# FUSION facts

A Monthly Newsletter Providing Factual Reports On Cold Fusion Developments

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*--Since 1989--*

***Fusion Facts* Reports on Both Cold Fusion and Other Enhanced Energy Devices.**

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* Ho, Ho, Ho, *Merry Christmas and Happy New Year*

## A. *FUSION FACTS* TO MERGE WITH *JOURNAL OF NEW ENERGY*

After over seven years of monthly publication, *Fusion Facts* will no longer be published as a monthly newsletter. The reason is to provide more detailed information to our subscribers. Most of the subscribers to *Fusion Facts* are scientists and engineers working in the fields of cold fusion and other enhanced energy systems. However, the *Fusion Facts* reporting on international cold fusion developments will continue as a part of the quarterly *Journal of New Energy.*

This is your last issue of *Fusion Facts* in the form of a monthly newsletter. The equivalent value of your remaining subscription will be credited to your choice: toward the quarterly *Journal of New Energy* or you may switch your remaining subscription directly to the monthly *New Energy News*, a newsletter for members of the Institute of New Energy. Please respond by return mail, phone, or fax to: Robyn Harris, Fusion Information Center, P.O. Box 58639, Salt Lake City, UT 84158; or phone 801-583-6232 or fax 801-583-2963. **If you fail to notify us, it will be assumed that you will want to switch your subscription to the *Journal of New Energy*.**

With the exception of the international journal of the American Nuclear Society, ***Fusion Technology***, under the courageous leadership of Professor George Miley, there has not been any U.S.

journal that has published articles on cold fusion, low-energy nuclear reactions, and other new-energy scientific studies. The editor/publisher and scientific advisors of *Fusion Facts* recognized the need for a peer-reviewed technical journal that would review and publish articles on cold fusion and other enhanced-energy systems. Therefore, in January 1996, the first issue of the Journal of New Energy (JONE) was published. The contents were the papers presented at the first conference on Low-Energy Nuclear Reactions, held at College Station, Texas, 1995. Volume 1, number 3, of the JONE was the proceedings of the second conference on Low-Energy Nuclear Reactions, in 1996. It is believed that some of the most important papers related to cold fusion were first presented at this conference and the proceedings were published within ninety days after the conference.

Beginning with volume 2, number 1, of the JONE, the abstracts of cold fusion papers (and of other important papers on enhanced-energy topics) will be published in the *Fusion Facts* section of each issue of the JONE. That means that instead of getting your information within thirty days of the time it is received at this office, the abstracts can be up to ninety days old. However, we intend to augment this service with an accessible on-line service that will post abstracts as soon as they are received. We hope that this service will help you in your efforts to follow the important further research and development in the areas of cold fusion and other enhanced-energy systems.

**TOPICS COVERED IN THE JONE**

The JONE is devoted to publishing professional papers, especially with experimental results, that may not conform to the currently-accepted scientific models. The topics to be covered in the JONE include cold nuclear fusion (aka new hydrogen energy), low-energy nuclear reactions, high-density charge cluster technology (including plasma physics) producing enhanced energy, high-efficiency (over 100%) motors and generators, solid-state circuits that produce anomalous amounts of energy, and other enhanced-energy devices and systems.

The JONE does not accept the negative experiments of Michelson-Morley as a proof of the non-existence of an energetic space (especially since Michelson and Gale later proved otherwise). Therefore, the JONE expects that where space energy exists (aka zero-point energy, zero-point fluctuations, the energetic aether, etc.), there will be found means by which such energy can be transformed into commercially useful forms of energy. The JONE recognizes that over 500 peer-reviewed articles have been published in respected journals about space energy. **The JONE expects that commercial devices will be available before the year 2000 that will transform energy from the environment to useful energy without transgressing the Law of Conservation of Energy.**

Some of our generous friends have credited *Fusion Facts* with providing a rapid exchange of information on cold fusion so that there was a continuation of international interest in this new science. We are grateful to be acknowledged for our service to the scientific and engineering community. **However, the greatest tribute should go to those who have persevered in the development of a new science that has been made unpopular by the strident, vociferous efforts of scientific lobbyists who have fought to preserve the current status-quo of funding for currently-favored energy projects.**

We shall continue in our goal to provide a rapid exchange of information on cold fusion and other enhanced-energy projects. The monthly newsletter, *New Energy News*, will carry information and experiments for both intelligent and interested subscribers including scientists, engineers, technicians, and others. The quarterly journal will provide a vehicle for peer-reviewed scientific articles on topics that are too often shunned by other journals. **For us to be successful, we will need to have well-written, experimental (and theoretical) papers from the scientific community. We urge you to send us your papers for review. We reserve the rights to keep our focus on cold fusion and other enhanced-energy topics. Authors, please request submission information.**

**Thanks for your past support and your future contributions,**

**Hal Fox, Editor-in-Chief of *Fusion Facts.***

## B. 6th INTERNATIONAL CONFERENCE ON COLD FUSION (continued from Nov. 1996 *FF*)

All the following abstracts are taken from the *Program & Abstracts* of the ICCF-6 Conference, held Oct 13-18, 1996, in Hokkaido, Japan.

**P.R.CHINA - BARRIER PENETRATION**

Yi-Fang Chang, Zheng-Rong Liu (Yunnan Univ.), "Nonlinear Barrier Penetration and Cold Fusion," pg 113.

AUTHORS' ABSTRACT

The most puzzling problem on the theory of cold fusion is the barrier penetration, which is too small in comparison with the experimental facts. In order to explain this contradiction, we propose a new penetration mechanism.

Combining the nonlinear quantum theory, which was developed at present, assume that one separate incident particle like a solitary wave, and obeys a nonlinear Schrodinger equation

$$\psi_{xx} + i\psi_t - 2a^2\psi^3 = 0 \qquad (1)$$

For the stable state and a square potential barrier, the equation (1) becomes,

$$d^2\psi/dx^2 + k_1^2\psi - 2a^2\psi^3 = 0$$
$$(k_1^2 = 2mE/\hbar^2), \quad for \quad x<0, \quad or \quad x>d \qquad (2)$$

$$d^2\psi/dx^2 + k_2^2\psi - 2a^2\psi^3 = 0$$
$$(k_2^2 = 2m(E-V_0)/\hbar^2), \quad for \quad 0<x<d. \qquad (3)$$

Let the integral constants $c_0 = 0$, $c_1 = k_1^4/4a^2$ when $|\psi| < k_1/\sqrt{2}a$, a particular solution is

$$\psi_1 = \frac{k_1}{\sqrt{2}a}\cdot\frac{A^2e^{\sqrt{2}k_1x}-1}{A^2e^{\sqrt{2}k_1x}+1} \text{ (for x < 0), or}$$

$$\psi_3 = \frac{k_1}{\sqrt{2}a}\cdot\frac{C^2e^{\sqrt{2}k_1x}-1}{C^2e^{\sqrt{2}k_1x}+1} \text{ (for x > d) .} \qquad (4)$$

It shows that this particle corresponds to a solition. When $V_0>E$, $K_2^2<0$, let $k_2'^2 = -k_2^2 = 2m(V_0-E)/\hbar^2 > 0$, $c_0 = 0$, $c_1 = k_2'^4/4a^2$,

$$\psi_2 = k_2' tg(k_2'x/\sqrt{2} + B)/\sqrt{2}a . \qquad (5)$$

According to the continuity conditions at points x = 0 and x = d,

$$tgB = \frac{1}{k}\frac{A^2-1}{A^2+1}, \quad tg\left(\frac{k_2'}{\sqrt{2}}d + B\right) = \frac{1}{k}\frac{C^2e^{\sqrt{2}k_1d}-1}{C^2e^{\sqrt{2}k_1d}+1},$$
$$\left(k = \frac{k_2'}{k_1} = \sqrt{\frac{V_0}{E}-1}\right) \qquad (6)$$

From above we obtain

$$A^2 = \frac{tg\left(\frac{k_2'}{\sqrt{2}}d\right)[C^2e^{\sqrt{2}k_1d}(1-k^2)-(1+k^2)] + 2kC^2e^{\sqrt{2}k_1d}}{tg\left(\frac{k_2'}{\sqrt{2}}d\right)[C^2e^{\sqrt{2}k_1d}(1-k^2)-(1+k^2)] + 2k} \qquad (7)$$

One-order approximation is $C^2/A^2 = e^{-\sqrt{2}k_1d}$. In the linear theory, the penetration factor is $D = |C^2/A^2|$. In the nonlinear theory, a probability current density is

$$J = \frac{i\hbar}{2m}(\psi\nabla\psi^* - \psi^*\nabla\psi), \quad \psi^* = \frac{k_1}{\sqrt{2}a}tg\left(\frac{k_1}{\sqrt{2}}x + A'\right),$$

$$\left(tgA' = \frac{1-A^2}{1+A^2}\right) \qquad (8)$$

Therefore, the penetration factor is

$$D = \frac{(A^2e^{\sqrt{2}k_1d}+1)^2\cos^2\left(\frac{k_1}{\sqrt{2}}d + A'\right)[(C^2e^{\sqrt{2}k_1d})^2 - 1 - 2\sin(\sqrt{2}k_1d + 2C')]}{(C^2e^{\sqrt{2}k_1d}+1)^2\cos^2\left(\frac{k_1}{\sqrt{2}}d + C'\right)[(A^2e^{\sqrt{2}k_1d})^2 - 1 - 2\sin(\sqrt{2}k_1d + 2A')]} \qquad (9)$$

The one-order approximation is D ~ 1. It is a character of the soliton, which has an invariant shape for the collision. But, the calculating results show that D has a periodicity with d (barrier thickness), when those other quantities are delineated. It is a new possible basis on the various resonance-penetration theories of cold fusion. In this paper the result is only a simplified model, but this new method can be discussed in detail, and may be applied to explain other experiments.

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**P.R. CHINA - X-RAY DIAGNOSTIC**

Suhe Chen, Dalun Wang, Gaoxian Cui, Yijun Li, Mei Wang, Yibei Fu (Inst. of Nuc. Phys. & Chem., China Acad. of Engr. Phys., Chengdu), Xinwei Zhang, Wushou Zhang (Beijing Inst. of Appl. Phys. & Comp. Math., Beijing), "X-Ray Diagnostic in Gas Discharge," p 142.

AUTHORS' ABSTRACT

X-rays were observed when the anomalous phenomenon in the metal loaded with deuterium was studied by the gas discharge method. The X-ray energy spectrum was measured and monoenergy X-rays were confirmed to exist by the absorption method, the characteristic X-ray approach and the NaI scintillation counters. The average X-ray energy (26.9 ± 2.2 keV) measured by the absorption method is in agreement within the error range with monoenergetic X-rays (26.0 ± 2.4 keV) detected by NaI scintillation counters. The X-ray intensity measured roughly by use of $^7$Li thermoluminescent foils is about $10^9$ - $10^{10}$ n/s.

Absorption method: Choose a set of $^7$Li thermoluminescent foils before calibrating the sensitivity, then make the sensitivity normalized and background corrected to the counts of thermoluminescent foils irradiated. The average X-ray energy derived from gas discharge is measured by the absorption method. If the thermoluminescent foils have the same thickness and uniform density, the total mass attenuation coefficient $\mu_m$ (cm$^2$/g) can be derived from the counts $N_0$ before and $N_d$ after penetrating of X-rays through the foil.

Given the experimentally measured $\mu_m$ (T) and the relation between $\mu_m$ (T) and X-ray energy, the X-ray energy yet to be measured will be given by interpolation.

Measurement of different absorption foils:

1) Choose Cu, $C_2H_4$, Cd and LiF as absorption foils, then measure the X-ray energy in gas discharge.

2) Measure the X-rays from discharging of various materials loaded with deuterium. The X-ray energy was measured in gas discharge by the absorption method when Ta, Ti, Pd, Nb, Zr and Te were used as electrode.

3) Measurement of self absorption of detector: Being taken as detectors and as absorbents of X rays, several of the $^7$Li thermoluminescent foils were arranged into a string and the counts $N_n$ refereed to the *n* th foil. Therefore $\mu$ m (T) can be obtained.

The specific X-ray approach: The specific absorption energy of the cadmium is 26.7 keV and there is abrupt reduction of photon mass absorption coefficient nearby the energy. Can we make use of this feature to identify whether or not the X-ray energy is 27 keV in gas discharge.

Measurement of NaI scintillation counters: The value 26.9 ±2.2 keV given by absorption method is the average X-ray energy. However, by using NaI scintillation counters and an $^{243}$Am $\gamma$ source to measure and calibrate the X-ray energy, the monoenergetic X- rays yielded through gas discharge can be confirmed.

Several points can be concluded from the diagnosis for X-rays yielded in deuterium-filled gas discharge: (a) In gas discharge, there exists a monoenergetic X-ray (27 keV) of which the energy is higher than the discharging voltage (11 kV). The repetition rate of the effect is 100%. (b) X-ray energy varies independent of electrode material. (c) X-ray energy is in no relation to the kind of discharging gas. (d) How is the X-ray yielded: Is it yielded in a normal way or an abnormal way? Problems remain to be investigated experimentally further.

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**P.R. CHINA - DIAGNOSIS OF NEUTRONS**

Dalun Wang, Suhe Chen, Yijun Li, Rong Liu, Mei Wang, Yibei Fu (Inst. of Nucl. Phys. and Chem., China Academy of Engr. Phys.), Xinwei Zhang, Wushou Zhang (Beijing Inst. of Appl. Phys. and Comp. Math., Beijing), "Diagnosis of Neutrons from the Gas Discharge Facility," p 128.

AUTHORS' ABSTRACT

On the base of special properties of some activated transitional-metals or hard-melted metals that have the strong capability of adsorption to active gas in certain range of temperature, we have activated some metals by way of gas discharge and made the adsorption of deuterium over saturated for the research of anomalous phenomena of deuterated metals. About

$1 \times 10^4$ neutrons per second have been detected by $BF_3$ neutron detectors. The neutron yield is controllable and reproducible.

In order to confirm further the existence of neutrons emitted from the gas discharge facility, five methods were used to diagnose the said neutrons.

(1) The characteristic spectra of pulse height distribution (CSPHD) of $^{10}$B (n, $\alpha$) $^7$Li reaction: The CSPHD of expressing the characteristic of two reaction channels of $^{10}$B reacted with neutrons have been measured with $BF_3$ neutron detectors after part of neutrons emitted from the gas discharge facility (abbr. GD neutrons) had been slowed down to thermal neutrons. The CSPHD of GD neutrons agreed with that of Am-Be source neutrons.

(2) The method of thermal neutron filter: The thermal neutrons slowed down from GD neutrons have been measured by the $^6$Li thermoluminescence films. The $^6$Li thermoluminescence films were irradiated both in Cd-wrapped condition and in non Cd-wrapped condition. The experimental results showed that the counts of thermoluminescence films in non-Cd-wrapped condition were higher than those in Cd-wrapped condition.

(3) n-$\gamma$ discrimination spectra: The n-$\gamma$ discrimination spectra from an Am-Be neutron source, the gas discharge facility and a $^{22}$Na $\gamma$ source all have been measured by an n-$\gamma$ discrimination technique with NE-213 organic liquid scintillation neutron spectrometer. The experimental result showed that the n-$\gamma$ discrimination spectrum of the gas discharge facility was similar to one of the Am-Be neutron sources, and one of $^{22}$Na $\gamma$ sources had $\gamma$ peaks only.

(4) Neutron energy spectra: The neutron energy spectra of GD neutrons have been measured with NE-213 organic liquid scintillation neutron spectrometer. The peak energy of GD neutrons was 2.38 ± 0.15 MeV, which agreed with single energy neutrons (2.45 MeV) of normal D-D reactions within the range of experiment error.

(5) Neutrons were not detected in the same conditions when $H_2$ was used to be discharged instead of $D_2$.

The above-mentioned experiments confirmed the existence of GD neutrons. Were these neutrons beam-target neutrons? Or anomalous neutrons? Or both? For answering these questions, further experiment researches are needed.

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**P.R. CHINA - MICRO-NUCLEAR FUSION**

Xing-liu Jiang, Li-jun Han (Dept. of Appl. Math. & Phys., Beijing Univ. of Aeronautics and Astronautics, Beijing), "Concentrated Energy and Micro Nuclear Fusion." p 145.

AUTHORS' ABSTRACT

The so-called cold nuclear fusion phenomena have been confirmed by more than 100 groups in the world. The experimental data show that the locus of the cold fusion reactions is the surface of some metallic deuterides (hydrides). The reactions take place only in some restricted areas that have specific properties. Nonequilibrium conditions created by some effects such as tip effect, phase changes, transit states of deuteron motion in solids and so on, lead to the occurrence of the concentrated energy, the "linear atom" containing degenerate electrons, which could transfer enough energy to deuterons for the fusion reaction to occur. There exist some anomalous reactions under conditions of high-density deuteron flux in some tiny areas.

Some experimental results by using CR- 39 solid detectors in the electrolysis cells and by the electrolysis with high pulsed currents of some hundreds of amperes have been presented in this paper for discussion.

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**P.R. CHINA - BOSE-EINSTEIN CONDENSATION**

Kuangding Peng, Shanna Chen (Dept. of Phys., Yunnan Univ.), "The Theory of Bose-Einstein Condensation in Finite System for Explanation of Cold Fusion," p 122.

AUTHORS' ABSTRACT

When deuterium ions ($D^+$) come into the gaps of Pd lattice, the potential well containing $D^+$ changes from a big space to a small one. The process can be regarded approximately as a contracted process of a potential well. It can be proved that in the process, the mean energy of a particle is constant, but the intervals of energy levels are inversely proportional to the square of the dimensions of the potential well. The contraction of potential well shows that the difference between the energies of basic state and first excited state increases.

Because $D^+$ are bosons, the system of $D^+$ can produce Bose-Einstein condensation (BEC). The limitation of the volume of the system leads to the change of temperature $T_c$ of BEC. It can be proved that at Dirichlet boundary conditions, $t_c = [T_c - T_c(\infty)]/T_c(\infty) \propto a^{-3/4}$, and at periodic boundary conditions, $t_c \propto 1/a$. Both boundary conditions are possible cases when $D^+$ are in gaps of Pd lattice. Thus, $T_c$ can reach room temperature. BEC leads to the increase of number of particles in basic state, so the more and more energy transfers to the particles in excited states.

Due to the above two processes of increasing energy, $D^+$ on excited states have the possibility to obtain enough energy so that the reactions, $2D^+ + 2e \rightarrow He$ and $2D^+ + 2e \rightarrow He + n$, can take place. The first reaction produces an excess of energy transferred to lattice. The two reactions can produce cold fusion. The results from the model are coincident with the experimental data of cold fusion.

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**P.R. CHINA - ANOMALOUS PHENOMENA**

Tieshan Wang, Genming Jin, Jifang Hao (Inst. of Mod. Phys., Chinese Acad. of Sci., Lanzhou), Yubo Piao, Xuezhi Wang, Zhanqi Niu (Dept. of Mod. Phys., Lanzhou Univ.), "Anomalous Phenomena in E < 18 KeV Hydrogen Ion Beam Implantation Experiments on Pd and Ti," p 137.

AUTHORS' ABSTRACT

Since 1989, various anomalous phenomena about "cold fusion" have been observed. However, most of the phenomena was not reproducible, and not enough reaction products were observed in all of the experiments. Otherwise, the excess heat could be still measured sometimes by different laboratories. Thus, we suppose that the excess heat is from some unknown physics interaction in the hydrogen-metal systems under very extreme conditions. Hydrogen implantation experiments of very low energy (E < 18 KeV) on Pd and Ti foils have been made to charge hydrogen and to induce the exothermic reactions.

In experiments, proton and deuteron beams, in which energy was adjusted from 1 to 18 KeV and beam intensity was adjusted from 0.05 to 5.0 mA, were used to bombard Pd and Ti targets. An effective cooling system with temperature monitor is employed to keep the target under room temperature. X-rays, neutron intensity and charged particles have been detected in experiments.

Some reproducible X-ray spectra were measured in intense beam implantation experiments. A clear anomalous peak in the X-ray spectra was observed. Its intensity is about $10^8$ - $10^{10}$/s, and its energy is about four times that of the beam energy. The FWHM of this peak reduced, while the peak moves from about 40 KeV to 62 KeV with increasing beam energy and beam intensity. **These anomalous phenomena occurred only when the energies of proton and deuteron were higher than 7 KeV and 10 KeV, respectively.** These threshold energies might be induced by the absorption of the carbon foil deposited on the target surface. The same phenomena have been reproduced in the experiments with both of Pd and Ti Targets, but the energy of the anomalous peak in hydrogen-titanium system was a little lower than that in the hydrogen-palladium system. This difference between two systems might be interpreted as the same type of interaction as between different atoms. About these phenomena, a quasi-atom multi-body theoretical model has been proposed. Further investigation on both the phenomena and theoretical model is necessary.

In the same experiments, anomalous intensities of neutrons correlated with a charged particle peak have been observed, which grew in sensitively with the growth of beam intensity and energy. The highest neutron intensity reached about $8 \times 10^4$ n/s, while a

1mA 15 KeV deuteron beam was used. That is much higher than the theoretical predictions for D-D neutrons at this energy. The ratio of neutron and charged particle intensities evidently did not change, while the beam energy and intensity were changed. So that the charged particles seem to be protons from D(d,p)T reaction. However, their energies located between 3-4 MeV; are somehow little higher than D-D protons. Therefore, the identification experiment should be done soon.

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**P.R. CHINA - QUASI-ATOM MULTI-BODY MODEL**

Tieshan Wang, Genming Jin, Jifang Hao (Inst. of Mod. Phys., Chinese Acad. of Sci., Lanzhou), Yubo Piao, Xuezhi Wang, Zhanqi Niu (Dept. of Mod. Phys., Lanzhou Univ.), "Interpretation of Excess Energy in Terms of Quasi-Atom Multibody Model," p 138.

AUTHORS' ABSTRACT

A quasi-atom multibody model is proposed for interpreting excess energy in some "cold fusion" experiments, based on analyzing experimental results. In such a quasi-atom, two nuclei rotate around a negative center, which can be a complex effect of one or more electrons. Electrons could rotate around the axis connecting two nuclei in some orbits. In the process to form a quasi-atom, some energy may be emitted. There may be two types of quasi-atoms in hydrogen-metal system:

1. Hydrogen-palladium double nuclei quasi-atom
Hydrogen ions (e.g., deuterons) in metals (e.g., Pd) getting some energy can go through the electron cloud of palladium without occurring nuclear reaction and might stay inside the palladium atom, because of the electron screening effect of palladium and other interactions (e.g., coupling of spins) from the palladium nucleus and other atoms. They could be either between the nucleus and electron cloud or between different electron shells, and form a double nucleus quasi-atom even like a cluster. The total energy of this quasi-atom is lower than the separated deuterium and palladium. Thus, some excess energy should be released in the process. Otherwise, the deuteron may catch an orbit electron, become a quasi-deuterium among the palladium, then a new electron from other orbits jumps to fill the empty inner shell with an emission of anomalous X-ray.

2. Double hydrogen nuclei quasi-atom
In some micro spots in the metal lattice, hydrogen atoms may be concentrated to very high density. Distances between different hydrogen nuclei in such spots are smaller than the radius of hydrogen atom. When electrons go into such a spot, a quasi-atom consisting of two hydrogen nuclei and one or two electrons might be formed.

Proton-electron-proton (p-e-p), deuteron-electron-deuteron (d-e-d) and deuteron-two electrons-deuteron (d-2e-d) three body systems have been studied in this work. Their stable energy states and orbit radii are 28.1, 56.2, 24.7 KeV and 140, 35, 28 fermi, respectively.

The reaction cross section of D-D fusion in such a bound state may also increase. Therefore, the anomalous intensity of D-D neutron has been observed in experiments. However, the reaction cross section of the quasi-atom is about four orders higher than D-D fusion cross section, and the total exothermic quantity from quasi-atoms is over two orders higher than that from D-D reaction at the same time. Thus, the energy from the quasi-atom reaction might be the main origin of excess energy.

These two types of quasi-atoms might have stable bound states under extreme conditions (e.g., D/Pd > 0.85). Therefore, experimental phenomena were reproduced only occasionally. X-rays may be easily absorbed in very short distance and turned into heat in the surrounding media, thus, only excess heat has been measured in most experiments without enough corresponding reaction products.

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**P.R. CHINA - MAXIMUM LOADING RATIO**

Wu Shou Zhang (Graduate School, China Academy of Engr. Phys., Beijing) and Xin Wei Zhang (Inst. of Applied Phys. and Computational Math., Beijing), "The Maximum Hydrogen (Deuterium) Loading Ratio in the Electrochemical System," p 106.

AUTHORS' ABSTRACT

In this paper, a general mechanism, Volmer-Heyrovsky-Tafel route, of hydrogen evolution reaction (HER) on Pd electrode and Temkin adsorption of H on Pd surface are supposed. Combining the thermodynamic data of Hydrogen (Deuterium) absorption in Pd, we find the mechanism of HER changes from Volmer-Tafel route to Volmer-Heyrovsky route with an increase of cathode overpotential (or current density), but not the opposite situation

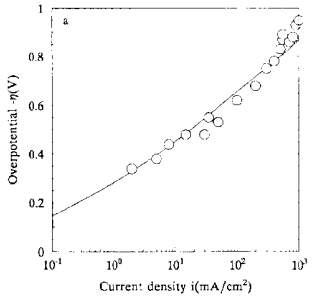


Fig.1

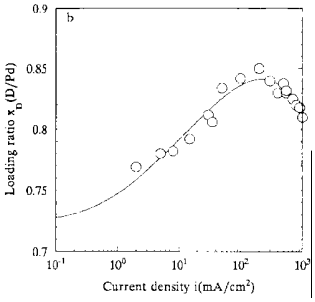


Fig. 2

The maximum loading ratio of Deuterium in Pd cathode. The circles are experimental data of H. Akita et.al. in ICCF-4. The solid lines is numerical results of this work. Fig. 1 is relation of overpotential and current density and Fig. 2 is relation of loading ratio and current density.

supposed by Bockris et al. in ICCF-4. The loading ratio of H(D) in Pd will approach a maximum value when the current density reaches a certain value if the symmetric factor of Heyrovsky step is less than that of Volmer step, but in the traditional view, the

loading ratio will increase with increasing of cathode overpotential (or current density). The numerical results fit that of an experiment of H. Akita et al. in ICCF-4 very well (shown below).

Based on our results, we find some factors can prompt the absorption of H(D) in Pd, for example, choosing a smooth electrode (which has small roughness factor), increasing the surrounding gas pressure about electrolyte, reducing the velocity of desorbing reaction (both Tafel and Heyrovsky step, especially the latter) through adding some surfactant, etc.

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**P.R. CHINA - RESULTS IN GAS GLOW DISCHARGE**

Xinwei Zhang, Yibei Fu, Jun Wu, Dalun Wang, He Qing Long, Wu Shou Zhang et al. (Inst. of Appl. Phys. & Comp. Math., Beijing), "New Experimental Results and Analysis of Anomalous Phenomenon in Gas Glow Discharge," p 150.

AUTHORS' ABSTRACTS

200 Energy Spectrums of X-ray have been registered in gas glow discharge system. Electrodes (Pd, Nb, Ta or other metals) were fixed to both ends of a glass reaction bulb. The thickness of the glass wall of bulb was 2.0 ± 0.2 mm, the voltage V and current I of discharge were 4-18KV, 1-50 mA (50 Hz) respectively: The pressure of discharge gas $D_2$, $H_2$, air, Ar⋯) was dynamic (flowing) low pressure (< 100 Pa).

The x-ray measurement system was composed of a high pure Ge detector (GMX200) made by ORTEC company of U.S.A., a pulse shape analyzer (CANBERRA, 2160A) and a IBM-PC/XT computer. The detector sensitive volume was 102 $cm^3$, the measuring range was 5 KeV to 1.64 MeV, the relative efficiency is 20%. The Ge detector was placed in a lead shielded cabin so that the background was 10 ~ 11 counts/sec within 24 to 4096 channels. For comparison and check, also applied NaI detector and Thermoluminescent Dosimeters (TLD). TLD was not affected by electromagnetic noise.

There were obvious anomalous phenomenon in about 100 energy spectrum of x-ray:
(1)There were 50 - 300 KeV continuous x-ray, their intensity were 30% - 100% of background. Using lead attenuator (thickness 1-6 mm) x-ray could still be detected.

(2) Using different combination of metal attenuator, the negative absorption was detected ten more times. It could not be explained by a multiplication effect and variation of detector efficiency with x-ray energy.

(3) Fixed conditions of gas glow discharge (current, Voltage, pressure) and using different thickness L metal attenuator (Pb, Cu, Al, Cd⋯), according to registered energy spectrums of x-ray, the energy dependence of the mass absorption coefficient $\mu/\rho$ ($E_x$) ($E_x$, the energy of x-ray) could be obtained, it was very different than standard $\mu^*/\rho$ ($E_x$), at low energy (< 20 KeV), $(\mu/\rho) / (\mu^*/\rho) \approx 0.01 \sim 0.5$, at high energy (> 30 KeV), $(\mu/\rho) / (\mu^*/\rho) \approx 2 \sim 100$, for some energy spectrums, $\mu/\rho$ might be negative at some energy interval, and $\mu/\rho$ depended on not only $E_x$, Z (atomic number) but also V, L⋯.

For explaining the above anomalous phenomenon, we suppose that some quasi-stationary compact small deuterium (hydrogen) atom (or molecule) ($De^*$, $Pe^*$, $De^*$ $De^*$, $Pe^*$ $Pe^*$) could be produced in the gas discharge, the dimension R of $De^*$, $Pe^*$ was smaller than Bohr radius $R_B$, $R / R_B$ might be 0.01 ~ 0.1, it could penetrate thick metal and interact with metal atom, when it broke up very near by the nucleus of metal atom, the electron was accelerated by the Coulomb field of the nucleus, and x-rays were produced. So in metal attenuator on the one hand x-ray were absorbed, and on the other hand, they were produced simultaneously. As the result, negative absorption might appear.

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**FRANCE - PRELIMINARY RESULTS**

J.F. Fauvarque, P.P. Clauzon, F. Joubert (CNAM), "Preliminary Results on CF Experiments," p 155.

AUTHORS' ABSTRACT

We describe the nature and results of new calorimetric experiments which have been set up in our laboratory. The experiments run thus far have been on two electrolysis systems: palladium/$D_2O$ (e.g. Pons & Fleischmann) and nickel/$H_2O$ (e.g. Mills et al.). The present experiments are designed only for the measurement of anomalous excess heat generation.

In our first sets of experiments, we have used a heat flux calorimeter (CALVET) with a sensitivity of up to 44 μV mW/sec. This calorimeter allows measurements of very small heat generation rates with an accuracy of about ±3% over the range from a few tens of mW to several hundred mW. The system uses very small cathodes so that the rate of loading of hydrogen isotopes into the lattice is quite fast. In the preliminary experiments performed to date, we have not yet observed significant excess heat generation using both constant current and pulsed current (16A-1.3μ /sec at 1 kHz). We discuss the advantages and limitations of this type of instrument in electrochemical calorimetric studies. Other experiments using thin film cathodes (about 1 μm thickness) of palladium and nickel are planned in the future.

We also describe experiments which ran with an isoperibolic calorimeter which we have designed. Typical heat transfer coefficients for this calorimeter are about 6°C W/sec for a bath temperature of 30° C. The power dissipation range of operation is thus from about 1 to 12W before boiling. The instrument has been calibrated using both pure resistance heaters and by electrolysis using platinum cathodes and anodes. We have performed only one experiment to date which incorporated a 60 cm

long by 125 μm diameter palladium wire and a 125 μm diameter platinum anode in a $LiOD/D_2O$ electrolyte. The response observed over a period of three weeks with temperatures up to the boiling point have not shown any appreciable excess heat generation. We described new experiments that are planned for this calorimeter, as well as those which we will undertake with a second unit now under construction.

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**ITALY - ASTROPHYSICAL FACTOR**

A. Scalia (Dept. di Fisica, Univ. di Catania), "The Enhancement of the Astrophysical Factor at Very Low Energy: Screening Effect or Nuclear Effect?" p 139.

AUTHOR'S ABSTRACT

Recent measurements of fusion cross section at very low energy show an exponential enhancement of the astrophysical S(E)-factor. Generally this enhancement is connected to a different nature of the target, atomic or molecular, by using the electron screening. In the present paper we show that this enhancement could not be due to electron screening. In fact by using the "shadow" model it is possible to reproduce in a satisfactory way the experimental values of fusion cross section for the reactions 3He(d,p)4He (atomic target), and d(3He,p)4He (molecular target) with values of parameters which are different for the different reactions. If we use a scale factor for one of these reactions, it is possible to reproduce the experimental data by using only one set of parameters for both reactions. So the astrophysical S(E)factor does not show (at very low energy) different behaviors depending on the use of atomic target or molecular target as claimed by many authors as an evidence of the electron screening. So the enhancement of the S(E)-factor at very low energy could be due to a nuclear effect.

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**JAPAN - SEARCH FOR TRITIUM**

T. Aoki, Y. Kurata and H. Ebihara (Isotope Center, Univ. of Tsukuba), N. Yoshikawa (Inst. for Nucl. Study, Univ. of Tokyo), K. Mori (Tanaka Kikinzoku Kogyo K.K.), "Search for Tritium in Pd + D System by a Gas Proportional Chamber," p 129.

AUTHORS' ABSTRACT

Tritium concentration in deuterium gas from Pd + D systems was measured by a gas proportional chamber. This type detector was able to observe directly a beta-ray spectrum of tritium decay. Measurements of the beta-ray spectrum could give genuine numbers of tritium compared with other methods, for example, an ion chamber or a mass analyzer. For this purpose, the gas proportional chamber was made and operated under the low level background.

The chamber was formed by two plain cathodes of 100 μm mesh and an anode plain with five 20 μm sense wires and six 100 μm potential wires. The spacing of sense and potential wires was 5 mm. The gap between cathode and anode was 5 mm. The effective area was 50 mm x 140 mm and the thickness was 10 mm. To calibrate the efficiency of the detector, deuterium gas which contained little tritium was put into the chamber. The efficiency was estimated to be 42 ± 8%. A $^{55}Fe$ source was used for the energy calibration and the energy resolution was 18% at 5.9 keV X-ray. The room background was reduced by aluminum and copper plates and lead blocks. Cosmic rays were suppressed by the anti-coincidence method with plastic scintillation counters which were put on the front of the chamber. The detection limit was 20 Bq($\cong 3\ \sigma$)in one liter of deuterium gas.

Tritium search was continued by this detector for deuterium gas in several different systems, i.e., from 2ϕ palladium wires (n = 0.66 in gas phase) and from highly loaded Pd wires by the electrolysis. The samples from other types of systems, i.e., titanium alloy in gas phase and the electrolysis with Pd anode and Pt cathode, were also investigated.

The clear spectrum of beta-ray originating from tritium decay could not observed due to low concentration of tritium in the examined deuterium gas systems. The report will show the upper limit of our wide-range survey.

This device is open for researchers who have any samples to measure beta spectra in gas phase. We take the sample gas, normally 10 - 40 ml, from the systems by a syringe. The device is not impossible to transport to another places, but an easy way is to bring only samples into our laboratory.

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**JAPAN - SONOFUSION**

Kenji Fukushima (Phys. Dept., Joetsu Univ. of Ed.), "Sonofusion - Dynamics of Supersonic Cavity," p 143.

AUTHOR'S ABSTRACT

Sonoluminescence phenomena have continually provided very interesting topics to many branches of science, that is, physics, chemistry, biology and so on. Among a variety of characteristic features of the phenomena, the author is especially interested in how high temperatures can be reached by a supersonic cavity. It is widely believed now that high temperatures such as $10^5$ K will be attained even under the experimental conditions of sonoluminescence.

We conduct, in this paper, the computer simulation of the dynamics of supersonic cavity to determine the upper bound of temperatures reached by a gas content of the cavity. Namely, a bubble formed in a liquid oscillates almost in phase with an applied supersonic field and then, in its contraction phase, the bubble content is tremendously compressed. As a result, a hot spot of high

temperature and high density is transiently formed. To get a quantitatively reliable result, we have to start with a realistic model. To be specific, let us consider an air bubble in water. The compressibility of water, diffusion of air molecules through the bubble wall, condensation and evaporation of water, heat conduction, thermal radiation from a hot spot, phase transition from gas to plasma phase and its reverse, are taken into account.

By use of the model, temperatures of the hot spot are calculated and then the optimum values of supersonic parameters, i.e., amplitude and frequency are sought for the purpose of getting high hot-spot temperatures. The tendency is pointed out that the larger values of amplitude and, in particular, the smaller values of frequency are preferable to attain the higher hot-spot temperatures. It is then concluded that there is the possibility of temperatures reaching $10^7$ K or more.

In this paper, however, the spatial uniformity is assumed for the temperature and pressure of bubble content. The formation of shock waves in a bubble may be expected to cause more rise of the upper bound of gas temperatures. This problem is very interesting and will be treated in the next paper.

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**JAPAN - NUCLEAR PRODUCTS OBSERVED**

Takehiko Itoh, Yasuhiro Iwamura, Nobuaki Gotoh and Ichiro Toyoda (Adv. Tech. Res. Cntr., Mitsubishi Heavy Ind., Ltd., Yokohama), "Observation of Nuclear Products in Gas Release Experiments with Electrochemically Deuterated Palladium," p 141.

AUTHORS' ABSTRACT

We previously reported on anomalous nuclear reactions observed in gas release experiments with electrochemically deuterated palladium metals. In order to investigate the nuclear reactions in detail, we performed similar experiments using a high resolution Ge detector and a gas analysis system, in addition to the detectors (He-3, SSB, CdTe, NaI, Q-Mass) described in the proceeding of ICCF-5.

A palladium rod ($\phi$3 x 25 mm) annealed at 900° C for 10~30 hours under high vacuum condition (< $10^{-7}$ Torr) was loaded with deuterium in a $D_2O$ - LiOD electrochemical cell. After loading, we electroplated the sample with Cu, Pt, or other metals to reduce the rate of deuterium gas release and to maintain high deuterium loading ratio.

The deuterated palladium sample was introduced into a vacuum chamber with a heater used for deuterium gas release. The chamber was equipped with two He-3 neutron detectors, a CdTe X-ray detector, two silicon surface barrier detectors (SSB), $\gamma$-ray detectors (NaI and Ge), two quadrupole mass analyzers (one was high resolution and the other was normal resolution) and an ion chamber for quantitative tritium production analysis. The chamber, furthermore, was connected with a gas storage chamber to store the released gas from the sample.

Experimental procedure is as follows. We heat the deuterated palladium up to 120°C to release the absorbed deuterium and observed nuclear products. The released gas is stored into the gas storage chamber during the experiment. After that, the stored gas is analyzed by two mass spectrometers and the ion chamber.

We will report on the results of observation and discuss the relationship between nuclear products and experimental conditions concerning behavior of deuterium in palladium.

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**JAPAN - TNCF MODEL ANALYSIS**

H. Kozima, K. Hiroe, M. Nomura and M. Ohta (Dept. of Phys., Faculty of Sci., Shizuoka Univ.), "Analysis of the Electrolytic Cold Fusion Experiments on TNCF Model," p 120.

AUTHORS' ABSTRACT

A model based on the stable existence of thermal neutrons in crystals was used to analyze experimental data obtained in electrolytic cold fusion experiments in these seven years. The density of the trapped thermal neutron $n_n$ in samples was determined using experimental results on the excess heat, helium-4 ($^4$He), tritium, neutron and/or the nuclear transmutation (NT). The values of the density $n_n$ determined by the experimental data were $10^5 \sim 10^{15}$ $cm^{-3}$. Another quantity we could determine from experimental data was the ratio of events generating tritium and neutron t/n and the ratio of events generating the excess heat and tritium (and $^4$He) $N_Q/N_t$, which had been a controversial quantities to reconcile with the existing common sense of physics. The value determined on our model has been t/n ~ $10^5$ and $N_Q/N_t \sim 10$; almost consistent with experimental data in one order of magnitude.

In the first cold fusion experiment reported in 1989, there are abundant data on various events in the cold fusion phenomenon. One of the data on the excess heat, tritium and neutron on rod samples gave us following results: $n_n = 1.5 \times 10^{10}$, t/n = $5.3 \times 10^5$ and $N_Q/N_t = 5.5$ is consistent with the data obtained experimentally in at least one order of magnitude. Other analyses gave similar coincidence.

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**JAPAN - TRAPPED THERMAL NEUTRONS**

H. Kozima (Dept. of Phys., Fac. of Sci., Shizuoka Univ.), "On the Existence of the Trapped Thermal Neutron in Cold Fusion Materials," p 121.

AUTHOR'S ABSTRACT

A model used to successfully analyze experimental data obtained in cold fusion experiments was based on the stable existence of thermal neutrons in crystals. It is well known that the thermal neutron in its free state decays with the half-life time of 887.4/sec. Therefore, it was a riddle of solid state - nuclear physics why the assumption of the stable thermal neutron is so successful to explain the cold fusion phenomenon which was almost impossible to understand with physics where there is no neutron included.

The physical basis of the stable existence of the thermal neutron in cold fusion materials has been discussed in this paper on the basis of the interaction of the neutron and the nuclei on the lattice points in the crystal. In the energy spectrum of the low energy neutron with less than thermal energy interacting with the lattice nuclei through the nuclear force, there appears a band structure. If a cold fusion material is composed of a part with a neutron band and another surrounding the first part with a different neutron band, a neutron in the first part could be trapped there by the difference of the energy of the forbidden band.

The trapped neutron can form the neutron Cooper pair lowering its energy interaction with each other through the phonon. The neutron, then, becomes very stable against the decay and also against the capture by one of the lattice nuclei and stays there for a long time until it is fused with a perturbing nucleus in the material.

The stability of the trapped thermal neutron in a material is determined by the interaction of the neutron and the lattice nuclei. To specify the stabilizing interaction, we have proposed a new concept "the neutron affinity," which reflects the experimental facts of the occurrence of the cold fusion phenomenon in special materials. The neutron band, the neutron Cooper pair, and the neutron affinity are explained fully in this paper.

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**JAPAN - COLD FUSION ON METAL FOILS**

K. Ochiai, T. Iida, N. Beppu, K. Maruta, H. Miyamaru, A. Takahashi (Dept. of Nucl. Eng., Osaka Univ.), "Deuteron Fusion Experiments on Metal Foils Implanted with Deuteron Beams," p 132.

AUTHORS' ABSTRACT

Deuteron beam implantation experiments with some metal foils have been performed to find energetic charged particles which might mean the evidence of new fusion reactions with large Q-values for the explanation of the Fleishmann-Pons effect or the large excess heat production in the $D_2O$ electrolysis experiments. The energetic charged particles from the sample foils were measured with a pair of Si-SSDs. The types of the particles were successfully identified with the energy loss in screen foils in front of the detectors. Also, some additional techniques were introduced in the beam implantation experiments considering the following effects: (1) temperature, (2) current stimulation, (3) molecular ion, and (4) defect. The temperature of the sample foil was controlled by using liquid nitrogen and a ceramic heater. Some samples were electrically stimulated by periodic pulse currents during the beam implantation. Occasionally, molecular ions ($D_2^+$, $D_3^+$) were also used as implantation beams. Moreover, some samples were irradiated with 300 keV helium ions for the micro-structure deformation before the deuteron beam implantation experiment. The transient temperature change and pulsed-current stimulation could induce non-equilibrium conditions of lattice atoms and could excite deuterium in the foil, which might lead to the opening of new fusion reactions like the multi-body cold fusion reactions. Also the use of molecular ion beams and the introduction of the defects might be effective in enhancing the deuterium density in the foil from a microstructural point of view, in other words, the proximity probability between deuteriums in a solid.

In some of these experiments, unusual counts were measured in the energy region higher than the proton peak of the well-known D-D reaction. More detailed experiments and long term measurements are now in progress to identify original reactions for the explanation of the high energy counts.

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**JAPAN - NEUTRON IRRADIATION**

Y. Oya, H. Ogawa, T. Ono, M. Aida, and M. Okamoto (Res. Lab. Nucl. Reactors, Tokyo Inst. of Tech., Tokyo), "Hydrogen Isotope Effect Induced by Neutron Irradiation in PD-LiOD(H) Electrolysis," p 131.

AUTHORS' ABSTRACT

The anomalous accumulation of deuterium and its dynamic movement have been discussed as the key factors of the occurrence of the anomalous nuclear effects in deuterium-condensed matter systems, like d-Pd and d-Ti, etc. However, these half-classic dynamics of deuterium may not have enough potential to initiate the deuteron-based nuclear reactions in solid states. To search for the trigger to initiate the deuteron-based nuclear reaction in d-Pd systems, the incident of the external neutron was discussed theoretically by K. Shiraishi. The concept seems to be consistent with the specific characteristics of the evidences obtained in the deuteron-based solid state nuclear reactions, such as very weak neutron emission, very weak radiation, very low reproducibility, and so on.

In the present work, we examined the neutron irradiation effects from Pd-LiOD(H) electrolysis. In our concept, the high energy neutrons should be contributing to our reaction system rather than the thermal neutrons. However, our experimental system which gave us many anomalous effects over these years, has been enclosed in a very thick neutron absorber with the aqueous solution of boric acid and polyethylene blocks. So, in the first stage to study the energetic neutron effects, the thermal neutron effects in our

ordinary electrolysis experimental systems have been verified by use of a $^{252}Cf$ neutron source.

The experimental system including the electrolysis cell has been modified to perform the neutron irradiation experiments. The neutron irradiation was repeated every other day into the electrode through a collimator for 26-30 days. The electrolysis mode was a pulse mode with 3 hours repetition in square pulse, and the current density was 200 mA/cm$^2$ in the high mode and 5 mA/cm$^2$ in the low mode. The neutron irradiation experiments were performed on (1) Pd-LiOD(H), (2) Pt-LiOD. The neutron energy spectrum was obtained by the same method reported previously.

The slight but appreciable excess heat generation was detected in Pd-LiOD system and the excess heat was evaluated to be up to 2.5 W (10% of input power). It should be reported that anomalous excess neutrons were detected under the neutron irradiation. The neutron ratios are larger than unity for the full range of neutron energy and the energy of detected neutrons varies from 2 MeV to 8 MeV. These facts are anomalous with respect to the energy of neutrons from $^{252}Cf$ (~3 MeV), and the deuterium well absorbs thermal neutrons. In the presentation, we will report the details of the work, and have a discussion on the above anomalous results.

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**JAPAN - IN-SITU MEASUREMENTS**

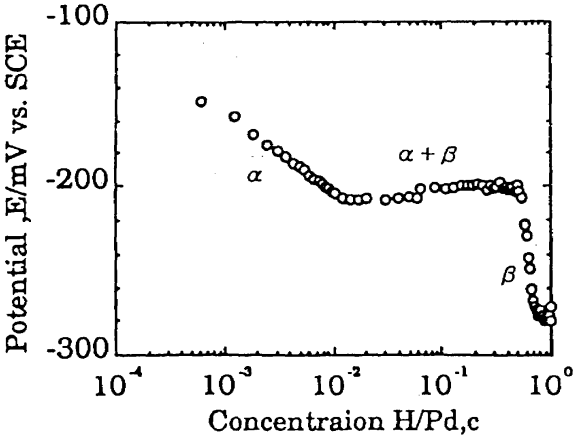
H. Numata, I. Ohno (Tokyo Inst. of Tech., Faculty of Engr., Tokyo), "In-Situ Potentio, Resisto, Dilatometric Measurement of Repeated Hydrogen Absorption in Pd Electrode by Electrochemical Cathodic Loading Method," p 104.

AUTHORS' ABSTRACT

Recently, deuterium loading more than $x \fallingdotseq 0.9$ (PdDx) resulted in cold fusion involving D atoms. **Hydrogen infusion into metal caused lattice expansion and miscellaneous micro-structure changes. Study of physico-chemical properties of the metal-hydrogen system is of great importance for understanding these phenomena.** In this study, the potential, resistance and dilation of Pd have been measured in-situ using a computer controlled potentiostat, milliohm meter and dilatometer under cathodic discharge in a glycerin and phosphoric acid solution (2:1 v/o). Special interest lies in a mechamisum that functions as a diffusion barrier and/or a window, allowing hydrogen compression and controlled transportation in a condensed matter. These functions might be brought out by repeated hydrogen loading through electrolytic charge and discharge.

RESULTS AND DISCUSSION: After the cathodic discharge (0.2 mA/cm$^2$, 500 s), the electrode potential changes with the change of hydrogen activity in Pd and stays at steady-state resulting in hydrogen being diffused into the interior side. Thus, "equivalent hydrogen pressure" $pH_2$, that is, hydrogen pressure equilibrated with that in Pd metal (in a void), is expressed as (assuming Nemst potential under the restricted condition) $pH_2 = \exp[-(E + E_{SCE})(2F/RT)]$ where $E_{SCE}$ is the potential of the reference electrode. The figure shows the plot of the potential vs. hydrogen concentration.

At $x \leq 0.01$ the electrode potential obeys the Nemst equation, while it exhibits constant value corresponding to the coexistence of $\alpha$ and $\beta$ phases ($0.05 < x < 0.55$). The concentration of on-set ($\alpha_{max}$) and end of phase transition ($\beta_{min}$) are well consistent with those obtained from the Pd-H phase diagram. The equivalent hydrogen pressure of a two phase region is 0.05 atm, which agrees with that obtained from pressure and composition isotherms of Pd-H. On the other hand, hydrogen infusion causes lattice expansion, which resulted in the dilation of Pd. The plot of the increase of dilation vs. concentration shows a straight line whose slope, the molar volume of hydrogen, is consistent with that of the gas equilibrium method. The relative




resistivity of electrolytically charged Pd at 40°C shows a steady increase and following flat regime at $R/R_0 \fallingdotseq 1.7$ with hydrogen content, in agreement with the results obtained by electrochemical methods.

The exact value of hydrogen content might depend on experimental conditions (i.e. under high current density), hence this hydrogen content is evaluated by DSC measurements accurately. During a few cycles of adsorption and desorption, the content to reach the flat regime shifts towards higher content, which is also reported: the experiments on thin Pd films (thickness < 100 μm). This is not the case at the electrolysis, where next charging was performed without any discharge intervening. The explanations evolved with the resistivity vs. content diagrams, directed toward micro structure change of Pd, could be concerned with the functions of the hydrogen diffusion barrier and the transportation window in Pd-H system.

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**JAPAN - TRANSPORT EXPERIMENTS**

H. Shinojima, T. Nishioka, K. Shikano and H. Kanbe (NTT Basic Res. Lab., Japan),"Detections for Nuclear Products in Transport Experiments of Deuterium through Palladium Metals," p 126.

AUTHORS' ABSTRACT

Detection of nuclear products is a direct way to confirm the fusion reaction. Yamaguchi et al. reported that $^4$He was detected as deuterium was released from deuterated palladium metals in a vacuum, and indicated the importance of deuterium dynamics in the metals and at the surface of the metals. We transported deuterium through the palladium metals by a diffusion effect and tried to detect nuclear products during the transportation. We used SSD to detect charged particles, a quadruple pole mass spectrometer with the cold trap of deuterium (Q-mass) to detect helium and an NE213 system to detect neutrons.

First, we bombarded palladium metals with deuterium ions in the energy range of 2.5 - 20 keV to investigate d+d reactions in a solid at a low energy region, and to determine the detection limit of the systems. We tried to detect $^4$He and simultaneously measured the cross sections and the branching ratios of d+d reactions as a function of the deuterium energy. $^4$He could not be detected by our system in this energy range. We did not find that there was remarkable enhancement of the cross sections and the branching ratios from those of the fusion reactions at a higher energy region (> MeV). The estimated detection limits of our detection systems were $5 \times 10^{-3}$ for protons by SSD, $3 \times 10^{11}$ for $^4$He by Q-mass, and two counts/sec for neutrons of the NE213 system.

Using these detection systems, we tried to detect nuclear products in the transport experiments. Deuterium was passed through a thin palladium disk, with a thickness of 0.5 mm and a diameter of 21 mm, covered with Au and MnO on each side. Two chambers were separated by the disk. One chamber was filled with deuterium and the other was empty. Deuterium was diffused through the palladium by heating it. In the experiments, we did not observe any fusion products within the detection limits and the accuracy of the detection systems.

From these experimental results, we were not able to obtain obvious evidence to confirm the "cold fusion phenomena." As many interesting results of fusion in a solid were obtained, we have to proceed with these measurements using more highly sensitive detectors and under the background reduced noise.

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**JAPAN - MECHANO-NUCLEAR INTERACTION**

T. Shirakawa (Dept. Soc. Info. Processing, Otsuma Women's Univ., Tokyo), M. Chiba, Y. Shioe, T. Hirose , M. Fujii, K. Sueki, H. Nakahara (Fac. of Sci., Tokyo Metro. Univ., Tokyo) and M. Utsumi (Dept. of Appl. Phys., Tokai Univ., Kanagawa), "A Study of the Mechano-Nuclear Interaction Using Piezoelectric Material of $LiNbO_3$ in $D_2$ Atmosphere," p 153.

AUTHORS' ABSTRACT

We have studied neutron generation from piezoelectric materials crushed in $D_2$ and $H_2$ atmosphere. Only in the system of $LiNbO_3$ with $D_2$ gas, the neutron emission was reproductively observed. Neutrons can only be emitted from the nuclear fusion of D-D in our experimental system. Therefore, the observed excess neutron is an evidence of D-D fusion occurrence in the crushing of $LiNbO_3$ in $D_2$ atmosphere.

Generally, in crushing of piezoelectric material, ionic charges appear on a crushing surface caused by breaking of chemical bonds, accompanied with the generation of a high electric field by piezoelectric effect. These surface charges activate the atmospheric substances, e.g., $D_2$ and $H_2$ molecules are decomposed and ionized. Thus, we speculate that some of the charged particles are accelerated by the piezoelectric field and collide each other; then D-D fusion occurs.

In order to confirm our speculation and to clarify the detailed mechanism of neutron emission, we measured the dependence of the excess value of neutrons for $D_2$ gas pressure. In a low pressure region, the excess neutrons were not observed. While in a high pressure region, larger than 30 kPa, the excess neutron was apparently generated (Fig. 1). The weighted mean value of the excess neutron rate at higher and lower region is $2.79 \pm 0.71$ c/h and $-0.04 \pm 0.56$ c/h, respectively.

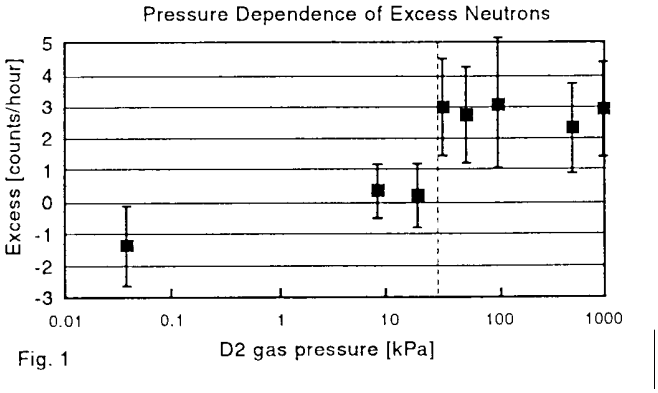


Fig. 1

In order to explain the effect of the property of the material, we also compared the difference between regulated and not regulated direction of the dielectric polarization of $LiNbO_3$. We observed the excess neutron in both. It is not confirmed in the difference between them. We need to investigate more statistically.

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**JAPAN - MODEL FOR NEUTRON EMISSION**

Toyu Tani (Saitama, Japan) and Yukio Kobayashi (Dept. of Info. Sys. Sci., Faculty of Engr., Soka Univ., Tokyo), "A Model for Neutron Emission from Condensed Matter," p 117.

AUTHORS' ABSTRACT

Since 1989, a lot of experimental investigations have claimed the neutron emission due to the nuclear phenomena in condensed matter. Although these phenomena are named cold nuclear fusion, they may not be ascribed to fusion reactions. According to new

experiments, these nuclear events present three important features: (i) The energy spectrum of the neutron shows the peaks at about 2.45 MeV and at 3 ~ 7 MeV. (ii) The T/n ratio is extremely large ($10^4$-$10^9$). (iii) The correlation between excess heat and nuclear products is small. Thus we may not attribute the nuclear phenomena observed in condensed matter to cold nuclear fusion.

We propose a model for nuclear emission from condensed matter on the basis of quantum mechanics. This model is based on the tunnel disintegration of an ionized deuterium molecule and the subsequent dipole disintegration of a deuteron. Our assumptions are as follows: When an ionized diatomic molecule interacts strongly with such a metal as palladium in its surface region, the two nuclei approach each other to exceed the region which, in classical theory, would be insurmountable and consequently the molecule disintegrates with the electron transition to the continuous-spectrum states. We call this disintegration the tunnel disintegration. The intensive excitation of the collective modes will occur in the surface region simultaneously with the tunnel disintegration. As a result instantaneous strong localized electric fields will be built up at the positions of $D_2^+$. These electric fields excite the dipole oscillations between proton and neutron in the deuteron, and thus the chance of the dipole disintegration of the deuteron happens. We calculate the probabilities of neutron emission from condensed matter. In contrast to our previous work (published in ICCF-3), we consider the mechanisms of the dipole disintegration in detail.

The dipole disintegration due to the direct transition from the ground state cannot be expected, since the present phenomena were observed in the lower-energy states. This indicates that prior to the dipole disintegration, the decaying state will be formed as the intermediate state. Then we consider the formation process of the decaying state. We assume that the ground state of the deuteron exists in $^3S_1$-state. The transition from the ground state to the decaying state may proceed gradually with $^3P$-state mixed with $^3S_1$-state, since the deuteron absorbs only a small energy from the electric fields at a time. At every step the deuteron is expected to stabilize so as to form a quasi-stationary state, which will be repeated until a final decaying state is reached before disintegration. This self-regularization of the deuteron will manifest itself as variations of the $^3S_1$-state parameters.

Our numerical calculation can explain the above three features of new experiments successfully. The ratio of the probability of neutron emission at 0 MeV and that at 2.5 MeV is ~$10^4$. Therefore, this model can predict the neutron energy spectrum, especially the peak at 2.45 MeV and the large T/n ratio observed experimentally. This indicates that the 2.45 MeV neutrons can be predicted by the dipole disintegration of the deuterons instead of the d-d nuclear fusion.

**JAPAN - SEARCH FOR NUCLEAR REACTIONS**

M. Taniguchi, N. Kaji, A. Takahashi (Dept. of Nuclear Engr., Osaka Univ.), "Search for Anomalous Nuclear Reactions in PdDx by Detection of Nuclear Products in Vacuum/Gas System," p 127.

AUTHORS' ABSTRACT

To detect the charged particles from deuterated palladium for direct evidence of anomalous nuclear reactions in solids, an experimental system in a vacuum chamber was designed and made. We can measure charged particles and neutrons and make mass spectrum analysis of released gas from the deuterated palladium in the chamber. The chamber is equipped with a silicon surface barrier detector for charged particle spectroscopy, an NE213 scintillation counter for fast neutron spectroscopy and a high-resolution quadrupole mass spectrometer for gas analysis.

We have performed two-type experiments to try to induce anomalous nuclear effects. The first is the heating experiment of the deuterated palladium plates (12.5 x 25 x 1 mm) that were deuterated by electrolysis with 0.2M LiOD/$D_2O$. In correlation with the $D_2$ gas release from a Pd plate with relatively high D/Pd ratio (~ 0.8), some anomalous effects are expected. The second experiment is a thermal cycle experiment. Palladium plates and powder (20 mesh), in a vacuum chamber that was filled with deuterium gas, were loaded with deuterium by thermal cycle condition, so that palladium samples absorbed and discharged deuterium repeatedly. This repeating condition was advantageous for the mass spectrum analysis of released gas. In the thermal cycle experiment, the D/Pd ratio was determined by measurement of $D_2$ gas pressure change and it was confirmed that the repeating thermal cycle enhanced D/Pd ratios. **The released gas from the deuterated palladium showed anomalous increase more than 10 times over the calibration line of peak ion currents around 5 amu in the mass spectrum analysis. Mass 5 is supposed to be either $DT^+$ or $DDH^+$ molecule. The cause of this peak ion current increase is under consideration.** In some cases, we observed neutron emissions at statistically significant levels over background, but it might be within the variation of background neutron level. Clear data for charged particle emission and $^4He$ production have not been obtained until now. Further experiments are under way to seek charged particles with spectra and helium atoms.

***NOTHING***: Nothing is an awe inspiring yet essentially undigested concept, highly esteemed by writers of a mystical or existentialist tendency, but by most others regarded with anxiety, nausea and panic.
(The Encyclopedia of Philosophy)

**ROMANIA - ELECTRON OVER-CONCENTRATION**

Dan Chicea (Phys. Dept., Univ. "Lucian Blaga" of Sibiu), "About Nuclear Coulomb Barrier and the Electron Over-Concentration," p 114.

AUTHOR'S ABSTRACT

When a conductor is the subject of a negative electric voltage, an electron concentration increase located very near the surface occurs. A model for estimating the electron concentration caused by this capacitor effect can be developed, assuming that the gradient of the electron concentration near the surface of the metal equals $n_0/1_D$ where $n_0$ is the "free" electron concentration and $1_D$ is the length necessary for the potential electric energy to equal the kinetic energy (the so-called Debye length). Considering a sharp peak on the surface of the metal and assuming it to have a spherical shape of radius R, and equaling the total charge required for an electric potential U with the electric charge excess under the surface having a thickness D and a linear concentration increase to the surface as mentioned, the average electron over-concentration can be described as:

$n = \frac{1}{2}\sqrt{\frac{2 n_0 \varepsilon U}{eRl_D}}$. Considering an electric negative potential of 200 V and the radius of the grains on the metal surface as small as 0.01 μm, an average excess electron concentration of $8^* 10^{28}$ $m^{-3}$ can occur, (value which is comparable with $6^* 10^{28}$ $m^{-3}$, the concentration of "free" electrons in Palladium) and **can reach values ten times higher when the surface is covered with oxide**.

For describing the screening of the Coulomb barrier by the electron excess in a low energy ion collision (e.g. $D^+$ ions), a Thomas-Fermi-like effective interaction potential between two ions has been used; the screening length has been considered to be $1_D$. The Coulomb barrier penetration probability has been numerically integrated for the values of the Debye length corresponding to several values of the electron concentration and energies, in the frame of the WKB approximation.

The result of these calculations show that the transparency of the Coulomb barrier can raise as high as $10^{-700}$ for the collision of two $D^+$ ions at an incident energy of 40 eV and as high as $10^{-200}$ at 4 KeV, for an applied electric negative voltage of 200 V, values which are not high enough for a detectable reaction ratio. The nuclear fusion of Deuterium ions at very low energies in the classical manner, even in the presence of a high electron concentration, can not reach a detectable reaction ratio for standing alone as the only explanation for the excess energy frequently reported in experimental works.

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**RUSSIA - "YUSMAR" TESTING**

Yu.N. Bazhutov, V.P. Koretsky, A.B. Kuznetsov ("Erzion" Center, Moscow), Yu.S. Potapov (Scientific Firm "Vizor," Moldova), V.P. Nikitsky, V.P. Markov, N.Ya. Nevezhin (Rocket-Space Corp. "Energiya," Kaliningrad), E.I. Saunin (Inst. of Phys. Chem., Russian Academy of Sci., Moscow), and A.F. Titenkov (Inst. of Nucl. Phys. of Moscow State Univ., Moscow), "Tritium, Neutron and Radiocarbon Registration with the Hydro-Aggregate "Yusmar" Running," p 134.

AUTHORS' ABSTRACT

Tritium, neutron and radiocarbon registration with the aggregate "Yusmar" running is given. These products occur as the result of nuclear transmutation of the Erzion model, fixed elements which were added into light water – the usual working liquid of the "Yusmar" device. The excess tritium of (5.0 ± 0.7) Bq/ml was measured by addition to 70 ml $D_2O$ into 10 1iters light water after 12 minutes of "Yusmar" running.

Neutrons (fast and slow) were measured with six $^3He$ - counters during "Yusmar" running when working liquid contained about 10 g lithium or 300 ml $D_2O$ with tritium specific activity of 3.5 kBq/ml. Maximum excess neutron of (304 ± 21) n was measured during 2.5 hours of "Yusmar" running. Neutron bursts (about 40 n) were registered also by fast neutron detector after released pressure from 2 to 0 atm.

The excess radio-carbon of (3.0 ± 0.03) Bq/ml was measured after 1.5 hours running with motor-car cooling liquid type "Tosol A40M" as working liquid of the "Yusmar" device.

The future investigation in the framework of the model will yield a large improvement of installation energetic parameters.

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**RUSSIA - WASTE UTILIZATION POSSIBILITIES**

Y.N. Bazhutov, and V.P. Koretsky ("Erzion" Center, Moscow), "Possibility of Radioactive Wastes Utilization in the Erzion Model Framework," p 135.

AUTHORS' ABSTRACT

The possibility of element transmutation in radioactive wastes of nuclear reactors was analyzed within the framework of the Erzion Model. The principal scheme of nuclear wastes processing is discussed. The conditions for the long-lived isotopes Cs137 to be stablized were defined.

The possibility of transmutation of twenty-six elements which form the main part of radioactive wastes of all sources was analyzed also. The final products of the transmutation reactions were examined. It was concluded that practically all radionuclides may be utilized.

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**RUSSIA - GEOPHYSICAL PHENOMENA**

Y.N. Bazhutov ("Erzion" Center, Moscow), "Erzion Model of Catalytic Nuclear Transmutation and its Interpretation of Ball-Lightning and Other Anomalous Geophysical Phenomena," p 136.

AUTHOR'S ABSTRACT

The principles of the Erzion Model of catalytic nuclear transmutation are described. The Erzion Model permits the main anomalous features of cold fusion to be readily interpreted. Ball-lightning and some other anomalous geophysical phenomena are interpreted in terms of this model. The fundamental and applied problems resolvable with the Erzion Model are indicated: 1) Explanation for the anomalous data in cosmic rays, astrophysics and geophysics; 2) explanation for all anomalous features of Cold Fusion; 3) creating of energy sources and reaching their optimum parameters; 4) burning away of radioactive wastes; and 5) the generation of some stable chemical elements and isotopes (He, Ne, Au).

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**RUSSIA - COLD FUSION & DARK MATTER**

E.M. Drobyshevski (Ioffe Physical-Technical Inst., Russian Acad. of Sci., St. Petersburg), "Cold Fusion in Metal Deuterides and Manifestation of the Dark Matter of the Universe," p 140.

AUTHOR'S ABSTRACT

Some 9/10 the Universe mass manifests itself by gravitation only. The nature of this dark matter (DM) is not known yet. Some scenarios of the Universe's origin suppose DM to be composed of relativistic objects, *viz*. black holes (BH) in which mass resides inside radius R = 2GM/c(E2). The smallest BH must have R equal to 1/4 of its Compton wavelength. That corresponds to Planck mass ~M = (hc/8G)(E1/2) = 1.93 10(E-5) g. Such a BH is able to carry an electric charge up to Ze = G(E1/2)M = 10.37e. I suppose such Dark Electric Matter Objects, "daemons," constitute the main part of DM of the Universe and, specifically, of the Galactic disk. By the catalytic action of the Sun-captured negative daemons on the proton fusion reactions, I've succeeded in explaining the Solar energetics and an observable deficiency of the Solar neutrino flux [Mon. Not. Royal Astron.Soc.(1996) - in press].

The daemon flux onto the Earth is formed by combined action of the gravitation and of dissipative processes in the Sun and in the Earth. It can reach ~3.4 10(E-7) cm(E-2)s(E-1) at the daemon velocity ~50 km/s. If the deuterium valence electrons in a metal deuteride are collectivized, then deuterium finds itself in a metallic phase. That has place at a relatively moderate deuterium concentration in a metal. When the negative daemon flies through the metal, it creates a void which is free of the valence-electrons and which contains Z ions. Then deuterons fall onto the daemon and are captured by the last due to mutual collisions with a frequency ~10(E15) s(E-1). These captured in the close-to-daemon levels deuterons fuse. Due to the internal conversion in the massive daemon electric field, the fusion energy transfer into kinetic energy of $^4$He mainly and, partially, of 3T and p. The Earth flux of daemons provides the so-called "Jones level" of ~10(E-24) fusions per d-d pair per sec with a great excess.

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**RUSSIA - TRITIUM WITH GLOW DISCHARGE**

V.A. Romodanov, V.I. Savin (State SRI SPA "LUTCH", Podolsk, Moscow), Ya.B. Skuratnik (State SC RF "Karpov SRPCI," Moscow), "The Tritium Generation at Transfusion of Hydrogen Isotopes Through the Target in Plasma of Glow Discharge," p 147.

AUTHORS' ABSTRACT

In our previous works on the hermetic samples of metallic targets (membrane type) which were bombarded by deuterium ions from plasma glow discharge, we investigated the composition of gas penetrating through membrane samples outside. We found for vanadium and niobium targets that the relational quantity of hydrogen complexes with masses of 3 to 6 amu were increased.

In the given work we investigated action of the hydrogen complexes, for gas flow contrary through membrane, on a tritium generation rate.

The first stage of these experiments was showed that flowing of gas through V, Nb and Ta samples didn't influence the tritium generation rate. It is the flowing of deuterium through molybdenum samples that increased the tritium generation rate about 2 times, the same for single crystal as for polycrystal.

The second stage of long (+1000 hr.) investigations on targets of polycrystaline molybdenum showed that, for flowing of deuterium through samples, a tritium generation rate was accidental; versus the flowing of protium through samples, the experimental results became stable.

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**RUSSIA - USING CERAMIC MATERIALS**

V.A. Romodanov, V.I. Savin (State SRI SPA "LUTCH," Podolsk, Moscow), Ya.B. Skuratnik (State SC RF "Karpov SRPCI," Moscow), "The Nuclear Reaction for Influence of Deuterium Ions on Ceramic Materials in Glow Discharge," p 148.

AUTHORS' ABSTRACT

We assumed, that addition of the light elements to metal targets will decrease the nuclear reaction rate for interaction of an accelerated hydrogen isotope with a solid target. Therefore, the ceramic material types of carbide or nitrogen must have less effectiveness to stimulate the nuclear reactions. At the same time, the ceramic materials may have complex physical, chemical, and

mechanical qualities, which may be unattainable for ordinary metals. In particular, the high temperature melting, the low sputtering coefficient by accelerated ions, the high mechanical qualities for abnormally high working temperature has allowed consideration of ceramic materials for special prospect materials in high loading nuclear apparatus.

It is shown that the highest tritium generation rate of materials TiC, VC, $ZrB_2$, ZrC, ZrN, $LaB_6$, was recorded for bombardment deuterium ions out plasma glow discharge, to $ZrB_2$ and equal 3, $6.10\,E_6$ - 3, $9.10\,E_6$ at/s, for effectiveness 2, $5.10\,E_{-13}$ at/ion, that is compared with results to metal targets. The tritium generation rate increased with the increase of pressure plasma formation gas.

The firmness of compound materials for abnormally high temperature in media of hydrogen plasma is by far less than in vacuum, that can lead to break down of glow form discharge and its transition in arcing. The transition of discharge in arcing form has lead to decreasing the tritium generation rate. The measurements of accompanying neutron generation and gamma-radiation was shown, that possibly their generation rate was several orders lower, as compared with the tritium generation rate.

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**RUSSIA - SCHRÖEDINGER EQUATION**

Lev G. Sapogin (Dept. of Phys., Tech. Univ., (MADI), Moscow),"Energy Generation Processes and Cold Nuclear Fusion in Terms of Schrodinger Equation" p 149.

AUTHOR'S ABSTRACT

In some experiments an approximate motion equation for an individual oscillating charge particle was proposed. It adequately explains both the cold nuclear fusion phenomena and the anomalous excessive energy occurrences of a mysterious origin being observed in experiments of a number of researchers. If the oscillating charge particle approaches the potential barrier at the phase when the charge is too small, then the repulsive force is likewise small and the former passes the barrier with ease.

Therefore, the tunnel effect and the nuclear reaction probability depend directly upon the wave function phase which in terms of the conventional quantum theory is viewed as a redundant parameter. When considered along these lines, the momentum conservation law for an individual process is not observed but is manifested when summing up the particle energy throughout all the phases.

In the conventional quantum mechanics such momentum and energy loss manifests itself indirectly through the uncertainty correlation. Yet, the said equation has resulted from purely heuristic reasoning, not in rigorous terms, when determining the electric charge value and the fine structure constant on the basis of the Unitary Quantum Theory (UQT). This invited correct criticism of many research workers and caused personal deep dissatisfaction.

In this report it will be shown that the above equation may follow directly from the Schröedinger's equation for small energies.

I wish to express my gratitude to colleagues Ryuichi Kubota, V. Boichen-ko, V. Dzhanibekov, and Prof. M. Mokoulsky. I also wish to thank Dr. Eugene F. Mallove for prolonged scientific discussions at the Loews Hotel, Monte-Carlo, Monaco.

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**RUSSIA - CHANGES IN SINGLE CRYSTALS**

S.V. Vakarin, A.L. Samgin, V.S. Andreev (Inst. of High-Temp. Electrochem., Russian Aca. of Sci., Ekaterinburg, R.F.), "Structural Changes of Single Crystals in Neutron Generation Experiments" p 151.

AUTHORS' ABSTRACT

The single crystals of oxide sodium-tungsten bronze are prospective materials for cold fusion. Our latest experiments, with the use of a two-ring detector and electronics in CAMAC-standard, have shown that some events were observed which can be interpreted as neutron bursts of a duration of some tens of microseconds. We have shown that neutron generation was fixed only with those crystals which had sufficient perfection. **Repeated use of the sample, growth regime and operations on preparation of sample can result in disorder of perfection and, as a consequence, in absence of neutron emission and in non-reproducibility of results.** In particular the generation of neutrons is sensitive to water-atmosphere. X-ray analysis of crystals has shown that under water-atmosphere, a disorder of structure perfection of single crystal surface takes place. This shows that water molecules in a surface layer form hydrogen bonds with atoms (ions) of oxygen-tungsten octahedrons, deforming them and accordingly deforming the channel structure formed by these octahedrons as a whole.

This paper presents the results of new analyses of X-ray data (crystal lattice parameters and elementary cell volumes) both pre- and post-experimental. The filming of X-ray patterns from the same planes of a single crystal was performed by a DRON-3 diffractometer. In experiments with positive results, the phenomenon of reduction of elementary cell volume after the experiment was observed.

All samples for which the effect was not observed were imperfect (microblocks and strong tension). The volume of elementary cells of the samples was not changed or was increased. For example, crystal $Na_{0.85}WO_3$, with which electrochemical stimulation was executed and which produced a significant overbackground neutron emission, had a volume of elementary cell $V = 57.24 \pm 0.02$ Å$^3$ before the experiment and $V = 56.89 \pm 0.02$ Å$^3$ after interaction with deuterium.

**With regard to these structural changes it is reasonable to suggest that the generation of neutrons occurs at the moment of distortion of a channel structure of substance which can be connected with the compression of the crystal lattice.** Perhaps the processes of explosive character inside the crystal cause the structural rebuilding. Such changes may be considered as phase transition.

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**RUSSIA - CONTROL AND CHANGE**

V.I. Vysotskii (Kiev Shevehenko Univ., Kiev, Ukraine), V.P. Bugrov, A.A. Komilova, S.I. Reiman (Moscow State Univ., Moscow), "The Experimental Discovery of the Phenomenon of Controlling and Changing Probability and Time of Spontaneous Decay and Gamma-Transmutation of Excited Nuclei Statuses," p 74.

AUTHORS' ABSTRACT

The paper discusses the process of controlling and changing the probability of spontaneous decay of radioactive Möessbauer nuclei.

We have considered the possibility of controlling the probability of decay $A_{ij} \equiv 1/\tau$ of excited Mossbauer nuclei by controlled mode restriction of electromagnetic vacuum. The main idea of the spontaneous decay velocity control is in the strong influence of averaged modes density in a unit frequency interval

$$<\rho(\nu_{ij})> = \int\int \rho(\nu_n) f(\nu_n,\nu_{ij}, \Omega) d\nu_n d\Omega, \quad \rho(\nu_n) = 8\pi\nu_n^2/c^3$$

upon the final possible decay $A_{ij} = (8\pi^3\nu_{ij} \mid d_{ij} \mid ^2/3h)<\rho(\nu_{ij})>$. Here $\rho(\nu_n)$ - density of central frequencies $\nu_n$ of modes; $f(\nu_n, \nu_{ij}, \Omega)$ is spectral-angular density of a single mode, having central frequency $\nu_n$, spectral width $\gamma_n$, and spreading in the direction of solid angle $\Omega$. Usually $f(\nu_n,\nu_{ij}, \Omega) = \gamma_n /8\pi^2[(\nu_n - \nu_{ij})^2 + \gamma_n^2/4]$, $\gamma_n = \gamma_n(\nu_n, \Omega)$. Spectral width of mode $\gamma_n$ is defined by time of life of photon $\Delta t = Q_n/\nu_n$ in this mode. Here $Q_n$ - quality of mode $\nu_n$. In usual case of free space ($\Delta t \to \infty$, $Q_n \to \infty$ and $\gamma_n = \nu_n/Q_n \to 0$, $f(\nu_n, \nu_{ij}, \Omega) \to \delta(\nu_n - \nu_{ij})$ ) and in case of frequency non-selective absorption ($\gamma_n$ = const $\neq \gamma_n(\nu_n)$) we have equivalent results:

$$<\rho(\nu_{ij})> = \rho(\nu_{ij}), \quad \tau = A_{ij}^{-1} = 3hc^3/32\pi^3\nu_{ij}^3 \mid d_{ij} \mid ^2.$$

Another situation appears with the presence of a frequency-selective absorber acting as a "black" screen in $\Delta\Omega$ and in a narrow frequency band $\Delta\nu \leq \Gamma = 1/\tau$ near resonant frequency of Mossbauer transition in source $\nu_0$. The decrease of quality of modes lying within a small interval of frequencies $\Delta\nu$ causes an essential change of mean modes density

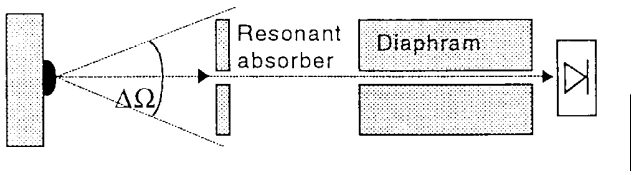
$$<\rho(\nu_{ij})> = \rho(\nu_{ij}) F(\nu_{ij}, \Delta\Omega), \quad F(\nu_{ij}\Delta\Omega) = \int\int f(\nu_n, \nu_{ij}, \Omega)\, d\nu_n d\Omega.$$

As a result it leads to a decrease (at $\nu = \nu_0$) and increase (at $\nu = \nu_0 \pm \Delta\nu$) of the probability of spontaneous decay $\tau^* = \tau/F(\nu_{ij},\Delta\Omega)$.

Total concentration of excited nuclei $n_t$ and intensity I of Möessbauer radiation in direction $(4\pi\text{-}\Delta\Omega)$ increase and

$$n_e^*/n_e = I^*/I = 1/[1 - f(1 - \tau/\tau^*)\Delta\Omega/4\pi(1 + \alpha)].$$

For the first time two experiments (like the one shown in the figure) have proved the possibility of changing the life-time of radioactive nuclei by surrounding them with screens having




resonant absorption frequency equal to the nuclear transition frequency. **For the first time in the experiments with gamma sources $Co^{57}$ ($Fe^{57*}$) and $Sn^{119m}$ and with gamma absorbers $Fe^{57}$ and $Sn^{119}$, we have discovered the change (increase) of Möessbauer radioactive spontaneous transition life-time by 20-100% and total life-time (including non-Möessbauer radiation and electron conversion) by 0.6-2%.**

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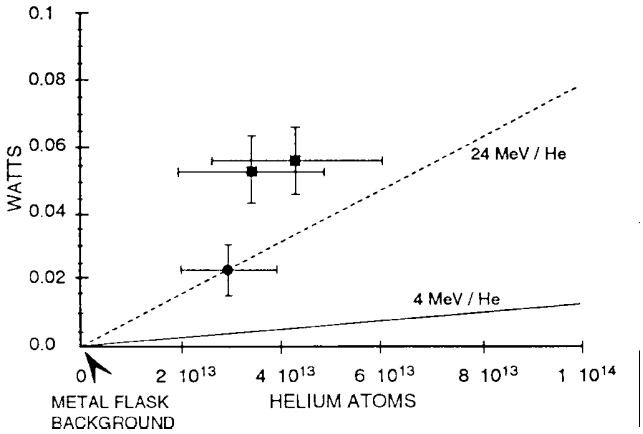
**U.S. - HELIUM, HEAT AND RADIATION**

B.F. Bush and J.J. Lagowski (Univ. of Texas, Dept. of Chem., Austin, TX), M.H. Miles (Naval Air Warfare Center, Weapons Div., China Lake, CA), "Nuclear Products Associated with the Pons and Fleischmann Effect; Helium Commensurate to Heat Generation, Calorimetry, and Radiation," p 156.

AUTHORS' ABSTRACT

The nature of the nuclear phenomena associated with the Pons and Fleischmann effect remains largely unexplored. The phenomena are reproducible, but the processes lack controllability. The circumstances of the electrolysis experiments do not produce the same nuclear product distribution as that expected during hot plasma D + D fusion experiments.

From our earliest qualitative heat versus helium nuclear products analyses (*J. Electroanal. Chem.*, vol 304, p 271, 1991) to our more recent quantitative helium analyses, the utmost care has been exercised with respect to the scientific rigor of our work. The correlation between the production of helium and the generation of excess heat has been reproduced in different laboratories and under different experimental protocols. Preliminary results are shown in the figure: The quantitative correlation between the amount of energy generated and the helium produced is at the level that is expected for a high energy nuclear reaction, such as fusion. These results are underwritten by extensive $^3He$:$^4He$: $^{20}Ne$ control experiments, which will be described in the presentation.




D + D → $^4$He + 24 MeV is the most energetic reaction known. The heat versus helium analysis can be used to attempt to identify the nuclear reaction pathway by comparing the quantity of helium produced to the amount of energy generated. Thus, the most energetic reaction known would generate 24 MeV/$^4$He, as shown depicted by the line in the plot. Likewise, the 4 MeV/$^4$He line is included to add perspective. These results were obtained with all-metal apparatus shown to be capable of eliminating atmospheric contamination.

Calorimetric quality is the foundation of this work. In our early work, isoperibolic calorimetry was used successfully. In our later work as depicted in the figure, high performance Calvet calorimetry is used. This is the most rigorous method of calorimetry known, amounting to an integrated measurement of the total thermal flux. Electrolysis off-gas production rates were measured to determine the Coulombic efficiency of the electrolysis. Atmospheric helium contamination was precluded by use of all-metal sampling flasks and all-metal gas collection equipment with helium leak-tight Cajon VCR metal seals. Radiation monitoring suggested the presence of a weak source of high energy γ-radiation. The weakness of the source tended to confound the analysis because of the statistics of the minimum detectable activity associated with various radiation detectors. The cathodes used in these experiments were palladium electroplated on gold-flashed copper. No calorimetry was associated with these radiation experiments.

The technical aspects of the nuclear products analysis will be described as it was reproduced under various protocols. The ultimate goal of this effort is to identify explicitly which nuclear reactions result in the Pons and Fleischmann effect.

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**U.S. - MANY-BODY SYSTEMS**

Yeong E. Kim and Alexander L. Zubarev (Dept. of Phys., Purdue Univ., Lafayette, IN), "Comment on Exact Upper Bound on Barrier Penetration Probabilities in Many-Body Systems," p 118.

AUTHORS' ABSTRACT

In 1989, Leggett and Baym (*Phys. Rev. Lett.*, 63, p 191 (1989)) investigated an upper bound on barrier penetration probabilities in many-body systems and claimed to obtain the result that the rate of tunneling of nuclei to classically forbidden small relative separation, in a fully interacting quantum-mechanical many-body system in equilibrium, is rigorously bounded above by a value calculable in terms of the Born-Oppenheimer potential (Ann. Phys. (Leipzig) 84, p 957 (1922)) between the nuclei. Using a specific counter example, we show that it is not possible to obtain such an exact upper bound.

To show that, in a general case, the Born-Oppenheimer approximation cannot provide a proof for the upper bound, we consider a simple example with the following effective potential:

$$\hat{V} = V^c + \Delta\hat{V}, \quad V^c = \frac{Ze^2}{r}, \tag{1}$$

where $\Delta\hat{V}$ is a nonlocal potential with a separable form, $\Delta\hat{V} = \lambda|\chi\rangle\langle\chi|$, with $\langle r|\chi\rangle = e^{-\beta r}$. In terms of regular and irregular solutions, X(r) and Y(r), respectively, of a Schröedinger equation without $\Delta\hat{V}$ term in eq. (1), the solution of Schröedinger equation with eq. (1) can be written as $\psi(r) = \mathrm{X}(r) + \bar{\psi}(r)$, where

$$\bar{\psi}(r) = \lambda\int_o^\infty G_0(r,r')\chi(r')dr'\frac{\langle\chi|\mathrm{X}\rangle}{1-\lambda\langle\chi|G_0|\chi\rangle},$$

$$G_0(r,r') = -\frac{2\mu}{\hbar^2 k}\begin{cases}\mathrm{X}(r)Y(r') & r<r'\\ Y(r)\mathrm{X}(r') & r'<r\end{cases}. \tag{2}$$

The barrier penetration probability P for tunneling to r = 0 is by definition given by

$$P = \left|\frac{\psi(r)}{kr}\right|^2_{r=0} \tag{3}$$

We find that for low energies,

$$\left|\frac{\mathrm{X}(r)}{kr}\right|^2_{r=0} = |C|^2 = 2\pi\,\eta\,e^{-2\pi\eta},$$

$$\left|\frac{\bar{\psi}(r)}{kr}\right|_{r=0} \geq |C|\cdot\frac{2\beta^3 R_B}{\beta^2+k^2}e^{2\varphi\eta}, \tag{4}$$

where $\varphi = \arctan(k/\beta)$, $\eta = 1/(2kR_B)$ and $R_B = \hbar^2/(2\mu Ze^2)$. In the case of small β values, $(2\beta^3 R_B/(\beta^2+k^2))\,e^{2\varphi\eta} > 1$, and hence eq. (4) leads to an enhancement of the barrier penetration probability for nonlocal potential $\Delta\hat{V} > 0$.

Eq. (4) shows that an upper bound for the barrier penetration probability P given by eq. (3) cannot be established for the case of the effective potential given by eq. (1). Therefore, it is not possible to obtain an exact upper bound for P in general. The Born-Oppenheimer approximation involves local potentials. However, the effective potential is nonlocal operator, and hence the Born-Oppenheimer approximation cannot provide the proof of the exact upper limit for the barrier penetration probability.

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**U.S. - COULOMB-FIELD CATALYZATION**

Yeong E. Kim and Alexander L. Zubarev (Dept. of Phys., Purdue Univ., West Lafayette, IN), "Coulomb-Field Catalyzed Nuclear Fusion," p 119.

AUTHORS' ABSTRACT

There have been many theoretical investigations of the asymptotic behavior of the wave function of two or more charged particles in a Coulomb field. A theoretical derivation was proposed [1] for obtaining an asymptotic solution of the Schröedinger equation for three charged particles ($\alpha$, ß, $\gamma$) in the configuration space for the case when one of the two radial variables is small and the other is large.

Recently, this problem has been solved without partial wave decompositions [2]. Solutions of the Schröedinger equation in all asymptotic regions have been found except regions involving singular directions. These solutions cannot be written as a product of the internal wave function of relative motion of pair ($\beta$, $\gamma$) and the wave function describing the relative motion of the third particle $\alpha$ with respect to the center of mass of the pair ($\beta$, $\gamma$). In the presence of the third particle $\alpha$, the relative momentum $\vec{k}_\alpha$ of the pair ($\beta$, $\gamma$) becomes $\vec{k}_\alpha(\rho_\alpha)$, i.e., a function of $\rho_\alpha$ where $\rho_\alpha$ is the distance between $\alpha$ and ($\beta$, $\gamma$). At low energies, the magnitude $k_\alpha(\rho_\alpha) = |\vec{k}_\alpha(\rho_\alpha)|$ at finite $\rho_\alpha$ can be much larger than the asymptotic value of the relative momentum $k_\alpha = k_\alpha(\infty)$. This fact can enhance the fusion probability of the pair ($\beta$, $\gamma$), leading to a possibility of Coulomb-field catalyzed nuclear fusion (CFCNF). We will present results of our theoretical investigation of whether CFCNF can provide explanations for some of the cold fusion phenomena.

1. P.L. Altick, *Phys. Rev. A* 25, 128 (1982); *J. Phys. B,* 16, p 3543 (1983).

2. E.O. Alt and A.M. Mukhamedzhonov, *Phys. Rev. A*, 47, p 2004 (1993); E.O. Alt, *Phys. At. Nucl*. 56, p 866 (1993).

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**U.S. - LATTICE INDUCED REACTIONS**

P.L. Hagelstein (Mass. Inst. of Tech., Res. Lab. of Electronics, MA), "Lattice-Induced Reactions," p 133.

AUTHOR'S ABSTRACT

Reports of anomalous nuclear effects in experiments with metal deuterides, if correct, imply the existence of a mechanism for coupling a large energy quantum from the solid state to the nucleus. We reported previously on some of the consequences that would follow from the existence of such a mechanism, including electron and ion recoil, and induced alpha and beta decays.

We also conjectured that neutron hopping might play a role. Recent theoretical results indicate that neutron hopping is possible in principle only with anomalous energy input from the lattice. In this case, the energy transfer is much more than would be required for other possible lattice-induced effects, so that it would not be expected to be a primary reaction pathway. While virtual neutron transfer would be expected for small energy defects, this process would be expected to produce significant real neutrons, in contradiction with experiment.

Consequently, we are now exploring lattice-induced alpha and beta decays as candidate explanations for claims of excess heat production and induced radioactivity. Heat would be due to exothermic lattice-induced alpha decays of heavy elements such as Pt or Ce that are present in large quantities on or in the cathode; tritium would be due to induced alpha decay of $^{7}$Li (the final state tritium would be slow); $^{6}$Li alpha decay (with a slow final state deuteron) would result in dd-fusion neutrons at low levels; and lattice-induced beta decay of Pd would yield residual radioactivity; lattice-induced recoil of deuterons would also lead to low level neutrons.

An atom interacts with only a small number of neighbors normally in a lattice, so that anomalous energy transfer is usually forbidden. In the presence of phonon gain, the number of neighbors that interact becomes much larger. Consequently, anomalous energy transfer would be expected only if phonon gain is present. We proposed earlier that surface phonon gain might be driven by exothermic desorption. Energy transfer in this model would come about through energy fluctuations associated with Duschinsky-type mode changes and dissipation in the lattice.

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**U.S. - CATASTROPHIC DESATURATION**

Mitchell Swartz (JET Energy Tech., MA), "Cooperative Phonon Coupling Following Catastrophic Desaturation," p 125.

AUTHOR'S ABSTRACT

A possible explanation for the anomalous branching ratio is based upon a cooperative removal of the $He^4$ energy just prior to the

decay by two body fission. Facilitated by isospin restrictions which limit conventional pathways, the observed excess heat is driven by the reconfiguration to the more tightly bound $He^4$ ground state. Catastrophic desaturation dominates, and we have now determined that the 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. Account is taken regarding four-vector analysis which indicates conservation of energy does occur. This also suggests the use of a fusion-related quantum of energy delivered to the lattice's phonon cloud – a phuson. Special relativistic and energy considerations indicate the phonon cloud may subtend about 45-800 unit cells. This and other results of the analysis may satisfy some of the difficulties, pointed out by skeptics, regarding the experimental observations in the field.

## C. NEWS FROM THE U.S.

### OHIO - FUEL FOR FRAUD OR VICE VERSA?

Courtesy of Mark Goldes

"End of Road for Car That Ran on Water," London Sunday Times, 1 Dec. 1996.

An Ohio court ruled against inventor Stanley Meyer, in a case recently brought against him by disgruntled investors. Meyer had sold "dealerships" and licensing rights in his Water Fuel Cell technology to interested investors, in anticipation of the day when it would power electric vehicles or even aircraft. That dream was shattered as Meyer was found guilty of fraud when his Water Fuel Cell failed to impress three "expert witnesses" who decided there was nothing revolutionary about it, rather that it was simply using conventional electrolysis. The newspaper article also stated that when one of the court experts went to examine the Water Fuel Cell driven car, it was impossible to evaluate because it was not working.

### UTAH - SIMULTANEITY INTERPRETATIONS

W. Vincent Coon, "Simultaneity Interpretations," *Galilean Electrodynamics*, vol 7, no 6, Nov/Dec 1996, pp 109-111.

AUTHOR'S ABSTRACT

It is shown that in inertial frame scenarios, the Einstein interpretation of the Lorentz Transformation (LT) competes with other transformations which do not support light speed invariance. These rival transformations can be obtained by re-evaluating LT simultaneity which is susceptible to overhauling.

INTRODUCTION

Isotropy postulates of space and the speed of light are the basis for defining simultaneity in Special Relativity Theory (SRT). [When,] in a simple text-book scenario, two identical clock-transmitters send signals toward each other precisely as each clock registers an agreed time, and if the signals meet at a point exactly mid-distant between the clocks, the clocks are said to be synchronized. Supposedly, the signals have the same speed relative to the clocks. This is an assumption that should not be taken for granted. In order to confirm that the signal speeds are the same, they must be verified empirically. But unambiguous measurements of one-way speed are impossible because of *speed synchronization circularity*. You see, in order to measure a signal's one-way speed we depend on synchronized, separated clocks, but in order to synchronize separated clocks we must know a signal's one-way speed to begin with. Defending light speed invariance by SRT's clock settings is therefore tautological. In short, the isotropy assertions of SRT remain postulates because they cannot be proven. Because these assertions cannot be proven, the synchronism required by light speed invariance is vulnerable to reassessment. Revisions of "synchronization" are accomplished by resetting clocks according to other standards of alleged simultaneity which are no less provable. The following exercise [paper] shows how to go about this algebraically.

## D. LETTERS FROM READERS

### LETTER: WE'RE BACKKKKKK!!!!

From: Dale Pond, Sat., Nov 23, 1996
To: Patrick Bailey, President INE

You probably have already heard, but in case you missed the REALLY BIG NEWS – Hot Fusion is back! They couldn't make it fly on the old promises so they wrapped it up in new names and new labels.

Billed as "**by far the largest and most powerful assemblage of lasers in the world**" by the recent edition of *Photonics Spectra* (11/96), this new foray into hot fusion and your grandchildren's pockets is yet another advance into science and technology that has proven itself to be outside of the laws of physics, economics, and bordering on insanity.

The old and failed hot fusion project is now relabeled "The National Ignition Facility" and now signed into existence by Clinton along with a promise of your money to the tune of $191.1 million dollars "**to speed the National Ignition Facility on its way**."

Listen to this, I think we've heard this before: "The feasibility of this task is still uncertain because it is awesomely difficult, to put it mildly. When completed, the National Ignition System will feature an array of 192 high-power lasers in a facility as large as two football fields - all focused on pea-sized fuel pellets that must be brought to the astonishing heat of 100 million degrees C... the goal is to liberate more energy than is required to initiate the capsule's implosion."

So even the naysayers are trying to get some Free Energy only this time, not out of nothing as they accuse us, but out of $191,100,000 of our money. They may succeed as long as they get us to pay for their strange, failed and out-of-date pseudo-science. Who needs free energy when you can so easily come up with that kind of dough?

And they call the Free Energy people crazy? At least we do not try to raid someone else's money pouch to pay for our own pay checks. Why con (steal?) when they can get an ignorant Congress and others to do it for them?

Anyhow, thought you'd like to know.

Dale Pond

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**LETTER FROM DR. POSITIVE**
Tokyo, Japan

THE SKEPTICISM IS MISTAKEN

Five years passed since the observation of so-called “Cold Fusion” was claimed by Fleischmann & Pons and Jones by means of electrolysis of heavy water. Various attempts of duplication of their experiments were carried out by many authors, but none with completely reproducible results have been reported. These experiments have suffered from general skepticism for their impossibility of realization of nuclear fusion at room temperature and so that it attracts the interest of many peoples as a mysterious, unusual phenomenon like UFO or mystery crop circles.

The skepticisms seems to be mainly due to the general concept that ultra-high temperature is the necessary condition for realizing every nuclear fusion of hydrogen, as it is for the conventional [Tokamak-style] nuclear fusion. In order to make nuclear fusion, bare nuclei must contact directly first, against the Coulomb repulsion force between them, because each nucleolus has the own ionic charge. This situation is often explained in the academic expression as “penetrating” the ionic potential barrier between them – in other words, "overcoming" the potential peak.

These words make the general people an image of a bullet "penetrating" the hard protection wall or that of a golf ball "climbing over" the hill side and falls down into the hole on the other side. In each case, the bullets or the golf ball needs to be accelerated with high enough energy to "penetrate" or climb up the hillside. These images often lead the common sense to the concept as if the objective temperature of $1 \times 10^8$ K of the conventional nuclear fusion research were the threshold energy for "overcoming" the potential energy between the nuclei; in other words, it means that nuclear fusion will never take place under this critical temperature of $\sim 10^8$ K, above all not at room temperature. If nuclear fusion were to be realized actually at room temperature, this concept would lead its origin directly to the unknown mechanism of acceleration of constituent nuclei. But it is not necessarily true because the original concept itself is not true but is a misunderstanding due to the subconsciousness from a mistaken common sense.

In fact, the objective temperature of $10^8$ K is not enough for overcoming the potential barrier peak. The real threshold temperature value for overcoming the peak is estimated to be $3 \times 10^{10}$ K , which is $\sim 10^2$ times larger in order than the proposed objective temperature for the conventional nuclear fusion project.

This objective temperature is not the threshold energy for making nuclear fusion, but only a technical parameter for obtaining the rate of energy production by nuclear fusion for even breaking with energy consumption including scaling factors of the reaction system, and the nuclear fusion is taking even under this temperature though the rate is small.

The bare nuclei can contact directly passing through the potential barrier by "quantum tunneling effect" even at lower energy than the potential peak. The words "overcome" or "penetrate" are not appropriate for this effect and "get through" or "permeate" might be much better but are incomplete, where the particle and the wave are treated as having the same nature. Gamov explained this effect as a wave nature. But the conventional analogous expression for explaining the quantum effects often stimulates dangerous ideas when the words are walking alone themselves.

The skepticism for the “cold fusion” may be summarized as follows:

The hydrogen nuclei must contact directly by “overcoming” the ionic potential peak between them for making the nuclear fusion. And at the lower temperature than the potential peak, nuclear fusion will never take place. Even though the tunneling effects were taken into consideration, the reaction rate might be negligibly small compared with those by "overcoming" the potential peak.

It is, however, the objective temperatures of conventional nuclear fusion or those of the sun and the other stars in space are far lower than that for "overcoming" the potential peak. If the skepticisms for the "cold fusion" claim their reasons as its "tunneling mechanism," they should also claim it for the conventional high temperature nuclear fusion.

The skepticism for the "cold fusion" is not true but obviously mistaken! The problem is not "yes" or "no" for its reality, but for the method of how to make it visible and how to utilize it. The skepticism for the cold fusion should not be applied to the reality itself but rather to the respective experiments for their reliability.

The skeptic experiments are often to promote the skepticism for the reality of the unknown phenomenon, rather than to prove it.

It is no use to compete with the mistaken skepticism, only by means of experiments. Think yourself, skepticism from your heart and if you can believe it, try again the experiment from the

beginning by yourself. It is not the duplication of the others even though it may happen to be the same. Then the real miracle will come true!!

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**LETTER FROM AUSTRALIA**
Sub: Plasma-Injected Transmutation

Dear Mr. Fox,

About a week ago I read your paper, "Plasma-Injected Transmutation," and would like to make the following comment. While I believe you may very well be on to something, in as much as I agree with you that this process probably does occur in many cases, I doubt seriously if it can account for the large energy excesses reported in some experiments (e.g. Patterson).

The reasoning behind this statement is as follows: Even for D-T fusion, the tunnelling maximum occurs at about 170 keV, if I'm not mistaken. Presumably for heavier nuclei it would, according to standard theory, be even higher. Now 170 keV / 1836*(2/1) (for deuterons) yields 46 eV. This implies that for the implanted ions to have an ideal energy of 170 keV, the electron cluster would need to be accelerated through a voltage drop of about 46 volts.

A NEV of $10^{11}$ electrons containing $10^6$ positive ions, accelerated through a voltage differential of 46 volts, will acquire a kinetic energy of
1e + 11 * 46eV =3D 4.6e + 12 eV (for the electrons)
+
1836 * 2/1 * 46 * 1e + 6 =3D 1.7e + 11 eV
(for e.g. deuterium nuclei, according to your formula).
Total 4.77e + 12 eV.
This energy must initially be supplied by the power source of the experiment.

Even if all $10^6$ deuterons were to fuse with a metal nucleus (highly unlikely?), and each fusion were to produce an energy of 10 MeV, the resultant energy production would be 1e + 6 * 1e 7 =3D 1e + 13 eV. (Though each could trigger a fission reaction in Pd resulting in about 40 MeV - 4e + 13 eV). If they were to fuse with stationary deuterons, the energy would be at most 24 * 1e + 6 * 1e + 6 =3D 2.4e + 13 eV. So in the most favourable case - ensuing fission, This is 10 times the energy supplied by the power source for the cluster in question.

In order to achieve the purported results of the Patterson cell (i.e. an excess of at least several hundred times raw input power), an improvement of at least 10 fold would be required (and probably more). This implies that the relative density of deuterons in the NEVs would need to be 10 times higher, i.e. 1 deuteron per 10,000 electrons. Under these circumstances, the approximation used in your formula is only borderline valid (i.e. the mass ratio of electrons to deuterons is 2.5/1).

As I see it this means that your proposed mechanism is not quite as wide spread in application as you would have us believe. I do not believe that this is the mechanism that is responsible for heat generation in a Patterson cell, particularly as I doubt seriously that every accelerated ion would result in a nuclear reaction. That is not to say that it doesn't happen anywhere, I suspect strongly that it does. I suspect, however, that it is just one of several mechanisms which occur in nature.

Regards, Robin van Spaandonk
<rvanspaa@netspace.net.au>

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**Reply by Dr. Jin to the Comments by Robin van Spaandonk on "Plasma-Injected Transmutation."**
11-20-96

A charge cluster with positive ions, with electron number $N_e = 10^{11}$ and ion number $N_i = 10^6$ accelerated through a voltage difference V = 46 volts, will acquire a kinetic energy

$$N_e \text{ eV} = 4.6 \times 10^{12} \text{ eV, (for the electrons)}$$

$$N_i \text{ A/Z V } 1836 = 1.7 \times 10^{11} \text{ eV. (for the deuterium nuclei)}$$

Where A is atomic weight and Z is atomic number. The total kinetic energy is $4.77 \times 10^{12}$ eV, as Mr. Robin van Spaandonk shows in his comment.

In the D-Pd system, we assume the most probable nuclear reaction is

$$D + D \rightarrow \text{He (23.85 Mev).}$$

In this case the resultant energy production would be

$$N_i \times 23.85 \text{ MeV} = 2.39 \times 10^{13} \text{ eV.}$$

This energy is 50 times the charge cluster energy.

The He nuclei($\alpha$-particle) with high energy (23.85 MeV) will not remain inside the Pd lattice. It will react with Pd and produce various kinds of transmutation as many experiments have already shown. If we assume $\alpha$ + Pd reaction produce average ~10 MeV (or 20 MeV), then the total energy produced is about 75 (or 100) times the input energy.

In the above, we considered the most favorable processes with 75 - 100 times energy amplification. In reality, considering various nuclear processes, the energy output may be much lower than above situation.

> True genius resides in the capacity for evaluation of uncertain, hazardous and conflicting information.
> (Sir Winston Churchill)

## E. BOOK REVIEW

**ENERGY FORMULAS - A HANDBOOK**
Courtesy of Bryan D. Kerwin

Bryan Kerwin, CEM, Editor, Publisher, Handbook of Formulae, Equations, and Conversion Factors for the Energy Professional, ©1994, third printing 1996, JOB Publications, PO Box 20121, Tallahassee, FL 32316-0121,

EDITOR'S COMMENTS

It has been claimed that if you want to be a successful engineer or technician you should learn 100 formulas. For those who would sooner look up the formulaes, this pocket handbook (4" x 5 1/2") of formulas will be helpful. The book is divided into several energy-related sections as follows:

1. Constants and Conversion Factors
2. Economics (meaning financial tables and formulas)
3. Electrical (including power factors)
4. Envelope (insulation and heat transfer)
5. Fuels and Steam (properties of fuels and air)
6. HVAC (heating, ventilating, and air conditioning)
7. Lighting (lamp types, illuminance)
8. Motors (horsepower, fans, air conditioning use)
9. Solar (solar insolation tables, shading factors)

We commend the author-publisher, for putting together a lot of good information in a pocket or tool box size book. Hopefully, for the 2nd edition, we will be able to provide some useful formulas and tables for a variety of new-energy devices and systems.

[Note: Special price for INE members. The author has agreed that he will send his book to any INE member for a flat $20. You save $2.45, essentially the shipping and handling charges are cancelled for INE members. Fax this page and send with your order, or call 904-531-7459 and order by credit card -- **be sure you mention that you are a member of INE.** Ed.]

## F. MEETINGS

CALL FOR PAPERS
**Intersociety Energy Conversion Engineering Conference**
**IECEC - 1997**
**July 27 to August 1, 1997**
Hilton Hawaiian Village, Honolulu, HI

Abstracts in the area of "Innovative Concepts – Cold Fusion" and other Advanced Energy Conversion Technology areas are being accepted until January 17, 1997. Draft papers due March 1997, and Final papers are due in May 1997.

Submitting abstracts -- more information available at:
http://members.aol.com/busassist/IECEC97.HTM

or mail 4 copies of your abstract to:
Eileen M. Grady
IECEC-97 Program Office
Business Assistants
16216 Frederick Road
at Comfort Inn Shady Grove
Gaithersburg, MD 20877

or Email to: <busassist@aol.com> for more information.

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**WORLD RENEWABLE**
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Florence, Italy
20-25 September 1998
Hosted by the University of Florence
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For further information contact:
Professor A.A.M. Sayigh
World Renewable Energy Network
147 Hilmanton, Lower Earley
Reading RG6 4HN, U.K.
Phone: (44) 0118-961-1364, Fax: (44) 0118-961-1365
(Dialing from abroad, omit the zero.)

# Commercial Column

The following companies (listed alphabetically) are commercializing cold fusion or other enhanced energy devices:

**COMPANY**: PRODUCT

**American Pure Fusion Engineering and Supply**: Information and trouble-shooting for the fusion research and development industry. Developing "Fullerene Fusion Fuel™." Salem, Oregon. The president, Warren Cooley, can be reached at 1-800-789-7109 or 503-585-6746. Email to: Coolwar@aol.com

**CAI, Inc., CAI has acquired rights to develop and produce a new-type of thermal power based on the controlled production of clean nuclear reactions from micro-miniature tokamaks (provided by nature). Contact through FIC, Voice 801-583-6232, Fax 801-583-2963.**

**CETI** (Clean Energy Technologies, Inc.): Developers of the Patterson Power Cell™. Dallas, Texas. Voice 214-982-8340, FAX 214-982-8349.

**Clustron Sciences Corp.**: New energy research consulting and information. Contact: Ron Brightsen, 703-476-8731.

**ENECO**: Portfolio of intellectual property including over thirty patents issued or pending in cold nuclear fusion and other enhanced energy devices. Salt Lake City, Utah. Contact Fred Jaeger, Voice 801-583-2000, Fax 801-583-6245.

**E-Quest Sciences**: Exploring The Micro-Fusion™ process. Seeking qualified research partners for their sonoluminesence program. Contact Russ George, FAX 415-851-8489.

**Fusion Information Center (FIC): Research and development of new energy systems. The world's most complete resource depository for cold fusion research information, as well as other new energy research including zero-point energy; space energy research; electronic, electromagnetic, and mechanical over unity devices and transmutation. We are the publishers for *Fusion Facts, New Energy News*, and *the Journal of New Energy.* Voice 801-583-6232, Fax 801-583-2963. Contact Hal Fox.**

**Holotec AG**: Clean Energy Technology, contact André Waser, Gen. Mgr., Bireggstrasse 14, CH-6003, Luzern, Switzerland. Phone 011 41-41 360 4485, or Fax 011 41-41 360 4486.

**Hydro Dynamics, Inc**.: Hydrosonic Pump, heat-producing systems using electrical input with thermal efficiencies of 110 to 125 percent. Rome, Georgia. Contact James Griggs, Voice 706-234-4111 Fax 706-234-0702.

**JET Energy Technology, Inc.**: Design and manufacture of π-electrode systems, calorimeters, and associated equipment and systems. Consulting regarding radiation, materials, and other scientific and engineering issues. Weston, MA. Contact Dr. Mitchell Swartz, Voice 617-237-3625. Fax 617-237-3625.

**Labofex, Experimental and Applied Plasma Physics**: R&D of PAGD (Pulsed Abnormal Glow Discharge) plasma technology. Applications under development include protable power supplies, electric vehicles and autonomous housing. Licensing. Ontario, Canada. Contact Dr. Paulo N. Correa. Tel 905-660-1040
Fax 905-738-8427

**Magnetic Power Inc.**: Solid-state, heat to electric transducers, for temperatures up to 300°F (low energy nuclear reactions, waste heat, etc.) featuring Ultraconductors™ under development by ROOTS, a subsidiary. Sebastopol, CA. Contact Mark Goldes, voice 707-829-9391, Fax 707-829-1002.

**Nova Resources Group, Inc**.: Design and manufacture ETC (Electrolytic Thermal Cell); EG (commercial power cogeneration module); and IE (integrated electrolytic system). Denver, CO. Call Chip Ransford, Phone 303-433-5582.

**UV Enhanced Ultrasound**: Cold Fusion Principle being used for an ultrasonic water purifier. Hong Kong. FAX 852-2338-3057.

**"YUSMAR"- Scientific-Commercial Company:** manufacture, licensing, research and development of water-based generators: thermal (5 sizes), electrothermal (up to 2 MW), and 'quantum' types. President: Dr. Yuri S. Potapov, 277012 Kishinev, Moldova. Phone and Fax 011-3732-233318.

**Zenergy Corporation**: Founded in 1996 to facilitate the introduction of commercially viable energy alternatives. 390 South Robins Way, Chandler, AZ 85225. Contact Reed Huish: 602-814-7865, Fax 602-821-0967, e-mail: info@zenergy.com

Note: The Fusion Information Center has been acting as an information source to many of these companies. We expect to augment our international service to provide contacts, information, and business opportunities to companies considering an entry into the enhanced energy market.

## INFORMATION SOURCES

Academy for New Energy (ANE) is a subsidiary organization to the International Association for New Science, which has specific goals directed toward the field of alternative and "New" energy research. 1304 S. College Ave., Fort Collins, CO 80524. Tel. 970-482-3731

*ANE Newsletter*, quarterly publication of ANE, providing an open forum for discussion, and disseminating newsworthy and inspirational information on invention and new energy. Edited by Robert Emmerich.

*Advanced Energy Network Newsletter*, quarterly, a reprint of articles and papers from other energy publications, with book reviews and worldwide conference list. Advanced Energy Network, P.O. Box 691, Rondebosch 7700 Capetown, Rep. South Africa.

*Cold Fusion*, monthly newsletter, edited by Wayne Green, 70 Route 202N, Petersborough, NH 03458.

*Cold Fusion Times,* quarterly newsletter published by Dr. Mitchell Swartz, P.O. Box 81135, Wellesley Hills MA 02181. Home Page: http://world.std.com/~mica/cft.html

*Cycles*, a R&D newsletter, published by Dieter Soegemeier, Editor, GPO Box 269, Brisbane, QLD.4001, Australia. Phone/Fax: +61 (0)7 3809 3257.

*Electric Spacecraft Journal*, quarterly, edited by Charles A. Yost, 73 Sunlight Drive, Leicester, NC 28748.

*Electrifying Times*, 3/year magazine, covers electric vehicles extensively, magnetic motors, and battery development.
63600 Deschutes Market Rd, Bend, OR 97701
541-388-1908, Fax 541-388-2750, E-mail <etimes@teleport.com>
www.teleport.com/~etimes/

***Fusion Facts* monthly newsletter. Salt Lake City, UT. 801-583-6232, see *Journal of New Energy.***

*Fusion Technology,* Journal of the American Nuclear Society, edited by Dr. George Miley, publishes some papers on cold nuclear fusion. 555 N. Kensington Ave., La Grange Park, IL 60525.

*Infinite Energy,* new bi-monthly newsletter edited by Dr. Eugene Mallove (author of **Fire from Ice**), P.O. Box 2816, Concord, NH 03302-2816. Voice: 603-228-4516. Fax: 603-224-5975
E-mail 76570.2270@compuserve.com

**Institute for New Energy (INE), organization to promote and help find funding for new energy research.**
**Home Page: www.padrak.com/ine/ contains many important scientific papers and current reports on all areas of research.**
**E-mail: ine@padrak.com Salt Lake City, Utah.**
**Voice 801-583-6232, Fax 801-583-2963.**

***New Energy News* monthly newsletter for INE, highlighting the research and development in the worldwide new energy arena. Edited by Hal Fox.**

***Journal of New Energy*, quarterly, presenting papers representing the new areas of energy research, leading-edge ideas in the development of new energy technology, and the theories behind them. Published by the Fusion Information Center, Inc. Editor: Hal Fox.**

KeelyNet BBS - Science and health oriented information exchange that specializes in nonstandard research, much of it on new energy. Jerry Decker, 214-324-3501
Internet: www.keelynet.com E-mail: jdecker@keelynet.com

*Planetary Association for Clean Energy Newsletter*, quarterly, edited by Dr. Andrew Michrowski. 100 Bronson Ave, # 1001, Ottawa, Ontario K1R 6G8, Canada. Web page: http://energie.keng.de/~pace

Now available: *Clean Energy Review*, a technical and scientific discussion on nuclear fuel wastes disposal. Discusses transmutation as one possible solution. $5 U.S. and Canadian, $7.50 other countries.

*Space Energy Journal*, quarterly, edited by Jim Kettner & Don Kelly, P.O. Box 1136, Clearwater, FL 34617-1136.

The above list of commercial and information sources will be growing. New listings will be added as information is received. Send information to *NEN,* P.O. Box 58639, Salt Lake City, UT, 84158.

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