec as its dimensions, can be shown to have relationship: gram = 7.8×10^6 mu (cm^4/s).

The *space* is the only entity of reality in the universe, and it follows from the postulates of the *Space Vortex Theory* (SVT) [1,2], that the electron is the *only fundamental particle* which is stable and can exist eternally, till it interacts with its own kind (positron) but *oppositely spinning vortex* relative to it, that leads to the phenomenon of annihilation. All stable particles of matter, including nuclei, atoms and cosmic bodies, are aggregates of electrons (conclusion from SVT), and hence are subjected to an *inward pressure* from space. With this structure of electron, gravity field is created in space at the time of creation of the electrons. The electron is not a *force-free* particle, and so also, all particles of matter, due to inward gravity pressure on them from space, are not *force-free* entities.

NATURE OF CHARGE

The electron (Fig.1b), due to the spin of space, which is termed as *velocity-field* around the central void, possesses electric charge, defined [1,2,3,] as

$$q_e = (\pi/4)\ (4\pi\ r_e^2)\ c \qquad (2)$$

where q_e is the charge of electron. In CGSE system of units, cm^3/s = esu, which is CGSE unit of charge. Depending upon the direction of spin of the particle, it can be termed as electron or positron, and *negative or positive* charge respectively [1,2].

A cosmic body, if it has circulation of space – that is, *velocity-field* around it – will develop electric-charge in direct proportion to its velocity-field. Thus all rotating cosmic bodies like the Sun and the planets (excluding Mercury) will have electric-charge due to their axial rotation.

SOLAR SPACE VORTEX

Refer to Fig.2 which shows the side view of the Sun (taken as spherical for simplicity of calculations) with radius Rs, and the Earth in the planetary plane which is transverse to the axis of the Sun. Consider an elemental-area dA on the rotating surface of the Sun such that

$$dA = 2\pi\ R_s \sin\theta\ Rs\ d\theta \qquad (3)$$

The period of the axial rotation of the Sun varies from 26 days at the equator to 37 days at the poles. Let the average angular velocity of rotation be ω. Then the tangential velocity at the elemental surface will be

$$V_s = \omega\ R_s \sin\theta \qquad (4)$$

where V_s is also the velocity-field of space in immediate vicinity of the surface and tangential to the elemental area dA.

Due to V_s at each point of space on dA, there will be an inward acceleration a_s, such that

$$a_s = V_s^2 / R_s \sin\theta. \qquad (5)$$

The product, dA a_s , will be

$$d\phi_s = (2\pi\ R_s^2 \sin\theta\ d\ \theta\ )\ (\omega\ R_s \sin\theta)^2 / R_s \sin\theta$$

where ϕ_s is defined as "*space acceleration flux.*"

Integrating for θ varying from 0 to π,

$$\phi_s = 2\pi R_s (\varpi R_s)^2 \int_0^{\pi} \sin^2 \theta \, d\theta = \pi^2 V_s^2 R_s , \quad (6)$$

where $V_s = \omega R_s \sin\theta$.

Assuming that ϕ_s, due to zero-viscosity of space, remains constant at any spherical space surface (Fig. 2) that is central with the Sun, from (6)

$$V_s^2 R_s = \phi_s / \pi^2 = \text{constant}$$

or

$$V_s \propto 1/\sqrt{Rs} \quad (7)$$

From (7), and the constancy of ϕ_s mentioned above, *velocity-field of space* (V_f), at any point within the solar vortex, distant r in the planetary plane (equatorial plane of the Sun), will be given by

$$V_f = k / \sqrt{r} \quad (8)$$

where k is a constant pertaining to solar space-vortex.

Eq.8, derived from the *spacedynamics* of the solar system, can be derived from Kepler's third law on planetary motion as follows:

$$T^2 \propto r^3 \quad (9)$$

where T is the period of any planet, and r is the mean distance of the planet from the Sun.
Substituting $T = 2\pi r / V$, where, V, is the orbital velocity of the planet, we get

$$(2\pi r / V)^2 \propto r^3$$

or

$$V \propto 1 / \sqrt{r} \quad (10)$$

which is similar to Eq.8, as per which the velocity-field of space within the solar vortex also falls in inverse proportion to the square root of the distance, just as it is the case with the planets [10]. Therefore, conclusion can be drawn that the solar space-vortex moves the planets at its own circulating motion provided the properties of the Sun and the planets, like gravity field and electric-charge, can be derived from it through methods independent of Newton's equations on gravitation and celestial mechanics as shown below.

SUN'S GRAVITY FIELD

Consider the innermost planet of the solar system, mercury, which has orbital speed of 47.9km/s, and its mean distance from the Sun is 57.9 x 10 km. If V is its orbital speed, and r, the distance form the Sun, from (8),

$$V \sqrt{r} = k \quad (11)$$

or

$$k = 47.9 \times 10^3 \text{ m/s } \sqrt{57.9 \times 10^9 \text{ m}} = 11.52 \times 10^9 \text{ m}^{3/2}/\text{s}, \quad (12)$$

where k is a constant described before.

The tangential V_f in the Sun's equatorial-plane in close vicinity of its periphery where the radius $R_s = 6.96 \times 10^8$ m, from (7) and (8) will be

$$V_s = k / \sqrt{R_s} \quad (13)$$

Substituting the value of k from (10), and R_s from above, we get

$$V_s = (11.52 \times 10^9 / \sqrt{6.96 \times 10^8})\ m/s = 4.367 \times 10^5\ m/s. \quad (14)$$

In the equatorial plane on the periphery of the sun, the velocity field, Vs , will create an inward acceleration field, V_s^2 / R_s, which from (12) is

$$a_s = (4.367 \times 10^5)^2 / 6.96 \times 10^8)\ m/s^2 = 274\ m/s^2$$

which happens to be exactly equal to the presently accepted value of the gravity field of the Sun, that is, 274 m/s^2. It is, therefore, concluded that the *gravity field of the Sun is determined by the inward acceleration field created in the vicinity of its surface due to space circulation around it.*

EARTH'S GRAVITY FIELD

Consider the motion of the Moon around the Earth at the orbital speed of 1017 m/s (derived from the orbital period: 27.3 days; orbital radius: 3.82 x 10 km). From (8),

$$V_m \propto 1/\sqrt{r} = k/\sqrt{r}, \quad (15)$$

where V_m is the orbital speed of the Moon, r is its distance from the Earth, and k is a constant pertaining to the Earth's space-vortex. Substituting the values from above

$$k = 1017\ m/s \times (\sqrt{3.82 \times 10^8\ m})^{1/2} = 1.987 \times 10^7\ m^{3/2}/s. \quad (16)$$

With the above value of k and from (8), the *tangential velocity of space* in the equatorial plane of the Earth in immediate vicinity of its periphery, will be

$$V_f = (1.987 \times 10^7 / \sqrt{6.37 \times 10^6})\ m/s = 7.8 \times 10^3\ m/s.$$

There exists a *velocity-field* due to *space circulation* at the periphery of the Earth and in the equatorial plane; it will produce an *inward acceleration field* given by

$$a_e = V_f^2 / R_e, \quad (17)$$

where R_e is the radius of the Earth. Substituting the values from above

$$a_e = (7.8 \times 10^3)^2 / 6.37 \times 10^6)\ m/s^2 = 9.55\ m/s^2$$

against the presently accepted value of the gravity field of the Earth which is: 9.83 m/s^2.

GRAVITY FIELD OF MARS AND OTHER PLANETS

The satellite of Mars , Phobos, completes one orbital revolution in 7 hours and 19 minutes, that is, 26340 sec. The orbital radius r_p being 9400 km, the orbital speed V_p will be, 2.241km /s. Similar to Eq.13,

$$V_p = k_p / \sqrt{r_p}.$$

Substituting the values from above,

$$k_p = 2241 \sqrt{9.4 \times 10^6} = 6.8 \times 10^6\ m^{3/2}/s.$$

With the equatorial radius of Mars R_p = 3395 km, the velocity field of space-vortex around Mars will be

$$V_f = k_p / \sqrt{R_p} = 6.8 \times 10^6 / \sqrt{3.39 \times 10^6} = 3720\ m/s.$$

Gravity field on Mars = $(V_f)^2/R_p = (3720)^2 / 3395 \times 10^3 = 407$ cm / s^2, against the presently accepted value of 372 cm / s^2. Similarly, the gravity fields of other planets derived from their respective space-vortices are: Jupiter 24.5 m/s^2, Saturn 10.4 m/s^2, Uranus 8.9m/s^2, Neptune 11.02 m/s^2 . The presently accepted values are: Jupiter 22.9 m/s^2, Saturn 9.05 m/s^2, Uranus 7.77 m/s^2, Neptune 11 m/s^2, that are quite close to the above computed values. *The derivation of the gravity fields of the sun and the planets without the use of Newton's equation provides a positive proof of the real existence of the space- vortices around the stars and the planets*.

SOLAR CHARGE

The electric charge of electron from Eq.2 is proportional to the product of the space-surface around the central void and the *spin-velocity c*. Similarly, it is supposed that the Sun will develop electric-charge on its surface on account of axial rotation. The surface of the Sun possesses tangential velocity, V_t: 1.945 km/s, at its periphery in the equatorial plane. The solar charge Q will be given by

$$Q = (\pi/4)\, 4\pi R_s^2 V_t = (\pi/4)\, 4\pi (6.96 \times 10^{10})^2 \times 1.945 \times 10^5 \text{ cm/s} = 0.928 \times 10^{28} \text{ esu}, \qquad (18)$$

where cm^3/s = esu, in CGSE system. The value of the solar-charge derived above is very close to the presently accepted value of 10^{28} esu.

AXIAL ROTATION OF THE EARTH

In Fig.3, the space-vortex encircling the Earth within the solar space-vortex is shown. The velocity-field in the equatorial plane around the Earth earlier computed as 7.8 km/s, will exist in the higher layers of atmosphere (ionosphere) making the same electrically charged, and imparting momentum to the ionized particles to move them at high speeds. The terrestrial atmosphere reduces the velocity-field to about half a kilometer/s, at which the surface of the Earth is rotated by the space-vortex. *There is no relative motion between the medium of space and the Earth's surface, though there is gradient of velocity-field that gives rise to electric potential-gradient in clear weather, varying from 150 to 550 volt/meter vertically up in the atmosphere.* Beyond the ionosphere, the velocity-field falls inversely as the square- root of the distance from the center of the Earth, as stated earlier.

ORBITAL STABILITY OF THE PLANETS

In Fig.4a, the Earth is shown within the velocity-field of solar space-vortex, while its own velocity-field due to space circulation around it, is shown in Fig.4b. The superposition of the velocity-fields within the larger solar vortex, changes the pattern of the streamlines that are shown in Fig.4c. Eq.11 implies that the product of the velocity-field at any space-point in the solar space-vortex and the square root of its distance from the sun center, is a constant quantity. Since the velocity-field on the nearer side of the Earth has decreased, it (Earth) should move farther from the Sun experiencing an outward repulsive force in view of the above constancy. Similarly, on the farther side of the Earth, due to increase in velocity field, it should move closer to the Sun to satisfy (11), and thus should experience an inward attractive force as a reaction of the outward repulsive force. The equal and opposite forces, required for the above radial movements of the Earth are electrical in nature (discussed below); and are produced by the interaction of the velocity-fields of the two space-vortices. The Earth is dynamically stable with regard to the above forces acting on it. The movement of the Earth in elliptical orbit is due to the tangential force by the velocity-field on each point of its orbit as further shown in this article. All planets with axial rotation will have similar forces for planetary stability such that there is no resultant radial force on them. For more rigorous calculations, the inclination of the planet's axis of spin (at right angles to which, in the diametrical plane, its space-vortex exists), with the solar space-vortex in the diametrical plane of the Sun, will have to be taken into consideration, since the interactions between these two vortices may tilt the planet, that are smaller in mass, to produce just the required amount of repulsive force for the stability of the planet in the orbit.

ELECTRICAL FORCE OF REPULSION BETWEEN THE SUN AND THE EARTH

The electrical charge of the Sun was computed in Eq.18. Similarly, the charge of the Earth Q_e can be determined as:

$$Q_e = (\pi/4)\ (4\pi R_e^2)\ V_t\ , \tag{19}$$

where , V_t is the tangential velocity of space (peripheral velocity in the equatorial plane) at its periphery. With Re = 6.37 x10^8 cm , and V_t = 0.464 x 10^5 cm /s, substituted in (19),

$$Q_e = 1.85 \times 10^{23} \text{ esu.} \tag{20}$$

The electrical force of repulsion [2] between the Sun and the Earth, due to their axial rotation being in the same direction, and hence producing the same kind of charge, will be given by

$$F = (c/4\pi)\ Q_s\ Q_e / r^2, \tag{21}$$

where r is the distance between the Sun and the Earth. Substituting the values from (18) and (20), and putting r = 150 x 10^{11} cm in Eq.21,

$$F = (3 \times 10^{10} / 4\pi)\ (0.928 \times 10^{28})\ (1.85 \times 10^{23}) / (150 \times 10^{11})^2$$

$$= 2.33 \times 10^{27} \text{ dyne.} \tag{22}$$

As stated earlier, electrical forces of outward repulsion and inward attraction, produced on account of unequal strength of velocity-fields on the farther and the nearer side of the Earth (relative to Sun), are equal and opposite, thus making the planet dynamically stable.

The calculation made with Newton's equation on gravitational attraction between the Sun and the Earth gives

$$F = 3.52 \times 10^{27} \text{ dyne,} \tag{23}$$

which is one and a half times larger than the electrical repulsion (22) and would, therefore, lead to the instability of the planet in the orbit by forcing the Earth towards the Sun. Further, the outward centrifugal force on the Earth does not exist (shown below) to oppose the above gravitational force (23) as postulated by Newton.

ORIGIN OF CENTRIFUGAL FORCE, AND INERTIA

In Fig.5 the spherical void at electron center is shown moving *relative to space* at uniform velocity v. Due to the existence of the field-less void as earlier stated, the electron is subjected to an inward *pressure* from space, shown as "p" in Fig.5a. The space-vortex of electrons is not shown in this figure since the velocity-field of the vortex of electron does not contribute to the properties of inertia and momentum as shown below. At point A at the interface, space is displaced horizontally at velocity v against the pressure p. While the radial component of the velocity-field at the *front* of the moving void indicates the velocity of the displacement of space; similar component at the *rear*, gives the *in-flow velocity* of space into the cavity left (Fig.5c) due to the motion of the void. Therefore, as regards the contribution to the *work done* in displacing space and moving the void against the space-pressure is concerned, the velocity-component, v cos θ at the front, gets canceled with the similar component at the rear. The tangential component v sin θ however, remains as a resultant velocity-field.

The Fig.5b shows an elemental volume $dV = \pi r_e^2 \sin^2\theta\ r_e\ d\theta$, which displaces space at velocity v sin θ, as earlier stated. From *mass- equation* (Eq.1), in which the product of the *void-volume* and *speed of light* is defined as *mass*, the elemental volume will have mass, c dV, and momentum,

$$dP = (c\ dV)\ v \sin\theta = c\ \pi\ v\ r_e^3 \sin^3\theta\ d\theta\ .$$

Integrating for θ varying from 0 to π,

$$\int dP = \int_0^{\pi} \pi c v r_e^3 \sin^3\theta \, d\theta = (4\pi/3) r_e^3 c v,$$

which from Eq.1 becomes:

$$P = m_e v. \quad (24)$$

In the above analysis, it was the *relative motion* between the electron-void and the medium of space that created the velocity, v sin θ, which produced momentum as derived above (24). Force was initially required to move the void against the space-pressure, however, the velocity-field created initially, due to zero-viscosity of space, carries forward the void. Since all the material particles and bodies must necessarily be built of electrons [1,2], the above derivation for the momentum and inertia are applicable in general. The property of inertia arises due to the fact that: (a) matter has void-content, (b) space exerts pressure on matter, (c) the medium of space is a non-viscous fluid.

The planets and the satellites are carried by their respective space-vortices, and hence there is no relative motion between their surfaces and the surrounding medium of space. It is therefore that the cosmic bodies orbiting around their respective primaries can not have outward centrifugal force acting on them.

CREATION OF SOLAR MATTER

Consider the case when the Sun had no matter and around its present center existed the solar vortex. Since electron is created [1,2,3] when space has rotational speed reaching light speed, it is shown below that the speed of space-circulation at the solar-vortex center does reach the limiting speed of light, thus fulfilling the condition for the material creation. The Eq.8 can be written as

$$\sqrt{r} = k / v_f. \quad (25)$$

Substituting the values, $k = 11.52 \times 10^9$ m / s from (12), and $V_f = 3 \times 10^8$ m/sec (speed of light) in (25), the value of r is found as

$$r = 1474.5 \text{ m}. \quad (26)$$

It is thus seen that at the center of the Sun, within a diameter of 2949 meters, **the medium of space is broken down and creation of matter, starting from electrons, is continuously taking place**. It appears that the created matter accumulated within the Sun over some time will lead to intermittent bursts that should account for the solar flares from the Sunspots as observed.

CONCLUSION

From the orbital rotation of the Moon, determination of the Earth's gravity field, which is an experimentally measured quantity, provides a clear proof that the space circulates around the Earth, and subjects it to an *inward pressure* that produces the gravity field. The exact value of the gravity field of the Sun, computed from the orbital motion of the planet, Mercury, points towards the universal applicability of some new principles:

1. *The space circulation around cosmic bodies causes their axial spin and produces gravity field by exerting pressure on matter.*

In terrestrial condition, the medium of space is stationary relative to the surface of the Earth (neglecting the velocity gradient vertically up in the atmosphere), and, hence, a body on the Earth, in uniform circular motion, develops centrifugal force; such a force is, however, absent in the orbital motion of the cosmic bodies where the space-vortices around the primaries (planets, stars, galactic centers) carry their respective secondary bodies in their orbits.

2. *The cosmic bodies in orbital rotation have no relative motion between their surfaces and the surrounding medium of space in the immediate vicinity.*

On the orbital stability of the planets, it is concluded that the electrical repulsive force exists between the Sun and the Earth. As an universal principle it can be stated that:

3. *All cosmic bodies with axial spin will possess electrical charge that will result in repulsive forces between the bodies with the similar spin, and attractive forces with dissimilar spin.* According to this, the movement of the galaxies speeding away from each other, should be due to repulsive electrical forces.

4. *The Sun, in its central zone, creates its own matter including the matter for the planetary system. Since the Sun rotates axially, possibility exists for the existence of a three kilometer diameter cylindrical hole along the axis of the Sun from north to south pole.*

In seventeenth century, Newton opposed the Vortex Theory of Descartes on the ground that it did not account for the quantitative observations on planetary motion, such as Kepler's laws did. Though the principle of inertia for straight line motion postulated by René Descartes found place in Newton's Principia, and was used by him for planetary motion, he did not consider space to play a role in driving the planets in their orbits. It was in this sense that Newton considered the medium of space inert, and generalized on the existence of the centrifugal force acting on bodies in uniform circular motion, in terrestrial as well as universal space. It has now been possible to derive from the postulates of the *SVT* (that pinpoints on the limiting speed of flow of space equal to the speed of light, and utilizes this process for the creation of universal matter), not only the third law of Kepler, but also the quantitative results on gravity field, charge, and electrical repulsion between the Sun and the planets. Newton's treatment of space as an *inactive* entity has been shown through the above analysis to be erroneous. It is concluded that while the celestial mechanics of Newton needs revision, René Descartes is vindicated for his most basic postulate that the planets are moved by the vortex of the fluid space.

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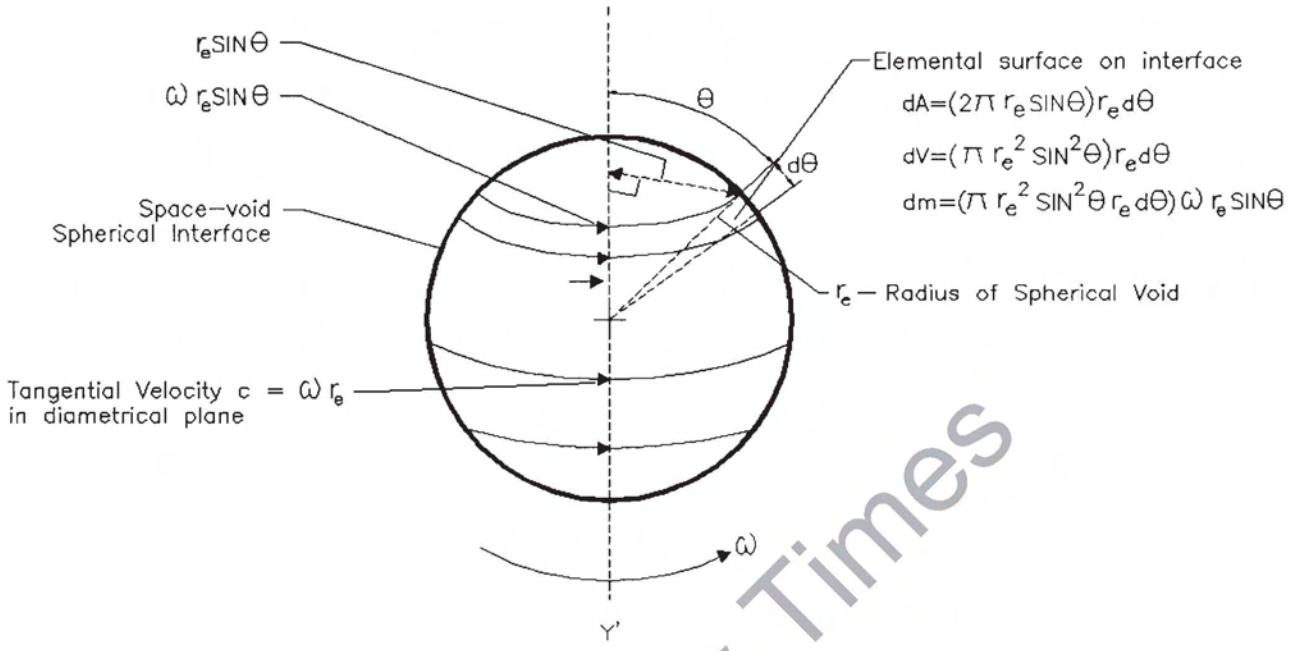


Universal Constant ω: Angular Velocity of Interface Around Y–Y' & equal to c/r_e

c : Speed of Light in absolute vacuum

q_e : Electronic charge
m_e : Electron's mass

L : Angular momentum of electron

Space : Non–viscous, mobile, continuous, incompressible

Void : Fieldless, spherical hole in space

Radius of spherical void $r_e \simeq 4\times10^{-11}$ cm

$$q_e = {}_0\int^{\pi} dA\,\omega r_e \text{SIN}\Theta = (\pi/4)(4\pi r_e^2 c)$$

$$m_e = {}_0\int^{\pi} dV\,\omega r_e \text{SIN}\Theta = (4\pi/3) r_e^3 c$$

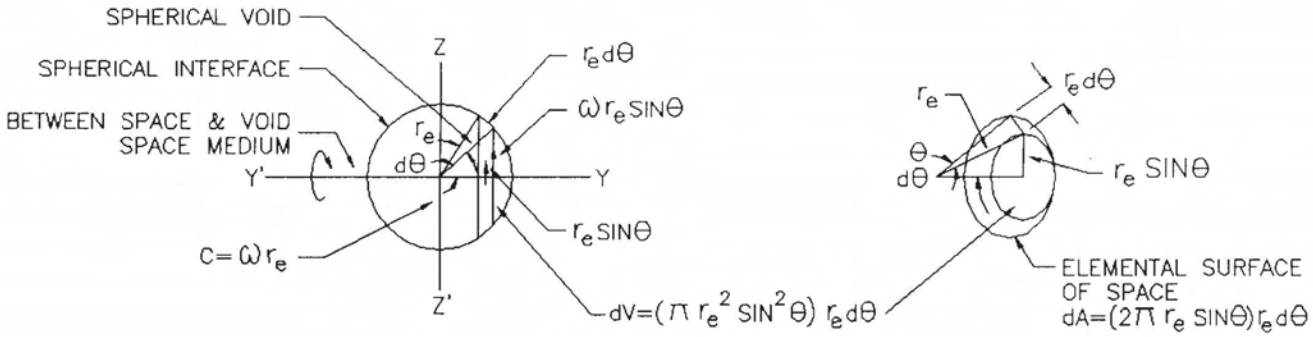
$$L = {}_0\int^{\pi} dm(\omega r_e \text{SIN}\Theta\, r_e \text{SIN}\Theta = (4/5) m_e r_e c$$

Gram = 7.8×10^6 Cm^4/s

Unit charge (CGSE) = Cm^3/s

Generation of Mass, Charge & Angular Momentum of Electron from Absolute Vacuum

Fig.–1



ω = ANGULAR VELOCITY OF SPHERICAL INTERFACE AROUND Y–Y'

VOID = FIELDLESS SPHERICAL HOLE IN SPACE

SPACE = NON–VISCOUS, MOBILE, CONTINUOUS, INCOMPRESSIBLE

VOID–RADIUS $r_e \simeq 10^{11}$Cm

CHARGE ON ELEMENTAL RING SURFACE (Dq) = RING AREA x SPEED OF CIRCULATING SPACE ON RING SURFACE

$$dq = dA(\omega r_e \sin\theta)$$

ELECTRONIC CHARGE $q_e = \int_0^{\pi} (2\pi r_e \sin\theta\, r_e d\theta(\omega r_e \sin\theta)$

DIMENSIONS OF $q_e = (\pi/4)(4\pi r_e^2 C)$

DIMENSIONS OF q_e = LENGTH^3/TIME

REST MASS OF ELEMENTAL DISC VOID

dm = dv x SPEED OF CIRCULATING SPACE AT THE INTERFACE OF THE ELEMENT

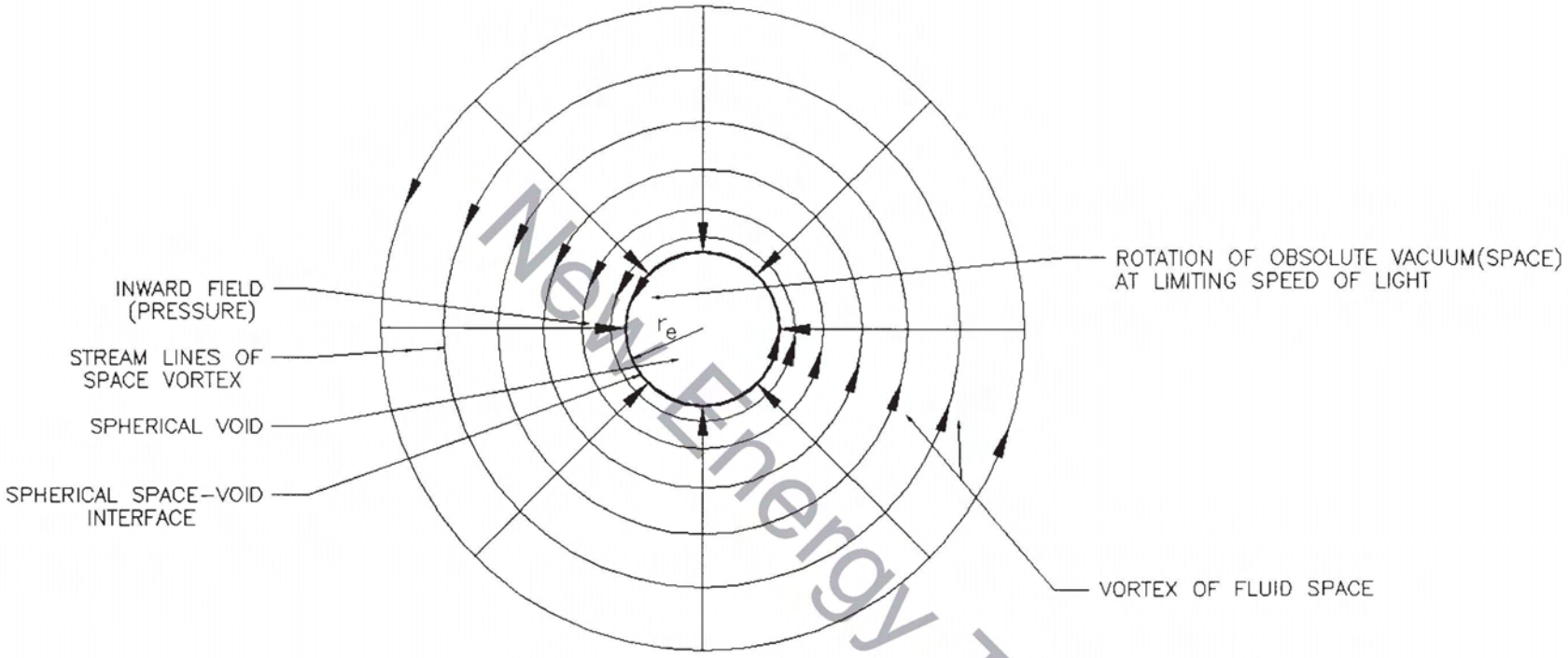
$$dm = (\pi r_e^2 \sin^2\theta\, r_e d\theta)\, \omega r_e \sin\theta$$

ELECTRONIC REST MASS $m_e = \int_0^{\pi} (\pi r_e^3 \sin^3\theta\, r_e d\theta) = (4\pi/3) r_e^3 C)$

DIMENSIONS OF m_e = LENGTH^4/TIME

GENERATION OF MASS & CHARGE OF ELECTRON FROM ABSOLUTE VACUUM

FIG.–1a



ABSOLUTE VACUUM WITH NON–MATERIAL PROPERTIES (INCOMPRESSIBILITY, ZERO–VISCOSITY, CONTINUITY & MASS–LESSNESS) OF AN IDEAL FLUID.

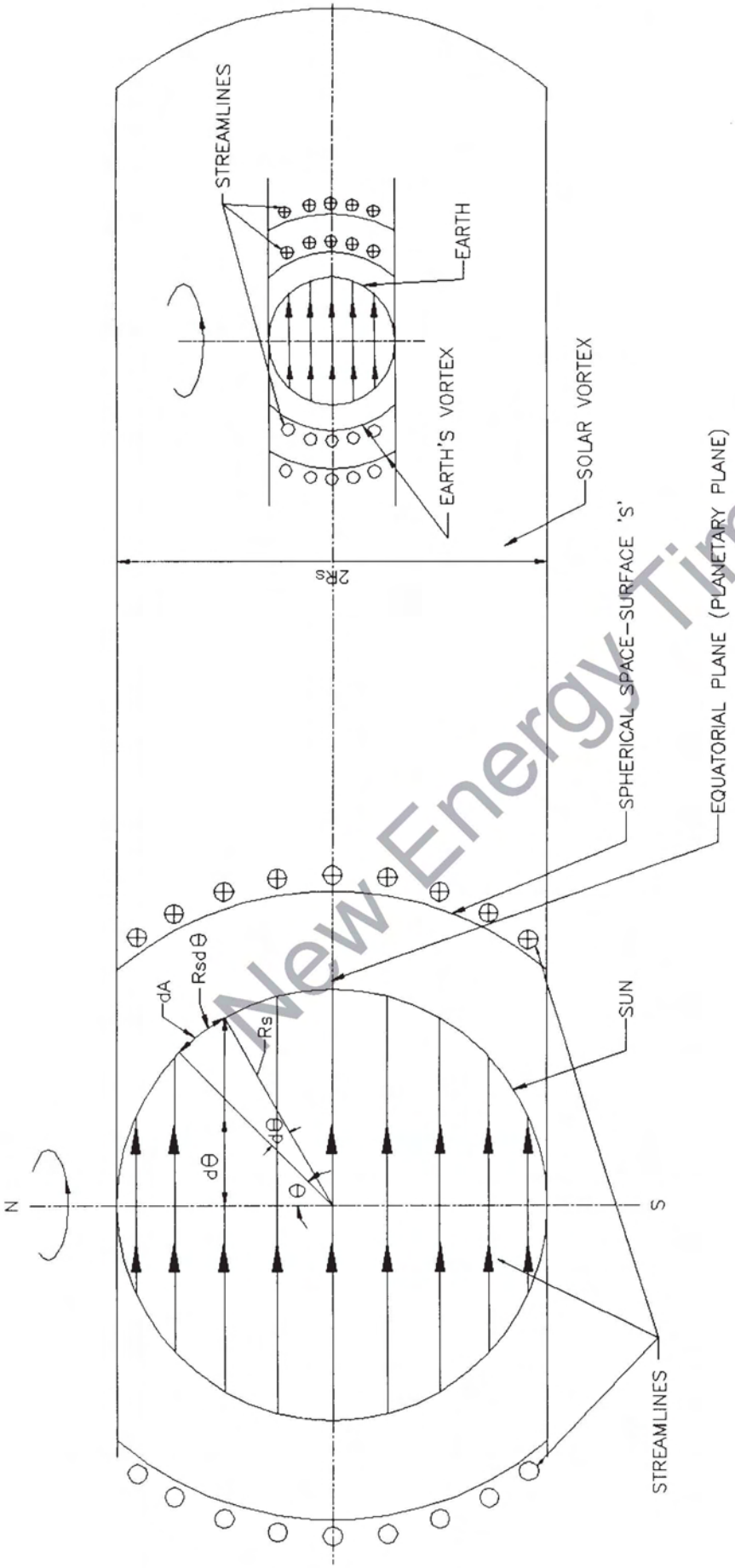
FIELDLESS, ENERGYLESS, SPHERICAL VOID, CREATED DUE TO ROTATION & BREAKDOWN OF OBSOLUTE VACUUM.

SPEED OF ROTATION OF SPACE FALLS OFF INVERSELY AS DISTANCE FROM THE CENTRE OF VOID.

RADIUS OF SPHERICAL VOID $r_e \simeq 10^{-11}$ cm.

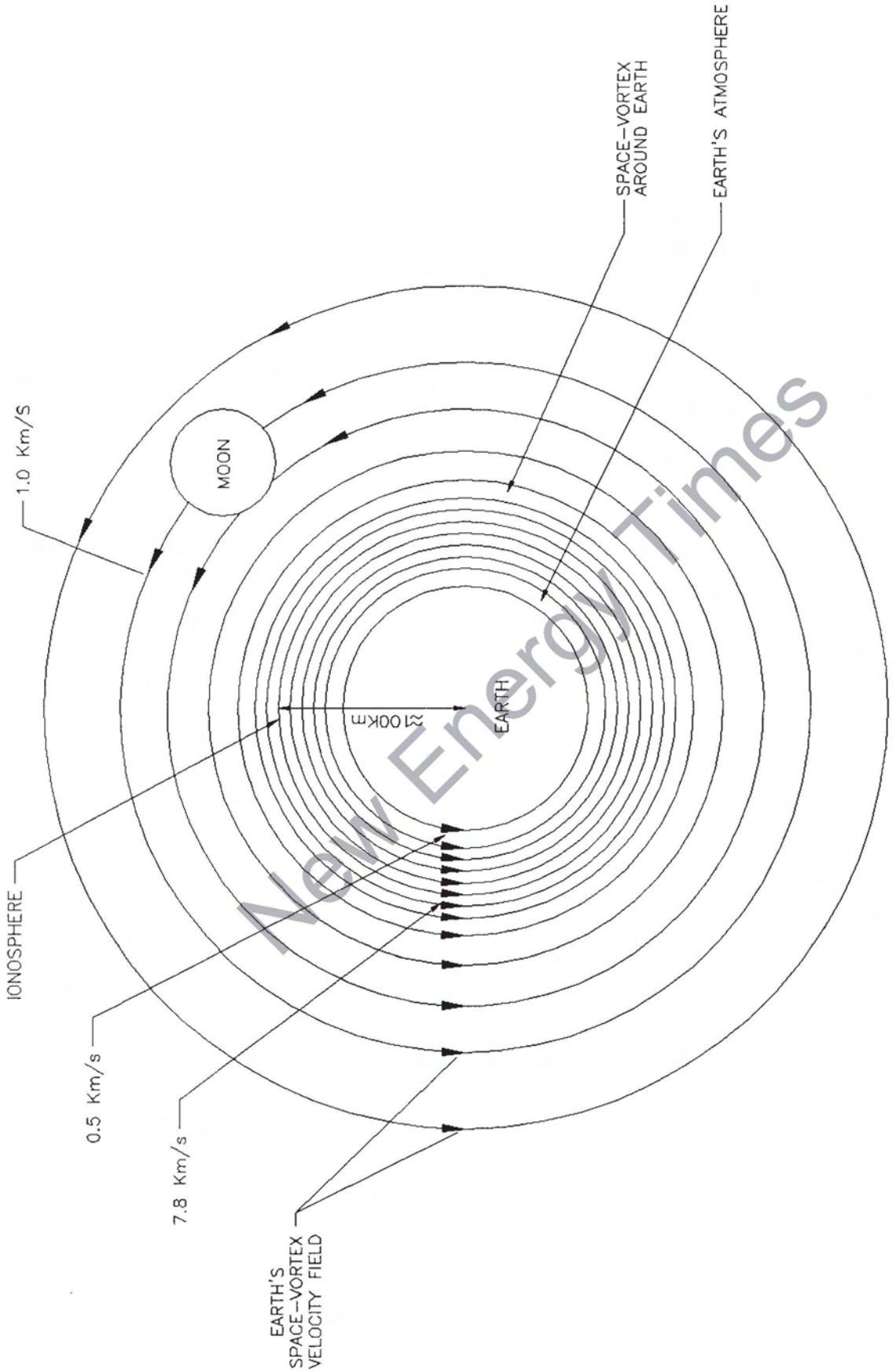
ELECTRON STRUCTURE

FIG.–1b



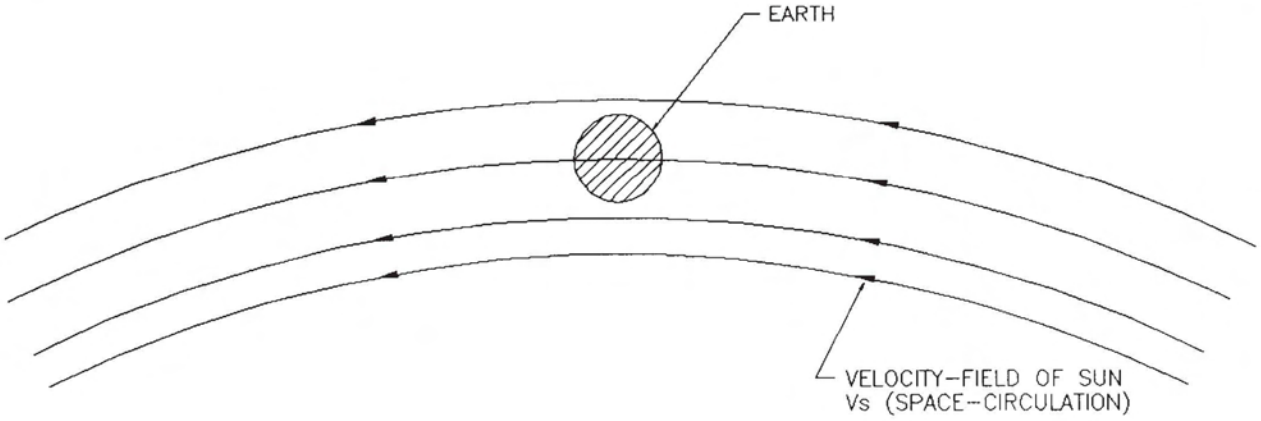
SOLAR SPACE VORTEX

FIG.–2

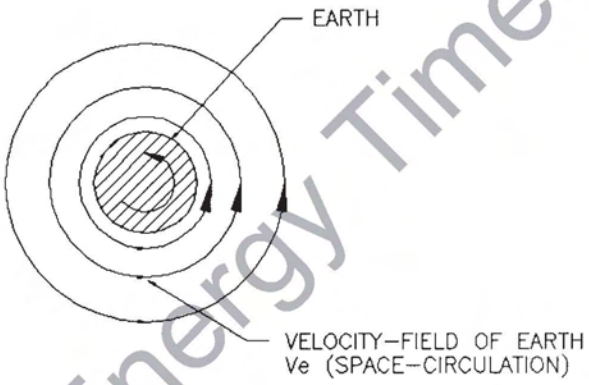


EARTH'S SPACE-VORTEX

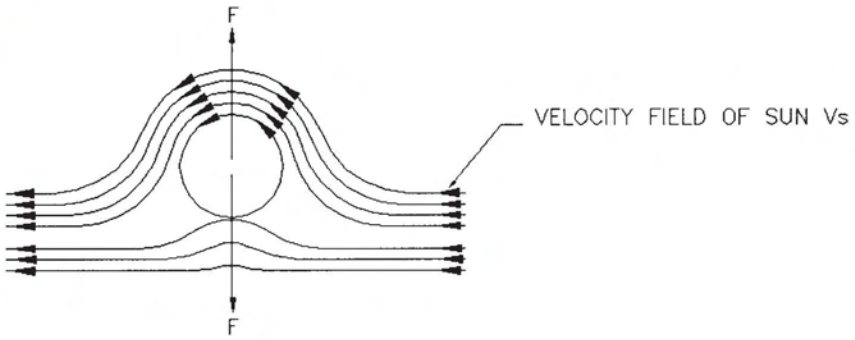
FIG.-3



(a)



(b)



(c)

ELECTRICAL FORCE ON EARTH

FIG.–4

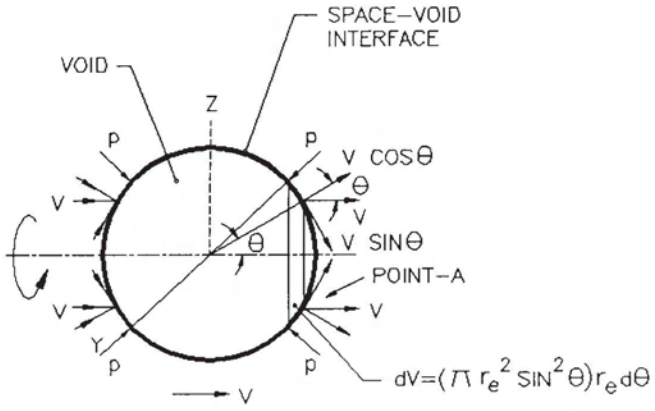


FIG.–5a

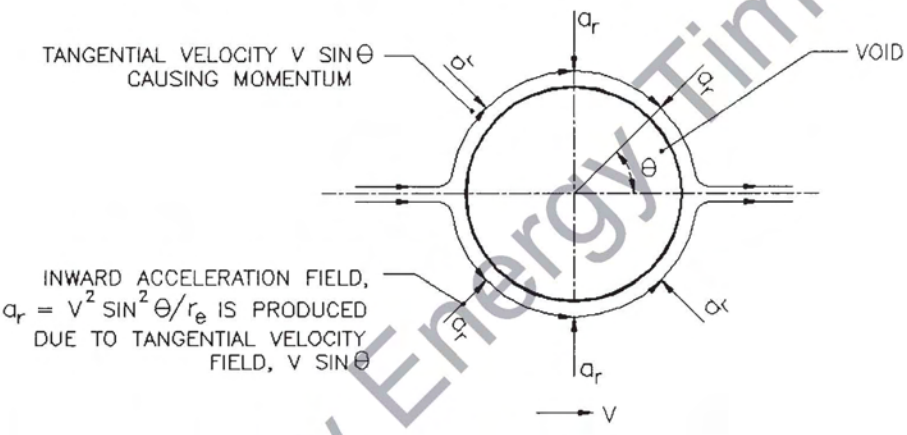


FIG.–5b

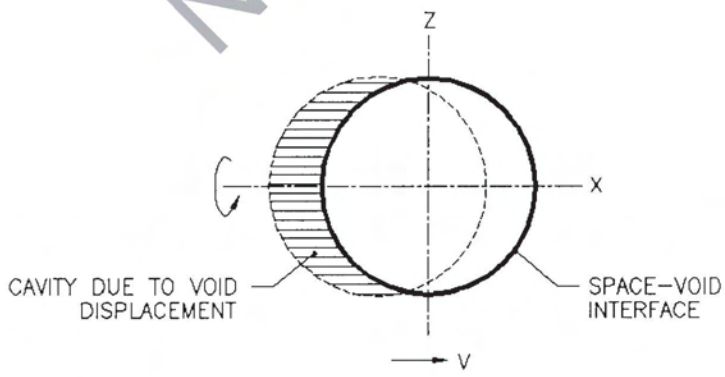


FIG.–5c

INERTIA & MOMENTUM

FIG.–5

A NEW APPROACH TO A UNIFIED FIELD THEORY

David G. Yurth, Ph.D. [1]

ABSTRACT

A new method for deriving a Unified Theory of primary fields is proposed as a means of accommodating numerous phenomenological anomalies not provided for in the current model of quantum mechanics. The thesis is that the current model, which relies on four primary fields (strong and weak atomic forces, electromagnetic forces and gravitational forces), is incomplete and should be expanded to include a fifth field described as the Torsion Field. It is demonstrated that the functional dynamics of all five fields can be described in terms of spin polarity and angular momentum. This suggests that all five primary fields are effects which arise from a universal, holographic causal plane described as the Physical Vacuum. The alternative model is shown to accommodate the phenomenological anomalies not provided for in the current model. A brief survey of current state-of-the-art torsion field devices and applications is also provided.

BACKGROUND

In the early 1970's, the leading physicists of the Western scientific community realized that their model of quantum mechanics was incomplete. In what has come to be recognized as one of the most unique events of the 20th Century, Neils Bohr worked together with a group of the world's leading physicists to reconstruct the paradigm which had been used to characterize the way the world works. It is enlightening to read the transcripts of their proceedings – they had the great, good sense to re-examine the assumptions on which their model was based in the context of observable phenomena which could not be accommodated by it. In the end, they succeeded in crafting a wholesale restructuring of their model so that it could, indeed, explain phenomena which at the time were inconsistent with what they thought they knew.

In the process, after less than 18 months of work, they published what has come to be known as the Copenhagen Interpretation [1]. Its publication was a signal event – a genuine milestone in the development of the modern theories associated with quantum physics. During the following ten years, the model they developed together provided the spring board for a whole new world of sciences, technologies and materials such as the world had never imagined before. The result of their work has been manifest in such things as lasers, fiber optics, photonics, atomically engineered Carbon and a vast array of electronic devices. The modern desktop computer represents perhaps the most ubiquitous deployment of the technologies which their work made possible. They changed the way the world works simply because they were willing to risk their professional reputations on the development of a new way of looking beyond the limits of their understanding.

We can say without fear of contradiction that our lives have been immeasurably enriched by the courage and foresight of those intrepid scientists who were willing to risk the censure of the conventional scientific community by stepping out of the box to re-examine what they thought they knew. This is the essence of great science. It is because of such courage that we have come to appreciate the inordinate value of science, when it is practiced with courage.

PHENOMENOLOGICAL ANOMALIES:

Today, we find ourselves on the brink of a similar crisis of nerve. The scientific community and the model of quantum mechanics currently in general use have been shaken to their very foundations by a whole litany of new phenomena which cannot be explained or accommodated by the current laws of quantum mechanics as we know them. Here are a few examples:

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1. In Switzerland at the CERN Linear Accelerator Laboratories, a team of world class scientists succeeded in separating the twin particles of a positron pair by sending them off in two opposite directions through more than 30 kilometers of fiber optic cable. As one of the particles was exposed to an electromagnetic field which altered its spin polarity, the second particle instantaneously accommodated this alteration by modifying its own spin polarity to compensate, in the same precise manner as it would have if the pair had not been separated. After verifying this experiment a number of times, the team published a report which made the observation that the information which was shared between the two particles could not have been transmitted by light because the velocity of the information exchange occurred at least one order of magnitude faster than the speed of light [2]. They further suggested that the information must have been conveyed by a mechanism which is not known to science or accommodated by our current model of quantum mechanics. They have called their result "Simultaneity – Local Effects at a Distance." This phenomenon is a key ingredient of our considerations in this paper.

2. In 1997, a team of more than 20 scientists on loan from a half dozen of America's top physics lab's participated in an experiment which has world altering implications. The fact that no one saw this result posted in banner headlines on the 10:00 o'clock news should not be surprising. At the Stanford Linear Accelerator facility in California, this team succeeded in creating positron pairs, with measurable density and particle mass, by crashing two high intensity laser beams of monochromatic light together in a vacuum. Their experiment was not an accident – they set out to do it deliberately and kept working at it for six months until they succeeded [3]. Their result has since been replicated by a number of other prestigious labs elsewhere in the world [4]. Quantum mechanics and Einstein's equations clearly assert that it is patently impossible to create matter with nothing more than real photons, in any environment, under any circumstances. The result speaks for itself. This part of the Special Theory appears to have been invalidated by their results. Since the results of this work cannot be denied, there must be something incomplete about the way quantum physics defines the way the world works.

The list of phenomena which cannot be denied and cannot be explained by the model currently in use is long and getting longer. Among other things, this list includes the following:

1. The seminal work of Alain Aspect, whose work demonstrated beyond question the inseparable relationship at the quantum level between the conscious choices of the observer, the means of observation and that which is being observed [5]. Since quantum physics absolutely excludes the role of consciousness in things material, this conundrum will require another kind of explanation.

2. The equally stunning work of Dr. John Wheeler, who demonstrated conclusively that photons of light originating with stellar objects billions of light years distant behave, at the moment of detection, according to the conscious choice of the observer at the time of observation [6]. The mind-matter connection which cannot be explained by quantum mechanics also operates in the macrocosm, in the far reaches of outer space. Unless we can find a way to accommodate this phenomenon, we cannot justify the assertion (now accepted without question by astrophysicists everywhere in the West) that the known universe operates as an open system.

3. The observable phenomenon of attraction and repulsion in laser beams is clearly prohibited by the current model of quantum mechanics [7]. This suggests, among other things, that light is probably not, as Faraday is attributed to have claimed, an electromagnetic phenomenon. Unless we can explain how information is exchanged between coherent beams of monochromatic light in such a way as to demonstrate attraction and repulsion, we will not be able to explain how light operates as a carrier of information in the most basic sense.

4. The difference in neutron scatter on ortho- and para- hydrogen defies the current laws of quantum mechanics [8].

5. The anomalous precession of neutrons as they are passed through a spin polarized target has been repeatedly observed – it is not accommodated by the current model [9].

6. The unusual change in hydrogen interference intensity in the states described as $^2S_{1/2}$ and $^2F_{1/2}$ are also excluded by the formulas which describe quantum interaction at the quark level [10].

7. The shift in circularly polarized electromagnetic waves from the plane of incidence, depending on their chiral direction and helical sign cannot be explained and, in fact, are prohibited by the current model [11].

8. The repeated observation that gyroscope weight varies in a non-stationary (non-equilibrium) state is also unexplainable [12].

9. The phenomenon described as "Dark Matter" is a demonstration of one of the most arrogant conceits of all time. The so-called hidden mass which is supposed to exist in the cosmos in sufficient quantity to accommodate the predictions of the current model of gravitational force has caused no end of grief in recent years [13]. It is likely that there is no such thing as dark matter and it is equally unlikely that any matter is missing from the fabric of the universe. Rather, we propose that the model in current use is incomplete and fails in a number of fundamental ways to recognize the dynamics by which the Cosmos really operates as a self organizing, open and complex system [45].

10. And, lastly, we cite the disturbing, impeccably documented observations cited in the Russian journal ***Achievements of Physics Sciences*** [14]. This journal reports the results of a vast survey of the heavens conducted with highly sensitive gravimetric sensors which clearly detail the analysis of numerous astrophysical objects which are shown to be traveling well in excess of the speed of light. As unthinkable as it might seem to conventional scientists, we have examined the data and methodology reported in the journal and find it to be quite beyond dispute.

METAPHYSICAL CONSIDERATIONS:

What are we to make of all this? There is another class of phenomena which, although equally well documented, are simply not allowed to impinge on the serious considerations of modern quantum physics. We refer to these phenomena collectively as Metaphysics. We are all familiar with the controversial list which follows: the extensive studies which clearly document the existence of such phenomena as ESP, remote viewing, pre-cognition, telekinesis and the interaction of human consciousness with plants. Dr. Dean Radin of the University of Nevada at Las Vegas has published the results of a lifetime of investigation on this subject in his beautifully documented book ***The Conscious Universe*** [45]. If you have any doubts about whether the phenomena I have just listed are documented with sufficient attention to satisfy today's demands for public verification and experimental repeatability, I suggest you read his book. There is simply no room left to argue the existence or validity of these phenomena.

Moreover, the life's work of Annie Besant and C.W. Leadbeater, as recorded in the carefully documented book ***Extra-Sensory Perception of Quarks*** [16], prepared by the eminent physicist Steven M. Phillips, demonstrates the value of the kind of legitimate role a disciplined approach to integrate metaphysics with those in common practice by the conventional scientific community. Between 1895 and 1933 these two gifted and highly disciplined scientists devoted their lives to exploring the quantum world using nothing more than their own psychic powers of observation. Until 1980 the results of their work were simply ignored by quantum physicists. But when Murray Gell-Mann announced the discovery of the quark and mapped the structure and behavior of this family of sub-atomic particles, researchers were absolutely shocked to discover that Besant and Leadbeater had produced nearly identical drawings more than 50 years earlier without the aid of a linear accelerator or a computer. This book makes fascinating reading and leads us to our next consideration.

The eminent physicist Per Bak and his colleagues at Brookhaven Laboratories have demonstrated beyond dispute that the Universe is a quantum system, complex by its nature and self organizing to a point of repeated criticality [45]. In his marvelous book ***How Nature Works***, he demonstrates that all open complex systems in the known Universe are self organizing at every level in compliance with a carefully defined set of what he calls "Power Laws." This includes not just physical systems, but all systems including those involving the human application of language and the structure of societies. This process is driven according to a set of power laws with which you are all familiar (punctuated equilibrium, fractal geometry, $1/f$ noise and linear exponential logarithmic relationships) but, which until

now, have not been integrated into a robust cosmology. Bak's work plays a central role in the model we are attempting to develop.

Further, Menas Kafatos and Robert Nadeau have developed the most cogent philosophical framework to date which supports the thesis that the Universe and all its phenomena arise from a universal causal field which they refer to as consciousness [15]. In their watershed book, ***The Conscious Universe***, they succeed in providing the philosophical underpinnings from which our proposed approach to a new theory of unified fields arises. They succeed in establishing a firm basis for two pieces of the cosmological puzzle which are central to our considerations: First, they establish that the Universe is an open, complex quantum system, operating at all levels according to the dynamic forces which we have observed in both the micro and macrocosm. Second, they establish that when all phenomena in the Universe are viewed as manifestations of information, the attributes of consciousness become intrinsic to and inseparable from any model we can construct to describe how the world we live in operates.

Finally, in case there is any question in anyone's mind that consciousness is inseparable from the most fundamental aspects of the world we live in, I highly recommend a stroll through the wonderful book ***The Secret Life of Plants***, written more than twenty years ago by Peter Tomkins [46]. In this simple paperback book is chronicled the impeccable work of Sir Chandra Bose, whose demonstrations of the effect of human consciousness on plants is legendary. Baxter's effective use of plants as reliable detectors of truth in the criminal process is described there, as is the work of Marcel Vogel, whose work with liquid crystals and human consciousness has still not been understood. Pierre Paul Sauvin created an anxiety response device which interfaced plants with electronic sensors which were more than 100 times more sensitive than Baxter's lie detector devices. Perhaps most astonishing is the work of Ken Hashimoto, Chief of Research and Development at Fuji Electronics Industries. His book, ***Introduction to ESP***, now in its 60th printing, established the basis under which plants have become regularly used as truth detectors in the Japanese criminal court system. His second book, ***Mysteries of the 4th Dimensional World***, now in its 80th printing, provides a voluminous catalog of carefully documented, often publicly repeated experimental results, which clearly demonstrate that nothing in this physical world operates without being effected at a fundamental level by human consciousness.

THE PROBLEM

Physicists refuse on the whole to even consider three important avenues of inquiry:

1. Super-Luminal Velocities – If Einstein said nothing can exceed the speed of light, then it must be so; and

2. Metaphysical phenomena – any concerted research directed at discovering the undeniable connection between consciousness and the operational dynamics of the material world is simply not allowed; and

3. The 5th Field – if Michelson and Morley couldn't find it, it simply doesn't exist.[17]

Herein lies the crux of the current dilemma – we are confronted today by a growing list of undeniable and inexplicable phenomena which cannot be accommodated by the current model of quantum mechanics. The psychological and cultural barriers which lie between us and the development of a new model are the same ones confronted by the Copenhagen School. And our alternatives are precisely the same as theirs – we have no choice but to attack this newly discovered set of problems from another point of view. We have to have courage and step out of the box, risk the censure of our peers and take the next giant leap...

TORSION FIELD PHENOMENA

Today, we propose a new cosmology which we believe not only accommodates the phenomena we observe and cannot explain, but which also provides the framework for conducting our investigations well beyond the limits of current understanding. Here is how we think it works:

Michelson and Morley looked for the mysterious energy source or field energy for seventeen years and because of the restrictions imposed on them by their experimental methods and the technologies which were then available to them, failed to identify it or confirm its existence [43]. They called it the "Aether." Over the past 150 years scientists from all over the world have been looking for evidence of its existence. They have given it all sorts of interesting names, including pseudo-magnetism; the 5th force; Tesla called it the Empty Wave; Moray called it radiation energy; Fienberg referred to it as the Tachyon Field – Star Trek picked this one up because it sounded so good. The current favorite appellation is Zero Point Energy. There are more than 50 other names which have been used to define the fabric of spaces.

The fact that so many excellent scientists attempted to name the field by describing it as a function of some of its observable attributes simply demonstrates that a sufficiently robust model has not yet been developed to accommodate the many interesting attributes which have been ascribed to it over the years. What is undeniably true about this field, which is generally referred to in current literature as the ***Physical Vacuum***, is the following:

1. More than 10,000 papers have been published by more than 500 teams of scientists over the past one hundred twenty years, describing what it is, what functions it performs, how it works and where it is to be found [18].
2. The state-of-the-art devices which have been created to operate in this field are becoming more prolific and sophisticated every day. Today, anyone can buy a 5th field generator from any of four sources in the former Soviet States. Their devices have been constructed, operated, tested, documented and patented. They propagate information into and retrieve information out of a field which we will describe as the Torsion Field [19].
3. The theoretical structure and functional dynamics of the Physical Vacuum and the role of the Torsion Field is becoming clearer every today. References are available to more than 250 different papers, journals and books which describe many of the interesting features of the Physical Vacuum and the Torsion Field. Locally, Trenergy, Inc. plans to offer a number of gravimetric sensors and torsion field generators for sale to other researchers. In addition, Nu OmniComm Technologies, a technology affiliate of Trenergy, Inc. and the WHY Group of Technology Affiliates, is in the process of patenting and constructing what they hope will be the first fully functional Torsion Field Communications System.

A NEW APPROACH

The context within which we propose to introduce a new approach to constructing a unified theory is not exotic in the least. Collectively, let us do what the Copenhagen School did – let's look at the current model with a different set of glasses for a moment. We propose that a unified medium – which we will refer to as a matter of convenience as the Physical Vacuum – can exist in a variety of different phase polarization states. In the state of charge polarization, the given medium manifests itself as an electromagnetic field. In the state of longitudinal polarization, the medium manifests itself as a gravitational field. In the state of transverse spin polarization, the same medium displays itself as a torsion field. When considered together, the Electromagnetic, Gravitational and Torsion Fields all correspond to polarization spin states of the Physical Vacuum. Please consider the following:

1. It is proposed that the weak and strong atomic forces, electromagnetic fields and the gravitational field are not separate and distinct phenomena. Rather, we suggest that they all arise from the same original causal plane which has been called the Physical Vacuum. As Akimov suggests, for a wide range of situations, it is useful to interpret all five of fields as polarized conditions of the Physical Vacuum. We grant that the spin polarization states S_L and S_R contradict the Pauli Prohibition [35]. We beg the question by suggesting that under certain quantum mechanical conditions, the fundamental laws of quantum physics may operate in ways we do not yet understand. If it were not so, Murray Gell-Mann would not have been awarded a Nobel Prize for the discovery and description of Quarks, which also violate the Pauli exclusion principle in every regard. The fact that the mathematical structure he ascribed to the operational states of quarks prohibited the existence of any smaller class of sub-atomic particles does not speak well of our understanding, since just last year his colleagues at Fermi Lab's validated the discovery of sub-quarks of six specific kinds. Presumably, they also violate the Pauli Exclusion Principle.

2. Along with the attributes which have been developed to describe the Torsion Field as a holographic medium, characterized by a variety of behaviors which have been described conceptually, experimentally and

mathematically as spin polarity and angular momentum, the formulas which have been developed over the past 100 years to describe the other four primary fields can all be converted to parallel geometricized form. A careful analysis of the basic formulas developed by Akimov, Ilyanok, Trefilov and others, is extremely revealing – the most stunning thing about them is the discovery that the characteristics of all four primary fields and the 5th field (which we have called the Torsion Field) appear to be completely accommodated by the set of functions which comprise spin polarity in linear, longitudinal and transverse functions, and angular momentum at both the quantum and macrocosmic level. While there is still much work to be done here, it seems more than coincidental that these attributes are precisely what cause the Torsion Field to operate as it does. The formulas referred to include Einstein's equations, the Young-Mills equations and Geisenberg's equations [47].

3. It has been shown that information is conveyed in the Torsion Field at a rate which is at least 10^9 times the speed of light. This revelation, which is largely due to the ground breaking work of Russian scientist V.A. Dubrovsky up to 1985, has now been confirmed by at least six other laboratories in the former Soviet States [19,20]. The group velocity of torsion waves has also independently been shown to be at least 10^9 times the speed of light[24]. A practical set of experiments which reveal just how important this concept is have been conducted both here and in the former Soviet States. Here in the United States, Bill Ramsay describes an experiment in which Greg Hodowanec was able to not only record the occurrence of a solar flare more than eight minutes before it was confirmed by the photons and particles which entered the earth's atmosphere, but he was also able to measure the magnitude of the event, as it occurred. Nick Anthony Fiorenza and Alistair Couper have both reported on the use of gravimetric devices to record the actual transit locations of the planet Pluto, orders of magnitude faster than was possible using measurements based on conventional light wave sensing devices [48,49,50].

4. We have reason to believe, based on the ground breaking work of V.A. Ablekov, David Bohm and Karl Pribram, that the Torsion Field is holographic. The combination of these features suggests that the phenomena which are otherwise inexplicable can now be accommodated.

5. Unlike electromagnetism, where analogous charges repel and opposite charges attract, in torsion fields similar charges attract and opposite charges repulse [21].

6. As the Torsion Field is generated by a classical spin, we can observe and measure the precise effects of the alteration of spin state of the object or system which is encompassed by it. At the Institute for Problems of Materials Science in Kiev, scientists have for more than 25 years used torsion field generators as an essential part of the manufacture of exceedingly exotic materials for which we have no comparable products in the West [22] [51].

7. Torsion Field emissions are non-dissipative and are not attenuated by the interposition of mass or the effects of distance. Torsion Fields cannot be screened by any known materials or combination of materials or fields [23]. The results of the 1986 Moscow M2 torsion wave communications experiments have been widely distributed. In this demonstration, a directional torsion field was modulated with a simple variation of the Morse code. The signal was instantaneously received at a point more than 22 kilometers distant using a similar low signal power device. The signal was passed through solid concrete more than 50 meters thick after having been propagated through a mountain more than 10 kilometers wide. Variations of this experiment have apparently been performed in a number of other locations in the former Soviet states since that time.

8. The absence or loss of signal strength during the spread of a torsion wave group suggests that long-distance communication may be possible with the use of very low transmission power. The fact that torsion waves are not attenuated by material substances suggests that we may be able to device systems which are capable of communication through water or any density of physical material.[25] This concept also suggests that we should be able to devise communications systems capable of supporting real-time communication without regard to the vast distances of space.

9. Since all known substances possess a non-zero collective spin state, then all substances must also create and exist within their own localized torsion fields. We now know that the expanse and frequency structure of any substance is determined by its chemical composition and the expanse structure of its molecules or crystalline lattice. A clear understanding of these mechanics will enable us to create energy storage devices which have energy conversion characteristics well in excess of gasoline (650 watt hours/kilo)[26]. At the Institute for Problems of Materials Science, Trefilov, Tovschuk and Kovalyuk have created a solid state energy cell which produces 850-1040 watt hours/kilo, in laboratory models. The reliability of their claims regarding this technology have been verified by INEL, DARPA and the ATML. A key element of their construction method relies on the effects of a torsion field beam which operates during the process of crystalline lattice deposition [51]. IPMS has also perfected the use of a torsion field device which enables them to manufacture mono-molecular powders of strategic metals which can be stored in conventional glass containers without voluntarily generating static electricity.

10. It has been shown that Torsion Fields demonstrate persistence. This attribute is referred to in the literature as a residual field effect [27]. A torsion source of a defined expanse and frequency has been consistently shown to polarize the localized region of the Physical Vacuum. Once the energizing space-spin source has been put in motion and a torsion field created, and then removed to another place, the space which surrounded the torsion field generator will continue to exhibit the effects of the torsion field for as long as several hours. If we can delineate the dynamics which cause the persistence of residual field effect, we will be able to explain and harness the functional features attributed to dowsing, magnetically effected molecules of water and so on [28].

11. Teams of scientists from more than 50 laboratories have shown that it is now feasible to deliberately perform a wide variety of carefully calibrated functions using torsion fields devices [29]. We can build torsion field generators of both static and radiating types [30]. We can select, adjust and fine tune frequencies modulated into the field with a high degree of precision [31]. We can modulate and retrieve data into and out of the torsion fields, including via two dimensional spin matrices [32]. We can operate efficiently in a variety of different modes of signal radiation [33]. We can adjust and smooth the intensity of the S-waves [34] and we can operate in both left and right S-wave chiral helicities [35].

12. Torsion fields can be detected, generated, switched on and off (such as in communications applications) [36]. We have demonstrated that Torsion Fields can be designed to interact with laser beams [37], to modulate light frequencies and perform other functions. Torsion fields have been demonstrated to have a specific effect on biological processes [38] and has been shown to be generated by certain melting and solidifying materials [39]. Torsion fields affect the oscillation of quartz crystals [40], affect the functional characteristics of some electronic components [41], and have been shown to have verifiable, measurable and predictable effects on gravity [42].

13. In practical fact, we can point to a long list of applications which could benefit from carefully planned applications engineering which recognizes the properties of Torsion Fields and harnesses them for practical purposes. Among these are revolutionary new propulsion systems, communications devices, long range sensors, astrophysical monitoring and metering devices, geo-physical devices which can be calibrated to locate mineral deposits, water, subterranean structures; photographic applications which are capable of imaging the interior of virtually any substance or structure and so on.

PRACTICAL APPLICATIONS

Trenergy, Inc. and its technology partners have embarked on an interesting development project. It attempts to integrate the features of a new torsion field pump with the information distribution properties discovered by Dr. John Hait of CyberDyne Computer Corporation [52]. In his patented applications of the photonic transistor, Dr. Hait established that a special class of monochromatic lasers which emit standing wave forms can be used to switch another similar wave form "on" and "off" without the interposition of an intermediary physical medium, such as an opto-electric crystalline substance. It has been shown that the beams of coherent light propagated by such devices exchange information via an interference fringe which interpenetrates and surrounds each beam of light. Information which has been encoded into one beam of light has been flawlessly transferred to the other beam of light to perform

all seven of the standard Boullean logic functions which are incorporated into the operating system of today's computer operating systems. With the assistance of a newly developed holographic compression algorithm developed by one of our Canadian technology partners and a new torsion field generator design, we are hopeful that we will be able to send and retrieve holographic packet data into the torsion field and retrieve it with predictable precision. We still have much work to do to make this integration perform as we would like, but we are convinced that the principles integrated into its design are sound.

CONCLUSION

In short, Torsion Field technology is here to stay. As we speak, some formidable barriers stand in the way of our pursuit of these avenues of inquiry. Physicists are unwilling as a community to even consider investigating super-luminal phenomena. Conventional science is altogether unwilling to re-examine the findings and methodology of the Michelson-Morley experiments. It is generally held that their methodology was so perfect that if they couldn't demonstrate the existence of the Physical Vacuum, it simply doesn't exist. Nevertheless, it should be noted that the extensive experiments conducted by Michelson and Gale [43], which substantially supported the case for a Physical Vacuum, are not even cited in conventional scientific publications or articles. This is a peculiar case of selective recall.

The demonstrated existence of Torsion Fields flies is contrary to some of Einstein's postulates and equations. If Torsion Field phenomena are given credence, it will result in the instantaneous invalidation of the second postulate of the Special Theory of Relativity and dismantle much of the basis upon which quantum mechanics is predicated. In order to explain how the world works; that is, to formulate a robust theory of unified fields, we must also be able to accommodate the phenomenological aspects of metaphysics, in all their manifestations. This will not happen soon because metaphysics is not a part of the scientific method, by definition. To succeed with this undertaking, we will have to be willing to conduct our pursuit of truth in a very different way. The scientific method will have to be expanded or redefined to embrace at least some metaphysical phenomena.

The good news, however, is that those exploring new technologies are in good company here. There are among us courageous, intrepid souls for whom the value of knowing the truth surpasses the value of any degrees, certificates, credentials or the investment in being right about outmoded notions. We are working very hard to reduce the functional aspects of Torsion Fields to a digestible compendium of carefully documented findings. The first of these efforts is the soon to be released book entitled ***Seeing Past The Edge***.[44] There is much work to be done – we are pleased to join you in this technological investigation. It is time for the greatest scientific minds of our time to turn their collective attention to solving the riddles associated with the discoveries cited in this paper. Science is teetering on the precipice of knowledge, standing in that place which overlooks the void where nothing more can be learned from a more powerful microscope or larger telescope. To go beyond the restrictions of our current level of understanding, the Edge of Knowing, there are no alternatives but to reconcile the pursuit of physics with the disciplined practices of metaphysics. The world has waited long enough to do this. Fritjof Capra showed us the way in the ***Tao of Physics*** [53]. In the words of Captain Jean-Luc Picard, "Let it be so, Mr. Laforge. Engage"

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BOOK REVIEW

By Dr. Myron W. Evans [1]

OPEN QUESTIONS IN RELATIVISTIC PHYSICS
edited by Franco Selleri, 375 pp.,
(Apeiron, Montreal, QC173.5.O64 1998)
Proceedings of an International Conference "Relativistic Physics and Some of its Applications," June 25-28, 1998, Athens, Greece, Softback with index. ISBN 0-9683689-1-3

This volume is a collection of papers presented at an international conference in Athens in June, 1998, and the publisher, C. Roy Keys Inc., has produced to a high professional standard a softback conference volume in a few weeks, a remarkable achievement. The volume is well produced and well edited by the eminent Franco Selleri. The papers are collected into sections: "velocity of light"; "history and philosophy"; "structures in space and time"; "cosmology and astrophysics"; and "quantum theory and relativity". There is no indication of the price on the volume but it is probably far less than other contemporary publishers in science. Therefore C. Roy Keys Inc. does a great service to pluralist theoreticians open minded and bright enough to understand the contents. In more conservative circles we would have to wait up to two years for the volume to appear with an astronomical price tag, and the subject matter would be less pluralistic and less interesting.

The standard of presentation is mixed, some papers are inevitably more thoroughly prepared than others. However, the conference organisers have had the liberality of outlook to invite papers from "non-professionals", and the volume is none the less important for that. There is a commensurate variety of hypothesis, underlying the basic tenet of natural philosophy, that any hypothesis being the product of imagination and therefore subjective, is always provisional, and can partially describe nature at best. A plurality of thought, clearly and professionally presented in one well produced volume such as this partially eliminates the dogma that has ossified late twentieth century physics fundamentals in conservative (mainly academic) circles and turned it too often into a dull, ill informed, rejection of good ideas. However, dogma is also to be found in radical thought, and must similarly be rejected as completely as possible.

The opening paper, by Fleming, is an interesting example of the open minded, or Boltzmannian pluralist, approach to the Sagnac effect, of which there are many explanations. Fleming suggests a neat, well presented, explanation based on finite photon mass and the concomitant existence of BOTH wave and particle, the Einstein / Bohm / Vigier theory. It is argued that the photon behaves as does the electron or neutron in the Sagnac effect, and therefore carries mass if particulate.

Unfortunately he does not mention the explanation (published in 1995) of the same effect by Barrett, using non-Abelian electrodynamics, which leads, if applied in vacuo, to the B(3) field, O(3) electrodynamics and the possibility of photon mass. This would have strengthened his own argument. In this context an excellent index allows one to cross refer to page 227, where Hofer derives the Maxwell equations without accepting them as "axiomatic". This is a mis-use of the term "axiom" by physicists. In Logic, an axiom has two definitions, it is either an undemonstrated proposition concerning an undefined set of elements, properties, functions, and relationships, or it is a self evident or accepted principle. Nothing in natural philosophy is self evident, least of all special relativity, as the many different interpretations in this volume show. An axiom in natural philosophy must lead to a statement about nature, and therefore cannot be self evident or permanently acceptable. The Maxwell equations as found in textbooks should be interpreted only in the first sense of an axiom in Logic, as undemonstrated propositions in the sense that they can only partially describe nature, and by no means without internal inconsistency and paradox. The "Maxwell equations" were in fact derived by Heaviside. The originals were twenty equations in quaternions of effectively SU(2) symmetry, not vectors in U(1) gauge symmetry. Only by continuously rejecting the "self evident"

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will any subject evolve, as demonstrated by Hofer. It is now known beyond reasonable doubt (but not of course beyond conservative or radical dogma) that the U(1) electrodynamics based on the Maxwell equations are paradoxical, and that electrodynamics may be written more self consistently and less paradoxically in a higher, non-Abelian symmetry, such as SU(2), O(3) or even SU(3). This leads back to the Barrett explanation of the Sagnac effect and the possibility of photon mass as discussed by Fleming. If the Maxwell equations are axiomatic in the sense of being self-evident, any development from U(1) violates the axiom, and no progress will ever be made.

Similarly we find dogma being dismissed in two papers by Arp and Roscoe, based on data and extensive scholarly experience in cosmology. These data lead to the rejection of the Big Bang theory in what appears to this reviewer to be the high ground of natural philosophy, empirical data, reduced by logic and without prejudice. The conclusion by Arp is that flat spacetime can and should be used in cosmology. This is the result of a lifetime of scholarship but is rejected almost completely by the adherents of general relativity in cosmology. Rejection takes place despite the data, and so strays outside the bounds of natural philosophy if the data are accurate and properly interpreted and reduced, as seems to be the case with both Arp and Roscoe.

However, "the rejection of the self evident" WITHOUT scholarship can only replace dogma by dogma, and we can see this process occurring in some of the poorer papers of this volume. This process leads to outright intellectual destruction rather than the evolution of thought, for example rejection occurs without anything being put in its place, as in the dark ages in Europe. The great synthesis of thought that went into special relativity and quantum mechanics is well reviewed by the better historical and philosophical papers in this volume and it would be a pity if this synthesis were to be destroyed by radical dogma, i.e. ill-conceived criticism. In order to reject a theory one must first learn all about it. Ill-conceived dogma results in the flooding of the email system with warnings about the eclipse of special relativity and the end of spacetime, in physics without equations and so on. Fortunately we are spared this to a very large extent in this volume because it is a pluralists' volume. At its worst, radical dogma can degenerate into solipsism, the reinstatement of absolute space and absolute time at all costs by fishing out obscure bits of data in favour of the hypothesis, however riddled with flaws. There are one or two papers like this in the volume, others which make a better argument for galilean principles applied to special relativity, self-contradictory as that may seem at first. One can only try to fish out the reasonable ideas if one is a pluralist oneself.

Selleri himself presents an interesting paper on the lack of a true inertial frame in physics, (precise opposite, apparently, of the galileans), and logically works out the consequences, showing what he claims to be a "discontinuity" in relativity theory. He may be right, the logic of his argument seems to be free of flaws, and leads to a velocity of light not equal to c, as in the theory of finite photon mass. The latter can be cross referenced to red shifts as long studied by Arp and others in meticulous detail, and long ignored by the "establishment", the mysterious, unelected elite of modern physics, as ossified as Lot's wife. This is what comes from looking backwards, a danger to radical and conservative alike. The middle ground then must rely on volumes and conferences like this, which circumvent the remarkably censorious nature of modern physics publishing while rising far above the end of millenium junk on the physics internet. This is no doubt due to Selleri's careful editing. Another interesting consequence of his argument, and that of other good papers in the speed of light section, is that it may lead ultimately to an explanation of the non-null result of the Michelson Morley experiment, following a recent re-analysis of Vigier. This analysis is not without its critics, but was recently published in "Apeiron", and elsewhere. A. G. Kelly, for example, discusses some related matters and the need for an ultra-accurate test of Michelson-Morley and related effects. The "establishment" in physics would reject (again) Vigier's argument outright, and again, despite the data.

This conference proceeding is then far ahead of the average textbook in accepting and discussing a variety of primitive concepts in relativistic physics, including Einstein's own, and their evolution. The pluralist approach has its clear merits but can lead to some violent contradictions as ideas develop in a historically transitional stage. For example Kapuscik in one paper attempts to develop generally covariant electrodynamics in arbitrary media (with a field tensor remarkably reminiscent of non-Abelian electrodynamics, but in curved spacetime), while Arp and Roscoe try to demolish general relativity in other papers, and apparently, reduce it back to special relativity (the one used in general gauge theory and non Abelian electrodynamics). Still others seem to deny special relativity and replace it with absolute space and time, while Selleri does the very opposite, denies the existence of the inertial frame: "..no perfectly inertial frame exists in practice. 2E" . Fleming discusses the very high accuracy to which the equations of special relativity have been tested, using muons in an accelerator ring, so the interpretation of these equations is the issue in many instances, surely, rather than the equations themselves. Where it seems to me that these various

examinations fall far short is their inability to construct a better general gauge theory in special relativity, one capable of predicting all the observed quarks in nature better than the Yang Mills theory in SU(3) gauge symmetry. (There appears to be no mention of gauge symmetry in the whole volume, and Wesley, for example, is known to dismiss the whole lot, quarks and all, reminiscent of Erasmus' "Praise of Folly".) Unless they do the quark thing better, they will remain quirks or tinkerers on the edges, to the vast majority of physicists. (Human nature being what it is, grossly blinkered 2E) This reviewer is far from being unsympathetic to the contributors in this fine volume, but if one is to criticise the most successful theory in twentieth century physics, Yang Mills gauge field theory based on special relativity, one must surely put something in its place at least as powerful. This effort does not even exist in this particular volume, despite the fact that quarks are products of special relativity, i.e. of gauge theory, and despite the fact that EVERY quark in nature is now known empirically. Perhaps this is why there is also no mention of non Abelian electrodynamics, the critics themselves appear to adhere rigidly and dare one say, dogmatically, to the Maxwell equations, actually Heaviside's creation. The name "Heaviside" is missing from the index and there is no progress beyond the U(1) in this volume. This is perhaps a counsel of perfection by the reviewer.

On the more philosophical level there is a particularly useful paper by Bastos Filho, who uses the Compton effect as an illustration of correspondence and commensurability, thus improving on the difficult abstractions that are the philospher's lodestone and making them comprehensible to the everyday physicist. Other papers in this section are impressive but heavy going to the uninitiated due largely to lack of illustration, i.e. giving examples, as in metaphor.

There are also interesting papers on the internal structure of the photon and electron, again ideas which would be rejected by "Physial Review Letters", and therefore interesting ideas. I like in particular the one by Bozic on this subject, but there are several more. I believe that Malcolm Mac Gregor was ostracised for life for suggestions along these lines for the electron, showing again the effect of contemporary dogma. Mac Gregor detailed some of these happenings to me at Vigier One, and I know some effects first hand. It seems amazing that an objective profession such as physics can be so unobjective, and therefore one must finally salute the courage of the Editor, the Publisher, and all contributors, whatever their views.

This volume should be on the shelves and libraries in every leading research University worth the name and worthy of Periclean Athens at her best.

Myron Evans, Ithaca, late September, 1998.

LETTERS TO THE EDITOR

INTRODUCTION AND INVITATION

Dr. Myron W. Evans, Director, AIAS,

I would like to extend an invitation to some more distinguished scientists to join the discussion groups on O(3) electrodynamics, radiation induced fermion resonance and optical NMR, with other topics in advanced electrodynamics. By way of introduction I am Director of the Alpha Foundation's Institute for Advanced Study (AIAS), appointed this year. My credentials are given in the form of an entry in the 16th edition (1999, in press) of "Marquis Who's Who in the World", a companion volume to MWW in America). The AIAS is registered in Budapest's Metropolitan Court, and its address is c/o Institute of Physics, 11 Rutafa Street, Budapest, Hungary. My home address in the United States is 82 Lois Lane, Ithaca, NY 14850, USA.

I am a theoretical pluralist and try to follow the basic tenet of forming a well worked out theoretical hypothesis and comparing it with as broad a range of data as possible in order to try to "test it to destruction" and in order to find an improved hypothesis and so on. In my opinion this is natural philosophical method at its best. I am currently an adherent of special relativity and gauge field theory, but am an ordinary chemist by training, so am always open to being educated by the discerning physicist. I dislike dogmatism, either conservative or radical. Theoretical dogmatism in my opinion is a belief in an untested hypothesis, or one which has been shown conclusively to be inconsistent, either internally or empirically.

Currently there are over a hundred scientists and engineers who have been participants on our very lively discussion group - some for nearly three years. The AIAS has appointed several emeriti and fellows recently, and forms the core of research activity based on shared interests. The larger discussion groups are generally copied transcripts of these discussions. If any member wishes to be REMOVED from the discussion group for any reason, I do my best to comply promptly and try to avoid forcing my views on anyone. Thus this introduction.

The header list to this message describes members of the first discussion group, there are now two more, a total of about 110 colleagues. Occasionally I send out pdf files which can be read on Adobe Acrobat Three and TeX files, which need special software. Unfortunately, pdf files can consume storage. I work from an IBM Aptiva personal computer at 56 kilobaud. There are three groups simply because my carrier allows mail to be sent only to 49 recipients at a time. Recipients are arranged in alphabetical order.

Entry for Marquis Who's Who in the World, 16th Edition (1999).

This entry reproduced here is not at all meant to be a display of vanity, but to introduce colleagues to my background, training, experience and interests. The MWW is generally regarded as the premier reference system in the world, and currently five AIAS fellows are listed therein, Profs. Abramson, Ciubotariu, Lehnert, Meszaros (the President), and myself.

"Evans, Myron Wyn, physicist, born Craigcefnparc, Wales, 26 May 1950, came to US 1986, married Dr. Laura Jean Evans, Feb. 18th., 1988. Father Edward Ivor Evans was a coal miner, awarded Bronze, Silver, and Gold Medals of the Mines Rescue Service. Mother Mary (Jones) Evans was a daughter of a coal miner, T. Elim Jones, who was head deacon of Elim Baptist Chapel, Craigcefnparc, composer and conductor, self educated from a Nonconformist Puritan background of coal miners and rural laborers of the coal mining valleys of South Wales. Entirely Welsh speaking, originating in the Silures (the earliest written record of which can be traced to Roman times), a Celtic Nation of Britain, inhabiting the region now known as Glamorgan and Gwent. B. Sc., Univ. College of Wales, Aberystwyth, 1971; Ph. D. 1974; D. Sc., 1977; SRC Fellow, Oxford University, 1974-1976; Junior Research Fellow, Wolfson College, Oxford, elected 1975; Ramsay Memorial Fellow, University College, London, 1976 to 1978; SERC Advanced Fellow, UCW, Aberystwyth, 1978-1983; University of Wales Fellow and Senior Fellow, 1983-1986; IBM Visiting Professor, Kingston, New York, 1986 - 1988; Visiting Scientist, Cornell University, 1988 - 1992; Professor,

Univ. North Carolina, 1992 - 1995; Presidium Member, Alpha Foundation 1995 - present; Director AIAS, 1998 - . National Committees British Science and Engineering Research Council, and Royal Society of Chemistry; advisory NSF committee. Visiting Scientist, Univ. Zurich, 1990 - 1991; Senior Research Associate, Penn State University, 1991. Founder and first scientific coordinator, European Molecular Liquids Group, 1980 - 1984; Sci. tech. advisor, Plaid Cymru, 1991. Visiting scientist, Univ. Pisa and Scuola Normale Superiore, 1980; Visiting Academic, Trinity College, Dublin, 1985; visiting professor, York Univ., Toronto, 1995; Indian Statistical Institute, Calcutta, 1995. Editor, "Modern Nonlinear Optics" 1997; "The Enigmatic Photon", in five volumes, 1994 - present; several other recent monographs; total of five hundred monographs, Wiley, World Scientific, Kluwer, and contributed articles to professional journals. Series Editor, "Contemporary Chemical Physics", World Scientific; Guest Editor, "Advances in Chemical Physics" (Wiley); Leverhulme Fellow (1985 and 1991); Humboldt Fellow (1985); British Imperial Chemical Industries European Fellow (1974); IBM Fellow (UK) (1985); SRC Fellow (1974) and SERC Advanced Fellow (1978); NRC Canada Fellow (1974); Junior Research Fellow, Wolfson College, Oxford (1975); British Ramsay Memorial Fellow (1976); recipient Harrison Memorial Prize, Royal Society of Chemistry of London, (1978); Meldola Medal, Royal Society of Chemistry of London (1979); several other awards for science publishing; sometime member RSC., Optical Society of America; American Institute of Physics (Sigma Pi Sigma, honoris causa); New York Academy of Sciences. Republican Welsh nationalist; Avocations: published poet; landscape photography (permanent exhibition); music, athletics. Home 82 Lois Lane, Ithaca, New York 14850, USA and 50 Rhyddwen Road, Craigcefnparc, Swansea SA6 5RA, Wales, Great Britain; Office, Alpha Foundation, Institute of Physics, 11 Rutafa Street, Budapest, Hungary. Mr. Evans has done over twenty five years of research at the international level in chemistry and physics, recorded in about five hundred communications and monographs. He pioneered the use of the far infra-red for analysis of molecular dynamics; and combined the technique with computer simulation and other spectral methods, culminating in the formation of the European Molecular Liquids Group in 1980 at the National Physical Laboratory in London. He pioneered the use of computer simulation for non-linear optical effects in molecular liquids, the technique of rotatively induced fermion resonance and the application of contemporary gauge theory to electrodynamics."

Marquis entry screened, ratified, accepted and updated, July 1997 to August, 1998.
Cordial Greetings!
Myron Evans

LETTER FROM WAYNE POWELL

Hi guys; thanks for printing my letters. All new ideas in science (T = (W ≠ P)) begin as heresy and are violently resisted at first. But if you really thought about it, this is society's way of protecting itself against inventor-epilepsy, or we can't be rushing off in all possible directions at once, that's chaos & anarchy. On the other hand, Jesus said: Lawyers / liars / pharisees / hypocrites... you praise the prophets...and your very own fathers killed them!!!

Anyway, my little klutz-amateur CF transmutation experiment worked. It was too big of a hassle to get pure Ni ion sputtering onto the beads as George Miley suggested, although he did tell me his / Patterson's secret of a popcorn popper type of gas flow to levitate the beads whilst ion sputtering. After fooling around with various non-ingenious ways to electroplate from a (green) nickel plating solution, working with a local jeweler, I finally had to settle for electroless Ni plating (which includes some phosphorus) by a company in Minnesota. Thus, not having a pure Ni film on the copper coated beads, I didn't think I had too good of a chance of Patterson-type heat / transmutation. But, I ran two half batches about a month apart anyway. Finally the opportunity came to travel the 700 mi round trip to MSU physics dept and a mass spectrometer analysis. Lo and behold: double the K^{41} ratio (15.6% vs 6.7% natural) from the KOH electrolyte itself!!! And, a spike at 3.0268 a.m.u. which the tech misinterpreted as a stable hydrogen 3 molecule (impossible).

So, to atone for my previous tongue-in-cheek approach to CF: the following recipe for others who are curious but don't have $3000 for a LENT kit or $3750 to lease a Patterson Cell for a year, visions of paying out millions for lab equipment / experiments turns them away. So, the cheap bootlegger approach for the beginner who can only handle a Jr High school-type of science experiment.

Scientific American used to have an experimenter section, yes?

Anyway, perhaps you could hand this out to beginning CF'ers as an easily do-able experiment.

Sincerely,
Wayne Powell
420 2nd Ave E
Kalispell, MT

MONTANA HOME BREW RECIPE

(Confessions of a CF Bootlegger)

"STILL" MATERIALS:

I. WalMart Sporting Goods Section: (2) stainless steel camper's cups, in diameter, 3 " high, with handles ($3.89 ea); (1) little milk carton of 5000 copper coated BB gun beads ($6.99).

2. Photographer or Photo Shop: Kg or pint of potassium hydroxide (KOH) photographic developer fluid (free to $10)

3. Hobby Shop or Bathroom: Pkg of 3 test tubes ($5.00) and Pkg of rubber stoppers ($2.25); or 3 old perfume vials or bottles, wash-cleaned ($0.00)

4. Kitchen: Stainless steel knife blade about 6" long or some other st. stl. type of rod ($0.00)

5. Garage: tickle battery charger with 6 V as well as 12 V setting ($0.00)

6. Work Area: 2 square foot area: table top/under bed/in closet/out in the garage / somewhere; with nearby 120 V electrical outlet for charger.($0.00)

PREPARATION:

1. Send BB's in to (& return address - from cardboard box) Technical Plating Inc in MN (Tony Duerr @ 1-612-424-6624 or 1-800-700-8760) for a quote to electroless nickel plate the beads to 1000 angstroms or less of thickness. Some phosphorus is in the Ni as a necessary alloy, but that's OK (S&H + $25)

2. Scissor cut thick plastic from old 8½" x 11" folder-cover to fit inside the cup and above the rim about 1/8" to 1/4", as an insulator-layer.

3. 2 or 3 basket-type coffee filters pushed into the bottom of the cup.

4. The beads come back in little plastic bags, nickel finish with a slight yellowish cast. Pour half (2500 beads) into the coffee filter(s).

COOK:

1. Fill cup 3/4 to 7/8ths full with tap water. Top off with the KOH. Add a pinch of table salt (NaCi) if it feels good.

2. Stick the stainless steel knife blade in the KOH at a slight angle, resting on the rim. Tape down / brace as required. Don't let it touch the cup.

3. Hook up the Red clamp (6V anode) to the knife, Black clamp to the cup handle (6V cathode), and plug the battery charger in.

4. Run for 2 to 10 days (pentagrams and magic chants optional). KOH will fizz / evaporate slightly. Top off with tap water once a day or so. The cup will get a bit warm to the touch as these are minimum energy QM tunneling events occurring in the Ni film. Very little radiation is given off.

5. When the KOH electrolyte finally starts to look tired, unplug / unhook.

6. Pour a few drops of the KOH into a test tube and excess into a clean, old coke bottle. Tweezer dump a few beads (now etched down to the steel) into the second test tube. Eyedropper-sloop out a few drops of the black flakes/black yuk left on the coffee filters, (Or Q-tip or itty-bitty spoon.) into the third test tube. Or use the little perfume vials or bottles as only a few drops are required for the mass spectrometer analysis. Masking tape-label each test tube.

ANALYSIS:

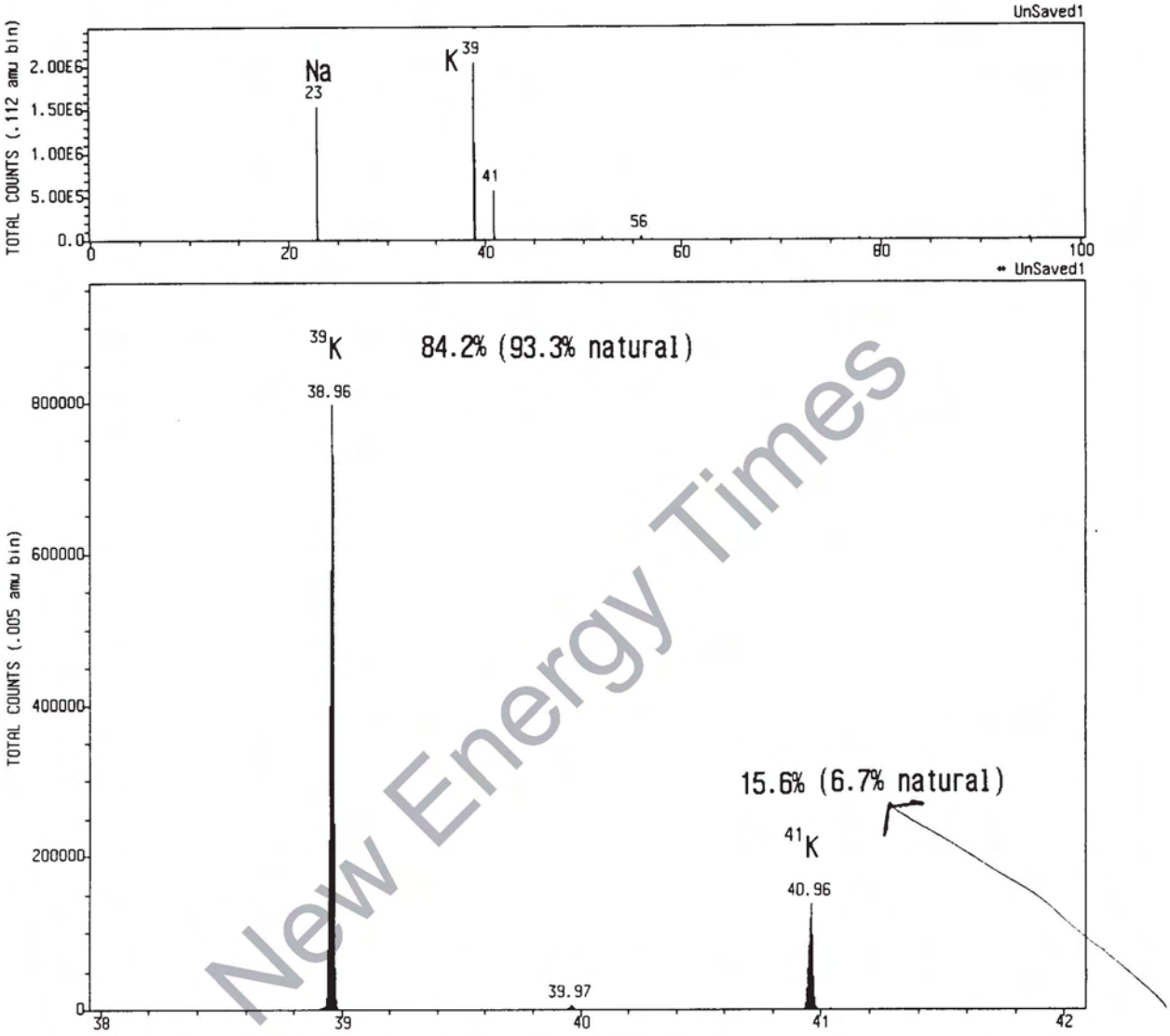
1. Up to this point you've spent less than $100, and a few days; now the expensive, hold-your-breath part.

2. Find the nearest mass spectrometer @ a commercial lab or university physics lab by phone. Send the 3 test tubes or vials for a full isotope spectrum analysis. ($100 to $500). The ubiquitous spike at 3 amu is **NOT** a stable H_3 molecule (such a thing doesn't exist), it must be ^{3}H. ^{3}He or $^{2}H + {}^{1}H$.

3. The print out/report you get back will be proof positive that skewed isotope ratios/low energy nuclear transmutation can be done in a simple Montana Home Brew Experiment.

4. If you are lucky enough to find a cold fusion sceptic and you have the Clintonoid touch, you could make **BIG BUCKS** on a sucker bet with your Mass Spectrometer report. As a sop, the discombooberated sceptic gets the other cup/2500 beads/left over KOH; a slap on the back, smile, and "thanks turkey"!

IMAGE AND CHEMICAL ANALYSIS LABORATORY
MONTANA STATE UNIVERSITY
Bozeman, MT 59717
Phone: (406) 994-4199 Fax: (406) 994-6165



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Black yuk deposited on silicon wafer; 12 micron, highmass resolution, area 4

+ IONS PRIMARY GUN: LMIG TIME RECORDER: Multi-Stop TDC X=Y SOURCE: Raster TIME PER CHANNEL: 138 ps DATA SET: 1 Spectra: 1 Image RASTER SIZE: 10 µm RASTER TYPE: 10

This is why I was in Bozeman, to get a Mass Spectrometer reading on my little cold fusion experiment. This, says the physicist, is impossible: twice the ^{41}K above the natural isotope %.

IMAGE AND CHEMICAL ANALYSIS LABORATORY
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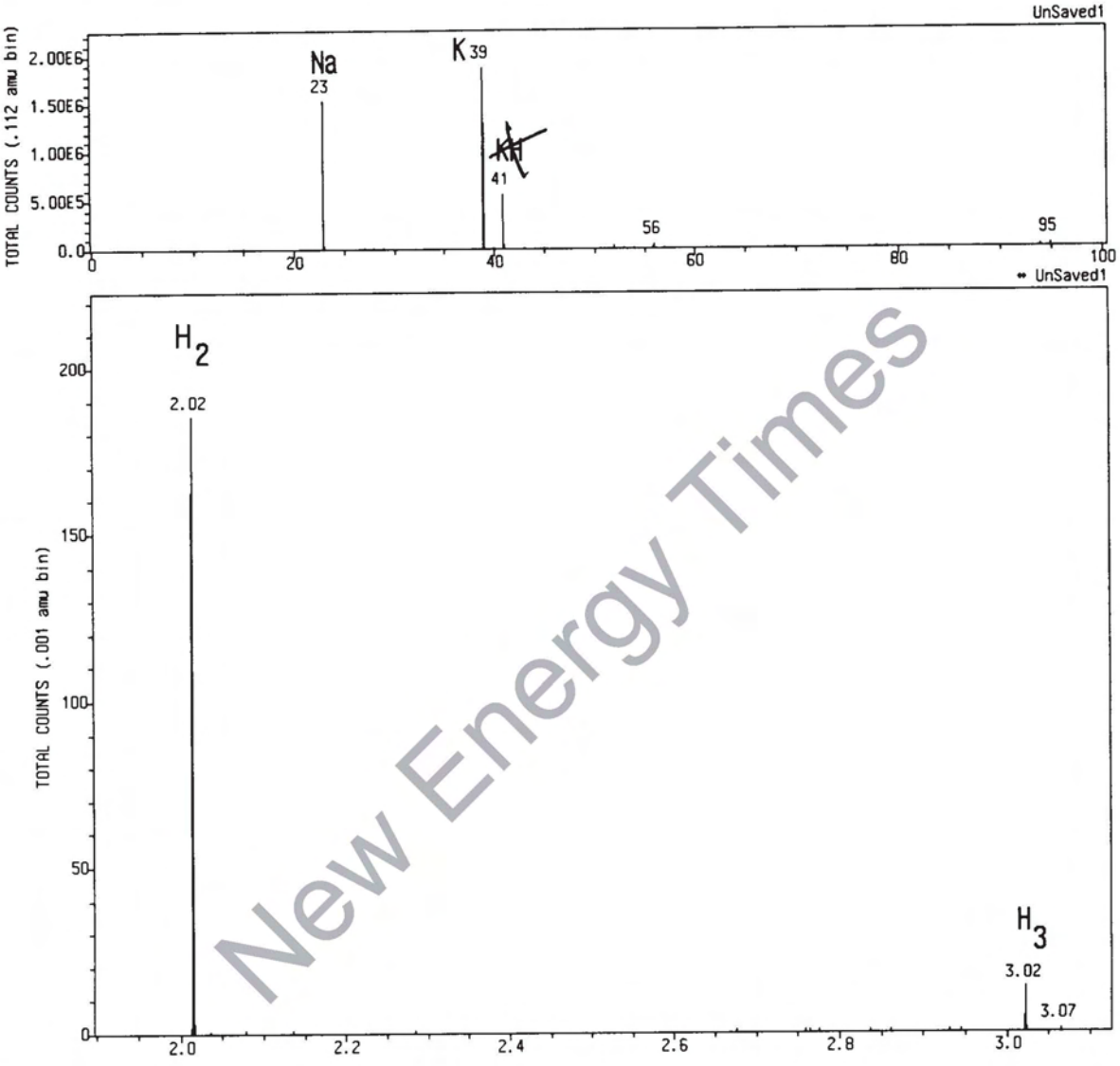
Phone: (406) 994-4199 Fax: (406) 994-6165



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FUSIONfacts

FORMERLY A MONTHLY NEWSLETTER FROM JULY 1989 TO DECEMBER 1996

WE DIDN'T QUIT, WE JUST CHANGED OUR LOCATION
***FUSION FACTS* to continue reporting on papers published in other venues**

N. V. Antonenko, G. G. Adamian, W. Scheid, V. V. Volkov (Inst. Theor. Phys. der Justus-Liebig-Univ., Giessen, Germany), "**Competition Between Complete Fusion and Quasi-fission in Reactions with Heavy Nuclei**," *AIP Conf. Proc.*, 425 (Tours Symp. on Nuc. Phys. III, 1997), pp 51-60 (English) 1998
and
N. V. Antonenko, G. G. Adamian, W. Scheid, V. V. Volkov (Inst. Theor. Phys. Justus-Liebig-Univ., Giessen, Germany), "**Competition Between Complete Fusion and Quasi-fission in Binuclear System**," *Nuovo Cimento Soc. Ital. Fis., A*, 110A(9-10), pp 1143-1148 (English) 1997

A model based on the dinuclear system concept is suggested for the calculation of the competition between complete fusion and quasi-fission in reactions with heavy nuclei. The fusion rate through the inner fusion barrier in mass asymmetry is found by using the Kramers-type expression. The calculated cross sections for the heaviest nuclei are in good agreement with the experimental data. The experimentally observed rapid fall-off of the cross section of the cold fusion with increasing charge number Z of the compound nucleus is explained.

T. Aoki, Y. Kurata, H. Ebihara, N. Yoshikawa (Isotope Ctr., Univ. Tsukuba, Japan), "**Search for Nuclear Products of the D + D Nuclear Fusion**," *Int. J. Soc. Mater. Eng. Resour.*, 6(1), pp 22-25 (English) 1998

A search was made for nuclear products from the D + D nuclear fusion reaction in electrolytic cells and in the gas phase of Pd + D systems. Measurements of nuclear products were made for gamma-ray, neutron, tritium and helium. To detect neutrons, liquid scintillation and 3He counters were used. For gamma ray measurements, a NaI detector was used. For tritium concentration measurements in the gas phase, a gas proportional chamber was fabricated and operated at low background level. The signals of those detectors were fed to a pulse height analyzer and recorded as energy spectra which were carefully compared with background spectra. Different types of neutron searches were also tried in the instants of pressurizing and depressurizing the deuterium gas in a crystal. A large size crystal of tungsten bronze was prepared for the experiment.

Vyach M. Bystritsky, V. M. Grebenyuk, S. S. Parzhitski, F. M. Penkov, V. T. Sidorov, V. A. Stolupin, T. L. Bulgakov, G. A. Mesyats, A. A. Sinebryukhov, V. A. Sinebryukhov, S. A. Chaikovsky, A. V. Luchinsky, N. A. Ratakhin, S. A. Sorokin, V. M. Bystritskii, A. Toor, M. Filipowicz, A. Gula, E. Lacki, J. Wozniak, E. Gula (Joint Inst. Nucl. Res., Dubna, Russia), "**A New Approach in the Experimental Studies of Nuclear Reactions at Ultra Low Energies**," *Nukleonika*, 42(4), pp 775-793 (English) 1997

A new experimental approach in the study of strong interactions between light nuclei at ultra low energies (100 eV - 3 keV) is proposed. The method is based on the use of nanosecond ion beams generated by plasma linear. This approach will allow one to obtain information about characteristics of nuclear reactions in the indicated energy region. The use of classical accelerators is difficult because according to theoretical calculations the range of the cross section values for the studied reactions in this energy region is $10^{-43} \pm 10^{-32}$ cm2. The method of measurement of the cross section is described and the first result of experiment on measurement of the (dd) reaction cross section at deuteron collision energies 220 eV is presented.

Warren Cooley (Salem, OR, USA), "**The Fullerene Fusion Engine**," *Cold Fusion*, 21, pp 56-57 (English) 1997

The possible fullerene fusion engine is discussed with an aerosol fuel mixture

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F. P. Hessberger, S. Hofmann, V. Ninov, P. Armbruster, H. Folger, A. Lavrentev, M. E. Leino, G. Munzenberg, A. G. Popeko, S. Saro, Ch. Stodel, A. N. Yeremin (Gesellschaft fur Schwerionen-forschung mbH, Darmstadt, Germany), "**GSI Experiments on the Synthesis of Superheavy Elements**," *AIP Conf. Proc.*, 425

(Tours Symp. .Nucl. Phys. III, 1997), 3-15 (English) 1998.

A review with 39 refs. The results of a series of previously reported experiments on evaporation residue production at SHIP in cold fusion reactions of Pb- and Bi- target nuclei with projectiles of elements between Ti (Z = 22) and Se (Z = 34) leading to compound nuclei ZCN = 104^{-116}. The isotopes ^{269}110, ^{271}110, ^{272}111, and ^{277}112 were unambiguously identified for the first time in bombardments of ^{208}Pb and ^{209}Bi with ^{62,64}Ni and ^{70}Zn. Excitation functions for ^{50}Ti + ^{208}Pb and ^{58}Fe + ^{208}Pb were measured with high precision, and three new spontaneous fission (sf) activities ^{253}104, ^{254}104, ^{258}106 were identified. A small a-decay branch of the even-even nucleus ^{256}104 (b_α = 0.003) was confirmed, allowing mass excesses Δmc^2 to be estimated for N - Z = 48 nuclei up to ^{264}Hs (Z = 108). An analysis of the a-decay chains observed in a bombardment of ^{209}Bi with ^{58}Fe projectiles showed evidence for an isomeric state in ^{266}Mt (Z = 109). The authors further report on an attempt to produce element 116 and a second isotope of element 112 by the reactions ^{82}Se + ^{208}Pb and ^{68}Zn + ^{208}Pb, respectively.

Hora, Heinrich (Dept. Theor. Phys., Univ. N.S.W., Sydney, Australia), "**Magic Numbers and Low Energy Nuclear Transmutation by Protons in Host Metals**," *Czech. J. Phys.*, 48(3), pp 321-328 (English) 1998.

The observed nuclear transmutations by protons or deuterons in host metals at low reaction energies are evaluated. Reactions probabilities N(Z) depending on the atomic number Z show maxima close to the magic numbers with the exception of Z=20. The exponential decay of the maxima on Z have an increment Z'=10. Exactly this empirically derived relation fits a sequence of the magic numbers of 3n, where the basis value 3 reminds of the threefold scheme of the quarks.

Shigeru Isagawa, Yukio Kanda, Takenori Suzuki (High Energy Accel. Res. Org. (KEK), Tsukuba, Japan), "**Present Status of Cold Fusion Experiment at KEK**," *Int. J. Soc. Mater. Eng. Resour.*, 6(1), pp 60-67 (English) 1998.

A review with 14 refs. Since the spring of 1989, the authors have attempted to confirm the so-called cold fusion phenomena by detecting excess heat and various nuclear products using open type electrolysis cells. A variety of cells containing Pd (cathode)/0.1M LiOD/Pt (anode) have been examined, but recently efforts have concentrated on dewar type cells containing a small palladium cathode, about 2mm ϕ × 7 mm in size. Until now a burst-like heat release, equivalent to 110% of the input elec. power, was observed in one cell, with neither increase of neutron emission nor that of tritium concentration. Helium was observed, but no decisive conclusion could be drawn due to incompleteness of the then used detecting system. In another experiment an abnormal increase of neutron emission, about 3.8σ above the background level, was observed with neither coincident heat burst nor tritium anomalies. It lasted for 9 hours and the emission rate that amounts to 27.2 ± 11.2 neutrons s^{-1} was 700 times as much as the background level. It happened also only once, which makes the possibility of the system error negligible and paradoxically supports its reality. In the other experiment, abnormal emission of the low energy (below 20 keV) x-rays has been detected during the D+ charging period, indicating some type of nuclear phenomena may be happening in the cell. Further studies as well as reproductions of the anomalies are becoming highly essential to understand totally these abnormal phenomena.

Kenya Kawataba, Nobuyuki Hashimoto, Yoshiyuki Kamiya (Furukawa Electric Co. Ltd, Yokohama, Japan), "**Anti-Gravity Heat Pipe**," Heat Pipe Technol.: Theory, Appl. Prospects, Proc. Int. Heat Pipe Symp., 5th, pp 168-175. Ed: J. Andrews, A. Akbarzadeh, I. Sauciuc, Elsevier: Oxford, UK. (English) 1997.

Various proposals have been made for heat pipes which will function even when the evaporator is positioned higher than the condenser. The authors have proposed a system in which the pressure difference between the evaporator and the reservoir is used to obtain high heat transport, returning the working fluid to the evaporator without using external energy. This is accomplished by mounting a reservoir above the equipment at a height somewhat greater than that of the evaporator, and installing a switching valve between the two. Heat transport is then effected by opening and closing the valve to alternate between a liq.-lifting and a return processes. Earlier tests performed on the first exptl. system using this design confirmed that continuous operation occurred. By improving the switching valve, we have been able to obtain even higher heat transport and a high heat transport ratio.

Hideo Kozima, Koki Yoshimoto, Kaori Kaki (Dept. Phys., Fac. Sci., Shizuoka Univ., Japan), "**Nuclear Fission in the Cold Fusion Phenomenon. A qualitative explanation of nuclear transmutation as a whole**," *Elem. Energy (Cold Fusion)*, 24, pp 4-9 (English) 1997.

The nuclear transmutation with large shifts of mass and atomic numbers in the cold fusion phenomenon is explained qualitatively by the TNCF model. The transmutation product is explained as a result of a nuclear fission of a nucleus in the material containing the trapped neutrons which destabilize the nucleus. Thus, a consistent explanation for the cold fusion phenomenon as a whole is given using the TNCF model.

Hideo Kozima (Dept. Phys., Fac. Sci., Shizuoka University, Japan), "**How the Cold Fusion Occurs (2)**," *Rep. Fac. Sci., Shizuoka Univ.*, 32, pp 1-43 (English) 1998.

Present status of the cold fusion research is surveyed after four years since the former report appeared in this journal in 1994. A model (TNCF model) proposed by the author based on the experimental facts have been used to analyze typical experimental data and have shown its ability to understand whole the cold fusion phenomenon consistently. More than 40 typical experimental data in the cold fusion phenomenon, which had been accepted as showing only confusion by people, had been analyzed consistently by the TNCF (trapped neutron catalyzed fusion) model based on an assumption of the quasi-stable existence of the thermal neutrons in solids with special characteristics, giving a unified explanation of the whole data. The density of the trapped thermal neutron in solids, a single adjustable parameter in the model, was determined in the analyses of various experimental data and was in a range of 105 ± 10^{12} cm^{-3} which was not ridiculous from the solid-state point of view. The success of the analyses verifies the validity of the assumption of the trapped thermal neutron. Physical bases of the model were speculated facilitating the quasi-stable existence of the thermal neutron in the crystals satisfying definite conditions. The cold fusion phenomenon is an efficient probe to explore the secret of the solid state-nuclear physics, or the physics of neutrons in solids, untouched by conventional tools of solid state and nuclear physics until now. A review with 79 refs.

Steve Lazarus, Chuck Bennett, Warren Cooley (USA), "**The Connection Between the Particle and the Wave in the Zero Point Energy Field as Applied to Cold Fusion Energy**," *Cold Fusion*, 18, pp 26-29 (English) 1996

We seek a means to shed light on the fundamentals that can be generally applied to direct a universal approach to all cold fusion systems.

Renbao Lu (Beijing Inst., Applied Phys. and Computational Math., Peop. Rep. China), "**Analysis of X-ray and γ-ray Production Mechanism Under the Condition of Discharge with D_2 Gas**," *Yuanzihe Wuli Pinglun*, 14(2), pp 114-117, 124 (Chinese) 1997

It is probable that since an x-ray with single energy was produced in the discharge process in D_2 gas, a g-ray was produced also. The g-ray must effect the spectrum of x-rays. The existence of a g-ray provides evidence for cold fusion.

Runbao Lu (Inst. Appl. Phys. Computational Math., Beijing, Peop. Rep. China), **"Electron-Ion Bound State and its Initiation of Nuclear Fusion**," *Qiangjiguang Yu Lizishu*, 10(2), pp 315-320 (Chinese) 1998

A strict description of quantum mechanics on electron-ions bound state three-body system and two approximate solutions are given, which are (1) corresponding to p-e-p bound state X-rays with Ep u 12.5 keV monoenergy is emitted, and also initiate cold (D, D) fusion to give out neutron, proton, triton 3He, 4He, and gamma ray. Some experiments such as Ni-H, deuterium gas glow discharge, are explained. The energy from the excess heat release is just a large quantity of X-rays released in the two electron-ion bound state mentioned above, and only (D+-e-D+) can initiate nuclear fusion. The author further analyzes a large number of the measured record solar flare energy spectrum and points out that the process of generating solar flares also contains the process of emitting X-rays with about 12.5 keV and 25 keV monoenergy and (D-D) fusion.

P. Moller, J. R. Nix, P. Armbruster, S.Hofmann G. Munzenberg (Theor. Div., Los Alamos Nat. Lab., NM, USA), "**Single-Particle Enhancement of Heavy-Element Production**," *Z. Phys. A: Hadrons Nucl.*, 359(3), 251-255 (English) 1997.

Fusion barriers were calculated in a macroscopic-microscopic model for several cold-fusion heavy-ion reactions leading to heavy and superheavy elements. The results obtained in such a picture are very different from those obtained in a purely macroscopic model. For reactions on ^{208}Pb targets, shell effects in the entrance channel result in fusion-barrier energies at the touching point that are only a few MeV higher than the ground state for compound systems near Z = 110. The entrance-channel fragment-shell effects remain far inside the touching point, almost to configurations only slightly more elongated than the ground-state configuration, where the fusion barrier has risen to ~10 MeV above the ground-state energy. Calculated single-particle level diagrams show that few level crossings occur until the peak in the fusion barrier very close to the ground-state shape is reached, which indicates that dissipation is negligible until very late in the fusion process. Whereas the fission valley in a macroscopic picture is several tens of MeV lower in energy than is the fusion valley, the authors find in the macroscopic-microscopic picture that the fission valley is only ~5 MeV lower than the fusion valley for cold-fusion reactions leading to compound systems near Z = 110. No significant extra-extra-push energy is needed to bring the system inside the fission saddle point and the typical reaction energies for maximum cross section in heavy-element synthesis correspond to only a few MeV above the maximum in the fusion barrier.

Peter Moller, J. Rayford Nix (P. Moller Sci. Compg. & Graphics, Inc., Los Alamos, NM, USA), "**Stability and Production of Superheavy Nuclei**," *AIP Conf. Proc.*, 425 (Tours Symp. Nucl. Phys. III, 1997), pp 75-84 (English) 1998.

Beyond uranium heavy elements rapidly become increasingly unstable with respect to spontaneous fission as the proton number Z increases, because of the disruptive effect of the long-range Coulomb force. However, in the region just beyond Z = 100 magic proton and neutron numbers and the associated shell structure enhances nuclear stability sufficiently to allow observation of additional nuclei. Some thirty years ago it was speculated that an island of spherical, relatively stable superheavy nuclei would exist near the next doubly magic proton-neutron combination beyond ^{205}Pb, i.e., at proton number Z = 114 and neutron number N = 184. Theory and experiment now show that there also exists a rock of stability in the vicinity of Z = 110 and N = 162 between the actinide region, which previously was the end of the peninsula of known elements, and the predicted island of spherical superheavy nuclei slightly southwest of the magic numbers Z = 114 and N = 184. We review here the stability properties of the heavy region of nuclei. Just as the decay properties of nuclei in the heavy region depend strongly on shell structure, this structure also dramatically affects the fusion entrance channel. The six most recently discovered new elements were all formed in cold-fusion reactions. We discuss here the effect of the doubly magic structure of the target in cold-fusion reactions on the fusion barrier and on dissipation. A review with 25 refs.

David Moon (Minneapolis, MN, USA), "**Carbon-14 Found in the YUSMAR Hydromachine,**" *Cold Fusion*, 18, pp 53-54 (English) 1996

Carbon-14 from cold fusion in the YUSMAR hydromachine is discussed.

A. G. Popeko (Flerov Lab. Nucl. Reactions, JINR, Dubna, Russia), "**Subbarrier Cold Fusion Reactions Leading to Superheavy Elements**," *Nuovo Cimento Soc. Ital. Fis., A*, 110A(9-10), pp 1137-1142 (English) 1997.

The elements with Z ≈ 107 were synthesized in cold fusion reactions based on Pb and Bi targets. Heavy ions undergo fusion with these target nuclei deeply in the subbarrier region. The analysis of the potential energy surface of colliding nuclei shows that a cloud of paired nucleons or massive clusters may be transferred from the projectile to the target.

A. Shyam, T. C. Kaushik (Neutron Phys. Div., Bhabha Atomic Research Centre, Mumbai, India), "**Absence of Neutron Emission during Interaction of Deuterium with Metal at Low Energies**," *Pramana*, 50(1), pp 75-83 (English) 1998.

Technique and instrumentation to detect reliably, multiplicity of neutrons emitted in sharp bursts (≤100 μs) has been developed where a burst of as low as 15 neutrons and continuous emission of ≃ 10^{-1} neutron/s may be detected. Using this technique, attempts were made to detect neutron emission from various experiments in which anomalous nuclear effects (or what is commonly referred to as cold fusion) may be expected to occur. No neutrons, above our detection threshold, were detected in the recent series of experiments.

M. Srinivasan (Phys. Group, Bhabha Atomic Res. Cent., Mumbai, India), "**Cold Fusion: Promising New Source of Energy from Water**," *Phys. News* (Mumbai, India), 27(1), pp 48-52 (English) 1996.

A review with no refs.

Akito Takahashi, Hirotake Fukuoka, Kenichi Yasuda, Manabu Taniguchi (Dept. Nucl. Engr., Grad. Sch., Osaka Univ. Yamadaoka, Japan), "**Experimental Study on Correlation Between Excess Heat and Nuclear Products by D_2O/Pd Electrolysis**," *Int. J. Soc. Mater. Eng. Resour.*, 6(1), pp 4-13 (English) 1998.

Using two electrolysis systems based on D_2O/Pd electrolysis, experimental searches were tried to find correlation between excess heat and possible nuclear products (neutrons, x-rays, tritium and helium). One was the open electrolysis system with twin cells to study correlation between excess heat, x-rays and neutrons. The other was the closed electrolysis system to study correlation between D/Pd ratios, excess heat, neutrons and helium. No very clear correlation between excess heat and any nuclear products were observed, but several marginal-level data were obtained to show helium-4 production when excess heat were observed in the closed electrolysis system. In few cases by the open electrolysis experiments, clear excess heat was observed with no visible increases of characteristic x-rays and neutrons over background. Burst events of soft x-rays and neutrons were observed in few cases, being independent of excess heat production.

Shaojie Wang, Lijian Qiu, Qiang Xu, Guishi Luan (Inst. Plasma Phys., Academia Sinica, Hefei, Peop. Rep. China), "**Analysis of ICRF Second Harmonic Heating of Tritium in a D-T Fusion Reactor**," *Hejubian Yu Dengliziti Wuli*, 16(4), pp 37-42, 6 (Chinese) 1996

From quasilinear theory, an approximate analysis expression was deduced to evaluate the average absorbed power density of ICRF second harmonic heating, and the conditions valid for this approximation are presented. To analyze the second harmonic heating of T, the cold plasma approximation was adopted to calculate the dispersion relations, and the code FPPAC was used to solve the 2-dimensional time-dependent Fokker-Planck equation. For a typical D-T fusion reactor, the time dependent evolution of core plasma temperature, the distribution function of T and the

reactivity enhancement were calculated The ICRF heating will induce significant non-Maxwellian ion distribution and hence the reactivity enhancement only when the core plasma temperature is not too high, and there will be no significant reactivity enhancement when the temperature is raised >10 keV.

Tieshan Wang, Yubo Piao, Jifang Hao; Xuezhi Wang; Genming Jin; Zhanqi Niu (Inst. Modern Phys., Chinese Acad. Sci., Lanzhou, Peop. Rep. China), "**Anomalous Phenomena in E<18 keV Hydrogen Ion Beam Implantation Experiments on Pd and Ti**," *Chin. J. Nucl. Phys.*, 19(4), pp 244-249 (English) 1997.

Implantation experiments of low energy (1 keV<E<18 keV) hydrogen ion beams on hydrogen loaded metals are performed with high beam density (J_{max} u1.2 mA/cm2) and low beam density (J_{min} u0.02 mA/cm2). Palladium and titanium foils (plates) are bombarded with proton and deuteron beams in order to compare the atomic and nuclear interactions between different ion beams. X-ray and charged particles are measured, and neutron and gamma doses are also monitored during the implantation experiments.

An anomalous peak in X-spectra, whose energy is about four times the beam energy, is observed during the high beam density experiment. The peak moves from about 40 keV to 62 keV and FWHM reduces rapidly, while the beam energy and intensity increase. Another wide peak with over twice the beam energy is measured in experiment with low beam density. It is located between 16 keV and 30 keV, and its peak energy increases with the increase of implantation dose (implantation time). Some anomalous intensities of neutrons correlated with a charged particle peak (2.93, 3.85 MeV) are also observed in the deuteron-palladium experiment. The highest neutron intensity reaches about 8×10^4 n/s, while the beam energy and intensity are about 15keV and 1.0 mA, respectively.

Hiroshi Yamada, Tamiya Fujiwara (Dept. Elec. & Electr. Engr., Iwate Univ., Morioka, Japan), "**Neutron Emission from Palladium Point Electrode in Pressurized Deuterium Gas under D.C. Voltage Application**," *Int. J. Soc. Mater. Eng. Resour.*, 6(1), pp 14-21 (English) 1998.

The nuclear reaction in a palladium electrode under a highly non-uniform electric field was studied using a neutron counting system. Excess neutron counts were observed with deuterium loaded palladium point electrodes in deuterium gas atmosphere in 9 out of 24 runs after activation by flashover between electrodes during d.c. high voltage application.

Similar neutron bursts took place without the activation under a d.c. glow discharge condition in 2 runs out of 37 runs. The tip surface of these two electrodes after the burst was observed by XPS to be covered by a large amount of carbon. Several craters of about 10 m m in diameter were formed on the tip surface of one of the two electrodes.

H. Yuki, T. Satoh, T. Ohtsuki, T. Yorita, Y. Aoki, H. Yamazaki, J. Kasagi (Lab. Nucl. Sci., Tohoku Univ., Sendai 982, Japan), "**D + D Reaction in Metal at Bombarding Energies below 5 keV**," *J. Phys. G: Nucl. Part. Phys.*, 23(10), pp 1459-1464 (English) 1997.

In order to study the electron screening effect on low-energy nuclear reactions in metals, the D + D reaction in Ti and Yb was investigated. Yields of protons emitted in the D(d,p)T reactions from the deuteron bombardment of Ti and Yb thick targets with bombarding energies between 2.5 and 7.2 keV were measured. The obtained yields were compared with those predicted by using the parametrization of cross sections at higher energies. The reaction rates in metals are enhanced over those of the bare nuclei for Ed < 5 keV, and the enhancement can be interpreted as caused by the electron screening. The electron screening potentials in Ti and Yb are deduced to be 19 ± 12 eV and 81 ± 10 eV, respectively.

PATENTS

DE 19649511; Plasma-technical layer preparation for nuclear reaction; Reinhard Hoepfl, Heinrich Harz, Frederick P. Boody (Hoepfl, Reinhard, Germany); iss. 4 Jun 1998, 4 pp. (German); appl. 29 Nov 1996. A method for nuclear transmutation of long-lived isotopes from radioactive wastes into short-lived or stable isotopes comprises introduction of a high concentration of p, d, t in the waste metal. The metals react with the H isotopes through an exothermic reaction similar to cold fusion and gets transmuted into a short-lived or stable isotope.

DE 19641471; Energy production by nuclear reactions; Heinrich Hora (Germany); iss. 16 Apr 1998, 2 pp. (German); appl. 9 Oct 1996. A method of generating nuclear energy comprises concentrating high levels of H or its isotopes in natural Th, and fission or internal conversion of Th into Pa-233. The concentration of H isotopes in Th surface can be carried out by contacting the Th with an organic polymer or a metal with high H solubility such as Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, Pt, Mn, Cr, Ti, Zr, Hf, V, Nb, Ta, Lanthanides, as well as actinides. The reaction can be controlled by variation of concentration of H or temperature of Th.

JP 09257973 A2; Exhaust device in analytical apparatus for proving cold fusion; Akiyuki Koreeda (ULVAC Japan, Ltd., Japan); iss. 3 Oct 1997; appl. 21 Mar 1996; 3 pp. The gas formed in an ambient-temperature reactor is fed through a connecting tube into a mass analysis tube evacuated by a turbo molecular pump and a rotary pump connected in series with it, and the change of He gas in the gas is detected. A non-evaporating getter pump is interposed in the connecting tube. The non-evaporating getter pump has a heated active adsorption surface made of Zr-Al alloy thin film. The change of He gas can be detected accurately when cold fusion is carried out in a reactor.

JP 09197077; Electrodes for cold fusion and methods for manufacturing radioactive and nonradioactive elements and noble metals using the nuclear transitions; Reiko Notoya (Japan); iss. 31 Jul 1997; appl. 16 Nov 1995; 6 pp. Materials which can bring about nuclear transitions are used as the electrode materials. The electrode materials contain ≥1 element whose atomic number is in the vicinity of rare elements (elements whose amount in the natural world is very little) and noble metals. Examples of the element whose atomic number is in the vicinity of rare elements include W, Mo, Tc, Re, Ag, Cd, Hg, In, Tl, Sn, and Pb. The electrodes contain radioactive elements. Electrodes which contain materials which can bring about nuclear transitions are used to manufacturing noble metals or rare elements. Compared with nuclear reactors and charged particle accelerators, the present method can manufacture the desired materials with more accuracy and easiness.

JP 09015210; Method for identifying nuclides that can be produced in cold nuclear fusion; Tetsuo Yuhara, Hiroshi Futami (Mitsubishi Heavy Ind Ltd, Japan); iss. 17 Jan 1997; appl. 29 Jun 1995; 4 pp. To make it easy to discriminate chemical species whose mass numbers are very close, chemical species containing the nuclide to be identified is irradiated with a characteristic wavelength of light for selective ionization, thereby the nuclide thus produced is identified. The ionized species is then further processed for identification.

WO 9803699; Nuclear transmuted elements having unnatural isotopic distributions by electrolysis and method of production; James A. Patterson, George H. Miley (USA), iss. 29 Jan 1998; appl.9 Jul 1997. A method for producing low temperature nuclear transmutations which occur during electrolysis in an aqueous medium within a cell. New elements produced by transmutation during operation of the cell are both higher and lower in atomic mass than the original element undergoing transmutation. Many of the new elements also exhibit isotopic shifts from natural isotope abundance. The electrolytic cell includes a nonconductive housing having an inlet and an outlet and spaced apart 1st and 2nd conductive grids positioned within the housing. A plurality of preferably cross-linked polymer nonmetallic cores each having a uniform conductive exterior metallic surface formed of a high H absorbing material, such as a metallic hydride forming material, form a bed of conductive beads closely packed within the housing in electric contact with the 1st grid adjacent the inlet. An electric power source in the system is operably connected across the 1st and 2nd grid whereby electric current flows between the grids and within the aqueous medium flowing through the cell during cell operation.

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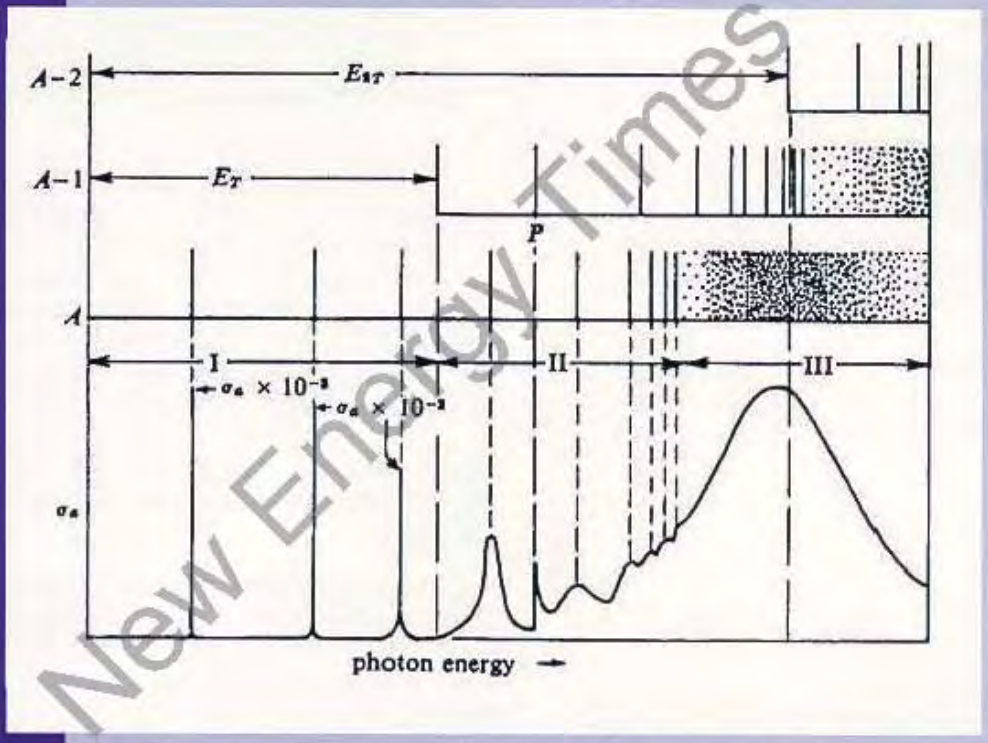

Brown -- The proton absorption cross-section for an idealized nucleus.

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