JOURNAL OF NEW ENERGY

An International Journal of New Energy Systems Vol. 2, No. 1, 1997

Published by the
Fusion Information Center
P.O. Box 58639
Salt Lake City, Utah 84158-0639

A Quarterly Journal
Subscription: $150 for 4 issues
Single issues: $45

Spring 1997
ISSN 1086-8259

EDITORIAL COMMENTS

For this first issue of volume 2 of the *Journal of New Energy*, it is appropriate to look at the need for new energy sources. (Our data sources are the the monthly newsletter published by Gordon Moody of the World Energy Group, *Global Energy Outlook* and *The Economist*.)

The Oil Demand and Supply

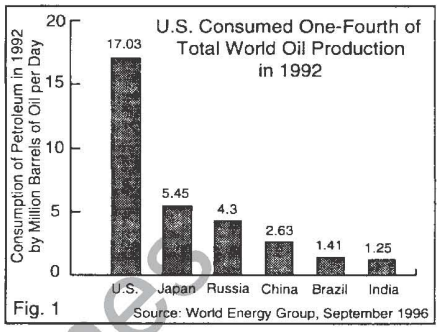


Fig. 1

As we all know, the people in the United States are the biggest consumers of the world energy as shown in Fig. 1. In 1992, the U.S. consumed 17.03 million barrels of oil **per day** which is about one-fourth of the total world oil production. Fig. 2 shows the oil consumption figures on a per-capita basis. Here again the U.S. leads the world with 23.8 barrels of oil per person per year (1992 figures). Japan is not far behind with 15.9 barrels per year of oil consumed per person. The per capita consumption in India is about 0.5 barrels of oil and China with about 0.8 barrels per person per year. With the huge population in China and India who are expected to increase their oil demand by about five percent per year, the world that had plentiful oil stocks may soon find that demand greatly outstrips available supply.

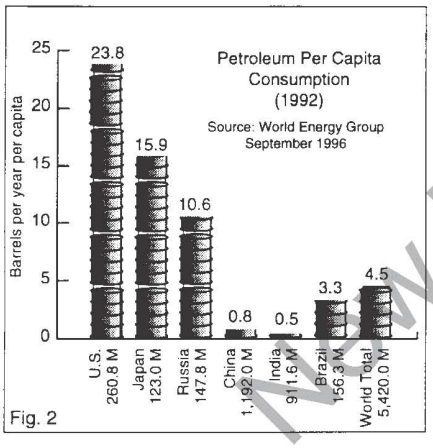


Fig. 2

Another way to look at the oil problem is provided in Fig. 3. This chart shows the number of oil fields discovered each year where the field capacity is greater than 500 million barrels. We added a five-year moving average to the data from *The Economist*. The largest number of giant oil fields found in one year was in 1961 when 14 new giant fields were discovered. The moving average of giant fields peaked in the mid 1960s and has been averaging none or one per year during all of the 1990s. This is fairly good statistical evidence that the days of plentiful oil are numbered. Our readers can hope that the coming reduction in the amount of oil burning will help reduce the world's level of air and water pollution.

The New Energy Supply

We do not need to address the demand – we are reasonably good at using all the energy we can get, if the price is low enough. The New Energy Supply is just now becoming commercially acceptable. (Note: the phrase is **acceptable** not **available**.) As we go to press there are only a few new energy devices that are

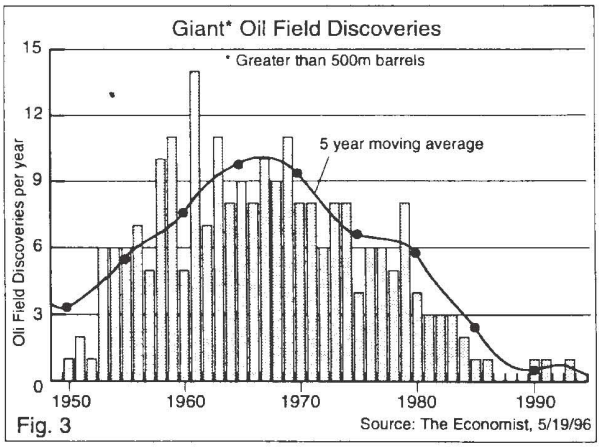


Fig. 3

commercially available (such as the Griggs Hydrosonic Pump™). There are a few more that are in process of becoming commercial such as the *Patterson Power Cell™*; the independently-proven system from BlackLight Power Inc. of Malvern, Pennsylvania (Dr. Randell Mills' invention); and some **planned** (soon to be announced) commercial developments from several other companies, such as Jet Energy Technology in Massachusetts, Labofex in Canada, Morning Star in Ohio, and Fusion Information Center in Utah.

We may be reminded that coal is a part of our energy supply mix and that we have enough coal to last us through the next century. Unfortunately, to build a modern coal-fired power plant to produce electrical energy **and meet all of the anti-pollution requirements of the U.S. Environmental Protection Agency** would increase the cost of electrical power (to as high as 40 cents per kWhr, according to one estimate). Therefore, almost no new coal-fired power plants are under construction in the U.S. However, over twenty such power plants are being planned or are under construction in China with huge amounts of pollution to be produced.

Nuclear power plants are notorious for producing long-term (up to 10,000 years) high-level radioactive wastes. Therefore, there are more nuclear power plants being dismantled in the U.S. than being planned. Fusion power from the highly expensive (and environmentally unsound) hot fusion power plants are not to be expected to be in operation for at least twenty years, **if ever.** However, **Nature's micro-mini Tokamak**, the high-density charge cluster appears ready to emerge onto the new energy stage and take a few bows.

Coming soon to the new-energy pre-commercial stage are the works of Neal and Gleeson in Ohio (radioactive reduction and excess thermal energy), the low-pressure work of Kenneth Shoulders, and the Fox-Jin-Bhadkamkar-Bass developments from Utah. By the end of 1987 you will probably be able to buy new-energy devices (at least to the stage of laboratory testing devices) from BlackLight Power, Jet Technology, Hydro Dynamics, CETI, Morning Star, Fusion Information Center, and probably from companies that we haven't hear of as yet.

Criteria for selection of papers for publication.

The peer-review process is useful to maintain the quality of published papers. Authors have the opportunity to answer appropriate questions and improve their papers. Because one of the major essences of science is to progressively improve scientific models, there is no value in using the peer-review system to perpetuate outmoded models. Therefore, this journal will err on the side of presenting challenging new information rather than to err on the side of maintaining current scientific dogma. In addition, the editor and publisher may choose to print a paper to elicit discussion. Such papers may or may not be peer-reviewed. Papers that are not peer reviewed will be clearly marked as **Editor's choice**. We encourage professional criticism of any papers published by writing letters to the editor.

Hal Fox, Editor.

Journal of New Energy

Volume 2, Number 1

POSSIBILITY FOR SPECIAL RELATIVITY TO BE EXTENDED FOR $v > c$ RELATED WITH VACUUM ENERGY

Petar K. Anastasovski [1]

ABSTRACT

Equations for total and kinetic energies of particles are formulated for a system in which $v > c$, and are applied to neutron-μ-neutrino and proton-muon reactions. The results justify the supposition $v > c$, for certain circumstances of the vacuum, and lead to important applications. The analysis gives new magnitudes which indicate the existence of new vacuum properties including the possibility for the existence of vacuum energy. The final resultssynthesize certain principles of special and general relativity with quantum mass theory of nuclear structures and nuclear reactions.

INTRODUCTION

Special relativity is based on a primary Einstein postulate that velocity of light is the same for all observers in uniform relative motion, i.e., velocity of light in vacuum is constant. Very often, in the literature this postulate is expressed in two other versions. Velocity of light is the ultimate velocity by which interactions in nature can be transferred, or, the velocity of any particle can not be larger than the velocity of light in vacuum, i.e., it is not possible for,

$$v > c \tag{1}$$

The factor,

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{2}$$

taken from the Lorentz transformations is essential in the formulations of the all important equations in the theory of special relativity [1], [2].

According to the principles of special relativity, the presence of the bodies, or more specifically, particles do not influence the space-time continuum [1], [2]. In contrast to this, in general relativity, the presence of bodies in general, and we shall add, the presence of particles too, influence the time-space continuum. In general relativity, c is not constant [3].

In Fig. 1 is presented the curve,

$$\gamma = f\left(\frac{v}{c}\right) \tag{3}$$

The diagram shows that for $v = 0$, $\gamma = 1$, and for $v = c$, $\gamma \to \infty$.

[1]Faculty of Technology & Metallurgy, University "Kiril I. Metodij", Skopje, Macedonia
brand @ lotus.mpt.com.mk or petar @ereb.mf.ukim.edu.mk

According to the special relativity principles, the momentum is expressed by the equation,

$$p = \frac{mv}{\sqrt{1 - \frac{v^2}{c^2}}} = \gamma mv \tag{4}$$

For $v \ll c$, γ =1, the last equation turns into the equation for momentum in classical dynamics, i.e.,

$$p = mv \tag{5}$$

One of the main principles of special relativity is that each particle has energy equivalent to its mass. Thus, a particle with mass m will have equivalent energy [1], [2],

$$E_{total} = mc^2 \tag{6}$$

where,

$$m = \frac{m_0 c^2}{\sqrt{1 - \frac{v^2}{c^2}}} = \gamma m_0 c^2 \tag{7}$$

and m_0 is the rest mass of the particle, which also has equivalent energy,

$$E_0 = m_0 c^2 \tag{8}$$

called rest energy of the particle.

The kinetic energy of the particle is defined by the expression,

$$E_{kin} = E_{total} - E_0 \tag{9}$$

or,

$$E_{kin} = m_0 c^2 \left(\frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} - 1 \right) = m_0 c^2 (\gamma - 1) \tag{10}$$

In all these equations, c is the velocity of light in vacuum, and v is the velocity of the particle.

There are two other main consequences in special relativity connected with factor γ. The first one is, contraction of the length of the body which travels with velocity close to the c, and the second one is, dialation of time for the body in motion. These two consequences of special relativity, although very important, will not be elaborated in this work.

In this work, the theory of special relativity is extended to the region of space where $v > c$ would be possible. There are many experimental proofs which support special relativity, and that justify the main postulate for $v < c$. However, all experimental proofs for the validity of the special relativity principles, have not made the fundamental postulate $v < c$ accepted as a physical law. It still remains a postulate, i.e., assumption.

It is worth mentioning here, that the factor

$$\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$$

which is essential in all principles of special relativity, is taken from Lorentz transformations, and has emerged as a result of the quest for vacuum properties. Also it has to be pointed out, that the main postulate for the ultimate velocity of the traveling particles is connected with the velocity of light in vacuum. These two facts show clearly, that the whole theory of special relativity is based on a supposition for the existence of certain properties of the vacuum. All performed and observed experiments which verify the theory of special relativity, also verify the existence of the supposed vacuum properties.

Vacuum properties which are directly connected with propagation of light in vacuum, are vacuum permeability,

$$\mu_0 = 1.2566 \times 10^{-6}\ mkg\ C^{-2}$$

and vacuum permittivity,

$$\epsilon_0 = 8.8544 \times 10^{-12}\ N^{-1}\ m^{-2}\ C^2$$

These magnitudes are defined by the phenomena in which the charge is traveling in the vacuum. A photon has no charge, however, the light has electromagnetic properties, and therefore these magnitudes determine the conditions for light propagation in vacuum.

According to Maxwell equation, velocity of light in vacuum is,

$$c = \frac{1}{\sqrt{\mu_o \epsilon_o}}$$

This explicitly shows the connection between vacuum properties and special relativity.

It is interesting that vacuum properties are determined and connected only by the properties of the charged particles, and consequently are determined only by the electromagnetic properties of the vacuum. The fact that particles which travel through the vacuum have this very important property (related to mass) is completely neglected.

Our view point is that vacuum should have properties which are connected with the mass of the particles, as well. Reference [4], elaborates such properties of the vacuum.

The main supposition of the theory and analysis presented here is that in addition to the vacuum properties covered by special relativity and corresponding observed phenomena, there exist some other vacuum properties, in addition to the first ones, but which allow the possibility for $v > c$.

For the region of the space, where vacuum properties allow $v > c$, special relativity principles will be extended by modifying the main factor γ into γ'. According to this, assumption for $v < c$, and all special relativity principles are valid only in the range of the space where certain vacuum properties prevail, while, in the region of the space where some other vacuum properties are dominant, it should be possible for $v > c$. This concept will have important consequences to the main physical laws as are conservation laws. The starting assumption in this work is that conservation laws should be preserved in this new system.

The region where factor γ is valid, will be called system γ, and region where factor γ' is valid, will be called system γ'.

Our main task is to try to formulate one of the most important laws in physics, the energy conservation law, in a space where $v > c$ is possible, and to find the connection between two regions of the space, where there are prevailing different vacuum properties. Our task is also to find the magnitudes which will determine the vacuum properties of this new region of the space.

The results of the analysis justify the validity of these new offered hypotheses and suggest performing experiments which will support the presented theory and analysis.

ANALYSIS

As it was stated in the Introduction, we shall assume that when certain vacuum properties prevail, then it must be, [1] [2]

$$v < c$$

and the factor is, [1] [2]

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

When some other properties, which will be defined by this analysis, will be dominant, then it will be possible for

$$v > c \tag{11}$$

and the factor then will be,

$$\gamma' = \sqrt{1 - \frac{c^2}{v^2}} \tag{12}$$

Shown in Fig. 2, are curves, representing both factors, γ and γ'. On the left-hand side of the diagram is presented function,

$$\gamma = f\left(\frac{v}{c}\right) \tag{13}$$

and on the right-hand side of the diagram is presented function,

$$\gamma' = f\left(\frac{c}{v}\right) \tag{14}$$

The ordinate for both curves is mutual and represents γ and γ', respectively. The abscissa on the right-hand side represents the values of v/c, while on the left-hand side the values of c/v. For $v = c$, both factors have the same value,

$$\gamma = \gamma' = 1 \tag{15}$$

Even on the first glance it is obvious that curves of both functions, plotted in two separate systems, actually form one curve, which in continuity, starting with

$$\gamma = 0 \tag{16}$$

for the value,

$$v = c \tag{17}$$

is stretching to the end of the other curve, where now for

$$v = c$$

it is,

$$\gamma \rightarrow \infty \tag{18}$$

The value

$$\gamma = 0$$

for,

$$v = c$$

in the system where $v > c$ is possible, is very important, because it should have many consequences in physics. Before we elaborate the concept, we have to first formulate the equation for momentum and the equation for energy, equivalent to the mass in this new system.

The momentum now is expressed by the equation,

$$p = m\,v\,(1 - \gamma') \tag{19}$$

or,

$$p = mv\left(1 - \sqrt{1 - \frac{c^2}{v^2}}\right) \tag{20}$$

Thus, the angular momentum is,

$$L = m\,v\,r\,\gamma' \tag{19a}$$

or,

$$L = mvr\left(1 - \sqrt{1 - \frac{c^2}{v^2}}\right) \tag{20a}$$

The total energy equivalent to the mass m, is now defined by the equation,

$$E_{total} = mc^2\,M_c \tag{21}$$

where,

$$m = m_0\,\gamma' = m_0\sqrt{1 - \frac{c^2}{v^2}} \tag{22}$$

hence,

$$E_{total} = m_0\,c^2\,M_c\sqrt{1 - \frac{c^2}{v^2}} \tag{23}$$

The rest energy of the mass is,

$$E_0 = m_0\,c^2\,M_c \tag{24}$$

where,

M_c - is newly introduced constant which connects energy magnitudes of system γ and γ';

m_0 - is rest mass of the particle, and
v - is velocity of the particle in the system γ'.

Now, kinetic energy of the particle can be defined by the expression

$$E_{kin} = E_0 - E_{total} \tag{25}$$

or,

$$E_{kin} = m_0 c^2 M_c \left(1 - \sqrt{1 - \frac{c^2}{v^2}} \right) \tag{26}$$

The last two equations (25) and (26), show that total energy equivalent to the mass m, is smaller in system γ' than the rest mass in the system γ.

Constant M_c plays very important role in this theory, because in the equation of the system for $v > c$, it establishes the correlation between the magnitudes of the both systems. By the analysis, the definition of this magnitude and its value, are found.

It has been found that,

$$M_c = 0.8 \frac{\lambda_{cp}}{\lambda_{ce}} = 4.35 \times 10^{-3} \tag{27}$$

where,

$$\lambda_{cp} = \frac{h}{m_p c} = 1.3214 \times 10^{-15}\, m \tag{28}$$

is Compton wavelength of the proton and

$$\lambda_{ce} = \frac{h}{m_e c} = 2.4262 \times 10^{-13}\, m \tag{29}$$

is Compton wavelength of the electron, where h is Planck's constant.

Thus, the constant M_c now can be expressed by the equation,

$$M_c = 0.8 \frac{m_e}{m_p} = 4.35 \times 10^{-3} \tag{30}$$

where, m_p - is the rest mass of the proton and
m_e - is the rest mass of the electron.

By Eq.(27), the M_c determines certain range of the space, between two limits, γ_{cp} and γ_{ce}, while by the Eq.(30) the same space is characterized by the ratio of the proton and electron rest masses.

If we connect constant M_c with velocity of light, then a new important constant emerges,

$$M_c' = M_c c^2 = 3.915 \times 10^{14}\, (m/s)^2 \tag{31}$$

This constant with dimension of $(m/s)^2$ determines the vacuum properties in the system where $v > c$ is possible.

Constant M_c' connects two systems γ and γ', and by that shows that these two systems are not two separate worlds with two different physics. First of all, it shows that in both systems physical laws are valid, for instance, the energy conservation law, and secondly, it also shows that in the same space may be either system γ or system γ', only depending on which vacuum properties prevail in certain situations.

Discussion for $\gamma' = 0$

Diagram on the Fig. 2 shows that for system γ', in which $v > c$ is possible,

for, $$v = c$$

the factor is,

$$\gamma' = 0 \tag{32}$$

According to the Eqs. (22) and (23) $\gamma' = 0$, implies that the mass of the particle in such case disappears, the mass is annihilated. Before making an attempt to explain what may happen with energy equivalent to the mass of the particle, in this hypothetical phenomena, it is necessary to say something about contemporary comprehension of the vacuum.

There are many references with reported theoretical and experimental results which indicate new properties of the vacuum, and the possibility for the existence of vacuum energy. It is not our intention to make a comprehensive review of such references, however, we need to cite at least two references related to this question. The first one is about vacuum properties [4] and the second is about vacuum energy [5].

In the Summary of the reference [5] entitled, "The Potential of the Vacuum Energy", it is stated: "Loopholes in the Law of Conservation of Energy (if based on an empty vacuum) have been realized by many new energy researches." We shall elaborate two important questions which arise from this sentence.

The first question is: How is the vacuum defined, according to the valid theory and is there an "empty vacuum", because the phrase implies a "not empty vacuum"? In the Ref. [6], the next definition for the vacuum is given: "Fock space contains all the states with an arbitrary number of particles as well as the state in which there is no particle present. This latter state is referred as *vacuum*." This definition for vacuum completely correspond to the definition of the classical physics, but only if a particle is understood as an object with mass. This is so, because according to kinetic theory of gases in a confined space, as it is in gas container, the pressure is defined by the number of particles pounding of the walls of the container. Photons and particles with no mass cannot produce such an effect which can be registered by a vacuum meter.

Hence, if there is no particle with mass in such a confined space, there is now pressure but it can not be considered as an "empty space". Because the term "particle" according to the contemporary comprehension has much broader meaning, the same confined space is not "empty" if there are massless objects of the matter, and consequently such vacuum is not empty. However, even when a confined space is without massless objects and without objects with mass, still this vacuum is not void, because it has certain properties. The reference [4] we cite here, treats that problem.

There is another interesting sentence from Ref. [5], referring to this question. It states: "But we know that the vacuum is not empty by a long shot."

That the vacuum is not void and that it has certain properties, is shown by theoretical and experimental results presented in Ref. [4]. In this reference are presented experimental and theoretical data which show what are the vacuum properties for distance between particles,

$$r > \frac{h}{m_e c} = \lambda_{ce} \tag{33}$$

In Ref. [4], is presented Quantum Mass Theory (QMT), by which, among the other things, are offered two new principles: mass conservation principle and mass quantization principle. This concept is not in conflict with the theory presented here, because QMT is valid in the system where $v < c$.

The references we have presented here, suggest the necessity to make a distinction between: vacuum as a space without particles either they are with mass or are massless, and the space which has certain properties even when there are no objects at all. According to this, the vacuum in any circumstances is not void. The term "empty vacuum" would imply the possibility the vacuum to be considered as a space without any physical properties at all.

The work here presented elaborates the possibility for the existence of certain vacuum properties of the certain part of space determined by the distances between particles, as it is given,

$$\lambda_{cp} < r < \lambda_{ce}$$

The second question from the first sentence of the Ref.[5], arises from the statement that new findings about properties of the vacuum and especially the vacuum energy are possible, because of "Loopholes in the Law of Conservation Energy". Our view is completely opposite: new discovered vacuum properties will make it possible to comprehend the hypothetical existence of vacuum energy, but only by preserving the energy conservation law. It is not justified to expect to have an energy balanced equation which will fulfill the energy conservation law, if we do not know all forms of energy participating in certain phenomenon. Consequently, if we do not know the corresponding magnitudes which represent some of the participants in a certain process, they will not be included in energy balance equation, and it is quite natural that it will not correspond to the energy conservation law. Thus, if we do not know the magnitude which represents the vacuum energy in the newly observed experiments, we can not use energy balance equation. Therefore, it is not justified to claim that energy conservation law is not valid, in the newly observed experiments.

In our statements, we shall try to prove when the new formulated equations for energy in the system γ', obtained by the presented analysis, will be applied to certain examples.

Before we do that, we still feel the necessity to explain our viewpoint about conservation laws described above.

If the new model for the molecule, atom or even nucleus, is accepted, it is still not a new physics. However, if some of the fundamental laws of the physics are canceled, like conservation laws, then it would be entirely new physics. Therefore, this presented theory and analysis is an attempt to extend the principles of special relativity by preserving the conservation laws.

Now, we may return to the result of the analysis, that in system γ', for $v = c$ the mass of the particle vanishes, i.e.,

$$m = 0.$$

Keeping in mind that energy conservation law should be preserved, it seems that there are four possible alternatives what could happen with energy of the vanishing mass of the particle. The essential assumption is that energy equivalent to the vanishing mass of the particle, should transfer into other forms of energies. Here are those four alternatives:

1. The disappearance of the mass of the particle may result in photon emission, hence,

$$E_{total} = mc^2 = \sum h\nu \tag{34}$$

The total energy of the particle will be equal to the sum of the energies of all kind of emitted photons.

2. Transmutation of the particle with mass m into massless particles, such as are neutrino and antineutrino, will be presented by the next expression,

$$E_{total} = mc^2 = E_\nu + E_{\bar{\nu}} \tag{35}$$

Where E_ν is energy of all emitted neutrinos and $E_{\bar{\nu}}$ is the energy of all emitted antineutrinos.

3. If the mass which disappears is from the charged particle, the charge will be preserved. All derived equations in the analysis do not include the charge, consequently, the charge conservation law is preserved as well. Therefore, it should be assumed that the possibility of transmutation of a particle with mass and charge into a massless charged particle [2]. Hence,

$$E_{total} = mc^2 = E_e \tag{36}$$

where E_e stands for the energy of the massless particle with charge.

4. Because there are many reported experimental and theoretical results about new vacuum properties and especially about the possibility for existence of vacuum energy, there are two additional possibilities what might happen with energy of the vanishing mass of the particle:

Firstly: If the vacuum is defined as a part of space where there are no particles with mass, but where there may be present all other massless objects from the microworld, including all kind of physical fields, then such space will contain the energy of all massless objects plus the energy of the physical fields. So comprehended, the vacuum will have vacuum energy expressed by the equation,

$$E_{total} = mc^2 = E_\nu + E_h \tag{37}$$

[2] The possibility of the existence of a particle with charge but without gravitational mass is predicted by Einstein in 1936. See Ref. [7].

where, E_v - is energy of massless objects, and
E_h - is energy of physical fields.

Secondly: If vacuum is comprehended as space without any kind of particles, with and without mass, and where are not present any kind of physical fields, still it has its own physical properties, and consequently its intrinsic vacuum energy. Thus, we may assume two possibilities:

a) part of the total energy of the vanished mass to be transferred to the massless particles and physical fields, and part of it into magnitude which we would call, ***intrinsic vacuum energy***.

This case may be expressed as

$$E_{total} = mc^2 = E_v + E_h + E_{vi} \tag{38}$$

where E_{vi} stands for *intrinsic vacuum energy*;

b) the possibility that the total energy of the particle is to be transferred to the *intrinsic vacuum energy*, i.e.,

$$E_{total} = mc^2 = E_{vi} \tag{39}$$

The last item suggests the possibilities for the reverse phenomenon: the vacuum energy to be transferred to other forms of energy, what is certainly of particular practical interest.

EXAMPLES OF PARTICLE REACTIONS

We shall try to apply our theory and obtained equations from the analysis, to the imaginary phenomena, which are very close to the real ones, because it will be based on real reactions. We shall use two fundamental reactions that underlie the nuclear structure, in which are presented the weak interactions of nucleon an lepton fields.

The first reaction is absorption of μ^- neutrino by neutron, with result of emission of muon and proton [6]:

$$n + \nu_\mu \rightarrow p + \mu^- \tag{40}$$

The second reaction is reverse to the first one, i.e., when proton capture muon and result is neutron and μ^- neutrino [6]:

$$p + \mu^- \rightarrow n + \nu_\mu \tag{41}$$

Where, in both expressions,

n - is neutron,
ν_μ - is μ^- neutrino,
p - is proton and
μ^- - is muon.

The muon decay is,

$$\mu^- \rightarrow e^- + \nu_\mu + \overline{\nu_e} \tag{42}$$

Where,

e^- - is electron,

ν_μ - is μ^- neutrino, and

$\overline{\nu_e}$ - is electron antineutrino.

The muon mean life is

$$T = 2.2 \times 10^{-6} \text{ sec} \tag{43}$$

Reaction No. 1

Neutron absorption of μ^- neutrino and neutron decay into proton and muon, [6]

$$n + \nu_\mu \rightarrow p + \mu^- \tag{44}$$

The energy of μ^- neutrino is, [6]

$$E_\nu < 1.6 \text{ MeV} \tag{45}$$

thus, in this case we shall take,

$$E_\nu = 1.5 \text{ MeV} \tag{46}$$

The energy of the neutron which has absorbed μ^- neutrino is,

$$E_{n\nu} = E_n + E_\nu = 941.05 \text{ MeV} \tag{47}$$

The mass of this neutron would be,

$$m_n' = 1.6744 \times 10^{-27} \text{ kg} \tag{48}$$

The mass of μ^- neutrino is,

$$m_\nu = 2.67 \times 10^{-30} \text{ kg} \tag{49}$$

The muon has energy, [6]

$$E_\mu = 106.6599 \text{ MeV} \tag{50}$$

and its mass is,

$$m_\mu = 1.8985 \times 10^{-28} \text{ kg} \tag{51}$$

We shall consider phenomenon in which, because of action of nuclear forces, neutron and proton will rotate. Neutron will rotate in one circle, and proton will rotate in another circle with another radius.

Let us assume that neutron will rotate in a circle with radius,

$$r_n < \frac{1}{2} \lambda_{ce} \tag{52}$$

where λ_{ce} is Compton wavelength for electron. Thus we shall take,

$$r_n = 1.3 \times 10^{-13} \text{ m} \tag{53}$$

Tangential velocity of the neutron will be

$$v_n = 1.4 \times 10^7 \; m/s \tag{54}$$

and its kinetic energy then is,

$$E'_{kn} = m'_n c^2 \left(\frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} - 1 \right) \tag{55}$$

where,

$$m_n' = m_n + m_v \tag{56}$$

thus,

$$E_{kn}' = 1.0223 \; MeV \tag{57}$$

According to the Eq. (44) this neutron will decay into proton and muon.

Let us assume, that nuclear forces will make proton and neutron to rotate in circle with same radius, i.e.,

$$r_p = r_\mu > \frac{1}{2} \lambda_{cp} \tag{58}$$

where,

$$\lambda_{cp} = 1.3214 \times 10^{-15} \; m \tag{59}$$

is the Compton wavelength of the proton.
We shall take,

$$r_p = r_\mu = 2 \times 10^{-15} \; m \tag{60}$$

The tangential velocity of the proton is,

$$v_p = 5.45 \times 10^8 \; m/s \tag{61}$$

and tangential velocity of muon is,

$$v_\mu = 3.13 \times 10^8 \; m/s \tag{62}$$

It is obvious that,

$$v_p > c \tag{63}$$

and also,

$$v_\mu > c \tag{64}$$

Therefore for this phenomenon we shall apply relativistic equation (26) for kinetic energies of the proton and muon, because they are in the system γ'.

The kinetic energy of the proton is,

$$E_{kp} = m_{po} c^2 M_c \left(1 - \sqrt{1 - \frac{c^2}{v^2}} \right) \tag{65}$$

which yields,

$$E_{kp} = M_c \; 155.157 \; MeV \tag{66}$$

The kinetic energy of the muon is,

$$E_{k\mu} = m_{\mu} c^2 M_c \left(1 - \sqrt{1 - \frac{c^2}{v^2}} \right) \tag{67}$$

what yields,

$$E_{k\mu} = M_c \, 76.17 \, MeV \tag{68}$$

The sum of proton and muon kinetic energy gives,

$$E_{kp\mu} = E_{kp} + E_{k\mu} = M_c \, 231.327 \, MeV \tag{69}$$

or,

$$E_{kp\mu} = E'_{kp\mu} M_c \tag{70}$$

The gain of the kinetic energy in the described reaction with phenomenon of rotation of the particles, is a result of the action of the nuclear forces which cause these particles to rotate.

Our initial viewpoint was, that conservation laws should be preserved. By using momentum conservation law, are determined tangential velocities of the particles in the second circle with radius r_p. The same procedure will be conducted in the next reaction, therefore, we may conclude that the momentum conservation law is already included. However, our main task is to show that energy conservation law is valid for both systems, γ and γ', and that magnitudes which are in these two systems can be connected by certain constant.

Supposition that,

$$E'_{kn} = E_{kp\mu}$$

or,

$$\frac{E'_{kn}}{E'_{kp\mu}} = M_c \tag{71}$$

yields,

$$M_c = 0.8 \frac{\lambda_{cp}}{\lambda_{ce}} = 4.38 \times 10^{-3} \tag{72}$$

The Eq.(71) becomes,

$$E_{kn}' = M_c \; E_{kp\mu}' \tag{73}$$

or,

$$E_{kn}' = 0.8 \; \frac{\lambda_{cp}}{\lambda_{ce}} \; E_{kp\mu}' = E_{kp\mu} \tag{74}$$

The last equation shows that by taking into account constant M_c, the energy conservation law is preserved. Eq.(72) shows that constant M_c is determined by two magnitudes λ_{cp} and λ_{ce}, which actually determine the space where the imagined phenomenon is taking place. This constant does not depend on the structure of the nucleus nor on the nuclear forces. It depends only on the magnitudes which determine the part of the space where given reaction and rotation of the particles is taking place.

There are two questions which arise from these results of the analysis.

The first question is: How is it possible the increase of the kinetic energy of the particles in the system γ', to be expressed only by magnitudes λ_{cp} and λ_{ce}, which actually determine only the range of the space where the whole phenomenon is taking place?

The second question arises from the diagram of the Fig. 2, if it is arranged as it is presented on the Fig. 3. The question is: How can the particle with $v < c$ in the system γ overcome the barrier

$v = c$, and achieve the velocity $v > c$, in the system γ' ?

In the results obtained for the first reaction, we have to verify to another reaction, before we try to answer the first question. Therefore we shall try to answer the second question first.

In our analysis we have seen that, the neutron at the beginning of the reaction has velocity,

$$v_n < c$$

while the particles emerging from the reaction, proton and muon have the velocities,

$$v_p > c \qquad \text{and} \qquad v_\mu > c\,.$$

On the Fig. 3, the curve of the function,

$$\gamma = f\left(\frac{c}{v}\right) \tag{75}$$

shows that for $c = v$, $\gamma \to \infty$, while the curve of the function,

$$\gamma' = f\left(\frac{c}{v}\right) \tag{76}$$

for $v = c$, gives,

$$\lambda' = 0\,.$$

The question was, how can a certain particle overcome the barrier $v = c$ in its transition from the system γ, into the system γ' ? For one particle to overcome the barrier $v = c$ means the mass of the particle first has to reach the value $m \to \infty$ in the system γ, which is impossible, and even if that happens, should drop instantly to the value $m = 0$. If there is any phenomenon in the nature which is at least close to this one, it would be necessary to find out what are the properties of both systems, in the sections where they are interconnecting, in order to explain it.

The phenomena we are considering, does not include such a situation, i.e., the particles of the system γ are not the same with particles of system γ'. It means there is not such a particle which has to overcome the barrier $v = c$.

In the system γ, before the reaction takes place, there is neutron with $v < c$. As a result of the reaction two new particles are emerging and they are in the system γ' with velocities $v > c$. It suggests the possibility that residual particles gain velocities $v > c$, if they find themselves in the system γ'. Because the system γ' is determined by certain dimensions of the space by the magnitudes λ_{cp} and λ_{ce}, these particles will be brought to the system γ' by the nuclear forces. All these also suggest that this part of space has such properties which allow these kind of transmutations and transitions.

It is worthwhile mentioning another phenomenon here. A photon emitted from electron transition in the atom has velocity c, the velocity of light in vacuum, which is not comparable with the velocity of the electron performing such a transition.

Now, can we specify the circumstances in which such kinds of vacuum properties can be expressed? These circumstances are expressed by the constant M_c which is defined either as,

$$M_c = 0.8\ \frac{\lambda_{cp}}{\lambda_{ce}} \qquad \text{or, as} \qquad M_c = 0.8\frac{m_e}{m_p}\ .$$

In the first version with λ_{cp} and λ_{ce}, M_c determines certain section of the space. However, the second version when M_c is expressed by the ratio of the electron and proton masses, the same part of the space is determined by certain properties of the mass. In other words, the part of the space where the system γ' is determined by M_c, has the properties defined by certain electron and proton properties, that is, by their masses. By this we have come up to very important conclusion: **besides the electromagnetic properties μ_0 and ϵ_0 vacuum has certain properties which are connected to the mass properties of the particles**.

The properties of the space designated as system γ' where is possible $v > c$, are more explicitly represented by the constant with dimensions, i.e.,

$$M_c' = M_c\ c^2 \tag{77}$$

$$M_c' = \frac{m_e}{m_p}\, c^2 \tag{78}$$

$$M_c' = 3.942 \times 10^{14}\ (m/s)^2 \tag{79}$$

By this constant, the properties of the space designated by the system γ' are expressed by a magnitude with dimension $(m/s)^2$. The velocity of light in the system γ' can be determined from this constant. Thus, the velocity of the light in system γ' where $v > c$, is possible

$$c' = \sqrt{M_c'} = 1.98544 \times 10^7\ m/s \tag{80}$$

The obtained value shows that $c' < c$.

The conclusion would be: in the system γ', which is part of space where $v > c$ is possible, is the vacuum with properties connected with masses of the particles. Thus, in the system γ' these properties prevail, over the electromagnetic properties of the vacuum. Therefore, the velocity of light in the system γ' is decreased comparing to its velocity in the system γ, where are dominant electromagnetic properties of the vacuum. Such part of the space, where prevail properties of the mass rather than the electromagnetic properties, the space is occupied by nucleons which constitute the structure of the nucleus.

According to the principles of general relativity [3], velocity of light is not constant, even in vacuum. The velocity of light depends on the distribution of the masses and on the distances between the bodies which produce gravitational fields [3].

According to the general relativity for propagation of the light in vacuum, on distance r from the body with mass m, the velocity of light is, [3]

$$c' \approx c\left(1 - \frac{2\,Gm}{c^2\,r}\right) \tag{80a}$$

where,

G - is gravitational constant,

r - is distance from the center of the body with mass m, and point where the light velocity is observed.

The last expression gives only first approximation of the change of the light in the described circumstances, but it is obvious that,

$$c' < c$$

something what we have obtained by the constant M_c'. This constant determines velocity of light in the space defined by the masses of two particles, proton and neutron.

Eq.(80) derived by the presented theory, determines the velocity of light in the space occupied by the mass of nucleus, and Einstein, Eq.(80a), determines the velocity of light as dependence of the gravitational mass and the distance from that mass. Both equations show that

$$c' < c\,.$$

By this, actually it is shown that general relativity can be applied to the nuclear processes if the principles of the presented theory will be applied. This notion should be thoroughly elaborated because it leads to the conclusion for the possibility, the principles of special and general relativity to be connected by quantum mass theory and applied to the nuclear structures and processes.

The conclusion for this subsection would be: the increase of the kinetic energy of residual particles of the reactions is a result of the action of nuclear forces, but that is possible because of existence of certain vacuum properties defined by the constants,

$$M_c = 0.8\,\frac{m_e}{m_p}$$

and,

$$M_c' = M_c\ c^2$$

To verify the validity of the obtained equations for the system γ' where $v > c$ is possible, and consequently the validity of constants M_c and M_c', we shall analyze another reaction by using those equations and constants.

Reaction No. 2

It would be convenient if we consider reaction which is a reversal to the first one, i.e.,

$$p + \mu^- \rightarrow n + \nu_\mu \qquad (81)$$

In this reaction a proton captures a muon and then the proton decays into neutron and μ^- neutrino.

Proton and muon will be in the same orbit as it is in the first reaction, i.e., they will rotate in a circle with radius,

$$r_p = r_\mu < \tfrac{1}{2}\,\lambda_{ce} \qquad (82)$$

that is,

$$r_p = r_\mu = 1.3 \times 10^{-13}\ m \qquad (83)$$

Their velocities will be the same,

$$v_p = v_\mu = 1.4 \times 10^{7}\ m/s \qquad (84)$$

Hence, kinetic energy of the proton is,

$$E_{kp} = m_{po} c^2 \left(\frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} - 1 \right) \tag{85}$$

which yields,

$$E_{kp} = 1.0212\ MeV \tag{86}$$

Kinetic energy of the muon is,

$$E_{k\mu} = m_{\mu} c^2 \left(\frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} - 1 \right) \tag{87}$$

which yields,

$$E_{k\mu} = 0.11235\ MeV \tag{88}$$

The sum of proton and muon kinetic energies gives

$$E_{k\,p\,\mu} = E_{k\,p} + E_{k\,\mu} = 1.1335\ MeV \tag{89}$$

According to the expression (81), the result of proton-muon interaction is a neutron and a μ^- neutrino. Neutron will rotate in the same second orbit as in the first reaction, with radius,

$$r_n < \tfrac{1}{2}\, \lambda_{cp} \tag{90}$$

that is

$$r_n = 2 \times 10^{-15}\ m \tag{91}$$

with velocity

$$v_n = 4.5335 \times 10^8\ m/s \tag{92}$$

It is obvious that $v > c$, therefore we have to apply here the Eq.(26) for kinetic energy, i.e.,

$$E_{kn} = m_{no} c^2 \left(1 - \sqrt{1 - \frac{c^2}{v^2}} \right) M_c \tag{93}$$

which yields

$$E_{k\,n} = 1.0294\ MeV \tag{94}$$

If we compare the latter value with $E_{k\,p\,\mu}$ of the first part of the reaction, the difference is 10%. The accuracy of 10% is not good. But constant,

$$M_c = 4.38 \times 10^{-3}$$

is determined only by using one reaction. The corrected value,

$$M_c = 4.6 \times 10^{-3}$$

which covers both reactions considered here, gives the accuracy of 4.8%, which can be considered as acceptable.

The necessary time for proton and neutron to complete one circle with radius,

$$r = 1.3 \times 10^{-13}\ m \tag{95}$$

is

$$T = 5.83 \times 10^{-20}\ s \tag{96}$$

Because this time is too short, when neutron is in this orbit, it will not decay before the described reactions are completed.

CONCLUSIONS

The presented theory about the possibility special relativity to be extended in the system γ' where particles may achieve $v > c$, is supported by the results of the analysis which connect both systems: system γ with $v < c$, and system γ' with $v > c$. The analysis is conducted for imagined phenomena, which actually are very close to the existing nuclear phenomena, because the new formulated equations are applied to the real reactions. The possibility for particles to achieve $v > c$, is explained by new proposed vacuum properties, defined by two new constants M_c and M_c'. These constants connect the kinetic energies for particles for both systems, γ and γ', and by that is shown that energy conservation law is preserved. The newly proposed comprehension of vacuum and its properties leads to the possibility of the existence of vacuum energy with the possibility that the phenomena connected with vacuum energy will go in both directions. Namely, it is elaborated how a particle's energy can be transferred to the vacuum energy, but it is very logical, the same process to go reverse, the vacuum energy to be transferred to other forms of energy. This certainly could be of great practical interest: extraction of energy from the vacuum.

How much the imagined phenomena, for which the present analysis is developed, are close to the real nuclear phenomena, will be shown again by comparison of imagined phenomena with nuclear structure of concrete nucleus.

We have considered two reactions: in first one, the residual main particle is a proton and in second one the main residual particle is a neutron. These reactions have been considered separately. Suppose that these particles, proton and neutron, are rotating in the same time, in the same orbit, with the same radius, which has been used in the computation, that is,

$$r_p = r_n = 2 \times 10^{-15}\ m$$

we may suppose that in a certain moment they will reach a distance between each other,

$$d = 4 \times 10^{-15}\ m \tag{97}$$

The system made of these two particles, proton and neutron in the described circumstances, will be with total kinetic energy, obtained as a sum of kinetic energies of both particles, i.e.,

$$\sum E_k = E_{kp} + E_{kn} = 2.26\ \ MeV \tag{98}$$

If we compare these two magnitudes of this imagined proton-neutron system, with corresponding magnitudes for deuteron nucleus, we shall come up to certain conclusions.

In the deuteron nucleus, the distance between proton and neutron is,

$$D_d = 4 \times 10^{-15}\ \ m \tag{99}$$

which is exactly the same distance between the proton and neutron in the imagined system.

The binding energy of deuteron nucleus is,

$$E_{bd} = 2.224\ MeV \tag{100}$$

Comparison of binding energy of deuteron nucleus with the kinetic energy of the imagined proton-neutron system shows difference of 1.6%.

These comparisons should not be understood as an offer for new model of deuteron nucleus, because there are several other magnitudes which characterize deuteron nucleus. However, the similarity between these two structures, the imagined one, and the real one, should not be taken as random occurance either.

We hope, the fact that the theory proposed in this report is supported by the analysis developed for real reactions, as well as the fact, that final results of the analysis are very close to the structure of one concrete nuclear structure will encourage further work on the ideas presented.

The possibility for new fundamental and applicable experiments are obvious.

One of the equations derived by the presented theory and analysis, show that the velocity of light in the vicinity of the nucleus is decreased compared with the velocity of light in vacuum, i.e.,

$$c' < c$$

This result corresponds to the result obtained by the expression of the general relativity for velocity of light is dependent on the distance from the body and its gravitational mass, where also,

$$c' < c$$

This fact indicates the possibility for principles of special and general relativity to be connected by the present theory and by quantum mass theory for nuclear structures and processes.

The immediate task which emerges from all the presented results is to determine the expressions for nuclear forces which would show that the described proton-neutron system is actually the real one.

FIGURES

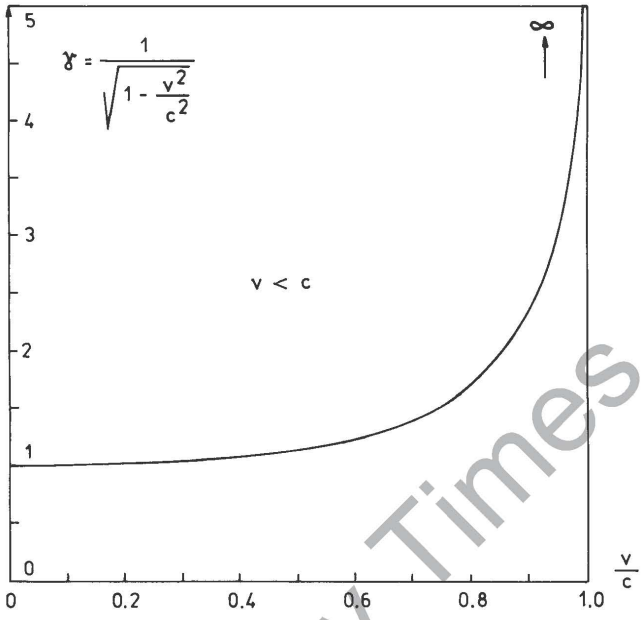


Fig. 1. Curve of the function $\gamma = f\,(v/c)$ in the system for $v < c$.

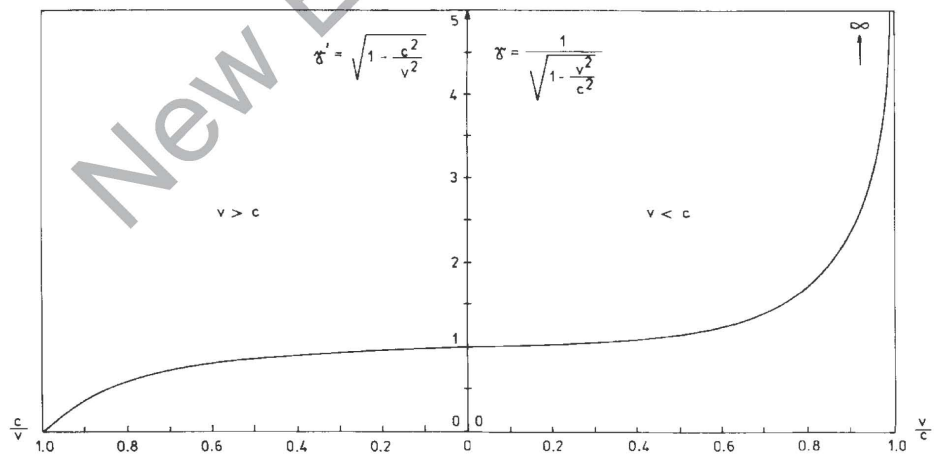


Fig. 2. Curve of the function $\gamma' = f\,(c/v)$ in the system γ' for $v > c$, and curve of the function $\gamma = f\,(v/c)$ in the system γ for $v < c$.

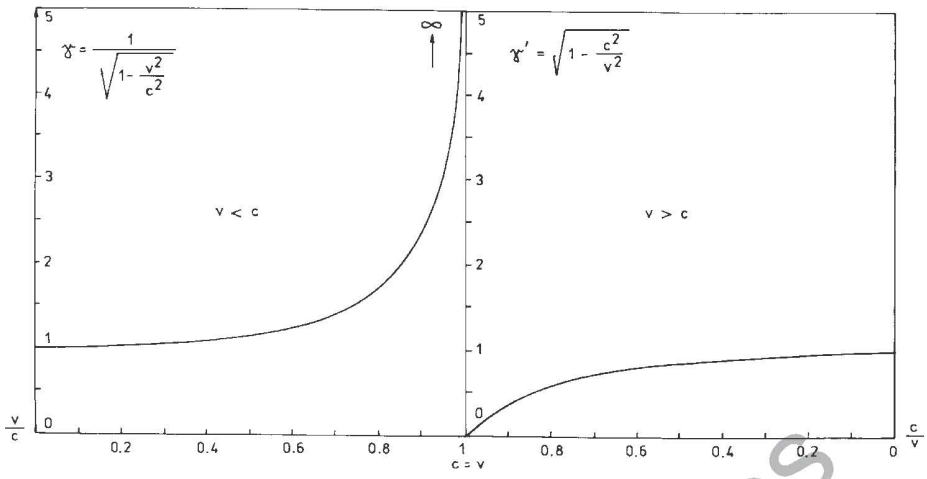


Fig. 3. Curve of the function $\gamma = f(v/c)$ in the system γ for $v < c$ and curve of the function $\gamma' = f(c/v)$ in the system γ' for $v > c$.

REFERENCES

1. Albert Einstein: "Zur Elektrodynamik bewegter Körper," *Annalen der Physik*, vol 17, p 891, 1905.
2. Albert Einstein: "Ist die Trägheit eines Körpers von seinem Energiegehalt abhängen?" *Ann. d. Phys.*, vol 18, p 639, 1905.
3. Albert Einstein: "Grundlage der allgemeinen Relativitätstheorie," *Ann. d. Phys.*, vol 49, p 769-822, 1916.
4. Petar K. Anastasovski and Trevor M. Benson, Quantum Mass Theory Compatible with Quantum Field Theory, Nova Science Publishers, Inc., New York, 1995.
5. "The Potential of Vacuum Energy," *Nexus*, vol 3, no 2, 1996, p 42, reprinted from the *Sunday Telegraph* (London), December 31, 1995, reported in *New Energy News*, vol 3, no 10, April 1996.
6. Amos de Shalit and Herman Feshbach, Theoretical Nuclear Physics, Vol. I: Nuclear Structure, John Wiley & Sons, New York, 1974.
7. Albert Einstein, "Physics and Reality," *J. Franklin Institute*, vol 221, no 3, 1936.

NOTE:

Dr. Anastasovski's super luminal dynamics should follow from his super luminal M(v) and the fundamental definition of energy or work, that is from

$$\int FdS = \int \frac{dMV}{dt}\, ds = \int VdMV = \int V\,(MdV + VdM) = \int MVdV + \int V^2\, dM\,.$$

This is how equation (10) was derived by Einstein.

Vincent Coon

DEUTERIUM NUCLEAR REACTION PROCESS WITHIN SOLID

Yoshiaki Arata, M.J.A., Yue-Chang Zhang [1]

ABSTRACT

In a series of studies, a significantly large amount of helium was clearly detected with a quadrupole mass spectrometer (QMS) as the deuterium nuclear reaction product ("ash") released from the highly deuterated palladium host-solid (Pd-black distributed 0.02~0.06 μm: average 0.04 μm) that had produced large amounts of anomalous excess energy (200 ~ 500 MJ/cm^3) through long periods such as 5000 hrs., when it was heated in a high vacuum ($\simeq 10^{-8}$ torr), high temperature ($\gtrsim$ 1000°C). On the other hand, a simultaneous measurement by another QMS caught a signal of the existence of $^3_2$He, a considerably smaller amount than the $^4_2$He.

In comparable measurements from non-deuterated samples, helium and deuterium were not detected. This means that there exist no well-known Rutherford types as a main reaction product of the deuterium nuclear reactions within a Pd host-solid, and an inherent feature of solid-state with a large valency electron cloud such as Pd presents a condition for a new type of deuterium nuclear fusion reaction which directly produces $^4_2$He as the main reaction product. Because the helium ($^4_2$He, $^3_2$He) was observed only after each sample had been heated in a high vacuum, in each case, the laws of physics require that this helium could not have diffused from any outside source other than the Pd metal sample. Also because helium was observed only after the sample was heated to a relatively high temperature, in each case, it must have been trapped within an interior location of the sample. Because there is no known process that can account for the diffusion of the large amounts of helium into the interior locations of the various samples at the levels that were measured, the only possible explanation for the helium being trapped in this fashion is that it was trapped within each sample after it was first produced within the sample as the nuclear ash from an electrolytically induced (Cold Fusion) deuterium nuclear reaction.

To understand these results, the authors have constructed a theory based upon a coherent process that is believed to be induced in highly deuterated Pd-black crystals. In this theory, it is postulated that Cold Fusion is initiated through the formation of a Strongly Coupled Plasma ("SC-Plasma"), reminiscent of the SC-plasma's that are found within stellar interiors. This postulate is consistent with the assumption that a deuterium nuclear reaction is initiated in a localized zone within a host solid, and it is indispensable that the deuterium be transformed coherently for at least a few picoseconds into a SC-plasma, which the authors refer to as a deuterium "coherent plasma" within the solid-state. It is also postulated that this "coherent solid-state plasma fusion" is initiated through a violent, localized vibration of the lattice, which the authors refer to as a "Latticequake." This "Latticequake" is essentially accompanied with both an intense electromagnetic turbulence and violently shaking electron cloud producing a many-body effect in coherent-state.

[1] Osaka University, 11-1 Mihogaoka, Ibaraki, Osaka 567
[Originally published in *Proc. Japan Acad.*, vol 72, Ser. B, no 9 (1996), pp179-184.]

INTRODUCTION

A deuterium nuclear reaction is a type of plasma fusion that holds great potential for use as a practical power source. As shown in Fig. 1, there are two types of reactions.

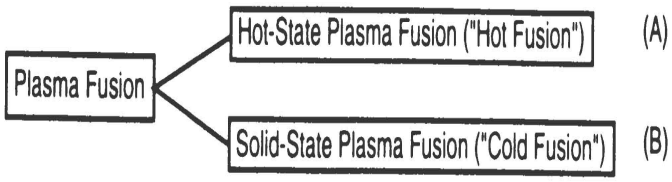


Fig. 1 Plasma fusion in deuterium nuclear reaction
Note: When deuteron-cluster intensively condenses among dense electron cloud within extremely localized zone of the solid, they are coherently transformed dense "deuterium solid-state plasma" for at lease a few picoseconds with the state of strongly coupled plasma. Solid-state plasma nuclear reaction (Cold Fusion) is initiated under such circumstances.

Fig. 1 (A) shows the hot-state plasma fusion ("Hot Fusion") which occurs at extremely high temperatures. Fig. 1 (B) shows the solid-state plasma fusion ("Cold Fusion") which can occur inside a solid at ambient temperature. The authors' basic concept explaining the generation of solid-state plasma fusion [1] is shown in Fig. 2.

"Cold Fusion" has received a dubious reputation both theoretically and experimentally, and the prime reason for its poor reputation is that experiments which have claimed the results of "Cold Fusion" have been virtually non-reproducible. Secondly, the phenomenon was so minuscule that the results were not dependable. The reason that studies of "Cold Fusion" were not taken seriously up to now is that past studies did not satisfy these two critical criteria as shown in Fig. 3. [2,3]

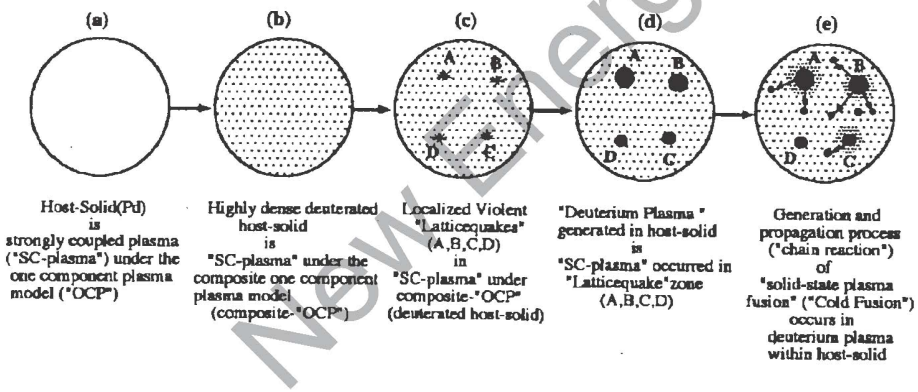


Fig. 2 Concept of Generation Process in "Solid-State Plasma Fusion" Note: Though it seems that a stripped atom (for instance, high energy "helium nucleus") does not make large damages for the host-lattice, it generates violently coherent-shaking electron cloud as a many-body effect and simultaneously causes "Latticequake" for very short time with intense electromagnetic turbulence in coherent-state under deuterium strongly-coupled plasma within extremely localized zone of host-solid as a "deuterium solid-state plasma," irrespective of the host-lattice crushed or not.

The first criterion, Fig. 3 (A), for determining the existence of a nuclear fusion reaction inside solid is that a large amount of energy must be released from highly deuterated solid, and the solid should be heated proportionally to the number of fusion reactions that take place, as shown in many authors' reports [1]. The second criterion, Fig. 3 (B), there must also be large amounts of nuclear fusion products as a "ash" inside the solid, corresponding to the amount of energy generated. There are many reports [4,5] about both known and unknown deuterium nuclear fusion reactions, and Fig.4 shows a deuterium nuclear fusion reaction which produces helium ($^{4}_{2}He$, $^{3}_{2}He$).

The well-known Rutherford type of reactions are shown in Figs. 4 (a1) and (a2) are reproduced in the "Hot Fusion" of Fig. 1 (A). This paper will discuss which reaction from among those shown in Fig. 4 is most representative of "Cold Fusion" in Fig. 1 (B). Rutherford type reaction is obviously two

body collision, where particles which are accelerated by an accelerator collide with a second body or in plasma fusion at an ultrahigh temperature (Hot Fusion).

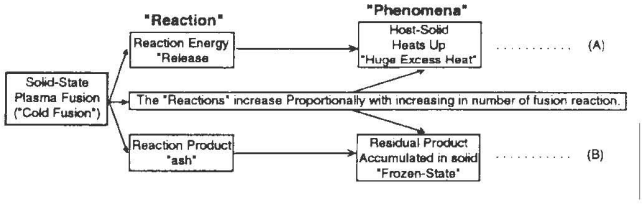


Fig. 3 Two criteria to prove a deuterium nuclear reaction inside a solid.

Note: The first criterion for determining the existence of a nuclear fusion reaction inside a solid is that a large amount of energy must be released from highly deuterated solid, and the solid should be heated proportionally to the number of fusion reactions that take place as shown in Fig. 2(A). The second criterion, there must also be large amounts of nuclear fusion products as an "ash" inside the solid corresponding to the amount of energy generated as stated in the formula in Fig. 2(B).

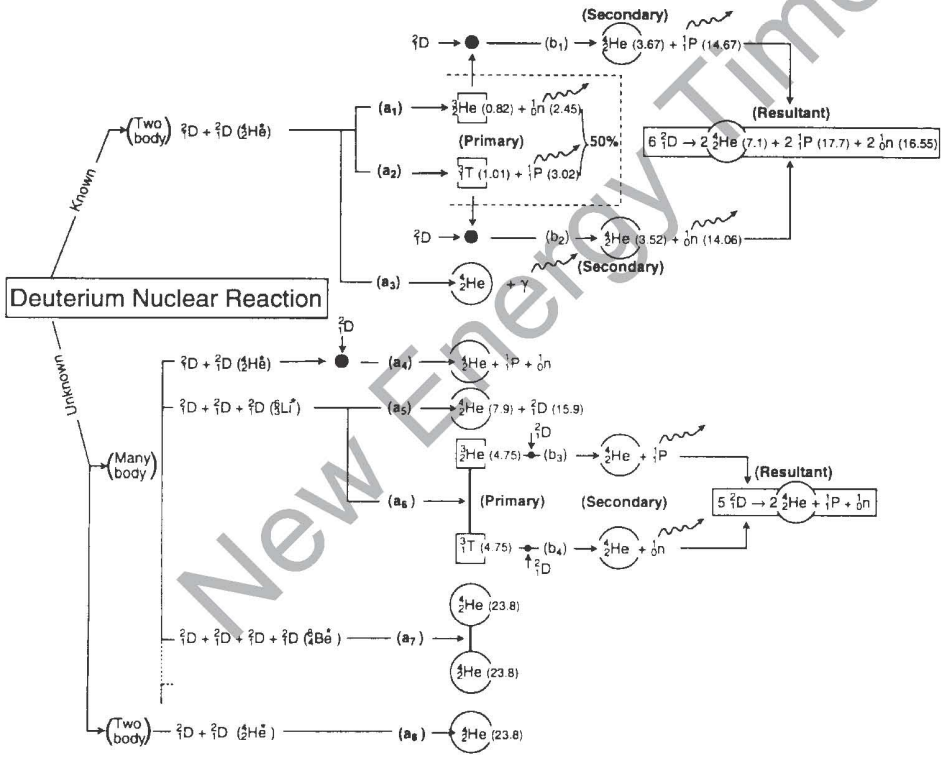


Fig. 4 Many kinds of deuterium nuclear fusion reactions which produce helium ($^{4}_{2}He$, $^{3}_{2}He$) to be considered, irrespective of the "known and/or unknown reactions." Note: Process of deuterium nuclear reaction inside solid is crucially decided when it is clearly elucidated that whether or not $^{4}_{2}He$ and/or $^{3}_{2}He$ exist, or which remains as a larger amount of "residual product" (ash) inside the solid.

If a deuterium nuclear fusion reaction of the well known Rutherford type stated in Fig. 4 occurs, there must exist ($^{3}_{2}He$, $^{3}_{1}T$, $^{4}_{2}He$) and high energy light elements ($^{1}_{0}n$, $^{1}_{1}p$, γ) as reaction products. If the nuclear fusion reaction takes place inside the cathode, the first group will be trapped inside the host solid in a "frozen state" as a "residual product" [6] and the second group will be instantan

eously scattered to the surroundings as an "outgoing product." The amount of the first group increases proportionally to the number of reactions that take place, so detection of this group becomes easier when the excess heat experiment is carried on for many months, and a large amount accumulates inside the host solid. This is a strong indication as to whether or not a nuclear fusion reaction has taken place within the solid.

In this case, if $^4_2$He as main reaction product is clearly detected with less $^3_2$He than $^4_2$He. This means that there exist no Rutherford reaction as a main reaction, and a new type of deuterium nuclear fusion reaction which directly produces $^4_2$He takes place under an inherent feature of solid state.

EXPERIMENT AND DISCUSSION

Proof of a nuclear fusion reaction inside a solid must satisfy the two criteria: First, that the host solid must have continuously created a large amount of excess energy. Second, that there must be "residual products" ("ash") corresponding to the amount of excess energy generated. In other words, in order to achieve the second criterion, using a sample with much excess energy is an indispensable condition. It is well known that many past studies were not taken seriously up to now and did not always satisfy these two criteria.

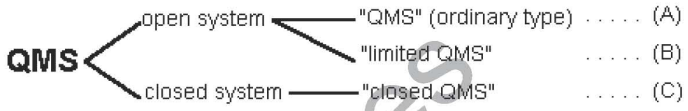


Fig. 5 Three kinds of quadrupole mass spectrometer "QMS" system detecting released helium.

Recently, the authors detected a significantly large amount of helium with a quadrupole mass spectrometer ("QMS") using highly deuterated Pd-black which had produced large amounts of anomalous excess energy (several hundred megajoules) which is the first criterion.

Fig. 5 (A) is the ordinary type, having test gas flowing through QMS zone. Using this system, it is

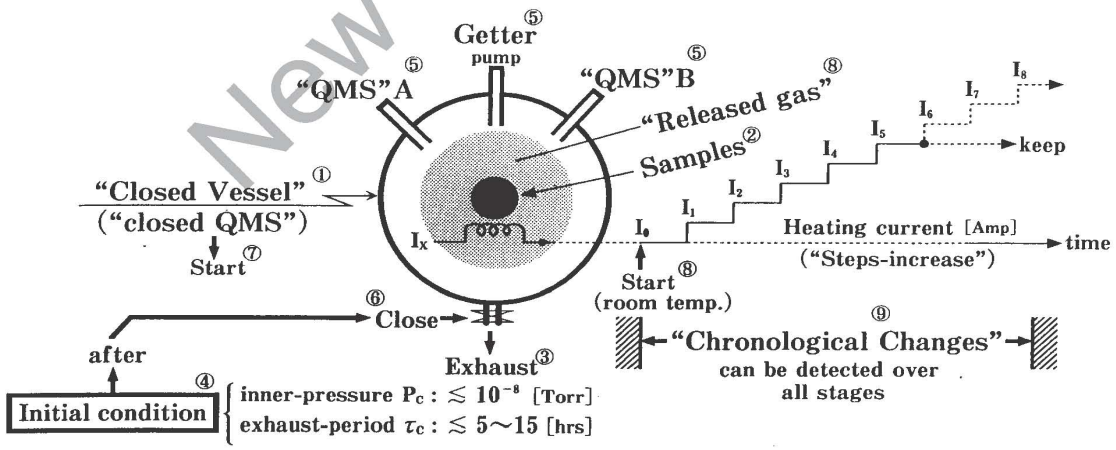


Fig. 6 Principle of "closed QMS." Note: 1) "Released Gas" remains in the sample for any number of days inside "closed QMS," especially **helium.** 2) Repeatedly can detect to reconfirm, at anytime. 3) Chronological change of "released gas" with increased temperature can be perfectly detected. 4) "Getter action:" doesn't work for helium, but strongly affects pollutants such as D_2 (against $^4_2$He), DH (against $^3_2$He), pollutants decreases and disappears in the end. Therefore: the ratio $^4_2$He/ $^3_2$He (if existing), $^4_2$He/D_2 are certainly obtained. Numbers of ① ~ ⑨ indicate the order of "closed QMS" operation.

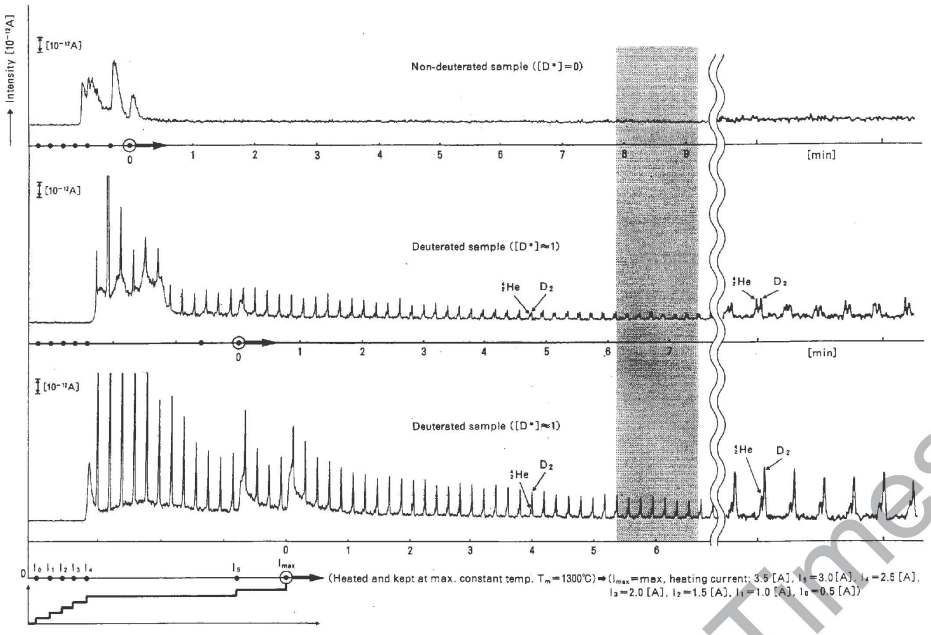


Fig. 7 Typical examples of relation between non-deuterated and two kinds of highly deuterated samples on their "Coupled Spectrum," using "closed QMS." Note: Right side diagrams are restored to original size in a recorder for a left side shadow zone.

Therefore we developed Figs. 5 (B) and (C) "QMS" system, (B) types are fine controlled back pressure of "QMS" to sharply limit a stream of test gas. We called "limited QMS" by which were obtained many important data. Thus, we arrived to final stage: "closed QMS", which is constructed by only a sample vessel, Getter pump and "QMS" as shown in Fig. 6, in other words, "closed QMS" is completely separated from any other system.

Using the "closed QMS" system, authors obtained many different types of experimental data demonstrating crucial proof of existence of "residual helium" as shown in Fig. 7, Fig. 8 and Fig. 9.

extremely difficult to accurately detect "chronological change" which is the most important feature of "released helium." Because this flowing gas system requires much test gas, many pollutants accompany and it can not be eliminated from QMS zone. For this reason, both accuracy and reliability, which are basically the most essential feature of "measurement instrument," would be significantly lowered.

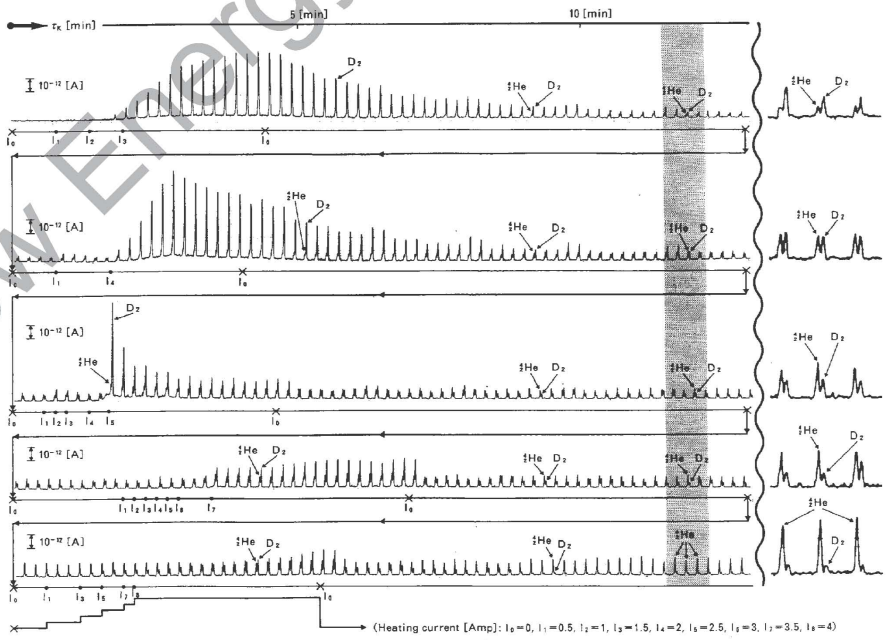


Fig. 8 Chronological change of "Coupled Spectrum" (D_2 : ^4_2He) during gradually heating of highly deuterated sample within "closed QMS" with beginning vacuum condition: ≲ 10^{-8} [torr] during 6 hrs. Note: The right side diagrams are restored to original size in recorder of the shadow zone. ^4_2He in "Couple Spectrum" increases with increased heating current and D_2 decreases. $^4_2He/D_2 \simeq 10^{-2}$ is obtained easily from this data.

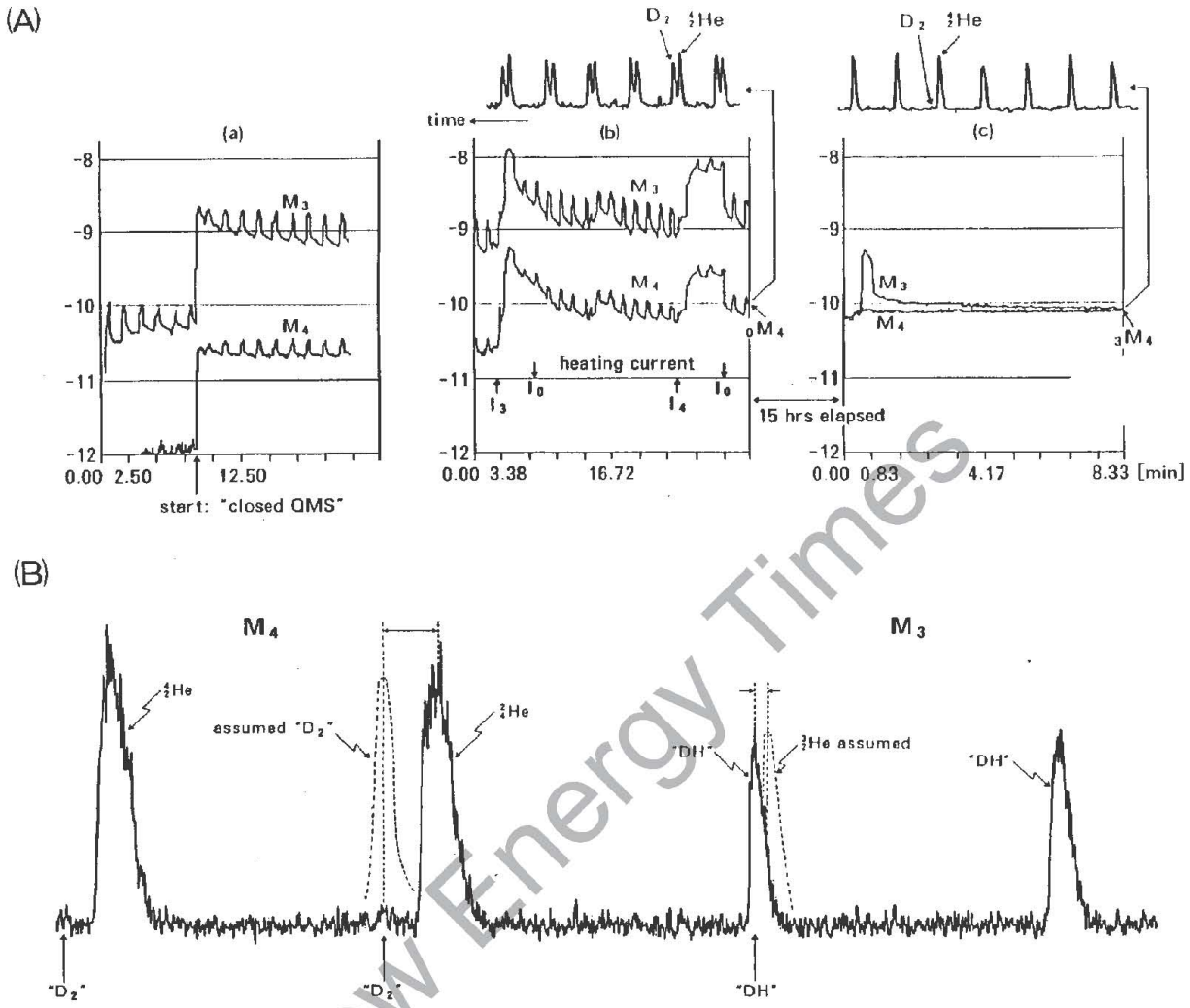


Fig. 9 Chronological change of characteristics of mass M_3 and M_4. Here Mn (= M/e); n = 1, 2, 3, ...
Note 1: (A) shows their intensity change using normal mode and (B) shows their spectrums using high resolution mode at point of ${}_3M_4$ in Fig. 22(A) [sic], and M_4 is almost $^4_2$**He**, M_3 is "DH" ($^3_2$**He** could not be detected in this case, because of too much "DH"). As a result, main reaction product is $^4_2$**He** and this means a new type deuterium nuclear reaction takes place inside the solid due to its inherent feature.
Note 2: Resolution (Re = M/ΔM), Sensitivity (Se = [A]/Torr)
For $^4_2$**He**: "closed QMS" {Re ≈ 39.1 M (12% PH)}; (limit of "QMS" {Re ≈ 37 M (10% PH)}
For $^3_2$**He**: "closed QMS" {Re ≈ 169 M (35% PH)}; (limit of "QMS" {Re ≈ 107 M (10% PH)}
For sensitivity of "closed QMS": high resolution (Se ≈ 0.3 ppt) : normal (Se ≈ 0.003 ppt).

Since Fig. 7 is considerably reduced to clearly display a chronological change in a "coupled spectrum" in which an accuracy is not so likely, the "coupled spectrums" in a shadow zone as shown in left side diagram were restored to original size in a recorder as shown in the right side diagram.

Many samples were measured by "closed QMS" and similar results were obtained with fully reproducible as shown in Fig. 8.

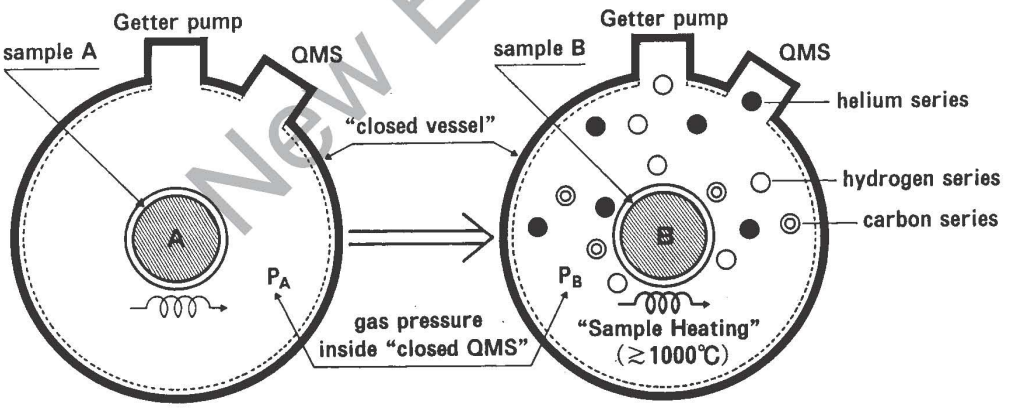
In "closed QMS" experiments, mass M_3 and M_4 were simultaneously detected in detail inside "closed QMS." Fig. 9 shows existence of almost the same quantity of M_3 and M_4; especially at ${}_3M_4$ point as indicated in Fig. 9 (A), and at the same time M_4 is almost ${}^4_2\mathrm{He}$ and negligible D_2. Even if M_3 contains "DH" and ${}^3_2\mathrm{He}$, it can be estimated that "DH" (in other words, ${}^4_2\mathrm{He}$) exists in the majority than ${}^3_2\mathrm{He}$ as shown in Fig. 9 (B). But using improved "QMS, by changing ionization voltage (70 ⇄ 20 V), ${}^4_2\mathrm{He}/{}^3_2\mathrm{He}$ ≃ 4 was obtained when "DH" more significantly decreases than ${}^4_2\mathrm{He}$. If the reaction is a Rutherford reaction, ${}^3_2\mathrm{He}$ must be significantly larger than ${}^4_2\mathrm{He}$ inside "closed QMS."

As a result, it is demonstrated that the first experimentally clear proof of a new type of deuterium nuclear reaction which directly produces ${}^4_2\mathrm{He}$ as a main reaction product, takes place inside the solid.

ACKNOWLEDGMENTS

This study was conducted through a research grant from the Japan Academy. The authors would like to thank Prof. Y. Imai, and Prof. T. Nagamiya, members of the Japan Academy, for their encouragement in this study; Prof. H. Fujita of Kinki University for his comments. ULVAC Japan, Ltd; Mr. K. Yanagishita and CRIEPI; Dr. Y. Asaoka for their help. The staff members of JWRI, Osaka University and Sulzer Meteco, JPN, Ltd; President F. Kawakami for their encouragement.

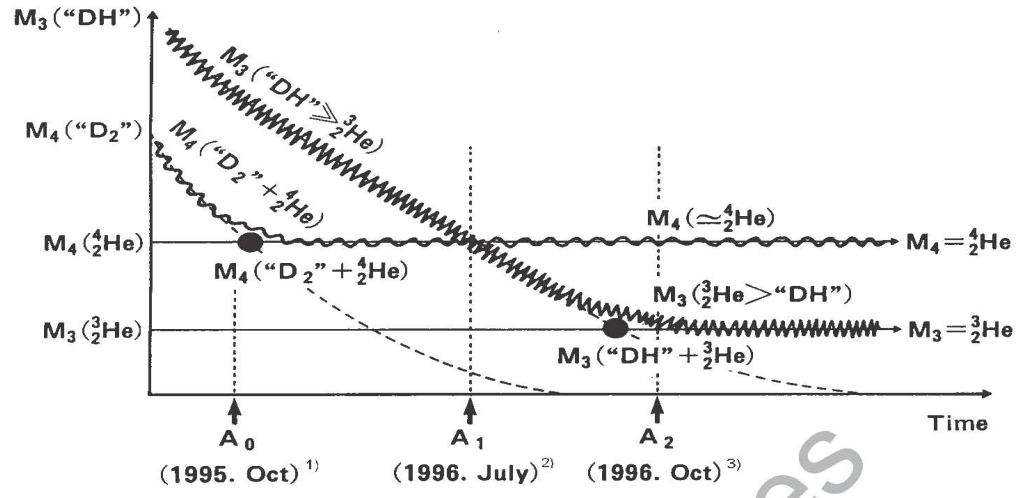
DISCUSSION 1: Crucial inherent characteristic of "Getter action" to detect helium (${}^3_2\mathrm{He}$, ${}^4_2\mathrm{He}$) inside "closed QMS."



(a) "Before-test" condition
{ Initial condition of "closed QMS" before detect ;
P_A : 3×10^{-9} [Torr] during $\tau \simeq 10$ [hr]
under sample A at room temp. }

(b) "During-test" condition
{ sample B : the sample A heated up by "Sample-Heating" (room temp.→1500 [℃]) only.
P_B : Gas pressure of elements released from sample B }

Figure 10.... continued next page.



c) The effect of "Getter-action" on helium (^4_2He, ^3_2He) detection.

Note: Authors reports published as follows
A_0. J. High Temp. Soc., vol 21 (1995), p 303; Proc. Jap. Acad., vol 71(B) (1995), p 304.
A_1. Proc. Jap. Acad., vol 72 (B) (1996), p 179.
A_3. Proc. Jap. Acad., vol 73 (B) (1997), p 1.

Fig. 10 Excellent inherent function of "closed QMS."

Indispensable condition to prove crucially the existence of helium (^3_2He, ^4_2He) within a solid is that the next two stages must be realized as follows,

A) First Stage

The first stage purposes that there exist almost no pollutants inside "closed QMS" under extremely high vacuum state, and the only sample is put in an isolated state inside "closed QMS" under such conditions.

As illustrated in Fig. 10(a), the sample must be confined in isolated state entirely inside closed vessel under ultra high vacuum condition during long time, for instance all the pollutants inside the "closed QMS" are removed thoroughly by Getter pump, and the inner vacuum pressure is balanced with "Getter action" to keep high vacuum state below 3×10^{-9} torr for about 10 hours.

B) Second Stage

The second stage purposes that the elements released from the sample heated by "Sample-Heating" exist in substance inside "closed QMS," and they are measured by "QMS."

As demonstrated in Fig. 10(b), the elements released from the "sample B" which is the same as the "sample A" heated up by "Sample Heating" (room temperature to 1500°C) are measured inside "closed QMS." As the result, "Getter action" doesn't work for helium (^3_2He, ^4_2He), but strongly affects pollutants released from "sample B," and then helium remains in a protected state for any number of days, while the pollutants such as "D2" (against ^4_2He) and "DH" (against ^3_2He) rapidly decrease and disappear as shown in Fig. 10(c). As a result, existence of both ^4_2He and ^3_2He and their ratio

($^4_2$He/ $^3_2$He ≃ 4) were certainly obtained.

In Fig. 10 (c), helium detected at the first time was $^4_2$He under condition at A_0 (Oct. 1995), the second also $^4_2$He at A_1 (July 1996), and at last, $^4_2$He and $^4_2$He, and their ratio ($^4_2$He/ $^3_2$He ≃ 4) were obtained under experimental condition at A_2 (Oct. 1996). Recently, however, as the results of experimental data for several samples, there exist some extended range of the ratio $^4_2$He/ $^3_2$He (≡ [He*]) such as [He*] ≃ 2 ~ 10.)

Using "ordinary QMS" with test gas flowing system, it is impossible to detect with "accuracy" and "reliability" for "residual helium" inside the host solid, because it cannot be achieved beyond the mentioned two stages and moreover a large amount of test-gas is required; it is difficult to get extremely clean test-gas with so much volume.

DISCUSSION 2: Separation Methodology for helium and other pollutants by "Vi-effect" inside "closed QMS" environment.

It is well established that when an applied voltage (V_{app} [v]) on the diverse elements inside "closed QMS" is lower than their ionization potential (V_i [ev]), they cannot be detected by "QMS." For instance, if $V_{app} \lesssim 25$ [v], hydrogen-series (H_2, D_2, DH, . . . ; $V_i \simeq 13.5$ [ev]) can be clearly detected, but helium-series ($^4_2$He, $^3_2$He ; $V_i \simeq 24.5$ [ev]) cannot be detected at all.

This made it possible to separate and clearly distinguish helium and others. If helium exists among the diverse elements released from non-deuterated Pd-black or highly deuterated Pd-black, it can be conclusively confirmed by employing the "V_i-effect", as we have termed the principle mentioned above, within a "closed QMS" environment.

Fig. 11 demonstrates "V_i-effect" curves for non-deuterated sample and highly deuterated sample. In case of non-deuterated sample, both curves M_2 ("H_2") and M_3 ("DH") in a graph (A) coincide entirely with each other as shown in graph (C), but in highly deuterated sample as graph (B), hydrogen-region ($V_{app} \lesssim 25$ [v]) on M_3 curve overlap with M_2 curve, same as the case of graph (C), while in helium-region ($V_{app} \gtrsim 25$ [v]), both curves are considerably separated, shadow zone, as shown in graph (D).

Such separated zone quantitatively corresponds to existence of $^3_2$He. Consequently the ratio [He*] (≡ $^4_2$He $^3_2$He/) ≃ 4 was obtained in this case (graph B), and using many samples the ratio is extended as [He*] ≃ 2~10.

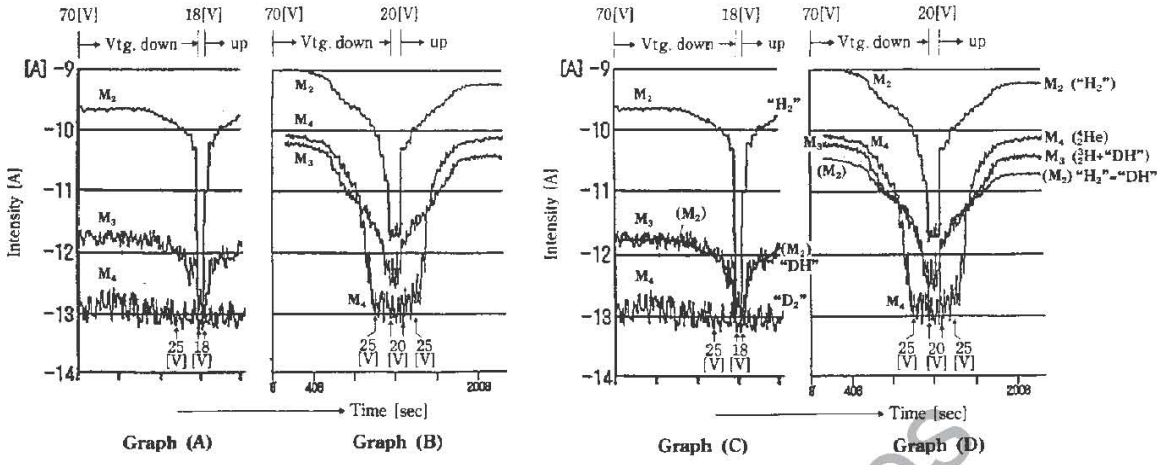


Fig. 11 "V_f-effect" curves for non-deuterated Pd-black (graphs (A) and (C)), and highly deuterated Pd-black (graphs (B) and (D)).

Fig. 11 "V_f-effect" curves for non-deuterated Pd-black (graphs (A) and (C)), and highly deuterated Pd-black (graphs (B) and (D)).

REFERENCES

1. Y. Arata, Y.C. Zhang, *J. Plasma & Fusion Res.*, vol 69 (1993), pp 963-967; *Proc. Japan Acad.*, vol 70B (1994), pp 106-111; *Proc. Japan Acad.*, vol 71B (1994), pp 98-103; *Proc. Japan Acad.*, vol 71B (1995), pp 304-309; *J. High Temp. Soc.*, vol 21 (1995), pp 130-141; *J. High Temp. Soc.*, vol 22 (1996) , pp 29-47.
2. M. Fleischmann, S. Pons, *J. Electroanal. Chem.*, vol 261 (1989), pp 301-308;
3. Proc. ICCF 2, 3, 4 and 5, (1992-1995).
4. A. Takahashi, *J. Nucl. Sci. Tech.*, vol 26 (1989), p 558; J. Kasagi, T. Ohtzuki, K. Ishii, M. Hiraga, *JPS (IPN)*, vol 64 (1995), pp 777-783.
5. T.A. Chubb, S.R. Chubb, *Bulletin of APS*, vol 41 (1996), p 341; *Fusion Tech.*, vol 24 (1993), pp 403-416; *Fusion*, vol 20 (1991), pp 93-99.
6. R.C. Bowman, R.S. Carlson, R.J. DeSando, *Trans. Am. Nucl. Soc.*, vol 24 (1976), p 496; G.C. Abell, L.K. Matson, R.H. Steinmeyer, R.C. Bowman, B.M. Oliver, *Phys. Rev. B*, vol 41 (1990), pp 1220-1223.

ELECTRON CLUSTERS - POSSIBLE DEUTERIUM FUSION CATALYZERS

Dan Chicea [1]

ABSTRACT

A simple model to assess the low energy nuclear reaction rates in an electron cluster, considering a strong screening of the nuclear Coulomb barrier, caused by the high electron concentration, is presented. The very low computed rates support the idea that the nuclear reactions occur at the impact of the cluster with the metal target and that the electron cluster acts like a microscopic particle accelerator. This hypothesis is analyzed by comparing the computed size of the impact crater with the published experimental data concerning the impact of the electron clusters on a metal target.

I. INTRODUCTION

In a recent paper [1] it is stated that the electron clusters, containing 10^8 to 10^{13} electrons, named Electrum Validum (EV) can be produced by electric discharges [2] and can contain embedded positive ions, in a concentration of 1 to 10 positive ions to a million electrons [1], capable of producing nuclear reactions, and named Nuclear Electrum Validum (NEV). The acceleration mechanism of the ions transported by the EV, and accelerated at the same velocity as they were having the same mass as the electrons, is presented in [1]. This mechanism and the nuclear reactions produced by the NEV at the impact with a target are not the subject of this paper.

The electron cluster exhibits a large negative electric charge concentration, therefore an intense electric field must be present inside it. A simple model will assume the EV to be a sphere, while a more developed model will consider it to be a toroid, perpendicular on the direction the velocity, stable for certain range of values for its parameters, as it is presented and explained in the theory paper [3].

In the next section a simple model for the electric field and potential distribution inside a EV is presented, considering both the spherical and the toroidal shape for the EV.

II. THE ELECTRIC FIELD AND POTENTIAL DISTRIBUTION

If a spherical shape for an EV is considered, having the radius R = 0.5 μm and the total number of electrons of $N = 10^{11}$ [4], then the electron concentration n can be calculated as:

$$\frac{4\pi}{3} R^3 n = N \qquad (1)$$

and will lead to $n = 1.9 \times 10^{29}$ m^{-3}, a value which is higher than the concentration of "free electrons" in palladium, which is 6×10^{28} m^{-3}. This value of 1.9×10^{29} m^{-3} is considered in this article to stand for the concentration of electrons in an EV, for both spherical and toroidal shape.

If a spherical shape is considered, the electric field distribution inside the EV can be easily found

[1] Phys. Dept., Univ. “Lucian Blaga” of Sibiu, Romania

using Gauss' law; E, the electric field intensity, can be described as:

$$E = \frac{\rho r}{3\varepsilon_0} \quad \text{where} \quad \rho = ne \tag{2}$$

The electric potential inside the EV can be found easily as:

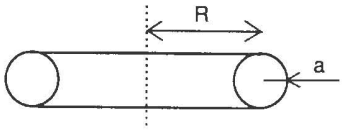
$$\Phi = -\int \bar{E} \cdot \bar{dl} = \frac{\rho r^2}{6\varepsilon_0} + C \tag{3}$$

where C is determined from the border conditions. The electric potential difference between the center and the edge of the EV will be:

$$\Delta\Phi = \frac{\rho R^2}{6\varepsilon_0} = \frac{1}{2}\frac{Q}{4\pi\varepsilon_0 R} = 142 \times 10^6\, V \tag{4}$$

In (4), Q stands for the total electric charge of the cluster, $Q = Ne$.

If a toroidal shape for an EV is considered, like in [3], and assuming that the electron concentration n has the same value, the external radius R and the total number of electrons N are the same, we can asses the transversal radius a from:



$$2\,\pi\,R\,\pi\,a^2\,n = N \tag{5}$$

The electric field distribution inside the EV can be found using Gauss' law for a cylindrical surface, with the assumption that $a << R$; E can be estimated as:

$$E = \frac{\rho r}{2\varepsilon_0} \tag{6}$$

The electric potential inside the EV can be found from:

$$\Phi = -\int \bar{E} \cdot \bar{dl} = \frac{\rho r^2}{4\varepsilon_0} + C \tag{7}$$

The electric potential difference between the axis and the edge of the toroidal EV will be:

$$\Delta\Phi = \frac{\rho a^2}{4\varepsilon_0} = \frac{1}{2\pi}\frac{Q}{4\pi\varepsilon_0 R} = 45 \times 10^6\, V \tag{8}$$

The electric field is strong enough to collect the positive ions in the core of the EV [2]. The high

[2] See S.X. Jin's comments.

electron concentration in the EV can act as a "screen" for the Coulomb barrier encountered by a positive ion when approaching another one. In section III, a simple model to describe the screening and to assess the nuclear reaction rate of the deuterons contained by an EV is presented.

III. DEUTERIUM NUCLEAR REACTION RATE IN AN EV

In order to assess the screening effect, we remember that when in a plasma, as a result of a fluctuation, a displacement of the electrons from the layers of positive ions occurs, the size of the displacement can be obtained from the equality of the electric potential energy with the thermal energy. The size of the displacement is called the Debye length and is given by [5]:

$$l_D = \sqrt{\frac{\varepsilon_0 k T}{n_0 e^2}} \tag{9}$$

and the electric potential energy between two positive ions in a plasma, having the electric charges $Z_1 e$ and $Z_2 e$ and be described as:

$$V(r) = \frac{Z_1 Z_2 e^2}{4 \pi \varepsilon_0 r} \exp\left(-\frac{r}{l_D}\right) \tag{10}$$

where ε_0 is the vacuum electric constant, n_0 is the electron and the positive ion concentration as well, k is the Boltzman's constant and T the temperature.

The screening described by [12] is valid for almost all type of plasmas, except the very low density interstellar plasma, as stated in [6], therefore we consider this kind of strong screening to describe the effective interaction potential of two approaching deuterons, in the core of the EV.

If we consider dR to be the number of nuclear reactions per volume unit and time unit, for the incident deuterons $n(v)$ having the velocities in an interval dv, centered on v, then dR can be described as:

$$dR = N_t \, n(v) \, dv \, \sigma(v) \, v \tag{11}$$

where n_t is the concentration of the target deuterons. As the deuterons will be conducted by the strong electric field toward the center of the EV, a realistic hypothesis would be to consider them not uniformly distributed in the whole volume, but forming a rather neutral plasma in the core of the EV, so n_t might be considered to have the magnitude of the deuteron concentration trapped in a metal's lattice. For the simple assessment which has been performed, a value of 6.25×10^{28} m^{-3}, which is the concentration of the deuterons trapped in the palladium lattice, for a loading factor close to 1, and 1.9×10^{29} m^{-3}, which is the deuteron concentration in the core of the EV, in the simple assumption that they form a neutral plasma (only in the core of the EV), have been considered.

Furthermore, we can consider that half of the deuterons are in the target and half of them are incident on them, hypothesis presented and explained in [7]. The screening length has been computed using the electron concentration. A Maxwell distribution of the deuterons with the velocity has been used for $n(v)$, which is:

$$P_M(v)\,dv = 4\pi\left(\frac{m}{2\pi kT}\right)^{3/2}\exp\left(-\frac{mv^2}{2kT}\right)v^2\,dv \tag{12}$$

where $m = m_d/2$ is the reduced mass of the deuteron pair, so we find:

$$n(v)\,dv = \frac{n_d}{2}P_M(v)\,dv = 2\pi n_d\left(\frac{m}{2\pi kT}\right)^{3/2}\exp\left(-\frac{mv^2}{2kT}\right)v^2\,dv \tag{13}$$

The nuclear reaction cross section can be estimated as in [7]:

$$\sigma = \sigma_0 P_c \tag{14}$$

where σ_0 is a pre-exponential factor of 10^{-24} cm^2 for a nuclear reaction like a(A,B)b and 10^{-30} cm^2 for a nuclear reaction of the kind a(A,B)γ, and P_c is the Coulomb barrier penetration probability.

The factor P_c has been assessed in terms of the W.K.B. approximation, so it is:

$$P_c \approx \exp\left[-\frac{2}{n}\int_{x_1}^{x_2}\sqrt{2m\,(V(x)-E)}\,dx\right] \tag{15}$$

where x_1 and x_2 are the classical turning points. For x_2 the value resulting from $V(x_1) = E$ has been used, while for x_1 the value which triggers the nuclear forces to act has been selected, which can be a value between 2 and 5 fm, as stated in [8, 9]. A value of 3.6 fm has been finally selected.

The volume rate of the nuclear reaction of the deuterons trapped inside an EV can be written as:

$$R = \int dR = \frac{n_d^2}{4}\sigma_0\int_0^\infty P_c(v)\,P_M(v)\,v\,dv \tag{16}$$

and the total number of nuclear reactions per EV and time unit as:

$$R_t = \frac{N_d n_d}{4}\sigma_0\int_0^\infty P_c(v)\,P_M(v)\,v\,dv \tag{17}$$

where N_d is the total number of deuterons in the EV and n_d their concentration in the core. For assessing the upper limit of the nuclear reaction rate, the higher value has been considered for σ_0. The value of P_c has been numerically integrated for each velocity step, and R_t has been numerically integrated over a large velocity interval. The computed values of the nuclear reaction number per second in the EV, for the two deuteron concentrations and for three values of the temperature are presented in the table.

n_d (m^{-3}) \ T (K)	300	1000	3000
6.25×10^{28}	2.62×10^{-29}	2.336×10^{-41}	4.72×10^{-53}
1.9×10^{29}	1.84×10^{-20}	6.67×10^{-30}	1.38×10^{-39}

Even if the values for R, computed with (16) might predict detectable nuclear reaction rates for high enough concentrations, in a macroscopic sample, the total number of reactions per second in an EV is far too low to consume the deuterium contained inside, because the life time of the cluster is very short, as it can exist only in high velocity states [3]. In spite of the very high electron concentration exhibited, the cluster can not catalyze the nuclear reaction of the deuterium trapped inside, during its short lifetime.

Still, the EV carries an amount of kinetic energy which will leave traces at the site of the impact with the surface of a metal. In the next section a rough estimation of the size of the crater produced on the metal surface is presented.

IV. THE IMPACT CRATER

The EV, containing a charge Q, when accelerated by an electric potential U, will have a kinetic energy $W = Q\,U$. Assuming for Q a value of 10^{11} times the charge of an electron [3] and a value of 1 KV for the acceleration electric potential, a value of 10^{14} eV is obtained, which is $W_k = 1.6 \times 10^{-5}$ J.

As this energy is transported mainly by electrons and as they have a lower interaction cross section, than the incident ions, not all the energy is deposited on the surface of a metal on impact.

It would be interesting to assess the fraction of W_k transported by the ions. Accordingly to the acceleration mechanism presented in [1, 3], both the ions and the electrons have the same velocity, leading to total kinetic energy of the ions:

$$W_1 = N_d \frac{m_d}{m_e} e\,U = \frac{N_d}{N} \frac{m_d}{m_e} W_k = f W_k \tag{18}$$

which leads to a value of 3.62% for f. This value is computed in the assumption that the EV contains 1 deuteron at 10^5 electrons; if the deuterium content of the EV would be 1 to 10^6, the lower limit stated in [1], then f would fall to 0.36%.

This consideration supports the idea that a fraction f = 5% of the kinetic energy of the EV is deposited on the surface and used to melt, evaporate and expel the metal at impact, and the rest will be dissipated by electrons in the metal in their stopping process. The dimension of the crater can be estimated as the $V^{1/3}$, where V is the volume of the crater. If we use ρ for the density of the target metal and if we consider a generic value of 10 g/cm^3 for it, c for the specific heat and take a value of 500 J/kg × K, and we consider that in order for the crater to be produced a temperature increase ΔT of 10^4 °C must be achieved by the metal to be vaporized and expelled, then:

$$f \cdot W_k = \rho \cdot V \cdot c \cdot \Delta t \tag{19}$$

which yields for the volume V about 1.6×10^{-18} m^3, which means a crater of a diameter of 2.5 µm.

V. DISCUSSION

The high electron concentration in the EV does not offer a strong enough screening for the Coulomb barrier of a deuteron to be penetrated at a sufficient rate, such as "cold nuclear fusion" between the deuterons trapped inside, to occur in the traditional manner inside the cluster.

The computed size of the craters produced by the impact of the EV is lower than some of the sizes of the craters presented in [4] and consistent with others. At the impact ,the positive ions trapped in the NEV will have the same velocity as the cluster, but much larger masses than the electrons, which will make them have kinetic energies of the magnitude of tens of MeV, as presented in [1]. The high energy of the ions and the screening effect of the high electron concentration in the impact moment will create the conditions for the nuclear reactions on the surface of the target material to be produced. The energy resulting from the nuclear reactions on the surface of the target must be added to W_k in (19) and will lead to larger craters, conclusion which is again in good agreement with the figures presented in [4].

It should be finally added that the nuclear reactions between the hydrogen isotopes is much more probable than between a hydrogen isotope nucleus and a host metal nucleus, therefore a metal highly loaded with hydrogen or deuterium must present larger craters on its surface, when it is the target of an EV implantation, in the same conditions, than when it is not loaded with hydrogen isotopes. An experimental work on this subject can confirm the acceleration mechanism connected with the EV and the nuclear reactions on the surface. If the results of such an experiment are as predicted, the fractofusion mechanism of Cold Fusion, with EVs produced and accelerated between the fresh faces of the crack, in a highly deuterium loaded metal, must be further developed to predict quantitatively the fusion rates and the energy excess.

Acknowledgements

I fully acknowledge Dr. Gheorghe Vasaru and Dr. Peter Gluck for the fruitful discussions, for the good advice, their guidance, and their encouragement.

REFERENCES

1. H. Fox, R.W. Baas, S. Jin, "Plasma - Injected Transmutation," *J. New Energy*, vol 1, no 3 (1996).
2. K.R. Shoulders, "Energy Conversion Using High Charge Density," US. patent 5,018,180, May 1991.
3. S.X Jin, H. Fox, "Characteristics of High - Density Charge Clusters: A Theoretical Model," *J. New Energy*, vol 1, no 4 (1996), pp 5-19.
4. K. Shoulders, S. Shoulders, "Observations of the Role of Charge Clusters in Nuclear Cluster Reactions," *J. New Energy*, vol 1 no 3 (1996).
5. J.G. Linhart, Plasma Physics, Euratom, 1969.
6. I.M. Popescu, Fizica, Vol 2, Ed. Didactica si Pedagogica, 1983, in Romanian.
7. V.I. Goldanskii, F.I. Dalidchick, "On The Possibilities of Cold Enhancement of Nuclear Fusion," *Phys. Lett. B*, vol 234, no 4 (1989).
8. D. Seelinger, "Theoretical Limits of Nuclear Reaction in Condensed Matter," *Acta Physica Hungarica*, vol 69, nos 3-4 (1991), pp 257-267.
9. W.N. Cottingham, D.A. Greenwood, "The Nuclear Reaction Rate of a Confined Deuteron Pair," *J. Phys. G*., vol 15 (1989), pp L157-L161.

COMMENT

It is the policy of the *Journal of New Energy* to encourage student papers. In this case, Dan Chicea is a Ph.D. student in Romania. He is one of the few persons in the world working on high-density charge clusters. The Journal staff did provide a review of his paper and he responded with an improved paper. Rather than wait for another cycle of exchanges, it was decided to publish his paper with comments from Dr. Jin.

A Comment to Dan Chicea's paper, "Electron Clusters – Possible Deuteron Fusion Catalyzers."
By Dr. S.X. Jin

The author has done a lot of work and revised his original draft. It has to be pointed out, however, that there are still some important problems.

1. The author's main assumption is "the electric field is strong enough to collect the positive ions in the core of the EV." Here the author neglected two physical facts:

(a.) EV is a highly dynamic vortex system, there is not only a strong time-varying electric field, but also a strong magnetic field. In crossing an electric and magnetic field, any charged particles (electron or ion) must travel perpendicular to $\vec{E}$ and $\vec{B}$, i.e., there are no paths directed to the core of the cluster.

(b.) Inside the EV, an electron (or ion) is not "free," there will be numerous collisions among them. Even if considering only a radial electric field, an ion on the border of the EV can arrive at the core only through a large number of collisions (typically ~10^8 times). This fact means that the time that an ion takes to travel to the core is much longer than the lifetime of the EV. Therefore, the author's assumption does not seem valid.

2. The authors assumes in part IV that the craters on the target are produced only by ions in the EV and electrons dissipate their energy only in their stopping processes. Experimentally and theoretically this is not the case. Usually the craters on the target surface can be produced by the electron clusters (even without positive ions), however, ions in the EV may greatly increase the cratering effect. Therefore, the calculation in part IV needs further discussion.

GENERATION OF FREE MOMENTUM AND FREE ENERGY BY THE HELP OF CENTRIFUGAL FORCES

Stefan Marinov [1]

ABSTRACT

It is pointed out that there are substantial differences between potential (such as the gravitational) and inertial (such as the centrifugal) forces. It is revealed that by the help of centrifugal forces, one can generate free momentum and free energy, i.e., one can produce momentum and energy from nothing. In this paper are presented the perpetual motion machines, discovered by the author, called "Segner-Marinov-turbine," "Bühler-Marinov generator" and "Deisting-Marinov machine." The first small Segner-Marinov turbine, which was recently constructed, demonstrates the effect of self-acceleration, but since the friction torque overwhelms the driving torque, it still does not rotate as a *perpetuum mobile*. "Deisting drives," which are a simple variation of the well-known "Bühler drive," constructed by Joerg and Friedrich (son and father) Deisting in Graz in the last decade produce free momentum, i.e., they set a body in motion by the help of internal forces. The author is working now on the Deisting-Marinov machine which is expected to produce the energy necessary for providing the inertial forces propelling the machine, i.e., it may also be a perpetual motion machine.

A. Potential Forces and Kinetic Forces

As I showed [1-3], the notion "force" is very complicated and if this physical phenomenon should be easily understandable, we must introduce axiomatically the notion "energy" and then the notion "force" is to be introduced as a rigorous **mathematical product** from the axiomatical (and therefore **undefinable**) quantities "energy," "space" (i.e., "length") and "time."

Let us consider two particles with masses m_1, m_2, electrical charges q_1, q_2 and velocities v_1, v_2 distant r from each other. Their gravitational and electromagnetic behavior is determined by the following potential energies (γ is called gravitational constant and c velocity of light):

1. Gravitational energy

$$U_g = \gamma \frac{m_1 m_2}{r(1 - v_1^2/c^2)^{1/2}(1 - v_2^2/c^2)^{1/2}} \cong \gamma m_1 m_2 / r \quad . \tag{1}$$

2. Electrical energy

$$U_e = q_1 q_2 / r \, . \tag{2}$$

3. Magnetic energy

$$W_e = - q_1 q_2 \, v_1 \cdot v_2 / c^2 r \, . \tag{3}$$

Equations (1)-(3) are these **axioms** from which I obtain [1-3] **all** equations in gravity and electromagnetism. I show [1, 2] that in gravity there must be an energy

$$W_g = - \gamma m_1 m_2 \, v_1 \cdot v_2 / c^2 r, \tag{4}$$

[1] Inst. for Fundamental Physics, Morellenfeldgasse 16, A-8010, Graz, Austria

analogical to the magnetic energy in electromagnetism, which I call "magretic energy," and, respectively, I call gravity "gravimagretism." Experiments have been proposed by me [1-2] which can demonstrate the reality of magretic energy.

The approximate result in equation (1) is obtained for $v_1/c << 1$, $v_2/c << 1$. By assuming $v/c = 0$, we remain in the physics of low velocities and by assuming $v/c \neq 0$, in the physics of high velocities. Throughout this paper we shall remain in the physics of low velocities. Thus, we shall consider only gravitational and electrical forces. The so-called "elastic forces" are, as a matter of fact, electrical forces.

If calculating the gravitational potential (which all stars in the universe produce) at a certain point far from local concentration of matter (i.e., in the cosmos), we obtain [1,2] a number very near to (but less than) c^2. I **assume** that if the **whole mass** in the universe will be taken into account, this number will be **exactly equal** to c^2 . Thus the gravitational energy of a mass m with the whole mass of the universe is

$$e = mc^2 \tag{5}$$

and is called its **universal energy**.

If this mass moves with a velocity v in absolute space (the space in which the mass of the universe as a whole is at rest and in which **velocity of light is isotropic**), its gravitational energy with the whole mass of the universe, according to (1), will be

$$e_0 = mc^2 / (1 - v^2 / c^2)^{½} \tag{6}$$

and is called its **proper energy**.

Proceeding from equations (1), (2) and (6) and the energy conservation law, I obtained [1-3] the fundamental equation describing the motion of mass m, having the absolute velocity **v**, respectively, in gravity and electricity

$$d\mathbf{p}_0 / dt = \partial U_g / \partial \mathbf{r}, \quad d\mathbf{p}_0 / dt = - \partial U_e / \partial \mathbf{r} , \tag{7}$$

where U_g and U_e are the gravitational and electric energies of mass m with the surrounding electric charges and masses. [For more detail see Refs. [1-3]).

In the equation

$$\mathbf{p}_0 = m\mathbf{v}_0 = m\mathbf{v} / (1 - v^2 / c^2)^{½} = \mathbf{p} / (1 - v^2 / c^2)^{½} \tag{8}$$

I labeled $\mathbf{p}_0$ **proper momentum**, **p universal momentum**, $\mathbf{v}_0$ **proper velocity** and **v universal velocity** of mass m.

The quantities

$$\mathbf{f} = d\mathbf{p}_0 / dt \tag{9}$$

and

$$\mathbf{F}_g = \partial U_g / \partial \mathbf{r}, \qquad \mathbf{F}_e = - \partial U_e / \partial \mathbf{r} \tag{10}$$

are labeled by me **kinetic force** and **potential force**.

Equations (7), (9) and (10) show that the kinetic force, **f**, is always equal to the potential force, **F**,

$$\mathbf{f} = \mathbf{F} \tag{11}$$

This equation is called **Newton's second law**. We say that the surrounding system acts on mass m with the potential force **F**, while mass m reacts to this action with the kinetic force **f**, i.e., with the time change of its momentum equal to $d\mathbf{p}_0 / dt$.

We see thus that in gravity and electricity the kinetic forces of two interacting particles are always equal and oppositely directed along the line connecting the particles (there is $U_{12} = U_{21}$)

$$\mathbf{f}_1 = - \mathbf{f}_2 \, . \tag{12}$$

This equation is called **Newton's third law**. **Newton's first law** is a triviality.

Equation (12) shows that one cannot set an **isolated system** as a whole in rectilinear or rotational motion. I have shown that by the help of magnetic forces, which violate Newton's third law, one can set an isolated system in a **rotational** motion and I have demonstrated this effect by two experiments: the rotating Ampere bridge with interrupted current and the Bul-Cub machine with interrupted current [3].

B. Inertial Forces

If a particle collides with another particle, with the assumption that there is no potential energy between them, an instantaneous change in their momenta, $\mathbf{p}_1$ and $\mathbf{p}_2$, does occur. In that case, the kinetic force of one of the particles, taken with an opposite sign, represents the "potential force" which acts on the other particle. These forces do not have the physical and mathematical substance of actual potential forces depending on the **distance** between the particles, and I call them **collision forces**. The fundamental equation of motion for collision forces is to be written not in the form (11) but in the form

$$d\mathbf{p}_1 / dt = - d\mathbf{p}_2 / dt, \tag{13}$$

i.e., in the form (12). Obviously, for **collision forces** Newton's third law is preserved.

Let us now consider a system of particles, the distances between which are kept constant by the help of elastic, i.e., electric, forces. Such a system is called a body. If the body is set in rotation about some axis, on the different particles of the system **centrifugal forces** begin to act. If the body moves along the radius of another rotating body, the so-called **Coriolis forces** appear. And if on a rotating body some external force acts, the so-called **gyroscopic forces** appear.

I label the collision, centrifugal, Coriolis and gyroscopic forces with the common name **inertial forces**.

The inertial forces do not appear as a result of the existence of some kind of potential energy. It is clear that if a rigid body hits another rigid body or if a rigid body rotates, then the inertial forces **manifest** themselves through the resulting elastic potential forces of deformation, however the **physical essence** of the inertial forces is **not** determined by the elastic **potential** energy inherent to the body's molecules. The resulting elastic potential forces **are results, not causes**. Meanwhile, if an apple on the tree is attracted by the Earth, the cause for this force is the gravitational potential energy between the apple and the Earth.

The cause for the centrifugal forces is the rotation of the body **and** the availability of gravitating matter in the **universe**[2]. Take away the stars and there will be **no** inertial centrifugal forces (see beneath).

The inertial forces are a **very delicate** chapter in physics and although many great thinkers, beginning with Galileo and Newton, have tried to clarify inertia, until recently the understanding of inertia has been obscure [12]. A proof that the inertial forces have not been understood by the illustrious physicists in the past is the **fact** that none of them has realized that inertial forces can violate the momentum and energy conservation laws. And none of them has envisioned perpetual motion machines and anti-gravity devices. Meanwhile, the most **elementary analysis** of the centrifugal forces shows that such machines can be constructed.

C. The Centrifugal Force

If a body is constrained to move along a circular path, a centrifugal force will act on it, **aiding in preserving its uniform motion**.

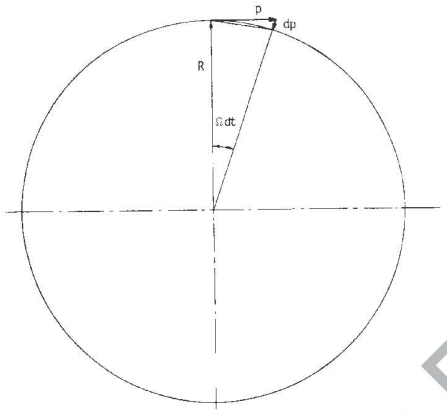


Fig. 1. Drewing for calculating the centrigugal force.

The mathematical calculation of this force is very simple (Fig. 1): Let us assume that a particle moves with a constant momentum **p**. If we wish to keep this particle moving always at the same distance R from a certain point in the plane determined by this point and particle's momentum, then for a time dt, for which the angle of rotation is Ωdt, where Ω is the angular velocity of rotation, the particle must change its momentum by d**p**. From the geometry we obtain

$$dp/p = R\Omega dt/R \,, \qquad (14)$$

so that

$$dp/dt = p\Omega = mv\Omega = mv^2/R = mR\Omega^2 \,, \qquad (15)$$

and d**p** is directed always from the particle to the center of rotation. The inertial force with which the particle **resists** this change is the centrifugal force which is directed toward the **opposite direction**. Thus the force $\mathbf{f}_{cp} = d\mathbf{p}/dt$ is caused by the elastic forces of the constraint (say, the elastic forces of the string with which the particle is attached to the point of rotation) and we call it **centripetal force**, while the force $\mathbf{f}_{cf} = -\, d\mathbf{p}/dt$ is the **centrifugal force**.

Conventional physics, comparing equations (7), (10) and (15), is inclined to consider the force

$$F = mv^2/R \qquad (16)$$

as "potential force." This is a noxious aberration. The centrifugal force is **not** a potential force, since it is not generated by some potential energy of interacting particles. It is very important to note that potential forces always appear with a respective **energy change**, while centrifugal forces appear **without** an energy change.

[2] This is Mach theory of inertia and implies an infinite speed of coupling between stars and a local body.

D. The Segner-Marinov Turbine

The author discovered the Segner-Marinov turbine on 3 May 1996, the day after returning from the free energy conference in Denver. In this machine free energy is produced by the help of centrifugal forces.

The Segner-Marinov turbine is a combination of two effects: The first effect is the rotation of a cylindrical recipient (a bucket filled with water) from whose periphery at the bottom water is squirting out into tangential directions. This effect is referred to Segner (*Segner Reaktionsrad*). The second effect is the lift of water up the cylindrical circumference of a container rotating about its axis. This effect is referred to Newton (Newton's water bucket).

Newton's water bucket **generates free energy**, since the water is lifted up its cylindrical circumference by the help of inertial (centrifugal) forces. Thus for this lift **no energy is to be invested**. But using the difference in the levels of water at the cylindrical circumference and at the axis, free energy can be produced. **None** of the great physicists has noticed this **obvious** effect.

The Segner-Marinov turbine is the practical realization of a perpetual motion machine based on this **elementary** free energy effect.

The **technical** drawing for the first **small** Segner-Marinov turbine is presented in Fig. 2 and the realization in Fig. 3. It consists of a stationary part which will be called "the pot" and a rotating part which is "the turbine." The diameter of the pot is 180 mm and from here all other sizes can be obtained.

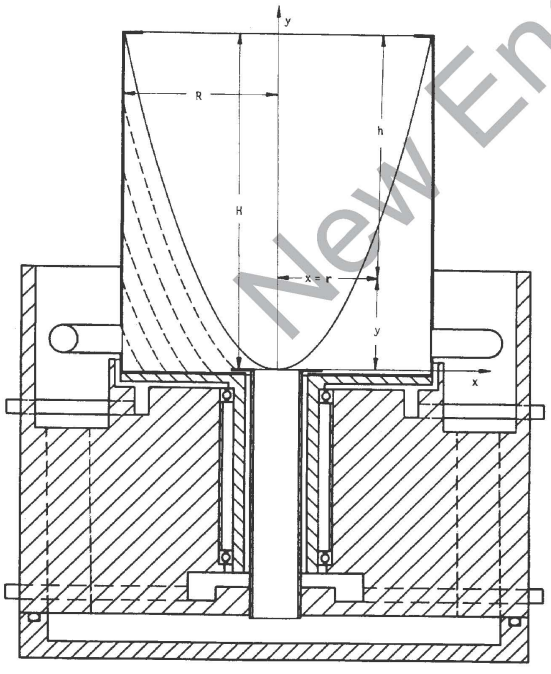


Fig. 2. Technical drawing of the Segner-Marinov turbine.

The pot and the turbine are made of PVC (poly-vinyl-chloride) and the turbine's holder, which is fixed to the internal races of two ball-bearings, is made of aluminum. When drawing the diagram, I intended to make the pot of two pieces and for this reason one sees in Fig. 2 a rubber O-ring, but later a better solution was found by making the pot of a single piece and connecting the two vertical cylindrical holes with the axial tube by two horizontal cylindrical holes bored from left and right which then have been closed by two corks. The dashed lines indicate cylindrical holes bored in the PVC-material which do **not** cross each other.

The Segner-Marinov turbine functions in the following way:

While at rest, the turbine is filled with water in the external ring recipient. Via the two vertical holes and the lower cylindrical recipient (which, I repeat, was substituted by two horizontal cylindrical holes), the liquid mounts along the axial tube until reaching its upper rim. Then the turbine is set in rotation with a certain rotational velocity Ω and one begins to fill it with water, as shown in Fig. 3. The angular velocity Ω is such that if the turbine has no holes the rotating water has to form a rotational paraboloid which just has to reach the rim of the turbine, as

it is shown in Fig. 2. Because of the action of the centrifugal and hydrostatic pressures, the water in the turbine begins to squirt out from the two outlets (nozzles) in directions tangentional to turbine's circumference. The ejected water immediately via the axial tube streams back into the turbine. We fill the turbine with water until the moment when its paraboloid reaches the upper turbine's rim and the bottom's center. Then we detach the driving electromotor which can be seen in Fig. 3 at right.

Fig. 3. Photograph of the Segner-Marinov turbine.

If the self-accelerating torque acting on the turbine (which will be calculated later) will be equal to the inevitable friction torque, the turbine will rotate eternally. If this driving torque will be larger than the friction torque, the turbine will begin to increase its velocity and water will begin to sprinkle out of its upper rim. If the driving torque will be less than the friction torque, the turbine will begin to decrease its velocity and water will begin to flow out via the space outside of the axial tube.

The calculation of the self-accelerating torque acting on the turbine can be done by **any smart college student** (Fig. 2).

The radius of the turbine is indicated by R and its height by H. The y-axis is along the axis of the turbine and the x-axis along one of its bottom radii. We shall assume that the radii of the axial tube and of the two nozzles are very small with respect to R and the y-components of the tube's rim and of the nozzles are very small with respect to H. At these simplifying assumptions, water will form a paraboloid with initial point at the center of turbine's bottom.

The coordinates of an arbitrary point in the water are indicated by x = r and by y, and the notation h = H - y is introduced. The pressure in water at the point x,y, i.e., r,h, will be

$$p = \mu g h + (1/2)\,\mu\Omega^2 r^2 \ , \qquad (17)$$

where μ (= 1 g/cm^3) is the density of water and g (= 981 cm/sec^2) is the gravitational acceleration.

The first term in (17) is due to the hydrostatic pressure and the second term is due to the kinetic pressure produced by the inertial centrifugal forces. At all points of the surface the pressure is constant and as for x = y = 0 we have $P_{surf} = \mu g H$ and for x = R, y = H we have $P_{surf} = (1/2)\,\mu\Omega^2 R^2$ we obtain

$$H = (\Omega^2/2g)R^2 \ . \qquad (18)$$

Thus for the constant of the surface parabola $y = kx^2$ we obtain $k = \Omega^2/2g$. At the left part of the diagram are drawn the parabolas for different constant pressures.

The velocity with which water will squirt out from the nozzles will be (Torricelli)

$$v^2 = 2p_{h=H,\,r=R}/\mu = 2gH + \Omega^2 R^2 \ , \qquad (19)$$

and the driving torque (using the **simplifying assumption** that the volume of water squirting out in 1 sec is 1 cm^3 or that μ is the mass squirting out in a unit of time) will be

$$M_{dr} = R\mu v = \mu(2gH + \Omega^2R^2)^{1/2}R \ . \tag{20}$$

The braking torque, M_{br}, will be generated by the Coriolis forces acting on the water which drops from the axial tube with velocity v = 0, but at the periphery of the turbine obtains a velocity v = ΩR.

As the Coriolis acceleration acting on a mass moving with a radial velocity v over a disk rotating with an angular velocity $\boldsymbol{\Omega}$ is $\mathbf{u} = 2\boldsymbol{\Omega} \times \mathbf{v}$, the torque executed by a mass μ of water moving from the center of the disk to its periphery with a velocity v = R **in a second** will be

$$M_{br} = \int_0^R r\mu\, 2\Omega\, v\left(\frac{dr}{R}\right) = 2\mu\Omega \int_0^R r\,dr = \mu\Omega R^2 \tag{21}$$

Consequently, the net driving torque will be

$$M_{dr\text{-}net} = M_{dr} - M_{br} = \mu(gH)^{1/2}R(2 - \sqrt{2}) \ . \tag{22}$$

The free power which the Segner-Marinov turbine will deliver will be

$$P_{seg\text{-}mar} = M_{dr\text{-}net}\Omega = \mu gH(2\sqrt{2} - 2) \ . \tag{23}$$

We have to take, however, into account that the velocity of the ejected water given by formula (19) is with respect to the turbine's cylindrical surface and since the laboratory velocity of the latter is ΩR, the ejected water will have a laboratory velocity

$$v_{lab} = v - \Omega R = (gH)^{½}(2 - \sqrt{2}) \ . \tag{24}$$

The power of this water can be used to rotate another turbine whose blades will serve as external border of the cylindrical recipient in Fig. 2. This second turbine will be set in rotation opposite to the rotation of the Segner-Marinov turbine. Assuming that the second one is a Pelton turbine which transforms the whole power of the squirting out water into kinetic energy reducing water's velocity to zero, we shall have for the power delivered by the Pelton turbine

$$P_{pelt} = (½)\mu v^2_{lab} = \mu gH(3 - 2\sqrt{2}) \ , \tag{25}$$

Thus the whole free power which will be produced will be, from equs. (23) and (25),

$$P_{net} = P_{seg\text{-}mar} + P_{pelt} = \mu gH \ , \tag{26}$$

where, I repeat, μ is the water mass ejected from the Segner-Marinov turbine in a unit of time when its friction (or load) torque is equal to $M_{dr\text{-}net}$.

Of the net power P_{net} 83% will be delivered to the Segner-Marinov turbine and 17% to the Pelton turbine.

What conclusion can we draw when analyzing the physical essence of the Segner-Marinov turbine? Obviously the conclusion is: Mankind, who for centuries have constructed waterdams (whose dimensions and costs can be compared only with those of the Egyptian pyramids), have missed a

possible alternative energy source. However, we admit that we have not proven the practicality of this device, only its potential value.

The dimensions (Fig. 2 and Fig. 3) were R = 5.4 cm & H = 12 cm. The water streaming out at the rotational velocity $\Omega = (2gH)^{1/2}/R = 28.4$ rad/sec = 4.5 rev/sec was V = 70 cm^3/sec, so that the net driving torque was $M_{dr\text{-}net} = \mu R^2 V(\sqrt{2}-1) = 24{,}011$ dyne.cm $\cong$ 24 pond.cm.

Since in the real apparatus the water paraboloid reached the bottom not at its center but at a distance r_o = 1.4 cm from the center, the rotational velocity was a little bit larger. On the other hand, the distance between the rim of the axial tube and the inner border of the cylindrical recipient was not 2 mm, as in the figure. The initial construction with this distance turned out to be not optimal, as water went over the internal border of the cylindrical recipient, and the latter was enhanced with 4 mm which led to respective enhancement of the nozzles. Thus the actual net driving torque was less but in the order of 20 pond.cm.

The friction torque evidently was larger, as the machine did not maintain eternally its rotation. However, by making coast-down measurements first when the machine worked as a Segner-Marinov turbine and then when the turbine's nozzles have been plugged and the same paraboloid formed, the times 3 minutes & 38 seconds and 1 minute & 08 seconds were measured. These measurements were a clear indication that **there was a driving torque** acting on the Segner-Marinov turbine.

If instead of water mercury will be used in **this** turbine, the torque will be 13.5 times larger and the machine is expected to rotate as a perpetuum mobile.

As I have no lab facilities to fill my turbine (shown in Fig. 3) with mercury, my attention was directed to the Deisting-Marinov machine (see Sect. H) which is a more easily realizable "centrifugal-forces-machine." This latter machine has the potential to produce abundantly not only free energy, but also free momentum.

But first we desire to analyze the so-called Bühler drive.

E. The Bühler Drive and Dean's Apparatus

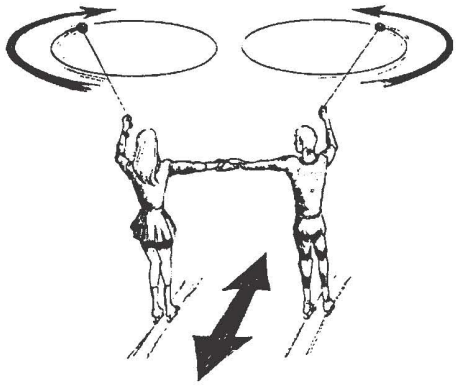


Fig. 4. The Bühler drive.

Let us consider two masses $m_1 = m_2 = m$ rotating **synchronously** about two parallel axes which are rigidly fixed to a greater mass (Fig. 4 and Fig. 5). The masses rotate in such a way that the projections of their radius-vectors on the x- and y-axes have always equal magnitudes. Now if choosing the x-axis to be this one along which the projections of the radius-vectors of the masses have always the same sign and the y-axis to be this one along which these projections have opposite signs, then the centrifugal force acting on the whole system will always be directed along the x-axis and will have the value

$$F = 2mR\Omega^2 \sin(\Omega t)\ , \qquad (27)$$

where R is the radius of rotation, Ω is the angular velocity and for t = 0, the rotating bodies lie on the y-axis.

It is clear that when both ice-skaters in Fig. 4 swing both heavy balls over their heads, they will move for half a period at a certain distance forward and then for the other half a period at the same distance backwards. Such synchronously rotating masses generating an oscillating motion, which is due **entirely** to the action of centrifugal forces, are known under the name "Bühler drive."

I do not know who Bühler was, when and where he lived, or why some authors think that he was the man who introduced this drive into physics. But as anything which is of some importance must be given a name, I shall also call the drive in Fig. 4 & Fig. 5 the **Bühler drive**.

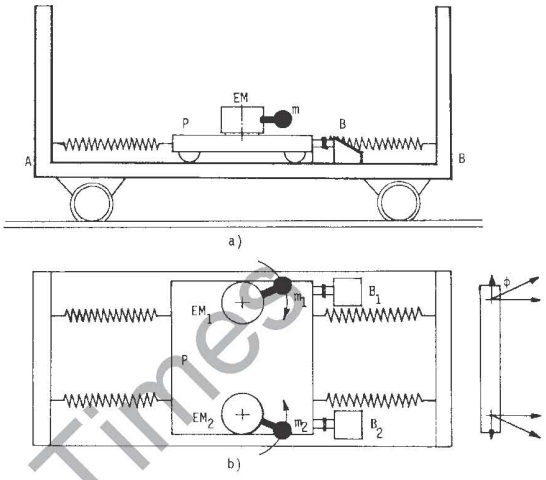


Fig. 5. Drawing for the Dean machine and for the Bühler-Marinov generator.

In this context let me note that the "Segner turbine" was constructed by Heron in Alexandria in the first century and four centuries before him by Ktesibios in Greece. And who were the Greek philosophers ruminating over "Newton's bucket"?

By the variation of the Bühler drive shown in Fig. 5, Norman Dean intended to produce **unidirectional** free momentum (let me emphasize that the Bühler drive in Fig. 4 produces free momentum, as the mass center of the system is set in motion by the help of **internal** forces, but the motion of the mass center is **oscillating**). The best articles on Dean's apparatus are given in Refs. [4 & 5]. The drawing in Fig. 5 is **mine** [6&7]) and this is, I hope, the best **didactic** presentation of Dean's machine:

The platform P which can roll in the wagon is attached to the walls A and B of the latter by four springs. On the platform there are two electromotors EM_1 and EM_2 which can set into rotation the eccentric masses m_1 and m_2. If taking away the buffers B_1 and B_2 and letting the motors synchronously rotate, the platform P will begin to oscillate to right and left and by pulling and pushing the walls A and B it will bring also the wagon into an oscillating motion.

Dean had the idea to put the buffers B_1 and B_2, so that the transmission of the momentum to the wagon to right should be "hard" and to left "soft," hoping in this way to have a larger momentum transmitted to the wagon to right. If this will be the case, the wagon will begin to move to right.

From the **numerous** papers which I read on Dean's apparatus in the **early sixties**, it was not clear whether Dean or some of the people who duplicated his apparatus were able to generate free momentum, i.e. to set a closed (isolated) system into a **unidirectional** motion (the wagon with the platform and the motors **is** a **closed** system).

In the early sixties there was an actual "Dean's boom" in the world, but "Dean's boom" in the Soviet Union was with **several orders** larger than in the West. The airplane-constructor Antonov appeared with a note in *Pravda*, stating that Dean's apparatus will be the future of air- and cosmo-nautics. In several months the patent office in Moscow received about half a million applications for Dean's patent. After the intriguing paper in the journal *Tehnica Molodeji* (Technics for youths), which at that time circulated in millions, the eager for knowledge students in the middle schools and universities ceased to attend lectures and began to construct Dean's apparatus or to ruminate on the dilemma whether it will "fly" or not. The situation became so critical, that Academician Kitaigorodsky appeared with a voluminous Savonarolian paper on the whole last page of *Izvestia* under the title

"Who is right - the Baron or Newton?" having in mind under "the Baron" the well-known liar Munchausen who, entering once on his horse into a swamp, pulled his hair with his own hands and so saved himself and the horse from sinking. The result was that the disciplined Russians **ceased to think**.

After having read many different papers (there was a big paper in the French journal with half-a-million circulation *Science et Vie*), I remained with the opinion that Dean's apparatus was ineffective, i.e., that it **cannot** produce **unidirectional** free momentum. My variation of Dean's apparatus [7] showed no effect.

Of the most interesting **later** variations of the Bühler drive, I shall mention the machine of my recently deceased friends Zorzi and Speri [7] and Cook's apparatus; the latter was presented in the excellent book of his collaborator Dickinson [8].

Cook **definitely** succeeded in producing free **unidirectional** momentum. The demonstration of the propulsion of a vehicle and a boat driven by internal forces, based in principle on Bühler drive, found coverage in **local** American press in the late seventies and early eighties. My friend Eike Müller (Zug, Switzerland) saw one of Cook's machines in motion and assured me that the generation of free momentum was without any doubt. It is unexplainable for me why Cook's machine fell into oblivion.

F. The Bühler-Marinov Generator

All inventors using the Bühler drive had the objective to construct a machine which will bring a closed system into a unidirectional motion, i.e., all of them have searched for producing free momentum.

It may seem strange but there was **no single** inventor (at least such a man is not known to me) who has tried, by the help of Bühler's drive, to produce **not** free momentum but **free energy**, i.e., who has tried to violate **not** the law of momentum conservation but the law of **energy conservation**. Meanwhile momentum is a **vector** quantity while energy is a **scalar** quantity and much more simple in its physical essence.

The **Bühler-Marinov generator**, invented by me ten years ago [7] is a machine which by the help of Bühler's drive can produce free energy. Ten years ago I had no money to construct it and it remained only "on paper." The Bühler-Marinov generator works in the following way:

Fix the wagon in Fig. 5 to earth and take away the buffers B_1 and B_2. Let us assume that the springs are ideal, i.e., that at contraction and extension they do not generate heat. We set both motors in action and we notice the power consumed. This power goes to cover all "losses," i.e., at **stationary** oscillation of the platform, the whole power will be transformed into heat, as the machine will produce **no other energy**.

Let us now assume that the springs are not ideal and at their contraction and extension produce heat. Will this case increase the power consumed by the electromotors?

My **firm** answer is: **No**. The consumed power will remain the same since the forces which contract and extent the springs are **inertial** forces.

And the Bühler-Marinov generator is to be constructed by replacing the springs by four cylindrical magnets which are fixed to the platform and at the oscillations of the latter will go in and out of four

coils fixed to the wagon, inducing electric current in the coil's windings. If the electric power produced by these coils will be higher than the power consumed by the motors, one will be able to "close the energetic circle" and the generator can work as a perpetual motion machine.

G. The Deisting Drive

I remember very well a colleague who used to repeat: "Physicists are crazy people. They run around the world going to congresses and conferences in a search for fresh and intriguing ideas. Meanwhile, a man who has the most original idea lives in a house next door to the physicists' house."

Such a man was Joerg Deisting, a **painter**, who lives a couple of streets from me. And Joerg Deisting told me in a café (located midway between our houses) which both of us used to visit: "If you wish to obtain a unidirectional propulsive motion with a Bühler drive (the name and the drive itself were **unknown** to Deisting) let the eccentric masses rotate not over 360° but over less than 180°."

When I heard this, I remained as struck by lightning. Such a **simple** solution of a problem on which **millions** of people have ruminated. (NB. A quarter of century ago I discussed Dean's machine with at least 10 of my colleagues in Sofia, none of whom had applied for Dean's patent at the Moscow patent office; and this patent office, as said, had received half a million applications).

Immediately I gave to this **epochal** invention the name "**Deisting drive**."

Joerg Deisting and his father Friedrich have constructed in the last decade several machines with this drive which were **unidirectionally** propulsing. Photographs of three of them are presented in Ref. [10].

Here I give the photograph (Fig. 6) of the most simple "Deisting drive" which **a child** can construct in half an hour:

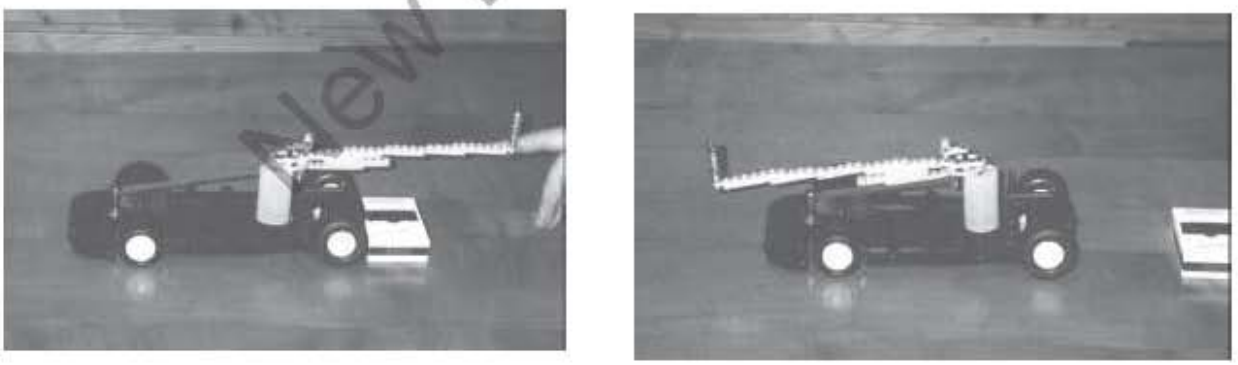


Fig. 6. Demonstration of the Deisting drive:
a) The rubber is strained by one's finger. b) After removing the finger, the eccentric mass at the end of the lever makes a couple of oscillations about the line along which the elastic energy is zero, and the car receives an impulse to left due to the centrifugal forces.

The rubber is strained and the eccentric mass is held in its initial position by one's finger. After removing the finger, the lever of the eccentric mass rotates from the position in which it points to right to the position in which it points to left, where the rubber's elastic tension disappears. At this **half-circular** rotation the lever with the eccentric mass obtains a certain velocity and it makes a couple of damped oscillations about the line on which the elastic energy of the rubber is zero (in Fig.

6b the elastic energy of the rubber is zero). In this system, which can be considered as an **isolated** system, the acting forces are **internal forces**. Thus, according to the momentum conservation law, the center of mass of the system must remain **at rest**. Consequently, as the eccentric mass has moved to left, the car must move to right, so that in both Figs. a) and b) the center of mass of the system should remain at the same point respectively to the table (remember that if one walks on a boat from right to left, the boat moves from left to right!).

However, the experiment in Fig. 6b showed **exactly the opposite effect**: the car moved **not** to right but **to left**, as the cigarette box remained all the time at rest. Obviously **many children** (but not many professors!) will conclude that the motion to left was due to the **centrifugal forces** acting on the eccentric mass which immediately have been communicated to the car.

The experiment demonstrated also the following important detail: For the first **fourth** part of the circular motion the centrifugal forces acted **to right** and during the respective time the car moved slightly to right, pushing the cigarette box at a couple of millimeters to right. Then, when the mass performed the oscillation motion about the "zero potential energy line" with a **much higher** velocity (the mass was accelerated by the elastic forces during the first and the second fourth parts of its circular motion), the car made the big propulsion to left over the several centimeters which can be seen in Fig. 6b. The propulsion was in jerks, as at the moments when the lever changed the direction of its rotation there were no centrifigal forces.

In Fig. 6 there is presented a **physical wonder**. But **who** has constructed and reported on such an experiment before Mr. Deisting? - NOBODY.

I was terrifically excited and said after the demonstration: "I have been familiar with the Bühler drive for **thirty-five years**, since the **early** sixties, when the machine of Dean was *en vogue*, but I do not know anyone who has proposed the Deisting drive. I myself have constructed Dean-type machines (see Fig. 5 in Ref. [11]) but I **never** have come to the idea of the 'Deisting drive." Look at Cook, at Dean, at Zorzi and Speri [11] and at their numerous followers: so many different, **much more complicated** tricks have been proposed and realized, however, no one proposed the Deisting drive. How can you explain the fact that no one before you has had this idea. I can't understand it." Mr. Deisting's answer was: "The other researchers who have worked in the field have not had this idea for the same reason that you during 35 years have not thought of it. And of the other 6 or 5 or 4 or 3 millions who visited schools, they have been told that propulsive motion cannot be realized by internal forces."

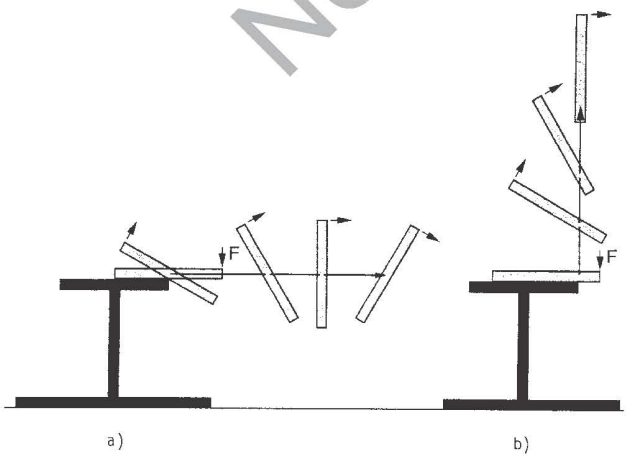


Fig. 7. Elementary rotational experiment demonstrating the Deisting drive:
a) the half of the ball pen juts out of the table.
b) only a small part of the ball pen juts out of the table.

A **very simple** experiment for the verification of the reality of the Deisting drive was demonstrated to me by Joerg Deisting by the help of a single ball pen.

First (Fig. 7a), a ball pen is put on the edge of a table, so that the one half lies on the table and the other one juts out of the table. If hitting strongly the free part (by one's hand

or better by a rod), the ball pen travels in a horizontal direction rotating about its central point which is also its mass center.

If however (Fig. 7b), only a small part of the ball pen juts out of the table and we again hit the latter strongly, the ball pen flies vertically up, rotating about this point which was at the edge of the table and **not** about its mass-center. It is evident that for the **first half** of the rotation the centrifugal forces acting in a vertical direction upward are much higher than those acting in a vertical direction downward and the former communicate to the mass center a certain velocity upwards. Then the **middle** centrifugal forces, calculated over a whole rotation, remain equal to zero (Bühler's drive) and if there is no gravitational attraction and there is no friction in the air, the upward motion will continue eternally with the velocity acquired at the first half of the rotation.

After seeing this experiment, I said to myself: "Such an experiment and its tremendously important conclusions can come only to a painter, never a physicist!"

Now I shall show how and why the Deisting drive will very easily produce free energy. Let us assume that the wheels of the platform in the Deisting drive are connected to an electromagnetic generator. First the generator is not switched on and we drive the electromotor of the drive by a battery. The energy of this battery is used only to overwhelm the friction losses in the Deisting drive and do **not** depend on the velocity of the platform. Thus if assuming that at any velocity of the platform the friction in the ball-bearings of the wheels remains the same, we shall always need the same amount of energy E_{in} for increasing the velocity of the platform by 1 m/sec. However, if switching on the generator, then for diminishing the velocity of the machine from a certain velocity v with 1 m/sec, we shall receive the following energy

$$E_{out} = (½)mv^2 - (½)m(v-1)^2 = (½)m(2v-1)\ , \qquad (28)$$

where m is the mass of the machine.

Thus always the inequality

$$E_{in} < E_{out} \qquad (29)$$

can be achieved and the machine can be run as a *perpetuum mobile*.

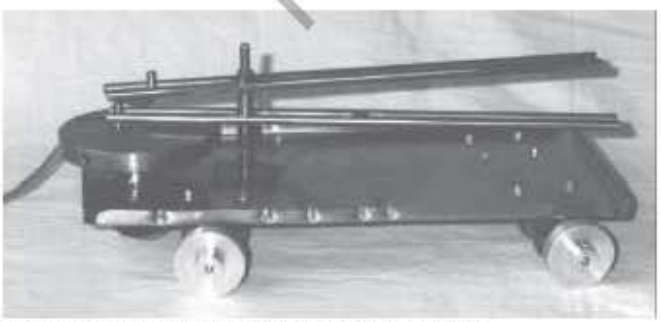


Fig. 8. The first Deisting-Marinov machine.

H. The Deisting-Marinov Machine

A Deisting drive, which produces alone the energy which is needed to run it, is labeled a "Deisting-Marinov machine."

I began with the construction of such a machine (Fig. 8). The car is set into propulsive motion to right by the vertical electromotor at left which drives an eccentric crank-shaft and brings into oscillating motion the two long double rods. I had two equal masses for fixing them to the ends of the double rods, i.e., at distances R from the rotational axis, as according to formula (16) the pushing centrifugal force is proportional to m. However their weight increased the friction, made the machine slothful and decreased perceptibly the angular velocity Ω. Since the pushing centrifugal force is proportional to the square of Ω, it is better to have smaller m and R but larger Ω. Thus without the additional masses, first, the machine went more quickly and, second, the motor driving it consumed less

electrical power. The "effective mass" causing the propulsive motion was, as a matter of fact, the **difference** between the rods at right and at left from the rotational axis.

In my Deisting-Marinov machine the car (the first prototype of which is shown in Fig. 8) will rotate on **circular** rails used for children's toy trains, being connected with two light rods to a ball bearing inserted on an axle at the center of the circular rails.

The "axles" of the car are **four** electromotors on whose shafts four wheels are inserted; thus any wheel can rotate independently of the other. This is important as the two "internal" wheels will make for one revolution **less** rotations than the "external" wheels. Moreover, the "axles" conclude a small angle (this can be seen in the photograph), so that **both** axles always remain **perpendicular** to the rails.

The four electromotors on the "axles" will work as **generators** and will be connected in series with the vertical electromotor setting the Deisting drive in oscillation. The car will be set by hand in motion with a certain velocity. If at this velocity the tension produced by the four "axles-motors" will be sufficient to run the vertical motor and the force F produced by the Deisting drive will be bigger than the **whole** friction force, F_{frict}, acting on the car (the electromagnetic braking of the four "axles-motors" is included into the "friction force"), the machine will rotate eternally.

If this will be not the case, a better variation is to be constructed. Formula (29) shows that a **self-propelling model is realizable**.

By comparing the Deisting-Marinov machine with the Bühler-Marinov generator, one sees immediately the **great advantages** of the first one. Indeed, the velocity, v, of the Deisting-Marinov machine can be increased without limit and, consequently, according to formula (28), the free power produced by it can also be increased withour limit (neglecting increased friction with increased velocity).

In my **first** machine, shown in Fig. 8, the friction was **too high**. The motor (a **highly efficient** Swiss motor) consumed some 10 W of electric power but the oscillating frequency of the two double rods was low and the propulsive force was almost unnoticeable.

It was clear that a second, better variation was to be done. It is shown in Fig. 9 & Fig. 10. In this improvement, in all "friction knots" ball bearings were used. The power consumption was **drastically** decreased to some 100 mW (i.e., **100 times less**) for the same oscillating frequency of the rods.

Fig. 9. The second Deisting-Marinov machine.

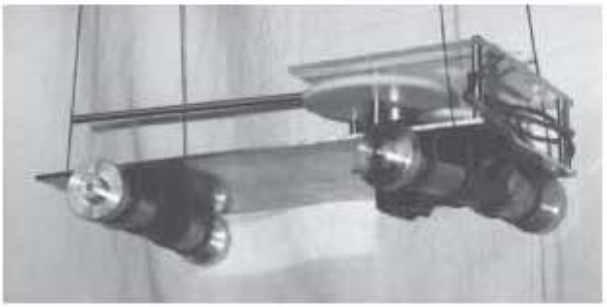


Fig. 10. The second Deisting-Marinov machine suspended on strings for observation of the pushing centrifugal force acting on it continuously.

At a higher oscillating frequency, when the power consumption was about 500 mW the pushing centrifugal force was already noticeable.

I did only approximate calculations of the pushing centrifugal force, as it is very difficult to make an exact calculation.

Any of the steel rods of the machine shown in Fig. 9 had diameter D = 0.5 cm and length L = 19.5 cm. Thus, if finding for the specific gravity of iron $\mu = 7.86$ g/cm^3, one obtains for the mass of any of the rods

$$m = \mu\pi D^2 L/4 = 30 \text{ g} . \quad (30)$$

When adding the additional masses of 50 g, shown in Fig. 9, the rotation and the pushing force were worse, so that the experiments were done **without** the additional masses.

At a power consumption of 500 mW, the frequency of oscillation (to left **and** to right) was estimated (**very approximately**) to be 12 Hz. Since the angle between the "left-right" deviations of the rods was 30°, the above frequency corresponded to a rotational frequency N = 1 rev/sec.

The pushing centrifugal force is to be calculated by putting into formula (27) m from (30), for R the **middle** length of the rods, ≅ 10 cm, for the angular velocity $\Omega = 2\pi N$, and for the phase angle $\Omega t \cong \pi/2$, thus obtaining

$$F = 2mR\Omega^2 = 237 \text{ mN} = 24 \text{ pond} . \quad (31)$$

This force will act, however, if the rods cover their whole path over 30° by a **constant velocity** and then **momentarily** change this velocity to the opposite one. As this was **not** the case, the value (31) is to be multiplied by a factor $k < 1$.

I **measured** the pushing force by suspending the whole car on a string. **Two** strings were used, fixed to the extremities of the car, as when setting the motor in action, a torque opposite to the torque acting on the motor's rotor (angular momentum conservation law!) begins to act on the car bringing the suspended system into **undesirable** oscillations. But if using the suspension shown in Fig. 10, these oscillations were minimal and could not mar the observed deviation of the system over s = 2 mm in the direction in which the force (31) acted. As the length of the strings was l = 2000 mm, the concluded angle of **continuous** deviation was $\alpha = s/l = 0.001$ rad.

Taking into account that the **weight** of the whole car was P = 1800 pond, the force which acted on it into horizontal direction was

$$F_{exp} = P\alpha = 1.8 \text{ pond} . \quad (32)$$

Thus for the factor k one obtains

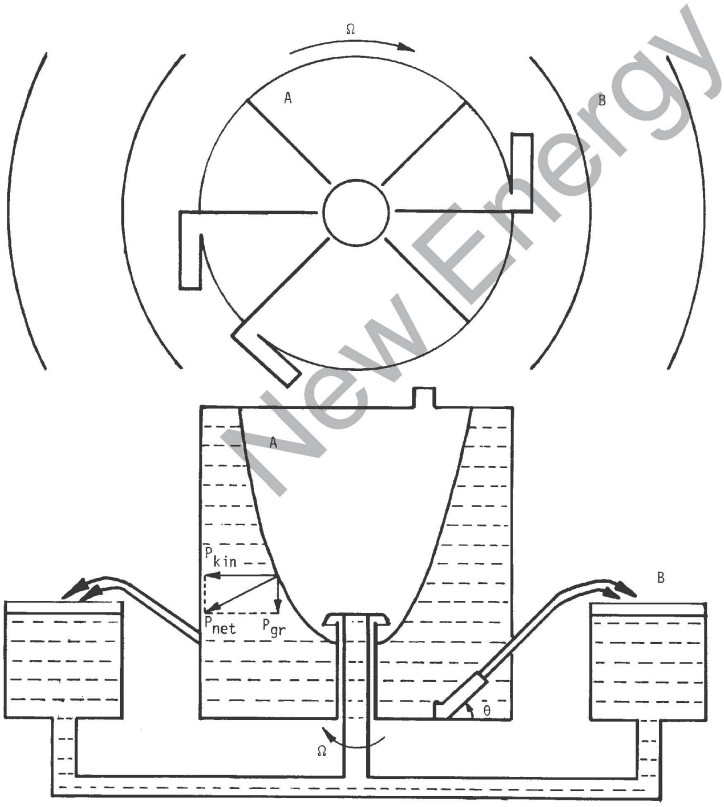
$$k = F_{exp}/F = 0.075 . \quad (33)$$

This is a **too small** factor, indicating that in the **observations** and **estimations** some errors have slipped, or there are **some other physical effects** due to the big vibrational forces which appear.

As already said, now I am working on the realization of the circular rails on which the car will rotate. The answer whether this **second** car will be able to produce alone the energy necessary for running the Deisting drive, i.e., whether it will become a Deisting-Marinov machine, is to be answered by me rather negatively. Thus the machine is further to be perfected in order to achieve a perpetual motion machine.

References

1. S. Marinov, Classical Physics, East-West, Graz (1981).
2. S. Marinov, Eppur si muove, C.B.D.S., Brussels (1977).
3. S. Marinov, Divine Electromagnetism, East-West, Graz (1993).
4. J.W. Campbell, Analog, vol 65, p 83 (1960). Repub. in: S. Marinov, The Thorny Way of Truth, East-West, Graz (1989), p 158, vol 6.
5. G.H. Stine, Analog, ?, 61 (1974). Repub. in: S. Marinov, The Thorny Way of Truth, East-West, Graz (1989), p 182, vol 6.
6. S. Marinov, Proc. International Conf. of Space-Time Absoluteness, Genoa, East-West, Graz (1982), p 103.
7. S. Marinov, The Thorny Way of Truth, East-West, Graz (1989), vol 6, p 11.
8. J. Dickinson, The Death of Rocketry, CIP Systems, Inc., P.O.Box 2997, San Rafael, CA 94901 (1980). Repub. in: S. Marinov, The Thorny Way of Truth, East-West, Graz (1989), vol 6, p 35.
9. S. Marinov, *Deustche Physik*, 5(20), 5 (1996); *New Energy News*, 4(3), 1 (1996).
10. S. Marinov, *Deutsche Physik*, 6(22), 5 (1997).
11. S. Marinov, *Deutsche Physik*, 5(20), 29 (1996).
12. Haisch, Rueda, & Putthoff, "Inertia as a Zero-Point-Field Lorentz Force," *Physical Reveiw A*, vol 49, no 2, Feb. 1994, pp 678-694.



FIRST ADDENDUM

In my paper "Segner-Marinov Turbine as a Perpetual Motion Machine" published in *Journal of New Energy*, 1(2), p 130 (1996), one figure was omitted. As the paper without this figure is not understandable, I publish it here. It is to be noted that the net pressure, P_{net} is presented in the drawing as a **geometrical** sum of the kinetic and gravitational pressures, P_{kin} and P_{gr}; as a matter of fact P_{net} is the **arithmetic** sum of P_{kin} and P_{gr} (see equation (17) in the preceding paper).

EXPLANATIONS FOR SOME DIFFERENCES BETWEEN REPORTS OF EXCESS HEAT IN SOLID STATE FUSION EXPERIMENTS

Mitchell R. Swartz [1]

ABSTRACT

Since the announcement of the discovery of cold nuclear fusion in March 1989, the phenomenon has been confirmed both for heavy-water electrolytic systems with palladium cathodes and lithium salts [1,2,3], and for light-water electrolytic systems with nickel cathodes with various electrolytes [4-11]. This includes demonstration of helium-4 [2] and tritium [12,13] as nuclear ash. Critics of cold fusion often use both the apparent irreproducibility of the phenomenon and the problems in electrolytic calorimetry to attempt to impugn the field and work therein.

REPRODUCIBILITY – PRACTICAL vs. STATISTICAL SIGNIFICANCE

The reproducibility argument is clouded by the two different meanings of the word(s) "(not) reproducible". In the parlance of the critics, when referring to "cold fusion," the word(s) "(not) reproducible" are a euphemism for "wrong".

When used more generally, however, these words can even apply to scientific (and medical) fields [cancer treatment, meteorology, or the sciences of earthquakes, lightning, sunspots, or solar storms] which actually do engender respect and/or validity, and where "reproducible" only refers to the number of samples in a cohort developing the desired effect. Consider cancer. Radiation therapy may be used to cure patients with microscopic or residual post-surgical neoplastic disease. But which ones? Reproducibility is not present in any single individual. Large cohorts of patients are required to demonstrate a statistical proof. On the other hand, because radiation therapy contributes to the cure of more than 60% of adults afflicted with solid malignant neoplasms, and dulls the pain in 90% (or more) of patients treated palliatively, there is almost always a clinical effectiveness [14,15,16]. Thus there is clinical proof and existence of the techniques. Yet, it is not possible to know in advance which patients are going to be cured, nor is the therapy necessarily reproducible in any single patient (or even cohort of patients).

Furthermore, not only are oncology and seismology true sciences, but some of the scatter of the data in this field may relate to the physics itself, and the calorimetric (and thermometric) problems are older than this relatively new field. Furthermore, there have been recent increase in attempts to increase the semiquantitative accuracy of cold fusion experiments [17,18,19].

However, this view is not shared by all. Because of the substantial criticism against cold fusion, it is recommended that those in the community recognize that several kilowatts of uncalibrated excess thermal power may be worth less than 50 milliwatts of true excess power [19]. We believe that there are several problems - material and geometric issues as well as the experimental coupling of that material to the laboratory setup [11,17,20,21]. The following equations and aspects of the material and nuclear physics may help to explain the differences between experimental reports.

[1] JET Energy Technology, Inc., P.O. Box 81135, Wellesley Hills, MA 02181

ACTUAL GAIN REMAINS LESS THAN PEAK POSSIBLE GAIN

Thermal spectrograms enable the determination of activity of select materials [11]. Although the phenomena described by cold fusion researchers are real, the peak activity of any given sample, [Π_{max}] varies from each individual piece to piece. It also may be dependent upon the samples preparation, connection, and history. We believe that each sample generally has a power gain (π) lower than Π_{max}. To observe the sample's maximum gain, Π_{max}, requires that the sample must be "driven" in the correct fashion. Thus, the actual observed power gain [π] of each sample, mathematically described, is that peak factor diminished by the failure to drive to the sample optimally [11]. The second factor in the power gain equation (eq. 1), δ, is less than unity. Therefore, both the sample's initial activity, and how it is actually "driven" effect its actual output.

$$\pi \text{ (power gain factor)} = \Pi_{max} * \delta \text{ (factor a function of "drive", etc.)} \qquad \text{(eq.1)}$$

LOADING IS ONE *sine qua non* FOR ACTIVITY

Many "negative" results in the field of fusion from isotopic fuel in a material are, in part, due to inadequate loading, and/or the failure to monitor said loading of isotopic fuel. One reason for failure to achieve positive results usually resides with the loading of the low atomic weight isotope (deuterium) into the Group VIII transition metal (palladium) lattice. The materials, such as palladium, must fill with, and thus physically absorb within it, enough deuterium to obtain the desired reactions.

LOADING ISSUES – NON-EQUILIBRIUM MODELS CAN PREDICT LOADING

Classical calculations of the activities of an ionic electrolyte [20,22,23] next to a metal electrode have been applied to cold fusion reactions following loading of isotopic fuel into a metal and have been used to derive the distributions of deuterium in the palladium and the solution. However one premise is that the systems are at equilibrium, and that may not be true [20,21]. Therefore, a quasi-one-dimensional model (**Q1D**) [24] for an electrode filled by the isotopic fuel was formulated and has enabled the cathode deposition of ions to be investigated using non-equilibrium calculations [21]. Because not all of the isotopic material of interest enters the metal, the loading flux into the bulk volume must be distinguished from the gas evolving flux. Without significant convection, the flux (J_i) of any i_{th} species (here deuterons) results from diffusion down concentration gradients and electrophoretic drift [20,21].

$$J_D = - B_D * \frac{d[D(z,t)]}{dz} - \mu_D * [D(z,t)] * \frac{d\Phi}{dz} \qquad \text{(eq. 2)}$$

The **Q1D** model of isotopic loading generates the isotope flux equation (eq. 2) which considers the differential isotope diffusivity (B_D), electrophoretic mobility (μ_D), inhomogeneous spatial distribution ([D(z,t)]), solubilities, magnetic susceptibilities and has offered insight into both competitive gas-evolving reactions at the surfaces of the electrode and the impact of the ratio of the applied electric field energy to thermal energy ($\kappa_B T$) [20,21].

The latter ratio is decisive in controlling the loading in palladium, and may be applicable to nickel and the proton reactions (or deuteron) at a nickel surface or in its volume. For nickel, some theoreticians believe that there may be a surface-local effect, perhaps on the 110 surface.

LOADING ISSUES – IMPACT OF ELECTRIC FIELD INTENSITY

There follows coupled equations of the deuteron flux at the cathode. The first flux component is the entry of deuterons into the bulk of palladium (J_e). The second flux component is the volume loss

of deuterons secondary to gas evolution (J_g). The mathematical solutions are determined both by the boundary conditions and by conservation of mass. The **Q1D** model indicates that the first order deuteron loading rate (κ_E) into the electrode is critically linked to gas evolution and is also first order on μ_D E.

$$\kappa_e = (\mu_D \ E) - (\kappa_g + \kappa_{fus}) \qquad \text{(eq. 3)}$$

This loading rate equation (eq. 3) relates deuteron availability (secondary to the applied electric field) to the losses of deuterons to both gas evolution and the fusion reactions [20,21]. One simple but important corollary is that the evolution of D_2 gas and deuteron loading to the palladium cathode are mutually exclusive for any given applied electric field.

LOADING ISSUES – LOADING FLUX RATIO

The loading flux ratio predicts how well metals and other materials are actually filling with the hydrogen. For electrolytic systems, the non-dimensional parameter $\lambda_{Pd,\ D}$, is defined as the ratio of the two largest and most important pericathodic fluxes; the loading flux (J_e) to the gas evolution (J_g). It is very much a function of the isotope and the material, hence the paired subscript.

$$\lambda_{Pd,D} = \frac{J_e}{J_g} \qquad \text{(eq. 4)}$$

Thus if $\lambda_{Pd,D}$ is .01, most of the current is going to gas electrolysis, whereas $\lambda_{Pd,D} = 100$ would indicate more efficient loading. The loading flux of deuterons into the palladium at the cathode surface (J_e) is sensitively dependent both upon the electric field energy as well as the competing gas evolving reactions [20].

IRREVERSIBLE CHANGES WROUGHT

Furthermore, some samples – even if sufficient loading is achieved by controlling the microscopic reversibility of loading at the interface – can have their peak obtainable power irreversibly destroyed by the testing, and/or the reactions [25,26]. The Group VIII transition metals (such as palladium in heavy water) are active media capable of catastrophic *in situ* desaturation with secondary redistribution of the low weight hydrogen isotope. The moving interstitials within the palladium are further augmented by recruitment and coupling with the generated phonons.

As if this were not complicated enough, the surface energy required to rupture the palladium temporarily prevent only temporarily the escape of the reactants during their accumulation secondary to the catastrophic reactions and thereby maintain close contact for the desired reactions. Unfortunately, when the internal pressures are able to exceed the energy needed to create fresh new surfaces in the loaded palladium then destructive changes are wrought. Leakage now occurs and the sample becomes, at best, loco-regionally inactive [25,26]. Therefore, the peak power gain is time-variant, and may significantly decrease with time.

$$\Pi_{max} \text{ (function of time)} = \Pi_{max}(t) \qquad \text{(eq. 5)}$$

This loss of activity in previously active samples is a type of irreversible hysteresis.

VERTICAL CALORIMETRY MAY INCLUDE POTENTIAL ERRORS

Non-flow and horizontal flow calorimetry (HFC) can generally be semiquantitative with appropriate controls and initial time base [17,19]. However, even given that the thermometry is correct, and the time base issue and controls correctly done [27,28], vertical flow calorimetry (VFC) can give false "amplification factors". VFC can amplify the output perhaps a thousandfold, because it can add in Bernard instability to total heat transport, thereby yielding false derivations of "heat" generated [17]. Although the equation used may be dimensionally correct, they are not valid for low flow rates where there is buoyant vertical transport (Bernard instability). When this effect occurs, the observed "heat" in VFC systems may be found to decrease in a static or an HFC system.

Furthermore, analysis of the quasi-1-dimensional model of heat and mass transfer has revealed that the apparent gain of a sample derived by such vertical flow calorimetry (VFC) is correctable [19] as

$$\text{"}\pi\text{" [Apparent gain]} = \pi\ [\text{Real Gain}]/\ (1 - \eta_B) \qquad \text{(eq. 6)}$$

This is the vertical flow calorimetry amplification equation (eq. 6). "π" is the Apparent gain, and π is the actual, or Real Gain. η_B is the fraction of heat vertically transported by Bernard instability. This is a positional error and the positional orientation refers to the direction of the flow, and not to the orientation of any temperature probes therein.

TOWARD SEMIQUANTITATIVE ACCURACY

None of the above is made to imply that such solid state systems do not exhibit 'excess heat'. Rather, it is important to note that there are geometric, material, nuclear, electrical and other activation factors which are *sine qua non* to understanding these complex rich materials.

Second, the materials themselves are time-variant as well as suffering from standard issues of contamination. The former are further discussed in the Catastrophic Active Medium (CAM) theory of the material breakdown [25,26], and the latter will be addressed elsewhere.

Third, any such reported 'excess heat' parameters in VFC systems may be inflated [17,19], if the information was indeed collected with a vertical flow calorimetric system, in the absence of confirmatory calibrations under low to moderate flow conditions where the non-dimensional number (η_B) is not trivial.

In summary, there are several equations (and thus models) involving the power gain factor of cold fusion systems that may explain some of the differences in cold fusion results. These can also improve the accuracy of such power gain measurements, even though some tend to deflate the apparent derived value (e.g. with vertical flow calorimetric systems involving Bernard instability).

Failure to correct power gain factors may not only lead to energized critics, but may slow the attainment of better engineering in the field.

ACKNOWLEDGEMENTS

The author thanks many individuals for the support, inspiration, and criticism toward the development of some aspects of this model and its presentation in this manuscript, including Drs. Stephen Baer, Alex Frank, Profs. Peter Hagelsetin, Marcus Zahn, and Keith Johnson, Gayle Verner, Isador Straus, Glen Dash, Steven Olasky, Richard Goldbaum, Raymond Kurzweil, Aaron Kleiner,

Brian Ahern, Jeff Driscoll, Emma and Allen Swartz, and others associated with JET Technology and JET Energy Technology, Inc., and also Hal Fox, Dineh Torres, and Robyn Harris.

REFERENCES

1. M. Fleischmann, S. Pons, "Electrochemically Induced Nuclear Fusion of Deuterium," *J. Electroanal. Chem.*, 261, pp 301-308, and erratum, 263, p187 (1989); M. Fleischmann, S. Pons, M.W. Anderson, L.J. Li, M. Hawkins, "Calorimetry of the Palladium-Deuterium-Heavy Water System," *J. Electroanal. Chem.*, 287, p 293 (1990).

2. M.H. Miles, R.A. Hollins, B.F.Bush, J.J. Lagowski, R.E. Miles, "Correlation of excess power and helium production during D_2O and H_2O electrolysis using palladium cathodes," *J. Electroanal. Chem.*, 346, pp 99-117 (1993); Miles, M.H., B.F.Bush, "Heat and Helium Measurements in Deuterated Palladium," *Trans. of Fusion Technol.*, vol 26, pp 156-159 (Dec. 1994).

3. M. Fleischmann, S. Pons, "Calorimetry of the Pd-D_2O system: from simplicity via complications to simplicity," *Physics Letters A*, 176, pp 118-129 (1993); M. Fleischmann, S. Pons, "Some comments on the paper 'Analysis of Experiments on Calorimetry of LiOD/D_2O Electrochemical Cells,' by R.H.Wilson et al., *J. Electroanal. Chem.*, 332 (1992), 1 ," *J. Electroanal. Chem.*, 332, pp 33-53 (1992).

4. R.L. Mills, S.P. Kneizys, "Excess Heat during the Electrolysis of an Aqueous Potassium Carbonate electrolyte and the implications for cold fusion," *Fusion Technol.*, 20, pp 65-81, Aug. 1991.

5. V.C. Noninski, "Excess Heat during the Electrolysis of a Light Water Solution of K_2CO_3 with a nickel cathode," *Fusion Technol.*, 21, 2, p 163, (1992).

6. R. Notoya, Y. Noya, T. Ohnishi, "Tritium Generation and Large Excess Heat Evolution by Electrolysis in Light and Heavy Water-potassium Carbonate solutions with Nickel Electrodes," *Fusion Technol.*, 26, pp 179-183 (1993); R Notoya, "Alkali-Hydrogen Cold Fusion Accompanied by Tritium Production on Nickel," *Trans. Fusion Technol.*, 26, pp 205-208, Dec. 1994.

7. T. Ohmori, M. Enyo, "Excess Heat Evolution During Electrolysis of H_2O with Nickel, Gold, Silver, and Tin Cathodes," *Fusion Technol.*, 24, 3, pp 293-295 (1993)

8. T. Matsumoto, "Cold fusion observed with ordinary water," *Fusion Technol.*, 17, pp 490-492 (1990); T. Matsumoto, "Cold fusion experiments with ordinary water and thin nickel foil," *Fusion Technol.*, 24, pp 296-306 (1993).

9. R.T. Bush, R.D. Eagleton, "Evidence for Electrolytically Induced Transmutation and Radioactivity Correlated with Excess Heat in Electrolytic Cells with Light Water Rubidium Salt Electrolytes," *Trans. of Fusion Technol.*, 26, pp 431-441 (Dec. 1994); Robert T. Bush, "A Unifying Model for Cold Fusion," *Trans. Fusion Technol.*, vol 26, pp 434-354. Dec. 1994.

10. M. Srinivasan, A. Shyam, T.K. Shankarnarayanan, M.B. Bajpai, H. Ramamurthy, U.K. Mukherjee, M.S. Krishnan, M.G. Nayar and Y. Naik, "Tritium and Excess Heat Generation During Electrolysis of Aqueous Solutions of Alkali Salts with Nickel Cathode," Frontiers of Cold Fusion, ed. by H. Ikegami, *Proc. ICCF-3*, 1992, Universal Academy Press, Tokyo, pp 123-138 (1992).

11. M. Swartz, "Consistency of the Biphasic Nature of Excess Enthalpy in Solid State Anomalous Phenomena with the Quasi-1-Dimensional Model of Isotope Loading into a Material," *Fusion Technol.*, vol 31, pp 63-74, January 1997.

12. F.G. Will, K. Cedzynska, D.C. Linton, "Tritium Generation in Palladium Cathodes with High Deuterium Loading," *Trans. Fusion Technol.*, vol 26, Dec. 1994, pp 209-213; "Reproducible tritium generation in electrochemical cells employing palladium cathodes with high deuterium loading," *J. Electroanal. Chem*, 360, pp 161-176, (1993)

13. E. Storms, C. Talcott, "Electrolytic Tritium Production," *Fusion Technol.*, 17, p 680 (1990).

14. T. Lo, F. Salzman, M. Swartz, "Radiotherapy for Cancer of the Head and Neck," *Otolaryngologic Clinics of North America*, 18, Aug 1985, pp 521-531.

15. C.A. Perez, L.W. Brady, Principles and Practice of Radiation Oncology, Lippincott, Co., Philadelphia (1990).

16. W. Moss et al., Radiation Oncology: Rationale, Technique, Results, C.V. Mosby Co., St. Louis (1979).

17. M. Swartz, "Potential for Positional Variation in Flow Calorimetric Systems," *J. New Energy*, 1, pp 126-130 (1996).

18. B. Merriman, P. Burchard, "An Attempted Replication of the CETI Cold Fusion Experiment," http://www.math.ucla.edu/~barry/CF/reportcover.html

19. M. Swartz, "Improved Calculations Involving Energy Release Using a Buoyancy Transport Correction," *J. New Energy*, 1, 3, pp 219-221 (1996).

20. M. Swartz, "Quasi-One-Dimensional Model of Electrochemical Loading of Isotopic Fuel into a Metal," *Fusion Technol.*, 22, 2, pp 296-300 (1992).

21. M. Swartz "Isotopic Fuel Loading Coupled to Reactions at an Electrode," *Fusion Technol.*, 26, 4T, pp 74-77, December 1994.

22. H.H. Uhlig, Corrosion and Corrosion Control, Wiley (1971).

23. J. O'M.Bockris, K.N. Reddy, Modern Electrochemistry, Plenum Press (1970).

24. J.R. Melcher, Continuum Electromechanics, MIT Press, Cambridge (1981).

25. M. Swartz, "Catastrophic Active Medium Hypothesis of Cold Fusion," Proc. ICCF-4, Vol. 4, sponsored by EPRI and the Office of Naval Research, December 1994.

26. M. Swartz, "Hydrogen Redistribution by Catastrophic Desorption in Select Transition Metals" *J. New Energy*, 1, 4, pp 26-33 (1996).

27. M. Swartz "A Method to Improve Algorithms Used to Detect Steady State Excess Enthalpy," *Transactions of Fusion Technology*, vol 26, pp 156-159 (Dec. 1994); M. Swartz, "Some Lessons from Optical Examination of the PFC Phase-II Calorimetric Curve," Proc. ICCF4 Vol. 2, sponsored by EPRI and the Office of Naval Research, December 1993.

28. M. Melich, W.N. Hansen, "Some Lessons from 3 Years of Electrochemical Calorimetry," Proc. ICCF-4, sponsored by EPRI and the Office of Naval Research, December 1993.

IN SEARCH OF A SINGLE PHOTON

Norman Silliman [1]

THE PROBLEM:

Newton proposed the first modern version of photons with his corpuscular theory of light in 1672. In the 1850's, Fizeau's and Foucault's measurements were reason enough to discard Newton's theory for Huygen's wave theory. The wave theory was strongly supported by the work of Young and Fresnel. Then in 1905, Einstein published his first serious paper in *Annalen der Physik,* reviving the corpuscular theory of light, putting forward the hypothesis that light was "parcels of radiant energy."

G.N. Lewis introduced the modern term "photon" in his 1926 paper in *Nature.*

We still lack a picture for the photon. In 1951 Einstein declared, "All the fifty years of conscious brooding have brought me no closer to the answer to the question, 'What are light quanta?' Of course today every rascal thinks he knows the answer, but he is deluding himself."[1]

Professor of physics Arthur Zaionc, 1993, points out that researchers who wish to study the isolated photon, must first construct a source of them. So they simply take a light source and dimmed it until it gives off a slow but steady stream of single photons [2]. For decades everyone assumed that dim light was a single-photon stream. Without experimental evidence, how could they be sure? Obviously, a suitable means of testing light sources is required.

The French group of Alain Aspect, Philippe Grangier and G. Roger [3] provided an elegantly simple single-photon test. One passes the suspected photon into an optical instrument that divides light, sending half one way and half another way. If at some point the light is no longer divisible, then we have reached the level of the photon, of the "atom" of light. The optical device that divides light in half is a half-silvered mirror, or 'beamsplitter.' When light falls on it, half of the light is transmitted and half reflected. Imagine a single, atom-like photon striking the beamsplitter. What will happen? If it is truly indivisible, then it will go one way or the other but **not** both. This is called "anticorrelation." [4]

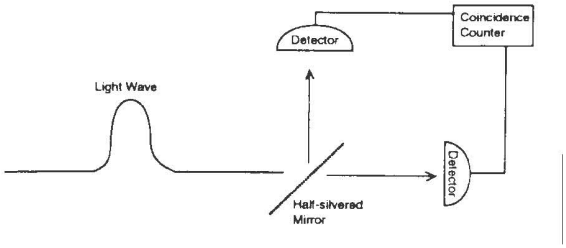


Fig. 1 Anticorrelation detector

Observations:

The classical wave theory of light conceives of light as infinitely divisible; there is no lower limit to how weak the light's intensity can be. Therefore the beamsplitter will always divide the light, transmitting half one way and reflecting the other half. In the corpuscular theory of light, the beamsplitter will sometimes pass a photon and sometimes reflect a photon. The beamsplitter is, therefore, a litmus test for light: wave or particle.

[1] 315 Betty Lane, Pleasant Hill, CA 94523-2808

Professor Zaionc tells us that all traditional sources such as candles, incandescent lamps, gas discharge or fluorescent lights, and even lasers show no anticorrelation, whatever their intensity. [5]

Zaionc continues, "In recent years, two new sources have been developed, one relying on atomic cascade and the other on what is call in the trade 'two-photon, parametric, down-conversion.' The specifics of these sources need not concern us, but in both cases, two closely related photons are generated, one of which signals the presence of the other to the experimenter. When properly used, these sources have been shown to pass the single-photon litmus test. The light they produce displays the anticorrelation looked for in single-photon sources. [6]

Analysis:

Not knowing anything other than these two reports, one from Aspect et al., the other from Zaionc, we can infer two strange results. First, 'natural' light always acts like a wave, even at its weakest level. Second, 'specially made' light acts like a particle, a "photon." The wave length or frequency of this 'specially made' light was not reported.

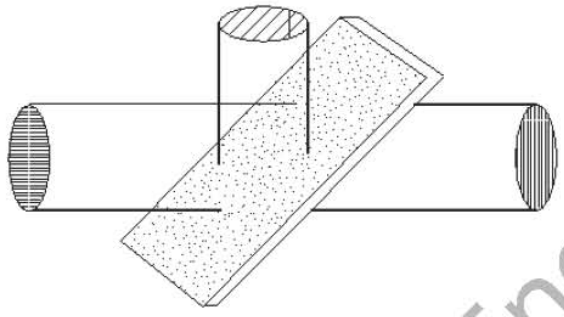


Fig. 2 Half-silvered mirror

Zaionc says that "the specifics of these sources need not concern us," but maybe they do. The other thing that concerns us is the "beamsplitter." What do we mean by a "half silvered mirror"? If we take a close look at the "beamsplitter," we may be able to explain the strange results from these two kinds of light.

Mirrors are manufactured by preparing a piece of glass so that it is "optically flat." That means it is as smooth as we can get it with mechanical means. Then the surface of the glass is coated with silver (or aluminum). The coating process takes some time (a few minutes) and continues until the surface of the glass is completely covered with metal. If we want a "half silvered mirror" then we interrupt the coating process when it is "half completed."

We must assume that the beamsplitter (half silvered mirror) has silver (or aluminum) spots that are smaller than the size of the forward 'foot print' of the wave. That is consistent with the result of half the wave going up and half the wave going straight through, at any intensity, as in Fig. 2. That is true if the light is a simple wave or the modern version of light, a "wave packet."

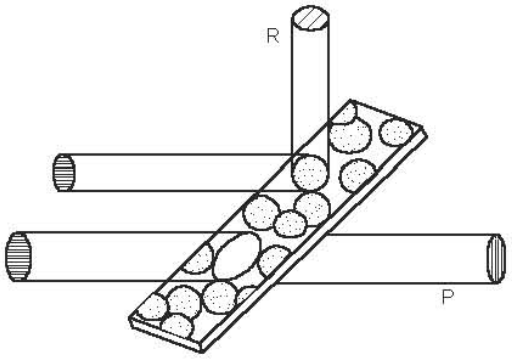


Fig. 3 Special light action

What results do we get if the silvered spots (and blank open spaces) are equal to or larger than the size of the light wave?

Fig. 3 shows what would happen if the light wave forward 'foot print,' the same size as the silver spot, hits the silver spot and is reflected at "R." If the light wave, the same size (or smaller) than the blank spot, misses the silver spot and hits the blank spot, then the wave passes through the glass, as at "P."

This is consistent with the results described above about the specially made sources of "photons" being "properly used."

New Point of View:

This interpretation of the mechanical actions at this step in this chain of logic provides us with one continuing problem, and two advantages. The problem of a simple test for a single photon remains. The half silvered mirror splitting the light energy for the anticorrelation detector is no longer a fool proof mechanism for detecting a single "corpuscle" of light.

The first advantage is that we have simplified things (again) back to one transmission mode. Only one model, the wave model, is required/needed and there is no more paradox.

The second advantage is that we have a new piece of knowledge coming out of this analysis: light has an additional attribute (circular foot print) that defines light formally; the others are polarization, wavelength, direction and intensity.

The circular (would be silly to consider it to be square) foot print would go a long way in helping to understand the Compton effect. If the propagation of light is in the form of a spiral helix, (argued in another paper) [7], then the results that Compton observed (the electrons scattering off to the side) are easier to understand. The spinning, side throwing wave makes more sense than the billiard-ball 'photon' barely nicking the electron, causing an impossible 90° deflection of the electrons.

The conclusion of this chain of logic is simple: the wave model is all that is needed to understand light, there is no paradox of modes, and there is no photon to search

REFERENCES

1. Quoted in "Einstein's Researches on the Nature of Light," *Optics News,* vol 5, no.1, Winter 1979, pp 24-39
2. Arthur Zaionc, Catching the Light: The Entwined History of Light and Mind, Bantam Books, New York, 1993, p 294-5
3. Philippe Grangier, G. Roger and Alain Aspect, "Experimental Evidence for a Photon Anticorrelation Effect on a Beamsplitter: A New Light on Single Photon Interferences," *Euro-Physics Letters*, vol 1, January 1986.
4. Zaionc, Catching the Light, p 294
5. Zaionc, Ibid, p 295
6. Zaionc, Ibid, p 296
7. Norman Silliman, paper arguing that light propagates in a spiral helix, private communications, June 1995

NOVEL ELECTROMAGNETIC CONCEPTS AND IMPLICATIONS FOR NEW PHYSICS PARADIGMS AND ENERGY TECHNOLOGIES

Don Reed [1]

ABSTRACT

The author discusses the need to understand the topology of high-energy soliton-like wave packets. The toroid is shown to be the most likely topology for such observed phenomena, such as high-density charge clusters.

Part of the dogma all electrical engineering and physics students have been subjected to since the advent of electrical science in the Maxwellian era, is the obsolete tenet that the standard linear Maxwell-Heaviside equations are the be-all and the end-all for the description of classical electromagnetic phenomena, only allowing for continuous traveling plane-wave solutions for the electric and magnetic field intensities [1]. These solutions are accordingly configured by topological wave-structures described algebraically by linear superpositon of field components. They are modeled by simply-connected Euclidean geometries, customarily infinitely extended and propagating infinite energy density [2].

However, since the early 20th century, dating from Tesla's research, it has become apparent that in certain regimes of high energy-density plasmas [3] and abrupt high-voltage electrostatic discharges [4], field structures are engendered which, contrary to the standard model, can only be described by closed finite-energy soliton-like condensed electromagnetic wave packets of multiply-connected (possibly toroidal [5]) topology. Moreover, these non-linear topological singularity defects are self-organizing structures which sometimes violate the laws of thermodynamics by increasing the energy gradient within the field over time, while standard continuum physics predicts the entropic dissipation of energy [6].

Particularly, in the waning years of the 20th century, with the development of high-power plasma generating devices in conjunction with fusion research, and high-intensity lasers whose operation can only be properly described with the aid of vacuum polarization phenomena predicted by quantum field theory, evidence continues to surface which clearly demonstrates inaccuracies from the linear Maxwell theory in the classical arena when extremely high energy intensities are involved. As case in point, the existence of EM soliton singularities has been demonstrated in recent years with Ken Shoulders' discovery of condensed charge-cluster EV units [7] and the important but overlooked observation of closed spark loops in high-voltage electrostatic discharges at the Holifield Heavy Ion Research Facility at Oak Ridge National Laboratory [8,9,10]. In the latter case, below 10 MV (Megavolts) the discharges resemble those of normal forked lightning. However, above this threshold, the discharges' topology changes dramatically. Here, at peak machine voltage (@ 20 MV), these structures have been ascertained as genuine multiply-connected closed-loop configurations, and not the accidental visual superposition of simply-connected spiral discharges [8]. Traditionally, Maxwell's linear theory is supposed to subsume all exhibits of classical electrodynamics, regardless of the level of energy- or charge-density of the field. However, the new spark discharge evidence and the Shoulders' research both indicate that there may actually exist,

[1] 44 Paul Place, Buffalo, NY 14201

hitherto unsuspected, separate regimes of classical electrodynamics in high energy density plasmas, delineated by a voltage phase transition [10]. Above this barrier of potential, finite closed energy wave-structures may exist which cannot be codified by the linear Maxwell field theory. We shall now examine theoretical reasons for the failure of customary classical EM thoery to account for these unique energy structures.

SYMMETRY GROUPS AND ELECTROMAGNETISM

The theoretical basis for soliton wave structures to exist in classical electromagnetism is established with an extension of Maxwell theory in terms of the type of symmetry groups considered. The unamended Maxwell theory which is currently taught, possesses an internal symmetry that is a geometrical description of transformation dynamics which, when described in group theory terms, is called U(1) symmetry. The extended Maxwell theory, on the other hand, possesses a more complicated internal symmetry called SU(2).

The form of symmetry that describes a field's dynamics is key in understanding changes in local field properties when the field is moved to a different location. The local differences between the field at the old and new locations is a difference in phase, which for historical reasons is called a difference in "gauge". Thus, the form of symmetry that describes a field's dynamics is a "gauge symmetry" [11].

It is well known that the gauge symmetry of the unamended Maxwell theory is of U(1) form. Simply stated, this means that the commutation relations of two unamended Maxwell fields are described by: [12]

$$XY - YX = 0 \qquad (1)$$

A field with such commutation relations is known as an Abelian field. A distinguishing difference between Abelian and non-Abelian fields is a difference in local degrees of freedom. U(1) fields have less local degrees of freedom than SU(2) fields, and SU(2) fields can be transformed into U(1) fields by a process known as symmetry breaking [13,14]. Therefore, from a theoretical standpoint, solutions of the Maxwell equations which include non-Abelian fields described by SU(2) symmetry can produce soliton wave structures.

Barrett, in particular, has re-examined the foundations of electromagnetic theory, underscoring the importance of higher symmetry groups such as SU(2) for modeling certain electromagnetic phenomena [15]. For instance, it can be demonstrated that Tesla's non-linear oscillator shuttle-circuit (OSC), due to reactive (capacitive, etc.) coupling, cannot be analyzed by standard lumped or distributed circuit frameworks, and is more compatible with the physics of nonlinear optics [16]. Consequently, for proper description of energy transfer dynamics in OSC systems, appeal must be made to non-Abelian quaternionic or higher SU(2) symmetries. By invoking an adapted Yang-Mills interpretation to low energy electromagnetic fields, Barrett transformed Maxwell's equations to a nonlinear non-Abelian form (see Table #1). Subsequently, he incorporated elements of this amended Maxwell model in a recent patent utilizing OSC networks as a phase conjugate mirror for four-wave mixing at RF frequencies [17]. Barrett has also shown that an electromagnetic field conditioned by polarization modulation is also in SU(2) or Yang-Mills form, and thus capable of affecting the space-time metric (gravitational field) [18]. This important finding, that electromagnetism in SU(2) symmetry form can possibly cause changes in inertia and gravitational potential, is also a feature of Barrett's paper "Sagnac Effect". This work is included in the recent watershed volume: Advanced Electromagnetism: Foundations, Theory and Applications.

Table 1	Maxwell Equations	
	U(1)	SU(2)
Coulomb's Law	$\nabla \cdot \boldsymbol{E} = \boldsymbol{J}_0$	$\nabla \cdot \boldsymbol{E} = \boldsymbol{J}_0 - iq(\boldsymbol{A} \cdot \boldsymbol{E} - \boldsymbol{E} \cdot \boldsymbol{A})$
Ampere's Law	$\frac{\partial \boldsymbol{E}}{\partial t} - \nabla \times \boldsymbol{B} + \boldsymbol{J} = 0$	$\frac{\partial \boldsymbol{E}}{\partial t} - \nabla \times \boldsymbol{B} + \boldsymbol{J} + iq[\boldsymbol{A}_0, \boldsymbol{E}] - iq(\boldsymbol{A} \times \boldsymbol{B} - \boldsymbol{B} \times \boldsymbol{A}) = 0$
Gauss's Law	$\nabla \cdot \boldsymbol{B} = 0$	$\nabla \cdot \boldsymbol{B} + iq(\boldsymbol{A} \cdot \boldsymbol{B} - \boldsymbol{B} \cdot \boldsymbol{A}) = 0$
Faraday's Law	$\nabla \times \boldsymbol{E} + \frac{\partial \boldsymbol{B}}{\partial t} = 0$	$\nabla \times \boldsymbol{E} + \frac{\partial \boldsymbol{B}}{\partial t} + iq[\boldsymbol{A}_0, \boldsymbol{B}] + iq(\boldsymbol{A} \times \boldsymbol{E} - \boldsymbol{E} \times \boldsymbol{A}) = 0$

CHARGE CLUSTER PHENOMENA AND SU(2) ELECTROMAGNETISM

The empirically verified highly-organized micron-sized charge cluster (EV unit) investigated by Shoulders for almost two decades, has been shown to exhibit soliton behavior [19]. Consequently, it may be possible to apply an SU(2) description of Maxwell theory in this case to assist in explicating the strange behavior of these units. For instance, it is not possible for the unamended linear U(1) Maxwell theory to account for a mechanism that overcomes the Coulomb force of electron repulsion, resulting in the collective state of approximately 1 micrometer in diameter containing 10^{11} electrons, known as the electron charge-cluster. Insight into this problem can perhaps be found from the fact that, in terms of conserved charges or currents, for the linear Abelian Maxwell theory only electric charge is conserved, whereas in SU(2) electromagnetism, magnetic "charge" (magnetic monopoles) is the conserved quantity [15]. This can also be understood from the process of symmetry breaking, where the degrees of freedom of a standard U(1) electromagnetic field under appropriate boundary conditions, can be embedded or compacted within an SU(2) field. This embedding also amounts to the inclusion of magnetic charges and currents into the Maxwell equations [20].

Recently Jin and Fox [21] have written an incisive report containing a theoretical model for the EV unit that not only corroborates many of the field parameters recorded by Shoulders in connection with the EV dynamics, but sheds light on the possible electromagnetic symmetries responsible for the forming and sustaining of these charge clusters. First, they calculate the potential difference from center to outer surface of the EV is 5×10^8 volts, a value which exceeds by several orders of magnitude the breakdown voltage of dielectric insulators of the highest strength. Also, the electrostatic potential energy is computed as 2.1×10^{14} MeV, producing an equivalent temperature several orders of magnitude higher than that in the core of a thermonuclear explosion, a supernova explosion, or in a white dwarf star. Finally they calculate an expansion pressure on the EV surface as 2.0×10^{14} atm, greatly exceeding the highest pressures created in any scientific laboratories. These findings would lead us to believe it would be improbable for the linear U(1) Maxwell theory to provide an effective description of the EV dynamics.

TOROID TOPOLOGY AND FUNDAMENTAL FIELDS

Another important result of the Jin/Fox analysis is that only a toroidal and not a spherical geometry can account for the stability of these EV units. This key finding, more than any other, suggests that an electromagnetic field with SU(2) symmetry is actually at work forming and sustaining charge clusters. For the explanation why this might be so, we return to the Barrett research. He showed that the gauge theory representation of polarization modulation based on local internal symmetry

is related to the global representation of spaces, that is, to their topology [15]. A practical result of this is insight into electromagnetic field emitter design which requires precise charge patterning. The requirement, in the case of the SU(2) EM field, is for a configuration permitting two types of closed paths: one for internal and one for external space. The torus exactly describes such a topology which represents a multiply-connected (as opposed to infinitely connected) space. See Fig. 1 for a depiction of the hypothetical toroidal EV emitted by cathode.

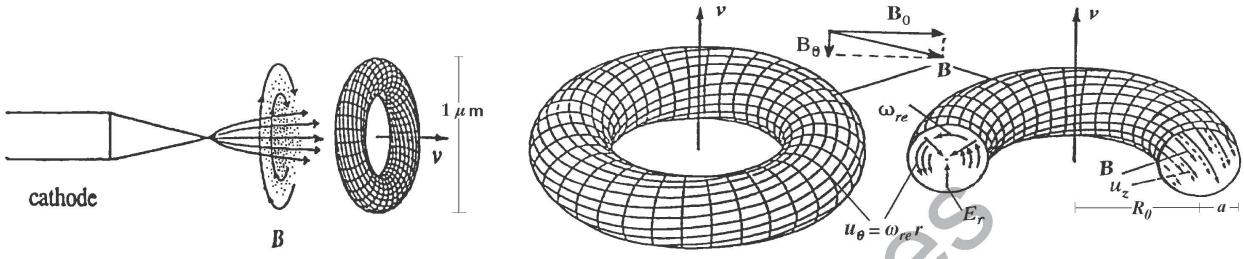


Fig. 1 A toroidal model of the EV. The combined radial electrostatic force - $neE(r)e_r$ and the centrifugal force $nm_e u_\theta^2 / r\, e_r$, on the electron fluid element are balanced by the inward magnetic force $neu_\theta(B_0 + B_z)\, e_r$ and $neu_z B_\theta e_r$, through the high speed angular rotation of the element.

In a more philosophical context, the toroid may serve an appropriate manifold providing for an everywhere continuous smooth (differentiable) vector field which forms discrete modules, thus helping to reconcile the apparent paradox inherent in the wave-particle duality principle in the current quantum mechanical paradigm. Mathematically, the torus is the only surface which can be covered at every point by a smooth vector field. The tangent vector on a torus can be split up into two orthogonal vector fields: toroidal (in a plane perpendicular to the major axis), and poloidal (in planes perpendicular to the circular toroidal axis). See Fig. 2. In this regard it is significant that these two vector fields are mutually interdependent, forming an infinite feedback loop from one to the other, through the operation of the vector curl [22]. Also, if we encounter a closed surface in solving a differential equation, it must be a surface that can be covered by a family of parallel curves. Of all surfaces, only the torus can appear as a closed integral surface for a 3-dimensional equation. Thus, the suggestion is made, that in the quest for a fundamental field structure that might serve as an archetype for both the EV charge cluster unit and sub-atomic particles, only the toroid topology is equal to the task.

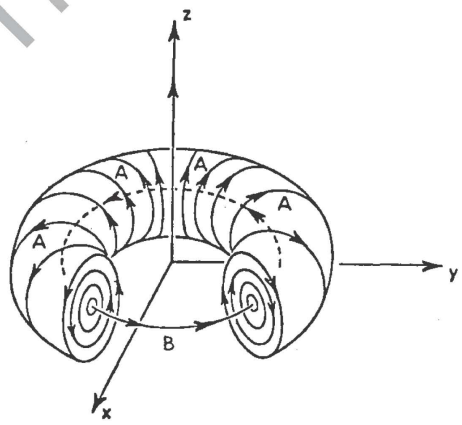


Fig. 2 Vector field on a torus (A -poloidal and B -toroidal).

REFERENCES:

1. J. Jackson, Classical Electrodynamics, Wiley, New York, 1975
2. R.H. Good. T.J. Nelson, Classical Theory of Electric and Magnetic Fields, Academic Press, New York, 1971.
3. C.B. Stevens, "The Plasma Focus Fusion Device – Universal Machine of the Future," *21st Century Science and Technol.*, vol 13, no 4 (1988), pp 38-45.
4. A. Samokhin (Novosti Press Agency, Moscow), "Vacuum Energy - A Breakthrough?" paper No. 03NT0-89071 7CM04, 1988.

5. D. Reed, "Foundational Electrodynamics and Beltrami Vector Fields,"Advanced Electromagnetism: Foundations, Theory and Applications, T. Barrett, D. Grimes (eds), World Scientific, Singapore, 1995.
6. C. White, Energy Potential – Toward a New Electromagnetic Field Theory, Campaigner Pub., New York, 1977.
7. K. Shoulders, U.S. Patent #5,018,180, "Energy Conversion Using High Charge Density," issued 21 May 1991.
8 I. Alexeff, M. Rader, "Possible Precursors of Ball Lightning: Observation of Closed Loops in High-Voltage Discharges," *Fusion Technology*, vol 27, May 1995, pp 271-273.
9. I. Alexeff, M. Rader, "Observation of Closed Loops in High-Voltage Discharges: A Possible Precursor of Magnetic Flux Trapping," *IEEE Transactions on Plasma Sci.*, vol 23, no 6, Dec. 1992, pp 669-671.
10. I. Alexeff, M. Rader, "Observations of Closed Current Loops in High Power Arcs," *Proc. 19th Int. Conf. Plasma Sci.*, Tampa, FL, Jun 1992, p 158.
11. C.R. Yang, R. Mills, "Conservation of Isotopic Spin and Isotopic Gauge Invariance," *Phys. Rev.*, vol 96, 1954, pp 191-195.
12. R. Gilmore, Lie Groups, Lie Algebras and Some of Their Applications, Wiley Interscience, 1974.
13. L. O'Raifeartaigh, "Spontaneous Symmetry Breaking for Chiral Scalar Superfields," *Nuclear Phys.*, vol B96, 1975, pp 331-352.
14. T.W. Barrett, Energy Transfer Dynamics: Signal SU(2) Symmetry Conditioning for Radiation Propagation, Discrimination and Ranging, W.J. Schafer Assoc., Rep., June 1987.
15. T.W. Barrett, "Electromagnetic Phenomena Not Explained by Maxwell's Equations,"Essays on the Formal Aspects of Electromagnetic Theory, A. Lakhtakia (ed), World Scientific, Singapore, 1993.
16. T.W. Barrett, "Tesla's Non-Linear Oscillator-Shuttle-Circuit (OSC) Theory," *Annales de la Fond.*, Louis DeBroglie, vol 16, no 2 (1991), pp 23-41.
17. T.W. Barrett, U.S. Patent #5,493,691, "Oscillator-Shuttle-Circuit (OSC) Networks for Conditioning Energy in Higher-Order Symmetry Algebraical Topologic Forms and RF Phase Conjugation," issued Feb. 20, 1996.
18. T.W. Barrett, "On the Distinction Between Fields and Their Metrics ...," *Annales de la Fond.*, Louis DeBroglie, vol 14, no 1 (1989), pp 37-75.
19. R.W. Ziolkowski, M.K. Tippett, "Collective Effect in an Electron Plasma System Catalyzed by a Localized Electromagnetic Wave," *Phys. Rev. A*, vol 43, no 6, Mar. 15, 1991, pp 3066-3072.
20. R. Rajaraman, Solitons and Instantons, North Holland, Amsterdam, 1982.
21. S. Jin, H. Fox, "Characteristics of High Density Charge Clusters: A Theoretical Model," *J. New Energy*, Winter 1996, vol 1, no 4, pp 5-20.
22. D. Reed, "The Vortex as Topological Archetype - A Key to New Paradigms in Physics and Energy Science," Proc. of the 4th Symposium on New Energy, May 1997, in press.

EDITOR'S CHOICE

EINSTEIN'S MASS DILATION AS AETHER DRAG

Chuck Bennett [1]

Objects approaching the speed of light undergo mass increase according to Einstein's relativistic mass dilation equation. Has anyone ever wondered where the extra mass comes from?

In 1905, Einstein derived the formula for mass energy equivalence as an afterthought to his publication on special relativity, "On the Electrodynamics of Moving Bodies" [1,2]. Special relativity is based on two principles that are "only apparently irreconcilable." One, that the speed of light is measured the same in all reference frames of platforms moving relative to each other; and two, the fundamental laws of physics must be upheld. It is a common misconception that the fundamental laws are altered, but they are not. It is the measurement parameters that undergo significant changes in order to facilitate Einstein's two seemingly dichotomous postulates. Time, forward dimension, and mass change according to the Lorentz formulas.

Einstein reasoned that if the law of conservation of energy is to be preserved, then an increase in mass is manifested as excess energy [2]. But what about the conservation of mass? The answer to this question in relation to the postulate of a new quantized aether will be set forth below.

The derivation of the mass-energy equation is as follows:

Force is the time rate of change of momentum, *mv*:

$$F = \frac{d(mv)}{dt} \tag{1}$$

The complete derivative is:

$$F = \frac{dm}{dt} v + \frac{dv}{dt} m \tag{2}$$

Apply the chain rule to expand the expression using *dr* as an infinitesimal increment of linear distance:

$$F = \frac{dm}{dr}\frac{dr}{dt} v + \frac{dv}{dr}\frac{dr}{dt} m \tag{3}$$

Re-arrange terms:

$$F = \frac{dm}{dr} v \frac{dr}{dt} + \frac{dv}{dr} m \frac{dr}{dt} \tag{4}$$

Recognize, dr/dt as the time rate of change of distance, which is velocity, v :

$$F = \frac{dm}{dr} vv + \frac{dv}{dr} mv \tag{5}$$

Multiply both sides by dr:

$$Fdr = dmv^2 + dvmv \tag{6}$$

[1] 3437 Birch Tree Way, Sacaramento, CA 95826

Recognize that force, F, times an infinitesimal increment of distance, dr, is an infinitesimal increment of energy dE:

$$dE = dmv^2 + dvmv \tag{7}$$

Now if we take the formula for mass dilation:

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{8}$$

re-arrange:

$$m\sqrt{1 - \frac{v^2}{c^2}} = m_0 \tag{9}$$

square both sides:

$$m^2(1 - \frac{v^2}{c^2}) = m_0^2 \tag{10}$$

Multiply by c^2:

$$m^2c^2 - m^2v^2 = m_o^2 c^2 \tag{11}$$

Differentiate the entire expression:

$$2mdmc^2 - 2mdmv^2 - m^2 2vdv = 0 \tag{12}$$

Divide by $2m$:

$$dmc^2 - dmv^2 - mvdv = 0 \tag{13}$$

Re-arranging:

$$dmc^2 = dmv^2 + mvdv \tag{14}$$

Now we realize that the term above in equation (14) is the same as in equation (7) and we substitute this in equation (7):

$$dE = dmc^2 \tag{15}$$

Upon integration, we achieve the famous formula:

$$\int dE = \int dmc^2 \tag{16}$$

or:

$$\Delta E = (m - m_0)\, c^2 \tag{17}$$

and:

$$\Delta E = mc^2 - m_0c^2 \tag{18}$$

Einstein reasoned that rest mass, m_0, must have energy, m_0c^2, and we later found out that this was true from the initial discovery of isotopic mass change in beta decay all the way to modern mass-energy changes in fission and fusion. More recently, we have seen the discovery of low temperature fusion and transmutation with subtle mass-energy release within the lattices and electrolytes of new hydrogen energy systems.

If we realize that dr could be an infinitesimal radial change as well as linear distance, we can write:

$$Fdr = dmv^2 + dvmv \tag{19}$$

Realizing that $-mv^2/r$ is also a force as related to inward centripetal force, we can write:

$$-\frac{mv^2}{r}dr = dmv^2 + dvmv \tag{20}$$

Re-arranging:

$$0 = \frac{mv^2\,dr}{r} = dmv^2 + dvmv \tag{21}$$

Divide by mv^2 :

$$0 = \frac{dr}{r} + \frac{dm}{m} + \frac{dv}{v} \tag{22}$$

Upon integrating, we have:

$$\int 0 = \int \frac{dr}{r} + \int \frac{dm}{m} + \int \frac{dv}{v} \tag{23}$$

or:

$$\text{constant} = ln(r) + ln(m) + ln(v) \tag{24}$$

or:

$$\text{constant} = ln(mvr) \tag{25}$$

Raising to exponent:

$$e^{\text{constant}} = e^{\ln(mvr)} \tag{26}$$

and:

$$e^{\text{constant}} = mvr \tag{27}$$

Recognizing that e^{constant} as just another constant but with larger magnitude, we have:

$$mvr = \text{constant} \tag{28}$$

Or the conservation of particulate angular momentum.

In a previous article [3], a sea of particles on the order of a million times lighter than the electron is proposed as a "quantized aether" in which aether drag is re-introduced as a plausible explanation for the Michelson and Morley null result. All subatomic and atomic particles are comprised of these small particles and the particles create the aether. Particles do not pass through an aether medium and the aether medium is not separate from particles. In other words, particles and the aether are one entity.

Thus, in conclusion, the postulate emerges that actual mass transfer is responsible for the mass change in relativistic mass. The law of conservation of mass is upheld. The fundamental particle introduced in reference [3] is the element for a quantized aether and acts as an agent for mass transfer in relativistic mass changes. In addition, as shown above, the conservation of particulate angular momentum is derived for the smallest particle of the aether. This particle can be taken to be the infinitesimal limit as the fundamental element of the aether approaches zero. These premises establish the seed of vorticual motion for the quantized aether.

REFERENCES:

1. A. Einstein, "On the Electrodynamics of Moving Bodies," *Annalen Derphysic*, Vol. 17, No. 5, Sept. 26, 1905, pp. 891-921.
2. A. Einstein, "Does the Inertia of a Body Depend Upon its Energy?" *Annalen Derphysic,* Vol. 18, No. 3, Nov. 21, 1905, pp. 639-641.
3. C. Bennett, "A Quantized AEther," *New Energy, News*, vol 4, no. 7, Nov. 1996, p. 7.

EDITOR'S CHOICE

THE FUNDAMENTAL FAULT WITH SPECIAL RELATIVITY

Robert L. Henderson [1]

ABSTRACT

There is a fundamental fault with special relativity that stems from a misunderstanding of the function of the FitzGerald and Lorentz contraction phenomena: the phenomena from which all the bizarre concepts of special relativity derive. Once this misunderstanding is cleared up, it can be seen that special relativity has never been anything more than mere speculation: an irrational theory of paradox that has served no useful purpose within the field of rational science.

DISCUSSION

The fundamental assumption of special relativity is that the velocity of every light beam is the same value "c" with respect to every reference frame that is either at rest or moving with uniform linear velocity. Although this assumption clearly violates the common-sense principle of the vector addition of velocities, it is assumed to be validated by the action of the FitzGerald contraction of length and Lorentz contraction of time phenomena: the two phenomena from which all the bizarre concepts of special relativity originate. However, although the belief in these two phenomena has existed for some 90 years, not one of the thousands of persons who have accepted the phenomena as fact has taken the time to verify them against a hypothetical test case, which would immediately show that they do not function in such a manner as to make the velocity of all light beams the same value of c in all reference frames that are moving with respect to each other.

Why the misunderstanding of these phenomena exists is because of the way light velocity was determined in the classical Michelson-Morley experiment: the experiment performed in 1887 that gave rise to the concepts of FitzGerald and Lorentz; and ultimately, to the concepts of Einstein's special relativity. For clarification, a brief, simplified explanation of this experiment follows:

During the 19th century it was believed (and rightly so) that light was a form of wave motion which propagated through an unknown light-conducting medium called the "luminiferous aether," or simply the "aether" for short. It was also believed that the velocity of light was the value "c" in every direction with respect to the reference frame of this medium; and it was further believed that the earth must be moving through this medium at some unknown velocity "v" with respect to the medium. It was therefore thought that if one could measure the velocities of two light beams which were traveling in opposite directions along the line of the earth's direction of travel through the aether, that the velocity of the earth through the aether could be determined from the two measured velocities. It was assumed that the beam traveling in the same direction as the earth's motion through the aether would have a velocity of c - v with respect to the earth, and that the beam traveling in the direction opposite to the earth's direction of travel would have a velocity of c + v with respect to the earth, and that from these two velocities, the velocity v of the earth through the aether could be readily calculated.

[1] 10529 W. Campana Dr., Sun City, AZ 85351

However, because of the extremely high velocity of light, no means existed to measure the two light-beam velocities individually with the degree of precision required for this experiment. Therefore a very unique method of determining the two velocities was devised, using an instrument called an "interferometer." (Now, although the method to be presented here is a slightly simplified explanation of the method actually used, it correctly contains, and more clearly explains, the element of confusion that has confounded scientists for over 100 years.) This test method consisted of transmitting a "test" light beam down a test path to a mirror at the far end of the path that reflected the beam back to its point of origin, whereupon the round-trip time interval was compared with the round-trip time interval required for a "standard" light beam traveling at the velocity "c" to travel out and back over an identical path at right angles to the test path. In addition, since it was not known in which direction the earth was traveling through the aether, the two paths were mounted on a table that could be rotated through 360 degrees in the horizontal plane so that tests could be run with the test path in every possible orientation, one of which would surely have to be in line with the direction of the earth's motion through the aether. And, for ease of designation, let us refer to the "test" beam path as the "in-line" path (i.e., the path "in line" with the earth's direction of motion through the aether), and the "standard" beam path as the "side-arm" path.

Now, under the initial assumptions, if the values of the "test" light-beam velocities were actually c - v and c + v as anticipated, the round-trip time interval for the "test" beams would – of necessity – be greater than that for the "standard" beams: a difference in time intervals which could readily be detected by the interferometer regardless of how small the difference. However, to the amazement of the experimenters, when the test was performed, it produced what was referred to as "null results": that is, the round-trip time intervals of the "test" and "standard" beams always came out exactly the same regardless of the orientation of the test path. **Now, Albert Michelson – the scientist who designed the experiment – immediately and correctly deduced that in order for null results to occur, the aether had to be in equilibrium with the earth in the region immediately surrounding the earth so that the velocity of the "test" beams were actually the same value c as for the "standard" beams.** However, that explanation was not accepted and more exotic explanations were proposed to account for the null results.

The first such exotic explanation was proposed by G.F. FitzGerald in 1889, who hypothesized that, *due to the interaction of a moving, physical body with the aether,* all dimensions on the body in line with the direction of the body's motion through the aether were contracted: a phenomenon referred to as the "FitzGerald contraction of length." This contraction was assumed to always undetectably shorten the in-line test path of the interferometer the exact amount required to cause the expected longer round-trip time interval of the "test" beams to be the same as the shorter interval for the "standard" beams, which traveled over the side-arm path that was assumed to always remain at its true, standard length. FitzGerald also derived an equation that expressed the required in-line path-length contraction needed to produce the null results. However, since FitzGerald's contraction of length hypothesis seemed rather far-fetched, it was not widely accepted, yet neither was it rejected outright as a physical impossibility.

Now, at this point, it is possible to discern the fallacy in the line of reasoning employed by FitzGerald. Note that the light beam velocities over the in-line test path were assumed to be c - v in one direction and c + v in the other, a combination of velocities which would always make the round-trip time interval for those beams greater than that for beams traveling over a similar path at the standard velocity c. However, by shortening the in-line path slightly in order to reduce the round trip time interval over that path, it will not convert the assumed velocities of the c - v and c + v beams both into c in the in-line path, which is the condition actually being sought. Note that if the in-line path is shortened, it will cause *both* the c - v and c + v beams to appear to speed up: but the velocity of the c + v beam is already *greater* than c! And, as we shall see, this same fallacy is present in all other

hypotheses proposed in the formulation of special relativity. It should be understood that the only rational way assumed light-beam velocities of c - v and c + v can both be converted to c is by altering the energy content of the light conducting medium so that the medium is actually in equilibrium with the test path, as discerned by Michelson.

Then, in 1894, H.A. Lorentz hypothesized that, again **due to the interaction of a moving, physical body with the aether**, time rate-of-flow slowed down in the vicinity of the body, **but only in line with the direction of the body's motion through the aether**: a phenomenon referred to as the "Lorentz contraction of time." And, as with the FitzGerald contraction of length, this time contraction was assumed to always be in the right amount to cause the expected longer round-trip time interval of the "test" beams over the in-line path to be the same as the shorter round-trip interval for the "standard" beams that traveled over the side-arm path where time rate-of-flow was assumed to always remain at its true, standard rate. Lorentz also derived an equation that expressed the time-rate-of-flow contraction required in the in-line arm to produce the null results. But again, since Lorentz's **time-contraction** hypothesis seemed even more far-fetched than the FitzGerald contraction of length, it, too, was not widely accepted, yet neither was it rejected outright as a physical impossibility.

Now, it should be noted that exactly the same fallacy pointed out for the FitzGerald contraction of length hypothesis applies to the Lorentz contraction of time hypothesis. Although reducing time rate-of-flow in the in-line path would conceivably cause the round-trip time interval in that path to equal that of beams traveling over the side-arm path at the standard velocity c, it would not convert the assumed "test" light-beam velocities of c - v and c + v both into c for exactly the same reason as for the FitzGerald case: both beams would appear to speed up, but the velocity of the c + v beam is already *greater* than c!

Furthermore, since only one of these hypotheses would theoretically have been sufficient to account for the null results of the experiment, common sense would dictate that at least one of them had to be incorrect: but which one? In actuality, both of them were impossible, since, as we have seen, neither of them served to convert the two assumed light-beam velocities of c - v and c + v in the in-line path both into c, which was the condition actually being sought.

Then, in 1905, in a paper entitled "On The Electrodynamics of Moving Bodies," Einstein proposed what came to be known as "The Special Theory of Relativity." In this paper, Einstein abandoned the concept of an aether and hypothesized that the velocity of every light beam was just naturally the value "c" with respect to every reference frame that was either at rest or moving with constant linear velocity: a concept that clearly violated the common-sense principle of the vector addition of velocities. However, Einstein assumed that the "constant-velocity" concept was true because of undetectable changes in physical lengths and time rates-of-flow which occurred in all moving reference frames, due to their relative velocities with respect to other reference frames. In essence, Einstein believed that *both* the FitzGerald contraction of length and the Lorentz contraction of time phenomena existed, but were caused by the abstract relative velocity between reference frames rather than by the interaction of a physical body with a physical, universal aether.

Furthermore, in his aforementioned paper, Einstein attempted to derive transformation equations that would relate the changes in physical dimensions and time rates-of-flow within moving reference frames required to make the velocity of all light beams a constant value c with respect to each moving frame. He attempted to do this by mathematically showing that an electromagnetic wavefront which was expanding spherically about some reference point in a stationary reference frame would also appear to expand spherically about an observer who had a velocity with respect to the stationary reference point. And, although it is generally assumed that the equations derived

by Einstein were the same as the equations previously derived by FitzGerald and Lorentz, such was not the case. The derivations performed by Einstein were crude and unscientific: the equations so derived would not convert assumed velocities c - v and c + v both into c in the moving frame (obviously not, since no transformations of time or length can do this, as previously explained): they did not resemble the FitzGerald or Lorentz equations; and they were, in fact, completely meaningless: never to be mentioned by anyone in the scientific community.

Even Einstein eventually realized that his equations were meaningless. He later abandoned them and simply assumed that the equations derived by FitzGerald and Lorentz were the equations which expressed his assumed physical-dimension and time-rate-of-flow relationships required between moving reference frames. The assumption was that any reference frame within which an observer resided was always considered to be a stationary frame within which all dimensions were "true" dimensions, and that the "contracted" dimensions of length and time computed by the FitzGerald and Lorentz equations were the dimensions that existed in any other reference frame which was moving with respect to the observer's frame. It was simply assumed that the changes in physical dimensions and time rates-of-flow as computed by these equations would suffice to convert light-beam velocities of c - v and c + v both into c in all moving frames, which they will not do, as we have previously shown! Only a light-conducting medium that is maintained in equilibrium about each physical body due to the physical interaction of each body with the medium (analogous to the condition in which the earth's atmosphere is found to be in equilibrium about each moving hot-air balloon) can account for the velocity of light being c in every direction with respect to every physical body – but only when measured in the immediate vicinity of the body! There is no other rational explanation for this phenomenon!

It should be realized, then, that special relativity has never been anything more than an irrational theory of paradox, and has served no useful purpose within the field of rational science. In fact, rather than being of benefit to the scientific endeavor, special relativity has been the most serious impediment to the rational progress of science encountered in the last 100 years. The most serious damage it has done has been to suppress the rational consideration of the universal medium, the existence of which provides the only rational explanation for the null results of the Michelson-Morley experiment.

Furthermore, in addition to providing the only rational explanation for the null results of the Michelson-Morley experiment, acknowledgment of the existence of the universal medium would provide the missing ingredient required to resolve substantially all the other problems yet facing the physical sciences: the medium from which to develop the rational explanations for the phenomena of light waves, gravity, nuclear energy, the nuclear binding force, electric and magnetic field forces, radioactivity, the Higgs boson, the Higgs field, the origin of matter, the missing mass of the universe, and the macroscopic configuration of the universe as well. In addition, it would provide the medium required to generate both the "zero-point energy," and the compressive force about every point in space called the "cosmological constant," which are the two hypothesized phenomena required to provide quantum mechanics with its long-sought, rational foundation.

COMMENT:
By Vincent Coon

I agree in spirit with the author's attack on Special Relativity. It is true that no clock-rate slowing or motionward contraction is sufficient to make the speed of light seem isotropically constant in all inertial frames. However, Special Relativity involves more than these. It is essential to consider the synchronization of clocks in reference frames. In addition to so-called time dilation and the Lorentz-

Fitzgerald contraction, if you allow the clocks of one inertial frame to be out of sync, in just the right way, with the clocks of another frame, you will find that it is possible to create the illusion of c measuring the same in both frames. Keep in mind that a reference frame, moving by, doesn't really have to be Lorentz contracted and clock-rate retarded in order for it to seem so, based on the "synchronization" (clock settings) of the bystander's frame.

Most erudite relativists understand that the Lorentz contraction is not something that can be photographed. One's evaluation of the lengths of moving meter sticks and the clock-rates of moving clocks is affected by the clock settings of separated clocks positioned in one's own frame. Thus, two observers in relative motion can surmise that the other is Lorentz foreshortened and clock-rate retarded. Restricted to a universe of inertial reference frames, the Lorentz transformation dies have a certain mathematical consistency. This does not mean that "relative simultaneity" works well in the real world. Relative simultaneity is the real fault with special relativity.

LETTERS TO THE EDITOR

THE NEW ENERGY SPECTRUM

Harold Aspden [1]

For several years, since I woke up to the prospect that one day our world may derive its power needs from the quantum activity of the omnipresent aether, I have tried to correlate information about the energy anomalies that I find particularly relevant to my interpretation of aether physics. Readers of the April 1997 issue of *New Energy News* will see mention of my latest "Energy Science Report No. 10," which has been my way of reporting my research interests in recent times. That report shows that the New Energy Spectrum extends into the biophysical world of the human body, which seems to exhibit, deep in its molecular structure, a form of room-temperature superconductivity and even a microscopic motor action in the our body cells.

I have been struggling, however, to keep at my experimental pursuits on magnetism, reluctance motors, and what I call **vacuum spin**, whilst trying to generate interest in my early theoretical research on the aether topic, and whilst keeping abreast of developments that I hear about from the world at large. I comment here on three topics that I believe contribute to the New Energy Spectrum. I had planned that two of these would be the subjects of my Energy Science Reports Nos 11 and 12, particularly on the themes of cold fusion and thermoelectricity. I will henceforth be completing this program by publishing instead on my Internet web pages. However, JNE readers may like to have some hint concerning my plans for three of these items.

Firstly, the experimental findings of Dave Gieskieng (Arvada, Colorado) deserve particular mention. Year after year he experimented in transmitting radio waves across deep canyons. He used an antenna designed to send an E wave in quadrature phase with an H wave and compared the results with conventional dipole antenna transmission which forces the E and H waves to propagate in phase. His findings convinced me that normal radio transmission sheds all the wave energy as heat over a short range from the transmitter but a quadrature phase EM wave (whether formed ab initio or as a residue of the conventional wave) still ripples on, not transporting energy, until intercepted by another antenna, **where energy in the local aether is then tapped**. Common sense should tell us that energy proper does not travel at the speed of light. Just imagine two waves traveling through one another in opposite directions and think through the physics of the energy deployment without getting too embroiled in mathematical symbols concerning photons! The experimental findings of Gieskieng should not have been ignored!

Secondly, on the 'supergraviton' theme, and its relevance to warm superconductivity, cold fusion and permanent magnetism, I will be reporting on this subject soon in a very comprehensive way, drawing attention to the copious data which supports my proposition that the range close to 101 atomic mass units plays a special role in the dynamic resonance of molecular forms in perovskites, organic matter, etc., and atomic groups in metals. This is marginally below the supergraviton mass of 102.18 amu, because the supergravitons lose a little effect in spreading their action over several atomic sites. I believe thermal energy is regenerated as electricity in the truly resonant states that one can then attribute to certain substances. I will, however, be pointing to recorded evidence of the tuning effects of hydrogen absorption by such molecules.

[1] Sabberton Research, P.O. Box 35 Southampton S016 7RB England
My Internet web page: http: / /ourworld.compuserve.com/homepages/H_ASPDEN

Thirdly, and to conclude these remarks with something more specific, I will be drawing special attention to the 'free energy' implications of a U.S. patent just cited against one of my patent applications. It is U.S. Patent 4,435,663 granted to IBM and dated March 6, 1984. Its title is "Thermochemical Magnetic Generator." What is described, however, is "a thermochemical magnetic generator which uses hydrogen as a working gas and magnetic intermetallic compounds which absorb hydrogen as the working magnetic material." The description of the invention says that "thermomagnetic generators are devices that convert heat into electricity." The description further shows that hydrogen is not consumed, it is trapped in an enclosure and merely transferred forwards and backwards from one absorbing substance to another cyclically under the regulated control of heat input. The magnetic transitions induce output electricity in a coil wrapped around the chamber housing the working substance.

This patent presents experimental data showing that the mere cyclical variation of hydrogen gas pressure resulting from the heat cycle will generate electricity. This is a room temperature device but the magnetic state of the intermetallic compound transits through the Curie temperature, converting ferromagnetic state to non ferromagnetic state, merely in response to hydrogen pressure, as thermally controlled. My interest is aroused by the fact that the chemical composition of the lanthanum pentacobalt working substance varies by absorption of hydrogen and a group of three such molecules, without the hydrogen, has a mass that is an integral multiple of 100.15. The operative cycle used by this IBM device cycles the composition between states where each molecule has 3.5 or 4.5 hydrogen atoms, respectively. This makes the mass transition one between an integer multiple of 100.96 and 101.19 amu. As I see it this is evidence of the **fine-tuning of the supergraviton** resonance and, indirectly, it does have bearing on the **cold fusion** theme. However, do not rush to procure a copy of that IBM patent in the hope of building an energy generator. The practical potential seems to me to be very limited. What is important, however, is the experimental confirmation of the physical principles by which I can see us harnessing in future power generators.

To conclude I mention that on March 26, 1997, I was granted GB Patent No. 2,278,491 entitled 'Hydrogen Activated Heat Generation Apparatus'. It has 18 claims and is part of my, albeit theoretical, efforts to contribute something to the cold fusion theme. I also mention that the British Patent Office has notified me that on April 16th the grant of my GB Patent 2,283,361 will be published. This is entitled 'Refrigeration and Electric Power Generation'. It bears upon the thermoelectric theme, the subject of my Energy Science Report No. 3, but it also exploits the 101-102 amu supergraviton resonance theme by disclosing why oxidized polypropylene is a room temperature superconductor and showing how this can be incorporated in a thermoelectric power converter. A group of seven molecules in the chain structure of oxidized polypropylene. $[C_3H_6O]_7$ has a molecular mass that is 4 times 101.5 amu.

DO PHOTONS LOSE ENERGY SPONTANEOUSLY IN THE FORM OF SMALL MASSIVE PARTICLES?

Henry P. Dart, III [2]

This letter refers to the article by Colin Walker entitled "Is the Redshift a Quantum Effect?" in the Summer 1996 issue of *Journal of New Energy* [1], in which the author discusses my article entitled "A New Alternative to the Big Bang Theory," published in *Apeiron* for October, 1993. [2].

Colin Walker in his article refers to my proposal that photons eject two very tiny particles with every cycle as they go through space, as an "emission" mechanism. He writes that the tiny particles, which are called

[2] 2048 East Seventh Street, Tucson, AZ 85719

"photinos," must be emitted ahead of the photon for conservation of momentum to be satisfied. Alternatively, an "entity with negative energy could be absorbed or emitted by the photon."

I want to make it clear that those are not my words. They are the words of Colin Walker. In fact, if those are the only alternatives that will validate my proposal, then my proposal is impossible because both of the conditions are themselves impossible. A particle cannot be emitted by the photon in a forward direction, for then the particle would be going faster than light, which is impossible. On the other hand, "an entity with negative energy" is impossible because the dimensions of an energy are those of a mass multiplied by the square of a velocity. A velocity is a vector which may be either positive or negative, but the square of a velocity is always positive. And a mass is always positive. Therefore, an energy is always positive, and "an entity with negative energy" is an impossibility.

My proposal calls for the little "photinos" to be "cast off" from the parent photon in a rearward direction at the speed of light relative to the photon, so that the little particles will be at rest in space as the photon moves forward, leaving in its wake a trail of tiny photinos. By analogy, it is like a truck moving down a road at, say, 20 miles per hour with a load of bean bags while a man in the back of the truck throws out the bean bags toward the rear at a speed relative to the truck of 20 miles per hour. Therefore each bag as it is thrown will fall on the road motionless. In that case, conservation of momentum is satisfied, for as each bag is thrown, there is a corresponding force in the forward direction that causes the truck to move a little bit faster, which increase in speed compensates for the loss of mass in the truck. Therefore, momentum is conserved. But in the case of the photon, the loss of mass when the little particle is "cast off" to the rear cannot be compensated for by an increased speed. The photon is going forward at the maximum speed, c, to begin with. It is simply impossible to increase that speed. I stated in my paper [2] that this situation constitutes an exception to the general rule that momentum is conserved. As a matter of fact, the general rule is that the total momentum in the universe is zero for there are as many particles going one way at any given moment in time as there are going in the opposite direction. This holds true for photons emitting little particles, for there are as many photons going in one direction as there are going in the opposite direction in the infinite universe. In a broad sense, therefore, momentum is conserved.

It is entirely unreasonable to condemn my proposal that the photon loses energy by casting off small particles, when I have shown that the increase in speed of the photon which would satisfy momentum conservation is impossible. There is certainly nothing that would prohibit a particle being cast off in the rearward direction. This situation constitutes a clear exception to the rule that calls for conservation of momentum, which is not a sacred law by any means.

There is still another reason why loss of energy by ejection of little massive particles from photons is a mandatory process. The reason is that if there is no mechanism for converting radiant energy back into material particles, the universe would have long ago become a sea of radiant energy. Nuclear reactions in stars are constantly converting massive particles into radiant energy by reducing the mass of the atoms that constitute the "fuel" of nuclear energy. My proposal describes just such a mechanism. I know of only one other person who made a similar proposal, namely, the late F.C. Jelen, who published an article entitled "Conversion of Radiant Energy to Mass" in *The Toth-Maatian Review*, Vol 3, Number 3, October, 1984 [3]. Jelen employed roughly the same principles which are employed in my article referred to above. However, he made an error in calculating the "half life" of a photon. Using a Hubble constant of 80 kms/sec per megaparsec, he arrived at a figure of 8.6×10^{23} years as the period of time in which a photon would lose half its energy. This is grossly wrong, as he admitted to me in writing after I wrote to him and told him that my figure using a slightly different Hubble Constant was about 7 billion years. He agreed that my figure is right for a Hubble age of 10 billion years. My initial work on this problem was done in 1979, 5 years before Jelen's article appeared, but I did not publish it until 1993. Jelen did not discuss the conservation of momentum problem at all.

It is my opinion that any "tired light" theory that does not provide for conversion of the energy lost by photons to massive particles is defective for the reason set forth above.

References

1. C. Walker, "Is the Redshift a Quantum Effect," *J. New Energy*, Summer 1996, p 88.
2. H. Dart, "A New Alternative to the Big Bang Theory," *Apeiron*, no 17, October 1993, p 5.
3. F.C. Jelen, "Conversion of Radiant Energy to Mass," *The Toth-Maatian Review*, vol 3, no 3, October 1984, p 1361.

{See also P. Anastasovski et al., "A New Approach to the Cosmic Red-Shift and to the Cosmic Microwave Sources," J. New Energy, vol 1, no 2, pp 79-87. – Ed.]

APOLOGIES TO DR. BOCKRIS

[In April 1997, an evening symposium on Alternative Energy Resources & Technology was denied a place to meet on the campus of Texas A&M University, because of the controversial nature of the speakers ("They're all kooks and charlatans," was the opinion of Prof. Frank Cotton of the Chemistry Department). The science being expounded at the meeting is not, as yet, fully accepted by the scientific community.]

The attached letter was received by Dr. John O'M. Bockris on Monday, April 21, 1997; therefore, the matter regarding the seminar's change of venue has been resolved. Out of respect for the individual that submitted the letter, the person's identity will be protected. The following information was forwarded to 1500 faculty, staff, and students on campus and the Board of Regents of Texas A&M..

◇ ◇ ◇

Dr. John Bockris
Distinguished Professor
Chemistry Department
Texas A&M University

On behalf of faculty, staff and students that were involved with the decision to cancel the "Alternative Energy Resources & Technology" seminar, please accept this humble apology for the poor judgement that resulted in reversing the decision to hold the seminar on campus. Based upon the material presented at the seminar at St. Mary's Catholic Student Center, you have proven that your work in cold fusion is legitimate and should be taken seriously. 173 patents in the cold fusion field is convincing evidence in and of itself.

It is truly unfortunate that you have unnecessarily [experienced] so much resistance in sharing your ground breaking research with the University community. I sincerely hope that the other people involved with making the mistake of forcing your seminar off campus will be open-minded enough to allow the Fall 1997 Alternative Energy Conference to be held on campus.

Sincerely, /s/ (name deleted)
Mechanical Engineering Dept.
Texas A&M University

MATSUMOTO CLARIFICATION

Memorandum From: John Bockris:

Matsumoto uses all sorts of anagrams which are not always obvious to everybody. Some of them are clear to me and others not, for example, BTR?, EPMA?, etc. This should be clarified in a proper paper which is meant to be informative to people in the field.

Note a typical Matsumoto statement on page 83 of the article which you have published. He says that the radiation which is presented "was neither gamma or x-rays." Of course, everybody wants to know what it is. They are not interested in what it wasn't.

There is one thing I don't understand about the Matsumoto paper and that is how he gets the transmutation by electronic acceptance. For example, his equation 9 of the appendix gives

$$^{40}K + e \rightarrow {}^{40}Ar(st)$$

I wonder what st means? Nuclei consist of protons and neutrons.

◇ ◇ ◇

Response from Dr. Matsumoto:

Thank you very much for the fax of March 17. Sorry for the late response, because I attended the two meetings of the Nuclear Energy Society and Physical Society. In the former, there were three presentations of cold fusion and in the latter, only one.

I would like to respond to Prof. Bockris' comments to my paper, "Experiments of Underwater Spark Discharges with Pinched Electrodes," which was published in the latest issue of *Journal of New Energy.*

A. The classification of anagrams is made in the second paragraph on page 80. I never used "BTR," but "VTR" which means video tape recorder.
B. "st" was not classified. It means "stable."

Thank you very much,
Dr. Takaaki Matsumoto

FUSIONfacts

FORMERLY A MONTHLY NEWSLETTER FROM JULY 1989 TO DECEMBER 1996

WE DIDN'T QUIT, WE JUST CHANGED OUR LOCATION
***FUSION FACTS* to continue reporting on papers published in other venues**

SOLID STATE PLASMA FUSION

Yoshiaki Arata, Yue-Chang Zhang (Arata Hall, Osaka Univ., Japan), "Generation and Mechanism of Solid-State Plasma Fusion (Cold Fusion)," *Koon Gakkaishi*, vol 22, no 1, pp 29-47 (in Japanese) 1996. *Chem. Abs.*, vol 124 (1996).

AUTHORS' ABSTRACT

When deuterium nuclear fusion takes place continuously in a solid, the tremendous released energy will heat the solid drastically and reaction products will be emitted spontaneously from and/or confined as the "frozen state" in the host solid. In other words, there are two kinds of reaction, i.e., energy release and product formation. The reaction should increase proportionally with an increase in the number of fusion reactions for a long period. As a result, a tremendous amount of reaction product, i.e. helium, should be accumulated in the host solid as the frozen state in ordinary temperature. Therefore, the Pd host solid was heated to high temperature in vacuum, and then a large amount of helium released from the solid was detected by mass spectroscopy. Namely, in the present experiment, the solid-state plasma fusion (cold fusion) was verified by the detection of a tremendous amount of helium as well as huge excess energy. It is theoretically demonstrated in detail that violent shaking of localized lattice in host-solid causes energetic deuterium "strongly coupled plasma" which enables generation of solid-state plasma fusion.

ACHIEVED FUSION

Yoshiaki Arata, Yue-Chang Zhang (Osaka Univ., Japan), "Achievement of Solid-State Plasma Fusion (Cold-Fusion)," Proc. Jpn. Acad., Ser. B, vol 71B, 1995, no 10, pp 304-309. *Chem. Abs.*, vol 124 (1996).

AUTHORS' ABSTRACT

Using a Quadrupole Mass Spectrometer (QMS), the authors detected a significantly large amount (10^{20} ~ 10^{21} cm^{-3}) of helium, which was concluded to have been produced by a deuterium nuclear reaction within a host solid. These results were found to be fully repeatable and supported the authors' proposition that solid state plasma fusion **(cold fusion)** can be generated in an energetic deuterium strongly coupled plasma (SC plasma). This fusion reaction is thought to be sustained by localized "lattice-quake" in a solid-state media with the deuterium d. equivalent to that of the host solid. While exploring this basic proposition, the characteristic differences when compared with ultra high temperature-state plasma fusion ("hot fusion") are clarified. In general, the most essential reaction product in both types of deuterium plasma fusion is considered to be helium, irrespective of the well-known and/or unknown reactions, which is stored within the solid-state medium in abundance as a residual product, but which generally can not enter into nor be released from a host solid at room temperature. Even measuring instruments with relatively poor sensitivity should be able to easily detect such residual helium. An absence of residual helium means that no nuclear fusion reaction has occurred, whereas its presence provide scrucial evidence that nuclear fusion has, in fact, occurred in the solid.

TORSIONAL* SPECTROSCOPY

Hector E. Avram, Robin L. Armstrong, (Dept. Phys., Univ. Toronto, Canada), "Spin-Polarization Torsional Spectroscopy in β-Phase Palladium Hydride," *Physical Review B*, vol 34, no 9, Nov. 1986.

AUTHORS' ABSTRACT

A spin-polarization torsional spectroscopy experiment is reported for three samples of β-phase palladium hydride (PdH_x) with hydrogen concentrations x = 0.80, 0.75, and 0.71. The measurements were carried out at a proton magnetic-resonance frequency of 30 MHZ and a temperature of 40 ± 0.5 K. Frequency spectra were obtained by Fourier transformation of the transient signals detected in the time domain as a function of the duration of the locking pulse after the spin-locking sequence. These spectra provide numerical values of the two lowest tunneling splittings. Both tunneling frequencies decrease in an approximately linear fashion with increasing hydrogen concentration as expected if the changes are related to the reduction in the number of vacancies to which a proton can tunnel. These data should provide a

useful test for future theoretical models proposed to describe phonon-assisted tunneling of hydrogen in metals at low temperatures.

* [Not Torsion Fields in the Russian sense. Ed]

NO VERIFICATION OBTAINED

A. Bertin, M. Bruski, V.M. Bystritskii, A. Vezzani, S. Vechchi, M. Villa, A. Vitale, YA. Voznyak, D. Galli, et al. (Ob'edinennyi Inst. Yadernykh Issledovanii, Dubna, Russia), "Negative Result on the Verification of Reported "Cold Fusion" Phenomena in Na_xW0_3 (D; D-T) Systems," *Yad. Fiz*, vol 59, no 5 (1996), pp 789-794 (in Russian). *Chem. Abs.*, vol 125 (1996).

AUTHORS' ABSTRACT

A search was made for low-temperature d-d fusion in Na_xWO_3/D systems. Within the limits of statistical errors, no excess of the neutron yield above the background level under the interaction of D with tungsten bronze was found. The experimental results also suggest that "hot" dt fusion is not possible in a system of such type. The results of this research have cast some suspicion on the validity of conclusions in IHTEC reports. At the 90% confidence level, the upper limit estimate of the intensity of a hypothetical neutron source owing to d-d and d-t fusion in single crystals of tungsten bronze was less than 5 x 10^{-3} s^{-1}

✦ ✦ ✦

A. Bertin, M. Bruski, V.M. Bystritskii, A. Vezzani, S. Vechchi, M. Villa, A. Vitale, Ya. Voznyak, D. Galli, et al. (Ob'edinennyi Inst. Yadernykh Issledovanii, Dubna, Russia), "Negative Results on the Verification of Hypothesis for Existence of "Cold" and "Hot" Fusion in Ti/(D-T) and ZrNbV(D-T) Systems," *Yad. Fiz.*, vol 59, no 5 (1996), pp 780-788 (in Russian). *Chem. Abs.*, vol 125 (1996)

AUTHORS' ABSTRACT

A search was made for low-temperature nuclear fusion in metal/hydrogen systems. Ti and the intermetallic compounds ZrNbV were selected as saturated substances. These samples were saturated with a D-T mixture. A neutron emission excess above the background level was not observed within the measurement error for these systems. The existence of "hot" d-t nuclear fusion in these systems was not verified experimentally either.

LITTLE NEUTRON EMISSION DETECTED

S. Daroczy, A. Bolyos, Z. Dezso, T. Scharbert, Z. Papp, J. Konya, B. Bertok (Isotope Lab., Kossuth Lajos Univ., Hungary), "Search for Neutrons from Electrochemically Deuterated Palladium Sheets," *Acta Phys. Chim.*, vol 30, no 1 (1995), pp 49-61. *Chem. Abs.*, vol 125 (1996)

AUTHORS' ABSTRACT

An attempt has been made to detect neutrons from electrochemically deuterated Pd sheets. For the detection of neutrons multi-electrode fission chambers surrounded by a water moderator were used. The neutron emission of 5 Pd cathodes was studied under similar electrochemical conditions during 8540 h. The summarized result for all cathodes and all electrolysis experiments and discharges does not show any excess intensity above the background. When the data are investigated in appropriate time resolution, it turns out that if neutron emission exists at all, then it is temporal rather than continuous and only extends over 0.6-1.3% of the duration of electrolysis and discharge measurements under the experimental conditions applied. The length of the active periods was found to be 5-18 h and their time of occurrence was very different with respect to the start of electrolysis. The largest value obtained for neutron production reaction rate is $\lambda = (2.0 \pm 0.8) \times 10^{-21}$ s^{-1} $(dd)^{-1} = (53 \pm 20)$ s^{-1} -cm^{-3}Pd.

ENERGY MEASUREMENT POSITIVE

J. Dufour, J. Foos, J.P. Millot, X. Dufour (Shell Research/CNAM Lab. des Sci. Nucl., Paris), "Interaction of Palladium/Hydrogen and Palladium/Deuterium to Measure the Excess Energy per Atom for each Isotope," *Fusion Tech.*, vol 31, no 2, Mar 1997, pp 198-209, refs, 9 figs, 2 tables.

AUTHORS' ABSTRACT

A search for the products of fusion reactions that could be triggered by sparking in hydrogen isotopes produced a negative result with no signatures above background being found. Very significant excess energy production in both hydrogen/palladium and deuterium/palladium systems is reported. The conditions of occurrence for this excess energy production are discussed, and the formation of a tightly bound state of the hydrogen (deuterium) atom is put forward to explain the results.

AUTHORS' CONCLUSION

From these results, we conclude that a very promising reaction occurs in metallic-hydride-forming metals when loaded with hydrogen isotopes and submitted to high transient electric currents. We think that explaining the phenomenon by a rearrangement of the bounding between the proton and the electron, due to the confinement of the metal lattice, is more plausible (although not known) than invoking highly improbable fusion reactions. We intend to put more effort into understanding this reaction.

ENERGY NOT CORRELATED TO NEUTRON EMISSION

José F. Fernandez, Fermin Cuevas, Miguel Algueró, Carlos Sánchez (Dip. Fisica Mats. C-IV, Univ. Autonoma de Madrid), "Experimental Investigation of Neutron Emissions During Thermal Cycling of TiD_x ($x \approx 2.00$)," *Fusion Tech.*, vol 31, no 2, Mar. 1997, pp 237-247, 32 refs, 8 figs, 4 tables.

AUTHORS' ABSTRACT

The production of neutrons from D + D reactions in thermally cycled titanium deuteride (TiD_x) ($x \approx 2.00$) is investigated in depth. Special attention is given to cubic-tetragonal (δ-ϵ) phase transition that TiD_x experiences near room temperature as a possible triggering mechanism of "cold fusion nuclear reactions." The (TiD_x) ($x \approx 2.00$) samples, possessing well-known properties about the δ-ϵ transition, are cycled at temperatures (from –60 to 60°C) where the phase transition takes place. The cold fusion signature is investigated by measuring the neutron flux of the sample during the experiments. No significant neutron signal above the background level is found during thermal cycling of the TiD_x samples. It is concluded that in the samples investigated, no correlation exists between the δ-ϵ transition and the trigger of the D + D reactions. Background deviations give an upper limit of the rate of the D + D → ^{3}He + n reaction of $\lambda < 10^{-23}$ fusion/p-d·s.

SURVEY OF C.F. RESEARCH

Hal Fox, Patrick Bailey, (Inst. New Energy, Salt Lake City, UT), "A Survey of Current International "Cold Fusion" Research," Proc. Intersoc. Energy Convers. Engr. Conf.,'30th, vol. 3, pp 281-6. *Chem. Abs.*, vol 124 (1996).

AUTHORS' ABSTRACT

A review with many references is given. A new energy producing technology has been found in several so-called "cold fusion" experiments. In years past, these effects have been difficult to reproduce, but are now being replicated internationally. Energy production has been achieved in reactors using heavy water (D_2O) and Pd cathodes. Excess energy has also been produced using light water (H_2O) and Ni cathodes. Significant results have been reported by SRI, International at the 1994 IECEC. In several types of experimental reactors, more thermal energy is produced than input by electrical energy. This "excess heat" has now been replicated in 30 countries and significant amounts of nuclear byproducts have also been measured. Whether all of the observed excess thermal heat is the result of nuclear reactions is still being investigated. A key to the process is the purity and quality of the cathode metals used. In addition, some of the reactors are strongly sensitive to H or D loading. Many papers have now been published reporting on excess thermal heat and on some nuclear byproducts. This paper summarizes the results of 6 yr of collecting and reviewing >2000 technical papers on cold fusion. Successful experimental papers are tabulated by country and year. Continuing experimental efforts are cited and the various types of experimental evidence are reviewed.

SYNTHESIS OF ELEMENTS 110 & 112

Raj K. Gupta (Gesellschaft Schwerionenforschung mbH, Germany), "Cold Synthesis of Z = 110 and 112 Elements," *J. Phys. G: Nucl. Part. Phys.*, vol 21, no 12 (1995), pp L89-L94. *Chem. Abs.*, vol 124 (1996).

AUTHOR'S ABSTRACT

Our earlier calculations of 1976-77 and their later extensions are reviewed to show that the reactions used in the recent synthesis of the Z = 110 element with masses A = 269 and 271 at GSI had been previously proposed by Gupta et al. on the basis of quantum mechanical fragmentation theory. This theory assumed cold fusion process which has been observed to be the case in these recent experiments. New calculations are presented for a neutron-rich isotope 276 of Z = 110 and a predicted element Z = 112 with mass A = 286. Target-projectile combinations for both the cold and relatively excited compound systems are discussed.

SUPERHEAVY ELEMENTS

F.P. Hessberger (Ges. Schwerionenforsch. mbH, Germany), "GSI Experiments on the Synthesis of Super-Heavy Elements," Int. Workshop Gross Prop. Nucl. Nucl. Excitations, vol 24; Extremes of Nuclear Structure, pp 1-10, 1996. *Chem. Abs.*, vol 125 (1996)

AUTHOR'S ABSTRACT

A review (29 refs.) on the identification of isotopes of the elements 110 and 111 as well as on the attempt to produce element 116 by cold fusion reactions.

NO HEAT WITH FOIL IMPLANTATION

Toshiyuki Iida (Fac. Eng., Osaka Univ., Japan), "Deuteron Fusion Experiments with Some Foils Implanted with Deuteron Beams," *Genshikaku Kenkyu*, vol 40, no 5 (1995), pp 77-83. *Chem. Abs.*, vol 124 (1996).

AUTHOR'S ABSTRACT

Deuteron beam implantation experiments were carried out with Ti and Pd foils to find out possibility of cold fusion. Possibly a high energy ~6.9 MeV He peak was observed. No temperature change of the target was observed during implantation.

HEAVY-ION FUSION

H. Ikezoe, Y. Nagame, I. Nishinaka, T. Ikuta, S. Hamada, Y. Sugiyama, K. Ideno, T. Ohtsuki, R. Sasaki, Y. Aoki (Adv. Sci. Res. Ctr., Japan Atomic Energy Res. Inst.), "Heavy-Ion Fusion and Jaeri Recoil Mass Separator," Perspect. Heavy Ion Phys., Jpn.-Italy Joint Symp., 2nd, 1995, pp 54-67. *Chem. Abs.*, vol 125 (1996).

AUTHORS' ABSTRACT

Sub-barrier fusion cross sections for the cold fusion and the hot fusion have been measured. For the cold fusion reactions, where the target of ^{209}Bi is used, the observed cross sections for light projectiles are enhanced compared to the result of the one dimensional barrier penetration calculation indicating the importance of the coupling of inelastic excitations to fusion. They decrease as the mass numbers. of projectiles increase, suggesting the extra-push energy needed to overcome the fusion barrier. On the other hand, for hot fusion reactions where the targets of ^{232}Th or ^{238}U are used, the static deformations of the targets are essentially important to explain the observed fusion cross sections. From the present data, the ratio of the neutron emission to the fission probability, Γ_n / Γ_f, is extracted. The ratios show the strong hindrance of the survival probability for the cold fusion reactions. The outline of JAERI recoil mass separator is shown, which has been just completed as one of the experimental apparatus installed at the tandem-booster accelerator.

FINDING HELIUM AMONG THE DEUTERIUM

S. Isagawa (Nat. Lab. High Energy Physics, Ibaraki, Japan), "Mass Spectroscopic Means for Determining ^{4}He in the Presence of Large Amounts of D_2," Proc. 13th Int'l Vacuum Congress & 9th Int'l Conf. Solid Surfaces, 1995, pp 497-499. *Chem. Abs.*, vol 125 (1996).

AUTHOR'S ABSTRACT

The low intensity of neutrons and the poor enrichment of tritium in so-called cold fusion experiments prompted proposals of nuclear processes that yield only heat and He as products. Determination of the presence or absence of ^{4}He as a nuclear product, buried in a large amount of D_2, became highly necessary. A novel mass spectroscopy system was designed and prepared to meet this special demand. In this system, effluent gas during electrolysis as well as electrically charged solid Pd samples can be analyzed with sufficiently high sensitivity and resolving power.

COMBINING FUSION TECHNIQUES

Yuuki Kawarasaki (Ctr. Res. Lab., Hamamatsu Photonics K.K., Hamakita, Japan), "Possible In-Lattice Confinement Fusion (LCF)," AIP Conf. Proc., vol 369 (Pt. 2, Laser Interaction & Related Plasma Phenomena, Pt. 2), 1996, pp 1244-1249. *Chem., Abs.*, vol 125 (1996).

AUTHOR'S ABSTRACT

A new scheme of a nuclear fusion reactor system is proposed, the basic concept of which comes from ingenious combination of hither-to developed techniques and verified facts; 1) so-called cold fusion (CF), 2) plasma of both magnetic confinement fusion (MCF) and inertial confinement fusion (ICF), and 3) accelerator-based D-T (D) neutron source. Through the comparison of the characteristics among ICF, LCF, and MCF, the feasibility of the LCFs is discussed.

TRANSMUTATION POSSIBILITY

A. A. Kozar, V. F. Peretroukhin (IFKH, RAN, Russia), "Feasibility of artificially producing ruthenium from the products of technetium-99 transmutation," *At. Energ.*,vol 80(4), pp 274-279 (Russian) 1996, Energo-atomizdat.

AUTHORS' ABSTRACT

^{99}Tc, which is unique among radionuclide candidates in burn-up, produces transmutation products of interest to industry in being able to recover some of the cost of a given process. Irradiation and processing of a Tc target for obtaining Ru, suitable for practical use outside the fuel cycle, were examined. The transmutation mechanism involves the following: ^{99}Tc « ^{100}Tc « ^{100}Ru « ^{101}Ru « ^{102}Ru « ^{103}Ru « short-lived and stable isotopes of Rh and Pd. The first 3 Ru isotopes are stable, and the ^{103}Ru (T1/2 = 39.3 d) forms stable ^{103}Rh.

CATHODE SURFACE MODIFICATIONS

Keiji Kunimatsu (Imura Japan Co., Ltd., Sapporo), "Surface Modification of the Cathode in the Study of Cold Fusion," *Hyomen Gijutsu*, vol 41, no 3 (1996), pp 218-222, in Japanese.

AUTHOR'S ABSTRACT

A review, with 12 refs., on relations between D Absorption on Pd cathode and excess heat, measurement of the absroption, and surface modification of Pd cathodes with thiourea for increase of the absorption.

DEMONSTRATION OF CASIMIR FORCE

S.K. Lamoreaux, "Demonstration of the Casimir Force in the 0.6 to 6 μm Range", *Physical Review Letters*, vol 78, no 1, 6 Jan 1997, pp 5-8, 4 figs, 15 refs.

AUTHOR'S ABSTRACT

The vacuum stress between closely spaced conducting surfaces, due to the modification of the zero-point fluctuations (ZPF) of the electro-magnetic field, has been conclusively

demonstrated. The measurement employed an electromechanical system based on a torsion pendulum. Agreement with theory at the level of 5% is obtained.

EDITOR'S COMMENTS

Call it ZPE, ZPF, or aether, we welcome any experimental evidence that provides a better understanding of the nature of space and, even more welcome, experiments or ideas of how to tap the infinite energy of space. The measurement of the Casimir force, as done in this experiment, between a metal plate and a metal sphere, is quite dramatic as the spacing is smaller than 1 micrometer. However, it has taken very sensitive measuring equipment to produce the results. The magnitude of the force is of the order of 100 microdynes. The plate was optically flat and the sphere was a spherical lens both of which were coated with a thin layer of copper. The size of the plate used was 2.54 cm. (one inch) in diameter and the spherical lens was 4 cm in diameter. The closest spacing achieved was about 0.6 micrometers.

NO NUCLEAR RADIATION NECESSARY

Xingzhong Li (Dept. Phys., Qinghua Univ., Beijing, Peop. Rep. China), "A New Approach Towards Nuclear Fusion Without Strong Nuclear Radiation," *Hejubian Yu Dengliziti Wuli*, vol 16, no 2 (1996), pp 1-8 (in Chinese). *Chem. Abs.*, vol 125 (1996).

AUTHOR'S ABSTRACT

The resonance tunneling via lattice-confined ion was quite different from that of beam-target nuclear reaction. Because of the Coulomb barrier, only the long life-time nuclear energy level had the chance to be in resonance with the lattice-confined ion. As a result, fast nuclear fusion with a strong n radiation cannot be induced by this kind of resonance tunneling. It means that obtaining the nuclear fusion energy without the strong n radiation is possible.

NASA PREPARING FOR THE FUTURE

Courtesy of Marc G. Millis, NASA Lewis Research Center

Marc G. Millis, "Breakthrough Propulsion Physics Research Program", NASA Technical Memorandum 107381, prepared for the Space Technology and Applications International Forum, Jan. 1997.

AUTHOR'S ABSTRACT

In 1996, a team of government, university and industry researchers proposed a program to seek the ultimate breakthroughs in space transportation: propulsion that requires no propellant mass, propulsion that can approach and, if possible, circumvent light speed, and breakthrough methods of energy production to power such devices. This Breakthrough Propulsion Physics program, managed by Lewis Research Center, is one part of a comprehensive, long range Advanced Space Transportation Plan managed by Marshall Space Flight Center. Because the breakthrough goals are beyond existing science, a main emphasis of this program is to establish metrics and ground rules to produce near-term credible progress toward these incredible possibilities. An introduction to the emerging scientific possibilities from which such solutions can be sought is also presented.

✦ ✦ ✦

Marc G. Millis. "The Challenge to Create the Space Drive", NASA Technical Memorandum 107289, prepared for the Interstellar Flight Symposium, May 1996.

AUTHOR'S ABSTRACT

To travel to our neighboring stars as practically as envisioned by science fiction, breakthroughs in science are required. One of these breakthroughs is to discover a self-contained means of propulsion that requires no propellant. To chart a path toward such a discovery, seven hypothetical space drives are presented to illustrate the specific unsolved challenges and associated research objectives toward this ambition. One research objective is to discover a means to asymmetrically interact with the electromagnetic fluctuations of the vacuum. Another is to develop a physics that describes inertia, gravity, or the properties of spacetime as a function of electromagnetics that leads to using electromagnetic technology for inducing propulsive forces. Another is to determine if negative mass exists or if its properties can be synthesized. An alternative approach that covers the possibility that negative mass might not exist is to develop a formalism of Mach's Principle or reformulate ether concepts to lay a foundation for addressing reaction forces and conservation of momentum with space drives.

SHOOTING DOWN RELATIVITY

Roberto A. Monti, "Theory of Relativity: a Critical Analysis," *Physics Essays*, vol 9, no 2 (1996), pp 238-260, 104 refs, 19 figs.

AUTHOR'S ABSTRACT

Einstein's theory of relativity is shown to be a physical theory of limited experimental validity. Twelve different experiments seem to disprove its two postulates.

THE PREMISES

Insufficiencies and gaps in Einstein's premise to his 1905 paper, "On the Electrodynamics of Moving Bodies," have been pointed out by several authors. A case in which Maxwell's electrodynamics and Einstein's electrodynamics give different results, which can be experimentally tested

as such, has recently been pointed out by Banocci and Marnone Capria. Moreover, background radiation anisotropy measurements today allow one to detect by electromagnetic means the Earth's motion relative to the background radiation, which can be considered at least quasi-stationary within the "blackbody" constituted by the aether, "certainly the most extended and probably the most homogeneous known body."

It is, however, exactly at the basic level of the postulates that experimental evidence seems to disprove Einstein's theory of relativity.

GENERAL CONCLUSIONS

Einsteinian relativity seems to be a physical theory of limited experimental validity on the basis of at least 12 different experimental tests, which seem to disprove its two postulates. Further tests that may disprove the theory of relativity are conceivable (new electromagnetic measurements of the speed of light, a modified Kennedy-Thorndike experiment).

The difficulty in dealing with the scientific matter of "the coming of relativity" is not due to a lack of scientific argumentation or experiment. These, in my opinion, already indicate that the theory is in trouble. The real difficulty seems to be that relativity is not a scientific question, but an academic subject. Many scientists work in research programs concerned with relativistic astronomy and astrophysics, relativistic cosmology, relativistic gravitational antennas, relativistic scientific and popular literature. And many scientists work in elementary particle physics to study the 10^{-37} s after an event (the big bang) that might never have occurred. Against this background the most sound scientific argumentations do not have much of an impact. But notwithstanding the present difficulties, the scientific should prevail.

ANOMALIES & HEAT

Hiro Numata (Tokyo Inst. Technol., Metallurg. Engr. Dpt.), Mikio Fukuhara (Toshiba Tungaloy, Tech. Res. Lab.), "Low-Temperature Elastic Anomalies and Heat Generation of Deuterated Palladium," *Fusion Technol.*, vol 31, no 3, pp 300-309, 42 refs, 8 figs.

AUTHORS' ABSTRACT

Elastic parameters (the Young's, shear, and bulk moduli; the Lamé parameter; the Poisson ratio; and the Debye temperature) and shear damping anomalies accompanied by the generation of excess heat (not less than 6 W) were observed between 116 and 190°K in deuterated palladium, $PdD_{0.719}$, suggestion dynamic interactions among deuterons squeezed between tetrahedral and octahedral and octahedral interstices in the palladium face-centered-cubic lattice.

SYNTHESIS OF SUPERHEAVY NUCLEI

Yu.Ts. Oganessian (Flerov Lab. Nucl. Reactions, Joint Inst. Nucl. Res., Dubna, Russia), "Synthesis and Properties of Super-Heavy Nuclei," Tours Symp. Nucl. Phys. II, 1994, pp 401-13. Edited by: Hiroaki Utsunomiya, World Scientific: Singapore, 1995. *Chem. Abs.*, vol 124 (1996).

AUTHOR'S ABSTRACT

Problems of synthesizing and studying the radioactive properties of nuclei of transfermium elements produced in heavy ion induced fusion reactions are discussed. The mass-asymmetry of nuclei partners in the input channel of the fusion reaction appears to be rather selective as regards the production of evaporation residues. The advantages and limitations of cold fusion reactions giving isotopes with $Z \leq 109$ are shown. The mechanism of production and decay of excited compound nuclei giving isotopes of transactinide elements in the vicinity of closed deformed shells Z = 108, N = 162 is being considered. The implementation of experiments is described and data on synthesis of new isotopes $^{262}104$, $^{265}106$, $^{266}106$ and $^{267}108$ in hot fusion reactions is presented. The properties of the new nuclides point to a considerable increase of the spontaneous fission half-life predicted by the macro-microscopic theory. Prospects for using fusion reactions in synthesizing new elements are discussed.

ENERGY & Fe IN GOLD ELECTRODES

Tadayoshi Ohmori, Tadahiko Mizuno, Yoshinobu Nodasaka (Hokkaido Univ., Japan), Michio Enyo (Hakodate Nat. Col. of Technol., Japan), Hideki Minagawa (Hokkaido Nat. Indust. Res. Inst., Japan), "Transmutation in the Electrolysis of Light Water – Excess Energy and Iron Production in a Gold Electrode," *Fusion Tech.*, vol 31, no 2, Mar. 1997, pp 210-218, 8 refs, 11 figs, 3 tables.

AUTHORS' ABSTRACT

The identification of some reaction products possibly produced during the generation of excess energy is attempted. Electrolysis is performed for 7 days with a constant current intensity of 1 A. The electrolytes used are Na_2SO_4, K_2SO_4, K_2CO_4, and KOH. After the electrolysis, the elements in the electrode near the surface are analyzed by Auger electron spectroscopy and electron probe microanalysis. In every case, a notable amount of iron atoms in the range of 1.0×10^{16} to 1.8×10^{17} atom/cm^2 (true area) are detected together with the generation of a certain amount of excess energy evolution. The isotopic abundance of iron atoms, which are 6.5, 77.5, and 14.5% for ^{54}Fe, ^{56}FE, and ^{57}Fe, respectively, and are obviously different from the natural isotopic abundance, are measured at the top surface of a gold electrode by

secondary ion mass spectrometry. The content of ^{57}Fe tends to increase up to 25% in the more inner layers of the electrode.

GRAVITATION SHIELDING POSSIBLE

E.E. Podkletnov (Moscow Chem. Scientific. Ctr.), "Weak Gravitation Shielding Properties of Composite Bulk $YBa_2Cu_3O_{7-x}$ Superconductor Below 70 K under E.M. Field," Univ. Cincinnati Engineering , report # MSU-chem 95, abstract cond-mat/9701074.

AUTHOR'S ABSTRACT

A high-temperature $YBa_2Cu_3O_{7-x}$ bulk ceramic superconductor with composite structure has revealed weak shielding properties against gravitational force in the state of levitation at temperature below 70 K. A toroidal disk was prepared using conventional ceramic technology in combination with melt-texture growth. Two solenoids were placed around the disk in order to initiate the current inside it and also to provide rotation about its central axis. Samples placed over the rotating disk demonstrated a weight loss of 0.3 to 0.5%. When the rotation speed was slowly reduced by changing the current in the solenoids, the shielding effect became considerably higher and reached 1.9 to 2.1 % at maximum.

PROCEDURAL DEVELOPMENT

S. Pons, M. Fleischmann (Cntr. Sci., IMRA Europe SA, Valbonne, France), "Calibration of the Pd-D_20 System: Effects of Procedure and Positive Feedback," *J. Chim. Phys. Phys.-Chim. Biol.*, vol 93, no 4 (1996), pp 711-730 (French). *Chem. Abs.*, vol 124 (1996)

AUTHORS' ABSTRACT

The authors' outline some of the considerations which have prompted their research on anomalously fast nuclear reactions of D^+ compressed electrochemically into Pd (and Pd alloy) host lattices. The most surprising result has been that the generation of high levels of excess enthalpy is not accompanied by the expected levels of tritium and neutron generation. Some of the major steps in the development of this particular aspect are outlined; it has been found that excess heat production is dependent on the protocol of the experiments mainly because of "positive feedback." A rationale for such "positive feedback" is presented which also explains oscillations in the system properties. The authors illustrate the progressive development of the investigation leading to the achievement of specific rates of excess enthalpy production of 4 kW cm^{-3} at temperatures up to 100° (i.e. of low-grade heat).

REMEDY FOR RADIOACTIVITY

Otto J.A. Reifenschweiler (ret. from Phillips Res. Labs., Eindhoven, Netherlands), "About the Possibility of Decreased Radioactivity of Heavy Nuclei," *Fusion Technol.*, vol 3, no 3, pp 291-299, 12 ref, 4 figs, 3 tables.

AUTHOR'S ABSTRACT

Recently a sharp decrease in the radioactivity of tritium was reported, and a preliminary explanation of this effect was formulated in terms of a nuclear-pair hypothesis. Through the evaluation of several gas-solid exchange and diffusion experiments of others, where heavy radionuclides (^{65}Zn, ^{63}Ni, ^{85}Sr) are used as tracers, it can be shown that such an effect may also exist for these nuclei. In all these experiments the second law of thermodynamics seems to be grossly violated. By pure formal application of the nuclear-pair hypothesis, all such deviations from normal behavior can be explained. Several straightforward experiments are proposed to prove the decrease in radioactivity of heavy nuclei.

HYDROGEN ATOM MODEL

N.V. Samsonenko, D.V. Tahti, F. Ndahayo (Dept. of Theor. Phys., Russian Peoples' Friendship Univ., Moscow , Russia), "On the Barut-Vigier Model of the Hydrogen Atom," *Phys. Lett. A*, vol 220, nos 4/5 (1996), pp 297-301. *Chem. Abs.*, vol 125 (1996).

AUTHORS' ABSTRACT

An explicit nonrelativistic mathematical analysis of a model proposed by J.P. Vigier (1993) to interpret (within the present frame of quantum theory, i.e. in terms of spin-orbit and magnetic interactions appearing in dense media) excess heat observed in the so-called "cold fusion" phenomena based only on hydrogen is presented. The existence of new "tight" Bohr orbits is demonstrated in this case.

RADIOACTIVE CATHODES

I.B. Savvatimova, A.B. Karabut (NPO "LUCH," Podolsk, Russia), "Radioactivity of Palladium Cathodes after Irradiation in Glow Discharge," *Poverkhnost*, vol 1 (1996), pp 76-81 (in Russian). *Chem. Abs.*, vol 125 (1996).

AUTHORS' ABSTRACT

Residual radioactivity of the surfaces of Pd, Nb, Ti, and Ag cathode foils and their combinations after irradiation with D ions in a glow discharge (c.d. 50 mA/cm^2 and voltage 50-500 V) was measured by autoradiography It was 5×10^5 -5 x 10^6 β / cm^2 -s some 2-20 h after the irradiation. The half-life was estimated as 13.8 h and could be attributed to the decay of ^{109}Pd. The activity of Pd shielded from direct action of the discharge was detected. The activity of Pd samples was higher after irradiation with Ar ions than with H and D ions under the same conditions.

✦ ✦ ✦

REACTION PRODUCTS IN CATHODES

I.B. Savvatimova, A.B. Karabut, (NPO "LUCH," Podolsk, Russia), "Nuclear Reaction Products Detected at the Cathode after Glow Discharge in Deuterium," *Poverkhnost*, vol 1 (1996), pp 63-75 (in Russian). *Chem. Abs.*, vol 125 (1996).

AUTHORS' ABSTRACT

Impurity concentrations were measured in the Pd cathode (99.9% pure) before and after experiments in a glow discharge in D, H, and D + H by SMS, SIMS, and x-ray microprobe analysis. Changes in the concentration of some impurity elements (Ag, B, Ni, Zr, and Br) were observed upon changing the composition, the flux of the bombarding ions, and other parameters. **The Ag concentration was maximally increased by a factor of 250 after the irradiation of Pd with D ions** (to 35 mA/cm^2) in the analysis zone (20 mm^2 x 10 μm) or by a factor of 10^4 - 10^5 in local areas of ~1 μm^3. Concentration of other elements were changed by a factor of 5-20 or 10^2 - 10^4 in a 10-μm or <1 μm layer, respectively. The isotope ratio of B, Ni, Zr, Br, Ca, etc., and the mass ratio of 109/107 in surface layers of the cathode samples was changed.

MEASURING TOROIDAL PLASMA

Masaharu Seki (Hokkaido Inform. Univ.), Shun-ichi Himeno (Nippon Bunri Univ., Elec. Engr. Dpt., Oita City, Japan), "Computer Method for Abel Inversion for Toroidal Coordinates and its Application to Plasma Diagnostics," *Fusion Technol.*, vol 31, no 3, pp 333-337, 11 refs, 4 figs, 1 table.

AUTHORS' ABSTRACT

A new technique, Abel inversion for toroidal coordinates, is presented for calculating spatial distributions of an axisymmetric toroidal plasma density from observation beam incidents in the toroidal 'y' direction. In this numerical method, inversion matrix elements are calculated analytically, and their usefulness is examined by using a hypothetical data set of beam intensity with asymmetry for the normal direction to the direction of observation, which results in a valid local plasma density. The asymmetrical character associates with fundamental fixed length 'd' for the toroidal coordinates.

EXCITED HYDROGEN SPECIES

Yu.F. Shmal'ko, M.V. Lototsky, Ye.V. Klochko, V.V. Solovey (Inst. Problems in Machinery, Nat. Ukrainian Acad. Sci., Kharkov, Ukraine), "The Formation of Excited H Species Using Metal Hydrides," *J. Alloys & Compounds.*, vol 231, nos 1-2 (1995), pp 856-9. *Chem. Abs.*, vol 124 (1996).

AUTHORS' ABSTRACT

A review with 33 references of information available from Russian and international publications on the effect of forming an excited hydrogen species in systems with hydride-forming materials as well as in physico-chemical processes. Possibilities of using the effect in vacuum physical energy units and electrochem. energy conversion systems are shown. A connection of the effect with a phenomenon of **cold fusion** is noted.

EFFECTS OF TRITIUM IN ELECTROLYSIS

R.A. Stukan, Yu.M. Rumyantsev (Semenov Inst. Chem. Phys., Russian Acad. Sci., Moscow), "Effect of Tritium on the Generation of Hard Radiation in the Electrolysis of D_2O with a Palladium Cathode (T-D Cold Fusion Reactions)," *High Energy Chem.* (Transl. of *Khim. Vys. Energ.*), vol 30, no 5 (1996), pp 343-346, 1996. *Chem. Abs.*, vol 125.

AUTHORS' ABSTRACT

The use of a palladium cathode saturated with tritium in the electrolysis of heavy water (T-D experiments) was found to result in a dramatic enhancement of the generation of hard radiation (likely neutrons) as compared with the conventional Pd cathode (D-D experiments). This isotope effect is viewed as support for the hypothesis on the occurrence of cold fusion reactions in the electrolysis of D_2O with a Pd cathode.

PHUSONS IN NUCLEAR REACTIONS

Mitchell R. Swartz (JET Energy Technol., Massachusetts), "Phusons in Nuclear Reactions in Solids," *Fusion Tech.*, vol 31, no 2, Mar. 1997, pp 228-236, 56 ref, 2 figs, 3 tables.

AUTHOR'S ABSTRACT

An explanation is given for the anomalous branching ratio in solids based on Boson-cooperative removal of the ^{4}He* energy prior to decay by two-body fission. Facilitated by isospin restrictions that limit conventional pathways, the excess heat is driven by the reconfiguration to the more tightly bound ^{4}He ground state. A temperature rise occurs as well-mixed acoustical and optical phonons are unable to carry off all the local momentum and excess energy of the reactions. Four-vector analysis indicates conservation of energy, which suggests the use of a fusion quantum of energy delivered to the lattice's phonon cloud: a phuson. Special relativistic considerations indicate that the phonon cloud subtends ~450 to 800 unit cells and can couple with de-excitation times >0.1 *fs*. Thus, commensurate levels of neutrons and gammas are not required because of unique isospin and energy restrictions that facilitate the alternate Bose-cooperative pathway leading from the excited state.

POLARIZED Pd/D SYSTEMS

J.P. Vigier (Univ. Paris VI, France), "On Cathodically Polarized Pd/D Systems," *Phys. Lett. A*, vol 221, nos 1-2 (1996), pp 138-140. *Chem. Abs.*, vol 125 (1996)

AUTHOR'S ABSTRACT

Excess energy in "cold fusion" with hydrogen and deuterium can be interpreted in terms of magnetic interactions. The corresponding new "tight" Bohr orbits explain new properties associated with this energy production.

✦ ✦ ✦

POLARIZED Pd/D SYSTEMS: RESPONSE

S. Szpak, P.A. Mosier-Boss (Naval Command, Control & Ocean Surveillance Ctr., RDT and E Div., San Diego, CA), "On the Behavior of the Cathodically Polarized Pd/D System: A Response to Vigier's Comments," *Phys. Lett. A*, vol 221, nos 1-2 (1996), pp 141-143. *Chem. Abs.*, vol 125 (1996).

AUTHORS' ABSTRACT

Electrodes prepared by Pd/D codeposition exhibit highly expanded surfaces which achieve high degrees of D/Pd loading within seconds. In this communication, morphology of the Pd electrode, the structure of the interphase, and selected thermal effects are discussed. A polemic (ibid, 138).

LATTICE ION TRAP

Vittorio Violante, Antonella De Ninno (ENEA, Settore Fusione Centro Ricerche Frascati, Rome), "Lattice Ion Trap: A Possible Mechanism Inducing a Strong Approach Between Two Deuterons in Condensed Matter," *Fusion Tech.*, vol 31, no 2, Mar. 1997, pp 219-227, 21 refs, 9 figs.

AUTHORS' ABSTRACT

The behavior of ions confined by means of quadrupolar electrodynamic containment around palladium lattice tetrahedral sites is discussed. Ion confinement in an quadrupolar trap is known to be strongly influenced by initial conditions and trap parameters. The system studied is a lattice ion trap for deuterons, supposing they occupy the tetrahedral sites over a certain concentration. The electron motions seem to have a dominant role in the dynamics of two deuterons moving around such lattice sites. A computer simulation describes the deuteron dynamics and reveals an approach mechanism that could dramatically decrease the mean distance between two positive charges embedded in a lattice.

NEUTRON PULSE SIGNALS

Xiaozhong Wang, Peijia Tang, Wenliang Zhang, Hengjun Liu, Zhonglin Chen, Zuochang Li, Chaohui Zhou, Rongbao Zhu, Dazhao Ding (China Inst. Atomic Energy, Beijing, China), "Time Distribution of Neutron Burst in Thermal D/Soiled System," *Chin. Sci. Bull.*, vol 41, no 1 (1996), pp 73-78. *Chem. Abs.*, vol 125 (1996).

AUTHORS' ABSTRACT

A high-level neutron coincidence counter (HLNCC) was modified into a system for measuring the time distribution of the signal to detect the die-away time of the neutron burst in the HLNCC in 1992. During the 3-month measurement, information was obtained about the anomalous nuclear reaction of metal (Ti)-absorbed D in pressurized D gas, which shows that there are some real neutron pulse signals originating from the anomalous nuclear reaction in thermal cycling of D/Ti systems.

PHONON MECHANISM

Fu-Sui Liu (Phys. Dep., Beijing Univ.), "The Phonon Mechanism of the Cold Fusion." *Mod. Phys. Lett. B*, vol 10, no 23 (1997), pp 1129-1132. *Chem. Abs.*, vol 126 (1997).

AUTHOR'S ABSTRACT

The longitudinal acoustic phonon can induce a time-dependent hopping rate of deuteron in PdD, and leads to the cold fusion.

CONTENTS OF THE PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON NEW IDEAS IN NATURAL SCIENCES

Compiled by Anatoly P. Smirnov and Alexander V. Frolov, St.-Petersburg, Russia, June 1996.
For copies ($50 International Money Order) contact Alexander V. Frolov, P.O. Box 37, 193024, St.-Petersburg, Russia. Tel: 011-7-812-2747877 Email: alex@frolov.spb.ru

Contents

Systems, *A.P. Smirnov, A.A. Smirnov*

On the Second Beginning of Thermodynamics, *G.N. Buinov*

N. Tesla's Unique Experiments in Colorado, *G.F. Ignatyev*

The Work is Created by Means of Potential Field, *A.V. Frolov*

Thermal Engine With a Single Heat Source, *A. Serogodsky*

3. Gravitation and Adjacent Technologies

Free Fall of Elementary Particles: On Moving Bodies and Their Electromagnetic Forces, *N. Rognerud*

Construction an Engine for Free Space on the Base of a Pondemotor Effect, *G.F. Ignatyev*

Experimental Fundamentals for Determination of the Nature of Gravitation Interaction Carrier, *A. Simakov*

Gravitation Results from Interaction of Substance with Gradient of Ether Density, *V.G. Shulgin*

The Quantum Gravitation, *P.D. Shpakov*

A Gyroscope Video Workshop Set Up to Observe & Determine Mechanical Gyro Properties of Forces, Torques & Motions, *F.J. McCabe*

Rotating Hemisphere: Center of Mass Shift, *E. Jeong*

Diffraction of Gravitational Field, *K.P. Butusov*

About Experimental Proofs of Gravitational Sun to Earth Influence by Screening of the Part of Inflowing Surrounding Space Neutrinos, *M.G. Vinogradova, A.E. Khod'kov*

Gravitational Technology, *G.R. Uspensky*

Possibility for the Existence of Anti-Gravity and the Complete Parity Breaking of Gravity: Evidence from Free-Fall Experiment Using a Spinning Gyro, *H. Hayasaka, H. Tanaka, T. Hashida, T. Chubachi, T. Sugiyama*

The Concept of Gravitation, *A.V. Frolov*

The Antigravitation Force in The Balanced Rotating System, *V. Kashuba*

The Beginning of Experimental Gravitonics, *S.M. Poliakov, O.S. Poliakov*

Principles and Bases of the Support-less Movement and Realization of it in Nature, *Y.G. Belostotsky*

The Inertial Propulson Drives, *B.D. Shukalov*

4. Researches of Space and Time

The Initial Principles of N.A. Kozyrev's's Causal Mechanics, *L.S. Shikhobalov*

Equivalence of Mass and Time, *A. Abita*

On the Question About Analytical Methods Those Reflect the "Substance-Space-Time" Unity of the Nature in the Laws of Natural Science, and about Main Properties of this Unity, *J.G. Goriachko*

Experiments on the Change of the Direction and Rate of The Motion, *V.A. Chernobrov*

The Energy Anisotropy of Space, *A.A. Efimov, A.A. Shpitalnaya*

On Some Properties of the Physical Time and Space, *A.I. Veinik*

To a Question on Reserves of Information Interaction in a Nature, *V.I. Stavitsky*

Generalized Golden Section and the Time Theory, *A.R. Timashev*

Information-Energy Model of Matter and Universe, *V.D. Plykia*

The United Holography Information Theory of the Universe, *G.V. Dvorin*

The Lorentz Component of the Cosmological Red Shift, *M/R. Sharipov*

SELECTED ABSTRACTS FROM THE INTERNATIONAL CONFERENCE OF NEW IDEAS IN NATURAL SCIENCES

Dr. Josef Gruber, Ph.D. (Dept. Econ., Univ. Hagen, Germany), "**Economic Effects of Space Energy Technologies (SET) on Individuals and Society**," pp 5-13.

AUTHOR'S ABSTRACT

Space energy (SE) is a new renewable source of energy. Examples of small working space energy technology (SET) devices are given. Such SET-devices are hard facts. They usually have been checked by independent experts and/or in replicated experiments and have been patented. They are usually based on new theories (still to be developed further), published in peer-reviewed journals of mainstream physics. SET-devices work permanently (24 hours per day, all year) and everywhere (on Earth and in space). These properties

make SET-devices not only economically viable but even highly competitive. SET-devices are now subject to developmental research. Their widespread use has tremendous economic, social, fiscal and environmental consequences: Humankind can reach, at least with respect to energy, a sustainable development.

Martin Mueller (Pfullingen, Germany), "**Saha-Equation – Undeniable Evidence for the Physical Nature of Chemical Bonding**," pp 141-150, 3 figs.

AUTHOR'S ABSTRACT

The captioned equation, authored by the Indian astro-physicist Megh Nad Saha in the 1920s, is one of the very few equations that were genuinely deduced in those times of "sloppy physics" (like a "de Broglie wavelength" or a "Schroedinger equation"). It defines the status of ionization of gases versus temperature, density and pressure. Its seemingly very obvious result was that under solar surface conditions (6000 K) all elements are ionized. Decades later someone applied this equation to terrestrial conditions (like florescent lamps) and found that Saha's result must be erroneous by a factor of 2 in temperature: total ionization already at 3000 K. In the paper it will be shown via the fact that thermal ionization is by "impact," that the first electron to be separated has to be (one of) the valence electron(s). Also will be deduced what the condition of movement of this electron was beforehand: Definitely, not in an "orbit" (= Circling, like in the Bohr atom model or in Schroedinger's) but "straight-on," along the "chemical bonding stroke". The mathematics of the processes will be presented.

George S. Turchaninov (Krasnoyarsk State Tech, Univ., Russia), I.G. Turchaninov (Omsk State Univ., Russia), "**Non-Dissipative Closed Electrical Current Process in Normal State (Non-Superconductive) Electroconductive Media,**" pp 189-211, 13 refs, 4 figs.

AUTHORS' ABSTRACT

It is found with the help of the Maxwell theory that thermoelectric effects can be excited and maintained in the nonhomogeneous electrically conducting media by the electrostatic field, but not only by the temperature field. The hydrodynamic condition of flowing of the closed steady-state electric current in non-superconductive media without integral energy dissipation is deduced. As appendix, there is considered operation of a heat pump that is permanently maintaining the temperature field in environment. It is shown that the obtained results contradict the Second Law and therefore extension of the Second Law matter is proposed.

James J. Hurtak (AFFS Assoc., Los Gatos, CA), Patrick G. Bailey (INE, Los Altos, CA), **"Cold Fusion Research: Models and Potential Benefits**," pp 261-275, 30 refs.

AUTHORS' ABSTRACT

Observations have been made of deuteron-deuteron fusion at room temperature during low-voltage electrolytic infusion of deuterons into metallic titanium or palladium electrodes. Neutrons with an energy of approximately 2.45 meV have been clearly detected with a sensitive neutron spectrometer at a rate of 2 x 10^{-3} n/s which cannot be accounted for by ambient neutron background variations. The reaction has been known to yield excess (or "latent") heat, where D+ D yields ^{4}He + 23.8 meV. This paper will examine the latest experimental results from several international researchers and summarize several new theories of nuclear model interactions that have been put forth to explain these intriguing results.

Alexander Frolov (St.-Petersburg, Russia), "**Patents Numbers on the Over-Unity Power Generation and Electrogravitation**," p 276.

All USA patents here are interesting as attempts of realization of the over-unity idea. In some patents there are notes about working devices. Patents on electrogravity also are connected with over-unity since powerful propulsion force in this case can be created by means of small input power source.

I am sure that this list will be useful for any inventor. Mainly this list is based on information from *New Energy News*, the newsletter of Institute for New Energy, USA.

3,913,004 of 14 Oct. 1975
4,975,608 of 4 Dec. 1990
5,288,336
5,065,085
5,101,632
4,622,510 of 11 Nov. 1986
4,006,401 of 1 Feb. 1977
3,811,058
3,879,622
2,982,261
4,595,843 of 17 June 1986
4,567,407 of 28 Jan. 1986
3,368,141 of 6 .Jan. 1968
3,890,548 of 17 June 1975
4,595,852 of 17 June 1986
4,831,299 of 16 May 1989
4,249,096 of 3 Feb. 1981
3,610,971 of 5 Oct. 1971
4,897,592 of 30 Jan. 1990
4,151,431 of 24 Apr. 1979
4,806,834 of 21 Feb. 1989
3,374,376 of 19 Mar. 1968
4,709,323 of 24 Nov. 1987

5,146,395 of 8 Sept. 1992
4,210,859 of 1 June 1980
4,500,827 of 19 Feb. 1985
4,904,926 of 27 Feb. 1990
4,945,273 of 31 July 1990
4,883,977 of 28 Nov. 1989
4,077,001
5,018,180 of 21 May 1991
4,652,771 of 24 Mar. 1987
4,772,816 of 20 Sept 1988
4,748,311 of 31 May 1988
4,835,433 of 1987
3,187,206 of 1 June 1965
3,022,430 of 20 Feb. 1962
3,018,394 of 23 Jan. 1962
2,949,550 of 16 Aug. 1960
1,974,483 of 25 Sept. 1934

T.E. Bearden (Alabama), "**Use of Regauging and Multivalued Potentials to Achieve Over-Unity EM Engines: Concepts and Specific Engine Examples**," pp 277-297, 7 figs.

AUTHOR'S ABSTRACT

Regauging and multivalued potentials (MVPs) occur widely in nature and may involve fields that are nonconservative i.e., the free production of excess force fields. Yet conventional electric and magnetic engines are designed with gauge frozen and utilizing conservative fields and single-valued potentials. Self-induced change of potential, as by an MVP, can be utilized to accomplish **self-regauging** of the engine's stored energy at a certain point or sector. This is equivalent to free "refueling" of the engine, at each regauging position in its cycle, with excess energy furnished from the vacuum. During regauging, the system is an open system receiving excess energy from a known external source; therefore a system utilizing regauging can permissibly-exhibit a COP > 1.0 without violating the laws of physics.

When Maxwell's equations are expressed in (A, ϕ) form, two equations result in which A and ϕ are coupled and the variables are not separated. Electrodynamicists then *arbitrarily* regauge these equations so that the variables are separated. Two simpler equations result, one of them in A and the other in ϕ. These, regauged Maxwell equations are then widely utilized in the literature, without further regauging. This practice has the added effect of **curtailing and closing Maxwell's EM model and the operation of any designed Maxwellian system to further self-regauging**. In short, it eliminates the system's permissible **free collection** of potential energy from the external environment (i.e., the vacuum) and use of that energy to assist its operation.

Yet engine designers **are** free to deliberately utilize self-regauging in their engines, in which case free collection of excess energy from the vacuum is permitted and OVER-UNITY engines result. It is easiest to utilize **fractional regauging**, where only a single potential is regauged with respect to a single field - so long as the accompanying change in the *other* field either (i) does no work upon the system and is thus nullified, or (ii) reverses the back-emf or back-drag forces that would otherwise reduce the energy of the system. In the latter case, the extra force generated by fractional regauging is deliberately used to *assist* the system's operation rather than hamper it.

Johnson has utilized an MVP in a patented nonlinear all-permanent-magnet stator gate with an MVP region. The rotor is attracted in and meets a regauging of the stator's magnetic scalar potential, which forcibly propels the rotor on through and out of the gate by means of a work-free information of an accelerating tangential H-field, providing a net propulsion gain in the gate.

The Takahashi and Kawai engines are two other examples of use of regauging, obtained different fashions. Kawai states figures for a 318% performance in his U.S. patent. This range of over-unity performance is readily achievable from a Kawai-type engine.

The Takahashi engine regauges once during each rotation to reverse the "back drag" force that would normally occur in the transition sector, turning it into a propelling force instead. The Kawai engine regauges 72 times in a single rotation, to eliminate the back drag forces that would otherwise be experienced in those 72 sectors. The Johnson magnetic gate regauges the stator once per gate for each passage of a rotor section, purely with nonlinear, patented arrangements of permanent magnets.

Dan Chicea (Phys. Dept., Univ. "Lucian Blaga" of Sibiu, Romania), "**Microscopic Acceleration Mechanism [of] Cold Fusion in Deuterated Materials**," pp 315-317, 8 refs, 2 figs.

AUTHOR'S ABSTRACT

The Ampere forces, occurring in a solid deuterated fibre which is the target of a high voltage capacitor discharge, has been numerically estimated, in a way resembling the computations of P. Graneau and M. Rambaut that have been performed and published. The energy increase of the ions trapped in the lattice caused by the Ampere force acceleration mechanism has been estimated. Considering the increase of a nucleus Coulomb barrier penetration probability caused by the electron over-concentration, the possibility of nuclear cold fusion is analyzed. The energy excess reported in the experiments traditionally named "Cold Fusion" can not be explained

only by means of a microscopic acceleration mechanism and a strong Coulomb barrier screening, but the low nuclear radiation level reported in some of the experiments can.

Igor V. Goryachev (Moscow, Russia), "**Free Energy Generation by Water Decomposition in Highly Efficiency Electrolytic Process**," pp 319-324, 3 refs.

The scientific community has long realized that water is an enormous natural energy resource, indeed a relatively inexhaustible source, since there are over 300 million cubic miles of water on earth's surface, all of it a potential source of hydrogen for use as fuel. In fact, more than 100 years ago Jules Verne prophesied that water eventually would be employed as a fuel and that the hydrogen and oxygen which constitute it would furnish an inexhaustible source of heat and light.

Alexander V. Frolov (St.-Petersburg, Russia), "**The Work is Created by Means of Potential Field**," pp 371-380, 7 refs, 12 figs.

AUTHOR'S INTRODUCTION

The concept for physical vacuum as an energy source is proved mathematically. It is recognized that space itself has inner structure and it can be used as a source of energy **if some process is organized to change the structure of space**. The existence of reality is described by means of density probability function for energy. So, any space is the result of some energy process and there is no space that has no energy at all. Some power process can be designed in any point of space by means of energy transformation.

Nils Rognerud (Rognerud Res. & Development, Concord, CA), "**Free Fall of Elementary Particles: On Moving Bodies and Their Electromagnetic Forces**," pp 389-406, 12 refs, 9 figs.

AUTHOR'S ABSTRACT

This paper is a review of the problem of the observable action of gravitational forces on charged particles. The author discusses the induced electric fields and the sometimes overlooked unique physical properties. He analyzes several experiments, showing the reality of the induced electric fields. The current interpretation, based on the idea of only one electric field, with certain characteristics, is compared with alternative approaches.

Hideo Hayasaka, Haruo Tanaka, Toshiyuki Hashida, Tokushi Chubachi (Fac. Engr., Tohoku Univ. Japan), Toshilci Sugiyama (Matsushita Comm. Ind. Co.Ltd., Yokohama, Japan), "**Possibility for the Existence of Anti-Gravity and the Complete Parity Breaking of Gravity: Evidence from Free-Fall Experiment Using a Spinning Gyro**," pp 467-479, 9 refs, 1 fig, 1 table.

AUTHORS' ABSTRACT

Free-fall experiment of a spinning gyro enclosed in a capsule has been conducted in order to investigate the effect of the effect of an object's spinning on the fall-acceleration. For ten runs of the fall-acceleration measurements, in which each run consists of left, right and zero spinnings about the vertical axis, it has been shown that the mean value of the fall-accelerations of the right-spinning <g (R) > is significantly smaller than <g (L) > of the left-spinning at 18,000 rpm, with the latter being almost identical with, g (0) of zero spinning. The result suggests that the right-spinning generates anti-gravity, and also that the parity (the reflection symmetry) of gravity breaks down completely.

A.V. Frolov (St.~Petersburg, Russia), "**The Concept of Gravitation**," pp 481-490, 4 refs, 10 figs.

AUTHOR'S INTRODUCTION

By Newton's laws and natural common sense, any active force can be created only in pair with reactive force. This rule describes a balanced interaction between two bodies. But there is a very interesting case: one body and some substance [area] around this body that also includes "empty space substance" – the aether. In empty space (vacuum) the body can be considered as localized in space energy ($E = mc^2$ that is not localized in time) and the substance energy (aether) can be considered as non-localized (dispersed) in space but localized in time energy. This symmetry for spatial or chronal localization is described by Heizenberg's $\Delta E \Delta t \cong h$. For this case the law of conservation of energy for this one-body closed system can be represented as a balance of energy in form of mass (body) and energy in form of space-time around the body. The conservation law is the reason for supposition about chronal effect, which must be demonstrated itself if the system uses transformation of different forms of energy (mass-form and time-form) to produce the non-reactive propulsion force or power generation. One such system is so called inertioid. Let us try to explain the nature of inertia.

By the above proposed formulation, Newton's Law describes the balance of different energy forms that has demonstrated itself as

reaction for any action. It is known that in empty space (in vacuum) any accelerating or decelerating body has some *reactive interaction with space: it is inertia effect*. So, space itself can be represented as some substance. Also, there is the equality of rest mass and inertial mass that confirms this supposition. I don't see any difference between space and aether concepts. There is no space without aether and aether cannot be considered as some material substance separately from space. Note that matter also cannot be considered separately from space. Matter is only a special structure of space or space is only different forms of the matter. Empty space (vacuum, aether...) also is some material structure and it is connected with some energy value per unit of space volume.

The important part of the gravitation concept that is proposed above, is followed by M. Faraday's opinion about the nature of matter. In his letter of June 25, 1844 to Richard Tailor, M. Faraday wrote: So, matter anywhere is continuous... it is not necessary to suppose the difference between atoms of matter and some intermediate space. The forces around centers impart to these centers the properties of the matter...

M. Faraday considered this aspect to make a conclusion for the nature of electric conductivity and insulation. But his point of view can be developed for the gravity aspect also. *The atom and the space around the atom is the same matter in different states*. An atom or element of the atom is a local change of space structure only.

The pre-conditions above are a basis for this conclusion: **Any body displaces aether mass that is equal to body mass: the well-known Archimedes' law for aether** (in generalized form). Since motion of any body has a place inside of real substance, this substance (space-time itself) can be used for "reactionless" or aether-dynamical (like aerodynamical) methods of motion. Forces acting on the body in this case are external and the law of conservation (for energy, momentum, impulse) is true if the body and substance around body (air, liquid, aether) is considered as a closed system.

Since aether-dynamical motion uses the mass of aether (that was demonstrated as inertial mass) to create the aether gradient, in this case inertia effect is not produced for accelerating or decelerating object, so: **reactionless motion is inertia-less motion**.

An important aspect of the gravitation concept described in this paper is the notion of paired processes of nature: gravitation - radiation. Joseph Hasslberger described this point of view in detail ("A New Beginning for Thermodynamics," of May 8, 1993). Two paired processes are created in Nature in regard to the energy balance, conservation law. So, if radiation is the emission of the photons (electromagnetic waves of any wave-length) from a mass object, the gravitation is the absorption of the photons by mass objects. In other words, the phenomenon of material mass as a source of a gravitation field can be presented as absorption and transformation of electromagnetic waves. The source of these waves are known as zero-point fluctuations. The concept of the zero-point electromagnetic energy fluctuations which exist in empty space is published by A. Sakharov, H. Puthoff, A. Rueda, and B. Haisch.

Yu.N. Ivanov (Russia), "**Compression of Standing Waves, Rhythm-Dynamics and Third Condition of Rest**," pp 495-528, 32 figs.

AUTHOR'S ABSTRACT

The problem of aether and problem of movement so far wait its decision. About ninety years ago, aether was moved into store of unnecessary ideas. But time has passed and followers who have acted in this hasty way have come to a dead end and crisis was designated. But there were some followers who, up to the last days, do not renounced the idea of aether's existence. Now is the time, "when the medium (aether) that had become unnecessary declares itself by new discoveries, then the question becomes lawful: whether a modern science is ready to direct its own ambitions to understand the problems at last? It is necessary for this purpose, to forget for a time about all theories created after the year 1900, and to look why all was received just so?

S.M. Poliakov, O.S. Poliakov (Russia), "**The Beginning of Experimental Gravitonics**," pp 529-536, 8 figs.

AUTHORS' ABSTRACTS

Now we can suppose that XXI century will be the century of Gravitation, like XX century was the century of Electricity and Atom energy, and IX was the century of the steam machine.

This thought appears to take more and more of the minds of engineers and scientists and to move them to activity in this direction. In a general sense, in all "gravitation research programs" have three main goals: a) real system for communication by means of gravitation waves; b) real

gravitation propulsion drives for space ships; c) real transformers of the space gravitation energy in electrical energy.

So, for goal-directed work in this new area of science, it is necessary to have minimum working equations to describe the physical mechanics of the processes.

We state: **Gravitation is the problem of non-linear mechanics for curvealinear motion.... and nothing more!**

In general, this problem could be solved in Dalambert's time but he did not completely solve the equation for the motion of a material point in 4-dimensional space.

We used another way and found new, approximate, analytical equations connecting the gravitation of macro-objects with rotation and magnetism with gravitation. The equations were checked in a series of experiments, from mechanical to quantum, and they proved their explanatory capacity.

Boris D. Shukalov (Russia), "**The Inertial Propulsion Drives**," pp 545-552, 18 refs.

INTRODUCTION

The notion of an "inertial propulsion system" or device that is moves by means of inertial forces is vague and it requires a better definition. Ordinarily the "drive" is a wheel, track, propeller or gas flow reaction. By means of the "drive," the moving device is attracted to or repulsed from the support that exists outside of the device.

Inertial drive is not interacting with any support outside of the device but it is interacting with body of device by means of inertia force.

So, it is more true to name the inertial drives as "inertioid" by inventor Tolchin., Perm, Russia. He made such sort of systems more than 30 years ago. His book about mechanics of 1969 was the cause for critic attack on the inertioids. For example, Prof. Dr. N.V. Gulia stated that unidirectional motion by means of inertia forces is impossible. But other scientists like Dr. L.B. Levinson, for example, wrote that in technics all calculations are taking into consideration real inertial forces.

So, the notion for inertioid depends on the inertial concept. Theoretical researches have concluded: reality of inertial forces follows from Newtonian mechanics but fictitious inertial forces are an Einsteinian relativity theory effect.

By Newton there are three real inertia forces: second law force, centrifugal force, and Coriolus force. Let's consider the notion for space and forces above.

A.A. Efimov, A.A. Shpitalnaya (Pulkovo Astron. Observ., Russ. Acad. Sci., St.-Petersburg), "**The Energy Anisotropy of Space**," pp 583-586, 13 refs, 2 figs.

AUTHOR'S ABSTRACT

The Energy Global Anisotropy of Space, connected with the new natural interaction was predicted theoretically and discovered experimentally by Yu.A. Baurov and his colleagues. The essence of that lies in ideas of physical vacuum structure. By this conception the masses of elementary particles are proportional to the magnitude of the intergalactic vector potential A_g (a new fundamental constant, related to one-dimensional discrete "magnetic" fluxes -byuons, which form our entire world). The modules $|A_g|$ has a limiting value near of $1.95\ 10^{11}$ CGSE units (or Gauss cm) and it cannot be increased but diminished by the vector potential of a certain magnet going to meet A_g inasmuch as masses of elementary particles are uniquely related to the value A_g, an assumption may be made about new type interaction existence, in a region of lowered $|A_g|$, that is acting on any material body located there.

Prof. Dr. Albert I. Veinik (Inst. Phys. & Technics, Belarus Acad. Sci., Minsk), "**On Some Properties of the Physical Time and Space**," pp 587-598, 7 refs, 9 figs.

AUTHOR'S ABSTRACT

A new paradigm theory is proposed. According to this paradigm. heterogeneous SIMPLE substances – chronal (Greek "chronos" - time), metrical (Greek "metron" - measure, size), rotational, vibrational, thermal, electrical, magnetic and others are the starting elements of the Universe Temple. Each such sort of substance have their own specific properties and the substances pass these properties to the object if the object include this substance. If the object has not some substance, it has no properties corresponding to this substance. Photons, for example, don't include electrical substance (charge) so photons don't have special electrical properties, it has no such reaction.

From 1950, more than 10 years were spent finding a special thermal (or vermical by German *die Warme* - heat) substance, and the transference of it is the explanation for all thermal phenomena. In experiments the existence of independent special particles – "satlons" – was proven.

It was discovered that all simple substances for the macro-world

level have continuous properties; for micro-world level - discrete, portion, quantum; and for more subtle level (in nano-world) the substances have force properties. For example, the so called gravitational and electrostatic field (nano-field). Quantum (minimum portion) sizes for chronal, metrical, rotational and magnet substances are unknown. As vibration substance quantum it is possible to accept the Plank constant, and as electrical substance quantum - the electron charge. Quantum of vermical substance (vermiant) was detected by many methods. Experiments on the heat flows and electric currents using Franz-Videman law, have the quantum result: 3.87 10^{-23} [J/K].

A so-called elementary particle is totaly composed of simple substances, portions of which are interacting in SPECIFIC ways (between quanta of the same type) and interact UNIVERSALLY by way of quanta of different types. In the electron, for example, the universal interaction force between portions of electrical and thermal substances, is equal to 4 10^{-25} N.

V.L. Stavitsky (Russia), "**To a Question on Reserves of Information Interactions in a Nature**," pp 599-603, 6 refs, 3 figs.

AUTHOR'S ABSTRACT

The original approach to revealing of latent (non-energy) information interactions is under consideration. Reasons for such statement of question, general principles and also probable variants of its decision are under discussion. The results of experimental researches are submitted.

Albert Serogodsky (Russia), "**Thermal Engine with a Single Heat Source**," pp 381-388, 6 figs.

AUTHOR'S ABSTRACT

In my short report I present you some results of our theoretical and experimental investigations of gas-liquid solutions in the retrograde condensation domain. Our investigation had shown the possibility of obtaining in this domain the full transition of the delivered heat to the useful work.

Since the determination of heat effects may imply, as a significant error we shall enlarge on the determination of some conditions which uniquely demonstrated the possibility of the isothermal cycle realization.

The singularity of properties of the gas-liquid solutions consists in feasibility to set up only through a supplied heat a non-equilibrium state of the isothermal cycle which is equivalent to an increase of the energy level of the system relatively to the heat source. As a result of our investigation one of such systems is found. It is the nitrogen-butan solution

---

V.G. Shulgin (St.~Petersburg, Russia), "**Gravitation Results from Interaction of Substance with Gradient of Aether Density**," pp 415-420, 3 refs.

AUTHOR'S ABSTRACT

It is known that an electric charge attracts a dielectric. A point charge attracts a dielectric with the force:

$$F = \frac{\varepsilon - 1}{\varepsilon + 1} \left\{ \frac{e}{2Z_0} \right\}$$

where ε is the permittivity, e is charge, Z_0 is distance from charge to dielectric.

The dielectric is attracted to the charge but it can't attract a neutral dielectric. On the analogy with dielectric, the passive gravitational mass is attracted to the active gravitational mass but it can't attract active gravitational mass. The aether has the passive gravitational mass and it is compressed by action of the gravitation. The compression of the aether increases both the dielectric permittivity constant and the permeability of space. Alteration in density of the aether and another its descriptions are established by means of the scalar gravitational potential which is discussed.

M.G. Vinogradova, A.E. Khod'kov (St.-Petersburg, Russia), "**About Experimental Proofs of Gravitational Sun to Earth Influence by Screening of the Part of Inflowing Surrounding Space Neutrinos**," pp 457-459, 4 refs.

AUTHORS' ABSTRACT

Twelve years ago Stefan Marinov made an experiment to determine the existence of the aether. This was more than 100 years after the famous Michaelson experiment. The treatment of the results of these experiments is shown from the point of view of the New Cosmological Theory (NCT) by Khod'kov-Vinogradova, to not be in conflict with the above experiments but in harmony with each other.

What is the basis of NCT that allows someone to make this logical conclusion and to explain of the results of the experiment by S. Marinov?

In the first place, NCT can give a positive answer to Newton's question: "Is the agent causing gravitation the material?" Yes, it is.

Y.G. Belostotsky (Russia), "**Principles and Bases of the Support-Less Movement and Realization of it in Nature**," pp 537-544, 8 refs, 4 figs.

AUTHOR'S ABSTRACT

Putting the purpose to find the explanation of some phenomenon of Nature, first of all, it is necessary to make a technique of a scientific search. We shall show, that such a technique can really be created and with its help we'll try to decide the problems mentioned in the heading.

In work the assumption is stated that natural phenomena always are mutually-connected, and the fundamental physical laws are expressed by inter-connected values (equivalence) and they are, without fail, submitted by the most simple parties (ratio) and, as a rule, three parameters, for example:

$$F = Ma \text{ or } a = F/M$$

$$E = mC^2 \text{ or } m = E/C^2$$

$$S = Vt \text{ or } V = S/t$$

i.e. they are expressed by three-elements formula, in which mathematical action or multiplication, or division (but not addition or subtraction) is used.

J.G. Goriachko (St.-Petersburg, Russia), "**On the Question about Analytical Methods Which Reflect the "Substance-Space-Time" Unity of Nature in the Laws of Natural Science, and About Main Properties of this Unity**," pp 569-573, 3 refs.

AUTHOR'S ABSTRACT

It is shown that nature unity "substance-space-time" is demonstrated in micro-world and in macro-world as planetary motions by various trajectories; forms of these trajectories are dependent on the chemical composition, atomic/molecular structure, and thermodynamic states of these planets. There are obtained some analytical methods that reflect the unity in the natural science laws and the virtual possibility is demonstrated for artificially adjusting the components of the unity up to matter-/anti-matter transformation.

V.D. Plykin (Izhevsk, Russia), "**Information-Energy Model of Matter and the Universe**," pp 615-620.

AUTHOR'S ABSTRACT

"...with much wisdom comes much sorrow, the more knowledge, the more grief" Ecclesiastes (1:18).

I would like to make a report on the discoveries made 14 years ago. For the modern materialist science they appear to be so unexpected as Galileo's discovery of the rotation of the Earth was in his time. The results we obtained prove that the basis of our materialist philosophy is false. The concepts suggested in the report deal with the problems of the Universe and the Earth coming into existence, as well as problems on the advent of life on the Earth, and are quite different from what we had before. But to have those results published in 1982 when "developed socialism" had reached its highest point was just suicide.

BOOK REVIEW

ÆTHER SCIENCE PAPERS by Harold Aspden

Alvin Miller, "The Æther Revival of Harold Aspden," book review: Æther Science Papers, Harold Aspden, 168 pages, 1996, Sabberton Publications, P.O. Box 35, Southampton S016 7RB, England, US$25 postpaid.

Publication of this book substantiates the existence of a movement to take the concept of the æther seriously. A plethora of models are already available, whether homebrew, quasi-academic or academic. A couple of samples: a Dirac Madelung fluid with spinning tops; empty set (vacuum) pixel space associated with localized vortex elements (Lazarus in *Cold Fusion*, #21); ticking cellular automata with pulsating toroidal spheres or annular wave packets packed linearly with spin traverse polarization. These are hidden variable theories that postulate vortex structures (harmonic oscillators, soliton lumps, topological kinks, vortex sponges, hollow spiral filaments, etc.) situated on a typically cubic lattice where adjacent neighbors rotate/oscillate in anti-ferromagnetic-type order (opposite).

The close consensus here is remarkable, but is explained in a paper by sociologist of science Shanks, "Stochastic Electrodynamics and Counter-Revolutionary Physics" collected in the Scientific Method by Snyder. Stochastic electrodynamics (Marshall, Barut, Boyer) is one variant æther theory. The operative word is "revival." This is conservative dissident physics with the avowed objective of rolling back the reigning Einstein-Heisenberg axis and replacing it, as far as possible, by dusted off classical æther circa 1905, as represented by, for example, Larmor, Bjerknes or Korn.

Actually, Einstein was pro hidden variable and quarreled with quantum physics (EPR paper, 1935). Based on this work, Bell later proved that any hidden variable theory must be nonlocal, a fact claimed to bury hidden variables. To the contrary, (weak) non-locality has always been a feature of æther models, with the proviso that no superluminal energy (signals) or superluminal matter transmission takes place. This is expressed variously as: phase locking (Aspden), mutual correlated synchro formation, organized collective guided motion with long term order, persistent correlation of passive information or contextual, unfragmented implicit order.

Next, we show how interactions are treated in the models. The æther is a Bose-Einstein condensate fluid so that, with respect to translation, it effectively acts as a super-cooled superfluid. But the æther behaves like an elastic solid that deforms like a jelly when subject to constant force or shatters for sharp forces. These torsions or stress/strains then give rise to particles (vortex desynchronization) and the various gauge fields. Further, a mechanism is needed to produce vacuum fluctuations, Brownian or stochastic type jitter. An appeal can be made to classical statistical mechanics as a source for this random motion, although the mixed state correlations that occur there are claimed to be already macroscopic quantum effects.

In Harold Aspden's book, these elements are assembled to form the best model in the æther resurgence so far. The book collects 14 of his articles over the past decade with a useful 62 page preface. His model is fairly sketchy, firstly because it is spread throughout the papers and varies in expression as the years go by. Another likely reason is that the æther concept is so loaded, as Aspden puts it, that he used a certain amount of camouflage to get published. But he does, indeed, propose a cubic lattice, where Planck's constant, h, gives the lattice spacing and h is not permitted to have any further metaphysical significance. Quantum numbers arise only because charge is integral (quantal) and conserved. He characterizes the æther lattice as a solid piece of iron to emphasize its crystalline solid aspect. He situates subquantal harmonic oscillators labeled quons on the lattice in antiphase configuration, Aspden's oscillators can process and can produce cavity wave resonances in the cube volume.

He proceeds in several articles to determine the mass spectra of elementary particles and other particle constants with his method of prime number harmonic wave resonance. This requires only "back of the envelope calculations" or "school level math," where he is at pains to deny that he is doing numerology. The method is analogous to the quantum field treatment of particle self-interaction or self-interference with the bare/naked particle being dressed/given fur by its cloud of surrounding virtual photons. Aspden proposes that prime ratios derived from specific combinations of the swarming virtual particles govern the oscillations and fix the constants. The numbers are significantly more precise than the results from the mathematically tortuous field theory. Perhaps these primes are the long sought ancient pythagorean harmony of the spheres he discusses.

Inertia and gravition, along with the other gauge forces, arise from the electrodynamic accelerated charged particle motion in conjunction with æther jitter. Puthoff proposes a similar mechanism in the zero-point energy theory. In agreement with stochastic electrodynamics, Aspden notes that the dielectric displacement current and magnetic induction are vacuum effects. Maxwell was historically inspired to posit the displacement current by his study of his cellular honeycomb æther model. Juxtaposed reference frames in motion with respect to the charges are integral to the production of jitter and gravitational forces in Aspden's model.

In the preface, Aspden properly complains that his work has been ignored, which is one of the reasons he is now doing primarily experimental work. He states that the two most likely routes to tapping the æther are ferromagnetism and his concept of æther spin/vortex shedding. In collaboration, he has constructed permanent magnet motors, plasma tubes and other free-energy devices and has had a number of patents granted on these devices with further patent applications filed. In a 1989 paper he postulates that æther spin can generate antigravity, possibly being confirmed by Finnish experiments and NASA replication attempts. Mass production of devices that "violate" conservation of energy (unless the æther contribution is included) should indeed focus attention on his theoretical work.

From a broader perspective, Aspden points out that our greed and exploitation have brought us to the brink of an apocalyptic "catastrophe sufficient to terminate human and animal life on earth." In this context, the diligent search for free-energy becomes imperative, and success will bring the power of the gods – a loaded gun is being handed to an Idiot Child (humanity). We can use it to speed up our hellbent race to oblivion and go out with a bang, or use it to heal the planet and ourselves.

Æther Science Papers is an oversize book with sturdy, plasticized covers. It has a complete bibliography but no index. The articles retain their original pagination, making reference to individual passages a bother. Aspden crosses swords with modern physics on a number of points. No one currently working in field theory would dispute that a properly constructed hidden variable theory can match them in substance. Aspden's model looks to be closest to this goal so far, and it uses comparatively trivial mathematics. He recognizes the necessity for nonlocality and reference frames and other features not normally discussed. This book is quite a bargain and the only verdict can be: both thumbs up!

BOOK REVIEW

QUANTUM RELATIVITY: A SYNTHESIS OF THE IDEAS OF EINSTEIN AND HEISENBERG
By David Finkelstein

Alvin Miller, "David Finkelstein's Postmodern Quantum Æther," book review: Quantum Relativity: A Synthesis of the Ideas of Einstein and Heisenberg, David Finkelstein, 577 pages with appendices and index, 1994, Springer, $89.

This book is the author' s (massive) magnum opus and crowns a brilliant career. During this time, he has rubbed shoulders with many of the notables of modern physics (e.g., von Neumann, Bohm and others), and posterity will place him in the same league. So, he's been there and done that. But along the way, he has always been willing to express his own, sometimes maverick, views. As the editor of the International Journal of Theoretical Physics ($795 for an annual subscription!), he does not demand political correctness (adherence to SM – the Standard Model). For example, early papers by Harold Aspden and a number of his own have been published there.

This book is a postmodern program to push modern physics (SM) to its extremes and thereby overcome it and move beyond. The explicit objective is replacement of the SM. He lists the various field theory models and rejects each in turn without explanation. One quantum chromo-dynamic model rejected uses lattice cells in phase space constructed out of the vacuum with creation/annihilation operators. Recently attempts have been made to place solitons on these lattices, all seemingly pertinent to Finkelstein's model. Incidentally, papers in the SM have speculated on when and what effects the present (metastable) false vacuum will make the final phase transition to the actual zero value ground state. The upshot is that all the parameters such as temperature and stress aren't known, so that this could happen a minute from now.

The author has demonstrated an early and growing interest in the vacuum as time went by. In 1969 he published an influential paper that was one of the earliest on solitons, leading to instatons, Higgs particles, Witten strings, etc. Edward Witten himself said of the paper that it "probably represented the first use of what would now be called vacua in quantum field theory." In a 1987 paper Finkelstein commented "**the structure of the vacuum is the central problem of physics today**; the fusion of the theories of gravity and the quantum is a subproblem."

The model is constructed of what the author labels chronons in fermionic pairs that form quasibosons and condense (Bose-Einstein supercondensate) into space time vectors to form an off diagonal (diamond) hyper-crystalline order. Chronons are postulated to be about the size of Planck time which then determines lattice spacing. Here ordinary "**particles such as electrons are comparatively huge light blimps with internal structure**." The space time vectors are placed at the lattice vertices of Feynman-style diagrams ("Feynman checkerboards with whiskers"). These are sited in complex valued phase cell space (discrete hyper-dimensional Hilbert space). If you're still following, the metric is potentially indefinite and fluctuating, and there is no absolute space nor instantaneous time. And the model has no underlying manifold, although, by construction it still retains causality and locality. The universe is seen as blinking into and out of existence frequently as space time and the constituting lattice are formed

To represent interactions, this mathematical set logic lattice is subjected to vacuum defects. An analogy with solid state crystallography, as in Burger's dislocation theory of disinclination, torsion, etc., is used to produce all particles and forces (weak, strong, EM and inertia and gravity). Again, in analogy to solid state, the coherent mode method can be used to place harmonic oscillators in the lattice to represent solitons, kernels, vortices, etc., and derive the mass spectra energy levels. After construction is completed, the lattice can be mapped to Minkowski space to embed the tiling there. From this point, thefinal mapping can

be made to produce a subquantal hyper-crystalline lattice in the real four-dimensional laboratory frame world.

One of Finkelstein's mottos is from Huckleberry Finn, "I don't hold much with mathematics." He is adept at keeping the necessary formalism to the minimum that will do justice to the model. Certainly his model is substantially less complicated than the SM, where field theory now resembles nothing so much as the gyres and epicycles prior to Copernicus. An example of minimal use technique is Finkelstein's employment of the Rubik's cube toy to generate the group theory rotation symmetries for the hypercube. One big mathematical surprise is the indication of octahedral instead of cubic lattice structure giving a hyper diamond with off-diagonal order.

Here the power of geometry and topology as tools is demonstrated. Even Newton had geometric effects – witness the Coriolis force. Modern physics has become a mathematical playground for all the various geometric entities now known, with topology as active agent. A viable aether theory must not reject these questions out of hand. Finkelstein is pioneering these applications and reaping unique physical insights as a reward.

Integrated into the book are a number of succinct, intelligent discussions of metaphysics. Such discussions are now a requirement in order to cope with the turmoil in modern physics. With respect to the æther, he is thoroughly conversant with the classical version (noting particularly Sommerfield) and its contemporary revival. Interestingly, Descartes in the fifteenth century already postulated vortices in his fluid æther. In the famous Newton (point particles in the empty Void) versus Leibniz debate (contiguous monads), Finkelstein sides with Leibniz and the concept of extension. Space is full - the plenum. Without wandering into theology, the concept is a benevolent, beneficent universe. Finkelstein has published elsewhere on process theology and similar topics.

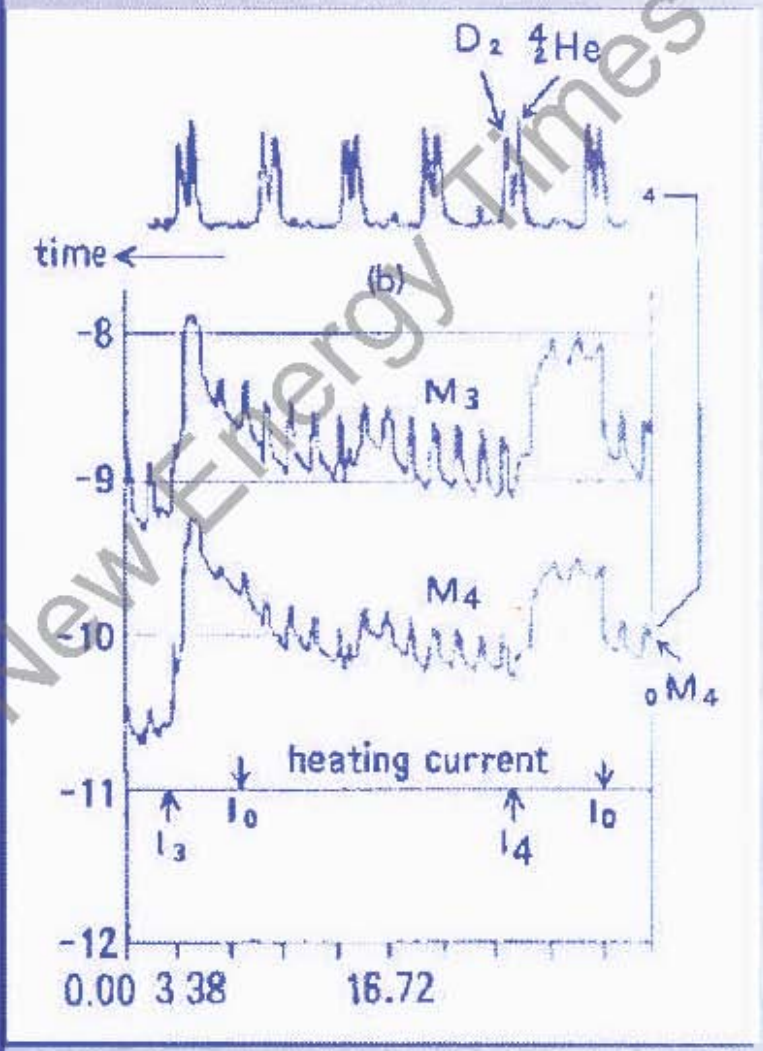
In spite of the lengthy convoluted route through mathematical spaces, the hyper-crystalline lattice that eventually falls out is markedly similar to classical æther models. But there are a number of significant distinctions instantly made. This is not a hidden variable theory. There is no underlying continuum into which the æther is to be placed, contrary to Newtonian physics. In compliance with the fundamental postmodern prescription, no absolute, preferred frame is granted the æther. The biggest advance over the classical model is that now for the first time the mathematical formalism has been developed that will permit the determination of the complete structure and dynamics of the lattice æther.

But this is also the source of the greatest disappointment with the book. It is admittedly only a work in progress. Results so far achieved are tantalizing but sparse. Dynamic predictions will have to await new papers or perhaps a second edition update. Finkelstein conducts lively workshops on Quantum Topology and Quantum Logic at the Georgia Tech. School of Physics that should generate added details. As it stands, the lattice is really only discussed in the last chapter of the book. The author doesn't elaborate the relation of his model to the classical æther or to the SM, in spite of similarities in all the models. There is no discussion of the features to be expected for the lattice in the real world space-time.

The book is not recommended for neophytes or those totally allergic to math. The index appears to be computer generated and not comprehensive. The book is pricey, although certainly packed with original ideas for that price. It represents a tentative, cutting edge effort to open physics to a radical, new frontier, as opposed to attempts to regress to an era that probably can't be recaptured. Understood in this way, the book will amply reward those intrepid enough to explore it.

JOURNAL OF NEW ENERGY

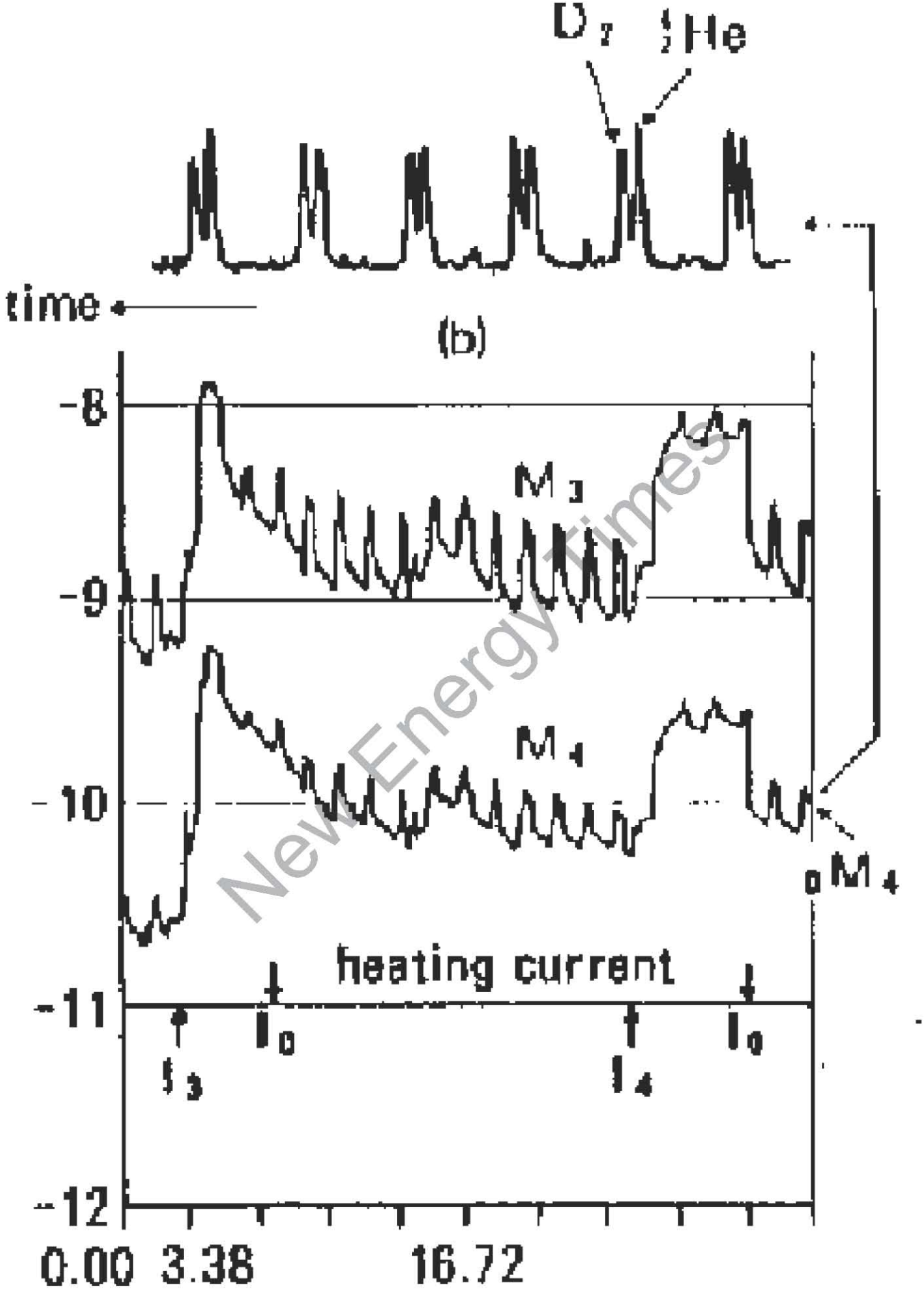
An International Journal of New Energy Systems Vol. 2, No. 1, 1997



Arata - Chronological change of characteristics of mass

Journal of JNE

Spring 1997
ISSN 1086-8259



Spring 1997 **Vol. 2, No. 1**

JOURNAL OF NEW ENERGY

An International Journal of New Energy Systems

The Journal of New Energy is published quarterly by Fusion Information Center, Inc., with offices at the University of Utah Research Park, Salt Lake City, Utah.

ISSN: 1086-8259

Mailing address:
Journal of New Energy
P.O. Box 58639
Salt Lake City, Utah 84158-0639
(801) 583-6232 FAX: (801) 583-2963

JNE Staff:
Hal Fox, Editor
Vincent Coon, Associate Editor
Dineh Torres, Publications Dir., Graphics
Robyn Harris, Circulation Mgr.

Printed in the U.S.A

Instructions to Authors:

Professional papers on cold fusion and other enhanced energy systems are solicited from scientists, engineers, inventors, and students. Papers from recognized professionals may be published immediately with an accompanying invitation for peer-review comments. Other papers will be submitted for peer review. Names and addresses of any reviewers will be sent to authors with reviewers' comments.

The Journal of New Energy (JNE) is devoted to publishing professional papers with experimental results that may not conform to the currently-accepted scientific models. The topics to be covered in this journal include cold nuclear fusion, low-energy nuclear reactions, high-density charge cluster technology (including some plasma circuits where enhanced energy is produced), high-efficiency motors or generators, solid-state circuits that appear to provide anomalous amounts of output energy, and other new-energy devices. Papers with experimental data are preferred over theoretical papers. Standard alternative energy topics such as hydrogen fuel, wind power, solar power, tidal power, and geothermal power are not solicited.

Authors should submit abstracts. If the abstracts are favorably considered for publication, the author will be sent an author's kit of instructions for the preparation of the paper. The editor and the editorial advisory board are responsible for making publication decisions.

Authors or their employers will be invoiced for production costs sufficient to cover the cost of publication in excess of subscription funds received. The JNE will try to match donors with authors from developing countries so that all acceptable manuscripts can be published. **Donors are requested to contact the JNE and they will be specially honored in the Journal.**

Editor Hal Fox is the leading founder of the Fusion Information Center which publishes both the *Journal of New Energy*, and *New Energy News*, a monthly newsletter covering new-energy developments for members of the Institute for New Energy. The previously published *Fusion Facts* newsletter (1989-1996) is now incorporated as a section in this Journal.

FUSION INFORMATION CENTER

The ***Fusion Information Center, Inc.*** (FIC) is a Utah corporation founded in April 1989, with the goal of being a part of the exciting new-energy technologies. FIC is best known for its publications: Journal of New Energy (since Jan. 1996), New Energy News (a monthly newsletter since May 1993), and Fusion Facts (1989 to Dec. 1996) which is now a section in the Journal.

FIC has the world's most complete collection of cold fusion papers and one of the best collections of new-energy papers and publications. We welcome the visit of authors, inventors, and scientists to our offices in the University of Utah Research Park.

FIC has world-wide rights to the patent pending on **Plasma-Injected Transmutation**. This invention provides means to do the following: 1. Create thermal power without neutrons. 2. Ameliorate high-level radioactive wastes. 3. Fabricate table-top particle accelerators to study nuclear reactions. 4. Produce some scarce elements from selected plentiful elements. Exclusive license rights are available for most nations, or for provinces or states. Contact our office for more information.

Fusion Information Center, Inc.
P.O. Box 58639, Salt Lake City, UT 84158-0639
(801) 583-6232 FAX: (801) 583-2963

INSTITUTE FOR NEW ENERGY

The Institute for New Energy is an international organization to promote new and renewable energy sources. Its monthly newsletter is **New Energy News,** reporting worldwide on all facets of new and enhanced energy.

The Institute for New Energy
P.O. Box 58639
Salt Lake City, UT 84158-0639
Phone: 801-583-6232
FAX: 801-583-2963
E-mail: ine@padrak.com
Web Site: www.padrak.com/ine/

New Energy News

New Energy News (NEN) is the monthly newsletter for the Institute for New Energy,. containing 20 to 30 pages per issue.
It is *FREE* with your membership.

Membership

- Membership to the INE is $35.00 per year for individuals in the U.S.A.
- $40.00 for Canada, and Mexico
- $50.00 for all other countries, *and*
- $60.00 per year for Corporations and Institutions

Call the INE for additional information at the above address, *or*
Contact the INE President: Dr. Patrick G. Bailey — inc@padrak.com