

# JOURNAL OF NEW ENERGY

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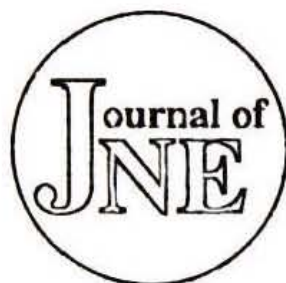
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## EDITORIAL COMMENTS

Some journals are formed to print articles to provide a forum for some new technology so that there will be a source for collected papers exploring such new technology. The *Journal of New Energy* had a similar reason for being. This Journal was begun because of a reluctance on the part of existing American journals to print papers on low-energy nuclear reactions. This article cites the need for publishing papers about new technologies by quoting from Arthur C. Clarke, one of the world's renowned communications specialists. Torsion fields are used as an example of the need to challenge current, well-established, and thoroughly-imbedded scientific beliefs that sometimes discourage articles having contrary views. This Journal's policy on publishing articles that promote new scientific ideas is explained.

### NEW COMMUNICATION TECHNOLOGY NEEDED

This editorial is for my friend, Arthur C. Clarke. In his book, *The Songs of Distant Earth*, Clarke invents the water planet Thalassa, which is all water except for two volcanic islands. Communication antennas adorn Mount Krakan and Clarke writes: *And it's the key to the inter-island communications system. The summit is six kilometers above sea level -- the highest point on the planet, of course. So it's the ideal site for an antenna park; all long-distance services are routed here and beamed back to the two other islands.*

*"It's always seemed a little odd to me," Kaldor said mildly, "that after two thousand years we've not found anything better than radio waves."*

This issue of the *Journal of New Energy* provides articles that suggest the following new ideas:

◆ Superluminal transmission of information may be possible (Arthur Clarke, please note). ◆ The Hutchison Effect (destruction and intermingling of some solids, levitation, and other strange physical behavior) may have an explanation. ◆ Neutrons induced by low-energy electrical discharge. ◆ The "Big Bang" is in trouble. ◆ The vacuum of space has a crystalline structure. ◆ Transmutation can be accomplished at low energies and even in biological systems. ◆ The "kinetobaric effect" may lead to new propulsion technologies.

Ideas, such as the above, that challenge existing scientific dogma could meet barriers to publication in some American scientific journals. The *Journal of New Energy*, although primarily devoted to expanding our understanding of various sources of new-energy technologies, is also devoted to peer-reviewed articles about other new discoveries. The papers must meet certain criteria: They must be subject to peer-review. They must be professional articles buttressed with experimental and/or analytical information. The author's knowledge of the literature should be apparent and sources cited. The author's writings should show competency in the subject discussed.

One of the examples of a new field of inquiry is the torsion field or torsion fields. Here there is a rich literature to cite but very little has been published in English. There are few peers among American scientists as most of the experimental work has been accomplished in the former U.S.S.R. and most of that work has been kept secret until recently. The concept that torsion fields may be able to carry information at many times the speed of light would be unacceptable to some scientists who are limited by the currently-accepted belief that neither energy nor matter can travel faster than the speed of light.



Another example of scientific dogma is the notion that nuclear reactions can only occur at high energies. While this notion has merit, there appear to be ways in which local energy gradients are able to produce nuclear reactions **even in biological systems**. In this latter case (biological transmutation) it is difficult to find peer reviewers. The number of persons or groups, known to the editor to be investigating biological transmutation at present, number only three: One in Japan (Komaki), one in India (and not ready to publish), and one in Greece (Pappas). This issue reports on the extensive decade of work by the Greek scientist, Panos T. Pappas. Pappas is a personal friend of the editor and his paper has not been peer reviewed but is published as "Editor's Choice".

Papers published by "Editor's Choice" are meant to challenge the readers with new ideas, new experimental results, or new anomalies that challenge existing hypotheses or theories. The paper by Panos T. Pappas challenges the currently accepted but unexplained concept of the sodium-potassium pump in human cells. Hopefully, there will be readers who will even respond to the challenges presented and send their professional responses to the editor.

The editor accepts full responsibility for any mistakes made by publishing articles that are not suitably substantiated by experimental facts. Critical examination of all papers are encouraged and **professional letters to the editor will be published** and shared with the authors. Readers may express a difference of opinion (unsupported by factual evidence), however, experimental evidence is preferred. For example, you may have a strong belief that nothing can travel faster than light. However, one replicable experiment of superluminal velocity is sufficient to change the long-held theory that information transfer is limited to the speed of light.

Writers of letters to the editor, please do more than cite standard scientific belief. This journal especially welcomes experimental data, even if preliminary. Inadequate theories are, and should be, challenged by new experimental facts. Remember that a good definition of a scientific fact is "the close agreement of a series of observations of the same phenomenon."

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## ELECTRICALLY INDUCED NUCLEAR FUSION IN THE LIVING CELL

Panos T. Pappas <sup>1</sup>

Paper presented to the ICCF-7, Vancouver, April, 1998

## ABSTRACT

Biology in order to explain the trans-membrane potential (TMP) of the cell adopts an unproven hypothesis of a procedure in which sodium Na is exchanged with potassium K through the cell wall. This assumed exchange in Biology is called the sodium-potassium pump. This SPP leads to elementary contradictions, known in the literature. However, the SPP is the best choice hypothesis based on the exclusion, assumed impossible, of cold nuclear fusion of sodium to potassium in the biological cell level.

In this paper, we prove that the SPP process in Biology is actually a cold nuclear fusion and transmutation of sodium to potassium in the presence of oxygen-SPT (sodium-potassium transmutation). In the paper, we also present for the first time, the relevant nuclear endothermic equation and its important relation to the cell parameters and needed energy resources.

The SPT is the most important process to sustain the living cell and its physiology. The complete physiology of the sodium and potassium of the cell and in extension of the sodium-potassium physiology of the human body, is understood and explained without not-understood artifact mechanisms and contradictions. The SPT and fusion is the basis of understanding several other mechanisms and similar cold nuclear fusions and transmutations in Biology and Medicine. The SPT nuclear process takes place continuously in the human body. It is the basis for the continuous function of the heart, and the key for the metabolism of all cells. It is clearly understood why the excess of Potassium in the blood stream prohibits the SPT nuclear reaction, leading immediately to heart arrest and death.

The basic cell physiology is presented in terms of standard osmosis, nuclear transmutation, and the physicochemical properties of Na and K, only.

## INTRODUCTION:

1. In 1964, G. Oshava and M. Torii [1] (OT) proved in an experiment that cold fusion of Na to K is possible. OT took 2.3 mg of Na, put it in a vacuum tube of 20 cm long and 2 cm in diameter, and sealed it. They ran electrical discharges of 60 watts through it for 30 minutes. After stopping the discharges, they inserted Oxygen in the sealed tube with the electrically treated Na. A second later Na transmuted K, according to the endothermal equation:



This experiment proves that if Na is first treated electrically, apparently its nucleus gets into an excited state, and secondly, when exposed to Oxygen, fuses with it to form Potassium.

2. In 1955, an assumed process related to the same elements of Na and K for the cell, was suggested by Hodgkin and Keynes [2] under the name of Sodium-Potassium Pump-SPP, in order to explain the trans-membrane potential of 0.07 volts that exist between the interior of the cell and its environment. This potential is also related to the cell content of K. According to this process, Na is assumed to be

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continuously exerted from the cell and simultaneously K to be continuously inserted. Since then, this "hypothetical" process of exchange is regarded in Biology as "truth" and its results elevated to "findings". According to Harold Hillman [3], Biology in this case, does not distinguish between hypothesis, truth and findings.

For SPP, a mechanical action of the cell membrane is assumed to selectively pick up 3 atoms of Na out, and simultaneously 2 atoms of K in. This assumed artifact process is also called the active transportation of the cell membrane. It is also assumed that the specific rates of the "in" and "out" exchange of Na and K are different for the two atoms. Specifically for 3 atoms of Na out, 2 atoms of K come in, by an artificially assumed specific "picking up" structure of the cell membrane. Therefore, it is believed that more positive Na<sup>+</sup> ions come out than positive ions K<sup>+</sup> go in. Thus, it is assumed that a net of positive charge is coming out at a rate of 3/2 for every K<sup>+</sup> going in. Standard Biology attempts to explain the cell's trans-membrane potential and its relation to the content of K<sup>+</sup> inside the cell as a difference in the "in and out" rates for Na<sup>+</sup> and K<sup>+</sup>, and by an artifact "picking up" mechanism of the cell membrane.

It is also experimentally found that for the charge of the trans-membrane potential, energy is required, as it should be expected. This energy was found (Skou (1957) in [2]) to be supplied by an exothermic consumption of a substance inside the cell called ATP. ATP is produced or actually reformed by a reverse process of energy which is supplied by the so-called Krebs' cycle. Krebs' cycle is powered by the burning of glucose inserted to the cell by insulin.

However, the actual active transportation of Na-K was never proved, but, remains as an unjustified hypothesis in Biology, see H. Hillman [3], and H. Hillman and P. Sartory [4] for a relevant analysis. Besides, contemporary University textbooks in Biology admit that the assumed process is not understood, for example, *ibid.* page 541, Molecular Cell Biology by James Darnell, et al. [5], "The activity of this (sodium-potassium pump) and other cellular ion pumps is closely regulated by mechanisms presently unknown..."

By the assumed sodium-potassium pump or exchange, saturation of K should eventually occur inside the cell, which has a finite volume. At the same time, Na inside the cell should eventually be completely depleted. The sodium potassium exchange should be over and terminated after a finite time depending on the initial concentration of Na inside the cell, and the available space inside the cell to be filled with K, a fact that is contrary to experimental observation.

3. It is also known that the correct concentration of Na<sup>+</sup> and K<sup>+</sup> inside and outside the cell is responsible for the normal trans-membrane potential 60 to 70 mvolts and the normal vitality of a cell. A dead cell equalizes by osmosis alone the "in and out" Na + -K<sup>+</sup> concentrations and drops its trans-membrane potential to zero. The normal in and out the cell concentrations are:

	Out (blood)	In (cell)	
Na +	145	12	mM
K +	4	139	mM

4. Lois C. Kervran [6] and Komaki [7,8] established after many years of observation and experimentation that there is a continuous intake of Na by humans and animals and a continuous exertion of K by urination, published in his celebrated book Biological Transmutations, Swan House Publishing Co. NY 11223, 1972. Kervran also established that with the intake of Na, K also increases. The ratio Na/K remains constant with or without intake of K, which is a generally known phenomenon in Biology.

Now it is very well known that for people with kidney deficiency, potassium increases continuously in their blood stream regardless of the food intake of K. From time to time, they have to go through a process, called blood dialysis, in order to remove the excess K among other toxins from their blood stream, otherwise, they die. It is also known that excessive concentration of K in the blood stream for any reason, instantly causes heart's function arrest.



5. Pappas [9], since 1989 and for 10 years of continuous observations and systematic research, established that the K concentration in the blood increases, when human or animal cell's are exposed to the PAP-IMI Device (PAP-Ion Magnetic Inductor) - a generator of pulsed magnetic induction field, causing to the exposed tissue, an instant electrical potential per meter (potential gradient or electrical field volts/meter) of a fraction of the normal trans-membrane potential gradient of the cell, which is of the order of 10 Megavolts/meter [5].

6. The phenomenon [9] of K increase by PAP IMI exposures is found to be more enhanced, when cells are in a state of edema or inflammation which are known to contain higher concentration of Na inside the membrane of the cell. At the same time, a drastic reduction of edema and inflammation is found to occur, which indicates a drastic reduction of sodium and a simultaneous increase of K inside the cell. These findings make the device characteristically known to be associated with one of the most, or in certain cases, the best anti-inflammatory and edema reduction method. In exposed inflammatory or edema cases, excess K accelerates in the blood stream, which under normal kidney function is excreted from the body by kidney function and immediate urination.

This is a decisive phenomenon for our paper, for it clearly proves a significantly increased production of K, in case of an increased concentration of Na, under an inflammation or edema, and which is treated by appropriate electrical pulses!

## THE EQUATION OF LIFE

Under the observation and the circumstances of [1, 2, 3, 4] and particularly under the findings of [5 and 6], we come to one unique conclusion that the unproved hypothesis of Biology [2,5] for the so-called sodium-potassium pump is an incorrect hypothesis, because of "having no means of explaining the phenomenon," excluding as unthinkable the case of cold fusion inside the human and animal cell. So the SPP hypothesis was formulated. On the other hand, a continuous transmutation of Na to K inside the cell seems to explain all the Na-K physiology of the cell and the Pappa's related electrical findings for the cell. The exchange of Na to K which logically contradicts all findings [6], and in particular the known physiology of Na and K is totally wrong and a forced assumption based on the *ad hoc* assumption that no cold transmutations may occur in Biology.

We propose for the first time, the Pappas' equation of fusion on the level of the living cell, indicating its relation to the involved vital energies as an endothermic reaction:



The exact role of the membrane's electrical energy or the externally supplied electrical energy, the separate role of the ATP energy, as well as the role of K to the trans-membrane potential (TMP) of the cell, the relation of TMP to the cell metabolism, and proper cell function, will become clear in the following.

It is well known that though K is a bigger atom than Na, Na's mobility should have been higher than K's. However, Na hydrates with 6 atoms of H<sub>2</sub>O, K does not. Thus Na + 6H<sub>2</sub>O is becoming extra large and thus Na's mobility is finally much less than K's. Thus once Na is inserted by osmosis into the cell and transmutes into K; the naked K escapes by osmosis more rapidly though the cell membrane, due to its smaller size and thus higher mobility. This causes an imbalance to the electrical charge concentrations, for positive ions may escape faster from the cell with the vehicle of the K ion, than they may be inserted into the cell with the vehicle of the Na ion. This process naturally explains, for as long as Na transmutes to K inside the cell, why the cell loses positive charges and becomes more negative with respect to its environment, until it reaches an equilibrium value of negative potential to retard the exit of K<sup>+</sup> and increase the input of Na<sup>+</sup> and other positive ions from the outside the cell medium.

The trans-membrane potential difference, thus created, enables metabolism for the cell by electrostatically attracting other materials into the cell – a phenomenon generally known from elsewhere as electroinsertion. In addition, the trans-membrane potential enables the nuclear transmutation of Na to K by preparing the

Na nucleus during its crossing the field across the membrane, in case of a normal TMP present which is of the order of 10 Megavolts/m. SPT maintains TMP, and TMP maintains SPT in an auto-catalyzed, mutually supportive mode.

A cell in the state of death -- known to have no trans-membrane potential -- may not initiate Na to K fusion and may not acquire the lost potential. Thus, the state of death with no trans-membrane potential for the cell is an irreversible state of zero metabolism.

The role of insulin enhanced by adrenaline, secreted from the adrenal gland on the top of kidneys is better understood as a mechanism of controlling ATP, which complementarily controls the fusion of Na to K, thus controlling the rate of metabolism and the rate of vitality of the cells of the body. This process, in respect to the adrenaline triggered by the state of the brain, eventually affects the state of mental perception and will of activity.

In an increased cell activity of SPT caused by the adrenal gland, kidneys are also required to be alerted by the same mechanism that triggers adrenaline, to quickly dispose of the expected increased quantities of K, as nuclear ash, to maintain the balance of low K concentration outside the cell's environment, in order to prevent reinsertion of mobile K into the cells by osmosis and electroinsertion, thus preventing the annihilation of TMP, and thus prevent cell death. This makes understandable the wisdom of positioning the adrenal gland on the top of kidneys.

This basic mechanism of cold fusion explains the simple wisdom and physiology of the cell and the miracle of life. The previously proposed unknown magical, and mysterious mechanical functions for the cell membrane contradict the elementary logic of saturation and depletion for finite volume cells.

## CONCLUSION

It has been shown that the assumption of nuclear fusion in Biology is not contradictory, but leads to the understanding of biological procedures free of contradictions. In particular, from over 10 years observations of the PAP IMI electric exposures on living cells, we are led to the correct assumption that the process known today in Biology as the Sodium-Potassium pump is incorrectly assumed to be a molecular exchange, but actually it is a nuclear process of fusion under an electrical excitation of the nucleus of Na, firstly by the charged cell membrane, and secondly via an endothermic catalytic action of ATP. The electrical excitation of the Na nucleus may be assisted externally by appropriate electrical pulses. ATP seems to control this fusion reaction which otherwise could exponentially increase under the self-catalytic excitation of the trans-membrane potential (TMP) which is related with a positive feedback reaction to the fusion of Na to K in the presence of O. The role of ATP, related mitochondria, Krebs's cycle, insulin, glucose, adrenaline, adrenal gland and kidneys is better understood as a co-mechanism to control this nuclear fusion which otherwise may increase exponentially or die out. The irreversibility to life from the death state for the cell is clearly understood.

The fusion of Na to K by Oxygen seems to be the most important function of the cell and the key to its metabolism. A great number of other biological and medical functions and malfunctions are better understood via this nuclear fusion and standard osmosis mechanism alone, and will be presented elsewhere.

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New Energy Times

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## THERMAL CONDUCTION AND NON-DIFFERENTIAL TEMPERATURE CORRECTIONS TO THE ENTHALPIC FLOW EQUATION

Mitchell R. Swartz <sup>1</sup>

### ABSTRACT

Conventional calorimetry uses Newton's method, assumes a linear time-invariant system, and determines output power from the temperature rise. Better analyses include thermal transfer by radiation, but most use lumped parameters and ignored terms involving heterogeneity, and those which are not a function of the differential temperature. The multi-ring model of calorimetry has used the corrected thermal mass of the inner ring and the previously neglected thermal mass of the barrier. These are now combined with the effective thermal admittance which superimposes the radiative term with the previously neglected conduction term to derive a better approximation. This method also enables consideration of enthalpic uptake by each barrier in a multi-ring system. This method is important because there is additional data which can be derived by the use of the additional rings, including tardive reconfirmation of the measurement of energy.

### INTRODUCTION

Conventional calorimetry examining the enthalpic behavior of electrolysis systems has involved the difficult determination of excess energy from the total heat produced from input electrical energy [1-8]. What is usually done is to use Newton's method and assume a linear time-invariant system. The output power is then determined from the enthalpic flow equation, using the temperature rise, that is  $T_1 - T_{bath}$  (defined as  $\theta$  in several papers). The better calorimetric analyses [2,3] include additional terms involving thermal transfer by radiation such as equation (1).

$$C_{P,H_2O,l} M_0 \times \frac{d\Delta\theta}{dt} = [V_{cell}(t) - V_{thermoneutral,bath}] \times I - \frac{3I}{4F} \times \frac{P}{P_{ambient} - P} \times [(C_{P,H_2O,g} - C_{P,H_2O,l}) \times \Delta\theta + L_{H_2O}] \\ + P_x(t) + P_h \times [u_{-1}(t) - u_{-1}(t-\tau)] + k_R \times [(\theta_{bath} + \Delta\theta)^4 - \theta_{bath}^4] \quad (1)$$

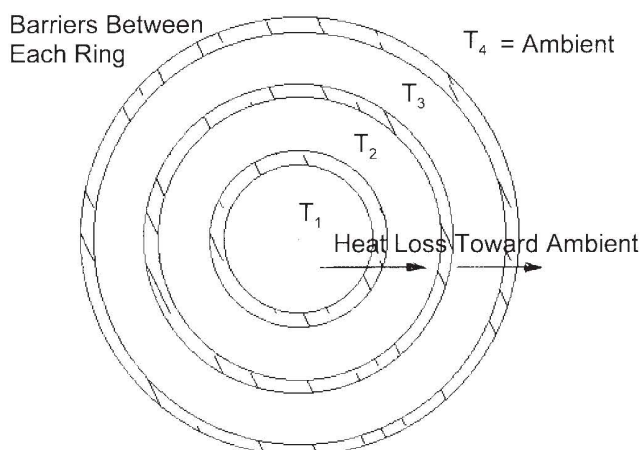
As discussed [2,3], the left hand term in this differential equation of thermal transfer (1) is the increase in enthalpy within the calorimeter. The terms on the right hand side are the presumed enthalpy input from the electrolysis, the contribution of enthalpy content leaving with the electrolysis gas stream, the putative excess power (if any), the heater calibration pulse (with the Heaviside functions), and the radiative heat transfer to the water bath. There are some major problems, however, with Eq. (1). First, in the left hand term, the lumped parameter increase in enthalpy within the calorimeter is actually composed of several terms. And most important [3], some of them are not even a function of  $\Delta\theta$ . Three other problems with the equation include the use of the thermo-neutral potential from the bath rather than the cell, the fact that some would object to this subtraction at all, and the admitted lack of thermal conduction term.

### SUCCESSIVE SHELLS ENABLE A MULTI-RING SYSTEM

For clarification here, a series of temperatures in shells (Fig. 1) is considered rather than one differential. Therefore rather than  $\theta$ , the symbols  $T_1, T_2, T_i$  are used.  $\Delta\theta$  is not used here simply because it is equal

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**Multiple Ring Calorimetric System** A three (3) ring calorimetric system is shown with three barriers which separate the inner electrolyte (not shown, but having temperature  $T_1$ ) from the ambient (at temperature  $T_4$ ). system is shown with three barriers which separate the inner electrolyte (not shown, but having temperature  $T_1$ ) from the ambient (at temperature  $T_4$ ).

Inhomogeneities in the barriers were not considered. Given that there were no sudden changes in thermal diffusion, and ignoring the inhomogeneities and anisotropies, the barriers 1, 2, 3, 4, and 5 remain spatially fixed, thereby making the mathematical solution amenable to a quasi-one dimensional analysis [3]. The boundary conditions are the first ring (containing the electrochemical cuvette and monitored as  $T_1$ ), the feedback-controlled midrings ( $T_3$  or  $T_4$ ), and the zone-controlled room temperature. The heat and mass transfer equations between each set of rings determines the excess heater power (both as an incremental term and amplification rate) and excess energy, if any.

to  $T_1-T_2$  but more importantly because there is additional data which can be derived by the use of the additional rings. Because successive rings are involved and used, additional information [enthalpy to ring 2 (previously "bath")] is not lost. It can be added in for each level. This analysis enables inclusion of those terms in the heat and mass transfer equations which are not a function of the differential temperature ( $\Delta\theta$ ). Some of the materials constitute barriers between rings and hence the energy terms have "additive-terms" [i.e.  $T_1+T_2$ ] terms as opposed to only differential [ $T_1-T_2$ ] terms [3].

The mathematical solution to the power and energy equations were derived from a quasi-one dimensional model [3,9] which should not be confused with the Q1D model of isotope loading [10,11]. Account in the calculations was taken of the specific heat and mass of all barriers.

## DERIVATION OF CORRECTED ENTHALPIC FLOW EQUATION

There remains confusion as to the definition of input power and excess heat [8]. Although power in electrical and power engineering is defined as  $V \cdot I$ , classical electrochemistry considers the thermodynamics by simply assuming the steady state is achieved. Although the standard free energy of water [ $\Delta G_{298}^0(H_2O) = -237.18 \text{ kJ/mol}$ ] yields a theoretical decomposition voltage of water [ $V_{\text{thresh}} = \frac{\Delta G}{2F}$ ] of 1.23 volts, it is the thermo-neutral potential ( $V_{\text{therm}}$ ) which is subtracted from the cell voltage to derive the electrochemical "input power" where the voltage is  $V_{\text{cell}} - V_{\text{therm}}$ . The thermo-neutral potential is based upon the standard free enthalpy of water  $\Delta F_{298}^0(H_2O) = -237.18 \text{ kJ/mole}$  and is 1.48 volts (light water, 1.54 heavy water) which is the potential which produces gas without temperature change [2,3,6]. Although most calorimetry in the field is directed towards utilization of the thermo-neutral potential [12] it is simply not respected universally [13]. The major reasons are the lack of thermodynamic equilibrium, the use of this number ( $V_{\text{cell}} - V_{\text{therm}}$ ) in a denominator, and the lack of evidence that this is isothermal.

These issues are now corrected, including the addition of thermal conduction and the compartmental correction for the rings which enable consideration of enthalpic uptake by each barrier.

$$\begin{aligned}
 & [C_{P,H_2O,i}M_0 + \sum_i (C_{P,i}M_i)] \times \frac{dT_1}{dt} + \left( \frac{[C_{12} \times M_{12}]}{2} \right) \times \frac{d[T_1 + T_2]}{dt} = [V_{\text{cell}} - V_{\text{thermoneutral}}] \times I \\
 & - \frac{3I}{4F} \times \frac{P}{P_{\text{ambient}} - P} \times \{ [(C_{P,H_2O,g} - C_{P,H_2O,i}) \times (T_1 - T_2)] + L_{H_2O} \} + \\
 & P_x(t) + P_h \times [(u_{-1}(t)) - (u_{-1}(t-\tau))] + k_{R_{12}} \times [T_1^4 - T_2^4] + k_{C_{12}} \times [T_1 - T_2]
 \end{aligned} \tag{2}$$

The solution of Eq. (2) has been discussed elsewhere [3]. Briefly,  $\alpha_1$  is the second term which is the integrated terms comprising the thermal capacity of ring 1 (electrolyte, electrodes and leads, thermal sensor and leads, and ohmic control and leads).

$$\alpha_1 = [C_1 \times M_1] + [C_{cathode} \times M_{cathode}] + [C_{anode} \times M_{anode}] + [C_{thermistor} \times M_{therm}] + [C_{ohmic\_control} \times M_{ohmic}] \quad (3)$$

$Y_{12}$  is the thermal capacity of each jth portion of the barrier, calculated from the specific heat ( $C_{12}$ ) and mass ( $M_{12}$ ) of each subbarrier.

$$Y_{12} = C_{12} \times M_{12} \quad (4)$$

The zeroth and first order terms of the source heat allow the definition of an effective thermal admittance [ $Y_{12}$ ]. This includes radiative and conductive components of the barrier between rings 1 and 2.

$$k_R \times [T_1^4 - T_2^4] + k_C \times [(T_1 - T_2)] \approx [(k_C + (4 \times k_R \times [T_2]^3)) \times (T_1 - T_2)] \quad (5)$$

The binomial expansion yields the effective thermal admittance [ $Y_{12}$ ].

$$Y_{12} = (k_C + (4 \times k_R \times [T_2]^3)) \quad (6)$$

In summary, using the quasi-1-dimensional multi-ring calorimetric analysis [3], the corrected thermal mass of the inner ring and the previously neglected thermal mass of the barrier are now combined with additive terms in the enthalpy flow equation to yield an effective thermal admittance [ $Y_{12}$ ] between the first two rings (i.e., the sample and the bath in the simplest of systems). Although there are limitations with this method, including failure to include possible phase changes within the material [14, 15], this method yields a more accurate derivation of the information sought as has been demonstrated by thermal waveform reconstruction of control enthalpic inputs [3].

TABLE OF VARIABLES			
$\alpha_1$ thermal capacity in 1st ring due to electrodes, leads, etc.	joules/(K-mole)	$P_h$ heater power	watts
$C_{P,H_2O}$ specific heat water light water	joules/(K-mole)	$P_x$ excess enthalpy = $P_{excess}$	watts
$C_{1,2}$ specific heat of first barrier	joules/(K-mole)	$P_{H_2O}$ partial pressure of water	torr
$\Delta F^0(H_2O)$ standard free enthalpy water	joules	$P_{electrolysis}$ ohmic control heat	watts
$\Delta G^0(H_2O)$ standard free energy water	joules	$P_{ambient}$ ambient partial pressure	torr
F the Faraday	96484coul/mole	$\theta$ temperature	degrees K
$Y_{12}$ thermal capacity 1st barrier	joules/(K-mole)	$T_1$ temperature inner ring	degrees K
I electrical current	ampere	$T_2$ temperature second ring	degrees K
$k_C$ thermal conductive coef.	joules/(cm <sup>2</sup> secK)	$u_{-1}(t)$ Heaviside function	nondimensional
$k_R$ radiative coef.	joules/(cm <sup>2</sup> secK <sup>4</sup> )	$V_{cell}$ potential across electrochemical cell	volts
$L_{H_2O}$ enthalpy of evaporation	joules/mole	$V_{thermoneutral}$ thermoneutral potential (H <sub>2</sub> O)	1.48 volts
$M_0$ mass of electrolyte in ring 1	grams	$Y_{12}$ combined thermal coefficient (conductive and linearized radiative)	joules/(cm <sup>2</sup> secK)
$M_{12}$ mass of barrier between rings 1,2	grams		

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## THE IMPORTANCE OF CONTROLLING ZERO-INPUT ELECTRICAL POWER OFFSET

Mitchell Swartz, Gayle Verner <sup>1</sup>

### ABSTRACT

Both palladium heavy-water and nickel light-water systems appear to demonstrate the biphasic character of the production rates of excess heat and nuclear ash for increasing input electrical power drive. Plots of excess heat, or power gain, as a function of input electric power drive indicate a narrow locus of optimal system operating points. At the center of the optimal operating point, the peak power gain may be at a relative maximum. Driving with electrical input power beyond this operating point yields a typical falloff of the observed power gain for increasing input power or current levels toward a power gain of 1 and less.

The failure to reproduce the cold fusion phenomena may have occurred, in part, because many experimental systems may have been inadvertently or unintentionally driven outside of the optimal operating point envelope (manifold). It might simply be the failure to appreciate noise power. This paper describes the importance of zero point corrections along the electrical input manifold. Failure to make semiquantitative corrections to control zero offset may generate artifacts in the power gain curve.

### INTRODUCTION

With improvements in calorimetry [1-8], noise analysis [9], and definitions of input power [1, 10], an optimal operating point in the response of the observed excess power to the input electrical power for nickel light water systems has been revealed. [1, 11]. Plots of excess heat achieved, or power gain as discussed here, as a function of input electric power drive indicate a narrow locus of optimal system operating points (Fig. 1). For electrical power input beyond the peak operating optimum, the power gain falls off toward, and then below, unity. The observed excess heat does not occur for ohmic controls or with iron, aluminum, or platinum as cathodes. For the controls, the detected enthalpy remains below or near unity (implying no excess heat) depending on several issues including possible chemical precipitation, possible heat loss in the exit gas stream, and the ratio of the cathodic potential to the thermo-neutral potential. The excess heat also persists when integrated energy, electrical noise, radiant heat, and chemical factors are considered [1].

Several years of our investigations of these nickel light-water systems has resulted in a more reproducible excess enthalpy, achievable through electrically driving these systems at their optimal operating point. When these studies began, we wanted to minimize electrolysis (thus increase loading) and, therefore, the term "(electrolysis production) notch" was initially used. In examination of the output power curves, "peak", or "optimal operating point" are more appropriate terms. This biphasic behavior of the excess heat is important for several reasons. First, it may account for some of the widespread difficulties in observing and resolving the phenomena. That is, this failure to reproduce the cold fusion phenomena may have occurred because many experimental systems may have been inadvertently or unintentionally driven outside of the optimal operating point envelope (manifold). Second, each sample is different, and, therefore, its optimal operating point must be individually determined. It is important to note that the obtainable peak (maximum output) may be an individual sample's characteristics with a decrease from the peak due to suboptimal drive conditions.

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We investigated the lower input power levels in the Kirk Shanahan-bead experiments undertaken and widely reported by Scott Little and Dr. Hal Puthoff [12]. As previously discussed [13], when a second hypothesis was examined and tested, the optimum operating point model was analyzed because it might offer improved utilization of these systems. This paper reports the results of a second issue which may offer improved accuracy of these calorimetric systems.

## INDEPENDENT NICKEL DATA

The Kirk Shanahan-bead experiments undertaken by Little and Puthoff [SLKS - ref. 12] have been emphatically claimed to show no excess heat. We undertook optical reconstruction and sampling of their data points by hand, using a Sylvac Ultracal Mark III caliper to test the hypothesis that their experiments might have actually demonstrated excess heat at lower input drive levels with the KS beads. Because of the absence of long term baselines, thermal waveform reconstruction or other time constant data, we eliminated the transition regions between different drive levels. Fig. 2 shows the analyzed data.

Regarding the concept of optimal operating points, this investigation found that the KS-beads may have had a very low level excess heat possibly consistent with the reports of the coated microspheres of which they are a reported copy. What appears as a possible optimal operating point can be seen. At the maximum, the SLKS data indicates  $\sim 15 \pm 15\%$  excess. That is, however, within a serious level of background scatter several standard deviations wide (shown by the upper and lower curves in Fig. 2). This example cannot corroborate the general findings of optimal operating points because the error bars are significant. Nonetheless, the power of the optimal operating point technique is that it may be applicable to independent data - and may suggest an operational region in which to examine this phenomenon.

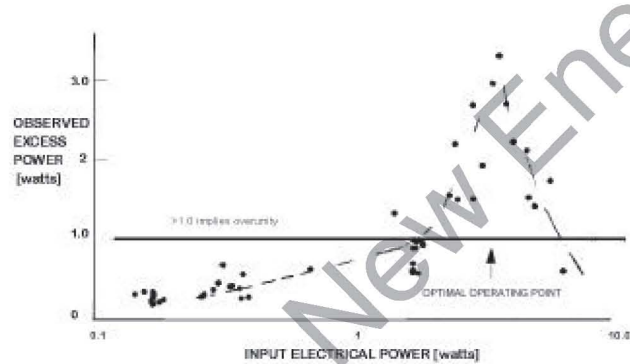


Fig 1 - A Possible Optimal Operating Point

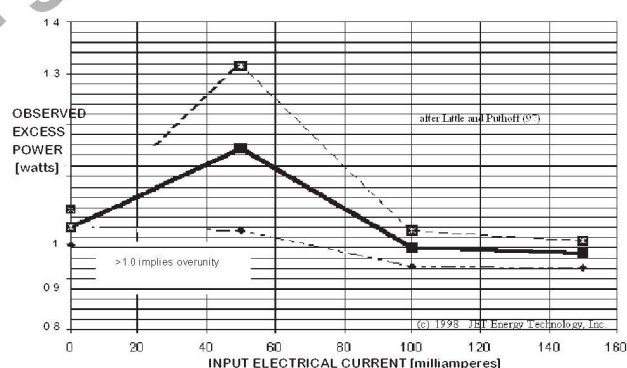


Fig 2 - Nickel-Light Water Optimal Operating Points

Fig. 1 - [left] - The upper graph shows the observed excess power (watts) as a function of applied input electrical power. The cell is a nickel spiral cathode versus two platinum anode plates (area  $8.0 \text{ cm}^2$ ), parallel-opposed in light water were used with a centrally placed nickel cathode (area  $4.8 \text{ cm}^2$ , volume  $0.059 \text{ cm}^3$ ).

Fig. 2 - [right] - Three curves are shown from SLKS data. Excess power gain is plotted as a function of input electrical current. Only a power gain greater than 1.0 demonstrates excess heat. The central curve is the actual reported output of the nickel light water system. The other two curves show several standard deviations (error bars) of the measurement at each input power level (after the Little-Puthoff examination of the Kirk Shanahan nickel plated plastic beads versus platinum anode in light water). Surface area, and volume unknown.

Several assumptions are important to this analysis: First, a vertical flow calorimetric system is used despite the possible pitfalls of a vertical rather than a horizontal system. Second, the cell, pump, and electrolyte reservoir were housed in an insulated enclosure (single ring), with a standard delta-T measurement across the enclosure. Therefore, problems of the Little/Earthtech system may include an apparent sensitivity to the ambient and/or other sources. Other problems include the calorimetric response possibly being sensitive to the location of those additional heat sources; the fan and pump dissipating ~20 and 250 milliwatts each. In our own experiments, because of potential errors associated with flow calorimetric systems [1, 4, 5, 7, 8], we have used static isoperibolic calorimeter with waveform reconstruction, noise measurements, thermal controls [1, 9, 11].

Such noise measurement was not present in the SLKS data which used two simultaneous systems to measure the heat output of the cell. Therefore, given these (and other) limitations, this is neither an endorsement of their calorimeter nor their claimed levels of accuracy. Nor is this an absolute claim that excess heat was achieved. Rather, this analysis suggests a possible location in the input electrical power drive curve where, in that drive-phase-space of the system, attention should have been focused to drive the system as taught [13, 14], if one is seriously interested in achieving results consistent with those reported in the literature.

Further caution is warranted because of the following. First, the precision at the zeroth power level is estimated, and cannot be corrected until adequate long-term temperature waveform reconstruction and cooling curve data becomes available. Second, the Earthtech equipment was elected to be used with an offset for reasons that may include: a) the time variation of effective thermal path lengths, b) the utilization of a single-ring calorimetric system, or c) the presence of remnant shift at zero input electrical power (~30 milliwatts) which the group elected not to reset with each recalibration of zero input electrical power.

Of concern here is that during portions of the experiment in question, at zero (0) input electrical power, the Earthtech system electively read a false positive of circa +20 to 30 milliwatts. This is in contrast to other studies where a semiquantitative correction is used. Third, the Earthtech equipment may have been designed to be insensitive to the peak magnitude of excess heat observed for nickel in light water systems (~88 milliwatts/cm<sup>2</sup>) because Earthtech has estimated their "accuracy as  $\pm 0.05$  watts or 10% relative, whichever is larger", with a precision of  $\pm 0.03$  watts, yielding a sensitivity usually in the range of 0.15 watts.

## IMPACT OF FAILURE TO REMOVE ZERO POWER OFFSET

Failure to "zero" a calorimeter is a poor technique because it may produce false positive and false negative indications of excess heat. It can produce artificial false positive power gains of infinity as the electrical input power levels approach zero. By contrast, applying the more widely accepted use of semiquantitative correction and linearization, electrode materials exhibit power gains of 1 (where  $>1$  indicates excess heat) or less at very low input power levels. As input electrical power further increases, except for materials which generate excess heat such as active samples of nickel with light water or palladium with heavy water, the power gains always fall to levels lower than 1 (as the energy exits in the electrolysis gas stream).

Therefore, attention to the zero power input correction seems reasonable because of the importance of having a calorimeter read as accurately as possible. Further confirmation of the appropriateness regarding the correction are the following three matters. The information derived from the semiquantitative correction also agrees with both L'Hospital's Rule and common sense, whereas the uncorrected Earthtech system yielding infinite power gain of all materials at low input electrical power levels, does not. However, most materials simply do not demonstrate infinite power gain [1,9,11,13,14], as described above. Third, if the offset were negative (again rather than correcting to null the calorimeter) the power gain would appear as minus infinity.



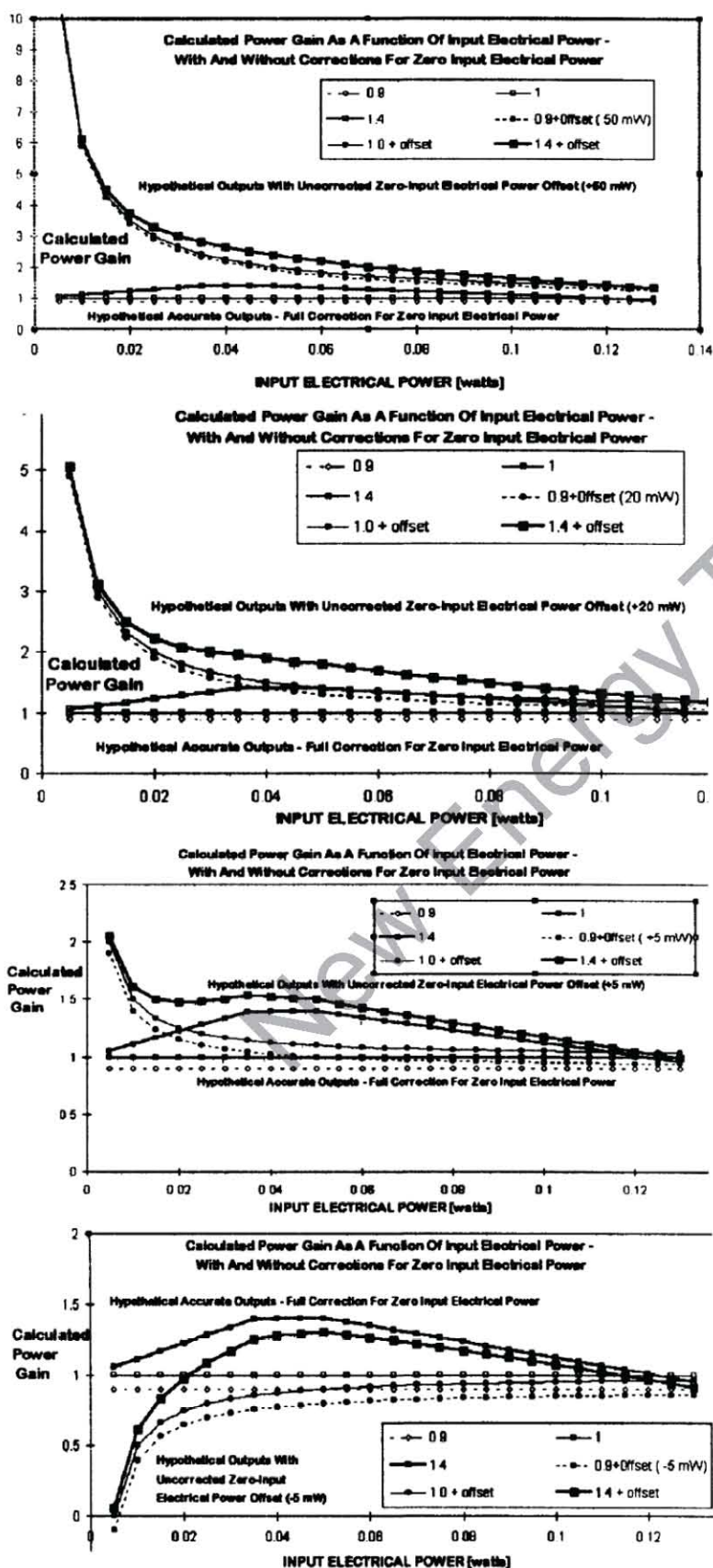


Fig. 3 - Mathematical Model of the Impact of a Zero-Offset Input Electrical Power Error

Calculated Power Gain – With and Without Corrections for Zero Input Electrical Power.

These four graphs showing the impact of different zero-offsets along the input electrical power axis.

Each graph within Fig. 3 shows six curves. The bottom three represent the output of a calorimeter which has been accurately calibrated and therefore represents the presumed 'accurate' output of the input. The upper three curves demonstrate the observed output if the calorimeter has varying degrees of power offset, if the calorimeter has a five milliwatt offset period.. The precision is not shown in any of these curves.

The dashed curves represent sub-unity performance. In the graph, this performance is represented by a calculated power gain of less than one. For example, this sub-unity result could be the formation of a colloid or phase which is endothermic. In this case the output is exactly equal to the input.

The solid curve (central in each set) represents unity performance.

The thick lines are a hypothetical excess heat with this excess heat production being present only over a limited range of input electrical power; that is, an optimal operating point in the range of 25 to 55 milliwatts.

#### TABLE OF OFFSETS

- a) upper) + 50 milliwatt (mW) offset at zero absolute input electrical power
- b) mid) + 20 mW offset
- c) low mid) + 5 mW offset
- d) lower) - 5 mW offset

A mathematical model was set up to explore this further. Fig. 3 shows four (4) graphs, each with six curves. The six curves in each graph represent paired hypothetical excess (or lack thereof) heats - with and without an offset. The three pair of curves in each graph represent sub-unity performance, unity performance, and excess heat with an optimal operating point in the range of 25 to 55 milliwatts for the input electrical power. The dotted lines are below unity, and therefore in each graph is represented by a calculated power gain of less than one. For example, this could be the formation of a colloid or phase which is endothermic. The central paired curves (solid thinner line) has unity performance. In this case, the output in a calibrated system **should** be exactly equal to the input. The upper of the three lower curves is the hypothetical case of a system which demonstrates excess heat production over a limited range of input power.

It can be seen that an offset as small as five milliwatts will have two effects. There is the possibility of obtaining a false negative output of excess heat. The offset produces an artifact which may actually mask the generated excess heat. In addition the location along the input electrical power axis where the optimal operating point was seen, is now shifted to the left. This is consistent with what is expected when a peak is superimposed on a sloping curve. The next three curves demonstrate the impact of varying offsets which have failed to be corrected. The first curve is a positive offset of 20 milliwatts which demonstrates significant masking of the excess heat signal. This continues for the two lower curves as well. The second group of curves represents a negative offset which has failed to be corrected of magnitude -0.5 milliwatts. In this case the dispersion of the error signal goes to minus infinity as the input electrical power goes to zero. The final curve represents an offset signal of 50 milliwatts which completely obliterates the hope of detecting small amounts of excess heat in the systems.

Thus, there are other implications from not applying a zero-point semiquantitative correction and linearization. One possible corollary of the failure to correct the zeroth level of indicated power to input power is that, in addition to lower accuracy increasing toward the smallest electrical input power levels, there may be a masking of the activity of very low to moderately active samples output even if they do produce excess heat. This is consistent with the Earthtech calorimetric sensitivity to excess heat being 100-150 milliwatts. Thus, it is demonstrated that zero point corrections are as important in obtaining accurate data along the electrical input manifold as they are in basic thermometry on which such calorimetric information depends.

Furthermore, such zero-point correction along the electric input axis must now be included with noise measurements [9] and other semiquantitative corrections [5-8, 15] that can be used to improve the performance of calorimetry.

## SUMMARY

Optimal operating points might be generalized behavior for hydrided solid state fusion systems. Both palladium-heavy and nickel-light water bead systems appear to demonstrate the biphasic character of the production rates of several products for increasing input electrical power drive. It cannot be emphasized enough for investigators to remain vigilant regarding possible optimal operating points because not all these systems are robust, and because the narrow loci of optimal operating points can be at relatively low input power levels resulting in their being overlooked.

Zero-input electrical power offset corrections along the electrical input manifold are also important because failure to make these semiquantitative corrections can generate an artifact of false positive indications of excess heat. Furthermore, if the optimal operating point loci are at low input power levels, failure to monitor zero point corrections can also yield false negative indications of excess heat.

## ACKNOWLEDGMENTS

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[See also: Mitchell R. Swartz, "Thermal Conduction and Non-Differential Temperature Corrections to the Enthalpic Flow Equation." this issue, p 10.]

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## NUCLEAR PRODUCTS AND TRANSMUTATION IN A GAS-LOADING D/PD AND H/PD SYSTEM

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### ABSTRACT

In a gas-loading D/Pd or H/Pd system, the nuclear products have been identified using mass spectroscopy, scanning electron microscope, electron probe microanalysis, and solid state nuclear track detector. In contrast with the electrolytic cell in most of the "cold fusion" experiments, the gas-loading system has the advantage of less contamination, and provides one more compelling evidence of anomalous heat production.

### INTRODUCTION

Nine years after the first announcement of Fleischmann and Pons experiment, the cold fusion community has confirmed a single fact: that is, "excess heat" is produced with no strong neutron and Gamma radiation. Two different conclusions were extracted from this single fact: (1) "excess heat" is a mistake because most of physicists believe that "excess heat" has to have strong neutron and Gamma radiation; (2) "excess heat" is a real phenomenon, because the experimentalists insist that their instruments and observation are reliable, although they do not understand the mechanism of this phenomenon.

The key issue to reconcile these two different conclusions is to find any nuclear products other than neutron or Gamma radiation. The low-energy nuclear transmutation is an important object for this purpose.

The nuclear transmutations in the "cold fusion" experiments have been reported in gas-discharge and electrolytic systems, but it was not given enough attention until a series of quantified measurements were presented in the Second International Low Energy Nuclear Reactions Conference and at ICCF-6 in 1996. In order to confirm these low-energy nuclear transmutations, the exclusion of any possible contamination was essential. Our gas loading experiment has the advantage of less contamination; therefore, various technologies were applied to our gas loading D/Pd and H/Pd systems to identify any possible nuclear products.

### HELIUM IN THE GAS-LOADING D/PD SYSTEM

Among the possible nuclear products, helium is the first object based on the D+D reaction. Miles and Arata showed that helium was generated in the heavy-water electrolytic system when the "excess heat" was generated. Hence, the gas in our gas-loading D/Pd system was analyzed using mass spectroscopy (NG-1000).

In order to distinguish the helium from the D<sub>2</sub> gas { $m(^4\text{He}) = 4.00260$ ,  $m(\text{D}_2) = 4.02820$ }, high-resolution mass spectroscopy was applied. The resolution, ( $m/\Delta m$ ), has to be greater than 156; however, the resolution of the mass spectroscopy in our experiment (NG-1000) is greater than 700.

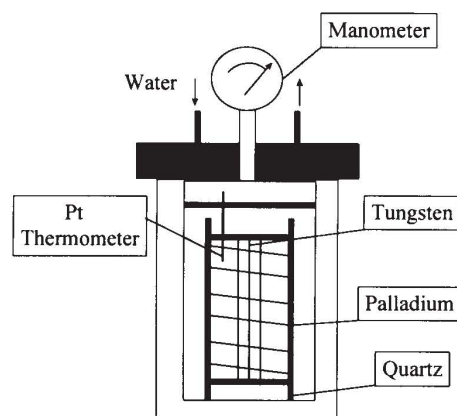


Fig. 1 The Gas-Loading System for H/Pd.

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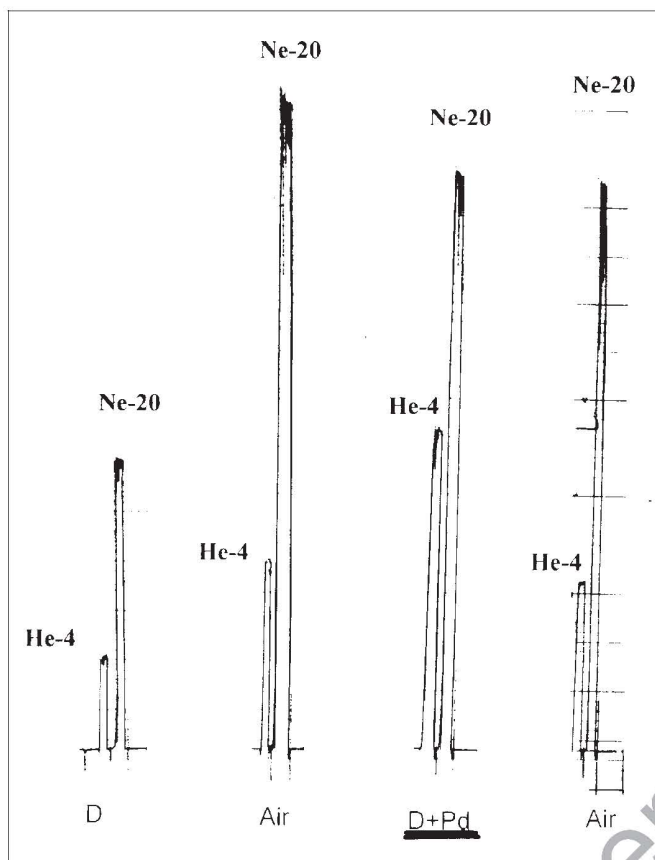


Fig. 2 Mass-spectroscopy measurement of the ratio of Helium-4 to Neon-20 for pure deuterium gas, air sample before from D/Pd dewar, and air sample after test.

The gas-loading system has been described in detail in the proceedings of ICCF6 [1]. To avoid the contamination from the air, we detect the ratio of  $^4\text{He}$  to  $^{20}\text{Ne}$  of the sample gas in the Dewar in parallel with the air sample. Fig. 2 shows the signal diagram in this experiment. We took the sample gas from the gas-loading D/Pd Dewar, where the "excess heat" experiments were done for more than one year. The ratio of  $^4\text{He}/^{20}\text{Ne}$  in this sample gas was 0.55. This ratio for the air sample was measured just before and after the sample test. This ratio of  $^4\text{He}/^{20}\text{Ne}$  for the standard air should be 0.318, and this ratio for our air samples are 0.296, 0.299, respectively. Thus, the accuracy is good enough to show there is a "helium" source in the deuterium gas-loading Dewar. We analyze the helium components in the original deuterium gas also. The absolute value of helium component is very low; however, the ratio of  $^4\text{He}/^{20}\text{Ne} = 0.318$  is very close to that of standard air. This confirms the conclusion that the "helium" source is associated with deuterium plus palladium system.

#### Nuclear Products in the Hydrogen-Loaded Palladium

In our gas-loading system, the H/Pd system was used as a control for "excess heat" measurement. Now it turns out to be a good system to detect the nuclear transmutation as well. After one year of loading experiment, Zinc was found on the surface of hydrogen-loaded palladium wire (Fig. 3) [2]. In order to exclude the possibility of contamination, we searched the rare-earth elements among the other nuclear products. Terbium ( $^{65}\text{Tb}$ ) on the surface of the hydrogen-loaded palladium was found (Fig. 4 and Fig. 5) [3]. Now we report the nuclear signal emitted by hydrogen-loaded palladium thin film.

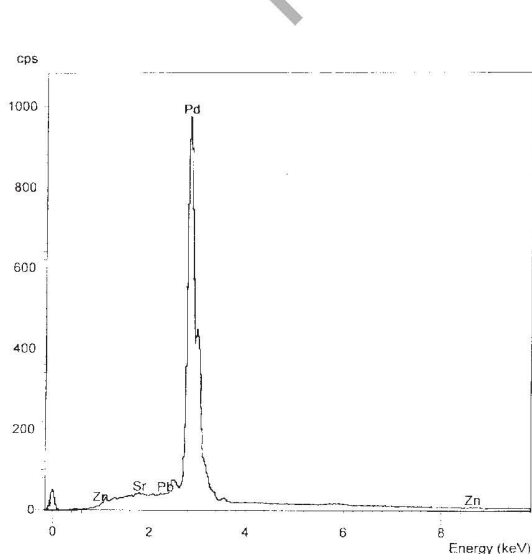


Fig. 3 (a) EDS analysis of the original palladium wire.

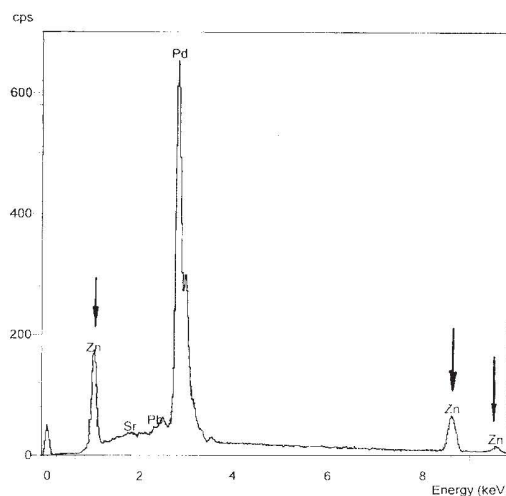


Fig. 3 (b) EDS analysis of the hydrogen-loaded palladium wire.



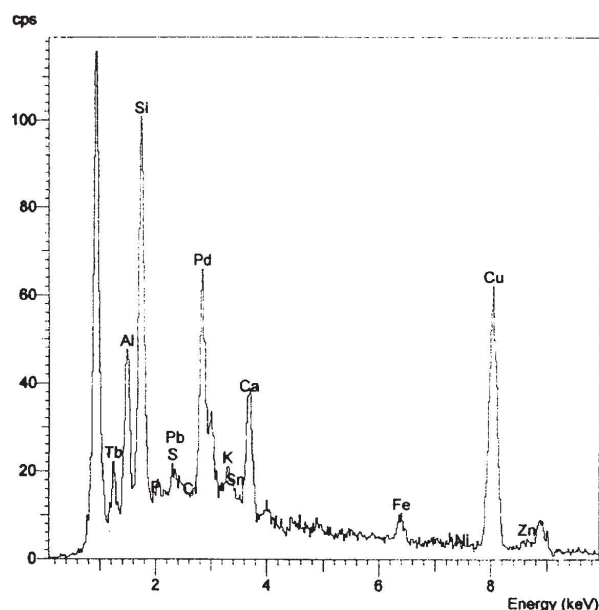


Fig. 4 EDS analysis of hydrogen-loaded Pd wire showing Tb peak.

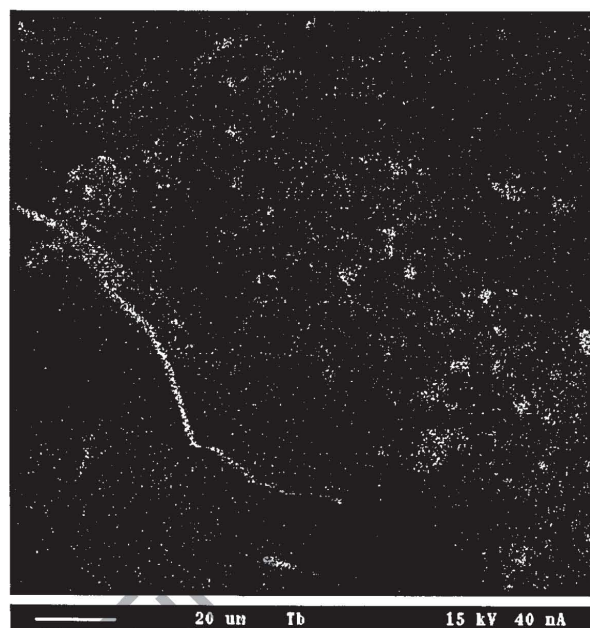


Fig. 5 Electron probe micro-analysis (EPMA) in WDX (Wave-length Disperse X-ray) mode showing terbium distribution on the surface of palladium wire loaded with hydrogen in a gas-loading system.

The solid state nuclear track detector (CR-39) was used to detect any energetic charged particle from the surface of a palladium thin film. Fig. 6 shows that a piece of hydrogen-loaded palladium thin film was sandwiched in between two pieces of CR-39 detector. 5½ months later, CR-39 was etched in 6.8N NaOH solution at 70°C for 5 hours, under the microscopy the etch pits were clearly shown. There is a big difference between the area covered by hydrogen loaded palladium film and the area not covered by hydrogen-loaded palladium film. **The number density of the pits is 30 times greater than that of background.**

An interesting signal was found in a pair of CR-39 numbered 1A178 and 1A148. The signals appeared in the same position with the similar pattern. It reveals that there might be an active region on the palladium thin film, which emitted energetic charged particles in both directions. Since the thickness of the thin film is about 1 micron, it gives an estimation of the energy of the charged particle also, which must be in the order of MeV.

## DISCUSSION

Zn components appeared in the Pd electrode in the early literature on cold fusion research also. It was considered as a contamination. Indeed this was one of the important evidences for nuclear signal. However, it means that "cold fusion" is just a part of this new category of anomalous phenomena in D/Pd, H/Pd or Hydrogen/Metal system. "Cold fission" might be another part of this anomalous phenomena. The three-body (3D) nuclear reaction [4] is also a part of this anomalous phenomena. However, they might be all predicted by the selective resonant tunneling model [5].

## ACKNOWLEDGMENTS

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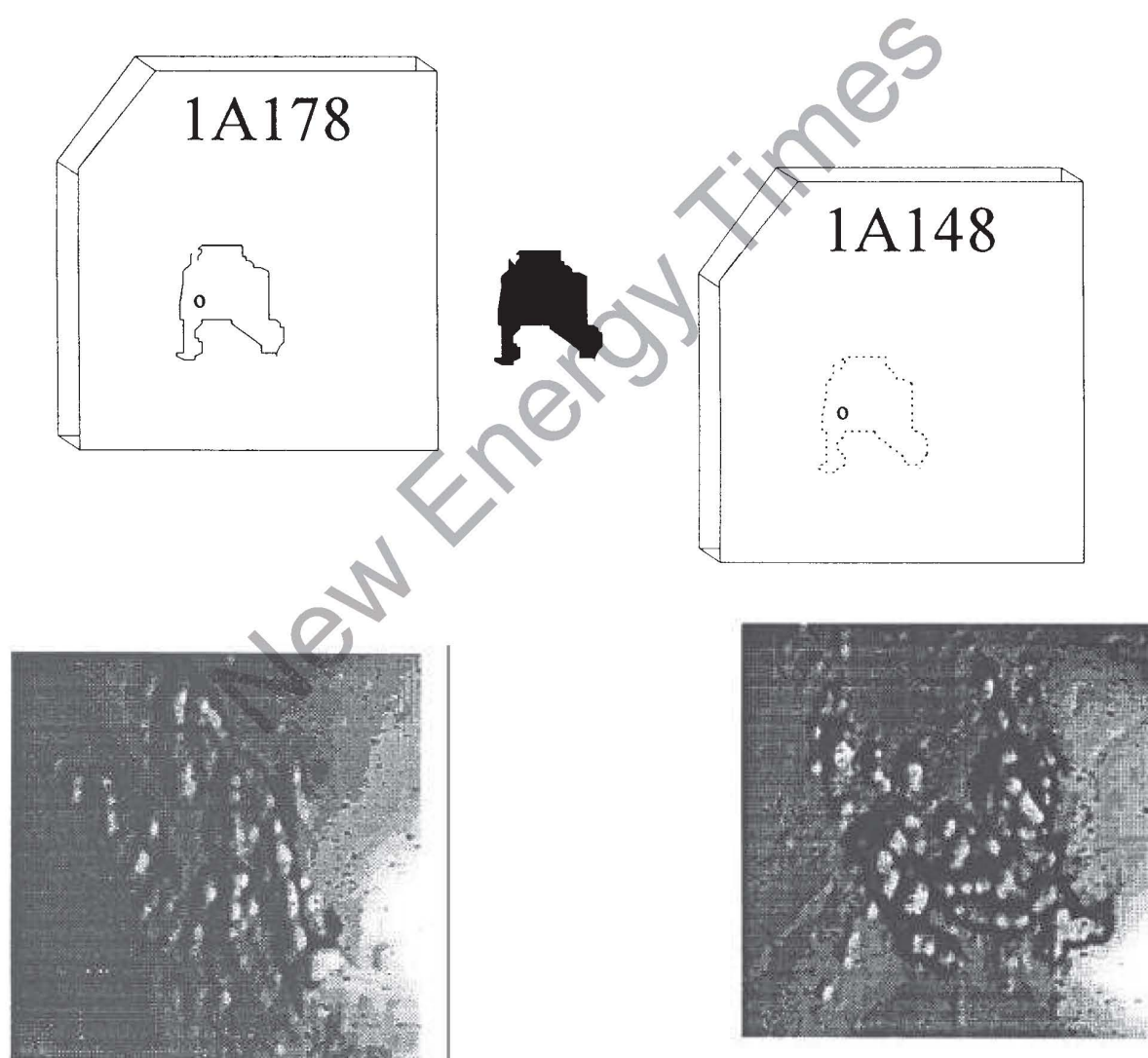


Fig. 6 The nuclear signal in the solid state nuclear track detector (CR-39).



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## A MODEL-BASED ANALYSIS OF HFS-INDUCED HEAT TRANSPORT IN CERTAIN METALS

Thomas Z. Fahidy <sup>3</sup> and Roman E. Sioda <sup>4</sup>

### ABSTRACT

High-Fusion-Spot (HFS) induced heat transport in metal spheres imbedding an HFS in their center is modeled by accounting for the temperature variation of thermal conductivity and thermal diffusivity in appropriate thermal balance equations. The utility of the model for the estimation of the radial temperature drop from cavity to heat sink is numerically illustrated in the case of palladium and titanium with estimated temperatures between 60,000 and 90,000 kelvin inside a 20 nm-radius spherical HFS. An approximate means of predicting the minimum HFS temperature required to induce melting at the cavity/metal interface is also described.

### INTRODUCTION

Pursuant to the hypothesis of Seitz [1] that a block of deuterated metal may contain localized "hot-spots" in which hot fusion may take place, Karabut et al. [2,3] showed experimentally the formation of small "bubbles" in deuterium-activated palladium, responsible for the production of excess heat. Typical bubble sizes of 10 - 100 nm with a density of  $10^{20} \text{ m}^{-3}$  were reported by the authors for Pd samples producing about 4.1 kJ of excess heat over a period of about 350 s; one average bubble would accordingly produce about 0.41  $\mu\text{J}$  excess heat. By analogy, similar observations could presumably be made for titanium, a metal used frequently in cold-fusion studies. In a detailed analysis of these findings, Sioda [4-7] proposed an approximate thermal characteristics-based model for the estimation of heat transport rates and hot-spot temperatures in palladium and titanium spheres embedding high-temperature radiating cavities of about 20 nm diameter. An important limitation in Sioda's analysis lies in using room-temperature thermal conductivity data of Pd and Ti, which assigns, at best, an order-of-magnitude accuracy to the numerical calculations.

While the concept of cold fusion continues to be a subject of controversy, the analysis of heat conduction in a small metallic particle with (at least) one face exposed to a very high temperature thermal energy source is of interest to new-energy studies, regardless of the true origin of the energy produced in the small cavity adjacent to the exposed metal face(s). The estimation of the lowest cavity temperature to generate melting at the cavity/metal interface is equally interesting. In principle, the temperature dependence of thermal conductivity *ab-ovo* indicates an inherently nonlinear mathematical formulation, which is further challenged by sparse experimental data available at temperatures near the melting point of many metals.

This paper presents an approximate model for estimating the radial temperature drop from the central cavity to the heat sink maintained at normal (low) temperatures, in the absence, however, of actual melting of the metal. The temperature dependence of thermal conductivity is considered in terms of a set of piecewise linear relationships, yielding a relatively straightforward numerical procedure for the estimation

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of steady state temperature profiles. A rapid analytical estimation of unsteady state temperature profiles in the metal is also briefly discussed.

## METHOD

We consider a single metallic sphere with a very-high temperature cavity in its center of radius  $R$ . In compliance with the literature cited above, the cavity is called a hot-fusion spot (HFS) which releases  $Q_0$  thermal energy per unit time. It is assumed that the rate of dissipation through the sphere via conductive heat transport is sufficiently strong to avoid melting, hence there is no source of heat generation in the metallic sphere itself. Hence, the classical Fourier's law of thermal conduction is the only propagation vector in the Gauss-Ostogradskii divergence theorem describing the overall heat balance. Since heat generated in the HFS is spatially uniform, it is sufficient to consider thermal energy propagation as a unidimensional radial process with thermal balance

$$\partial/\partial t[\rho(T)c_p(T)T] = k(T)[\partial^2 T/\partial r^2 + (2/r)\partial T/\partial r] + (dk/dT)(\partial T/\partial t)^2 \quad (1)$$

where metal density, specific heat capacity, and thermal conductivity are *a priori* temperature dependent. Eq.1 cannot be solved analytically, and a rigorous numerical solution is encumbered by mathematical complexity resulting from the temperature dependence of all physical parameters of metals. In a simplified approach, the metallic sphere is assumed to be free of interaction with neighboring spheres exposed to a similar HFS-induced thermal energy flow, and the auxiliary equations for Eq.1 may be stated as

$$(a) \ t = 0; T(r, t) = T_0; R \leq r < \infty \quad (2a)$$

$$(b) \ r = R; [\partial T/\partial r]_{r=R} = -\sigma T_c^4/k_R \quad (2b)$$

$$(c) \ r \rightarrow \infty; T(r, t) \rightarrow T_\infty; t > 0 \quad (2c)$$

### (a) The steady-state temperature distribution model

Anticipating a piecewise-linear temperature dependence of thermal conductivity of Pd and Ti shown in the sequel, the time-invariant form of Eq.1 is written as

$$(k_0 + \beta T) (d^2 T/dr^2) + (2/r) (k_0 + \beta T) (dT/dr) + \beta (dT/dr)^2 = 0 \quad (3)$$

with  $(k_0; \beta)_n$  data pairs established for the  $n$  temperature segments of interest. In the numerical solution starting at  $r = R$ , the thermal conductivity varies in the first segment according to data-pair set  $(k_0; \beta)_1$ , until  $T(r)$  drops to the upper limit of the second segment. In the second segment data-pair set  $(k_0; \beta)_2$  is employed until  $T(r)$  drops to the upper limit of the third segment, where data-pair set  $(k_0; \beta)_3$  is employed, and so forth.

It is instructive to compare the  $T(r)$  distribution obtained from Eq.3 to the approximate analytical solution based on a single-valued mean thermal conductivity  $k_m$ , computed by averaging the thermal conductivity data pertinent to the temperature domain of interest. As shown in the classical literature [8,9], the solution of Eq.3 is straightforward, yielding the temperature/distance relationship

$$T(r) = T_\infty + Q_0/4\pi k_m r \quad (4)$$

Eq.4 may be used for a quick approximate estimation of the cavity temperature by setting  $r = R$  in Eq.4, and computing the temperature gradient in Eq.2b, the latter then yielding  $T_c$ , provided that the relative magnitude of radiation and electron-thermal conduction is known [5].

### (b) Estimation of the unsteady-state temperature distribution with mean thermal conductivity

Since the numerical values of metal thermal diffusivity change slightly with temperature [10], an appropriate value of  $\alpha_m$  reduces Eq.1 to the much simpler form of

$$\partial T / \partial t = \alpha_m [\partial^2 T / \partial r^2 + (2/r) \partial T / \partial r] \quad (5)$$

with auxiliary conditions listed in Eq.2. A slight alteration of the integral transform-based approach shown by Özisik [9] yields

$$[T(r,t) - T_\infty] / [T_R - T_\infty] = (R/r) \operatorname{erfc}[(r - R) / (4\pi\alpha_m t)^{0.5}] \quad (6)$$

if it is assumed that the cavity/metal interface temperature reaches its steady-state value very rapidly. The validity of this assumption may be demonstrated by applying a local heat balance to the interface, involving Fourier's law of conduction and the Stephan-Boltzmann law of radiation:

$$Q_o = -4\pi R^2 k_m [dT/dr]_{r=R} = 4\pi R^2 a \sigma T_c^4 \quad (7)$$

where "a" is a coefficient determined by the relative magnitude of electron-thermal conduction and radiation in the cavity. The resulting relationship

$$T_R(t) = T_\infty + [a \sigma T_c^4 / k_m] (4\pi\alpha_m t)^{0.5} / [(4\pi\alpha_m t / R^2)^{0.5} + 2] \quad (8)$$

clearly indicates that, with the exception of extremely short times,  $T_R$  is essentially a constant, since  $(4\pi\alpha_m t / R^2)^{0.5} \gg 2$ , due to the extremely small cavity radius. Eq.8 yields an approximate value of the minimum HFS temperature  $T_c$  required for the condition  $T_R = T_M$ , i.e., for reaching the temperature of melting from lower temperatures, but without the onset of melting. If melting occurs, the heat transport process becomes a moving boundary problem with model equations to incorporate (e.g. Özisik [11]). This particular aspect is beyond the scope of the current paper.

### Numerical Illustration: HFS-induced Conduction in Palladium and Titanium Spheres

#### (a) Steady-state temperature distribution

Thermal conductivity values taken from Ho et al. [12] were sorted into a set of linear segments, shown in Table 1. For sake of convenience, the temperature distribution was obtained by solving the dimensionless form of Eq.3:

$$d^2\theta/dx^2 + (2/x)d\theta/dx + [1/(\beta + \theta)](d\theta/dx)^2 = 0 \quad (9)$$

using a vector-matrix differential equation solver [13] on a personal computer. The negative values of  $\beta$  in Table 1 appear due to the anomalous variation of the thermal conductivity of titanium in the 200 - 600 Kelvin range: from the value of 24.5 W/mK at 200 K;  $k_m$  drops to 20.4 at 400 K; and to 19.4 at 600 K, prior to rising to 19.7 at 800 K, then to consistently larger values as  $T$  increases. The interface temperature was set to the melting point of the metal, and the heat flux at the interface was computed via Eq.7 with  $a = 2$  (following Sioda [5], i.e. by assuming that energy produced in the cavity is transferred to the metal in equal parts by radiation and electron-thermal conduction [14]). Representative values of  $T(r)$  are given in Tables 2 and 3.

#### (b) Unsteady-state temperature distribution and the prediction of melting at the interface

The physical parameters required for this set of calculations are assembled in Table 4. The unsteady-state temperature distribution may be written in a slightly rearranged form of Eq.6

as

$$[T(x,t) - T_\infty] / [T_R - T_\infty] = (1/x) \operatorname{erfc}[(x - 1) / (4\pi t)^{0.5}] \quad (10)$$

in terms of dimensionless radial distance  $x$  and dimensionless time  $T$ . The interface temperature reaches rapidly (via Eq.8) its steady-state value

$$T_R = T_\infty + 2\sigma T_c^4 R/k_m \quad (11)$$

By setting  $T_R = T_M$ , the approximate values of the minimum cavity temperature required for interfacial melting may be computed as

$$(T_c)_{\min} = [k_m(T_M - T_\infty)/aR\sigma]^{1/4} \quad (12)$$

as 89,221 Kelvin for palladium and 62,821 Kelvin for titanium, when  $R = 20$  nm.

## DISCUSSION

Inspection of Tables 2 and 3 demonstrates the tendency of the  $k_m$ -based (quick) approach to consistently underestimate the steady-state temperature distribution in both metals, with respect to the segmented piecewise-linear, thermal-conductivity model. However, a  $k_m$ -based calculation scheme offers reasonable estimates of temperature which may be acceptable under certain technological conditions.

The unsteady-state temperature profile Eq.10 is well justified not only by its relative simplicity and its familiar form from unidimensional transport in a semi-infinite block or rod [8], but also on account of the relatively narrow range of the numerical values ( $2.45 \times 10^{-6}$  to  $3.11 \times 10^{-5}$  m<sup>2</sup>/s for Pd;  $6.8 \times 10^{-6}$  to  $1.15 \times 10^{-5}$  m<sup>2</sup>/s for Ti) of thermal diffusivity and their standard deviation ( $2.09 \times 10^{-6}$  for Pd and  $3.11 \times 10^{-6}$  for Ti) in the 200 - 1500 K range of temperature. In a rigorous computation, however, the solution of Eq.1 by a finite difference or finite element procedure which would closely account for the temperature dependence of density and specific heat capacity of the metals in addition to their thermal conductivity, would be necessary.

## FINAL REMARKS

The scope of this paper is by no means limited to the specific application described. Consideration of temperature-dependent, thermal properties in the analysis of heat flow in any system over a wide range of temperature is clearly necessary in principle, and the results obtained in the case of palladium and titanium furnish specific proof for the danger of overestimating HFS temperatures (at about 100,000 Kelvin) via constant thermal conductivity data taken at room temperature.

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### Nomenclature

a	coefficient related to the relative magnitudes of thermal radiation and electron-thermal conduction
$c_p$	specific heat capacity of the metal
$\text{erfc}(z)$	complementary error function of argument "z"
k	thermal conductivity of a metal; $k_o$ constant term in the temperature-dependent linear relationship; $k_m$ mean value; $k_R$ value at the cavity/metal interface
$Q_o$	rate of thermal energy emanating from the HFS-cavity
r	radius
R	radius of the spherical HFS-cavity
t	time
T	temperature; $T_R$ metal temperature at the cavity/metal interface; $T_M$ melting point of the metal; $T_\infty$ metal temperature far from the cavity; $T_c$ HFS-cavity temperature
x	dimensionless radius; $r/R$
$\alpha$	thermal diffusion; $\alpha_m$ its mean value
$\beta$	temperature coefficient in the linear relationship for thermal conductivity; $\tilde{\beta} = k_o/\beta$ for each piecewise-linear segment
$\theta$	dimensionless temperature; $T/T_R$
$\rho$	density of a metal
$\sigma$	Boltzmann's constant of radiation, $5.67 \times 10^{-8} \text{ W/m}^2 \cdot \text{K}^4$
T	dimensionless time, $\alpha_m t/R^2$

Special symbols: HFS – acronym for high-fusion-spot

**Table 1: The set of piecewise-linear thermal conductivity data for the numerical solution of Eq. 9**  
(Source: Ref. 12)  $\tilde{\beta} = k_o/\beta$  ;  $k = k_o + \beta T$

Palladium  $k_m = 93.71 \text{ W/m.K}$

Temp. range, Kelvin	$\tilde{\beta}$
200 - 300	1.9495
300 - 400	2.0191
400 - 600	0.9602
600 - 1200	0.8446
1200 - 1300	1.2041
1300 - 1400	2.1620
1400 - 1500	1.1859
1500 - 1700	2.1894
1700 - 1800	5.3092

Titanium  $k_m = 21.28 \text{ W/m.K}$

Temp. range, Kelvin	$\tilde{\beta}$
200 - 400	- 0.71345
400 - 600	- 2.2939
600 - 800	6.3151
800 - 1000	1.6078
1000 - 1200	1.1186
1200 - 1950	0.7403

**Table 2:** Steady state temperature distribution in a palladium sphere with HFS cavity diameter of 20 nm and estimated cavity temperature of 62,821 K;  $T_{\infty} = 293$  K.

Radial position	T (kelvin)	T (kelvin)
(nm)	Eq. 9	Eq. 4
20	1827 (*)	1827 (*)
22	1713	1688
24	1616	1571
26	1534	1473
30	1398	1316
40	1172	1065
50	1021	907
100	698	600

\* melting point at atmospheric pressure: the shift in melting points under high pressure in cavity is very slight [15].

**Table 3:** Steady state temperature distribution in a titanium sphere with HFS cavity diameter of 20 nm and estimated cavity temperature of 89,221 K;  $T_{\infty} = 293$  K.

Radial position	T (kelvin)	T (kelvin)
(nm)	Eq. 9	Eq. 4
20	1953 (*)	1953 (*)
22	1838	1801
24	1738	1676
26	1652	1569
30	1508	1399
40	1258	1122
50	1097	957
100	750	625

\* melting point (see footnote in Table 2)

**Table 4:** Physical parameters of palladium and titanium employed in the estimation of unsteady state temperature distributions.

Item and unit	Palladium		Titanium		Reference
volumetric expansion coefficient, $K^{-1}$	$3.6 \times 10^{-5}$		$2.55 \times 10^{-5}$		16
Density at room temp. $kg / m^3$	12,000		4,540		16
Specific heat capacity $J/kg.K$ [T] : K	T	$C_p$	T	$C_p$	17
	200	227	200	465	
	400	251	400	551	
	600	261	600	591	
	800	271	800	633	
	1000	281	1000	675	
	1200	291	1200	620	
	1500	307	1500	686	
Thermal conductivity $W/m.K$	See Table 1		See Table 1		12
Mean thermal diffusivity $m^2/s$	$2.788 \times 10^{-5}$		$8.071 \times 10^{-5}$		computed

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## A NOTE ON LOW ENERGY NUCLEAR REACTIONS IN CONDENSED MATTER

Dan Chicea <sup>1</sup>

### ABSTRACT

Since the first announcement [1] where the authors hypothesized that nuclear fusion of deuterium nuclei occurred at low temperature, without any external acceleration, experimental work both for validating and for invalidating the statement has been done all over the world [2], [3], [4], in both sophisticated and in poorly equipped laboratories. The main objection against the existence of low energy nuclear reactions is the non-concordance between the excess heat resulting from the experiments and the level of nuclear radiation detected, which was much lower than it was expected to be, should the  $d + d$  nuclear reactions be the cause. In addition, there was firm belief among trained nuclear scientists that low-energy nuclear reactions were not possible. This paper explores the experimental evidence for low-energy nuclear reactions.

### DISCUSSION

In order to convince a nuclear physicist that nuclear reactions occurred in condensed matter, the nuclear signature, also called "nuclear ashes", should be present; i.e. gamma rays, charged particles or neutrons should be detected during the experiment. Alternatively considerable isotopic concentration changes must be revealed in the sample after the experiment, measured in exactly the same conditions as before the experiment. The low energy nuclear transmutations, have been experimentally confirmed by isotopic concentration changes in the samples [5], [6] which isotopic changes are produced through an yet incompletely understood mechanism, without any emission of neutrons, charged particles, or gamma radiation and which, the author believes, in certain conditions, might proceed in the classical known manner.

It is worth noting that the Coulomb barrier encountered by two approaching nuclei, trapped in the lattice of a metal such as palladium or titanium, can be significantly reduced by the electron screening [7], [8], [9], [10], especially in the locations where the electron concentration is increased, such as the interface between different metallic layers [6] or near the surface of a metal connected to a negative electric potential, as it is described in [8] and [9]. The "free" electron concentration in a metal is increased by loading the lattice with deuterium or hydrogen, simply because the sample keeps being electrically neutral and absorbing an extra-electron with each absorbed nucleus.

Therefore in the regions where the loading factor is close to 2, like in titanium, the "free" electron concentration might be close to 3 times the concentration in neutral titanium, leading to a considerably increase of the penetrability of the Coulomb barrier [10]. In addition, the flow of electrons through the metal electrode is an additional source of electrons and of electron screening [11].

Electron clusters carrying a small concentration of positive ions with the same velocity as the electron [12], [13] can act like a microscopic particle accelerator and can produce nuclear reactions at the impact with a target. It is well known that the fracturing of crystal lattices [14], [15] produces high voltages. In a metal lattice, the fracto-emission is produced in the nanosecond duration of the high voltage before the voltage disappears by conduction through the metal lattice. Electron clusters are produced by high local potential

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gradients and high current, so they might be produced between the fresh faces of a crack [12], [13] in a metal like Ti or Pd, produced by the large strain caused by the difference in D concentration.

Also the frequency of the deuteron energy fluctuation, as presented in the frame of a simple model in [16], can be increased in certain non-equilibrium conditions created by the strain produced by a high loading ratio in certain spots of the sample.

The effect of the energy fluctuation and of the reduced Coulomb barrier, combined with the microscopic level acceleration produced by the micro-cracks caused in the sample by lattice strain which accompanies the delta-epsilon phase transitions in deuterided titanium having a loading factor around 1.7, at temperatures close to 22°C [17], might be some of the factors which trigger the shift, the turn of the mechanism of low energy nuclear transmutation to the known classical manner, by penetrating the Coulomb barrier and producing neutrons and tritium from D-D reactions, at a very low rate. This rate may seldom become detectable, but cannot be the explanation for the excess heat or for the isotope concentration changes in the samples used in hydrogen-isotopes loading experiments.

Recently we performed experimental work to verify the possibility of the low energy nuclear reactions to proceed in condensed matter by monitoring the low intensity neutron emission from TiD<sub>x</sub> systems. Three kind of experiments have been done; first the neutron emission from Ti slabs while loading them with deuterium at temperatures between 500 and 800°C from the gas phase, at pressures around 6 MPa; then the neutron emission during the heating of the samples in deuterium gas and maintaining them for hours; and then the neutron emission during ultra-fast cooling the loaded samples at 77K and maintaining them for hours (all emissions having been monitored). All three kind of runs, each repeated several times with different samples, reveal low intensity fast, neutron emission in bursts, randomly distributed over the time span of the experiment, presenting count rates more than three standard deviations above the background. These results, which will be submitted soon to be published, are similar with those published in [18], [19] and confirm the hypothesis presented here, that in certain conditions, in condensed matter, in a rich electron environment and a high concentration of hydrogen isotopes nuclei, the rate of nuclear reactions can be considerably increased, leading to the emission of nuclear radiation which, intermittently, can rise above the background and thereby become detectable.

A possible direction for further experimental work might be to identify the conditions which catalyze the low energy nuclear transmutation and make them proceed in the novel reported way [5], [6], without emitting any kind of nuclear radiation and the conditions which turn them proceed in the classical manner, emitting nuclear radiation, then create the conditions to avoid the turn. Another promising experimental procedure [20], [21], [22] as contrasted to the tedious process of loading a metal electrode with hydrogen isotopes until it become brittle and starts producing charge clusters at random times and places, is the direct production of high density charge clusters.

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## NEUTRON AND HEAT GENERATION INDUCED BY ELECTRIC DISCHARGE

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### ABSTRACT

Production of low energy neutrons was confirmed during electrolytic discharge at high voltage in a heavy water solution. We employed a  $\text{He}^3$  neutron detector and a NE-213 scintillator to measure neutron emission and energy distribution. We counted several thousand thermal neutrons per second. High heat output of the order of 20% above input power was observed from input power of tens of watts. The neutron counts detected by the  $\text{He}^3$  detector increased with discharge time after an induction period, and showed radical fluctuations. Absorption of neutrons by cadmium showed them to be thermal. Copper and iron showed no count changes. The ratio of fast neutrons was shown, by the NE-213, to be 0.01%. These figures were estimated from a count observed to be 30% above background (0.048/s and 0.036/s respectively). We found only 0.14 counts per second of neutron emissions from the electrode above the 0.7 MeV level. The values are estimated from their counting differences and the efficiencies of the detecting equipment. The neutron emission rate corresponded linearly with the input current, except at the low input Coulomb range due to induction time. From this linear relation, it was observed that the typical dependence of neutron emission/current during 1 hour was  $3500 / \text{s} / \text{A/cm}^2$  for a platinum electrode. We conclude that a nuclear reaction was induced by the electric discharge on the metal surface in the solution. The reaction probably took place in the thin layer between the electrolyte and electrode.

### INTRODUCTION

Many researchers have reported nuclear reactions in a solid electrode at ambient temperatures since 1989 [1-3]. Replication of the process requires highly sophisticated control techniques. This complication, coupled with inexplicit understanding of cold fusion reactions generally has resulted in the reality of the phenomenon failing to achieve wide acceptance.

Early researchers seeking to replicate the results Fleischmann and Pons achieved in 1989 may have been too rigid in their experimental procedures, using exclusively the materials specified by that particular experiment, or only using other metals with high hydrogen absorption properties.

In our experiments we used electrodes constructed from Ti, Ni and the alloy LaNi, preferring to use an alkaline Li solution as the electrolyte for the purpose of maximizing the potential of the electrolytic reaction. Generally, we measured the current density in the electrode area to be several hundred amperes with an input of several tens of volts.

Subsequent researchers, assuming their observed reactions to be nuclear fusion, concentrated their efforts solely on the detection and measurement of the daughter products of fusion such as thermal heat, neutron, tritium charged particles, and radio emissions. The only reaction they considered was fusion. We did not restrict ourselves to seeking only fusion byproducts, we carefully measured and noted all observed effects, frequently even adapting our measurement technique to ensure accuracy and precision.

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If an electrochemical process induces nuclear reactions, there ought to be clear evidence of radiation or isotopic changes and it would be possible to define such effects in terms of accepted theory. We have demonstrated that isotopic changes occurred within the reaction products deposited on the electrode surface. Such transfigurations cannot be regarded as the result of impurities within the system, the total amount of which had been carefully measured prior to and following experimentation. We attempted to explain the production of these anomalous products within the framework of the accepted theory. In this way we show the relationship between production of heat, neutrons, and other products following the electrolytic processes.

## EXPERIMENTAL

The Pt wire and mesh electrode was of the highest quality (99.99% pure, supplied by Tanaka Precious Metals Ltd.). The trace impurities, above the limits of detection, were Rh at 18 ppm; Si, Cr, Pd each at 2 ppm and Au, Ag, B, Ca, Cu, Fe all at less than 1 ppm. The heavy water used (99.75% pure, supplied by Showa Denko Ltd.) contained 0.077 micro Curie  $\text{cm}^{-3}$  tritium, was purified in a quartz glass distiller before the addition of a reagent. High purity lithium hydroxide (produced by Merck Ltd.) contained Cl and  $\text{SO}_4$ , both at 10 ppm and  $\text{SiO}_4$  and Ba both at 5 ppm. Other trace impurities were all below the 0.1 ppm level.

The electrolytic cell and measurement systems are shown schematically in Fig. 1. The cell measured 6 cm in diameter and 15 cm in height. The cathode comprised a rectangular Pt plate (0.5 cm x 1.0 cm) and incorporated a 15 cm length of Pt wire. The anode, also rectangular Pt had an integral lattice constructed using a 15 cm length of 0.1 cm diameter Pt wire. Teflon tubing encased the adjacent surfaces to prevent any explosive H-O recombination reaction occurring within the cell. The cell had a Teflon cap with openings to allow the insertion of cables and thermocouples.

A Teflon-coated stainless steel heater calibrated the temperature to compute power-input ratio. Heater output was typically 300 watts and temperatures ranged from 45° to 95°C. The homogeneity of the electrolyte was facilitated by use of a rotating Teflon-encased iron stirrer driven magnetically from beneath the cell. The temperature: power-input results obtained from this arrangement were correlated with those of previous experiments. The thermal effects of vapor release from the top of the cell had not been allowed for during calibration, therefore, at higher input levels, with the attendant possibility of electrical discharge, heat output levels needed to be underestimated. Three K-type thermocouples sheathed in Teflon film recorded the temperature levels at distinct points within the cell. Temperature levels were collected by a computer-linked data logger (R7326B, made by Advantest Ltd.). Environmental conditions were regulated by encasing the cell within an incubator (Yamato IL-61 ) which maintained a constant temperature of 23°C.

We used a Takasago Products Ltd., EX-I500L unit to supply DC power ranging upward to maximum levels of 25A and 240v. The data logger converted input levels into a digital format acceptable to the computer software and the input voltage was directly measured between the two electrodes of the cell. Heat created by the power supply during lengthy neutron detection runs, was dissipated by means of an electric fan. We carried out a trial run of 30 minute duration with input levels of 60v and 3A in order to remove impurities from the electrolyte.

The measurement of neutron levels was carried out by a  $\text{He}^3$  survey meter (TPS-451S, Aloka Ltd.) at energy dependencies of  $1.5 \text{ s}^{-1} / \text{micro Sv/h}^{-1}$  from 0.025 eV of thermal and 10 keV. A substantial increase was noted in the fast neutron range of 15 MeV. The detector is spherical in shape, with a diameter of 30 cm, and has a block of controls to the front of the device. The signal is output through a counter scalar. Measurement of the neutron energy spectrum was handled by a NE-213 scintillator, previously described [4]. The detectors were calibrated to the standard level of 20 micro Curie using a Cf-252 source. The total efficiencies including intrinsic and geometrical factors for  $\text{He}^3$  and NE-213 system were 0.001 and 0.07 respectively for the calibrated energy range.

We employed the rise-time discrimination technique to eliminate noise induced by gamma radiation, and by the electrical and thermionic side effects of the photo multiplier. A transducer was used to reduce emanations from the two power supplies in order to prevent noise pollution from that source interfering with the neutron measurement apparatus. A liquid scintillator of NE-213 (proton recoil detector, 12.7 cm diameter x 12.7 cm length) analyzed the energy spectrum of the neutrons. Thermal neutron absorption was facilitated by the use of a metal sheet plated with an alloy of cadmium, copper and iron, 30 cm x 30 cm x 1 mm thick. This had the added advantage of also acting as an electrical noise shield.

To verify levels of gamma and x-ray emission, a GM survey meter (TGS-11, Aloka Ltd.) was used both during and following electrolytic discharging. Existence of neutron emission was confirmed by siting a rectangular gold plate, 2 cm x 2.5 cm x 0.5 mm thick, close to the cell. After 6 hours exposure, the plate was examined using gamma spectroscopy.

## RESULTS

### 1. Electrolytic light emission

Fig. 2 shows a typical correlation between applied voltage and current in the 0.1 mol lithium hydroxide solution. Cathodic current increased linearly to 10 A/cm<sup>2</sup> with an input power of 80 volts. At around the 100 volt input level, a considerable quantity of hydrogen gas and vapor was expelled from the cell, the electrode emitted a resounding rumble and the current became very unstable. At just over 120 volts the current decreased sharply and, simultaneously, the electrode became bathed in an intense pink light. Typical light emission levels are shown in Fig. 3; spectroscopic examination of the sample plate confirms these radiance levels. This, previously observed, electrolytic light emission was reported by Jasnorodski [5], Polakowski [6] and precise details of the mechanism of the phenomenon were reported by Owaku and Kuroyanagi [7] in the 1950's.

### 2. Neutron emission

Fig. 4 shows characteristic neutron measurement results. Neutron counts were taken at 10-second intervals from the data collected by the He<sup>3</sup> detector. Count levels showed a gradual increase with time at the onset of electrolytic discharging and then changed radically. An iron and copper plate, used to shield the detector from electric noise, did not alter the count levels achieved before its installation. However, the substitution of a 0.3 mm thick cadmium sheet caused a steep decline in the order of 1/10th of previously recorded levels. It can be said, therefore, that electrolytic charging induced the slow neutron emission. At the same time, the NE-213 detected values of 0.048 count/s, 30% in excess of the 0.036 count/s background level. Adjusted for sensor efficiency, thus 0.14 counts per second of high-energy neutron emissions were observed from the electrode above the 0.7 MeV level. This value is calculated allowing for counting differences and detector efficiency. The ratio of fast to total neutrons, measured by the He<sup>3</sup> and NE-213 detectors, is of the magnitude 10<sup>-4</sup>.

The neutron emission rate corresponds linearly with the level of input current, as shown in Fig. 5, with the exception of the low input Coulomb range. This means that neutron emission began occurring after an unquantified induction period and then began to increase. From these data, we calculate the average number of emissions/hour to be 3500 count/s where electrical input to the electrode is 1.0 A/cm<sup>2</sup>. The criterion used for neutron emission calculation was the same as that for the electron ( $5.6 \times 10^{-16}$  cm<sup>2</sup>), assuming electron discharge at the electrode surface was the impetus for the reaction. On this basis, we can calculate a reaction cross-section estimated from current density in the order  $5.6 \times 10^8$ . It was noted, however, that counts of gamma and x-ray emissions increased by 50% during discharging.

### 3. Neutron activation measurement



Fig. 6 shows the spectra of the gold plate before and after electrolytic discharge; the data, in both cases, being accumulated at 86,400 samplings per second. The clearly visible peak at 0.412 MeV derives from Au-198 gamma emission.

#### 4. Excess heat evolution

Fig. 7 shows the results described in 4 above, together with the excess heat production measurements. In this instance, at a sampling rate of 10 per second, a constant 140 V input was maintained while the current was decreased from 8A to 0.4A within a period of 2000 seconds. Power input began at 1120 W and was reduced down to 56 W, during which time the temperature of the electrolyte rose steeply from 38°C to 90°C after a period of 1100 seconds. A temperature ceiling of 95°C was necessary as above this temperature there was a substantial release of vapor and gas from the cell, rendering excess heat estimation difficult.

Production of excess heat occurred 50 seconds after discharge and showed variations in level throughout the measurement period. We estimate the maximum value of excess heat observed to be 180 W after 100 seconds of discharge at an input level of 400 watts. Input and output energy was 145,903 and 154,080 joule respectively which gives us an excess heat measurement of 8,177 joule. Although this value only represents 5.6% of total input energy, it is significantly underestimated as the original calibration allowed no margin to correct for energy lost through gas and vapor release. Following this heat measurement experiment, the quantity of electrolyte was depleted by 10 grams. Using this data it is possible to approximate the rate of energy lost through vapor release as 30,815 joule, giving the measurement of excess energy as 20% of input power.

#### DISCUSSION

The relationship between the production of excess heat and neutron levels has been approximated from the experimental results. With excess heat at 8,200 joule and total neutron production at  $3 \times 10^6$ , we can estimate the heat evolution for the neutron as  $1.7 \times 10^{10}$  MeV. The resulting value is excessive in comparison with the level at which conventional thermal-energy-producing nuclear reactions occur. We should have obtained  $10^{12} - 10^{13}$  neutrons/s if the reaction remained strictly concordant with wattage levels. Conversely, we detected heat generation of the order  $10^{-3} - 10^{-4}$  watts when observed neutron levels were  $10^3 - 10^4$ . From these results, we concluded that an unusual reaction took place during discharging in that very few nuclear products were created when excess heat generation was at its highest recorded level. In postulating a mechanism for this reaction, we considered a likely occurrence might be that the majority of neutrons interacted with the nuclei of the electrode metal, becoming absorbed and evolving into new nuclei, even in instances where neutron generation was substantial.

This effect could be considered to be occurring in tandem with the electrochemical reaction. The interaction between an energetic proton and electron can be preceded by electrochemical hydrogen evolution. Enyo [8-10] reports that the effective hydrogen pressure at the hydrogen-evolving electrode is dependent upon the recombination of hydrogen atoms following the electrolytic process. The total hydrogen overpotential  $E_t$  is represented by the addition of two other components, i.e.,  $E_t = E_1 + E_2$ ; where  $E_1$  and  $E_2$  represent the discharge and recombination processes respectively. Application of the Tafel relationship equation shows the reaction scale of  $E_1$  to be much more protracted than that of  $E_2$ . The Nernst Equation enables us to estimate effective hydrogen pressure at the electrode, suspended in an alkaline solution, to be up to  $10^{16}$  atm [11,12] for normal electrolysis. However, if total cell input reached 1 V at the current density of  $0.2 \text{ A/cm}^2$  on a noble metal surface [13], Tafel lines would indicate a maximum  $5 \times 10^4$  atm actual pressure. In this instance, we can estimate the total overpotential up to a level of 150V. When the overpotential realized at the electrode was estimated to be at least 1 V, the statistical pressure is assessed to be  $10^{30}$  atm. We therefore calculate that the proton/electron distance narrowed considerably under such high pressure.

It remains a difficult task to explain the reaction, using established quantum mechanical theory. However, the origin of the mechanism may be traced back to Rutherford [14] who conceived this physical process and the new kind of interaction  $V'(r)$  which Conte [15] derived in Bi-quaternion Quantum Mechanics (BQM). The BQM enables us to address the basic features of the nuclear structure and also to introduce new data observed from interactions created by the neutron emission process during electrical discharge. Conte explains that the theory can be fundamentally explained using a generalization of the Schrodinger equation. Here, we can show the theory briefly; a quantum action  $A = -i\hbar q \log y$  is considered, where  $q$  is a bi-quaternion (the bi-quaternion are numbers that Conte has introduced in quantum mechanics, for a detailed derivation (see Eq. 1 and 2) and  $y$  is a wave function. This quantum action is a generalization of the usual quantum action  $B = -i\hbar \log y$  by which the usual Hamiltonian  $H = -d^2B/dt^2$  and the standard Schrödinger equation may be obtained.

When we consider the generalized action  $A$  instead of  $B$ , we obtain a generalized Schrödinger's equation that has the following form:

$$Ey = HTy \quad (1)$$

Where  $T$  is a proper bi-quaternion operator that assumes a particular form in consideration of the particular problem to be examined. As example, if we consider  $T$  given as it follows:

$$T = 1 - |y \times y| \quad (2)$$

We obtain the non-linear Schrödinger equation formulated by N. Gisin to approach open quantum systems [16]. This is not, however, our case of interest. Consider, instead, a given system whose Hamiltonian is  $H$  and contains interactions deriving from a usual potential that we indicate by  $V(r)$ . We have the usual Schrödinger equation.

$$E_u u = Hu \quad (3)$$

Let us return now to Eq. (1) and consider that the operator  $T$  is now given as follows

$$T = 1 - |u \times u| \quad (4)$$

We may now insert Eq. (4) in Eq. (1) and we have

$$Ey = H(1 - |u \times u|)y \quad (5)$$

Or

$$Ey = (H - E_u \langle u/y \rangle u/y)y \quad (6)$$

In other terms, the generalized Schrodinger equation (1) becomes

$$Ey = H'y \quad (7)$$

Where the new Hamiltonian

$$H' = H - E_u \langle u/y \rangle u/y = H_0 + V(r) + V'(r) \quad (8)$$

is now given and it contains the new interaction

$$V'(r) = -E_u \langle u/y \rangle u/y \quad (9)$$

Eq. (9) forms the basis of this discussion.  $V'(r)$  is a new, natural form of attractive interaction as derived by the BQM generalized Schrödinger Eq. (1). It is important to note that the equation is not written in the customary manner, as it does not represent the usual interaction deriving from a potential. The salient

feature in Eq. (9) is the expression  $\langle u/y \rangle$ , which has a new and categorical meaning. This new interaction is due to mutual overlap of the involved wavepackets  $u$  and  $y$ .

This is truly a new and natural phenomenon. We are convinced that this relationship can explain all anomalies observed in nuclear reactions following electrical discharge. We would repeat that this interaction is unusual in that it is not derived from a potential, but is due solely to the mutual overlap of the involved wavepackets  $u$  and  $y$ .

Rutherford, in fact, conceived the neutron as a compressed hydrogen atom dominated by an interaction due to the total immersion of the wavepacket of the electron inside the dense medium of the proton. He considered the neutron to be a particle in a naturally bound state (anchored by the proton and the electron) at low temperature and at a short distance of under 1 fm. As we know, the existence of the neutron was confirmed by Chadwick in 1932, and that Rutherford's conception of the neutron was rejected because it did not comply fully with the laws of quantum mechanics, in that:

- (a) there was a requirement for a positive binding energy (the neutron's mass being greater than that of the proton and electron);
- (b) it was impossible to define the relatively large mean life of the neutron because of the diminutive mass of the electron and,
- (c) the impossibility of giving the total spin  $\frac{1}{2}$  of the neutron from two component particles each of spin  $\frac{1}{2}$ .

However, established quantum mechanical theory was essentially conceived to facilitate studies on atomic structure. On this level, the electron can be envisaged as being a point-like particle moving in vacuum. The physical conditions introduced by Rutherford and which we have now characterized in Eq. (9) are fundamentally different.

Eq. (9), in fact, characterizes the total immersion of the electron wavepacket inside the dense medium of the proton. A new explanation for this interaction is now required and we have thus applied a generalization of QM principles and, in particular, of the Schrödinger equation. As we discussed in Eqs. (2) and (3) this BQM theory fully resolves the problems posed in (a), (b) and (c) in the second preceding paragraph above which formed the basis of objection to Rutherford's original conception of the neutron

As we have shown in detail in Eqs. (2) and (3), if we consider that  $H$  of the Eq. (3) includes a usual potential interaction  $V(r) = -e^2/r$  as it is the case of the proton and the electron, then we calculate consequently that  $V'(r)$  of the Eq. (9) assumes the following form:

$$V'(r) = -k \exp(-ar) / (1 - \exp(-ar)) \quad (10)$$

with  $k > 0$  and constant.

Eq. (10) is well established in nuclear physics. It is referred to as the "Hulthen potential." In other words, in addition to the traditional interaction...and, in brief, the nuclear reaction in accordance with the following equation:



Conte et al., have had direct experimental evidence confirming BQM and Eq. (11) from which reaction they have observed the experimental formation of the neutron. Other reported experimental results must also be considered. K. Kamada [17] performed experiments on electron impact p-p and d-d fusion in (hydrogen) molecules embedded in Al. Kamada used an ion implant technique to yield a high surface loading of hydrogen. Although Al does not absorb hydrogen in large quantities, it has a high hydrogen diffusion capability. It also has a rather high electro-negativity meaning that there are many available electrons. Kamada observed that when a suitably prepared hydrogen-implanted Al sample was bombarded with an intense electron beam at about 175 keV, high-energy charged particles were produced, representing reaction products at energy levels over 1 MeV. He also observed anomalous heat evolution in deuterium-implanted Al.

From Eq. (9), and in accordance with Eq. (11), we conclude that the following reactions:  $e^- + p^+ + p^+ \rightarrow d^+ + \text{neutrons (1.44 MeV)}$  and  $d^+ + e^- \rightarrow 2n + \dots$  occurred in Kamada's experiments. In fact, Kamada's experiment provided us with the most favorable conditions under which to examine and consider the new interaction Eq. (9). It gave us, in fact, a deliberate combination of protons and electrons in a physical situation, which promoted wave-function overlap. It clearly illustrated neutron emission from the electrical discharging process to be the result of electron capture within a proton.

## CONCLUSIONS

We can confirm from data gathered on neutron production and heat measurement during electric discharge of a Pt electrode in a carboric acid heavy water solution the following: The emission of low energy neutrons following high voltage discharge was noted after several tens of seconds of discharging. Emission levels fluctuated greatly and neutron energy extended in range from thermal to fast. Generation of excess heat also fluctuated considerably. The reaction is 100% reproducible.

## ACKNOWLEDGMENTS

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## Schematic drawing for measurement system

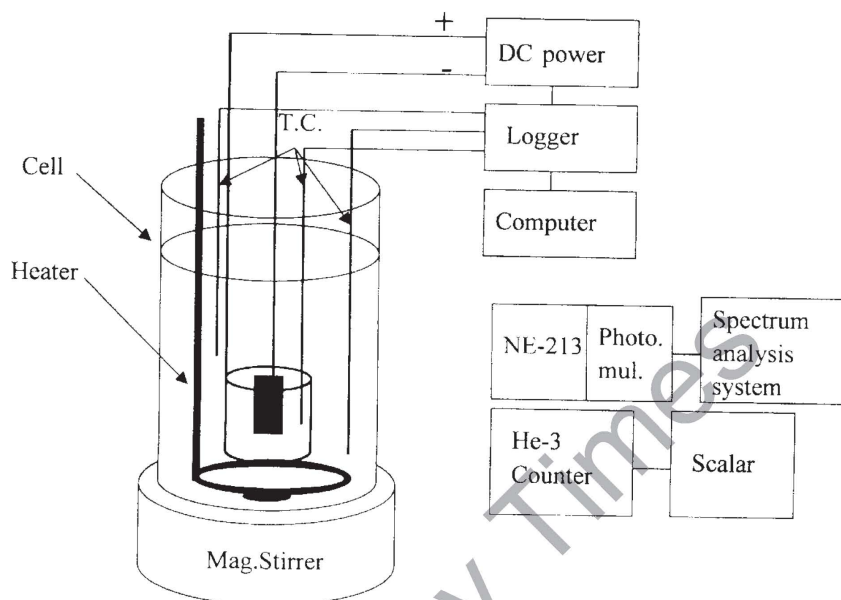


Fig. 1. Schematic drawing of measurements system; the system is surrounded with plastic bricks and set in a constant temperature room

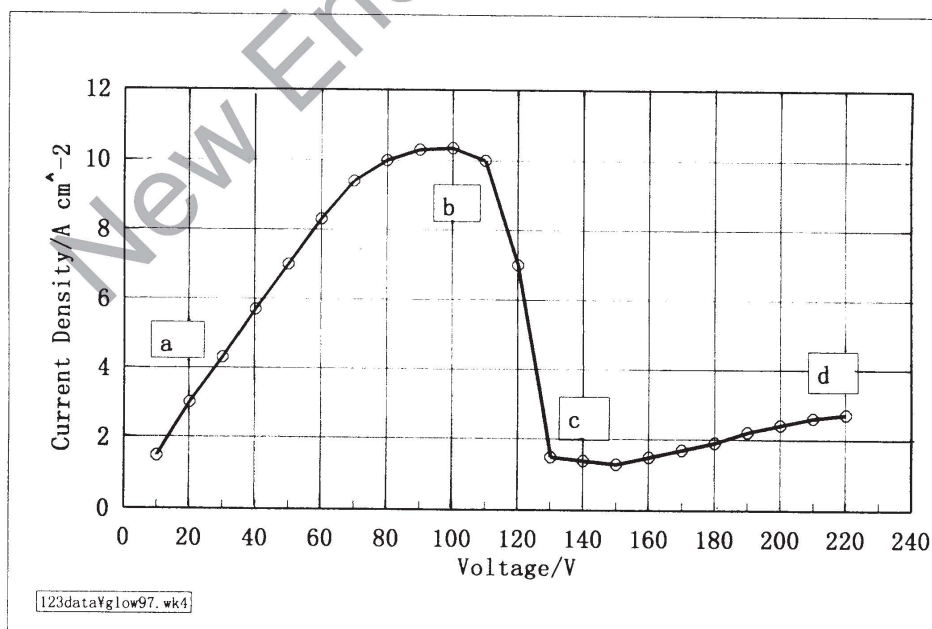


Fig. 2. Current-voltage relation of cathodic discharge in lithium hydroxide solution. Range a-b, normal hydrogen evolution, Range b-c, unstable, Point c radiation start and range c-d is stable radiation.

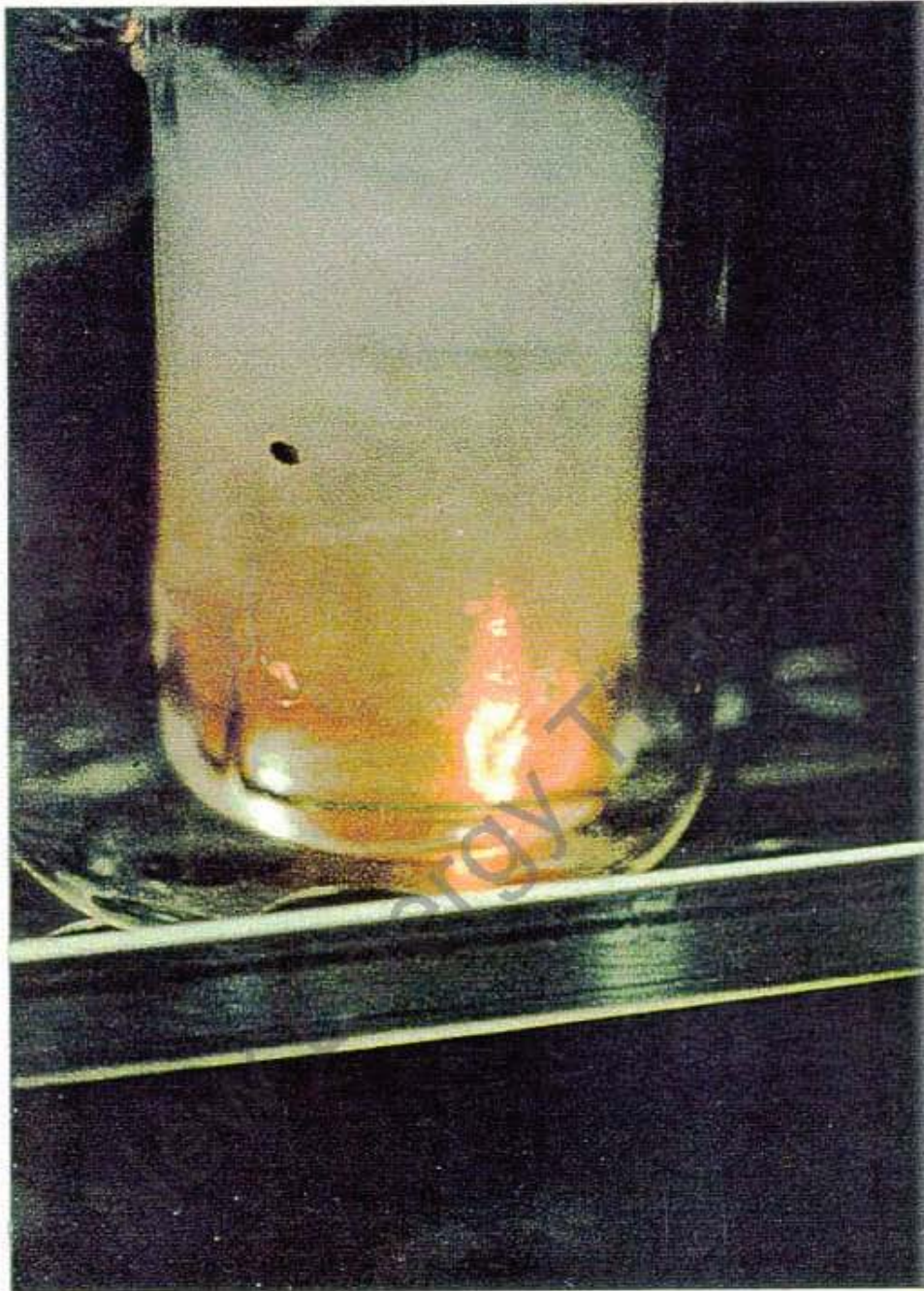


Fig.3. Typical radiation during electrolytic discharging of platinum plate in lithium- hydroxide heavy-water solution.

New Energy Times

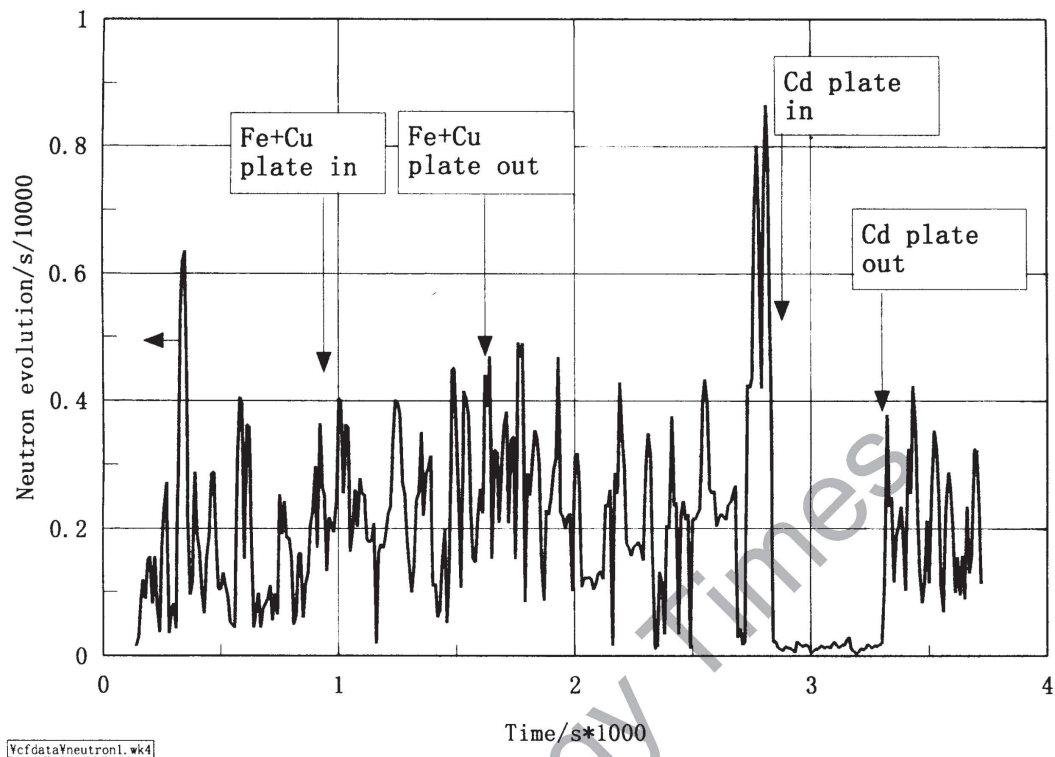


Fig. 4 Time deviation of the neutron evolution; each arrow shows noise and thermal neutron controlling by metal absorbers.

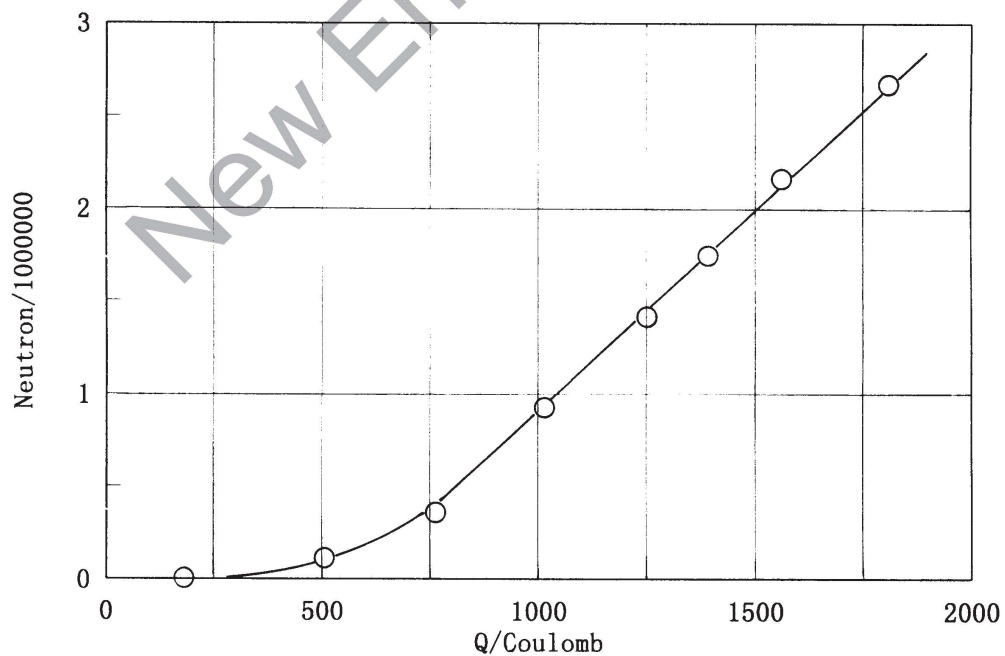


Fig. 5. Gamma-ray emission from the gold plate for the after and the before being irradiated by neutron emission from the cell for 6 hours.



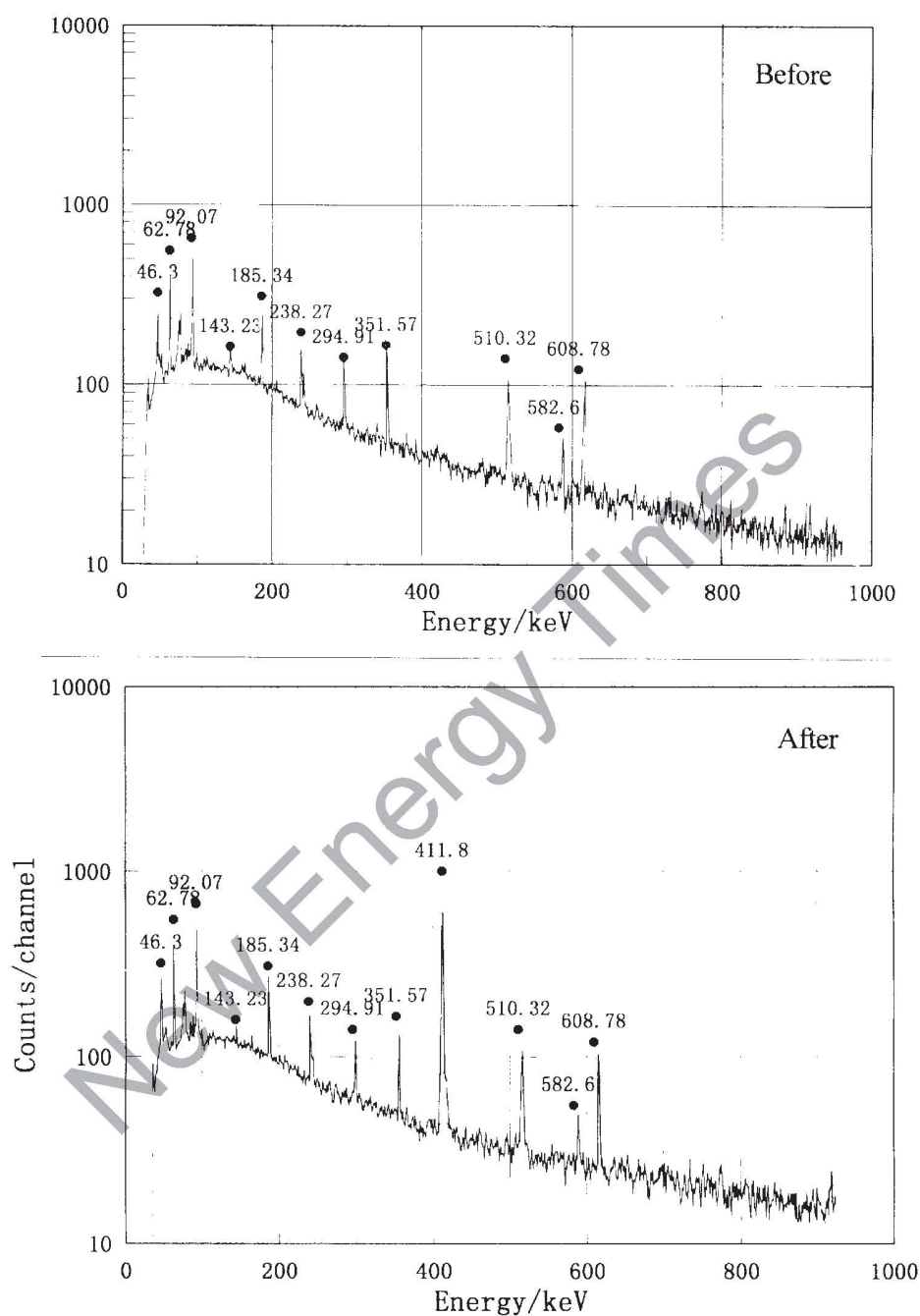


Fig. 6. Neutron evolution and input electric charge relation; neutrons were evolved after some induction periods.

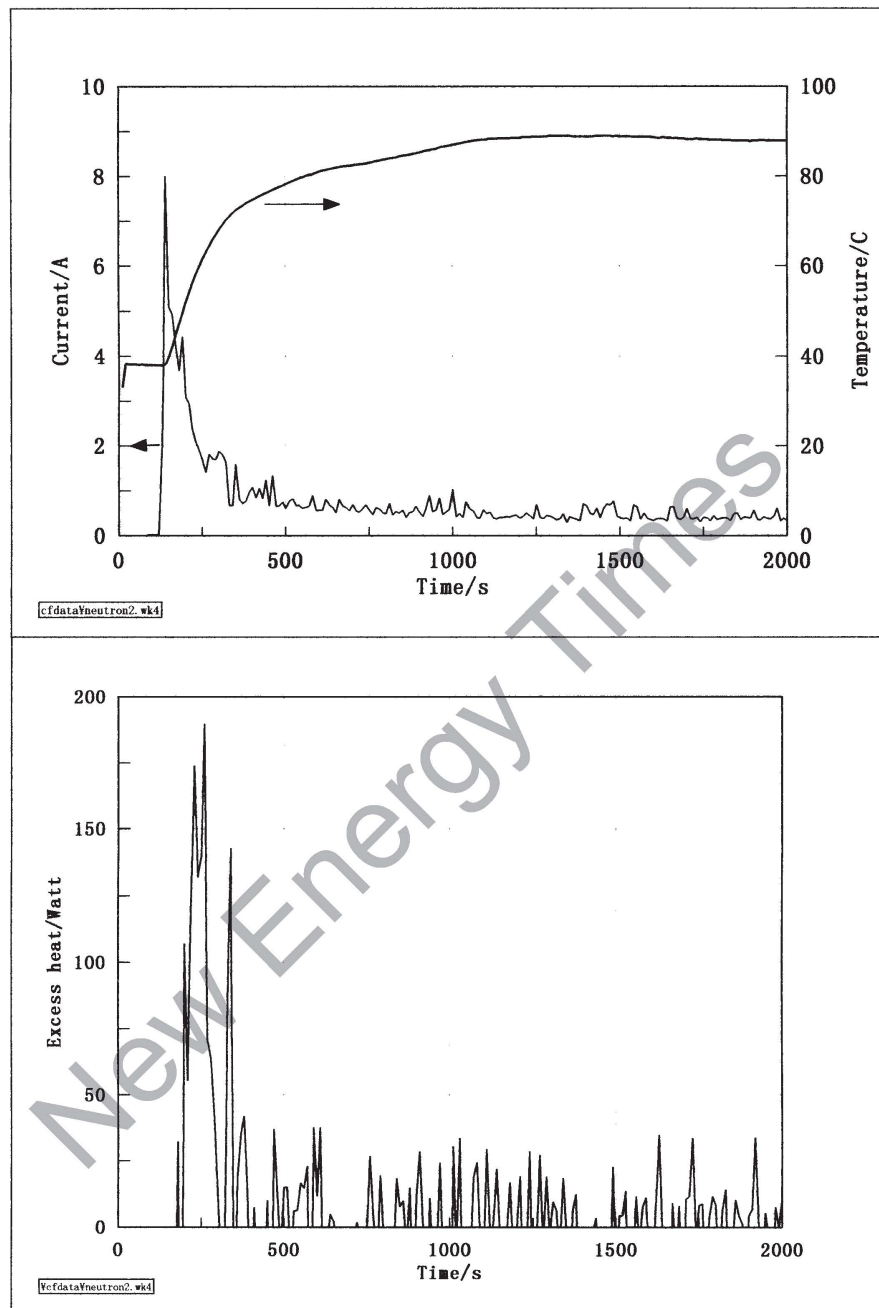


Fig. 7. Time change of the temperature, current (above figure) and the excess heat generation (bottom figure).

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## EDITOR'S CHOICE

## THE CRYSTALLINE VACUUM

Harold Aspden <sup>1</sup>

## ABSTRACT

The vacuum is a cold ionized medium having a crystalline structure, which can be rotated. The rotation and its effects are found from photons to the rotations of stellar objects. These claims all discussed.

## INTRODUCTION

In the January 30, 1998 issue of *SCIENCE*, vol. 279, pp 675-676 and pp. 686-689, there are two articles concerning the discovery that ions can form into a crystal-like cubic array in a cold plasma. The experimental technique by which the crystal structure is detected is quite interesting as is the fact that it has an intrinsic tendency to rotate.

This effect is particularly interesting to me because I have, over the years, been advocating the belief that the vacuum itself is a very cold ionized medium having a crystalline structure and that it is the rotation or rather spin of a small  $3 \times 3 \times 3$  cubic element of such a structure that really constitutes what we know as the 'photon'.

Furthermore, I have, in my writings, drawn attention to the fact that it is the rotation of large spherically bound forms of such a vacuum structure that accounts for the rotation of stars and, indeed, planets, as well as explaining their magnetic properties. I have regarded the event of the cooling of that ionized world of free space as forming the crystal structure which, by analogy with the onset of ferromagnetism as iron cools below its Curie temperature, is the event which initiates the related action we refer to as 'gravitation'. Indeed, the onset of gravitation is the event which, in lieu of the so-called 'Big Bang', nucleates the protons dispersed throughout space and forms the stars. The initial concentration of positive charge in that way sets up the radial electric fields which act upon the cold and structured space plasma to promote the rotation which is imparted to stars at birth.

All of the above is mere theory, but theory from which I have developed a truly wonderful unifying account of the fundamental features of the aetherial world which we inhabit.

In recent times I have seen developments on the 'New Energy' front which have further encouraged my efforts and provided what I regard as confirmation of my theoretical efforts. So it was that I developed a particular interest in claims concerning the anomalous generation of electrical power as if by tapping the energy of the environment by techniques using plasma discharges of a special kind. One such technique reveals ionized plasma spheres or charge clusters, which seemingly defy what can be expected using standard physical principles.

In my own experiments in which I had a magnetic rotor spinning I sensed an anomalous inertial effect which I could attribute in quantitative and qualitative terms to the induction of a radial electric field which in turn induced **aether spin** or what one could call **vacuum spin** [1].

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Therefore, it came as a pleasant surprise when I received a letter dated April 10, 1998 from Gerald Lindley [2] of Manchester, Connecticut, USA, drawing my attention to those two articles in the January 30, 1998 issue of *SCIENCE* [3]. He claimed that what is disclosed in those articles is "enough to falsify and disprove the charge cluster hypothesis of Jin and Fox plus Shoulders, King, and Aspden."

I use the word 'pleasant' because it is pleasing to be informed that the model of the simple cubic structure that I developed for the old but yet energy-active vacuum has been found to have an analogous counterpart in the ionized matter form. It is pleasing to see that rotation develops naturally in such a medium. Also, in some respects, it is pleasing to receive criticism, rather than being ignored, because such criticism then excites a greater interest in one's onward efforts to unravel whatever it is that hides us from the truth.

Therefore, this is my introduction to Essay No. 13. I can now present my comments concerning aether, photons, and 'vacuum spin' energy with more chance of being given a hearing than hitherto and I appreciate Lindley's consideration for drawing those *SCIENCE* articles to my attention, notwithstanding a certain lack of grace in his assertion that "The charge cluster hypothesis of... and Aspden is totally absurd" and that "The entire charge cluster hypothesis is falsified, disproved, demolished, torn to shreds, blown to pieces, smashed, annihilated and obliterated."

#### THE CRYSTAL STRUCTURE OF THE VACUUM MEDIUM

The **vacuum medium**, otherwise known as the **aether**, is a cold neutral ionized plasma that has such a perfect crystalline form that it cannot be 'seen' or 'felt' as a medium resisting force. In fact, it responds so easily in its reaction to invasion by matter that it dissolves its structure and reforms that structure in the wake of matter that does move through it. These are mere words, but they will be converted into a formal physical description once we explore the structural form of the aether and connect that form to observable phenomena.

I will build my case by reference to the second of those articles in *SCIENCE*, namely that by Itano et al., at p. 686 of Vol. 279, 30 January 1998 [3].

That article begins by saying:

"Plasmas, the ionized states of matter, are usually hot and gaseous. However, a sufficiently cold or dense plasma can be liquid or solid. A one-component plasma (OCP) consists of a single charged species embedded in a uniform, neutralizing background charge. Aside from its intrinsic interest as a simple model of matter, the OCP may be a good model for some dense astrophysical plasmas, such as the crusts of neutron stars or the interiors of white dwarfs, where nuclei are embedded in a degenerate electron gas."

That statement is a good introduction to an interesting topic in physics in this year 1998. However, something very similar was seen by me, back in the early years of the 1950s, when I was trying to devise a model which I could apply to a ferromagnetic crystal in a way which could account for the magnetic polarization of the magnetic domains inside the body-centered crystal structure of iron. That model had a version that regarded one solitary electron in each atom as moving in synchrony with corresponding electrons in adjacent atoms, each contributing to the ferromagnetic saturation in the host domain.

My model was an 'OCP', a one-component plasma, that approach being initially the easiest case to treat mathematically. I did, however, abandon the 'OCP' model when I saw that two electrons per atom had to cooperate in the co-ordinated motion. I was not worried about the fact that the 3d electrons in the atom are the ones responsible for the ferromagnetic state, but only have an orbital motion able to contribute two Bohr magnetons per atom. My reason was that I knew (a) that the measured value was 2.221 Bohr



magnetons and (b) that there was something wrong with the existing theory and that in fact that magnetic moment was really double the value normally assumed. So, I had my sights on a contribution per atom of 8 Bohr magnetons which my intuition, based on the need to keep magnetostrictive strain within the bounds of sensible theory, said was flipping between the three axial directions in the body-centered structure. That model meant that, on average, there would be 2.667 Bohr magnetons developing the primary polarization in one crystal axis direction, with the lateral transient polarizing effects compensating to zero. It further meant that, since I had established, by my theoretical probing, that the prevailing primary polarization effect would set up a half-canceling reaction confronting the instantaneous 8 Bohr magneton field, then half of 2.667, divided by 3, would be the true mean offset. That process said that the 2.667 Bohr magnetons per atom of the iron crystal would be offset by 0.444 Bohr magnetons to give, overall, a net effect of 2.222 Bohr magnetons.

The experimental value was 2.221 Bohr magnetons and so, as you can imagine, I was rather pleased with this discovery, especially when I got similar results for nickel and cobalt which have a different crystal structure. That work was eventually published, but it was frowned upon by the referee physicists who saw themselves as experts in magnetism. After all, I was suggesting that there is a universal reaction to any primary magnetic field and that it acts to half-cancel that field.

To me, given that a unit measure is unity, it is not that outrageous to suggest that unity is 2 minus 1, especially when that unity reaction can be the action which feeds inductance energy back to a solenoid when power is switched off. However, those experts had somehow convinced themselves that ferromagnetism in iron comes from something called 'electron spin' and here I was suggesting it all came from the orbital motion of electrons! Add to that challenge the fact that a discerning referee could well have sensed that I was talking about a real field reaction seated in a real aether and it is no wonder that I was left to wander in the scientific wilderness.

I did wander and I also wondered about that 'OCP' model of mine, eventually seeing this model, not as the kind of structure to expect in a neutron star, whatever that is, but rather the very structure that must exist in the aether itself!

That intellectual process is how my all-embracing unified 'field' theory was born, because that 'OCP' model of the vacuum medium, with its structural features, yielded a valid theoretical account of the fine-structure constant.

A point vital to this onward discourse, however, is that I discovered that the structure of the vacuum is not body-centered-cubic, as it is in the ionized plasma of the experiments reported in that article in *SCIENCE*. No, the vacuum has a simple cubic structure, not body-centered (bcc) and not face-centered (fcc)! If you wonder why, then ask yourself what determines the (bcc) structure in the real crystals we see around us.

The answer is that atoms in a solid do bond together owing to some overlap in the electron entourage and so, in effect, all crystals are, in some respects, ionized plasma forms, though one does not use that terminology. In the cold plasma experiments of that article in *SCIENCE*, one can assert quite authoritatively that the crystal structure that develops is governed *by least energy* considerations.

Now the problem with applying such theory to real matter is that we can build material systems in which the internal electric potential has a negative value. Take a cube of positive charge which is distributed uniformly throughout that cube and put a particle having a compensating negative charge at the very center of that cube and you have a model of a material cell in that 'OCP' plasma form. Work out the electric potential energy attributable to the interaction between the positive and negative charges and the self-interaction as between the distributed elements of that positive charge. This net energy potential governs the position adopted by that negative charge within that cubic cell. It has a minimum when the charge is at the center of the cell, but that minimum value is a negative quantity!

One needs to do work to displace the negative charge from the center of that cube, but you will find that the overall potential becomes positive before the negative charge reaches a cube face. However, if the potential can be negative then that negative charge will come to rest at the cube center.

If negative potential is permitted and there are numerous negative charges all seated in a corresponding cube of positive charge, then they will pool their energy potential and not just take up positions each at the center of a simple cubic structure. Instead, the (bcc) structure is adopted by the plasma, such as we see in our material systems, typically iron. However, underlying the real world there is that backcloth or sub-structure of the quantum world of the aether. If the aether is intolerant of the negative energy potential state there can be no way in which it can tolerate the presence of matter in (bcc) or (fcc) or other structural form. Yet, as we well know, it does tolerate those (bcc) and (fcc) crystal forms and the aether itself cannot have regions of negative potential.

So here was my breakthrough, made in the mid-1950s, the realization that the aether is a cold plasma, essentially of that 'OCP', one-component plasma form, and it has the one structure which corresponds to least electric energy potential, provided that potential is a little greater than zero everywhere. The potential has to be sufficiently greater than zero for it to outweigh the negative energy potential densities that accompany the (bcc) and related crystal structures in matter present locally. **This tells us that the lattice spacing as between the charges constituting the aether itself is very much smaller than those we see in crystalline matter. Indeed, there are of the order of tens of millions of aether lattice cells within every lattice cell of an iron crystal, for example.**

The resulting structure of the aether is simple-cubic and every one of the charges which are that **one-component** constituent must be displaced from the center of the compensating charge cell in which it is located. Yet its energy must remain minimal and positive. That can only be if all those charges orbit their cell centers in unison so as to preserve their relative structural arrangement. This in turn introduces the features we associate with quantum theory, the Bohr magneton quantization in particular.

Such then was my introduction to the mysterious realm we call the 'aether' and it will take a great deal more than criticisms of the kind raised by Gerald Lindley to knock me off course, bearing in mind that I am now more than 40 years on past these initial discoveries and my onward research during those years has reinforced my position.

### THE LINDLEY CRITICISMS

This particular discussion is not the place in which I wish to spend time explaining details concerning my theory. I will therefore concentrate on the specific attack mounted against my work by Gerald Lindley.

The case he puts is that the experiments reported in the *SCIENCE* articles prove that an ion plasma in its lowest energy state has a maximum ion density experimentally measured as being of the order of  $2.15 \times 10^8$  to  $4.53 \times 10^8$  per cc. He concludes from this that "the charge cluster hypothesis of Jin and Fox plus Ken Shoulders, Moray B. King and Harold Aspden requires a charge cluster density that is fifteen orders of magnitude greater than the physically possible maximum density."

Now, that, without him having elaborated further, is his total case. He declares that whatever I and these other worthy individuals have said in our quite independent utterances on this charge cluster topic has to be in error by an enormous factor, solely because something measured in very cold plasma involves an ion concentration that does not square with our independent assertions.

Now, firstly, so far as I am aware Ken Shoulders has not claimed that the charge clusters appearing in his experiments have any crystal structure. Furthermore, I have assumed that those experiments were

performed in a laboratory using vacuum tubes that would no doubt get rather warm in their operation. I note that the *SCIENCE* article experiments were performed on plasma that is cooled, not just to a very low temperature near absolute zero Kelvin, but down to 10 mK, that is one hundredth of a degree absolute!

There is no comparison between the energy states in that cold plasma experimental work and the energy levels involved in the research aimed at generating excess energy from spinning plasma. However, the use of the word **spinning** does warrant comment.

First, I make the simple point that if, by cooling an ionized plasma down to 10 mK, it is possible to slow the ions down to the level at which they can each stay within an orbit confined to a single cell volume of that plasma, then that is the basis on which the cubic structure can form. As I have read the *SCIENCE* articles the plasma is a very rarified state set up in a vacuum environment as otherwise there would be more ions present than some  $4.53 \times 10^8$  per cc. This measure of the uniformly dense plasma was what was dictated by the criteria needed to permit formation of that cubic structure.

Surely, if one ionizes a gas that is at a normal or moderate pressure, as in a lightning discharge, there will be a higher concentration of ions per cc than the  $4.53 \times 10^8$  figure relied upon by Lindley in his criticism. No one is suggesting that there will be structure, cubic or otherwise, in the plasma formed in a lightening discharge.

I can only assume, therefore, that Lindley has misdirected his comments by including names other than mine in his attack.

I will, however, concede that I have suggested in my writings that it is the structural crystal-like form of the vacuum state that gives scope for its exploitation as a source of energy in those plasma cluster experiments that do concern Lindley. I need therefore to clarify why Lindley's remarks are utterly absurd in that connection.

## VACUUM SPIN

When I realized that the vacuum medium, the aether, had a cubic structure owing to there being within it a crystal-like array of electric charges uniformly distributed in a background continuum of opposite charge, precisely that (OCP), one-component plasma, system mentioned in the article in *SCIENCE*, I was interested in how spherical sectors of that medium could spin, as with body Earth. How would the rotation affect its cubic structure? Keep in mind that, besides there being that cubic distribution of charge, each such element of charge describes a small orbit to ensure that it stays displaced from the position of minimal, but negative, energy potential and holds itself at a positive level of potential.

That orbital motion or quantum jitter, as I have called it, ensures that those charges keep in synchronism in their jitter motion. **Now, to do that, it works out that they must suffer a slight radial displacement with respect to the spin axis.** This radial displacement is because, if the rotation is in the same sense as that orbital jitter motion, the charges are traveling faster at their outermost positions than they are at their innermost positions and, relative to the center of charge about which they orbit, they must therefore be displaced inwardly in order that they can stay in synchronous motion throughout their orbital jitter motion.

In short, this meant that if, for some reason, there was a radial electric field set up by a concentration of electric charge, then the enveloping aether would develop a spin motion about that charge concentration. That was what my theory predicted and it caused me to understand how astronomical bodies develop their rotation. I presented the theory in mathematical terms in a small 48 page printed booklet, the preface of which bears the date 22 November 1959. That is nearly 40 years ago. My aether theory not only gave

the theoretical value of the fine-structure constant, meaning the dimensionless constant combining Planck's constant, the electron charge and the speed of light, all parameters of the vacuum itself, but it gave, both qualitatively and quantitatively the value we observe as the Earth's magnetic moment.

This concept convinced me that the vacuum medium was as I suggested, namely a simple cubic array of charges set in a uniform background continuum of opposite charge.

This concept has led me, in recent times, to suggest that the setting up of a radial electric field about an axis will develop aether rotation about that axis, something I have called **vacuum spin**. More than this, however, it meant that, in constraining those orbital jitter motions to keep in step, the external enveloping system of charge which is all part of the same dynamic system, must supply energy as necessary to assure that the charges do not get out of step. This is a one-way process in that such energy converges on the focal point or rather on the system at the focus or center of this activity. Here then is a mechanism by which excess energy can be expected to creep into plasma discharges or other physical systems which develop electric fields directed radially with respect to a spin axis.

Naturally, although my theory concerning this concept dates from the 1950s, I could not, merely on the strength of this theory, contemplate such a breach of the kind of physics I had been taught in my early academic years. However, when I did hear of claims concerning experiments that implied generation of excess energy, I then started to wonder and began to see a connection with the theory I had been developing since the mid 1950s.

So now in early 1998 when Gerald Lindley draws my attention to an experimental discovery reported in *SCIENCE*, one which he says disproves my theory but yet which on my reading indicates otherwise, I am more than just interested.

I have said above that my case as published in my copyrighted work back in 1959 was that a radial electric field acting on a cubic charge array would cause it to spin owing to a phase-lock acting throughout that structure. So I say that my prediction is confirmed when I read in the Itano et al. *SCIENCE* article [3]:

"In our experiment the ions were confined in a cylindrical Penning trap, consisting of an electrostatic quadrupolar potential and a uniform magnetic field. The radial electric field leads to a rotation..."

Yes, the plasma not only developed its cubic structure, but it then began to rotate about a spin axis owing to the setting up of a radial electric field inside that plasma. The test data indicated that the spin speed was determined by the strength of that radial electric field.

How can it be that an ionized plasma will spin bodily about a central axis merely because there is an electric field radial from that axis? Surely it will only do that if it is a least energy state for that spin to develop. The magnetic field will no doubt help to keep the charge orbits in mutually parallel planes, but that will not account for that plasma spin. In fact, the magnetic field acting alone would merely develop a reacting motion of charge in tiny helical paths. The data concerning the strength of the magnetic field then tells us that such helical motion would be at frequencies far in excess of those observed for the plasma spin.

## SUMMARY

In summary, therefore, the *SCIENCE* articles support the proposition that the combination of a cubic charge structure in an ionized plasma plus the presence of a radial electric field will assure that plasma spin develops.



I am now left to contest Lindley's assertion that the charge densities observed in those plasma experiments are far less than those deemed necessary to assure excess energy gain in charge clusters formed by experiments such as that of Ken Shoulders or, one presumes, those of the PAGD (Pulsed Abnormal Glow Discharge) experiments performed by Paulo and Alexandra Correa in Canada.

Well, first of all I am looking at cubic charge structure in the vacuum medium, whereas Lindley is looking at a cubic charge structure generated in an extremely-rarified ionized plasma, which by some very freak conditions of extreme cooling to incredibly low temperature happen to permit such structure to develop.

I know that the charge density of that (OCP) vacuum medium itself is very nearly  $4 \times 10^{30}$  per cc. If it were as low as Lindley suggests as the maximum value then the spacing between the charges in the cubic structure would be about  $1.35 \times 10^{-3}$  cm. That means that the aether, which contains charge needed to explain Maxwell displacement currents and the energy storage in the electric field, would have to get by on having its charge components, if of electron size, spaced so far apart that one could, for example, not set up electric fields in logical circuitry on the microscopic scale prevalent in the computer industry.

So I simply cannot understand how Lindley can question the need for the very substantial ion densities that go with normal electrical activity in plasma generally, and in the aether in particular. There are of the order of  $10^{23}$  free ions per cc in copper at room temperature, but they do not form into any structure. However, if I set up a strong flow of current through a copper rod I well know that those electrons will experience an electrodynamic pinch effect, meaning that they will set up a radial electric field with respect to the central axis of that rod. I suspect that the effect of that radial field upon the structured aether 'plasma' inside that rod will promote rotation of that 'plasma', but it makes no sense at all to hear from Lindley that, because the ion density in a rarefied plasma in a Penning trap with no copper core present is quite low, notwithstanding the presence of that plasma rotation, so one cannot have plasma ion densities any greater in that copper rod or in a normal room temperature plasma glow discharge.

I submit that the *Science* articles to which Lindley has referred help my case in asserting that the setting up of a radial electric field in a conductive medium, be it of metal or plasma, will induce what I call 'vacuum spin'. That spin arises because of a phase-lock enforced by the constraints set up by the cubic ion structure and the need for synchrony in the motion of those ions to conserve that structure. Such constraints exerted as between charges constituting a real aether medium are then likely to be effective in drawing energy from the enveloping environment in order to keep the charge motion in a phase-locked state.

So long as physicists accept that an ionized plasma can contain more than  $4.53 \times 10^8$  ions per cc, the case presented by Lindley has to be considered meaningless. Numerous chemical solutions that are subject to ionic dissociation have far more free ions per cc than Lindley suggests as being the possible maximum.

The thunderball could not exist if Lindley's assertion was true. In a book *Modern Aether Science*, that I wrote in 1972, I drew attention to the experiments, in 1963, of J Ritchie of the Bendix Corporation. (*Journal of the Institution of Electrical Engineers*, p. 202 (1963)). Ritchie was experimenting on the assumption that the thunderball is an ionized sphere of gas energized by the induction of short-wave electromagnetic oscillations produced in a thunderstorm. As the years went by it came to be recognized that the energy densities inside thunderballs based on measurement of their capacity to heat water when terminating their stable existence upon falling into a water barrel was between  $2 \times 10^9$  J/m<sup>3</sup> and  $5 \times 10^9$  J/m<sup>3</sup>. This was reported by M D Altschuler et al in *Nature* in 1970 at p. 545 of vol. 228. Later, in 1979, one could read in *Reviews of Modern Physics* at p. 417 of vol. 51 that Nobel Laureate P L Kapitza had recognized that the energy densities of the thunderball are of the right order for application in fusion reactors and that he sought to create them artificially by radio frequency techniques.

Lindley would have us believe that such phenomena are not possible because he has read about an experiment in a Penning trap which shows that the maximum ionic density in a plasma that can create a spherical charge cluster having cubic structure is  $4.53 \times 10^8$  ions per cc.

I will therefore adhere to the opinion which I expressed on p. 14 of my 1972 book Modern Aether Science:

If a spherical volume of the unseen aether medium rotates, it may result in an electric displacement effect radial from its axis of rotation. It is well known from Maxwell's work that a vacuum exhibits electric displacement properties so we are not making an unreasonable proposition. Rotation of a sphere of aether would then develop a magnetic field. It is easy then to say that if such a sphere housed an ionized plasma rotating with it, then both the radial electric field and the magnetic field would be canceled. However, we know that the sun has a magnetic field and we also know that "lightning bails have been known highly to magnetize metallic objects such as gun-barrels" [Here there was a footnote reference to that above-mentioned paper by Ritchie]. Therefore, the cancellation may only be partial and we can examine with justified curiosity the properties of the rotating aether medium.

In conclusion, do keep in mind that those experimental results reported in *Science* do show that ions in a cold plasma can form into cubic structure and that such structure not only may have relevance to there being a kind of crystal structure in stars, but undoubtedly must have relevance to the prospect of there being such a charge structure in the vacuum medium itself; meaning the aether!

## REFERENCES

1. Harold Aspden, "Discovery of 'Virtual Inertia,'" *NEN*, vol 2, no 10, Feb. 1995, pp 1-2; Hal Fox, "The Aspden Effect," *ibid.* pp 2-3.
2. Personal communication
3. Itano, et al., *Science*, vol 279, Jan 1998, p 686.

## COMMENTS ON THE ZINSSER-DEVICE AND TORSION FIELDS

Don Reed <sup>2</sup>

### ABSTRACT

During the 70's, when the Zinsser experimental apparatus underwent its first testing in an official capacity, the explanation of the accompanying effect in terms of known natural forces was not possible [7]. At that time, the physics community accordingly dismissed its significance, attributing the anomalies either to a fluke or experimental error. Thus, they failed to recognize its veritable import, not only for the purpose of tapping a source of potentially inexhaustible energy, but as providing a possible groundwork for forging a new paradigm of physics and metaphysics. However, since that time many other effects of a similar nature have been reported through the utilization of various diverse electromagnetic apparatus. Through this research the field source of these effects, as well as its mode of interaction with known physical forces, has been more clearly delineated. Thus, in the interim it has been determined that the Zinsser effect, among others, can be attributed to the interaction of **activated** mass with the all-pervasive energetic vacuum medium. Although the role of the vacuum as viewed by contemporary physics up to this point, has been limited to microscopic quantum interactions (i.e., via quantum electrodynamics, quantum chromodynamics, Casimir effect, etc. [1]), in this report we wish to consider a principally classical model for this interaction. This paper attempts to show that by attributing the Zinsser effect to a type of vacuum polarization understood from a macroscopic classical context, this research deserves a second look through replication of the prime mover.

### DISCUSSION

In this light, the specific operation of the vacuum in rendering force effects, can perhaps be best ascertained via a scrutiny of the recent Russian findings on so-called torsion fields [2]. These fields have been modeled in essence as a product of the characteristics of classical long-range spin effects, which in turn cause specific modes of vacuum polarization to occur. A classical analysis of the phenomenon is also in keeping with Zinsser's original account of the functioning of the apparatus, which appeals to a macroscopic classical treatment as well. This analysis was recently included in the documentation of the discovery of the so-called kinetobaric force published by Integrity Research Institute [3], to which we will make continual reference. Moreover, studying the phenomena engendered by this early 70's experiment hopefully can provide a better understanding of the process of anomalous energy generation from mere recent related experimental research.

With the following account, which explores findings from the Zinsser research and other related work, perhaps more of the missing pieces of the still mysterious puzzle surrounding the role of the vacuum in nature, can be put into place. Also, hopefully, any confusing data or information rendered from weaknesses in the translation of the original German document might be made clearer. Above all, through the effort taken here to recount these events, perhaps mainstream physics will come to the realization of the authenticity of these effects and that it is time to sit up, take notice, and squarely face the potential ramifications of energy generation out of the vacuum, from the standpoints of both future energy science and for shaping the emerging paradigm for the imminent millennium. Clearly, the coming new outlook on nature's operations is destined to make the prevailing one seem archaic in comparison.

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<sup>2</sup> Translator of the Zinsser paper. Contact through JNE.

## EMBODIMENT OF THE ZINSSER POWER-GENERATING PRIME MOVER

The original conception for the power-generating unit in the Zinsser device derived from a unique type of pulse generator described in his U.S. Patent #4,085,384. As can be seen from Fig. 1, this generator is

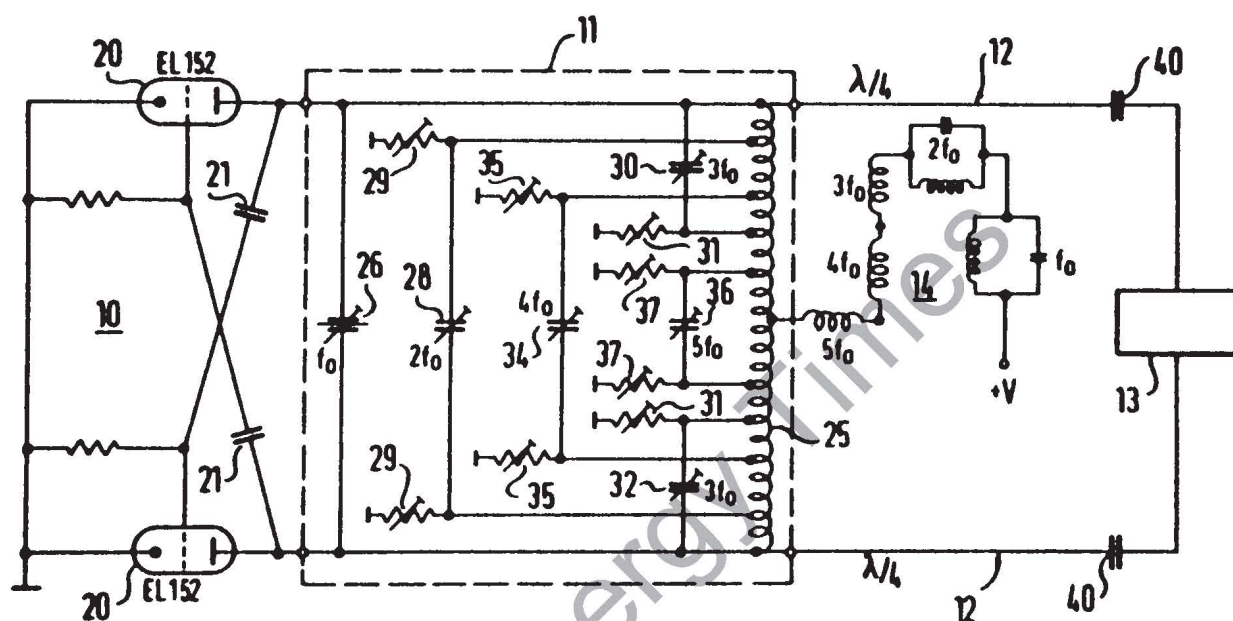


Fig. 1 Pulse Generator

comprised of a standard push-pull oscillator which includes a resonant circuit having multiple resonances. This circuit is tuned to the fundamental frequency, corresponding to the pulse repetition rate, and at least the 1st and 2nd harmonics in such a way that on the output side a sawtooth wave is generated whose steep leading edge has a pulse width corresponding to the 3rd (or highest) harmonic. The fundamental frequency mainly determines the pulse power of the generator, whereas the harmonics chiefly have an influence on the shape of the pulse, specifically the steepness of the leading edge. Thus, for optimum operation the amplitude of the highest harmonic is substantially smaller than that of the fundamental frequency (about 1/6).

This system must then be modified to accommodate the specific embodiment of Zinsser's prime mover. Here, instead of a load the output is connected to two electrodes consisting of zig-zag circuits which are submerged in water whose dielectric constant is 80. These twin electrodes are aluminum tapes 15mm wide, 70mm long (1/4 wavelength), and are separated by 10mm distance.

## BRIEF COMPILATION OF FIELD EFFECTS

Upon application of high frequency electromagnetic energy (microwave) to the device, persistent deflection of the torsion balance was observed for much longer periods than the original "trigger" energy, after the initial excitation was turned off. Residual anomalous forces of up to 10 dynes were observed to be activated within the sample and deflect the balance. The longest of the effects lasted for a period of several weeks. The period of oscillation of the balance was noticeably affected by outside weak electrical effects from sine wave sources (lightning flashes, switching on electrical apparatus, etc.) which, by standard electrical theory would be deemed too weak to influence the system. It is to be noted that sine



wave forms of electromagnetic energy only influenced the device after it had been first activated by the sawtooth EM pulse. In addition, long term effects exerting a measurable influence on the system were noted from astrophysical sources such as the Sun, moon, stars, etc. Also, personnel that had been present in the test room at the time of activation of the system caused measurable deflections of the balance after they had left the room and re-entered, whereas those individuals originally outside the room at activation time caused no such effects upon coming in to the test room later. Moreover, ambient inanimate objects within the test room at the time of primary activation having the same mass as test personnel, did not cause any deflections to occur when they were brought back into the test room.

### PROPOSED EXPLANATION FOR FIELD EFFECTS

As has been indicated, two decades ago when these type of effects were first recorded, little information was available on the role of the vacuum in promoting manifestations of various energy phenomena in a classical context, such as the anomalous inertial impulses produced with the Zinsser apparatus. Moreover, the prevailing physics paradigms at that time did not allow for the vacuum to play an active role, especially in a macroscopic context. Also, the law of conservation of momentum presupposes that there must be a common definable center of mass between the two reaction partners of the dynamic process. However, with the Zinsser kinetobaric effect, a second ponderable body mass is not a factor. Moreover, the laws of conventional dynamics operate in a closed physical system in which the center of mass law can and must be applied, whereas the kinetobaric impulse gain occurs in an open system. Because of these unique counterintuitive features of the kinetobaric system, Zinsser originally conceived the effect as the result of creation of an anisotropy in the gravitational field, caused by a specific electromagnetic "trigger" energy [3].

According to the insight which has been provided in the interim on the key role of the vacuum in physical processes, we wish to make certain observations and specific important adjustments to Zinsser's interpretation. For this purpose, we adopt the Dirac model of particle-antiparticle pairs as representative of primordial vacuum structure. Here, however, in non-polarized vacuum the pairs are mutually interpenetrating annular wave-packets. Moreover, pursuant to the vacuum model advanced by Russian research on torsion fields, we shall postulate that classical spin motion, either from macroscopic bodies or sub-atomic particles can perturb the quiescent state and create a specific, type of vacuum polarization [2,4]. Modern physics of the electron dictates that only the quantum-mechanical spin concept governed by the Dirac equation, can effectively account for energy effects from the vacuum via quantum electrodynamic formalism. However, unlike the mechanism attributed to quantum spin effects, the torsion fields involve the use of long-range classical spinors to describe such interactions. Here, focus is not on the Dirac equation to describe fermion spin, but on a classical analogue, the Bargmann-Michel-Telegdi (BMT) equation to account for spin effects [5]. BMT follows from a quasi-classical extension of the Dirac equation and accounts for vacuum energy effects usually attributed to quantum electrodynamic treatment, such as the anomalous magnetic moment of the electron and radiative self-polarization.

Thus, classical angular momentum or spin has been shown to be the source of the torsion field in the same manner as electric charge and mass produce electromagnetic and gravitational fields, respectively. In regards to the current report, we will attempt to show that Zinsser's kinetobaric effect, as well as other key (yet unexplained) electromagnetic effects, are a result of coupling of EM fields to torsion fields.

One of the most fascinating and mysterious features of torsion fields, apparently well validated by Russian experimentation, is the ability under torsion action for the physical vacuum to be preserved in a prolonged polarized metastable state long after the removal of the original excitation [6, 8]. This unique ability, which is one of the key signatures of torsion fields, to apparently structure space, was also a feature of the kinetobaric effect in which anomalous inertial impulses deflected the torsion balance for days and weeks

after the original EM excitation was turned off [7]. Also, Chernetsky's plasma experiments which produced the so-named, self-generating discharge (SGD) featured similar effects [8]. In one experiment, a resistor placed between the plates of a capacitor, showed a decrease by 6-8% when the generator was turned on [8]. However, when the generator was turned off, the pointer maintained its position showing that the resistor continued to maintain reduced resistance [8]. Curiously, when the resistor was removed from between the capacitor plates, the resistance returned to normal. Residual effects as a result of torsion field action were also recorded at PERM university, where measurements of the electromotive force of various galvanic cells and hydrogen permeability of metal membranes during electrolytic evolution of hydrogen were carried out [9, 15]. With a torsion generator on, not only was there a shift of electrolytic potential to more negative values and a slow increase in hydrogen flow, but when the torsion excitation was removed hydrogen flow increased further for an additional half hour [9]. It goes without saying that this key finding might have importance for the future development of technology for the facilitation of nuclear reactions with the aid of low-energy electrolytic action [10].

A related effect of torsion field action is the permanent re-structurization of the atomic-molecular matrix of various metals, before they have crystallized from a melt into a solid [4]. A similar phenomenon was evidenced with the catastrophically fractured metal samples which were exposed to radiation from Hutchison's electromagnetic field effect [11]. Also, in the latter as well as in Zinsser's work, anomalous inertial impulses were recorded. In Hutchison's research, the complete lift/levitation of different substances of varying mass was observed [11]. In contrast to the Zinsser and Chernetsky experiments, there were no reported residual vacuum polarization effects after turn-off of the Hutchison apparatus.

Biological human informational fields also possess a unique active component of torsion energy, which is not present in inanimate matter. This has been demonstrated in both the Zinsser and Chernetsky research. Accordingly, a feature of the kinetobaric effect was the deflection of the torsion balance by re-entry into the test room of personnel who were present at the time of original excitation [7]. With the Chernetsky SGD, the human biofield was able to decrease the stability of a quartz generator by 3 orders of magnitude [8]. Moreover, additional anecdotal evidence suggested that both the clairvoyant and telekinetic abilities of humans was increased when they were subjected to the SGD [8]. Zinsser has offered the following explanation for the biofield effect, which bears a remarkable resemblance to the residual "vacuum-storage" ability of torsion fields. He claims that with primary activation, a certain "baric" pattern may have been impressed on the vacuum, stored partly by the activated matter and partly by the experimenter's mass. Upon re-entry into the test room, the similarity of both patterns is possibly "recognized" and thus triggers the effect [3].

The continual appearance of research results, such as the kinetobaric effect, which cannot be explained in terms of conventional scientific paradigms, offers clear evidence of the incompleteness of our knowledge of nature even in this enlightened era in the waning years of the 20th century. Accordingly, hints as to how the kinetobaric effect arises and interacts with known physical forces, can perhaps assist us towards the development of a more comprehensive paradigm which embraces a wider spectrum of human knowledge. For instance, the fact that the rise time of the EM pulse that is applied to the Zinsser device is very fast, may have key importance in this regard [3]. The Russians, for example, have claimed success in accelerating the treatment of various diseases through application of millimeter electromagnetic radiation pulses with very fast rise time [12]. In general, it may be the case that high-voltage nonlinear EM "impulses" with very fast rise time and very short duration might tend to induce vacuum coherence and information propagation via torsion wave coupling.

Secondly, such empirical evidence which generally flies in the face of current scientific wisdom, also presents the greatest challenge to our on-going search for new sustainable energy sources which will be absolutely essential in the coming millennium. In this regard, the exposition in the original German document on a possible revolutionary new means of communication where, via the kinetobaric effect, weak

outside EM excitations are boosted and carried great distances apparently with little attenuation, deserves closer scrutiny [7]. Also, similar propagation characteristics have been reported through Russian experimentation showing actual communication via torsion fields where speed of transmission has been claimed to greatly exceed the velocity of light [2,4]. Kozyrev's work on the true positions of stars in the stellar realm also imply a superluminal transmission of torsion radiation [13, 14].

Thirdly, focus on the cause of the kinetobaric effect in connection with the various findings on torsion fields, can perhaps assist us towards development of a more comprehensive paradigm; one in which the current conundrums rampant in the foundations of theoretical physics - especially electromagnetic theory preventing the establishment of a unified macroscopic model of all physical interactions, can be resolved. On the basis of currently inexplicable electromagnetic anomalies, such as the kinetobaric effect, in a forthcoming paper the author will advance a theoretical model for EM - torsion field coupling that might suggest future experimental protocols for tapping the energy of the vacuum [16]. As an offshoot of this exposition, possibly a new more expansive understanding of the role of the vacuum in nature will be in the offing.

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## COMPLEXIFIED EM, GRAVITY, AND ENERGY

Shiuji Inomata <sup>1</sup>

### ABSTRACT

Complexified EM theory is a core theory for the author's new-paradigm of science/psychotronics. The theory predicts two phenomena: the change in gravitational mass of a condenser charged with the shadow electrical charge and the production of a gravitational vortex. Years of experiments have been done in studying or discovering these phenomena, using condensers and coils. In this paper, the successful experiments are described, which have confirmed the existence of the predicted phenomena. And, undeniable phenomena in which coils extract energy from the vacuum, have been found.

### INTRODUCTION

The complexified EM theory, which is a core theory of the new paradigm science; psychotronics, predicts two phenomena [1]; the change in gravitational mass of an electrical condenser charged with the "shadow electrical charge" and the existence of the gravitational vortex. In search for these phenomena, the author has conducted experimental research for several years [2, 3]. Recent experiments have shown the positive conclusions for these phenomena [4, 5], and the detailed experimental information has been provided for those who hope to replicate them. The experimental findings are really astounding, in view of the paradigm of conventional physics. However, rational explanations can be given by the complexified EM theory. The complexified EM theory is an integrated theory of EM and gravity. It has been shown that EM and gravity exist by their own rights, but interact with each other in a manner as disclosed by the experiments. The confirmed phenomena clearly had escaped the Faraday's experiments on EM and gravity and consequently indicate the inadequacy of the Maxwell's formulation of EM. As the EM theory is the central theory of the theoretical physics, the impacts of these experiments on science are immense. Also, undeniable results have been obtained that the coils extract energy from the vacuum. It has also been shown that there exist the gravitational vortex induction phenomena between two coils. Some experiments were video-recorded and distributed for objective evaluations.

### COMPLEXIFIED EM THEORY

In the complexified EM theory, the electric and magnetic fields are complexified as below,  $i = \sqrt{-1}$  is an imaginary unit.

$$\begin{aligned} E &= E_1 + iE_2 \\ H &= H_1 + iH_2 \end{aligned} \quad (1)$$

And the complexified EM becomes as below (CGS unit)

$$\nabla \cdot E_1 = 4\pi \rho_e \quad \nabla \times E_1 = (-) \frac{1}{c} \frac{\partial H_1}{\partial t} \quad (2)$$

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$$\nabla \cdot H_1 = 0 \quad \nabla \times H_1 = \frac{1}{c} \frac{\partial E_1}{\partial t} + \frac{4\pi}{c} J_e \quad (2)$$

$$\begin{aligned} \nabla \cdot (iH_2) &= 4\pi i\rho_m & \nabla \times (iH_2) &= \frac{1}{c} \frac{\partial (iE_2)}{\partial t} \\ \nabla \cdot (iE_2) &= 0 & \nabla \times (iE_2) &= (-) \frac{1}{c} \frac{\partial (iH_2)}{\partial t} + \frac{4\pi}{c} iJ_m \end{aligned} \quad (3)$$

and

$$\begin{aligned} \rho &= \rho_e + i\rho_m \\ J &= J_e + iJ_m \end{aligned} \quad (4)$$

are the generalized electrical charges and currents. The equations (2) indicate the conventional electromagnetism. The equations (3) are, on the other hand, supposed to represent the gravitational fields. It is concluded that an electrical condenser, if charged up with the shadow electrical charge  $i\rho_m$ , will change its gravitational mass  $M$  by the following amount. The derivation of this relation was given elsewhere [6].

$$\Delta M = G^{-1/2} \rho_m \quad (5)$$

Where  $\Delta M$  is the change in gravitational mass,  $G$ , gravitational constant. here  $G^{-1/2} \approx 10^4$  CGS unit [ $L^{-1/2} M^{1/2} T^2$ ]. On the other hand, the flow of real current  $J_e$  produces a magnetic vortex  $H_1$  by Biot Savart law. And the flow of the shadow current  $iJ_m$  is supposed to produce the gravitational vortex  $iE_2$  by the shadow Biot Savart law;  $iH_2$  is the ordinary gravitational field. The experiments have been performed to see whether the gravitational mass change really exists, and to see whether the gravitational vortex really exists. Incidentally,  $i\rho_m$  is the same thing as "ki" or "prana" in eastern philosophy and is non-existent in conventional physics.

## CONDENSER EXPERIMENTS

It should be pointed out that conventional physics predicts no measurable weight change of an electrically charged condenser. In this case, the weight change  $\Delta M = E/c^2$  is expected by Einstein relation. However,  $E$ , charged electrical energy is too small, and  $c^2$ , square of light velocity, is too large. And so, mass change  $\Delta M$  cannot be measured by ordinary means. New paradigm science predicts one more possibility of weight change other than that predicted by the equation (5). This is the case where the motional energy  $E = \frac{1}{2} mV^2$  and momentum  $p = mV$  are created from the vacuum by the consciousness;-mass-energy triangle, see Table 1 "New versus Old Paradigms". In this phenomenon, the third law of Newton mechanics, that is, action-reaction law is violated. And this phenomenon could preferably be called the "Invisible Hand Phenomenon" (IHP). The Biefeld-Brown phenomenon [7] concerning a condenser is supposed to be an "IHP". Levitation phenomena, known in psychotronics, are also considered to be "IHP". To isolate Biefeld-Brown effect from the genuine change in gravitational mass predicted by the equation (5), cylindrically-wound plastic condensers were used, in which the thrust forces created are considered to be canceled out in the opposite directions. Two plastic condensers of 0.022  $\mu F$  and rating 8 KV are connected in series, which made one condenser of 0.011  $\mu F$  and 16 KV rating. The power supply was 15 KV DC 1 mA, and the weight changes were measured by an electronic balance of 1 mg accuracy. The plastic condensers were hung under the electronic balance with about 50 cm silk thread to avoid an electrostatic interference on the electronic balance, see Photo 1. The author actually detected several milligrams weight change as witnessed by other people. An important thing for the occurrence of the phenomena is that the "spark-charging" is necessary. This perhaps means that the shadow electrical

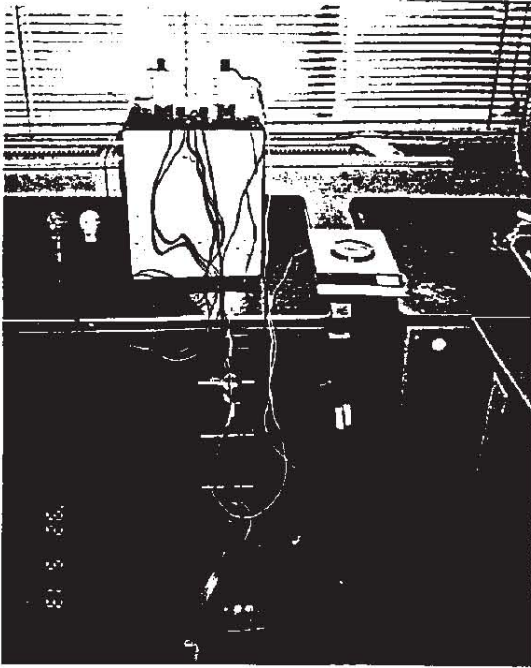


Photo 1: Gravitational mass experiment

charge  $i\rho_m$  does not come from the 15 KV DC power supply, but from the surrounding vacuum. Another interesting observation is that the condensers sometimes weigh less and sometimes weigh more, in milligrams seemingly by chance. This might mean that the vacuum is a balanced sea of both positive and negative shadow charges of infinite depth. On the other hand, a plastic condenser covered with metal enclosure does not show the weight change. So, the selection is necessary for the condenser samples to arrive at the theoretically predicted phenomena. The used condensers weighed about 77 gr. One example of the experimental data is as follows. The experiments were performed in the afternoon of 18 May 1992.

77.522 gr before charging

77.515 gr after charging. - 7 mg

77.522 gr before charging

77.517 gr after charging, -5 mg

These weight changes remained for a while and then disappeared suggesting that the real electrical charge did not cause the phenomena. The biggest weight

change so far obtained in the experiment is 10 mg. This is the order of  $10^{-4}$  of the total weight of about 77 gr.

## COIL EXPERIMENTS

In the stationary case, the lower-right equation of (3) reduces to the following form.

$$\nabla \times (iE_2) = \frac{4\pi}{c} iJ_m \quad (6)$$

This means that if shadow current  $iJ_m$  flows in the coil, together with real current  $J_e$ , the coil generates the gravitational vortex  $iE_2$  as well as the magnetic vortex  $H_1$ . As the shadow magnetic monopole  $i\rho_m$  contained in the gravitational mass  $M$  is  $iG^{1/2} M^8$ , where  $G$  is gravitational constant, the gravitational mass  $M$  feels the following pulling gravitational force in the existence of the gravitational vortex  $iE_2$ , that is,

$$\begin{aligned} f &= i\rho_m \cdot iE_2 \\ &= iG^{1/2} M \cdot iE_2 \\ &= -G^{1/2} ME_2 \end{aligned} \quad (7)$$

The author thought, to make  $f$  measurable, it is necessary to overcome  $G^{1/2} \approx 10^{-4}$  CGS [ $L^{1/2} M^{-1/2} T^2$ ], and prepared a special air core coil of  $2.5 \times 10^5$  windings using insulated copper wire of 0.06 mm diameter, the coil formerly being made of ebonite. The coil resistance is about 130 k $\Omega$  and energized by the 300 - 400 V DC. As the detector of the gravitational vortex force, a tooth-pick torsion balance hung with silk thread is used. The coils are wrapped by aluminum foil and is connected to the laboratory earth to avoid an



influence of electrostatic field. See Photo 2. The first try was successful; an electrostatically-shielded coil of a quarter million turns, when energized, clearly "pulled" the wooden tooth-pick and force acting on it was estimated as 0.035 dyne. Fig. 1, Case 1: The coil attracted a copper-wire torsion balance. Copper is known as anti-magnetic material. Much stronger Samarium Cobalt magnet does not affect the wooden tooth-pick but does repel the copper wire torsion balance. As the comparison experiment, the author wound 240 turns air core coil (right-hand side coil in Photo 2) and electrostatically shielded it by aluminum foil. The



Photo 2: A quarter million and 240 windings coils. A line between two coils is the earth line.

coil was connected to 10 V 1 Amp DC power supply, to see if the coil attracts the tooth-pick torsion balance. But, the 240 turns energized coil did not pull the tooth-pick torsion balance; that is, the anomaly did not occur. As the ampere-turn of the  $2.5 \times 10^5$  turn coil and 240 turn coil is the same order in this case, the gravitational vortex anomaly of the energized coil is attributable to the dense windings. The EM coils have been usually of several thousand windings at most, and have been used in energized states. This is, perhaps, the reason why the gravitational vortex anomaly has not been noticed by experimenters including M. Faraday. So far so good; however, the next finding, Fig. 2, Case 2, is clearly beyond comprehension of the common sense of conventional EM and physics. That is; the author accidentally found that when one connected both terminals of the passive quarter million winding coil, no energy source whatsoever in the coil, the coil attracted the tooth-pick torsion balance as almost equally as the energized case. In this situation, we cannot but think that shadow current  $iJ_m$ , energy and momentum of the tooth-pick come from the vacuum. In the new paradigm science, psychotronics, the balanced vacuum  $[o]$  is non-material and is expressed as below [9]  $E$  is energy,  $i = \sqrt{-1}$  imaginary unit.

$$[o] = -iE + iE \quad 0 \leq E \leq +\infty = -i \frac{c^2 \rho_m}{G^{1/2}} + i \frac{c^2 \rho_m}{G^{1/2}} \quad 0 \leq \rho_m \leq +\infty \quad (8)$$

Either positive or negative flow of  $i\rho_m$ , ie,  $\pm iJ_m$  can be extracted from the vacuum in infinite quantities. **The author also accidentally found that passive 240 turns coil, of which the author already described, when the both terminals were connected, attracted the tooth-pick torsion balance.** This suggests that real current  $J_e$  suppresses the inflow of shadow current  $iJ_m$  from the vacuum in the coils of ordinary number windings. In other words, in a quarter million winding coil, the real current  $J_e$  fails to suppress shadow current  $iJ_m$ , and so, a magnetic vortex and gravitational vortex co-exist. The author tried coils and small iron-core transformers at hand.

They all surprisingly showed gravitational vortex phenomena, more or less, in passive states. We have suffered from the misconception that the passive coil is "passive" and of no use. As a matter of fact, A. Sandor of Slovakia is using passive coils to enhance the animal production [10] and W. Mohorn of Austria uses them to dry house wall [11]. And we have been brainwashed by the relativist's claim that the vacuum

is both void and inert. As a matter of fact, the vacuum has turned out to be energy-rich. The author also accidentally found that 240-turn coil, with both terminals were connected, attracted the tooth-pick torsion balance, when the quarter-million-windings coil, placed nearby. energized, and released it. when de-energized. Fig. 1, Case 3. This phenomenon is nothing but the gravitational induction phenomenon, so far unnoticed. Faraday's EM induction is time-derivative type. But, the gravitational induction is non-time-derivative type, as electrostatic induction. The author also found that for the gravitational induction to occur, no energy source, whatever. was necessary see Fig. 1, Case 4. The all necessary energy comes from the vacuum. That is, 240-turns coil, whose both terminals are connected, attracted the tooth-pick torsion balance, as the both terminals of a quarter-million-windings passive coil were connected, released it as disconnected. Also, in this case, the gravitational induction is non-time derivative type, as electrostatic induction.

### EXPERIMENTER'S CONSCIOUSNESS

Criticisms have been raised among the skeptic conventional physicists that the above mentioned phenomena are not attributable to the coil *per se*, but to the author's psychic abilities. The phenomena in question are not physics phenomena, in a true sense of words;  $i\rho_m$  and  $iJ_m$  are not physical quantities but consciousness quantities. So, the experimenter's consciousness and the phenomena could not be separated in principle. As a matter of fact, without using coils, the author, by raising hands towards the tooth-pick torsion balance, at about one meter distance, and by the strong mental concentration, could deflect it by the induced gravitational vortex. However, during these experiments no such mental concentration on the part of author, as an experimenter, was tried. The author also had confirmed that several other experimenters, clearly in their normal state of consciousness, replicated the experimental phenomena using the same device. So, the authors conclusions are that they are attributable to the interaction between energetic vacuum and the coils *per se*. Nonetheless, the author witnessed the case, where experimenter's consciousness, or more precisely, experimenter's gender affected the experimental outcome. A passive triple coil (coil of coil of coil), when both terminals were connected. deflected the tooth-pick torsion balance in the opposite directions, depending on the sex of the experimenters. who were in normal states of consciousness.

It seems that the consciousness structure of the both genders are different and they trigger the opposite flow of  $+iJ_m$  from the vacuum. So. the absolute objectivity could not be secured in psychotronic phenomena, in any case. During several month's of experiments, the author has noticed that in clear days, the phenomena are distinct and strong, but in cloudy and rainy days, they are weak. **Meteorological conditions seem to have an influence on the state of the vacuum.** Finally, an attraction force has been found to be "sticky"; it remains attracting for a while after disconnecting the circuit.

### CONCLUSIONS

The predictions of the complexified EM theory; the change in the gravitational mass of a condenser charged with the shadow electrical charge  $i\rho_m$ , and the existence of a gravitational vortex have been confirmed by the experiments using condensers and coils. Ordinary Maxwell's equation (2) has been shown to be inadequate to describe the full spectrum of EM and gravity phenomena. The author proposes the use of the shadow EM equation (3), together with Maxwell's equation (2) for the future study of theoretical physics. The author feels that the complexified EM equation could solve the divergence difficulties of the present QED (quantum electro-dynamics). The success of the experiment to change the gravitational mass of a condenser, by the new paradigm method, even in milligrams, will open up a new possibility of the future gravitational technologies. On the other hand, the location / modification the inertial mass of the same condenser has not shown experimentally at this time. Further study will tell us other information on whether the equivalence principle is right or wrong. Wide appearance of the gravitational



vortex in passive coils has been a strong surprise to the author. These phenomena are undeniable evidences to suggest that we could tap even larger amounts of usable energy from the vacuum by suitable means, such as N-machine [12]. As the complexified EM theory is the core theory of the new-paradigm science, see Table 1, "New versus Old Paradigms", the successful experiments described in this article can be said to have confirmed the plausibility of the new-paradigm science, that is, psychotronics. The author's thanks are due to many people too numerous to mention, both domestic and abroad, who have been interested in these experiments.

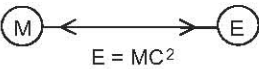
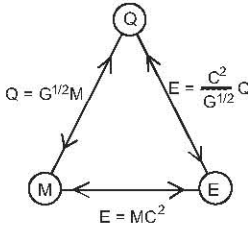
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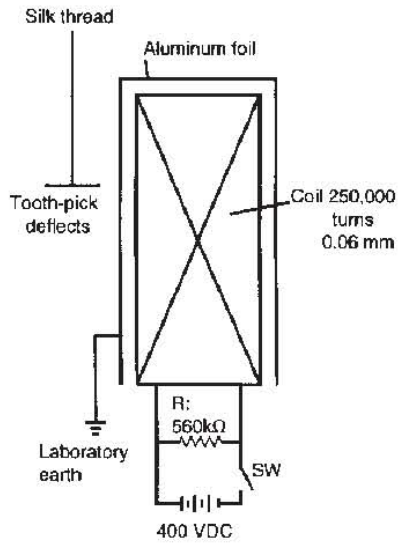
Table 1: Old vs. New Paradigms

Old Paradigms	New Paradigms
Newton's Mechanics	Newton's Mechanics
1st Law: law of inertia 2nd Law: equation of motion $\frac{dP}{dt} = F(P=mv, m, \text{inertial mass})$ 3rd Law: law of action & reaction  Gravitation $f = \frac{GM_1 M_2}{r^2} r^0$	1st Law: law of inertia 2nd Law: equation of motion $\frac{dP}{dt} = F(P=mv, m, \text{inertial mass})$ 3rd Law: law of action & reaction Above laws are effective only if there is no consciousness function Gravitation $f = \frac{Q_1 Q_2}{r^2} r^0$  $Q_1 = iG^{1/2} M_1$ $Q_2 = iG^{1/2} M_2$
Electromagnetic equation (CGS unit in vacuum)	Electromagnetic-gravitational equation (CGS unit in vacuum)
$\nabla \cdot \mathbf{E} = 4\pi \rho_e,$ $\nabla \times \mathbf{E} = (-) \frac{1}{c} \frac{\partial \mathbf{H}}{\partial t}$ $\nabla \cdot \mathbf{H} = 0,$ $\nabla \times \mathbf{H} = \frac{1}{c} \frac{\partial \mathbf{E}}{\partial t} + \frac{4\pi}{c} \mathbf{J}_e$	$\mathbf{E} = \mathbf{E}_1 + i\mathbf{E}_2, \quad \mathbf{H} = \mathbf{H}_1 + i\mathbf{H}_2$ $\nabla \cdot \mathbf{E}_1 = 4\pi \rho_e, \quad \nabla \times \mathbf{E}_1 = (-) \frac{1}{c} \frac{\partial \mathbf{H}_1}{\partial t}$ $\nabla \cdot \mathbf{H}_1 = 0, \quad \nabla \times \mathbf{H}_1 = \frac{1}{c} \frac{\partial \mathbf{E}_1}{\partial t} + \frac{4\pi}{c} \mathbf{J}_e$ The above equations indicate electromagnetic field
	$\nabla \cdot (i\mathbf{H}_2) = 4\pi i \rho_m$ $\nabla \times (i\mathbf{H}_2) = \frac{1}{c} \frac{\partial (i\mathbf{E}_2)}{\partial t}$ $\nabla \cdot (i\mathbf{E}_2) = 0,$ $\nabla \times (i\mathbf{E}_2) = (-) \frac{1}{c} \frac{\partial (i\mathbf{H}_2)}{\partial t} + \frac{4\pi}{c} i\mathbf{J}_m$ Above equations indicate gravitational field
General representation $\square \Phi = -4\pi \rho$ $\square \mathbf{A} = -\frac{4\pi}{c} \mathbf{J}$ $\square = \Delta - \frac{1}{c^2} \frac{\partial^2}{\partial t^2}$ Lorentz condition $\nabla \cdot \mathbf{A} + \frac{1}{c} \frac{\partial \Phi}{\partial t} = 0$	General representation $\square \Phi = -4\pi \rho \quad \rho = \rho_e + i\rho_m$ $\square \mathbf{A} = -\frac{4\pi}{c} \mathbf{J} \quad \mathbf{J} = \mathbf{J}_e + i\mathbf{J}_m$ $\square = \Delta - \frac{1}{c^2} \frac{\partial^2}{\partial t^2} \quad \Phi = \Phi_1 + i\Phi_2$ Complex Lorentz condition $\nabla \cdot \mathbf{A} + \frac{1}{c} \frac{\partial \Phi^*}{\partial t} = 0$
Integration theory of electromagnetism and gravity	Integration theory of electromagnetism and gravity
none	$\square \Phi = -4\pi \rho$ $\square \mathbf{A} = -\frac{4\pi}{c} \mathbf{J}$ $\square = \Delta - \frac{1}{c^2} \frac{\partial^2}{\partial t^2}$ $\rho = \rho_e - G^{1/2} M_2 + i(\rho_m + G^{1/2} M_1)$ $\mathbf{J} = \mathbf{J}_e + i\mathbf{J}_m$ $M = M_1 + iM_2, \quad \text{complex mass.}$
Thermo-dynamics	Complex thermo-dynamics
	Complex temperature, $T = T_1 + iT_2$ Complex heat quantity $Q = Q_1 + iQ_2$

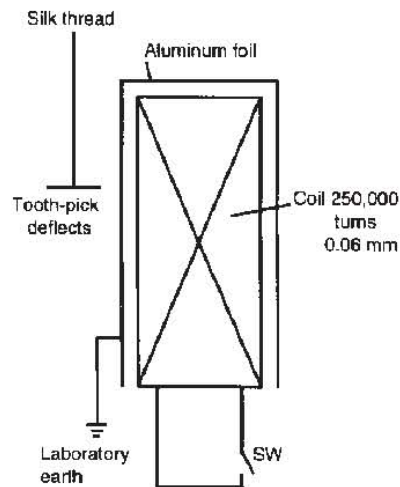
Table (cont.) Old vs. New Paradigms

Entropy $\Delta S = \frac{\Delta Q}{T}$	Entropy $\Delta S = \Delta S_1 + \Delta S_2$ $\begin{cases} \Delta S_1 \frac{\Delta Q_1}{T_1} \\ \Delta S_2 \frac{\Delta Q_2}{T_2} \end{cases}$
Quantum mechanics/elementary particle theory	Quantum mechanics/elementary particle theory
Schrödinger Equation $i \frac{\partial}{\partial t} \phi = H \phi$	Schrödinger Equation $i \frac{\partial}{\partial t} \phi = H \phi$ Shadow Schrödinger Equation $- \frac{\partial}{\partial t} \phi = i H \phi$
Klein-Gordon equation $- \frac{\partial^2 \phi}{\partial t^2} = (-\nabla^2 + m^2) \phi$	Klein-Gordon equation $- \frac{\partial^2 \phi}{\partial t^2} = (-\nabla^2 + m^2) \phi$ Shadow Klein-Gordon equation $\frac{\partial^2 \phi}{\partial t^2} = (-\nabla^2 + m^2) \phi$
Dirac equation $i \frac{\partial \psi}{\partial t} = (-i \alpha \cdot \nabla + \beta m) \psi$ Dirac neutrino $i \frac{\partial \psi}{\partial t} = -i \alpha \cdot \nabla \psi$ (natural unit)	Dirac equation $i \frac{\partial \psi}{\partial t} = (-i \alpha \cdot \nabla + \beta m) \psi$ Shadow Dirac equation $- \frac{\partial \psi}{\partial t} = (-i \alpha \cdot \nabla + \beta m) \psi$ Shadow Dirac neutrino $- \frac{\partial \psi}{\partial t} = -i \alpha \cdot \nabla \psi$ (natural unit)
Yukawa equation $\square \phi_1 - \mu^2 \phi_1 = 0$ (strong interaction)	Yukawa equation $\square \phi_1 - \mu^2 \phi_1 = 0$ (strong interaction)
(CGS unit)	Shadow Yukawa equation $\square i \phi_2 - \beta^2 i \phi_2 = 0$ (weak interaction) (CGS unit)
Space-time	Space-time
$x, t$	$x \quad x_1 - i x_2$ $t \quad t_1 - i t_2$
Conversion formula: inertial mass and energy	Conversion formula: consciousness, mass and energy
$E = Mc^2$ 	
	As to the meaning of symbols, please confer with reference

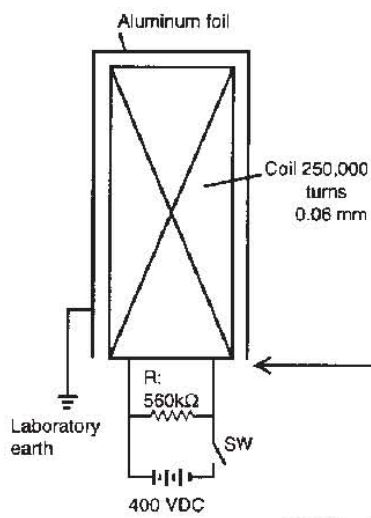
# Gravitational Vortex and Induction



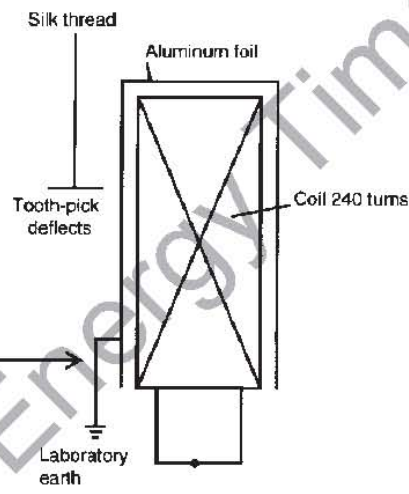
CASE 1 GRAVIATIONAL VORTEX



CASE 2 GRAVIATIONAL VORTEX



CASE 3 GRAVIATIONAL INDUCTION



CASE 4 GRAVIATIONAL INDUCTION

Fig. 1 Phenomena with Coils



## EDITOR'S CHOICE

**A POSSIBLE EXPLANATION FOR CROP CIRCLES WITH SOME  
COMMENTS ON ANIMAL MUTILATIONS AND FLYING SAUCERS**

Roy Stewart (Design Engineer)

**ABSTRACT**

An extremely strong, if not unassailable, case can be made that all crop circles not produced with ropes and boards are made with another human technology and that we need not assume any "alien" participation whatsoever. That technology is an array of orbiting radar satellites linked in such a manner as to create a single "synthetic-aperture" antenna encircling the earth. We shall be examining this hypothesis from three main viewpoints: motivation, history and a technical analysis. By extension the same line of reasoning can be, and has been, applied to abductions, animal mutilations and flying machines. The attached book list gives several sources of well reasoned arguments and reverse engineering to support this mostly ignored viewpoint. This paper is addressed to the technically competent, open-minded sceptics among us.

**PREFACE**

Let me start by stating a few assumptions I have made. Some of the circles are undoubtedly rope and board productions and I assume that there is no disagreement as to that. I also assume that most of the rest are of such a perfect and pristine character as to virtually rule out such crude methods. Although I am not a student of crop circles and have maintained only a passing interest in such phenomena, I am assuming that the scientific analyses made, indicating microwave-type evidence were competently performed (i.e.: using modern equipment, highly-trained personnel and rigorous methodologies such as double blind studies) and that the data are reliable. I admit that I don't know for a fact that the markings started out simple and evolved more complexity over the years but rather that my memories of the earliest ones seem to be that they were the more primitive patterns. An interesting analysis would be to do a complete "time-line" history of patterns including designating which were obviously rope and board, crop types and age, etc. If this has been done I am not aware of it. All of that said, let's take a look at the hypothesis.

By the late fifties it was undoubtedly realized by the defense forces of the United States that the DEW line (Defense Early Warning) system left a lot to be desired. Orbital surveillance capabilities must be provided ASAP. The ultimate goal would obviously be a system with ultra-high resolution, deep penetration and globe-covering reach. Additional goodies would be offensive capabilities. For instance, one could heat organic substances, possibly altering chemicals, and perhaps even set off explosives which are unshielded. Maybe it would be possible to affect living systems, entrain brain waves, stop hearts, etc.

An array of radars synchronized via atomic clocks, radio or laser linked, meta-tuned and computer holographic would be awesome indeed. Such a system would be a single synthetic-aperture "dish" larger than the earth, looking inward, although with the added expense of steerability it could also look outward, with an almost unimaginable resolution. We would have been stupid not to have built it.

I propose that the crop circles are most likely test patterns for tuning such a device. The agency in charge would hardly paint a reticule with calibration scales, they would want to hide their capabilities. One would

certainly not want to "dazzle 'em with your brilliance" if the secret were to be maintained; so, "baffle 'em with baloney"! Crops are made to order for this purpose as we shall see, so are the "alien" myths. If the credulous can be made to believe that the geometries are alien (as if any geometric pattern could be alien or human - just don't paint a portrait of Marilyn Monroe) they are home free. I think that they goofed when they did the Mandelbrot figure. If it were aliens, would they not have impressed us with a set we haven't discovered yet? As for "sacred geometry", that is in the eye of the beholder and has been over-flogged by the new-agers and even a couple of mathematical physicists who should know better. If it were aliens doing them, wouldn't it be more impressive for their "millions of years in advance of us" technology to make the wheat a healthy, growing, iridescent, metal-flake, electric blue with humongous grains that tasted like honey-toasted, cinnamon crunch, right off the stalk? Or how about just dropping in and saying: "Hi, we're here!"? Maybe they're just some teenagers in daddy's saucer out for a Saturday lark or a couple of five-year-olds kicking open the ant hill to giggle at all the bugs scurrying around.

In the middle fifties the defense techies were dreaming and planning, ECM's were already more than a concept. By the sixties the system was starting to gestate, the launch capabilities were maturing and several of our engineers, including Bob Grisham, were envisioning astonishing possibilities. There are two ways to keep a secret: don't tell anyone or hide it right out in plain sight and if anyone asks say: "Oh! Well we're using it as a paper-weight. We looked at it real close but it's just not viable as an airplane!" The Air Force has done this before, as in de-classifying the Gravity Rand Report just before embarking on the B-2 program (see: Paul LaViolette - "The US Antigravity Squadron"); 'Yes the T.T. Brown stuff is real, it works, but not well enough to carry along the power supply.', to paraphrase.

Let me say right here that I am a firm believer in the "universe is well- provided with intelligent life" theory. If they're around, they would be crazy not to be keeping a close eye on us and I'll even concede a "tip-o'-th-hat" to the "we were seeded" hypothesis. It's possible. So, discounting the swirly grass spots which may be the saucer landing remains in previous centuries and today (or maybe more mundane effects), the truly impressive, delineated round spots seem to have appeared in the seventies. The system was demonstrating phase one activity. As more and better satellites were brought on-line we see, in a year or so, groups of spots, then later on as the tuning gets straightened out, some circles (spots with centers) make their appearance. My timing may be off a bit, I have never been a student of circology, so please allow me some rope. As more capability is developed in a few more months or years, we begin to see the ability to make lines fairly sharply and thus combinations with some complexity start to appear. After about a decade some very nice patterns are showing up and by now, 20 or so years later, we have a complete, very competent system and have found some artists worthy of it to produce some stunningly gorgeous works-in-wheat. If it were aliens, they would have known that we knew about DNA in 1970; wouldn't they have shown us a nucleotide sequence for a gene that we weren't to decode until recently? I still haven't seen anything that wasn't already in our own repertory.

Why wheat and other cereal grains? They are good canvases for microwaves. Would alfalfa or potatoes or grapes work? Not very impressively. Grasses have stalks that grow tall and straight and close together. They are mostly dry but have moisture laden nodes where the leaves come off the main stem; the larger and moister ones are closer to the ground. These nodes, where we see the plants bend, show signs of being microwaved and they are apparently sometimes even burst. With a holographic coherence of phase fronts the beam can be swept around like a board or rope, heating and thus bending the stalks from one side, laying down the swath in an orderly direction. As this is happening, the stems could be making any or all of the sounds reported thermo- and hydro-dynamically. Our orchestras are full of these forms of cellulose: oboe's have reed mouthpieces, woodwinds are cellulose tubes, bamboo makes nice flutes, even tree trunks make ethereal music when carved into violins. Is it too much of a stretch to imagine that the wheat can sing? The soil below, when analyzed, appears to be cooked as if in a microwave oven. Plasma balls have been reported and they also are a possible side effect or purposeful effect of radar beams.

In a recent issue of *New Energy News* Hal Fox, the editor, asks if anyone can explain the anomalous effects listed by Freddy Silva in issue 14 of "Atlantis Rising" magazine. Point by point:

- 1) local removal of moisture - microwave heating effect
- 2) cooked from the inside - microwave heating effect
- 3) expulsion cavities - microwave heating effect
- 4) very rapid rate of heating - microwave heating effect
- 5) plant germination changes - microwaves can affect plant chemistry either by heating or by direct bond energy changes
- 6) uniform bending length - addressed above
- 7) preceded by a trilling sound - addressed above
- 8) 5.2 kHz beat frequency - a sub-harmonic or possibly an overlaid wave form
- 9) video cameras trashed - people also report getting dizzy or having strange feelings when in the circles. They claim that there is lingering "magic" in the circles. I say that I think the operators are having a good laugh; after all, the radars can certainly see when people enter the circle, their main function is surveillance. So, turn the beam back on. They can focus the beam smaller than a video camera and no commercial cameras are shielded. They can tune the beam to low power and impress upon it beat frequencies or sub-harmonics at the brain wave entraining frequencies and spook the gullible "believers", especially those with little or no technical expertise. These activities would serve to lead people further down the rosy garden path of "mysterious aliens" and away from the truth. An additional benefit would be the furtherance of an overall mind control agenda.

## NEW MODEL OF MOLECULAR VELOCITY DISTRIBUTION

Igor V. Pomerantsev <sup>1</sup>

### ABSTRACT

The equal limited velocities of chaotic molecular movement are introduced. A set of the projections of these velocities normal to a surface under gas pressure is considered. Mean value and the distribution of these velocities are determined. The distributions in space (volume) and over a plane are similar.

### INTRODUCTION

Maxwell molecular distribution with respect to the velocities of their motion [1] is based on the change of these velocities from zero to infinity and their equiprobable distribution in space. Velocity distributions in space and in a selected are considered to be the same. Therefore, the projections of velocities normal to a surface under pressure are not taken into consideration. Such analysis would have implied deterministic approach. The development of the theory verifies the assumption of distributions. Maxwell molecular velocity distribution concerns molecular distribution in space [1]. Boltzmann distribution, as it has been established, considers molecular distribution over a plane [2].

### CONCEPTS

Let us consider a new model of molecular velocity distribution which treats space distribution and plane distribution similarly. Thus, this new model will correspond to Boltzmann distribution model and will not correspond to Maxwell distribution model. What is referred to as model is the problem of definition of distribution.

For this purpose it is necessary to consider the distributions of molecular velocity projections normal to a surface under pressure.

No matter how varying molecular velocities may be, it is always possible to pick up such mean maximum velocity which will determine the actual mean velocity. This enables us to introduce equal limited velocities of chaotic molecular movement and consider their varying projections.

Let us enter equal velocities of chaotic molecular movement into our analysis. We shall not specify their values and the conditions of entering. The development of theory combined with practice will determine both the values and the conditions. Let us determine the mean velocity of molecular motion to the surface under pressure.

When the velocities of chaotic molecular movement are equal and the direction of molecular motion in space is the same, the problem of mean velocity of motion in any selected direction of chaotic movement and its normal oriented in the selected direction can be solved with the help of hemisphere model of radius - vector corresponding to the velocity of chaotic movement and its normal oriented in the selected direction, Fig. 1.

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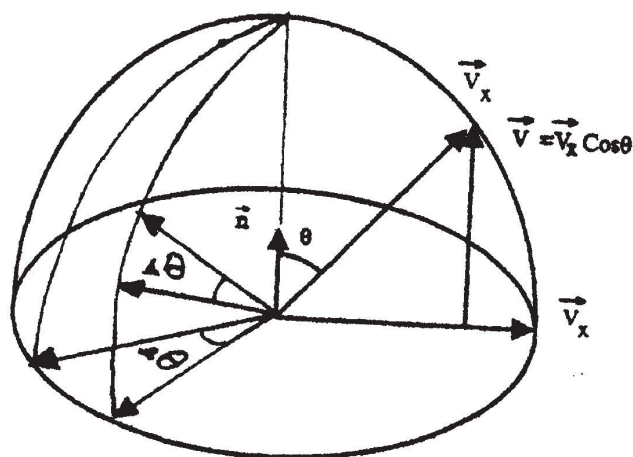


Fig. 1. New velocity distribution model of chemically uniform gas molecules in selected direction.

movement in space. We shall always replace the central molecule by the one which hits it which will give us a chance to consider a hemisphere instead of a sphere so all the velocities will be directed to consider a hemisphere instead of a sphere so all the velocities will be directed to the surface under pressure.

Molecular velocities vary in chosen directions ranging from zero to chaotic movement velocity. They are projections of variously directed chaotic molecular movement velocities on normal. This set of velocities will exist at any point in space and will not depend on the chosen direction of normal. The only changing velocities of the model are the chaotic velocity projections on normal. From this point on we will refer to them as "changing velocities".

Let us determine mean changing velocity.

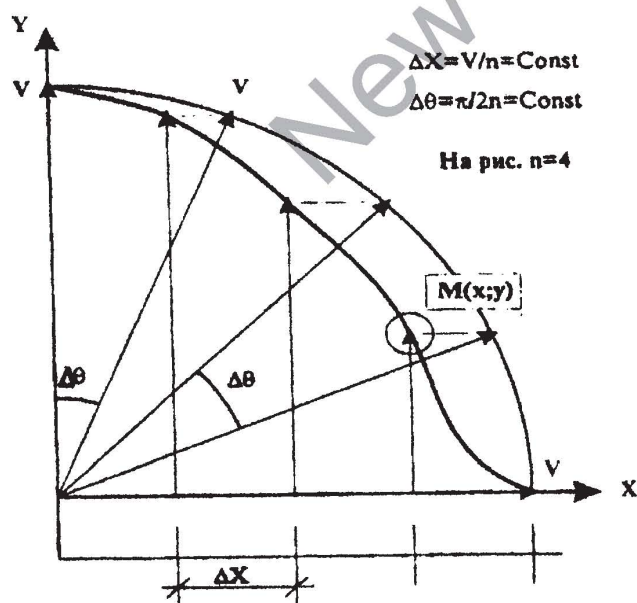


Fig. 2. Solution of the problem of mean gas molecular movement velocity definition.

$$\vec{v} = \vec{v}_x \cos \theta$$

Where:

$|\vec{v}_x| = \text{Const}$  – chaotic molecular movement velocity,

$\vec{v} \neq \text{Const}$  – the velocity of  $\vec{v}_x$  projections on selected direction,

$\theta$  – angle between a unit vector and the velocity of chaotic molecular movement,

$\Delta\theta$  – angular step.

What we locate in the center of the sphere is a set of molecules each with its direction as well as one molecule with its equiprobable directions of

movement in space. We shall always replace the central molecule by the one which hits it which will give us a chance to consider a hemisphere instead of a sphere so all the velocities will be directed to consider a hemisphere instead of a sphere so all the velocities will be directed to the surface under pressure.

Molecular velocities vary in chosen directions ranging from zero to chaotic movement velocity. They are projections of variously directed chaotic molecular movement velocities on normal. This set of velocities will exist at any point in space and will not depend on the chosen direction of normal. The only changing velocities of the model are the chaotic velocity projections on normal. From this point on we will refer to them as "changing velocities".

As we fill the area of the large hemisphere circle in with appropriate vectors of changing velocities, we determine the mean velocity by during half - volume of a sphere by the area of large circle. However, this definition would be incorrect.

On center of the hemisphere, we should note that their density is increasing with every equal angular step from the center to periphery, the condition of equiprobable distribution in space being assumed.

Equiprobability of molecular distribution in space does not mean uniform changing velocities distribution over the large circle area of the above model. Therefore, the basis of changing velocities vectors should be arranged with uniform density over the large circle area and then a new volume of the figure formed by the vector ends should be estimated. Construction of this in the plane is shown in Fig. 2.

Let us determine the mean velocity as the function

of similar equiprobably space-oriented chaotic molecular movement velocities. The analysis is carried out according to the model in Fig. 2.

Let us determine the coordinates of "M". Let the number of equal intercepts on the "X" axis equals, then the length of one intercept is equal to  $V/n$ . If  $m$  is the ordinal number of an intercept then "X" coordinate of "M" can be obtained:

$$X = m \frac{v}{n} \quad (1)$$

Velocity projection –  $v$ , is:  $y = v \cos \Theta$

The angle  $\Theta$  is  $\Theta = m \frac{\pi}{2n}$

We split  $\frac{\pi}{2}$  into  $n$  angles, and if  $m$  is the angle ordinal number, then:

$$y = v \cos \frac{m\pi}{2n} \quad (2)$$

Basing on (1) we replace the value in (2):

$$\frac{m}{n} = \frac{x}{v}$$

then

$$y = v \cos \frac{\pi x}{2v} \quad (3)$$

$$\begin{aligned} x = 0 &\rightarrow y = v \\ x = v &\rightarrow y = 0 \end{aligned}$$

Using the formula:

$$V = \pi \int_0^v x^2 dy \quad (4)$$

We may find the volume of body rotation around the OY axis bounded by this function.

Then we can obtain the desired mean velocity by dividing the volume "V" by the large circle area "S":

$$\bar{v} = \frac{V}{S} \quad (5)$$

The expected result proves to be invalid because of nonuniform density of changing velocities arrangement in azimuth direction of the above model (Fig. 1). As the choice of an angular step (in azimuth as well) is done, the chaotic vectors density in azimuth decreases dramatically in the large circle area closer to the periphery.

Hence, by analogy with Fig. 2 we should rearrange changing velocities vectors uniformly over the large circle area. Now the uniform density in both radial and azimuth direction is by the large circle area, which is rather a complicated task.

There exists a more simple way of solution.

There is no need to arrange the vectors over the large circle area as soon as their number and values are known. We may leave them where they are. The mean vector value may be obtained from the division of the sum of vector values by their number. The sector area (Fig. 2) determines the sum of vector values. The velocity of the sector base determines the number of vector values. The velocity of the sector base determines the number of vectors in the sector. Let us build up the hemisphere volume (Fig. 1) from the

sectors (Fig. 2) with as small step " $\Delta\theta$ " as is wished. Then we divide the number of sector areas by the number of corresponding velocities. Thus we get one sector area and one velocity. Now we may divide one sector area by one velocity. The resulting value will be the mean vector value deduced from the plane and valid for the space.

Thereby we answer the question why Boltzmann distribution being defined from molecular distribution in the plane is at the same valid for the distribution in space.

We pass on to the analysis of mean velocity in a sector which is the plane of Fig. 2. The equation of the curve bounding the changing velocities is written as (3). Consequently, the sector area determining the total vector value is defined upon integrating:

$$S = v \int_0^v \cos \frac{\pi x}{2v} dx \quad (6)$$

We divide the velocity which determines the vector number thus obtaining the mean changing velocity:

$$\bar{v} = \frac{S}{v} = \int_0^v \cos \frac{\pi x}{2v} dx = \frac{2}{\pi} v \quad (7)$$

where  $v = v_x = \text{Const}$  - the chaotic molecular movement velocity.

Then:

$$\bar{v} = \frac{2}{\pi} v_x \quad (8)$$

or:

$$\bar{v} = I V_x \quad (9)$$

where:

$$I = \frac{2}{\pi} = 0.63662 - \text{velocity ratio.}$$

We will define changing molecular velocities distribution using Fig. 2. Basing on (3) we determine the correlation  $x = f(y)$ :

$$\begin{aligned} \cos \frac{\pi x}{2v} &= \frac{y}{v}; & \frac{\pi x}{2v} &= \arccos \frac{y}{v} \\ x &= \frac{2v}{\pi} \arccos \frac{y}{v} \end{aligned} \quad (10)$$

From the definitions (Fig. 2) and the value (10) the changing molecular velocities integral distribution may be written as (11)

$$n = n_0 \frac{2}{\pi} \arccos \frac{v}{v_x} \quad (11)$$

where in (10) and (11):  $x = n$ ;  $2v = 2n_0$ ;  $y = v$ ;  $v_x = \text{Const}$  - chaotic molecular movement velocity.

Differentiating (11) and considering the module we get differential distribution as:

$$\frac{dn}{n_0 dv} = \frac{2}{\pi} \left( v_x^2 - v^2 \right)^{-1/2} \quad (12)$$

If we take the probable velocity (1) as the mean one:



$$v_e = \sqrt{2 \frac{k_e T}{m}}$$

where  $k_e$  is Boltzmann constant,  $T$  - absolute temperature,  $m$  - mass of one molecule, then chaotic movement velocity based on (8) is:

$$v_x = \sqrt{\frac{\pi^2}{2} \frac{k_e T}{m}} = \sqrt{4,935 \frac{k_e T}{m}} \quad (13)$$

This velocity agrees with the maximum one of the Stern's experiment in 1920 [1]:

$$v_{\max} = \sqrt{5 \frac{k_e T}{m}}$$

## CONCLUSION

Molecular velocities varying from zero to infinity are replaced by mean maximum chaotic molecular movement velocities all having the equal values. Their arrangement in space is taken as rigidly equiprobable.

New model of constant velocity distribution is described as a hemisphere with radius - vector of constant velocity. The projections of chaotic velocities on normal make up a set of velocities ranging from zero to constant chaotic velocity value.

These are the only changing molecular velocities.

When the changing molecular velocities are distributed uniformly over the large circle area the mean velocity is:

$$\bar{v} = \frac{2}{\pi} v_x = 0.63662 v_x$$

Changing molecular velocities integral distribution can be written as:

$$n = n_0 \frac{2}{\pi} \arccos \frac{v}{v_x}$$

Consequently, the differential distribution has the form:

$$\frac{dn}{n_0 dv} = \frac{2}{\pi} \left( v_x^2 - v^2 \right)^{-1/2}$$

These distributions are similar both in a plane and in space. Now it seems evident why Boltzmann distribution defined by molecular velocities in the plane corresponds to velocity distribution in space of the same time. If we take the probable velocity as the mean one



$$\bar{v} = v_e = \sqrt{2 \frac{k_e T}{m}}$$

then the maximum velocity of our model will correspond to the maximum velocity in Stern's experiment:

$$v_{\max} = \sqrt{5 \frac{k_e T}{m}}$$

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## KINETOBARIC EFFECT AS POSSIBLE BASIS FOR A NEW PROPULSION PRINCIPLE

W. Peschka <sup>1</sup>

### ABSTRACT

A report is given on experimental investigations originally made by R.G. Zinsser. In this work the existence of a new type of dynamic effect (named Kinetobaric effect) on bodies has been found. As the result of experimental investigations, these dynamic effects can be considered to be well established. The prospect of having a new phenomenon provides both cause and justification to continue this work in order to provide further experimental facts.

### PRINCIPLE OF THE EXPERIMENTS

The tests carried out made use of a basic tuned, resonant electrical circuit, essentially of inductance and capacitance, for example, the quarter-wave high-frequency circuit represented in Fig. 1. This resonant circuit is positioned (immersed) in water (conducting water or salt water). This arrangement thus forms part of a container (and contents) made of insulating material. It appeared that, in this connection, water is not exclusively required to produce these effects. The advantage in the use of water lies in its high dielectric constant, by means of which comparatively minute test measurements on the water sample become feasible, for the attainment of frequencies and wavelengths through its use. Among other manifestations which this experiment can produce, is inductive or capacitive coupling of dynamic force effects. These experiments underlie a new power source. The detection of such dynamic effects by the use of these tests was relatively small (force in the range of 1 to 10 dynes), which the sample exerts on the sensitivity of torsion balance (T.B.).

### DESCRIPTION OF THE TORSION BALANCE (TB) AND THE MEASUREMENT APPARATUS

A T.B. was in suspension (the suspension wire was protected from material influences) Fig. 2. The composition of the T.B. as well as the entire moveable section is not paramagnetic nor ferromagnetic, but consisted substantially of aluminum and brass. The suspension is of pure 0.3 mm steel wire. The whole T.B. is itself contained in a housing secured from influence of outside air currents, electrostatic, as well as magnetic influences, where no interfering effects occur that are of the order of magnitude of the expected effects to be measured. Above the driving system of the T.B. is situated a lighting system alignment, revolving mirror, and recording device. The recorder consists of a photocell apparatus, to which passes a light beam. The light path measures 7m. The sensitivity of the T.B., relative to the recorder, measures 25 dyn/cm for a 7m light path. The T.B. was suitably oiled and periodically dampened. The undampened oscillation period measured about 120 sec. Fig. 2 illustrates the significance of the following elements: P = sample, G = weight, S = rotating mirror, D = dampening oil, L = flexible suspension, B = recorder, s = light path.

The coupling of high frequency was capacitive via air capacitors situated in the sample attached to the T.B. (in specific tests inductive coupling was also employed). The high frequency (H-F) supply unit voltage was 10 volts RMS. The input power was in the region of from 20 microwatts up to a few hundred milliwatts.

<sup>1</sup> (translated from German by Donald Reed from *RAUMFAHRT-FORSCHUNG* Feb. 1974)

The production of input H-F was from a push-pull oscillator, which can be utilized to modulate a push-pull power amplifier. While it is customary that full amplification is not employed, but only part of the H-F (high-frequency) which the oscillator attains in the test apparatus higher than the full amplification of the capacitor grid plate (voltage damping factor is around 100 to 200). The full power of the final amplification of the push-pull amplifier is around 20 to 50 watts. By utilization of the power output, which can be implemented by the present method, no further augmentation of the effect can be detected (saturation effect). Accordingly, for the most part, the tests were conducted without the power amplifier, and therefore very negligible standard power output was employed. The frequency measurements were taken with an 8-digit frequency meter.

## IMPLEMENTATION OF THE APPARATUS

At first in 1970, two torsion balances (T.B.s) finished undergoing extended neutral operation (Null-Laufen)-that is, with no H-F excitation applied. There was no affect from temperature deviation to movement of the apparatus framework. The latter was controlled by an electronic spirit level on a precise second of arc. Likewise ruled out were electrostatic effects (stray sparking discharges were taken care of by insulating sections with high voltage from a 15KV transformer, with corresponding modifications to allow no kind of excessive feedback effects). Furthermore, there is no detectable influence from outside magnetic fields. To this end, the whole apparatus was surrounded with a magnetic coil generating an intensity of about 100 times the horizontal intensity of the Earth's magnetic field. Also, there was no influence from the solid foundation of the T.B.

Investigation of influence from air motion on the deflection of the T.B. demonstrated that the greatest influence from thermal turbulence occurred when the balance casing contained a large volume. Accordingly, after decisive experimentation, the balance was surrounded by the least possible spacing, specifically selected whereby the existing sensitivity of the T.B. to the influence of air turbulence has been practically entirely eliminated. Also, it should be remarked that this balance was proven to be a remarkably reliable measuring instrument. The TB had a feature of high sensitivity in regards to large-scale measurements, but practically negligible sensitivity to outside mechanical disturbances, in a manner similar to a galvanometer, for example. There was a further observation that the balance sensitivity is minor (compared to mechanical disturbance) to a factor of  $10^{-3}$  to  $10^{-4}$ . This pertained to both balance 1 and balance 2 (the Eotvos balance), which can be made to function impeccably on this basis, only in a very high vacuum.

Subsequently, according to this arrangement, the neutral operation (Null-Laufe) of the T.B. was guaranteed, and the 2nd balance was situated in the same apparatus in another section of the structure, in order to begin carrying out the experiment. The water in the probe was evacuated of air-especially the conducting water, but also salt water at room temperature in the sample- by means of a water jet pump. Thus, the water remains in the enclosed sample during a whole test period- in general length of from 4 to 6 weeks. To begin with, the sample was secured to the T.B. and activated by the H-F supply source for a period of general length of 1 to 2 minutes. In a few cases this activation was repeated several times, pausing repeatedly for a few minutes. The power fed to the sample amounted generally to 'around 20 microwatts to 100 milliwatts. In the course of approximately 3 years, 200 tests were run. Most of these tests would be terminated after 2 days. Approximately 12 tests would be taken over a long period (6 or 8 weeks). According to these tests, the two balances performed with a ballast weight. The Eotvos balance, due to its high sensitivity, insured that there were no influences from outside vibrating structures such as tectonic processes, tidal influences, etc.

## TEST FINDINGS

1. Supplying suitable H-F energy to the sample results in a force effect on the sample. The measured reaction on the T.B. was a force in the area of 10 dyn. (Figs. 3, 4). It is supposed that progressively greater forces can appear, such as those from the measurement records of R.G. Zinsser, according to which, in rare cases, forces of up to 1500 dyn. over many hours were observed. **The employment of specific frequencies had to be strictly adhered to.** These were in the characteristic frequency range of the test apparatus and must be held precisely constant near 10 to 100 Hz. over 1 minute. There are many critical frequencies which are likely discretely distributed, and result in activation (Ansprechen) of the sample. The exact adherence to these respective frequencies is absolutely essential. These areas in which are found the critical frequencies are 30 to 40 MHz., 120 to 130 MHz., 200 to 350 MHz. With a sinusoidal supply source no dynamic effect could be demonstrated. Apparently, partly harmonic (Oberwellenteile) are necessary. Supply of H-F energy with a grid-dip-meter for the determination of resonant frequency, resulted in a similar effect.
2. The force effect could not be traced to reciprocal action (Wechselwirkung) with electric or magnetic fields or with outside influences like air movement, heat, structure shocks, etc. It is a case of the finding of a completely novel phenomenon.
3. The force also maintains itself even after the H-F conducting power is turned off, exhibiting on the one hand a short period (approx. 2 hrs.), and on the other hand, a long period nature (lasting for days) Figs. 5, 6.
4. The source H-F power was set in the area (maximal) of 100 Milliwatts. The duration of the source current was a maximum of up to 5 minutes. Thus, any such heating effect caused by the H-F source was impossible.
5. Such an "activated" sample reacted dynamically to weak short-time (Kurzzeitige) outside H-F energy effects, such as the switching on of a neon tube, "burning" (Verbraten) of a layered resistor, electric spark discharge at great distances, any H-F oscillations which were not placed in the test room, and also to lightning. With these, a reaction occurred on the T.B., resulting essentially in deflections of the T.B. for a period of 1 to 2 hours. This naturally made a completely accurate test performance very difficult, since with the available tools a perfect shielding against outside H-F static disturbances was not possible. The influence of the outside H-F electric discharges could give reason for postulating the deliberate coupling of the ambient H-F energy to the dynamic effect. This outside H-F influence could even be from such weak sources as due merely to the presence of personnel in the test room, which engendered additional effects on the activated sample, exhibiting deflections on the T.B. of up to 2 hr. There could be no demonstrated influence from known effects produced by the presence of humans, such as the heating of air due to the entrance of test personnel, air currents, ground sag (Bodendurchbiegungen), etc. It is therefore supposed that from humans and other living creatures emanates and is transmitted a H-F field, in the microwave-range which must be made responsible for this influence on the "activated" sample.
6. Furthermore, there appeared long-time effects (Langzeiteffekte) in the activated sample. The balance executed periodic deflections with a duration of about 12 hr., which moreover, was the superposition of short-time effects, possibly arising from outside H-F source disturbances as indicated in Figs. 5, 6. The long time periodic deflection was likely due to the activity of the Sun, or from atmos-"spherics" feedback (zurück ruhrbar). The influence from perceptible sunlight is nevertheless ruled out since the test room was constantly in complete darkness. Consequently, only the microwave part of the Sun's spectrum and the atmosphere comes into question. These long-time effects subsided in a time period of about 1 to 2 months.



## CONCLUSIONS WITH REGARDS TO THE DYNAMIC EFFECT

Although the described demonstrated forces have not yet attained the order of magnitude of that of the electric power plant level, the availability offered by such hitherto unknown forces, for which a meaningful concurrence with present mechanical-electrical axioms must first be established, gives reason for plenty cause for further scrutiny. This is also in regards to new, very unconventional propulsion principles. For instance, a sample can release for 120 seconds, a H-F field with a steady energy flux of 1 Milliwatt; a force effect of between 5 to 10 dyn. over 2 hr. is observed. This corresponds to an accumulated (gespeicher) impulse of  $3.6 \times 10^4$  e.g. over  $7.2 \times 10^4$  sec., or energy is fed corresponding to an accumulated impulse of  $(7.2 \times 10^4) / (120 \times 10^{-3}) = 6 \times 10^5$  dyn-sec/Ws = 6 Ns/Ws. **This value surpasses that of conventional power sources by several powers of ten. This fact provides sufficient grounds to further investigate this phenomenon.** Evidently, we must find an answer to the question of exactly how this phenomenon is related to known physical phenomena; can it be traced to an effect of one of these known phenomena? An accurate analysis of all possibilities suggests, however, that there is no known physical effect by virtue of which this phenomenon can be explained. Initial attempts were made to explain this effect through torque which arises from atomic "spin-orbit-coupling" processes (variation of torque-impulses) - for instance by "nuclear-spin-resonance" e.g., dipole-dipole resonance. This hypothesis could be valid if the H-F was supplied, corresponding closely to the resonant frequency of a spin-orientation appearing in the sample, which becomes broken down (abgebaut) with corresponding "relaxation time" and resulting in the variation of the torque-impulse-moment, and hence exerting a dynamic effect on the sample. Thus, in that manner the effect could be associated with nuclear-spin-resonance. However, precise investigations have demonstrated that force, and not torque is at issue. Namely, the deflection of the T.B. is dependent on the position of the sample on the balance, which definitely demonstrated the existence of a force effect.

## CONCLUSION WITH REGARDS TO A NEW MEANS FOR TRANSMITTING INFORMATION

Doubtless, it is a matter of a type of force effect which causes alterations in physical matter. Over a long period of time these alterations exist in an accumulated form and can be accompanied by a dynamic effect. Concerning the exact nature of this effect, at present we can not yet say. However, it stands at present firmly established that the balance serves as a detector for any process which can disengage the T.B. with almost ludicrously negligible H-F power. Thus, the possibility of the system registering extraordinarily minute power effects is of the greatest significance. The occurrence of dynamic effects through the existence of outside source disturbances which can be at relatively far distances from the test apparatus, indicated that the sensitivity of this apparatus is susceptible to such H-F outside influences.

Likewise, the firm support for the appearance of the dynamic effect by the presence of test personnel in the room could possibly be explained by postulating that living creatures produce an extremely weak H-F field in the microwave range. Moreover, the requisite high constant supply frequency, suggests that the resonant process in the sample can terminate (ablaufen) with very negligible half-band-width. Indeed, this is also the case in nuclear-spin-resonance and dipole-dipole resonance in fluids and gases, where half-band-width of a few Hertz are thus realized. Consequently, it is concluded that due to this very small half-band-width, on the one hand the possibility exists of producing minute H-F power effects, as long as the frequency is held constant. On the other hand, a lower limit for the necessary H-F power is conferred to the system if the supply H-F power frequency interval reaches the order of magnitude of the thermal noise level. By virtue of a half-band-width of a few Hertz, power of  $10^{20}$  watts is conveyed. Although the origin of the dynamic force cannot yet be explained, nevertheless these considerations thus indicate why the application of the experimental apparatus can have sensitive response to outside electromagnetic disturbing influences. For instance, the power-flux-density output of a transmitter of 1 watt sending power to a distance of  $10^5$  km. =  $10^{21}$  watt/cm<sup>2</sup>, so that a signal source under these conditions can still produce

an effect at extraordinarily far distances. The possibility that this could yield a new information transfer process, has been previously articulated and needs no further suggestion. When one further considers the propagation of electromagnetic energy under the existing requirements, then another very interesting aspect arises. Normally, through propagation (Ausbreitung) the electromagnetic energy becomes absorbed in matter. This occurs on the one hand through dielectric loss, and on the other hand through reciprocal action of the electrons with the crystal lattice in electrical conductors.

We take into consideration the propagation in insulators (small loss mechanism which becomes produced through conducting electrons). In this case the possibility exists that, in the same manner as in Maser inversion by composition state (Besetzungszustande), which is induced in conjunction with the collapsing (einfallenden) electromagnetic wave, a coherent amplification mechanism is achieved. This mechanism could lead to propagation occurring with damping loss (dielectric loss). The inversion of the composition state could constantly make available higher H-F energy (pump frequency). The propagation of electromagnetic waves in the water sample for instance could signify that by virtue of absorption of suitable (geeigneter) H-F energy, either from the Sun, or from storm activity, or stemming from any other world-wide source of application of electric energy, a corresponding inversion is brought about in the water energy condition. At this stage, a H-F signal of appropriate frequency is initiated in the water. Consequently, it is possible that through induced emission the propagation of the electromagnetic wave over long distances becomes realized. The intensity of the electric or magnetic field strength could be nevertheless, extraordinarily small- even below the thermal noise level. It is only necessary that the half-band-width, which is connected with the induced emission resonant process, is correspondingly small, e.g., the life span of the inversion condition is correspondingly high. From this could result the possibility of communicating signals and thus information over long distances through water, even water-conducting strata (Schichten). Requirements for an effective information transmission however, is an appropriate narrow-band receiving system with a bandwidth in the area of a few Hertz. Yet, at the present moment, no accurate statement can be made concerning the necessary frequency for transmission. According to the previous experimental results, this frequency can lie in the ultra-short wave zone, possibly in the microwave region.

Also, the propagation of electromagnetic energy in metallic conductors can be shown to be at odds with the conventional interpretation, when the intensity of the electromagnetic field of the wave is very small. For instance, in the case of an electromagnetic wave with higher intensity than the metal surface of a conductor, the free electrons in the metal become stimulated to resonance with the electric field vector of the wave. This resonance results in large coherent field amplitudes; that is, there exists within large local areas a definite phase relationship between the resonant electrons. It follows that, the oscillating electrons generate electromagnetic fields which superpose (hetero-dyne) with the original collapsing electromagnetic wave, and these are attenuated through superposition. This resulting condition is known as the skin effect. However, the attenuation through wave interference is prevented when the definite phase relationship between the oscillating electrons is also altered, which is the case when the electrons deliver collision (Stoße) energy to the lattice. Since this whole irregular impact process develops, the coherence is interrupted. Consequently, the insistence (Eindringtiefe) of the skin effect is increased, with increasing reciprocal effect from the conducting electrons with the lattice. We now consider the other case, where the electromagnetic field vector amplitude is accordingly negligible. Correspondingly, the energy growth of the conducting electrons is small compared with the thermal electron energy. In this case it is demonstrated that now a different kind of behavior than normal skin effect exists. By the well-known explanation of the skin effect, the energy of the oscillating (resonant) electrons is great compared with the electron thermal energy.

We thus take into consideration that for the second case, the thermal energy of the conducting electrons is possibly greater than for normal skin effect. This deep penetration is due to the thermal state (thermalisierung) of the collapsing electromagnetic energy that is yielded to the conducting electrons through scattering (Streuung). The difference of this state compared to that of the customary skin effect

is now readily apparent. By the collapsing of an electromagnetic wave of corresponding feeble intensity, the electrons become stimulated to resonance. This electron oscillation state now places a small disturbance of stochastic agitation on the electrons on account of their particular thermal agitation. In this manner, no coherence exists between the oscillating electrons, and an attenuation of the collapsing wave through interference cannot take place. This is because this portion (Anteile) of the oscillating electrons is seen to exhibit eccentricity (Ausmitteln) temporally and spatially. Thus it now becomes evident that the propagation of electromagnetic energy under the thermal noise level, over long distances - and also through metallic conductors - is now possible. This important new finding could signify that the electromagnetic energy is not allowed to be completely screened, contrary to present conceptions. The skin effect is naturally a means for possible shielding of electromagnetic energy only up to the noise level (Rauschpegels). However, within the noise level there exists the possibility of an (unimpeded) propagation of electromagnetic energy. It is realized that this aspect for the transmission of signals and information can be of great significance. However, this situation can only be obtained in case extremely narrow bandwidth receivers for electromagnetic energy are known (bekannt) which can respond to extremely weak signals under the noise level.

These findings, the import of which possibly approaches a new realm currently imperceptible (ubersehbare) to human knowledge, grows in its significance when one considers that also biological aspects must be taken into consideration. The production as well as the absorption of electromagnetic energy of such minute intensity, also possibly corresponds to the frequency spectrum of the molecular structure of living cells, and likely it would seem, is intimately related to the evolution of life itself. Considering that researchers in the USSR have published work in this area, there thus exists the possibility of an information transfer between cells utilizing electromagnetic waves, perhaps in similar fashion as in the experiments under discussion in the present report. **These new findings mark the unfolding of a science on the borderland between physics, psychology and biology, which is destined to assume a central role within the next 20 years.**

## FUTURE PROGRAMS

A future program must undoubtedly include a guarantee (Sicherung) for experimental undertakings under application of the most exact rigorous measurements. One of these experimental arrangements should include placing the T.B. in a high vacuum secured from all air disturbances and which serves as a shield to all outside electromagnetic radiation. In that case, experiments carried out, as in the present report, could possibly yield the undisputable conclusive confirmation of the described dynamic effect. In addition, the investigations should include a greater frequency range - extended to about 30 Megahertz to 1.4 Gigahertz. In the "Test Findings" section are recorded "long-time" effects, causing a strong influence from the electromagnetic radiation of the Sun to possibly appear. Accordingly, the investigated frequency range must be extended to the microwave spectrum of the Sun e.g. around 20 Gigahertz. Aside from the measurement of the dynamic effect with the T.B., this essentially corresponds to application of H-F spectroscopy with corresponding tools and methods.

Also an effect which must be scrutinized further is the absorption of H-F energy in the sample itself with corresponding investigative methods. Furthermore, a receiver for the electromagnetic waves must be at ones disposal which can detect the feeble signals from the thermal noise. Such an apparatus could be developed from utilization of knowledge from the discipline of nuclear-spin-resonance spectroscopy. As is well known, in nuclear-spin-resonance spectroscopy there are employed resonant systems of half-band-width up to 1 Hertz, whereby the thermal disturbances could bring about an increase (Erhöhung) in the eccentricity (ausmitteln) of this bandwidth temporally and spatially.

The dynamic force recorded in the experimental findings has been definitely and formally established, and can be attributed to no previously known phenomena, which can be of the order of magnitude of 1 to 10 dynes. The observed force manifested itself by H-F coupling and is maintained even with the detachment



of the supply power. A constant time of up to 2 hours was ascertained. Although these established force effects have not yet attained the order of magnitude that occurs in standard electrical power plants, there is offered the availability for demonstration of previously unknown forces, for which a meaningful harmony with the axioms of mechanics must be found, which provide sufficient reason for further investigation - also with regard to unconventional propulsion systems.

Emphasis must be placed upon extremely negligible standard supply power (20 microwatt up to a few 100 milliwatt), with which these effects can be brought about. The frequency of the source H-F energy must be held precisely constant if the effect is to be produced. Thus it is a question of the characteristic quality (peculiarity) of the sample. Furthermore, it is indicated that a periodic signal can be established, which is drowned (untergehen) in thermal noise. It was indicated that the propagation of such feeble H-F signals is prolonged not only in insulators but also in conductors, as compared to hitherto diverse (Geubten) approaches. That is why through induced emission, an amplification mechanism exists by which a propagation of feeble electromagnetic signals over long distances is possible. With regard to the propagation of weak electromagnetic signals in conductors it became established that likewise, in contrast to known diverse approaches, the superimposed (heterodyned) auxiliary energy is small compared to the thermal energy of the electrons.

Although the present experimental findings cannot yet be completely assured of value, there nevertheless exists remarkable consequences arising from these findings. Doubtless, it is a matter of a phenomenon, which through "conduction" by electromagnetic energy, gives rise to alterations in material substances. This energy can be available in potent form over a long period of time resulting in a dynamic effect, whereby gravitational reciprocal action is not to be ruled out (auszuschließen).

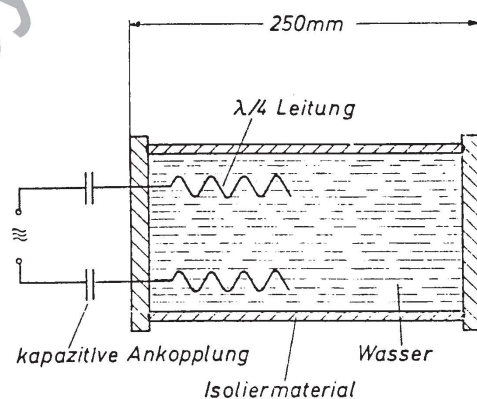


Fig. 1 Diagram of the employed sample probe.

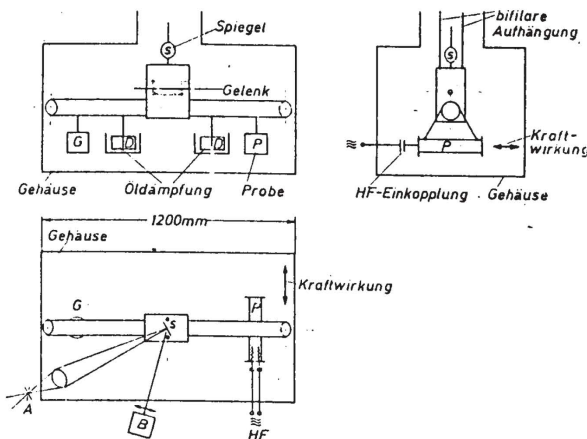


Fig. 2 Diagram of the torsion balance apparatus  
P = sample, G = weight, S = rotating mirror,  
D = damping oil, B = recorder, A = lightsource



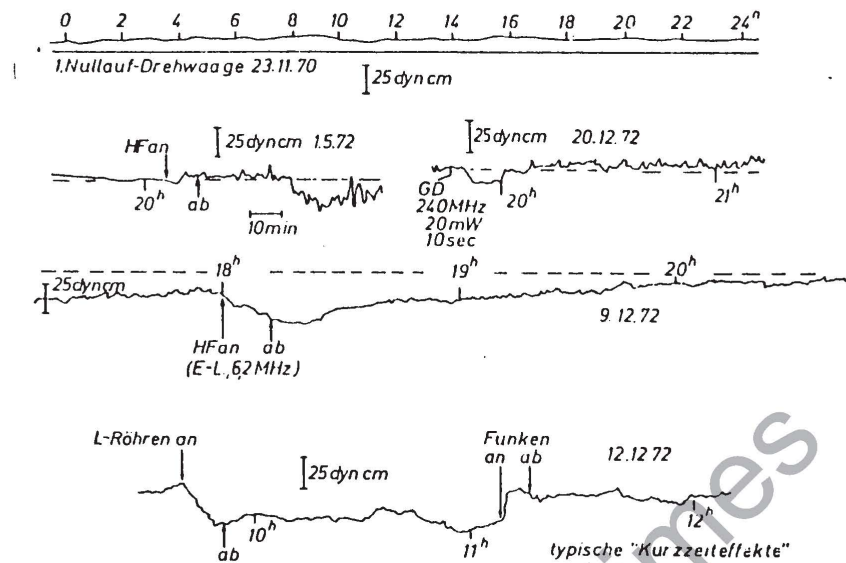


Fig. 3. Typical short-time effect resulting from source H-F. The distance from the null-line corresponds to the deflection of the T.B. The source H-F results partly from a corresponding oscillator, partly from a grid-dip-meter (GD). The 4<sup>th</sup> series (last reading) indicates the influence of outside disturbances on the activated sample.

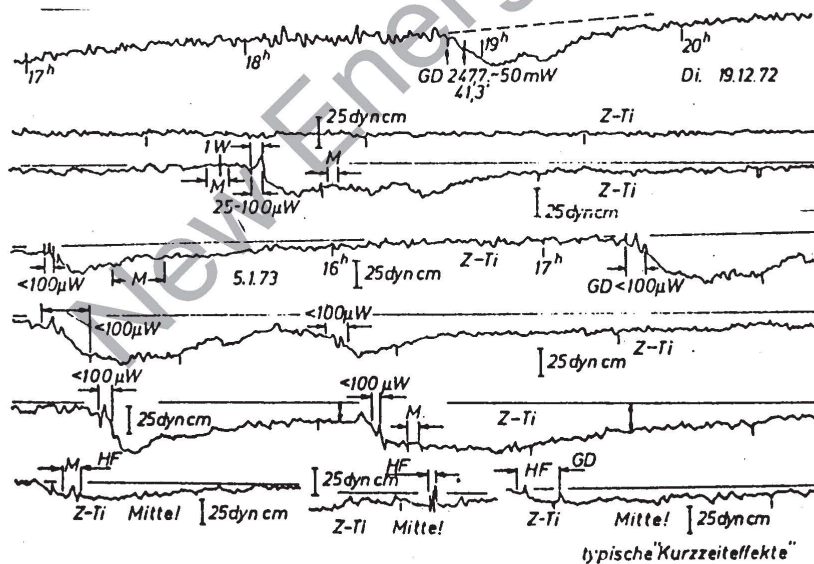


Fig. 4 Typical short-time effect resulting from source H-F. GD signifies feeding from a grid-dip-meter; the numbers nearby are frequencies. Also, the max. value of the source power (mW,  $\mu$ W) is given. "M" signifies additional superposition for a magnetic field - intensity 100 times that of Earth field (Z-Ti is a sample). Also the absolute sensitivity of the T.B. (dyn-cm/cm) is given. The short vertical line of the curves are time units (distance 1 hr.), with corresponding day units given.. In contrast to the other curves, the sample is represented by the last (bottom) series. The resistance to activation is shown in this series in advance of practically no deflection present, which refers to a force effect and not to a torque-moment effect.

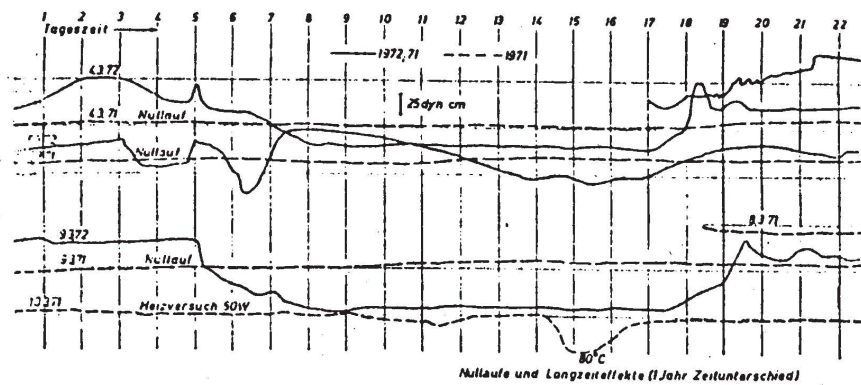


Fig. 5 Typical long-time effect with superposition of corresponding short-time effects. In comparison is the null operation of the T.B. (dotted line curve). In comparison in the lowest series is the influence of a similar disturbance directed to the T.B. Here, the water of the sample becomes, under the filament resistance of 50 watts, heated up to a temperature of 80°C. The current through a gold leaf results in 20 m strength.

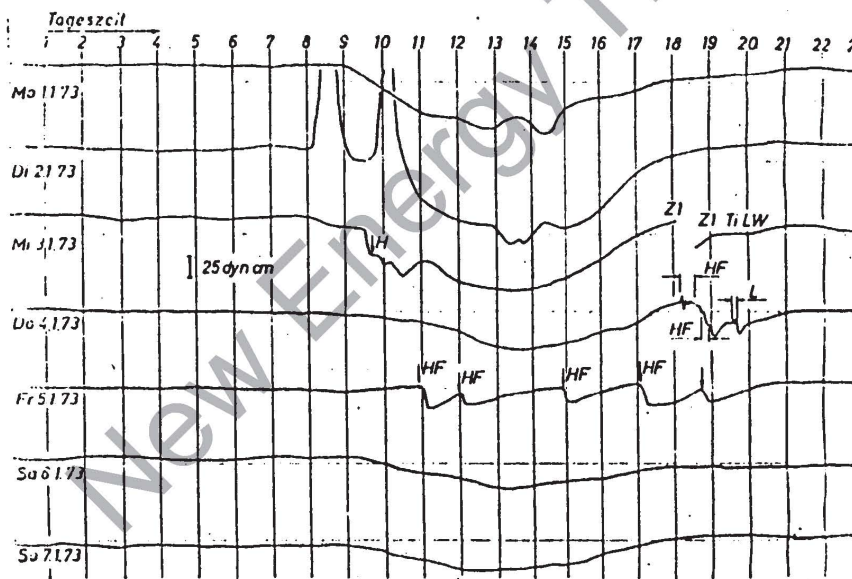


Fig. 6 Typical long-time effects with superimposed short-time effects. The short-time effects are partly affected by the H-F conducted energy (series 3 and 5 above), and partly by the influence of outer (weak) H-F disturbances (series 2 and 4 above).

## NEW ASTRONOMICAL DATA FINDS SUPPORT IN THE NUCLEON CLUSTER MODEL

Willard D. Nelson <sup>1</sup>

### ABSTRACT

Several teams of astronomers have been using very distant Ia-type supernovas to measure how cosmic expansion may have changed over time. Surprising results now being reported indicate, contrary to expectations based on standard inflation-based Big Bang scenarios, that the expansion rate is actually speeding up, not slowing down. Given the lack of sufficient observed mass density to close (i.e., "flatten") the universe, some astronomers and cosmologists are now thinking of reviving the theoretical idea of a non-zero cosmic constant, which amounts to finding an expansive energy in the cosmic vacuum or in a hidden antigravity force.

This article points out that a theory of nuclear structure, the Nucleon Cluster Model (NCM) of R. A. Brightsen, includes the description of antimatter nucleons associated with antigravity, as well as the normal association of mass with gravity. Thus, the NCM offers a source of repulsive force and additional mass for use in cosmological models. NCM suggests a solution to the older problem of "missing matter" and the new problem of "missing anti-gravity".

The Nucleon Cluster Model and its utility is generally described. The NCM by its logic and pattern requires the peaceful coexistence of matter and antimatter nucleon clusters in abundant hydrogen, helium-4 and a few low mass beta-stable nuclides. It also requires the antimatter nucleon clusters to exhibit antigravity effects equal and opposite to corresponding ordinary matter clusters in the same low mass nuclei. The NCM then logically predicts its own extension through the 'zero mass point' into a symmetric antimatter-antigravity world that, to an earthbound observer, would be equivalent to observed systems and bodies of ordinary matter.

### INTRODUCTION

A recent article, "Astronomers See a Cosmic Antigravity Force at Work," in the journal *Science* [1] describes convincing new evidence that "Seemingly in defiance of (accepted scientific) sense, space itself appears to be permeated by a repulsive force that is counteracting gravity on a large scale". This is the reluctant and shocking conclusion of several teams of astronomers reporting at the Third International Symposium on Sources and Detection of Dark Matter in the Universe, held Feb. 18-20, 1998, in Marina Del Rey, CA. These findings, based on repeated observations of unexpected dimness of very distant supernovas, reportedly have "A statistical confidence of between 98.7% and 99.99% that cosmic expansion is receiving an antigravity boost". Of course, this discovery of an accelerating universe will have

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a major impact on existing theories of how the Big Bang 'unfolded'!

Earlier observations of very distant "standard candle" (Ia) supernovas had revealed that, if the universe is indeed 'flat' (coasting to a stop in infinite time), "matter may account for only 40% to 80% of the critical density, with the cosmological constant ( $\lambda$ ) making up the rest" [2]. Previous estimates of the total amount of bright (or observable) mass were only 10% of the critical density, with some type of "dark" matter making up the rest. These discrepancies are characteristic of a theory in development, with specific reference here to the tenuous condition of current Big Bang theory. This apparently large deficit in mass density has been made up, by theorists, on the assumption that a mysterious background **energy** must exist to fuel the already known expansion rate of the near universe, and it pushes outward against gravity just enough to stop the expansion and close the universe. Now, with an **increased** expansion rate detected, the possibility of an antigravity force operating on a large scale must also be considered. Or, perhaps virtual particle activity of the universal vacuum is accelerating the expansion. Whatever it is, "The new observations could lead to a revised recipe of just what the universe is made of" [3].

This is an exciting time when scientific frontiers are being pushed forward. Theoretical speculation has begun to progress at such a rapid pace that it often outruns experiment. On the other hand, there are areas where experiment is outrunning theory. Examples of the latter are low energy nuclear transmutation (LENT), cold fusion, particle physics - and now cosmologists are again searching for an adequate mechanism to support observations!

## THE NUCLEON CLUSTER MODEL

One grand theoretical construction that has both cosmological implications and practical explanations for nuclear experiments, and deserving much closer attention than it has received to date, is the Nucleon Cluster Model (NCM) of Ronald A. Brightsen [4]. It is complex enough that I will not try to describe it in full detail; instead, I refer readers to the references. A first question asked about the NCM, of course, is whether it has a one-to-one correspondence with the Classical Periodic Table of Elements. It does have that correspondence, but it also provides an explanation of the experimentally known stable isotopes of any given element. This new feature and the correspondence with the classical periodic table were succinctly described in a paper first published in *Journal of New Energy* [5] along with a chart, in color, of Brightsen's Atomic and Nuclear Periodic Table of Elements and Isotopes.

This path-breaking work bears on all of the above-mentioned areas of investigation at the scientific frontier, including **prediction of anti-matter and anti-gravity**. Suddenly, the Nucleon Cluster Model is found to support cosmological implications of the above astronomical findings that an antigravity force is accelerating universal expansion.

The NCM took Mr. Brightsen, a retired nuclear chemist, educated at the University of Michigan and MIT, many years to perfect. It is a discovery that the nuclei of all beta-stable atoms, instead of being random mixtures of neutrons and protons, are composed of three types of nucleon subclusters: NP, NPN and PNP, where N represents the neutron and P the proton. These sub-nuclear cluster identities are found to be maintained throughout the various nuclear decays, fissions, transmutations, transformations and newer processes still being discovered in atomic physics. It implies that the cluster identities have greater binding energy holding cluster nucleons together than attractive energy between clusters.

The germane paper discussing the gravity/antigravity feature of the NCM is Brightsen's "Nucleon Cluster Structures in Beta-Stable Nuclides" [6]. The paper "discusses the logic of nucleon cluster structures and, especially, negative or antimatter clusters", i.e., how they must push up (↑) against earth's gravity while normal matter clusters push down (↓). Since the overall pattern of the NCM requires antimatter (negative)



nucleon clusters coexisting with matter clusters in the nucleus to define the very lightest elements (H, He, ...), the logical assumption is that these negative antimatter clusters (existing stably in the nucleus) **must also exhibit anti-gravity**. They escape detection in the laboratory because the negative nucleon clusters cancel the gravity mass of equal numbers of (positive) matter clusters in the same nucleus; i.e., the antigravity **strength** of an anti-matter cluster is equal to but opposed to that of a corresponding matter cluster.

The model describes a systematic and beautiful pattern of NP, NPN and PNP sub-clusters that brings complete order and symmetry to the subject of the nuclides. And the pattern includes not just matter as we know it; it extends logically and symmetrically into a 'hidden' world of antimatter beyond the zero mass point. Brightsen has now published the new Atomic and Nuclear Periodic Table of Elements and Isotopes [7]. Progressively describing each stable isotope of each element in terms of nucleon clusters, this table, and the overall cluster model the table is based on, not only complements but extends and **corrects** both the Z-N diagrams and the Periodic Table of the Elements found in current physics texts. Orbital electron descriptions per atom are retained implicitly since proton number alone determines the number of electrons associated with each element.

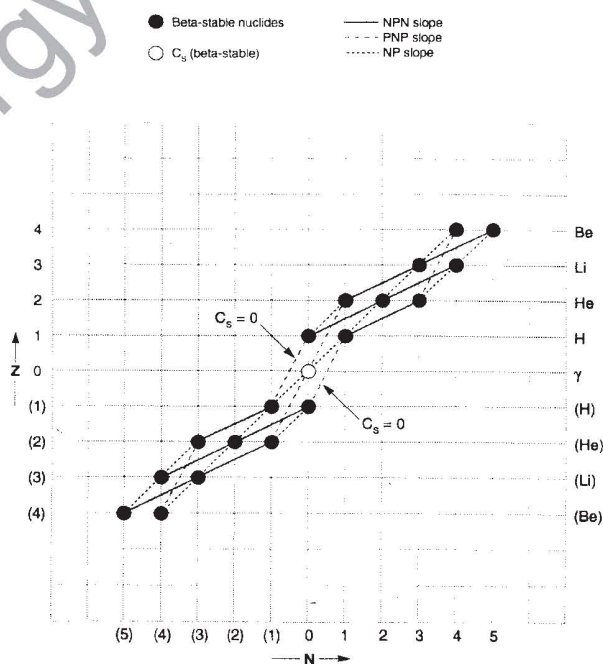
It may be surprising to consider antimatter (-) and matter (+) clusters coexisting in the same nucleus without mutual annihilation; however, Brightsen points out that "In the NCM, independent (unbound) neutrons and protons **do not** exist, and the nature of the mathematical series ... makes it impossible for matter and antimatter clusters of the **identical structure** to exist. Thus, since annihilation can only take place between mirror images (i.e., identical matter and antimatter structures), annihilation cannot take place, only strong attraction" [8].

### THE ANTI-MATTER / ANTI-GRAVITY CONNECTION

To my knowledge, anti-gravity has not been considered by others to be a property of anti-matter. If bulk antimatter were observable in the universe outside the laboratory, an anti-matter/anti-gravity association might already have been established by science [9]. As it is, anti-gravity itself has not been accepted. A reputable dictionary of scientific terms defines it thus: "Anti-gravity. The repulsion of one body by another by a gravitational type of force; this has never been observed" [10]. Perhaps now is the time for the conjunctive association, anti-matter = anti-gravity, to be considered possible, with the NCM as an impetus for discussions.

As already mentioned, the NCM requires, in its most simple description of the lowest mass atoms such as hydrogen and helium isotopes, that a certain number of anti-matter clusters coexist in those nuclei. These were discovered to be a necessary consistency with the model's description of the great preponderance of other elements with greater mass. What is further described is that these lightest elements, containing anti-matter clusters, transition negatively from positive mass greater than one, through zero mass into an

Figure 1  
Mass-Charge Symmetry System for Region 6 ( $C_s = 0$ )



increasingly negative universe of undetectable 'shadow matter' which is merely the 'negative' version of the 'positive' universe of the Nucleon Cluster Model's construction. This is best illustrated by Fig. 1, which has been duplicated here with Mr. Brightsen's permission from his basic paper [11]. Fig. 1 depicts a portion of the proton-neutron (Z-N) diagram which displays radial symmetry about a "zero point" where both Z and N equal zero. This portion of the so-called "valley of stability" extends from positive Z,N into -Z,-N, and then on into still more negative territory, mirroring the matter world. Here is a source for the dark matter discussed by theorists.

## A DIVERSION INTO DETAILS

A striking feature of the NCM is that any beta-stable nuclide is not describable by a unique set of nucleon clusters, due to the absolute equivalence  $3NP \equiv 1NPN + 1PNP$  (i.e., 6 individual nucleons equal 3 nucleons plus 3 nucleons, whether each type of cluster is positive or negative). This potential source of confusion when studying the NCM is relieved by use of the organizing equation:

$$(NP + NPN) + 2(PNP) = Z, \quad (1)$$

where Z is the number of "net positive charge" protons in a nuclide. Standard nuclear physics 'assumes' Z is composed of only (+) protons; however, equation 1 arithmetically handles both negative and positive clusters, correctly defining cluster patterns for each stable nuclide. Thus, Z becomes negative on the other side of the mass-charge zero point in Fig. 1.

The standard atomic mass number, A, must also be conceptually modified to become the "effective mass number" ( $A_{\text{eff}}$ ) to account for the 'extra' numbers of (-) antiproton-antineutron clusters in the light elements. This is where the net effective mass/weight is a result of anti-gravity associated with anti-matter clusters cancelling the weight effect of equal numbers of positive gravity clusters in a nucleus.

Tables 1 and 2 are constructed using Eq. 1 to determine several possible cluster configurations of hydrogen ( ${}_1\text{H}^1$ ) and helium-4 ( ${}_2\text{He}^4$ ), respectively. A boxed outline is drawn around the simplest NP, NPN, PNP configuration (with the lowest cluster count,  $\Sigma_c$ ) for matter and anti-matter versions of each nuclide.

Table 1  
Hydrogen and Antihydrogen at the Origin

	Nucleon Cluster Configurations	Number of Clusters			Effective Mass Number		Absolute Number of Nucleons
		NP	NPN	PNP	$\Sigma_c$	$A_{\text{eff}}$	
Matter +	---	(etc.)	---	---	(etc.)	+1	(etc.)
	5	-2	-1		8	+1	19
	-4	1	2		7	+1	17
	2	-1	0		3	+1	7
	-1	0	1		2	+1	5
Mass-Charge Center at Origin ( $C_s = 0$ )							
Antimatter -	1	0	-1		2	-1	5
	-2	1	0		3	-1	7
	4	-1	-2		7	-1	17
	-5	2	1		8	-1	19
	---	(etc.)	---	---	(etc.)	-1	(etc.)

Note that effective mass number ( $A_{\text{eff}}$ ) of each nuclide remains the same, except for sign, on either side of the zero mass-charge origin. Table 1 also indicates, with dashed arrows, the "path of  $\beta$ -stability", diverging at the right from hydrogen to higher positive mass nuclides and lower negative mass antinuclides. Note also that as the cluster count increases for each configuration (or "isodyne") the actual number of nucleons per nuclide ( $\Sigma_n$ ) increases accordingly.

Table 2 shows the simplest cluster configurations for  ${}_2\text{He}^4$ . It is notable that the



lowest cluster count configuration for helium-4 - also known as the alpha particle - consists of just 2 NP clusters. One of the basic notions of radio-active alpha decay theory says an alpha *may exist as an entity* within a nucleus, and the particle "is almost invariably emitted because of its high binding energy" [12]. So with regard to NP and 2NP clusters, already standard theory partially supports the NCM notion of separately identifiable nucleon clusters and qualitatively different levels of binding energy in nuclides (as distinct from nucleon energy levels defined in the theoretical Shell Model).

### THE COSMOLOGY QUESTION AGAIN

The *Science* article [1] did not speculate what kind of 'hot dark', 'cold dark' or shadow matter could be the source of the verified universal repulsive force. Because both matter **and** energy can **curve** spacetime, some at the meeting said a mysterious energy, rather than missing 'dark' matter, was the culprit beefing up the Einstein cosmological constant (termed lambda). That background energy would push, rather than pull, and speed up cosmic expansion over time. The study results imply that the universe contains roughly twice as much energy in the cosmological constant as in matter.

It may not be just background energy causing increasing expansion. Those scientists seem to discount the possible presence of bulk antimatter which would add mass back into the picture because antimatter - or dark matter itself - has yet to be detected by observations of the universe. In laboratories on earth, negatively charged anti-matter particles can be created and then observed. And, some high altitude balloon-borne experiments detect a few positrons and anti-protons in energetic cosmic rays, but no heavier anti-nuclei [13].

Current theories of the Big Bang say anti-matter disappeared by annihilation reactions during the first moments of "expansion" of the universe and that only some positive (observable) baryonic matter survived. Unobserved anti-matter, as a substantial constituent of all matter, as asserted by Brightsen's NCM, could provide at least some of the missing mass density and repulsive force to open the universe, or at least keep it geometrically flat. Calculation of the amount of antimatter available per the NCM has not been accomplished, to my knowledge. Qualitatively it appears that there could be at least twice as much "NCM" mass density as now observed to contribute toward a cosmic constant (lambda) required to match the new observations that trouble cosmologists.

### CONCLUDING REMARKS

A feature of Brightsen's Nucleon Cluster Model not adequately discussed in this article, but of importance to experimental results, are the alternative descriptions of each nuclide - here called 'Isodynes.' This term, isodynes, was first suggested by Dr. R. W. Bass in a paper [14] describing successful application of the NCM to determine the novel photon-induced process by which a nuclear transmutation of mercury-201 to gold-197 was observed in an experiment by Lin and Bokris [15].

Table 2

Helium - 4 Cluster Configurations  
(The Alpha Particle)

	Nucleon Cluster Configurations			Number of Clusters		Effective Mass Number Absolute Number of Nucleons
	NP	NPN	PNP	$\Sigma_c$	$A_{eff}$	$\Sigma_n$
Matter + ${}^4_2\text{He}$	--- (etc.) ---			(etc.)	+4	(etc.)
	-4	2	2	8	+4	20
	5	-1	-1	7	+4	16
	-1	1	1	3	+4	8
	2	0	0	2	+4	4
Antimatter - ${}^4_{-2}\text{He}$	-2 0 0			2	-4	4
	1	-1	-1	3	-4	8
	-5	1	1	7	-4	16
	4	-2	-2	8	-4	20
	--- (etc.) ---			(etc.)	-4	(etc.)

Another application of the NCM to the field of nuclear physics, in general, and low temperature transmutations/low energy reactions in particular, was seen in the explanations of transmutation of palladium isotopes to seven lower mass nuclides as measured in experiments of Dr. Wolf and presented by Dr. Passell at a conference in Monaco [16].

Additional information about the NCM and the Clustron Sciences Corporation, headed by R.A. Brightsen, may be found on the Internet at:

<http://www.gslink.com/~ncmcn/Clustron/>

With Mr. Brightsen's permission, I have included his list of *Attributes of the Nucleon Cluster Model (NCM) and the Periodic Table of Beta-Stable Nuclides* as found on his internet site, identified above.

1. Provides a detailed explanation of fission (U-235, Pu-239, Pu-241)
2. The Periodic Table of Beta-Stable Nuclides:
  - a) is systematic, symmetric and periodic, and includes all beta-stable nuclides
  - b) explains "missing" Z and N values in standard Z,N plot
  - c) confirms "magic" neutron numbers (20, 50, 82, 126)
  - d) provides strong evidence that the proton contains antimatter, in the form of anti-matter clusters
3. Explains production of radioactivities in cathodes
4. Explains origins of excess heat in "cold fusion"; accounts for all observed phenomena (neutrons, tritium, helium-4; absence of high-energy gamma)
5. Accounts for "missing mass" problem in cosmology, by the mechanism of anti-gravity
6. Predicts (and requires) the existence of antigravity
7. By supporting antigravity, confirms the age of the universe as  $\approx 16$  billion years
8. Predicts a method for remediation of radioactivity in nuclear waste; provides a process for conversion of Pu-239 to U-235
9. Conforms with the classical Periodic Table of Elements (Mendeleev, 1869)

There is one additional 'claim' I would add to those of Brightsen's list: There is still a **hidden world of symmetry** left in cosmological processes after the Big Bang - and the NCM reveals it. It lies in anti-matter isodynes of hydrogen and other low mass elements as well as negatively beyond the zero mass 'Center of Mass-Charge Symmetry' at the origin of both mass and antimass in the model (Fig.1). The NCM suggests that a hidden world of symmetry has just not been available to our senses or measuring instruments. Faced with the astounding regularity and logic of the Nucleon Cluster Model, science must devise experimental means either to refute or verify the reality of these preferentially bound nucleon clusters in nuclei of atoms.

Help in finding the "missing matter" of cosmology may now be on the way. Newly announced computer simulations by Ostriker and Cen [17] show that "the primordial clouds (of the early universe) condensed over time into a vast filamentary network of fully ionized plasma which now links galaxies and galaxy clusters." This baryonic plasma, heated at present to about a million degrees kelvin, gives off only a faint x-ray glow that is extremely difficult to detect with present satellites. Says the article, "Soon-to-be launched x-ray satellites should be able to see the plasma". And one x-ray observer (Q. Daniel Wang) has announced that he "may already have seen a hint of these hot filaments." If the existence of this warm and widely dispersed baryonic plasma is verified, it can also be used by theoreticians to validate new aspects of nucleogenesis that would explain the nucleon cluster patterns of the Nucleon Cluster Model [18]. Meanwhile, the NCM will be justified in practise by its use to explain experimental results.



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4. R.A. Brightsen, The Nucleon Cluster Model and The Periodic Table of Beta-Stable Nuclides, Published by Clustron Sciences corporation, 4500 South Four Mile Run drive, Suite 804, Arlington, VA 22204. Phone (703) 845-8531.
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6. R.A. Brightsen, "Nucleon Cluster Structures in Beta-Stable Nuclides", *Infinite Energy*, Vol. 1, No. 4, Sept/Oct 1995, pp. 55-56.
7. This 11x17 inch color chart, entitled Atomic and Nuclear Periodic Table of Elements and Isotopes (Based upon the Nucleon Cluster Model of the Atomic Nucleus), is published by Clustron Sciences Corporation, address and phone number above, in Reference 4. Please enquire about price and current availability. [Published in book format in Ref. 5.]
8. *Ibid*, *Infinite Energy*, vol 1, no 4, p 56.
9. Note: The term "bulk antimatter" is used here to designate bound clusters consisting of antineutron and antiproton combinations allowed by the Nucleon Cluster Model. These must be differentiated from the rare individual positrons and antiprotons observed from collision of high energy cosmic rays with molecules of the earth's atmosphere. See "Cosmic Antimatter", *Scientific American*, Apr. 1998, pp. 36-41. The observed high energy antiparticles, positrons and antiprotons, are thought to originate with supernova explosions accelerating interstellar protons or heavier nuclei that collide with other interstellar particles. The article concludes that it is unlikely that heavy antiparticles or antinuclei will be found.  
The bulk antimatter can, of course, be manifested in various astronomical systems and bodies. To the earthbound observer these would appear to be identical to equivalent systems and bodies of ordinary matter.
10. McGraw Hill Dictionary of Scientific and Technical Terms, 5th Edition, McGraw-Hill, Inc. (1994).
11. *Ibid* Brightsen, Ref. 4, Figure 8.
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13. G. Tarle and S.P. Swordy, "Cosmic Antimatter", *Sci. American*, April 1998, pp 36-41.
14. Robert W. Bass, "Experimental Evidence Favoring Brightsen's Nucleon Cluster Model", *Infinite Energy*, vol 2, no 11, Nov/Dec. 1996, pp 78-79.
15. G.H. Lin and J.O'M Bockris, "Anomalous Radioactivity and Unexpected Elements as a Result of Heating Inorganic Mixtures", Second Annual Conference on Low-Energy Nuclear Reactions, *J. New Energy*, vol 1, no 3 (1996), pp 100-105.
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17. James Glanz, "Cosmic Web Captures Lost Matter," *Science*, vol 280, 26 June 1998, pp 2049-2050.
18. Note: If the warm intergalactic baryonic plasma is confirmed and it can be shown to exist and cool to form neutron-proton and antineutron-antiproton couplets and triplets coexisting in harmony, then the formations and isodynes of abundant hydrogen, helium-4 and other light elements as defined by the NCM can be validated.

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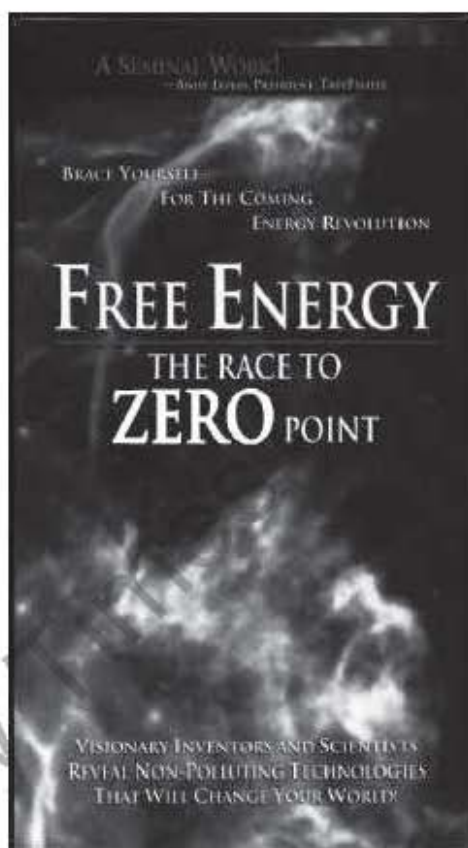
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John C. Fisher (Carpinteria, CA),  
**"Liquid-Drop Model for Extremely Neutron Rich Nuclei,"**  
*Fusion Tech.*, vol 34, no 1, Aug. 1998, pp 66-75, 11 refs, 2 figs, 5 tables.

### AUTHORS' ABSTRACT

Nuclear energy levels are characterized in part by their isospin quantum numbers. Ordinary nuclides are well described by an independent-particle model with ground-state isospins equal to the minimum possible value  $T_{min} = \text{abs}(A/2 - Z)$ . It has been suggested that extremely neutron rich nuclei constitute a second branch of the table of isotopes whose ground states have the maximum possible isospin  $T_{max} = A/2$  and that neutral members of the  $T_{max}$  branch (i.e., poly-neutrons) serve as mediating particles for the new class of nuclear reactions discovered by Fleischmann and Pons. The energetics of the new reactions have been qualitatively described by a liquid-drop model. Recent measurements of the mass spectrum of reaction products produced in the new reactions make possible a refinement of the model, providing an explanation for gaps of instability separating ranges of stability in the mass spectrum.

R.A. Oriani (Univ. Minnesota, Dept. Chem. Engr. & Matls. Sci., MN),  
**"Anomalous Heavy Atomic Masses Produced by Electrolysis,"** *Fusion Tech.*, vol 34, no 1, Aug. 1998, pp 76-80, 11 refs, 3 figs, 3 tables.

### AUTHORS' ABSTRACT

By applying to electrolysis cathodes a technique that produces essentially only oxides that are volatile at room temperature, spectroscopically determined masses between 222 and 351 atomic mass unit (AMU) are found that cannot be ascribed to known compounds. In particular the masses found between 231 and 240 AMU cannot be ascribed to random signals but do correspond to  $\text{CO}_2$ , the carbon of which is a neutron-rich nuclide as predicted by a recent theory of poly-neutron nuclear reactions.

Gherardo Stoppini (Univ. Pisa, Phys. Dept. Piazza Torricelli, Italy),  
**"Nuclear Processes in Hydrogen-Loaded Metals,"** *Fusion Tech.*, vol 34, no 1, Aug. 1998, pp 81-85, 8 refs, 1 fig.

### AUTHORS' ABSTRACT

Miley et al. and, independently, Mizuno et al. claim to have observed nuclides produced in  $Ni$  ( $Z = 28$ ) when an electrolytic

light-water cell is used. Miley et al. use thin layers of  $Ni$  ( $\leq 5 \times 10^{-6}$  cm) and claim that the effect is reproducible. The secondary nuclides are distributed in a wide range of  $Z$  and  $A$  and show nuclides with  $Z < 28$  and accumulations at  $Z = 48$  and  $78$ . If the nuclides at  $Z = 48$  and  $78$  are  $Ni-Ni$  fusion, they can be produced only when the original  $Ni$  nuclei gain sufficient kinetic energy to overcome the  $Ni-Ni$  repulsive Coulomb barrier.

The foregoing data are discussed in terms of current physics. In particular, it is assumed that the gain of kinetic energy derives from an impulsive increase of absolute nuclear binding energies of  $Ni$  due to a high rate of capture of orbital electrons and consequent almost instantaneous multiple  $p - n$  transitions. Under this hypothesis, neutrino emission should be detected during nuclear transmutation.

M. G. Olayo, G. J. Cruz, L. Balderas, L. Melendez, A. Chavez, R. Valencia, E. Chavez, A. Flores, R. Lopez (Dept. de Fisica, Inst. Nacional de Investigaciones Nucleares, D.F. Mexico),  
**"Absorption of Deuterium in Titanium Plates Induced by Electric Discharges,"** *Int'l. J. Hydrogen Energy*, vol 23, 1998, pp 885-890.

## AUTHOR'S ABSTRACT

In this work, the absorption of deuterium in titanium plates induced by electric discharges is studied. The objective was to measure the amount of deuterium that is absorbed in the titanium structure under the influence of an electric discharge. The ionization and the free radicals produced by the electric field act as a promoter to the absorption mechanism. Thus, the absorption can be enhanced by the use of an electric discharge. The results indicated that there was a rapid desorption of deuterium at the beginning of the discharge, followed by an additional absorption to levels higher than those before the discharge. The additional absorption of deuterium was about 20% of the initial absorption. When the titanium was completely saturated with the gas, no additional absorption occurred through the electric discharges. As a result of the absorption conditions of deuterium in the titanium structure, anomalous emission of neutrons was recorded as tracks in a CR39 type plastic solid state nuclear-track detector.

Waldry A. Rodrigues Jr. (Instituto de Matemática, Estatística e Computação, Brazil), Jian-Yu Lu (Biodynamics Research Unit, Dept. of Physiology and Biophysics, Mayo Clinic and Foundation, MN), "On the Existence of Undistorted Waves (UPWs) of Arbitrary Speeds  $0 \leq v < \infty$  in Nature," *Foundations of Physics*, vol 27, no 3, 1997, pp 435-508, 86 refs, 12 figs, 1 table.

## AUTHORS' ABSTRACT

We present the theory, the experimental evidence and fundamental physical consequences concerning the existence of families of undistorted

progressive waves (UPWs) of arbitrary speeds  $0 \leq v < \infty$ , which are solutions of the homogeneous wave equation, the Maxwell equations, and Dirac, Weyl, and Klein-Gordon equations.

[This paper also presents a discussion of the potential need to modify some concepts of the principle of relativity. The authors treat this issue extensively. They also suggest that "it seems possible with present technology to launch in free space superluminal electromagnetic waves." Ed.]

Alfonso Reuda (Dept. Electrical Engr. & Department of Phys., CA State Univ., Long Beach, CA), Bernhard Haisch (Solar & Astrophysics Lab., Lockheed Martin, Palo Alto, CA & Max-Planck-Institut für Extraterrestrische Physik, Germany), "Inertia as Reaction of the Vacuum to Accelerated Motion," *Phys. Letters A*, vol 240 (1998) pp 115-126.

## AUTHOR'S ABSTRACT

It was proposed by Haisch, Reuda and Puthoff that the inertia of matter could be interpreted at least in part as a reaction force originating in interactions between the electromagnetic zero-point field (ZPF) and the elementary charged constituents (quarks and electrons) of matter. Within the limited context of that analysis, it appeared that Newton's equation of motion ( $f = ma$ ) could be inferred from Maxwell's equations as applied to ZPF, i.e., the stochastic electrodynamics (SED) version of the quantum vacuum. We report on a new approach which avoids the *ad hoc* particle-field interaction model (Planck oscillator) of that analysis, as well as its concomitant formulation complexity. Instead, it is shown that a non-zero ZPE momentum flux arises naturally in accelerating coordinate frames

from the standard relativistic transformations of electromagnetic fields. Scattering of this ZPF momentum flux by an object will yield a reaction force that may be interpreted as a contribution to the object's inertia. This new formulation is properly covariant yielding the relativistic equation of motion:  $F = dp/dt$ . Our approach is related by the principle of equivalence to Sakharov's conjecture of a connection between Einstein action and the vacuum. **If correct, this concept would substitute for Mach's principle and imply that no further mass-giving Higgs-type fields may be required to explain the inertia of material objects, although extensions to include the zero-point fields of the other fundamental interactions may be necessary for a complete theory of inertia.**

Mitchell R. Swartz (JET Energy Technol., Inc., Wellesley Hills, MA), "Patterns of Failure in Cold Fusion Experiments," IECEC-98.

## AUTHORS' ABSTRACT

Although reproducible cold fusion experiments continue to be difficult to achieve, analyses of these experiments offer preliminary suggestions on improving yields and reliability. Patterns of failure of cold fusion experiments can be divided into physical issues such as sample activity, loading achieved, ambient noise power, paradigm used, and possible material degradation.



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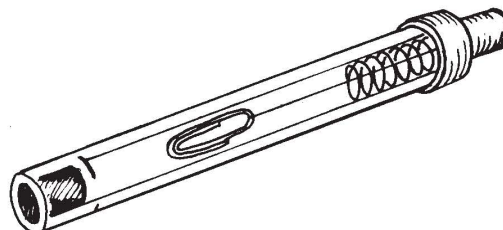
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## LETTERS TO THE EDITOR

### FORCE IS FORCE

From: Harvey Morgan

In thinking about the work discussed at the AAAS meeting, it occurred to me that force due to various sources is the same phenomena regardless of source. That equivalence wasn't exactly voiced at the meeting, but most likely is true. Hodowanec's work and that of Bill Ramsey points in that direction. The significance of this equivalence (equality?) is not clear, but needs to be considered by the scientific community. I'm heavily involved with other work and don't presently have the time to work on it. I intend to later build a sensor such as Hodowanec described for measurements other than gravity variations. If what I suggest in the last paragraph is followed up experimentally by electronic people, there could possibly be a substantial improvement in receiver sensitivity due to improvement of noise figure.

### ELECTRICAL 1/f NOISE

Harvey Morgan <sup>2</sup>

From the experiments of Gregory Hodowanec and Bill Ramsey, as reported in May, 1998 at the AAAS meeting in Grand Junction, CO, it has become apparent that force is a force is a force, to misquote a famous woman writer. That is, force from gravity, magnetic fields, electric fields, or from changing momentum fields can have identical effects (adjusted for magnitude). That expands Einstein's famous equivalence theorem to cover all force sources. Hodowanec and Ramsey experimentally detected gravity field variations, such as due to the sun or planets passing over the zenith (and other cosmological events) by the interaction of gravity fields and electric fields in electronic components. One over f (f is frequency) noise in particularly resistive electronic components has been a 'fact of life' for electronic engineers for many decades. The fact that 1/f noise was greater for carbon composition resistors (for example) than metallic resistors such as wire-wound types of equal resistance value has long been known. The fact that metallic resistance has greater physical strength than carbon composition resistors was never considered (that I'm aware of).

Metallic resistors would commonly (depending on physical configuration) have much more resistance to gravitational and electric field stresses, hence have much less resistance change due to those stresses. The fact of resistance change due to stress is well known as 'strain gages' (commonly made of metal) have been used for decades.

1/f noise is known to be proportional (for a given resistor material) to the value of resistance. Structurally, resistor have an inverse relation between the amount of conductor resistance and the resistance value. If, as indicated above, 1/f noise is related to the interaction of electric and gravitational fields, there should be a variation of 1/f noise amplitude with changing resistor inclination with respect to the gravity field (the gravity field of earth is essentially perpendicular with respect to the earth's surface). With a constant angular relation with respect to gravity fields, there also should be a small variation of average noise voltage with altitude due to the decrease of gravity intensity, at constant temperature. (Resistors have a plus or minus variation of resistance with respect to temperature.)

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<sup>2</sup> HC 66 Box 542A, Deming, NM 88030., (505) 546 6971

The effect of a force on a conductor is either tension or compression but commonly compression. The effect of an electric field on capacitors, for example, can be quite noticeable if the voltage varies. A reliability test in which an AC square wave (plus and minus alternately) caused a bank of capacitors to physically vibrate at a 120 Hertz rate (60 Hertz applied voltage) to the point of being audible. The capacity variation was not measured but could have been substantial. Hodowanec's electronic circuit measured capacity variation due to the interaction of an electric and the ambient gravitational fields. The stresses of Hodowanec's sensor capacitor were far less than in the reliability test referred to, but the sensor electronic circuit provided a large amount of amplification to the voltage variation caused by gravity field variation.

All electric components are subject to the interaction of electric and gravitational fields, depending on structural strength, applied fields, and likely other structural features. It is possible that  $1/f$  noise due to the minute variations in the gravity field could be canceled out by appropriate structural design of the components. With the same electric field on parts of an electronic component which have opposite orientation (half up and half down) with respect to the gravity field, cancellation of  $1/f$  noise due to gravity field variations may be possible. How much improvement can be made is unknown.

#### References:

'Gravitational Impulses,' a paper made available at the Natural Philosophy Alliance sessions of the May, 1998 AAAS conference at Grand Junction, CO by Hal Fox and Bill Ramsey.

'Momentum is a Field Quantity,' by Harvey Morgan, paper presented at the AAAS meeting at Texas A&M, College Station, Tx in May 1997.

Hal Fox and Bill Ramsay, "The Superluminal Velocity of Gravity Waves,"

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#### PURPORTED OVERUNITY RESULTS BY HEWLETT PACKARD

From: Tom Bearden

#### FOREWORD

There was a report on the Keelynet that Hewlett Packard was using a special multiple-transistor circuit of some sort, which was purported to produce COP (coefficient of performance)  $>1.0$ . Jerry Decker asked me about the circuit, or if I knew anything about it. I had no knowledge of what Hewlett Packard was doing, but had been involved in overunity transistor circuits in a couple of cases. The below were my informal comments back to Jerry on the spur of the moment, on how multi-loop germanium semiconductors can achieve  $COP > 1.0$ , and a case where they did. The letter has been slightly re-edited, and my use of a time-like EM wave with time oscillations -- but no 3-spatial energy oscillations -- as a new kind of longitudinal EM wave has been further clarified.

Jerry,

Probably a circuit that was somewhat akin to a thing that Westinghouse placed in the Minuteman missile some years ago. In those days electronics were very bulky, and space and weight were at a premium onboard ICBMs etc. So the Westinghouse engineers set about to design a highly efficient power frequency converter for the Minuteman missile. It had to be at least 90% efficient, preferably 95%. The engineers used germanium transistors and state-of-the-art feedforward and feedback loops, to squeeze

every bit of efficiency that was possible. Something like 64 transistors were involved in the forward and reverse multiple looping.

Well, one sometimes gets a peculiar effect in such multi-loop feedback cases. Let me diverge a bit for some necessary background.

Nonlinear optics [NLO] is based on the fact that, when materials (3-space) are sufficiently nonlinear, then wave-to-wave interaction occurs, instead of just absorption and emission of radiation. Linear materials (those which do not usually produce harmonics) essentially react classically. For most cases, sufficient nonlinearity only occurs at optical-band frequencies. Hence such materials are called "optical materials." That just means they produce (1) harmonics, and (2) wave-to-wave interactions. In nonlinear multiwave interactions, production of a time-reversed wave is well-known in quantum electrodynamics. [A very good introduction to the field is given by David M. Pepper, "Nonlinear Optical Phase Conjugation," *Optical Engineering*, 21(2), March/April 1982, p 156-183].

Normal NLO theory uses transverse EM waves for the input, and for the pumping. "Pumping" in simplest case means this (we are working in the optical band): If two opposing waves strike a NLO material, equal and opposite forces (force fields) are created in and on the material. In short, you are "squeezing" the material rhythmically. If you introduce a third wave (referred to as the "signal" wave) to this "squeezed NLO material", then all 3 waves may interact to produce a fourth wave. This fourth wave is (1) a true phase conjugate (time-reversed) replica (PCR) of the input signal wave, and (2) amplified in that it can contain up to all the energy in the two "pumping" waves. Further, (3) in simplest case the PCR wave will just precisely backtrack the path previously taken by the signal wave (in short, the vacuum "has a memory," although the NLO folks do not say that at all). For a truly beautiful example of this "backtracking" ability through a tortuous medium, see David M. Pepper, "Applications of Optical Phase Conjugation," *Scientific American*, 254(1), Jan. 1986, p. 74-83. See particularly the striking photographic demonstration of time reversal of disorder on p. 75.]

Normally, when you transmit a wave in space, it diverges even though you try to "beam" it as tightly as possible. But if you produce one of these PCR waves (time-reversed) out there in space, in response to the received signal from your diverging beam, that response PCR wave will converge back upon that distant transmission point! In advanced systems this can be done very well. The plans for the Star Wars space-borne laser, e.g., used this plus another fact to be able to keep a laser beam locked upon a single spot on a rising hostile booster -- say, 10,000 miles away -- for long enough dwell time to burn right through the booster casing and destroy the missile.

The other fact used in the Star Wars laser was "self-targeting," which is very important. The "hot spot" being heated on the distant booster was itself highly nonlinear, basically "pumped" by the heat energy, and thus acted as a pumped phase conjugate mirror. Here you have two pumped phase conjugate mirrors (PPCMs) facing each other (they may be a great distance apart). When PCM 1 receives a signal from PCM 2, even a diverging signal, PCM 1 will emit a PCR wave that will converge entirely upon the transmission point in PCM 2. In return, when PCM 2 receives a signal from PCM 1, even diverging, PCM 2 will emit a PCR wave which precisely backtracks to PCM 1, converging all the while.

In the perfect case, what happens is that all the energy emitted between PCM 1 and PCM 2 narrows into precisely parallel beams of energy joining the two. This adaptive process is an example of self-targeting. In the real world, the two PPCMs approach this condition sufficiently for burn through of the booster.

Suppose your transmitters (PCM 1 and PCM 2) are pumped, so that they are pumped phase conjugate mirrors (PPCMs). Immediately you see that enormously greater energy density can now be transferred between PPCM 1 and PPCM 2, because of the dramatic reduction in beam divergence.



Consider the average energy density existing in the separating space (beam path) between PPCM 1 and PPCM 2. It is now much higher.

That is where the conventional theory essentially stops. We need to go a little further, because conventional theorists do not utilize extended Poynting energy flow theory, and multiple, iterative retroreflection of the same energy flow. Note that what they use is always additional energy, constantly being input by the pumping waves of PPCM 1 and PPCM 2. So there is no overunity there at all (although a British scientist did some interesting things which essentially involved overunity, but was never so stated). He produced a theory and an effect whereby the energy in an array of such things becomes proportional to the square of the number of units in the array, instead of the sum of the number of array units.

Essentially all semiconductor materials are also NLO materials, as is well-known. Voila! Under the right circumstances, semiconductors will play "self-targeting" (which I just called "ping pong" for simplicity) with each other. That's pretty rare, though, because we normally don't use optical transmissions between them, but instead use much lower frequency signals along wires, so that any ping pong is continually extinguished and seldom noticeable.

So let's change that, with a mechanism I worked out in deciphering what the actual Priore mechanism was in his plasma mixing tube. The radiated emission from a pulsed coil surrounding that plasma tube could heal cancer, infectious diseases, etc.

Briefly, if you pump a properly nonlinear material with transverse EM waves and use a transverse signal wave input, you get transverse PCR wave outputs. A transverse EM wave is actually an oscillation of spatial energy density. It is also an oscillation in the curvature of spacetime, but only in the "space" portion of it. The time is left alone, at least in the conventional model, and does not oscillate. Waves do carry time as well as energy, although physics does not account for it. The wave is made of photons (particle view), and each photon is made of angular momentum - energy x time. In other words, the wave carries lots of little "pieces" of spatial energy which are dynamically changing, but its concomitant "pieces" of time are considered to be nondynamic.

The longitudinal EM wave I use is not the conventional longitudinal EM wave in advanced physics papers. That conventional longitudinal EM wave (LW) is considered again to only involve spatial energy oscillation. In this conventional LW, the X and Y directions of oscillation are considered frozen, and the wave to vary (oscillate) its energy in the Z direction along its line of motion. In short, it is a sort of "surge" wave.

The longitudinal EM wave I use (and am trying to patent ways to make) is a wave where all three spatial axis are "frozen" so that the spatial energy does not oscillate at all. Instead, the time components being transported by these special photons are oscillating. So this wave is oscillating in time-density, not spatial energy density. Hereafter, when I speak of "longitudinal" EM waves, it is this special "time wave" I am referring to. Such a "time oscillation only" photon is roughly known as a "scalar" photon (no spatial vector) in advanced electrodynamics. It has been considered always unobservable, but we have found that it also transduces - at least partially - into ordinary EM waves. When it does, the amount of time oscillation that transduces into energy density oscillation gives a gain of about  $9 \times 10^{16}$ .

Here is something else we are trying to patent right now [note added: we have filed an Invention Disclosure in the interim], and something I included in my graduate seminar at the University of Louisville on Nov. 20, 1997. If you pump any material with (the new) longitudinal EM waves, you are pumping with time oscillations along the time axis (I'll go into that in my forthcoming Priore book, to show that such new longitudinal EM waves also are oscillations of the rate of time flow). Well, the time axis is at right angles (simple case) to 3-space and therefore to 3-space materials. That's about as nonlinear as you can get to 3-space; so it's totally nonlinear. That is the great secret! You get NLO functioning at any and every frequency, even ELF (extra-low frequency).

In this "longitudinal wave pumping" (LWP), you do not use conventional transverse EM waves, either to pump or as a signal wave. Instead, you use the pattern of all variations in the time portion of spacetime (st) surrounding each and every piece of mass in the pumped mass. Here you must pass into full general relativity. Wheeler's general relativity principle tells us that mass (trapped energy forms) curves local spacetime, and curved local spacetime produces a force upon that mass. Complexes of mass (as in an atom or a molecule) produce complexes (templates) of inter-nested local spacetime curvatures. Remember, in general relativity the spacetime geometry is active, always acting on any mass embedded in it. It is therefore a very special kind of active medium. Not just space, but spacetime.

Imagine a mass and all its internal dynamics (quarks, nucleons, electron shells, lattice structures, etc.) as a very dynamic sort of "hand." The local spacetime exists as a dynamic "glove" precisely fitting all aspects of that hand, in the greatest detail. Call this "dynamic glove" of inter-nested local curvatures of spacetime a vacuum engine or a spacetime engine. Note that we are using vacuum/spacetime engines that are made of time-density alterations of spacetime (ST). That is, we still curve ST, but we use the far more powerful, time-induced curvatures rather than the much weaker spatial-energy-density curvatures.

Well, if you separately produce a vacuum/spacetime engine of any kind, it will act upon any mass embedded in it (that's just GR). But the new longitudinal EM waves oscillate the rate of flow of time. For every part of a mass that they interact with, the new longitudinal EM waves affect and change (and oscillate) those little pieces of time that are part of that local spacetime "glove."

If you vary the energy density of ST, you affect the time portion also (as in the well-known time dilation with velocity, a most simple case). On the other hand, if you vary the time density of ST, you also affect the energy density portion. In GR, nothing much has been done with the time density and how to vary that. In fact, they just missed about half the GR that is available to use -- in fact, the part that can be done on the bench electrodynamically.

Interestingly, since we get so much gain in transduction from the time-curvature of ST to the energy-density curvature of ST, one may consider time to be length compressed by the factor  $c$ , or transverse EM wave energy compressed by the factor  $c^2$ .

So we may regard complexes of the new longitudinal EM waves as also clusters of time-density ST curvatures, and therefore, very powerful vacuum/spacetime engines in spacetime itself. This is why (from a GR view) such complexes -- such vacuum engines -- will powerfully affect any matter, regardless of the frequency involved, and regardless of how fine a level we wish to affect. In theory one can as easily flip quarks in nucleons as anything else, which of course directly transmutes the element. Further, one can create a local curvature of spacetime wherein the "flow of time" seems to be reversed (to an embedded mass). In that region (in that spacetime engine), like charges attract and unlike charges repel. In experiments such as cold fusion experiments, this leads to hosts of dramatically new kinds of particle interactions.

After all that, we are now ready to return to arrays of semiconductors that use very sophisticated feedforward and feedback. We add one additional fact: Germanium has a unique characteristics. There is some transduction of transverse waves into surface longitudinal waves, and vice versa, in germanium. This means that germanium transistors or semiconductors can give - under the right circumstances - a little transduction between the net time-oscillation EM waves and ordinary transverse EM waves. In the transduction, "decompression" of a minuscule bit of time gives extra energy. Energy overall is still conserved, if we extend the present conservation law to include both "uncompressed" (transverse) EM wave energy and "compressed" (time-oscillatory) EM wave energy. It appears that germanium diodes and transistors - particularly in multiple arrays with sophisticated feed-forward and feed-back, can produce coherence in decompression of a bit of time-oscillating LWs into ordinary transverse energy-oscillating TWs.

With such multi-loop feedbacks, particularly lots of them, the individual germanium transistor may have feedback signals from many others at once. Examine now those aspects of the transverse signals that "cancel" because of phase antiparallelism. Voila! The energies of the zeroing components exist and superpose, and the transistors also perform a little phase conjugation, adding phase conjugates. This means that elements of the time aspects in the "zero force field" stress oscillation wave are antiparallel.

When that occurs, we have a stress energy oscillation and also a time-stress oscillation component. That actually turns part of antiphased, zero-vector-summing EM waves into a time-oscillating spacetime curvature wave – a special kind of gravitational wave – where the energy density (stress) of ST is oscillating, and the degree of forceful opposition of the time axis components are oscillating. In short, we have "time stress" oscillations as well. That makes an oscillating scalar potential (in terms of 3-space) and also an oscillating time wave. In short, that makes the new kind of longitudinal wave.

Ziolkowski also had a recent beautiful paper where he showed you would get longitudinal waves anyhow, except that when you make a transverse wave, you also make a function that "kills" or cancels the longitudinal wave. Well, some time ago I had stumbled into the fact that when you zero-summed transverse waves, you made longitudinal waves if you also restricted the transverse (X and Y) directions.

Anyway, engineers just discard such zero vector field EM summations, so they (1) do not track such time-oscillatory longitudinal wave formation in their circuits, (2) do not use such, and (3) do not even know about such. So they are always trying to optimize the transverse waves, which means they are also optimizing the destruction of the new longitudinal waves that are very powerful! They throw away the powerful lab bench engineering of full general relativity, just so they can continue to use transverse wave electronics!

Now one can begin to see what happens (inadvertently to the engineers) when the cancellations in all those feedback and feedforward loops get going, and the array has germanium semiconductors. You can get some accidental stabilization of small residues of the "new kind" of longitudinal EM wave pumping. So you get vacuum engineering going just a bit, that is, you are now using vacuum engines rather than signals -- two quite different matters. In signal theory, the vacuum does not interfere. In vacuum engineering, the vacuum is the active ingredient, and the signals are just the byproducts. If you get ping pong (self-targeting) going between various semiconductors in such arrays, you get these effects: (1) you get self-targeting in the energy domain, so that multiretroreflection of the same Poynting energy occurs. This means that in the multiple collections, you are getting a little additional collection from the huge normally nondivergent (nonintercepted, noncollected) Poynting flow after every pass. End result, as I showed in my May 1997 paper at the New Energy Symposium in Denver, is that the participating retroreflectors start to asymmetrically self-regauge themselves. In short, they start to collect more energy from the same energy flow, retroreflected multiple times. They increase their own potentials, thereby increasing their own Poynting flow output, which is being extracted directly from the vacuum interaction with the charged particles and dipoles (particle physics, not classical EM). At the same time, disturbing factors also start to increase as a function of the increasing local energy density. This means that, where the disruption curves and increasing energy density curves cross, there will result a stabilized threshold level where the unit can operate. If, however, this level is well-beyond the failure aspects of the participating components (which is most often is), then the array will just self-destruct in one or more transistors.

Our own team was blowing transistors off the board in sudden violent explosions with one foot diameter flashes in 1990. We knew what has to be done to control the excess energy buildup, but certainly did not have the type of team and laboratory facilities necessary to tame it. Perhaps Hewlett Packard has done so, and had the necessary team. If so, they almost certainly do not understand the mechanism, but have discovered how to do it. In the Westinghouse Minuteman case, all the output side electronics (i.e., beyond the output of the transistor array frequency converter) started failing out there in the field. **After much**

investigation, it was found that the average unit was putting out from 105% to 115% as much energy as it received. The receiving electronics could not accept that much. Corporate officials came down hard on the engineers, so they just put in limiting diodes, etc. and spoiled the feedback and the ping pong. That brought the thing down to about 95% efficient, and the electronics on the output side quit blowing out.

Everybody was happy, and everybody continued to use those "crippled overunity units" in the Minuteman missile. Westinghouse quietly filed five or six patents around such transistor arrays with sophisticated feedforward and feedback, and that was the end of that. Everybody "knows" that you cannot produce an EM system that puts out more than you yourself input! We have all been educated in the crippled (symmetrically regauged) Maxwellian equations that only deal with EM systems that have already been violently wrenched into local equilibrium with their vacuum energy exchange. Prior to arbitrary regauging, Maxwell's equations (Heaviside version) do indeed allow and include open EM systems freely receiving excess energy from their environment, and producing overunity. Such open dissipative systems can (1) self-oscillate, (2) self-organize, and (3) power themselves while simultaneously powering a load.

There is no problem at all in extracting all the EM energy you wish from the vacuum. Everything does that anyway! Every electrical charge and magnetic charge (pole) does that. Our normal circuits only capture and use about  $10^{-13}$  of the actual energy flow extracted from the vacuum by the power source dipole. Heaviside pointed out that most of the energy was just wasted in nondivergent form. Lorentz impatiently formulated a procedure that just discards all that  $10^{13}$  component, leaving only the  $10^{-13}$  component. That tiny little remaining "diverged" (collected) fraction is what drives our circuits. Lorentz also taught us the completely stupid (from a power system viewpoint) procedure of symmetrically regauging Maxwell-Heaviside equations before we use them. In other words, he taught us to discard far more systems -- all those that asymmetrically self-regauge so as to retain a net force and be able to use that excess free energy in a load -- than he retained. Since then, all our engineers have dutifully applied those equations after the Lorentz procedure has been invoked. Free energy experimenters always expected a conspiracy somewhere. It actually was an innocent conspiracy originally. The old guys did it to ease the solution of the equations mathematically. After all, since they thought the potentials were only fiction anyway, it seemed to them that they could freely change potentials mathematically as they wished, without implying any change in the system. It appears that one or two later realized what I speak of in this write-up. However, their controllers (the financial end) in secret have had this kind of thing suppressed for decades. Now one knows the exact nature of the real conspiracy. It is innocent on the part of the scientists for 99.9999% of the cases.

Both the Russians (Moscow University) and the U.S. (the great Gabriel Kron for a contractor in a Navy contract at Stanford University) made free energy devices in the 1930s. The Russian work is fully documented in the hard Russian physics literature and the French physics literature. The KGB/Communists suppressed the Russian work at the beginning of WW II. I do not know what happened in France to cause its abandonment there. In the U.S., Kron's work was never openly released on what he called his "negative resistor" which, when connected to the Network Analyzer at Stanford, allowed the NA to be disconnected from the generator because the negative resistor would power it.

Anti-Stokes emission, e.g., has been verified overunity (the medium outputs more energy than the operator inputs) for more than 50 years. It just applies ping-pong multiple retroreflection of the Poynting energy, to increase the energy collection and thereby asymmetrically regauge. However, you will not find that explanation in the literature. Instead, conventional scientists avoid the issue by saying something like "it takes the excess energy from the internal energy of the molecule." Well, just apply the conservation of energy law to the molecule as well. Since it does not collapse, it has to get that excess energy from someplace else. Nothing is said about that! Patterson's process utilizes ping pong also, as we pointed out at the New Energy Symposium in Denver. In a particularly dense medium or under very particular circumstances, the levels of energy due to the sudden asymmetrical regauging of the kick-in of multipass



multiple collection, can be enormous. It accounts, I believe, for the gamma ray burster, among other superenergetic astronomical entities. Recently a gamma ray burster was observed to "kick-in" in an already exploding gas. Here, the forces produced immediately caused tremendous acceleration of the particles participating in the asymmetrical self-regauging "kick-in". With substantial particle movement, the geometry was broken. So the product was an outburst of enormous energy density that then sharply extinguished. Holding the geometry a little longer gives a higher energy density burst, such as from pair annihilation. At extremely rare intervals (say, every so many billions of years), one of these ping pongers kicks in, in just the right medium, so that the energy density rises sufficiently to break 4-d Minkowski spacetime. That is, the energy rises asymptotically and bursts the very ability of 4-space to contain it. It therefore directly spill out into higher dimensions. What happens is that you burst 4-d spacetime, and spill out enormous (energy x time) buildup in a new 4-space in the n-space of the supercosmos. In other words, you create a new big bang which in turn creates another universe.

In our paper at the 1997 Energy Symposium, we modified the standard work energy theorem to incorporate the new phenomenon, because the present theorem implicitly assumes single-pass collection of energy from the Poynting flow. So that change to one of the fundamental theorems of physics has been formally proposed. It is regrettable that the physics journals and hard conferences will not examine such a thing dealing with a change in the assumed foundations of physics. However, we get it published one way or another, in whatever means we can. Presently several of my write-ups have been graciously placed on the web by Dr. Myron Evans, a scientist of first caliber, who has himself played a major role in a forthcoming rebirth and extension of physics by establishing the nonzero existence of the B(3) gauge. Dr. Evans has the web site <[www.navi.net/~rsc/physics/B3/evans/](http://www.navi.net/~rsc/physics/B3/evans/)> which contains papers dealing with the very forefront of physics today.

My own work is largely dealing with foundations concepts. Most of the mathematics I leave to others, being far too rusty in it myself to do proper justice. But there certainly are physicists today who are doing work in these areas, and who have the full competence in all the advanced mathematical areas.

Electrodynamics is now in a revitalization and rebirth, a revolution if you will, with the incredible work of scientists such as Dr. Evans, Barrett, Ziolkowski, Rodrigues, Lu, and others. As an example, embedding EM back into the quaternions from whence it came, or into the even higher topology Clifford Algebra, is producing a revolution. EM particles (solutions to the equations that move slower than lightspeed), superluminal solutions (which move faster than lightspeed), and others -- mostly longitudinal EM wave solutions -- have emerged. Some empirical data now supports these developments. Evans cites a specific experiment which clearly shows B(3) nonzero, in contradiction of the standard assumption. Mozart's 40th symphony has been translated through a waveguide at 4.7 c. So the old notion that one cannot transmit information or energy faster than the speed of light in ambient vacuum must be changed. By using the longitudinal EM waves (which are also time oscillations), you can indeed transmit both energy and information faster than light speed.

Hopefully, the top theorists will also start to drive into additional areas: (1) the fact that photons and waves carry time components as well as energy components, (2) there is an electromagnetic mechanism that generates the rate of flow of time itself, and that mechanism is engineerable, and (3) all the old 4-space Minkowski limitations may be overcome or avoided by higher topology and higher dimensions, and (4) there also exists a hidden EM topology and dynamics infolded inside any ordinary EM wave, field, or potential, and (5) the infolded electromagnetics -- the "infolded topology within the outfolded topologies" -- is the secret to developing a unified field theory that is engineerable upon the laboratory bench.

Anyhow, hopefully the above gives you some insight into the business of multi- arrayed semiconductors performing overunity. If our own team had had the funding and lab facilities, you would already have seen such on the market.

Cheers, Tom Bearden

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#### PATENTS

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New Energy Times

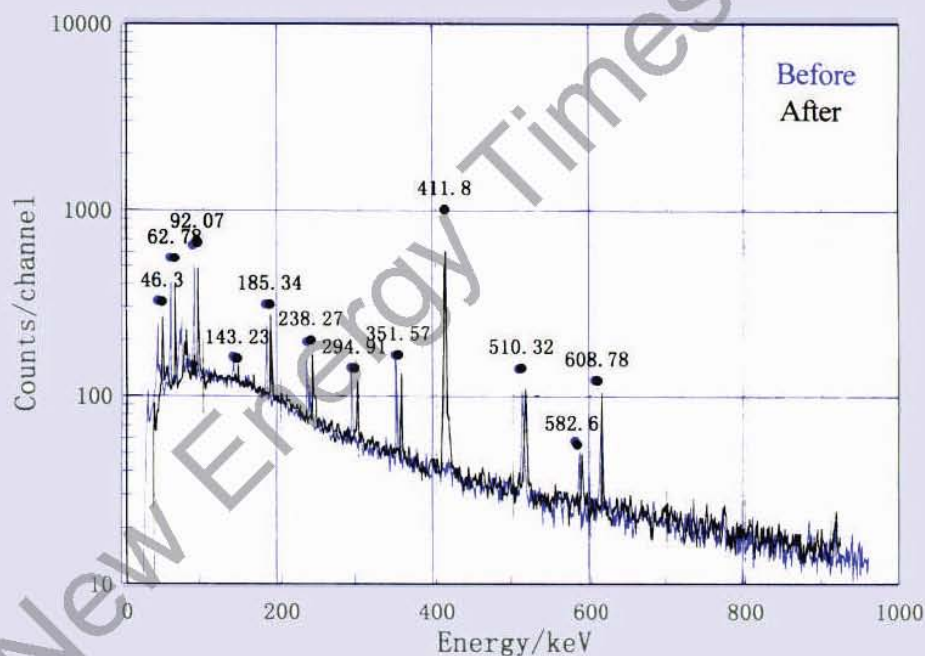


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