FUSION facts

A Monthly Newsletter Providing Factual Reports On Cold Fusion Developments

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

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ERROR NOTICE

A mistake in translation was noted in the September issue of *Fusion Facts*. We have corrected the error and have enclosed with this issue a new replacement sheet with pages 15 and 16 as corrected. Please insert this new sheet in your September 1991 issue.

LATE NEWS FLASH

Courtesy of Prof. Carlos Sanchez

World's first Cold Fusion Doctoral Thesis?

On July 17th, 1991, Mr. J. Sevilla presented his Doctoral Thesis, "Hydrogen absorption and nuclear effects in Cold Fusion Experiments," to an international jury at the Universidad Autonoma de Madrid. He is now Dr. Sevilla and received a "Cum Laudem" for his Ph. D. degree in Physics.

A. LETTER TO THEORETICIANS

From Dr. David J. Nagel, Superintendent
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Open Letter to Cold Fusion Theoreticians

Ideas abound to explain the occurrence and characteristics of low energy (low temperature) nuclear reactions in condensed matter. Their essence and elaboration are of broad interest, especially to those doing experiments on or related to cold fusion. However, some of the theories are complex and most have evolved since their original formulation. In order to promote wider understanding of the contents and status of cold fusion theories, I am seeking answers to several questions from the proponents of each major cold fusion theory or model.

These are the questions to be addressed:

1. What are the basic physical ideas?

2. What nuclear (or other) reactions are involved, either by class or by specific reaction?

3. What host materials are acceptable or excluded?

4. What ambient conditions, e.g., temperature, and time variations or spatial gradients are required?

5. What is predicted in terms of heat generation, particle emission and energy, etc.?

6. What phenomenon does the theory/model exclude, that is, what does it predict not to happen?

7. Can the theory/model explain loading (e.g., D/Pd) requirements, incubation times, bursts, and other characteristics common to cold fusion experiments?

8. Has the theoretical formulation been made quantitative, that is, reduced to numbers?

9. What past experimental results does the theory/model explain, such as low neutron/tritium ratios?

10. What future experimental results does the theory/model predict, such as correlations between heat and nuclear particle production?

11. What experimental results would either solidly validate or refute the theory/model?

12. What are the implications of the theory/model outside of "cold fusion"? That is, what other experiments or observations does the theory/model explain or predict? For example, is the theory consistent the understanding of superconductivity?

13. What are the major shortcomings or problems with the theory/model and computational results based on the theory/model?

Comments, and additions to this list, are welcome. It would be most widely useful if the answers to these questions and any comments were published in *Fusion Facts*. However, a private correspondence would also be appreciated.

EDITOR'S COMMENTS

Fusion Facts welcomes this communication from Dr. Nagel. We challenge our theorist readers, such as Drs. Bass, Bush, Chubb & Chubb, Hagelstein, Mayer, Preparata, Schwinger, and many others, to respond to the above questions and send a copy to *Fusion Facts*. We will be pleased to publish your contributions.

B. COLD FUSION AND ZPE

By Hal Fox

Although Dr. M. H. Miles and his group [1] have made good progress in identifying ^{4}He as a major byproduct of the nuclear reactions produced by a working cold fusion cell, not all of the excess heat has, as yet, been explained. To the extent that excess heat is produced in a Pons-Fleischmann electrochemical cell and is not accounted for by nuclear reactions there is a possibility that Zero-Point Energy (ZPE) may be involved. Admittedly, the tapping of ZPE may appear to be an unusual (to some - an outrageous) suggestion. However, *Fusion Facts* is dedicated to bringing to its readers information, resource citations, and an exchange of scholarly ideas that are involved (or may be involved) in enhanced energy devices.

This writer has had the privilege of meeting and discussing ZPE with Dr. Hal Puthoff [2,3,4]. In addition, I recently have had the pleasure of meeting briefly with Dr. Kiril Chukanov and seeing the equipment he uses to produce ball lightning and excess energy [5]. These visits together with a careful review of Ken Shoulders' electron-bead patent has provided an expanded view of new technology which may be involved in the development of commercial clean energy systems. In addition, the work by Dr. Randall Mills [6] in which he obtains excess energy using light water should not be dismissed. This is especially true now that replication has been achieved in at least two independent laboratories.

We have all been taught that the best theories are often the most parsimonious in terms of complexity of explanation. Therefore, we seek to find the simplest explanations for new phenomenon. Hal Puthoff has explained the creation of electron beads by showing that the Casimir force can be larger than the Coulomb forces within certain dimensions. Puthoff suggests that these electron beads capture some ZPE which can then be recovered. Chukanov has demonstrated that ball lightning can be produced. Within this plasmoid-like structure are things which, to quote Chukanov, "are like seeds in raspberry jam". It is suggested that these "seeds" are electron beads and that Puthoff's explanation of tapping ZPE with electron beads is valid for Chukanov's measurements of excess energy. Chukanov has a different theory.

Mills theorizes that his excess energy is derived from the collapse of the hydrogen atom below its ground state. A few dozen theories have been presented to explain the excess heat produced in a successful Pons-Fleischmann electrochemical [Li-Pd-D_2O] cell. The purpose of this note is two-fold:

1. To expand our collective consideration of enhanced energy devices and, hopefully, discover a simple explanation to cover all observed phenomenon.

2. To explain to our readers why *Fusion Facts* is reporting on technologies outside of the cold fusion literature.

One of the important things that must be explained by a cold fusion theory is how the Coulomb barrier can be overcome so that fusion events can occur in or on a metal lattice. Now that we know that electron beads and ball lightning can be formed, we know that nature knows how to overcome the Coulomb barrier. *Fusion Facts* earnestly solicits your ideas, letters, and comments on these new technologies. Can any one of you suggest how an electrochemical cell (either Pons-Fleischmann-type or Mills-type) can tap zero-point energy? If, after reading some of the latest papers about the energy which might exist in the vacuum of space, you do not accept the energetic nature of free space, then can you offer alternative explanations?

REFERENCES:

[1] M.H. Miles, G.S. Ostrom, (Naval Weapons Center, China Lake) B.F. Bush, J.J. Lagowski, (Dept of Chem, U of Austin, Texas), "Heat and Helium Production in Cold Fusion Experiments," Proceedings of The Second Annual Conference on Cold Fusion, June 30-July4, 1991, Como, Italy. See also *J. Electroanal Chem,* **304**, p 271, 1991.

[2] Harold Puthoff, "Everything for nothing," *New Scientist,* pp 52-55, (28 July 1990).

[3] Harold Puthoff, "Where does the zero-point energy come from?" *New Scientist,* p 36, (2 December 1989).

[4] Harold E. Puthoff, "The energetic vacuum: implications for energy research", *Speculations in Science and Technology,* Vol 13, No 4, pp 247-257, (1990), 33 refs.

[5] Kiril Chukanov, "Ball Lightning as a New Soruce of Energy", unpublished manuscript translated from Bulgarian, 4 pages, 2 figs, 1 ref. See review in this issue on page 13.

[6] Randell L. Mills, Steven P. Kneizys, "Excess Heat Production by the Electrolysis of an Aqueous Potassium Carbonate Electrolyte and the Implications for Cold Fusion," *Fusion Technology*, Vol 20, No 1, pp 65-81, (August 1991), 10 refs.

C. NEWS FROM THE U.S.

RESEARCH PROJECTS SPONSORED BY EPRI AND POWER UTILITIES

Courtesy of Mark Hugo

University of Rochester sponsored by the Rochester Gas & Electric Corp., "Cold Fusion: Measurements," duration: 890701 to 901231.

ABSTRACT

During March 1989, two University of Utah researchers announced they had succeeded in generating excess energy from cold nuclear fusion with a tabletop device (palladium rod immersed in an electrolytic cell containing heavy water with deuterium). Verification was announced almost immediately by Brigham Young University [sic]. Many laboratories raced to confirm or disprove the findings and much skepticism has surfaced regarding the existence of cold fusion. Results have been both positive and negative. The controversy continues. EPRI has approved $2.4M in research projects over the next three years to Texas A&M and other locations to investigate the responsible phenomena. The University of Rochester has been conducting experiments in an attempt to reproduce the results obtained at the University of Utah. After electrolysis, the palladium electrode was placed inside a vacuum chamber connected to a mass spectrometer. The mass spectrometer results displayed peaks at an atomic mass unit of three and four. This experimental evidence hints at the possibility of fusion reaction products but further experimental work is required to confirm their existence. More sophisticated measurements will be performed as a part of the project. The objective of this project is to gain increased theoretical and experimental knowledge on cold [fusion] activities, worldwide, by producing a literature survey (experimental and theoretical) of published information. Experimental investigations will be conducted in two modes: (a) electrochemically-induced fusion; and (b) high pressure-high temperature process in which palladium is exposed to high pressure deuterium at temperatures up to 300 degrees centigrade. This is a "Sponsored Project" under the UR Research Fund.

SRI, International sponsored by Electric Power Research Inst. (EPRI), "Separate Effect Tests to Understand Cold Fusion Phenomena.", duration: 891027 to 891231.

ABSTRACT

Recently several laboratories have produced evidence in support of the Phenomenon of "cold fusion." Of most significance to those interested in the practical application of this phenomenon are the reports of large amounts of heat and generation of tritium. However, one of the most puzzling aspects of these finds is the **apparent random occurrence of this heat and tritium**. The experimental system, while apparently simple, contains many variables that in combination probably affect the occurrence or absence of the phenomenon. To understand the role that current distribution may have in cold fusion, we need to conduct experiments designed to study the effects of cell geometry on current distribution and its consequent effects on the spatial dependence of the D/Pd ratio in the cathode. Specific tasks include: (1) measure the electrochemical parameters of a typical electrochemical fusion cell, including the cell voltage and current, the anode and cathode overvoltages, the electrochemical impedance, and the conductivity and temperature of the electrolyte; and (2) measure any other parameters relevant to the phenomenon.

Texas A&M Research Foundation sponsored by EPRI, "Nuclear Reactions in Cold Fusion," duration: 891121 to 900215.

ABSTRACT

The phenomenon of cold fusion has received considerable attention since the initial report of heat release and of the detection of nuclear products from electrolytic cells. The nuclear data have been shown to be in error, but reports of small amounts of neutron emission from electrolytic cells appear to be correct. The intense interest in the field reflects the unlimited economic importance that controlled nuclear fusion could have in the future. Through the reconfiguration of existing research equipment, the program outlined here has applied and developed nuclear techniques in the confirmation of neutron emission and in the discovery of tritium production on Pd-Ni electrolytic cells. This effort will apply technology in terms of nuclear detection techniques, but tailor it to the rather unusual environment of chemical cells and low background. The existing technology base has allowed a rapid and considerable impact on the cold fusion area. This project will help to sustain the effort with supplies and personnel dedicated to fusion research. **Neutron emission from electrolytic cells has been established in the present program, and large tritium yields have been found in nine cells,** suggesting strongly that nuclear fusion has taken place.

Texas A&M Research Foundation sponsored by EPRI, "Nuclear Reactions in Cold Fusion," duration: 910101 to 920228.

ABSTRACT

The major objective of this project is to conduct a search through various cell parameters in order to characterize the mechanisms that may be operating to produce nuclear reactions. This effort will apply technology in terms of nuclear detection techniques, but tailor it to the rather unusual environment of chemical cells and low background. The existing technology base has allowed a rapid and considerable impact on the cold fusion area. This project will help to sustain the effort with supplies and personnel dedicated to fusion research. **Neutron emission from electrolytic cell has been established in the present program, and large tritium yields have been found in nine cells,** suggesting strongly that nuclear fusion has taken place. The major goals of this project fall into two categories: (1) the measurement of neutron emission from electrolytic and gas phase cells, and (2) a thorough program on the verification of tritium production. Three types of cells based on deuterium in metals will be investigated: (1) the electrolytic cell of Fleischmann and Pons; (2) the electrolytic cell of Jones; and (3) high pressure, low temperature D_2 gas with Pd, Ti and several alloys.

NEI International Combustion Ltd., Stanford University sponsored by EPRI, "Exploratory Research Investigations of Cold Nuclear Fusion in Solids," duration: 890101 to 921231.

ABSTRACT

Recent experimental evidence suggests that deuterium nuclear fusion can occur in solids at room temperature. If some of the experiments prove to be correct, the rates of fusion can be substantial (20 to 30 watts per cubic centimeter [of Pd] even with crude apparatus. The objective of this project is to pursue: ways to enhance the phenomena; use of alternative, nonelectrolytic means; alternatives for energy extraction, including direct energy conversion; and testing of laboratory-scale prototypes of devices for utility use. This project will be conducted only if sufficient interim information is obtained from ongoing experimental work by EPRI and others confirming the existence of a cold fusion phenomenon.

Texas A&M Research Foundation sponsored by EPRI, "Surface Electrochemical Studies of Palladium in Alkaline D_2O Solutions," duration: 890810 to 891231.

ABSTRACT

The systematic investigation of the influence or surface purity and/or composition on the possibility of deuterium fusion in Pd electrodes is the principal objective of this research effort. Although experiments by various groups on excess heat generation have largely been successful, **skepticism is pervasive, especially because detection of nuclear particles and/or radiation has not been unambiguously established.** A principal feature in all of the studies reported to date is the irreproducibility of results from various research groups. Presumably, this **irreproducibility stems primarily from the fact that optimum experimental conditions for this process have not yet been identified.** The strategy to be pursued will center around the use of a unique electrochemistry-surface spectroscopy instrument. The main surface analytical tools that will be relevant to this research are Auger electron spectroscopy (AES), X-ray photoelectron spectroscopy (XPS), IR reflection-absorption spectroscopy (IRRAS), and thermal desorption mass spectrometry (TDMS). AES and XPS determine surface elemental composition; XPS helps distinguish between elements of different oxidation states. IRRAS will assist in identifying surface species. TDMS is important in probing species that are desorbed from the surface and the bulk of the Pd electrode upon thermal treatment. It is important to emphasize that, in view of the alleged sloppiness of many of the ongoing studies in electrochemically induced cold fusion, it will be essential that this experiment be done with utmost care. A primary concern will be the

reproducibility of the experimental conditions and results. EPRI shall implement and maintain a program that ensures correct handling of tritium and any other radioactive substances generated in these experiments, and shall ensure that proper equipment and procedures are used to prevent any health hazard which could be presented by radioactivity from "cold-fusion" experiments.

SRI, International sponsored by EPRI, "Development of Advanced Concepts for Nuclear Processes in Deuterated Metals," duration: 900201 to 911231.

ABSTRACT

This project potentially examines the phenomenon of "cold" fusion. The experiments have the following objectives: (A) verify the results of calorimetric experiments performed by both contractor and Stanford University under prior EPRI contracts; (B) explore and optimize the parameters that produce the anomalous or excess heat in the calorimetric experiments by making suitable changes in material preparation, electrolyte purity, and other conditions; (C) explore and enhance the phenomena associated with "cold" fusion, principally the production of tritium, neutrons, and possible gamma radiation; (D) seek a fundamental understanding of the origins of the observed phenomena; (E) seek ways to enhance the phenomenon; and (F) begin to explore the ways of contributions under which the phenomenon can be initiated, and seek some clarification of the type of nuclear byproducts that may be produced. Tasks include: (1) calorimetry; (2) surface electrochemistry; (3) materials issues; (4) nuclear products; and (5) scale-up. Specific tasks include: (1) materials exchange experiment; (2) test effects of electrolyte purity; (3) test effects of current and voltage transients; (4) temperature effects; (5) optimization of parameters; (6) physical and chemical properties of electrodes; (7) concurrent plastic deformation; (8) effects of electromagnetic energy; (9) high temperature tests; and (10) radiation measurements.

University of Kentucky sponsored by EPRI, "Physical and Electrical Properties of Two-Dimension Metal Hydrides," duration: 900511 to 910901.

ABSTRACT

The purpose of this research is to examine the nature of the metallic state of novel two-dimensional layered hydrides (deuterides) in which the hydrogen (1s) band is cut by the Fermi energy. If funds permit, the University will carry out preliminary experiments to search for products of cold fusion. These experiments might involve the submersion of the hydride GICs in a liquid scintillator, or placing the material in proximity to a surface barrier detector. Experiments in which pulsed high currents are used to simulate cold fusion will be considered.

SRI, International sponsored by EPRI, "Electromechanical Fusion Studies," duration: 890801 to 900630.

ABSTRACT

SRI, International will perform an experimental evaluation of the conditions and parameters of electrochemically-induced "cold" fusion. Specific tasks include: (1) SRI Differential Calorimetry to investigate temperature increases, if any, and determine whether they are due to an increased power input or to other sources; (2) detection of radioactive particles by means of a variety of detectors positioned around a reaction cell, the entire experimental setup enclosed in an ant-coincidence shield; (3) determination of the resistance of Pd metal as a function of deuterium loading Pd; (4) flow calorimetric determination of the total heat output for an electrochemical D/Pd cell; and (5) diffusion coefficient measurements.

Colorado School of Mines sponsored by EPRI, "Search for Nuclear Products from Condensed Matter Fusion," duration: 900201 to 920331.

ABSTRACT

The most important objective of this work is to demonstrate that nuclear effects indeed occur in some deuterium/metal systems close to, or below, room temperature and to discover if their origin involves new nuclear physics. These findings, if positive, must be developed to demonstrate reproducible behavior. It is important that such results be demonstrated with sufficient quality that they can be published in major peer-reviewed journals. In addition, it is an objective to discover as much as possible about the nuclear reaction and the conditions that are responsible for them. Specific tasks include: (1) neutron burst time structure; (2) pressure loading; (3) electric discharge; (4) ion implantation; (5) particle identification; (6) workshop support for the Workshop on Anomalous Nuclear Effects in Deuterium/Solid Systems, held in Utah in October 1990; (7) development of an eight-channel CAMAC - base multiparameter analog-to-digital converter; (8) completion and installation of a new spectrometer chamber; (9) a focus on low energy deuterium plasma interaction with Titanium; (10) neutron/gamma studies at Kamioka, Japan; (11) charged particle/neutron detection at BYU; (12) neutron burst time structure; (13) neutron detection at the University of Hawaii; (14) identification of trigger mechanism; and (15) cooperation.

University of Rochester sponsored by Rochester Gas & Electric Corp, "University of Rochester (UR) Research Fund," duration: 890701 to 931231.

ABSTRACT

RG&E supports research in energy-related fields at academic institutions. Funding may be provided to investigate specific needs or to support traditional institutional costs related to energy research. Such research is performed by graduate students, postdoctoral fellows, faculty, or incorporated (academic) organization. In most cases, educational institutions are supported on a project basis for their research expertise in addressing a specific objective. During 1989, RG&E initiated a Research Fund with a local university. The energy-related research activities to be undertaken would be classified either as Sponsored Projects or Advanced Projects. Sponsored Projects would be directed research in areas of priority importance to RG&E based upon proposal selections from the nearer-term time frame in the utility arena. Advanced Projects would be nondirected, longer-termed research, and less mutual agreement of a selection committee comprised of RG&E and university representatives. Base funding for Sponsored and Advanced are accommodated under this Research Fund. Four sponsored research projects are currently underway: (1) Computerized Chromosome Fragment Counting; (2) Crack Identification and Characterization; (3) EMF Study on Mammalian Cell Growth; and (4) Cold Fusion: Measurements.

ARIZONA - FUSION IN JUPITER

Mariusz Gajda and Johann Rafelski (Dep. Phys., Univ. Arizona, USA), "Jovian limits on conventional cold fusion", *J. Phys. G: Nucl. Part. Phys.*, Vol 17, No 5, pp 653-61, 1991.

AUTHORS' ABSTRACT

The fusion rates are evaluated occurring naturally and according to conventional wisdom in the planet Jupiter. In particular, considerations are given if any significant part of Jupiter's excess heat could be due to fusion, and ● if significant limits arise for terrestrial cold fusion experiments.

CALIFORNIA - see also UCLA

CALIFORNIA - FUSION NOT PRACTICAL

Courtesy of Steve Roen

Glenn T. Seaborg (University of California, Berkeley), "Cold Shoulder: Scorned now, fusion may answer our energy problems," *Omni*, September 1991.

AUTHORS' COMMENTS

After careful evaluation, I do not foresee cold fusion as a practical source of energy at any time in the future. However, there would be a fantastic payoff for such an improbable source of energy, and in the spirit of scientific inquiry, the whole process should be better understood. Therefore I agree with the recommendation of the cold fusion panel that modest support should be given for cold fusion research.

EDITOR'S COMMENTS

Here is another example of another scientist who makes professional statements, apparently without reading the literature. Does Seaborg depend on the now outdated and discredited cold fusion panel's recommendations? A recent check with the DoE shows that they are not providing even "modest support" for cold fusion.

CALIFORNIA - COLOR FORCE TO FUSE

Courtesy of Dr. Samuel Faile

Shu-Yuan Chu and Benjamin C. Shen (Physics Dept., University of California, Riverside), "Can the color force be used to achieve fusion?" *Modern Physics Letters A*, Vol 6, No 3, pp 237-244, 4 Refs, Jan 30, 1991.

AUTHORS' ABSTRACT

We explore the possibility that the color force can be used to overcome the Coulomb barrier in fusion. If there are small deviations from exact color neutrality, large separations of color may occur when two elements of opposite color defects are mixed non-uniformly. In order to restore color neutrality locally, the strong color force polarizes the nuclei and brings them close enough to fuse. If palladium and deuterium are such elements, it is possible that all the recent cold fusion results are but different manifestations of the above process.

EDITOR'S COMMENTS

The authors make the following statement, "Ideally one should conduct a cold fusion experiment by creating and maintaining a density gradient of deuterons in palladium. One possible way to achieve this is by forcing the deuterons through a thin sheet of Pd, maintaining a known concentration difference between the two sides of the sheet. Varying the concentration difference and the thickness of the sheet should give different types of experimental signals." It would also appear to be possible

to create a deuteron density gradient by the internal structure of the electrochemical cell. For example, in the patent applications by Pons and Fleischmann [1] as contrasted with Schoessow [2], there are distinct differences in the cell configuration which would be expected to provide considerable differences in deuteron gradient.

[1] Pons et al, "Method and Apparatus for Power Generation," International Publication Number WO 90/10935, 20 Sept 1990.

[2] Schoessow, "Electrochemical Nuclear Process and Apparatus for Producing Tritium, Heat, and Radiation," International Publication Number WO 91/02360, 21 Feb 1991.

CALIFORNIA - THERMAL MEASUREMENTS

Andreas Belzner, Ulrike Bischler, Steven Crouch-Baker, Turgut M. Gur, George Lucier, Martha Schreiber, Robert A. Huggins (Dept. Mat. Sci. Eng., Stanford Univ., USA), "Two fast mixed-conductor systems: deuterium and hydrogen in palladium -- thermal measurements and experimental considerations," *J. Fusion Energy,* Vol 9, No 2, pp 219-227, 1990.

AUTHORS' ABSTRACT

A direct comparison was made of the thermal behavior during electrolysis of the deuterium-palladium system with the hydrogen-palladium system. Experiments were conducted using isoperibolic calorimetry. A 0.1 M LiOH solution was used with H_2O in 1 of 2 closely comparable cells and 0.1 M LiOD in D_2O in the other. The thermal power output and the electric power input is discussed.

GEORGIA - VIRTUAL ELECTRON CAPTURE

J.J. Russell, Jr. (USA), "Virtual electron capture in deuterium," *Ann. Nucl. Energy*, Vol 18, No 2, pp 75-79, 1991.

AUTHOR'S ABSTRACT

An unconventional quantum mechanical description is used to describe the process of a D nucleus capturing its orbital electron to temporarily become a di-neutron plus a bound neutrino. The resulting rates so estimated are consistent with the phenomena of cold fusion provided the rest mass of the neutrino is very approximately 0.1 eV.

ILLINOIS - DEUTERON DISINTEGRATION

Courtesy of Dr. Samuel Faile

M. Ragheb and G.H. Miley (Dept. Nucl. Eng., Univ. Illinois, USA), "Deuteron Disintegration in Condensed Media," *J. of Fusion Energy*, Vol **9**, No 4, pp 429-435, 6 fig, 21 ref, 1990.

AUTHORS' ABSTRACT

We discuss the Oppenheimer-Phillips process as a possible phenomenon leading to deuteron disintegration due to polarization in the Coulomb field of a target nucleus. This reaction may be possible in the context of electrochemically compressed deuterons in a palladium cathode. The process is exothermic and may lead to neutron capture from the deuterons into the palladium isotopes, as well as between the deuterons themselves. **In the last case, the equivalent of the proton branch of the D-D fusion reaction occurs in preference to the neutron branch.** Such a process could provide a model for the processes involved in the observed energy release and tritium production in conjunction with neutron suppression in recent experiments. Possible interactions with Be and fertile isotopes are discussed in the context of breeding fissile isotopes in subcritical configurations.

ILLINOIS - COMMENTS ABOUT DIAGNOSTICS

Courtesy of Dr. Samuel Faile

George H. Miley and Magdi Ragheb (Fusion Studies Lab., Univ. Illinois, USA) and Heinrich Hora (Dept. Theor. Phys., Univ. New S. Wales, Aust.), "Comments About Diagnostics for Nuclear Reaction Products from Cold Fusion," NSF/EPRI Workshop, Oct. 16-18, 1989, 23 pp, 10 fig, 15 Ref.

AUTHORS' INTRODUCTION

An uncertainty still remains about whether or not cold fusion actually exists. Experiments that support this possibility have been reported by some laboratories but a number of negative experiments have also been obtained by very reputable groups. In the present discussion, however, we will simply make the assumption that the phenomenon occurs and proceed to discuss diagnostic requirements to confirm the production of nuclear products and shed light on possible reaction mechanisms.

Since the reaction mechanism(s) is(are) presently unknown, we must consider a wide variety of diagnostics. Much of the focus to date has been on use of calorimetry to measure excess heat production. This is an important diagnostic but requires extremely careful control. Also, taken alone, it will not resolve the issue of the existence of fusion reactions, i.e., the need to simultaneously

confirm the generation of fusion reaction products. In that respect, neutron measurements have been a primary focus, but this approach has faced many problems due to the low signal-to-noise ratio typically involved. Thus we must consider other possible reaction products. Helium is frequently mentioned, but in view of the variety of products that could occur, an appropriately diagnosed experiment should consider a wide range of possibilities.

Indeed, the problem becomes even more complex when we consider that different mechanisms may be operative in different experiments. This can confuse and cloud the issue unless this possibility is recognized in advance and incorporated into the diagnostics plan. For example, some experiments appear to have neutron bursts associated with high-field acceleration of deuterons caused by crack propagation in the electrode. In that case, one would expect conventional d-d reaction to occur as a result of beam-target type fusion. Then equal rates of neutron and tritium production should occur. On the other hand, if an entirely different mechanism is found under different experimental conditions (e.g., tunneling through the Coulomb barrier combined with the high density at the reaction site), this could possibly lead to a different channel for decay of the compound nucleus created in fusion. As a result, uneven ratios of tritium/neutrons or even different reaction products might occur. Consequently, until these experiments are better understood, the observation of different experimental arrangements does not necessarily indicate an inconsistency. Further, experimenters must remain alert to the possibility of a variety of reaction products and provide the necessary array of diagnostics to handle this situation.

AUTHORS' CONCLUSION

The objective of nuclear product diagnostics is to identify the mechanism(s) involved in cold fusion. Thus the choice of diagnostics must be tied to a hypothesis (or conjecture) about the mechanism and the products involved. Any considerations of mechanisms must revolve around two key issues: how to explain the high reaction rates implied by some experiments and how to explain the unique branching ratios for reaction products that are observed. For example, there appears to be an indication from experiments at Los Alamos, Texas A&M, and Bombay that the tritium production rate is a factor if 10^8 to 10^9 higher than the neutron production rate. Also, there is some possible confirming evidence for a large branching ratio from ^{3}He measurements during the cluster experiments at SNL. However, it appears that the tritium production rate is still only able to account for 1% to 5% of the heating rate reported. These factors put together represent a very unique, but in some ways mutually exclusive set of circumstances. At present it is very difficult to explain how the high reaction rates can occur.

Various mechanisms that have been proposed however, might explain the branching ratios between reactions. For example, if the reaction were due to neutrons splitting (deuteron disintegration via Oppenheimer-Phillips reactions), the heating would occur from (d,p) reactions in the palladium. However, the tritium and neutron production would be attributed to the corresponding Oppenheimer-Phillips reaction of deuterium with itself, perhaps near the electrode surface. This would rationalize the high ratio of tritium/neutron production rate. Still it is not clear how tunneling (or whatever mechanism is involved) in the palladium would result in a higher rate for d,p reactions in the palladium than the corresponding d-d reaction.

The other possibility for tritium production, which might be more plausible in combination with heating via the d,p reaction in palladium, would be neutron/deuterium tunneling as suggested by Collins and discussed earlier. This would provide d-d reactions with low energy tritium production, avoiding 14-MeV neutron production.

While this line of reasoning provides some "clues," the mechanism involved remains a "wide open" issue. Thus we come back to the earlier discussion and again conclude that, in addition to an examination of the electrodes in search for palladium transmutation products and embedded helium (both He^4 and He^3), it is important to continue the search for neutrons, gamma rays and X rays with the objective of ultimately establishing both energy spectra and time history. In addition, certainly the study of tritium production which has already begun, should be continued with the goal of obtaining online measurements that can be time correlated with other products, e.g., with neutrons and heating rates. Other studies should focus on the issue of the possible existence of the very low fluxes of 14-MeV neutrons due to the secondary reactions of product tritium with deuterium.

The above remarks concentrate on the broad range of reaction products. However, in some specific experiments, more restricted objectives may be desireable. For example, in a number of instances neutron emission has been reported but the energy was not measured. In those cases, neutron energy resolution is an obvious goal. Also diagnostics should be considered with the objective of explaining the nonreproducibility and long delay times preceding rapid rises in the reaction rates that are reported in some experiments. Whether or not these observations are unique to certain classes of experiments, e.g., cases involving crack propagation, dendrite formation, etc. (vs. generic characteristics associated with all experiments) is not clear. It is essential to resolve this issue in order to solve the "mystery" of cold fusion. However, the explanation will probably require a combination of nuclear product detection and a variety

of other diagnostic techniques, e.g., a metallurgical examination of electrodes and electrode surfaces.

In closing, we should stress that the main thrust for fusion product detection should be to provide a correlation between several reaction products, thus shedding light on the mechanism involved, as well as unique characteristics such as the neutron bursts, delay times, etc. This will probably require an interdisciplinary team approach since the diagnostics involved span a variety of areas and optimized "operating" cells are difficult to obtain. Clearly a combination of the two requires experts' input from several disciplines.

IOWA - CLUSTER IMPACT FUSION

Courtesy of Dr. Samuel Faile

C.J. Benesh, J.R. Spence and J.P. Vary (Physics Department, Iowa St. Univ.), "Cluster Impact Fusion by the Formation of Compact Electron Deuteron Resonances," Abstract from *Bulletin of the American Physical Society*, Ser.II, Vol 35, No 8, page 1673.

AUTHORS' ABSTRACT

We speculate that the anomalously large cluster fusion yields measured at Brookhaven may be explained in terms of the formation of compact electron deuteron resonance states with energies of the order of electron volts above threshold. Similar states have been predicted to exist in the electron-proton system, and their geometrical sizes have been estimated to be of order fermis. We argue that these states, once formed, will screen the Coulomb repulsion between deuterons in a manner analogous to muon-catalyzed fusion, allowing fusion rates much higher than what one would ordinarily expect. Using a thermodynamic model for the cluster impact, we calculate the yield of resonances produced per cluster incident on the target. If we assume that each resonance formed produces one fusion event, we obtain a reasonable quantitative description of both the cluster size and energy dependence of the observed fusion yields.

IOWA - ABRIKOSOV VORTEX

Courtesy of Dr. Samuel Faile

Qiang Li, J.R. Clem, and D.K. Finnemore (Ames Lab. and Dept. Phys., Iowa State Univ., USA), "Nucleation and Motion of An Isolated Abrikosov Vortex," *Phys. Review B*, **43,** 12, pp 843-847, 5 fig., 9 Ref..

AUTHORS' ABSTRACT

A new family of superconductor--normal-metal--insulator--superconductor (S/I/N/S) Josephson junctions have been developed in which a single Abrikosov vortex can be nucleated and systematically moved to selected positions. The location of the vortex within the junction is determined from the shape of the diffraction patterns. Methods have been developed to push the vortex to most any desired location within the junction by applying currents in either or both of the cross-strip legs of the junction. The elementary pinning force for a vortex in a pure Pb film was measured and found to be much smaller than for a Pb-Bi film. In addition, the vortex moves in much smaller steps for the Pb film than was found for the Pb-Bi films. For S/I/N/S junctions, the voltages and currents are in the microvolt and milliamp range; so very conventional detection can be used if a device is to be built based on the motion of a single Abrikosov vortex.

[This paper was included because it has been suggested that superconductivity and cold fusion may have a common theoretical explanation. Ed.]

MASSACHUSETTS - QUANTUM MOTION OF H

Courtesy of Dr. Samuel Faile

C-H Hsu, B.E. Larson, M. El-Batanouny and C.R. Willis (Dept. Phys., Boston Univ., USA), K.M. Maritni (Dept. Phys and Astro., Univ. of Mass., USA), "Evidence of Quantum Motion of Hydrogen on Pd(111) in Helium-Diffraction Data," *Physical Review Letters,* Vol **66**, No 24, pp 3164-3167, 3 Fig, 16 Ref, 17 June 1991.

AUTHORS' ABSTRACT

We investigate the behavior of hydrogen on the Pd(111) surface by elastic scattering of a monoenergetic thermal He beam. Dramatic changes in the intensities of the diffraction peaks are observed as a function of sample temperature in the range 140-350 K, and are attributed to changes in H coverage. A consistent explanation of the diffraction data is achieved when we consider the H system as a correlated quantum fluid where particle delocalization occurs at medium and low coverages.

EDITOR'S COMMENTS

The authors show that a specular He beam can be used to determine the H coverage on the surface of the Pd. The authors note, "He scattering is sensitive to the atomic arrangement of **the topmost layer** only. Consequently, it can provide information about the distribution of H atoms on the Pd(111) surface." In their conclusions the authors cite two remarkable features and conclude, "Taken together, these features provide strong evidence of the fundamental change in the surface charge-density corrugation. A classical interpretation of the motion of hydrogen either fails to reproduce the measured attenuation or leads to contradictory and unphysical

conclusions regarding the metal-hydrogen bonding or the surface equilibrium. An alternative quantum-mechanical model has been introduced, with diffraction intensities interpreted with the sudden-approximation formalism. A consistent and satisfactory agreement with the variations in the measured diffraction intensities has been obtained."

MICHIGAN - EXCESS ENERGY PATENT

Courtesy of Dr. Samuel Faile

Joseph F. Pinkerton (Pinkerton Generator Inc.), "High Efficiency Electrical Machine," U.S. Patent No. 4,945,273, July 31, 1990, 67 claims, 5 drawings.

INVENTOR'S ABSTRACT

A rotor has outside conductors and inside conductors. The outside conductors are connected together at spaced connection points to form an outside loop which is preferably triangular. Each inside conductor has an outer end connected to one of the connection points, and an inner end provided with an output electrical connection. Each outside conductor and the inside conductors connected to its connection points form an inside loop that occupies only a portion of the rotor's circumference. The rotor lies in oppositely oriented magnetic fields which are disposed so that the total magnetic flux through all of the inside conductors varies during rotation, and the total magnetic flux across the outside loop is zero at all times during rotation.

EDITOR'S COMMENTS

The inventor states in the patent, "The arrangement of the conductors or the rotor and the positioning of the rotor with respect to the magnetic field has shown an improved efficiency over traditional electrical generating machines." This patent was referenced on page 23 of *Fusion Facts* for September 1991 and is included here for your information. Currently tests are being run to determine the overall efficiency of this device. Previous results indicate that excess energy has been achieved.

NEW MEXICO - SANDIA CITEST PROBLEMS

Bruce D. Kay, Keith R. Lykke, Richard J. Buss (Sandia Natl. Lab, Albuquerque, USA), Problems with the mass spectrometric determination of tritium from cold fusion", *J. Fusion Energy*, Vol 9, No 4, pp 491-3, 1990.

AUTHORS' ABSTRACT

Among the attempts to measure particles produced in the cold fusion of D in Pd metal is the mass spectrometric observation of T. An experiment which was reported in the popular press involves attaching a hollow Pd electrode to a vacuum chamber and measuring the T produced during electrolysis using a mass spectrometer. Data are presented demonstrating that mass 5 and 6, which could be mistaken for the ions DT^+ and T_2^+, can arise from ion-mol. reactions in the ionizer of the mass spectrometer giving the ions HD_2^+ and D_3^+. With H_2 and D_3 present in the vacuum chamber, there are about 8 reactions which lead to these triatomic species, and these may contribute to a complex time and pressure dependence of the signals.

NEW MEXICO - NEUTRON EMISSION

H.O. Menlove, M.M. Fowler, E. Garcia, M.C. Miller, M.A. Paciotti, R.R. Ryan, S.E. Jones (Los Alamos Natl. Lab., N.M.), "Measurement of neutron emission from titanium and palladium in pressurized deuterium gas and deuterium oxide electrolysis cells," *J. Fusion Energy*, Vol 9, No 4, pp 495-506, 1990.

AUTHORS' ABSTRACT

Experiments using high-efficiency neutron detectors detected neutron emission from various forms of Pd and Ti metal in pressurized D_2 gas cells and D_2O electrolysis cells. Four independent neutron detectors based on ^3He gas tubes were used. Both random neutrons (0.05-0.2 *n*/s) and time-correlated neutron bursts (10-280 *n*) of < 100 microsec's duration were measured using time-correlation counting techniques. The majority of the neutron burst events occurred at approx. 30 deg as the samples were warming up from the liquid N temperature.

NEW MEXICO - LEAF TURNER

Courtesy of Dr. Samuel Faile

Leaf Turner (LANL), "Thoughts Unbottled by Cold Fusion," *Physics Today*, p 142, Sept 1989.

AUTHOR'S INTRODUCTION

A possible explanation for the cold fusion phenomenon that seems to me to be missing from merely two-body explanations, such as those given by Clinton Van Siclen and Steven Jones or Steven Koonin and Michael Nauenberg and referenced by Levi, is that of enhanced transmission of deuterons through the deuteron Coulomb barriers because of resonances on the atomic scale. For example, instead of an exponentially small transmission coefficient, conventional quantum mechanics yields a transmission coefficient of unity whenever the resonance condition of Integral of k(x)dx = (n + 1/2)pi is satisfied by the wavenumber of the particles crossing the potential well between two barriers.

EDITOR'S COMMENTS

We missed listing this reference previously. It is important because Dr. Robert T. Bush cites Leaf Turner's suggestion in building his Transmission Resonance Model.

NEW YORK - FUSION BOOKS REVIEWED

Courtesy of Dr. Samuel Faile

Bruce V. Lewenstein (Prof of Communication, Cornell), "Energy in a Jar - The Search for Morals to the Cold Fusion Fiasco", *The Sciences*, pp 44-49, July/August 1991.

EDITOR'S COMMENTS

Bruce Lewenstein is co-director of the Cornell Cold Fusion Archive at Cornell. In this publication he reviews the two current books on cold fusion - by Frank Close and by Eugene F. Mallove. Lewenstein appears sold on the mistaken notion by Frank Close that Pons and Fleischmann failed to "do good science". He does get the main point of Mallove's book "Searching for the Truth Behind the Cold-Fusion Furor". The point noted by Lewenstein is, "It is time for the scientific community to turn its attention away from defining the morality of science and turn it toward defining the behavior of whatever unexpected phenomena its adherents discover." In focusing only on these two books, Lewenstein missed the opportunity for a more contemporary view of cold fusion which can be stated as: **It started with Pons and Fleischmann, has spread to over 23 countries (demonstrated by their successes), and is a revolution in science.**

SO. CAROLINA - ACOUSTIC/THERMAL EFFECTS

Robert L. Carroll, "Cavitation and Boundary Layer Acoustics," published by the Carroll Research Institute, P.O. Box 3425, Columbia, SC 28230, 15 manuscript pages, 3 refs.

ABSTRACT

It is shown that a boundary layer in a shearing flow acts as an acoustic generator. The acoustic intensity is calculated and applied to the problem of cavitation of high-speed marine propellers. The worst aspect is shown to be that of impact flow. Pressure variations in the interior of the blade yield values in excess of the destructive limit for the particular case chosen.

EDITOR'S COMMENTS

The conclusion of the paper is that cavitation damage depends on the high intensity of the acoustic wave in the interior of the metal. These acoustic waves stem from the continuous noise of the action of the driven propeller blades against the seawater boundary layer. Carroll points out, "The change in phase of the reflected wave must essentially double the effective pressure on the interior surface of metallic structures. This results in surface damage which continues with time for any flow velocity in excess of a lower limit of criticality. Surface erosion rates can be quite severe above this critical limit." Carroll shows in his paper that the Acoustic power per unit area is proportional to the ninth power of the wave velocity!

Carroll also shows that frequencies (inside the metal) can be very high and approach the range of molecular frequencies. At these high frequencies (above 10^9 Hz) the manifestations would be more thermal than acoustic. After some further equations, he concludes that "...the only external manifestation of the acoustic effect [inside the metal blade] is thermal in nature." The question that may be asked (in terms of cold fusion) is whether this work may have some importance in the dispersion of energy generated within a palladium lattice (such as from cracking, fracto-fusion, bubble formation, surface fusion events, etc.)? Compare this paper with Suplee's article on Sonoluminescence on the following page.

SOUTH CAROLINA - He IN TRITIDES

Courtesy of Dr. Samuel Faile

R.T. Walters, A. Nobile, Jr., and W.C. Mosley (Westinghouse Savannah River Laboratory, Aiken, S.C.), "Helium dynamics in metal tritides: II. The significance of microstructure in the observed helium behavior for La-Ni-Al tritides", *J. of Less-Common Metals,* **170**, pp 63-74, 7 figs., 17 ref., (1991).

AUTHORS' ABSTRACT

Helium from tritium decay causes the desorption isotherm plateau pressure for $LaNi_{4.25}Al_{0.75}$ tritide to be lowered. From the shape of the ^3He altered isotherm, it appears that the material becomes disordered and possibly disproportioned. The microstructure of the parent $LaNi_{4.25}Al_{0.75}$ tritide material is believed to influence the behavior of ^3He from tritium decay.

AUTHORS' INTRODUCTION

There is presently emphasis on understanding the properties of metals containing helium. As in most recent investigations into the behavior of helium in metals, these studies are facilitated by the solubility of tritium; tritium decay produces a distribution of helium throughout the metal lattice. This "tritium trick" is a means of charging metals with large amounts of helium without the complications associated with methods such as ion implantation. In the case of metal tritides, in general, and

intermetallic tritides in particular, very large tritium concentrations can be obtained causing severe changes to occur in the lattice when tritium transmutes into the larger virtually insoluble ^{3}He atom. Since most of the helium generated by tritium decay in a metal tritide is retained in the solid, the behavior of helium in metal tritides must be understood to design effectively gas handling systems which use metal tritides for tritium storage and compression. Also, these studies will contribute to the understanding of helium in metal.

UCLA - SONOLUMINESCENCE
Courtesy of Marge Hecht, 21st Cent. Sci. & Tech.

Curt Suplee (Washington Post Staff Writer), "Searching for Nature's Message in a Bottle of Glowing Water," *Washington Post*, Science, p A-3, August 12, 1991.

AUTHOR'S LEAD-IN

"SOUND THAT SHINES. Ordinary water can be made to glow through the phenomenon of sonoluminescence. Discovered half a century ago but still not understood, it happens when sound vibrations cause bubblelike cavities to form in the water and then collapse. As water molecules slam together, the energy of their motion is somehow converted into light."

EDITOR'S COMMENTS

Sound waves, under proper conditions, can cause water to emit light. This sonoluminescence was first reported in the 1930s, according to Suplee. In the 1980s, a group from the University of Mississippi developed this effect to where they could make a "trapped bubble" glow continuously. In 1989 Dr. Seth Putterman, a physicist at UCLA calculated that sound waves having an energy level of a fraction of an electron volt were producing photons with energy levels of 3 electron volts. His calculations showed that the effect was equivalent to having a 100 billion-to-one amplifier. Please note that this is not an amplifier that produces "excess energy," but an amplifier for a low-level to a high-level energy conversion. Dr. Putterman and Bradley Barber (a graduate student) are now able to produce a repeating blue pulsing light having a pulse duration of less than a billionth of a second with a high repetition rate. According to this article the light is similar to laser light (coherent). **Suplee makes the following statement, "At these points in the fluid, a collapsing bubble's volume shrinks by a factor of 100,000 in less than a billionth of a second, slamming the molecules together with tremendous force. Somehow--nobody knows exactly how--the force causes the water's atoms to emit the units of light called photons."** It appears to this editor that the article above on cavitation (By Dr. Robert L. Carroll) has at least a part of the answer.

VERMONT - PALLADIUM & DEUTERIUM
Courtesy of Dr. Samuel Faile

Ted B. Flanagan, W. Lui, & J.D. Clewley (Chem. Dept. U of Vermont), "Calorimetric enthalpies of absorption and desorption of protium and deuterium by palladium," *J of the Less-Common Metals*, Vol 172-174, pp 42-55, 6 figs, 21 refs, Aug 20, 1991.

AUTHORS' ABSTRACT

In this research enthalpies were measured calorimetrically for the reaction of gaseous hydrogen (protium or deuterium) with palladium over a range of hydrogen contents from H/Pd = 0 to about 0.77 (at 298 K). A twin-cell, heat leak differential calorimeter was employed for these measurements. Results for the hydride formation enthalpies are -19.1 kJ per mol H and -17.2 kJ per mol D at 298 K. Enthalpies of essentially the same magnitudes, i.e. +/- 0.1 kJ, are obtained from the decomposition of these hydrides. Entropies were determined from the calorimetrically measured enthalpies and the geometric mean of the plateau pressures for hydride formation and decomposition. The magnitudes of these entropies are 46.3 J per mol H per degree K and 46.7 J per mol D per deg K using the calorimetric enthalpies of absorption; they agree very well with values determined in the literature from van't Hoff plots of the plateau pressures. For the first time relative partial molar enthalpies have been obtained by calorimetry for the beta-phase of Pd-D. The magnitudes of these enthalpies decline markedly with increasing deuterium content. This largely accounts for the marked increase in mu_D with deuterium content and the concomitant difficulty in obtaining high values of D/Pd.

AUTHORS' CONCLUSIONS

The highly precise results (at 298 K) shown and discussed above, are completely consistent with Lasser's recent plateau thermodynamic parameters derived from van't Hoff plots. The present data do not offer support for the occurrence of any heat production in deuterated palladium, beyond that which is expected from the chemical reaction, because the values determined calorimetrically and from van't Hoff plots agree very well. Any additional heat production in the Pd-D system would also have been noted by unusual isotopic differences between the calorimetrically measured enthalpies for protium and deuterium. In the cold fusion type of experiment excess heat has been detected during dynamic conditions, i.e. during electrolysis. It should be noted that the enthalpies measured in this research also reflect dynamic conditions which occur during hydriding or dehydriding, i.e. the interface penetrates into the palladium during hydriding or the dilute phase penetrates into the hydride phase during decomposition.

EDITOR'S COMMENTS

In this research small pieces of palladium foil were used and mixed with finely divided copper. These samples were exposed to hydrogen gas and the heat of reaction(s) measured. Most of the measurements were made at 298 K. Accurate data was obtained for the heat of absorption and desorption. Unfortunately, no special attempts were made to get the D/Pd ratios high enough to correspond to the necessary (apparently) loading ratios for cold fusion reactions to occur (in an electrochemical cell).

WASHINGTON - CATALYZED FUSION

R.M. Karlsrud (Pacific NW Lab, Richland, WA), "Cold fusion catalyzed by muons and electrons," *Energy Res Abstr.*, Vol 15, No 23, Abstr. No 52517, 1990.

AUTHOR'S ABSTRACT

Two alternative methods were suggested to produce fusion power at low temperatures. The lst, muon-catalyzed fusion or MCF, uses muons to spontaneously catalyze fusion through muon mol. formation. Unfortunately, this method fails to generate enough fusion energy to supply the muons.

WASHINGTON, D.C. - THEORY

C.T. White, B.I. Dunlap, D. W. Brenner, R.C. Mowrey, J.W. Mintmire (Naval Res. Lab., Washington DC, USA), "Limits of chemical effects on cold fusion", *J. Fusion Energy*, Vol 9, No 3, pp 363-366, 1990.

AUTHORS' ABSTRACT

Cold fusion enhanced by chemical confinement of deuterons was suggested as an explanation of recent reports of the production of neutrons in electrochemically-generated PdD_X. To test this suggestion, local-d.-functional cluster calculations were used to study the Coulomb barrier between 2 deuterons within the octahedral cage in crystalline Pd. The calculated repulsive forces were always greater than the corresponding forces between deuterons in molecule D_2, implying that the room temperature fusion rate at this site is negligible.

D. NEWS FROM ABROAD

BULGARIA - ENERGY FROM BALL LIGHTNING

Kiril Chukanov, "Ball Lightning as a New Source of Energy," unpublished manuscript translated from Bulgarian, 4 manuscript pages, 2 figures, 1 ref.

EDITOR'S COMMENTS

Chukanov cites two conferences on ball lightning (Vaseda Univ., Tokyo, 1988 and Budapest in 1990.) The author cites the problems of logically explaining the compact gaseous body with a gas media: elastic noncompressible, forces of internal cohesion (ball lightning snakes through small openings and reforms without breaking), separation of charges within a plasma, continuous energy radiation, and enormous internal energy. Chukanov notes, "ball lightning behaves like an autonomous body unconnected with a current or wave conducting channel with any external energy source." In his explanation (not fully understood by this reader) Chukanov states, "Quantum limitations act in nature, determining the space, size and the energy of physical objects (cites Chukanov, "Quantum Limits" manuscript in Bulgarian). He goes on to explain that outside of the quantum limits there are regions in which the known laws of conservation of energy are not valid. Chukanov theorizes that the lightning ball is formed and obtains a "pure quantum gift from the **vacuum**." He goes on to state, "The conversion of energy from the ball lightning can be realized only by direct contact with another body. From such contact the hot ball lightning does not lose anything - it gives energy without using energy..." [we assume, within some limits. Ed.]

The paper states later, "The author has invented a reactor that will extract energy from the vacuum... There is no doubt that a new source of colossal energy has been discovered..." Chukanov states that he and his co-worker, P. Radivoev built a proof-of-concept device. They used a 120 liter vacuum chamber and a 6 kilowatt high frequency (27.12 MegaHz) generator operation in a vacuum of about 10^{-2} millibars. Spectral analysis of the lightning balls formed showed that the temperature was 10,000 to 20,000 °C. Chukanov states, "Combined calorimetric and electric measurements showed that, in continuous operation, ... produced output energy equal to twice the input energy." However, the low efficiency of the high frequency generator was such that the overall **system efficiency** was less than unity.

More information is expected to be obtained from Chukanov within the next few months concerning his latest ball lightning research.

GERMANY - NO NEUTRONS

Courtesy of Dr. Samuel Faile

W. Vielstich, T. Iwasita (Institute of Physical Chemistry, Univ. of Bonn), H. von Buttlar, K. Farzin and K. Uebelgunn (Inst. of Exp. Physics, Bochum, Germany), "Search for neutrons from controlled deuterium concentrations in palladium," *J. Electroanal Chem.*, Vol 303, pp 211-220, 5 figs, 14 refs, 25 Mar 1991.

AUTHORS' ABSTRACT

Neutron emission would be a convincing proof for cold fusion of deuterium in palladium as proposed by Fleischmann and Pons. In recent experiments essentially no neutron events of technical interest have been observed. But Jones et al. claim for deuterium charged titanium and palladium a low fusion rate of almost 10^{-23} events per second per D-pair above background. We have therefore repeated the search for neutrons, but using electrochemically controlled high deuterium concentrations in palladium and a NE-213 neutron detector of well known efficiency. The result of this investigation is that a possible fusion rate would be lower than 10^{-25} events per second and D-pair.

EDITOR'S COMMENTS

In this experiment neither the cell configuration nor the charging time appears to be appropriate to achieve the required D/Pd ratio of about 1.0 to expect cold fusion nuclear events to occur. It is a continuing source of interest that many experimenters fail to start with a successful arrangement before they launch into an experiment for cold fusion. It is strongly suggested that serious researchers correspond with the many experimenters who have successes in replicating cold fusion experiments before they design and carry out their own experiments.

GERMANY - MUON-CATALYZED FUSION

H.E. Rafelski, D. Harley, G.R. Shin, J. Rafelski (Inst. Theor. Phys., Univ. Frankfurt, Germany), "Cold fusion: muon-catalyzed fusion", *J. Phys. B, At. Mol. Opt. Phys.*, Vol 24, No 7, pp 1469-516, 1991.

AUTHORS' ABSTRACTS

A review with many references is given on the muon-catalyzed fusion, with the objective of identifying the key physical processes in the t(d,n)alpha fusion cycle relevant to energy related applications. The fusion cycle is discussed and the importance of direct nuclear reactions in the catalyzed fusion processes is shown. This is followed by an in-depth discussion of the muon loss reaction by attachment to the fusion alpha-particle. Finally, some special topics are examined that have attracted the attention of workers in the muon-catalyzed fusion (MuCF) community, such as energy efficient production of muons and proposals for MuCF reactors, the potential of Z > 1 fusion, and other recently discussed forms of cold fusion.

GERMANY - HYPERSPHERICAL FORMALISM

Courtesy of Dr. Samuel Faile

Michael Decker (Math. at Rheinischen Friedrich-Wilhelms-U, Bonn), "Neutron-deuteron problem in the hyperspherical formalism," *Univ. Bonn, Phys. Inst. Tech. Rept BONN-IR*, BONN-IR-91-13, 92 pages, 1991, in German.

AUTHOR'S ABSTRACT

The n-d problem is examined in hyperspherical coordinates using the Malfliet-Tijon potentials. Expanding the 3-body problems wave function in surface functions the Schroedinger equation is solved. The t binding energy as well as elastic scattering parameters are calculated

HUNGARY - FLASH ON COLD FUSION # 11

Courtesy of Dr. Samuel Faile

T. Braun (Ed. J Radioanal Nucl Chem), "World flash on cold fusion. No. 11. A selective, annotated bibliography," *J. Radioanal Nucl Chem,* Vol 19, No 4, pp 237-239, 1991.

AUTHOR'S ABSTRACT

A bibliographic flash with 25 references. Citations are classified by experimental effect detected (heat, neutrons, gamma, tritium), theory, or comments.

INDIA - COLD FUSION THEORY

Lali Chatterjee, Goutam Das (Phys. Dep., Jadavpur Univ., Calcutta), "Sub-barrier nuclear fusion of amuonic and muonic flavor," *Phys. Lett. A*, Vol 154, Nos 1-2, pp 5-8, 1991.

AUTHORS' ABSTRACT

Sub-barrier nuclear d-d fusion was investigated for low energies, using the Allis-Morse cut-off type screening potential. Cut-off parameters smaller than 0.1 Angstrom are required to explain the new experimental results for cold fusion in condensed matter. Possible theoretical bases for realizing such anomalous screening conditions are explored. The study is extended to collisional muon-catalyzed fusion as well.

INDIA - A REVIEW
Courtesy of the author.

S. Arunachalam, (Editor *Indian Journal of Technology),* "Chronicling Cold Fusion Developments," *Journal of Scientific & Industrial Research*, Vol 50, Jan 1991.

There is no other issue which has attracted media attention as much as 'cold fusion' had in the recent past. Majority of the scientific community has now dismissed it as simply a 'cold confusion' or an 'aberration in science;' but a few incorrigible optimists still feel that cold fusion is still not out of the race. The author focusses attention on the efforts being made by individuals and groups who keep track of developments in this field.

INDIA - PLASMA FOCUS
Courtesy of Dr. Samuel Faile

R.K. Rout, A. Shyam, V. Chitra, and M. Srinivasan (BARC), "Delayed Neutron Emission from a Plasma Focus with a Titanium Disc Affixed on its Central Electrode," *Japanese J of Applied Physics*, Vol 30, No. 8A, pp L1422-L1424, 2 Figs, 11 Refs, August 1991.

AUTHORS' ABSTRACT

A low energy (2kJ) plasma focus has been operated with central electrode end covered with 500 micro-meter thick disk of titanium. When this electrode was suitably conditioned and the device was operated at negative voltage, neutron emission from the plasma focus was observed even ten seconds after the focus formation.

EDITOR'S COMMENTS

When a titanium cap is subjected to 40-50 positive discharges and then subjected to negative plasma discharge, it is noted that neutrons of the order of 5×10^6 per discharge are produced. The unusual observation is that the neutron production is maximum at about 10 sec after the discharge and decay with about 23 sec halflife. The authors note that there is no known plasma focus mechanism which could explain the delayed neutron production. They suggest, "The delayed neutrons produced by the plasma focus may be by an anomalous mechanism in solids which may be similar to the neutron production in electrolytic or other experiments." Ideas anyone?

INDIA - HYDROGEN SOLUBILITY
Courtesy of Dr. Samuel Faile

R. Ramesh, S. Anapoorni and K.V.S. Rama Rao (Magnetism and Magnetic Materials Laboratory, Dept. of Phys., Indian Institute of Technology, Madras), "Solubility of hydrogen in Zr_{1-x} Ho_x Co_2 ($0 < x < 1$) alloys," *J. of Less-Common Metals*, **170**, pp 75-82, 4 figs, 13 refs, (1991).

AUTHORS' ABSTRACT

Hydrogen absorption studies were carried out on the pseudobinary system Zr_{1-x} Ho_x Co_2 (x=0.2, 0.4, 0.6, 0.8) belonging to the C15-type Laves phases in the temperature range $RT < T(^0C) < 300$ and the pressure range $0.001 < P$ (bar) < 1. Hydrogen absorption was found to increase with increasing holmium concentration. For the compositions x=0.6 and 0.8, the pressure-composition isotherms indicated the occurrence of a phase transformation. The relative partial molar enthalpy and entropy of hydrogen solution calculated for all the concentrations were found to be approximately -(7 to 18) kJ $(mol\ H)^{-1}$ and -(10 to 48) J K^{-1} $(mol\ H)^{-1}$ respectively.

JAPAN - REPORTING NEUTRONS
Courtesy of Jed Rothwell

"Detected Neutrons Indicate the Possibility of Cold Fusion," *Asahi Shinbun*, short newspaper article, June 19, 1991, page 2 of Science section. Translated by Jed Rothwell, July 1, 1991.

EDITOR'S COMMENTS

Immediately after the completion of the Kamioka-Cho (Univ of Tokyo, Cosmic Ray Research Institute) tests (ran from April 17, 1991 to May 22, 1991) of Jones (BYU) cold fusion experiment using a heavy-water electrochemical cell with Pd and Ni electrodes, a press conference was called in which negative results were reported. Later, a second report was given to *Asahi Shimbun*. The resulting article states, "The number of neutrons emitted every two thousandths of a second was studied. In six cases, more than two neutrons were counted. The highest number counted was four." As background radiation is about one neutron every four hours, the results would not be expected to occur. The article quotes Jones: "Dr. Jones had predicted that if a cold fusion reaction occurred, several tens of neutrons would be observed per millisecond. A very low number of neutrons was acutally observed; fewer than one tenth the number he had predicted. . . . "Dr. Jones said that in his view, the neutrons measured in this experiment, 'were caused by cold fusion.' However, Dr. Totsuka said that 'we cannot assert this at the present stage.' The heavy water in the experimental apparatus will be replaced with light water and the experiment run again according to the article. Because the head of the university was quoted as saying "if fusion is that easy, I will give up physics, shave my head, and become a Buddhist monk.", there is

apparently no rush to proclaim that cold fusion was observed. Jed Rothwell has been corresponding with several Japanese writers and scientists. He believes that the experiment was set up to prove that cold fusion is a fake and that the experimenters completely failed in that regards. Rothwell speculates that events in Japan are favorable to the acceptance of cold fusion as soon as the data analysis from Kamioka is completed and made public.

KOREA - PREVENTING OXIDATION

Courtesy of Dr. Samuel Faile

Dong-Bok Lee (Dept of Metallurgical Eng., Sung Kyun Kwan Univ., S. Korea) and G. Simkovich (Dept. Material Science and Eng., Penn. State U.), "Oxidation resistant Mo-W-Cr-Pd alloys with palladium coatings," *J. of the Less Common Metals*, Vol 169, No 1, 5 figs, 9 ref., April 15, 1991.

AUTHORS' ABSTRACT

Oxidation studies have been carried out on (40-55) wt.% Mo - (35-45) wt.% W - 9 wt.% Cr - 1 wt.% Pd alloys with and without palladium coatings in atmospheres of both air and pure oxygen at temperatures between 1000 and 1250 C. The coated alloys displayed excellent oxidation resistance compared with the uncoated alloys. Palladium electroplated to 7 micrometers thickness prevented the formation of volatile oxides of molybdenum and tungsten during the initial oxidation stage. Contrary to the behavior of most metals, an increase in oxidation resistance with increase in temperature was observed. The alloys presented are considered to be a major improvement over the existing molybdenum- and tungsten-based alloys.

JAPAN - RESEARCH PROFILE

Courtesy of Dr. Samuel Faile

Hiroshi Kawai (At. Energy Res Inst, Kinki Univ, Osaka), "Profile of the cold nuclear fusion fever," *Kinki Daigaku Genshiryoku Kenkyusho Nenpo*, Vol 27, pp 19-22, 1990, In Japanese.

AUTHOR'S ABSTRACT

A profile of the research on cold nuclear fusion which was initiated by M. Fleischmann and Steve Jones (both in 1989) is introduced. A number of researchers in the world tried to elucidate the cold nuclear fusion phenomenon, but systematic explanation was not found until the end of 1990. A half of them are affirmative and the other half negative. The phenomenon is that D_2O is electrolyzed with a Pd negative electrode and after several hours produced and adsorbed D on the Pd may make nuclear reactions. Fleischmann et al observed excess heat and gamma-ray due to the nuclear reaction, while Jones et al observed only neutrons slightly abNEC Silentwriter LC-860+NESILC86.PRSby D nuclear fusion with their sensitive neutron detector newly devised. Their results were not consistent with others'. Kawai suggests making the electrolysis experiment with graphite or Uranium electrodes, both of which adsorb a great amount of H. Multiplication of neutrons will be expected in case of electrolysis with enriched U electrode if it is surrounded by appropriate moderator, which may make easy to detect produced neutrons. Another suggestion is to use DTO for the electrolysis, since the potential barrier of DT is one order lower than that of DD.

SWEDEN - HYDRIDE PROPERTIES

Courtesy of Dr. Samuel Faile

M. Kadir, M. Kritikos, D. Noreus & A.F. Andresen (Dept of Structural Chem, Stockholm Univ.), "Metallic properties in the series $K_2Pd(II)H_4$, $Na_2Pd(0)H_2$, & $Li_2Pd(0)H_2$ correlated with the stabilization of a formally zero-valent palladium-hydrogen complex," *J of Less Common Metals*, Vol 172-174, pp 36-41, 2 Figs, 10 Refs, Aug 20, 1991.

AUTHORS' ABSTRACT

Two new hydrides, Li_2PdH_2 and K_2PdH_4, are compared with Na_2PdH_2. Both Li_2PdH_2 and Na_2PdH_2 are found to be metals, and their structures are characterized by linear, formally zero-valent PdH_2 complexes in an alkali atom framework. The structures are isomorphous with Na_2HgO_2. The palladium-hydrogen bond length is 1.68 Angstrom. The usual stabilization mechanism for a low formal oxidation state, by back donation to orbitals on the ligand, is inoperative when hydrogen is the only ligand, and the metallic properties of Li_2PdH_2 and Na_2PdH_2 are attributed to a stabilization mechanism in which electrons are delocalized into a conduction band. In K_2PdH_4, with the Na_2PtH_4-type structure, the larger and more electropositive potassium atom allows a more common four-coordinated d^8 square planar palladium complex to be formed. The palladium-hydrogen bond length is 1.63 Angstrom. The electrons are localized and K_2PdH_4 is a yellow-green non-conducting powder.

EDITOR'S COMMENTS

The above paper is from a series of papers presented at the Proceedings of the International Symposium on Metal-Hydrogen Systems, Fundamentals and Applications, held in Banff, Alberta, Canada, September 2-7, 1990. The papers were published in the *Journal of the Less-Common Metals*, in Volumes 172-174, August 20, 1991.

TAIWAN - NEUTRON DETECTION

Tsang Lang Lin, Chi Chang Liu (Dept. Nucl. Eng., Natl. Tsing-Hua Univ., Taiwan), "Cold fusion experiment at Department of Nuclear Engineering, National Tsing-Hua University," *J. Fusion Energy*, Vol 9, No 4, pp 487-90, 1990.

AUTHORS' ABSTRACT

The so-called cold fusion experiment was repeated by electrolyzing D_2O, with 0.1M LiOD, with Pd rod as the cathode and Pt wire as the anode. The purpose of the experiment is to detect the neutrons that are produced from the fusion process of D if fusion does occur. One ^3He detector and 1 BF_3 detector were used to detect the thermal neutrons coming out of the H_2O bath that surrounds the D_2O cell. Possible neutron bursts were detected by the ^3He detector during a period of approx. 7 hr. after electrolyzing for 11 days.

U.S.S.R. - REVIEWS COLD FUSION

Courtesy of Dr. Samuel Faile

P.N. Tsarev (P.N. Lebedev Physics Inst. of the Academy of Sciences of the U.S.S.R.), "Cold Fusion," Translation from *Soviet Physics--USPEKHI*, **33** (11) Nov. 1990.

AUTHOR'S ABSTRACT

The experimental and theoretical investigations of cold fusion, performed during the year after the discovery of this phenomenon, are reviewed. The results, obtained by differing groups concerning the detection of neutrons, gamma-rays, and charged products of the reactions, as well as analysis for the content of tritium and helium, and calorimetric analysis, are summarized. Information about experiments on the fracture of substances containing deuterium is presented. Different attempts to understand the mechanism of this phenomenon are discussed. An example of a substantially nonequilibrium mechanism, connected with the acceleration of ions in strong local electric fields, generated when hydrides fracture, is studied.

CONCLUSIONS

The analysis performed in this section shows that for steady-state systems there is no mechanism based on the standard ideas of nuclear and solid-state physics that can explain the results of experiments on cold fusion, even at the Jones level. In the next section we shall study a possible version of a substantially nonequilibrium "acceleration" mechanism that, being quite simple and natural, is capable of explaining the basic features of cold fusion.

CONCLUSIONS FOR EXPERIMENTS

The assumption on which the acceleration model is based and the conclusions following from this model can be directly checked experimentally. We shall once again formulate the basic assumptions.

a) When nonequilibrium saturation of transition metals with hydrogen (D,T) occurs unstable hydride phases with a high concentration of hydrogen, higher than in the stable phases, can arise.

b) The properties of hydrides in these phase states can be close to those of dielectrics or semiconductors.

c) The expansion of the crystal lattice and the concentration-induced stresses and embrittlement, which accompany the growth of the hydride layer, result in fracture of the hydride and its saturation with a network of microcracks.

d) The appearance of cracks is accompanied by the appearance of electrical charges. The fields generated by these charges can accelerate deuterium ions and initiate cold-fusion reactions with adequate efficiency. From here there follow a number of conclusions and predictions:

1. Cold fusion is primarily of a surface process, i.e., it develops in the surface of the hydride, which in this time interval is subject to fracture. As the process progresses deeper into the material it encompasses new layers of the hydride.

2. Nonequilibrium conditions of saturation of the metal with deuterium or desorption are important for the process to proceed.

3. To create favorable conditions it is necessary to use metals that are capable of dissolving large quantities of deuterium (hydrogen). (Owing to the extensive development of hydrogen-storage technology a large number of such metals and alloys are now known.)

4. The conditions of saturation must provide an adequate concentration gradient, capable of generating internal concentration stresses which locally exceed the fracture stress of the material.

5. The hydride formed should have a low plasticity.

6. The temperature and rate of saturation must be chosen so as to eliminate any effects due to stress relaxation.

7. Since the fracture of the hydride occurs in a stochastic manner with some possible quasiperiodic modulation in

time, the cold-fusion reactions proceed in an analogous manner.

Based on the foregoing conclusions we can make quite obvious recommendations in order to check the proposed mechanism experimentally.

a) Since an important part of the model is the assumption that there exist unstable phases with a high concentration of hydrogen, it is important to analyze the structure and composition *in situ* i.e., directly in the course of nonequilibrium absorption of hydrogen. This can be done, in particular, by means of x-ray structural analysis, neutron-diffraction analysis, and electron-microscopic analysis of the surface and surface layer.

b) Information about the enhancement of dielectric properties in the unstable phase can be obtained from measurements of the electrical conductivity (also *in situ*). Such measurements are obviously best performed with the help of thin films, whose thickness is close, in order of magnitude, to the characteristic critical (for fracture) thickness of the hydride layer (approx. 10^3 - 10^5 A). Another possibility is to use hydrides in which the bonding is known to be ionic or varies with the concentration, as in the case of hydrides of rare-earth metals.

c) The conjecture that cold-fusion reactions are connected with the appearance of cracks can be checked by studying the correlation between the detected products of cold fusion (neutrons and protons) and the acoustic emission generated when cracks form. Another possibility is to study the correlations with initiation of crack formation, for example, with the help of mechanical strains, ultrasonic pulses, thermal, cryogenic and electric shocks, etc.

d) The role of acceleration in electric fields can be studied with the help of correlations of the products of cold fusion and the electromagnetic emission at different wavelengths.

Obvious recommendations can also be made for checking the consequences (1 - 7 given above):

1) The surface character of the phenomenon can be checked by comparing the results for samples with different surface to volume ratios.

2) The great importance of nonequilibrium saturation can be checked by varying the experimental conditions. The items 3 - 6 (above) can also be easily checked by changing the experimental conditions and the materials employed. We note that different metals and alloys can have a very different susceptibility to hydrogen-induced fracture and this makes it possible to vary this property of a material over wide limits.

3) Finally, the stochastic and quasiperiodic nature of the cold-fusion signals has actually already been confirmed in the analysis of events as a function of time with narrow time bins.

CONCLUSIONS

We shall now summarize our discussion and formulate the main results.

1. Evidence of the existence of cold-fusion phenomena, i.e., the appearance of reactions in which deuterons, injected into the crystal lattice of metals, fuse at room temperature has been obtained in a number of experimental investigations.

2. The rates and character of cold-fusion reactions can be different. The reactions can be manifested either in the form of chaotic emission of single neutrons, which can continue for several hours at an average rate of lambda = 10^{-24} to 10^{-22} s^{-1} per DD fusion, or in the form of separate "neutron bursts," in which up to 10^3 - 10^5 neutrons can be emitted in short time intervals (seconds, minutes). The emission induced by the charged products of DD fusion (p, T, ^{3}He) has also been recorded.

3. The characteristic features of experiments on cold fusion are that the results are not consistently reproducible, the signals are sporadic, and signals appear only if nonequilibrium conditions are created in the metal-deuterium system.

4. In spite of the significant efforts made by many tens of scientific groups throughout the world, cold-fusion has been studied only at the "preliminary," qualitative level. Many results require further checking. This primarily concerns the question of the relationship of different channels and the possibility that cold fusion occurs with a high rate primarily in the neutron-free channel (n/T 10^{-7} K). More detailed experiments on the direct detection of charged particles and the study of fusion in pD and DT systems as well as correlation experiments in several detection channels must be performed, and the effect of different factors on the character of the flow of cold-fusion processes must be investigated.

5. At the present time there is no generally accepted viewpoint regarding the mechanism of cold fusion. The experimentally observed results cannot be explained on the basis of the standard ideas of nuclear physics and solid-state physics for equilibrium systems. The most promising model is apparently the acceleration model, in which it is posited that cold fusion is brought about by the acceleration of deuterons in strong electric fields

generated in microcracks. Actually, "microscopically hot fusion" (T_{EQV} about 10^7 K) rather than "cold fusion" occurs. The sporadic character of cold fusion, the observation of "neutron bursts," and in many cases the quasiperiodicity of the bursts and the absence of the 5.5 MeV gamma-ray line are the evidence for such a model. More definitive evaluations, however, require correlation experiments, in which the "associated" signals (radio and acoustic emission, etc.) are detected and detailed theoretical calculations, in which different solid-state effects (screening, enhancement of dielectric properties, etc.) are taken into account, must be performed.

6. The energy released in cold-fusion reactions corresponding to the observed neutron fluxes is too low to be of interest from the standpoint of the production of electricity. The situation could become more interesting, if the possibility of a substantially higher rate of cold fusion in the neutron-free channel is confirmed. Irrespective of this, the study of cold fusion is certainly of interest for a number of disciplines, such as solid-state physics, geophysics, geochemistry, radiation chemistry, radiation acoustics, etc.

USSR - NO NEUTRONS
Courtesy of Dr. Samuel Faile

A.V. Antonov, B.A. Benetskii, V.B. Ginodman, L.N. Zherikhina, A.V. Klyachko, E.S. Konobeevskii, M.V. Mordovskoi, V.I. Popov, A.I. Rozantsev, & A.M. Tskhovrebov (Inst Yad. Issled., USSR), "Attempts to observe cold nuclear fusion during electrolysis of heavy water," *Kratk. Soobshch. Fiz.*, No 5, pp 38-40, 1990, in Russian.

AUTHORS' ABSTRACT

The neutron emission was searched for in D_2O electrolysis with measurement of the neutron spectrum. In the first series of measurements a Pd plate (mass 1 gm, area 5 sq cm) was situated in D_2O containing 30% D_2SO_4. A Pt plate of the same size and form served as the anode. An electric current of 200 to 300 mA was applied. The neutrons were detected by a stilbene scintillator (40 x 40 mm) with the use of a FEU-30 photomultiplier. In the 2nd series, the Pd electrode mass and areas were of 7 grams and 20 sq cm. A Pt electrode of the same size and form was used again. A 7% solution of LiOD in D_2O served as the electrolyte. A current of less than 2 amp was applied in the course of the electrolysis. In the lst and 2nd series, the times of the measurements were 58 and 90 hours respectively. The effective background measurements were carried out. In both cases, the spectra of recoiled p exerted the same shape. In additional measurement, a proportional BF_3 counter situated in a paraffin moderator was used for revealing possibly present 4n pulses, the results demonstrated the absence of n flares. The results of measurements are summarized. No effect of neutron emission was observed within the precision range.

EDITOR'S COMMENTS

No mention is made in the abstract of the magnitude of the D loading. When a cold fusion electrochemical cell works, it is difficult to measure near-aneutronic phenomenon with neutron detectors.

USSR - SOME NEUTRONS
Courtesy of Dr. Samuel Faile

V.S. Bushuev, V.B. Ginodman, L.N. Zherikhine, S.P. Kuznetsov, Yu.A. Lapushkin, I.P. Matvienko, A.I. Nikitenko, A.D. Perekrestenko, N.P. Saposhnikov, et al (USSR), "Some results on recording nuclear radiation during electrolysis of heavy water," *Kratk. Soobshch. Fiz.*, No. 5, pp 41-44, 1990, in Russian.

AUTHORS' ABSTRACT

Results of detecting nuclear radiation during the electrolysis of D_2O are presented. Thermal neutrons and gamma-rays were detected. In the center of the experimental arrangement, an electrolyzer was situated surrounded by a 5-cm layer of water serving for the thermalization of the fast neutrons and cooling of the electrolyte in the course of the electrolytic process. The thermal neutrons were detected by a battery of 6 ^3He counters (type SNM-18) situated around the volume filled with H_2O. The counters were surrounded by a paraffin reflector (5 cm. thick) to increase the efficiency of the neutron detection. The detectors were shielded against the external neutron background by a 7-cm layer of polyethylene containing Boron and by a metallic, earthed electromagnetic shield. Above the electrolyzer, there was a scintillation gamma-ray detector consisting of CsI(Na) scintillator and FEU-85 photomultiplier shielded by a 5-cm Pb-layer. The external neutron background was checked by a neutron counter situated close to the experimental arrangement. Different types of Pd cathode (0.3, 2.39, and 11-g foil, and 86-g rod) and difference electrolytes (heavy water with 7% LiOD & 30% D_2SO_4) were used. For 19 measurements carried out under different conditions, the results of the neutron detection are summarized. In average, these ratios are greater than 1; particular measurements are not quite reproducible. This indicates a poor stability of the neutron emission, which does not explain the mechanism of the effect and estimate it quantitatively.

E. SHORT ARTICLES FROM AUTHORS

ITONS COULD PLAY A MAJOR ROLE FOR VARIOUS ENERGY PRODUCING TECHNIQUES

by Dr. Samuel P. Faile, August 13, 1991

The string-like character of the ITON [1] and the ability to form multiples that act as a single particle suggest the discovery of a particle that plays a basic primordial role that tends to be associated with collective quantum events. This particle could be considered to have a subquark mesonic role since it decays to electrons, positrons and neutrinos. A particle that could provide string-like binding energy would be considered an unlikely prospect if it only decayed into the lepton particle and antiparticle pairs. However, the additional decay product consisting of neutrinos indicates that nuclear-type role changing properties are possible, including gravitational decay. The particle-antiparticle decay product suggests something that could be sparked from the vacuum and would be connected with many vacuum processes involving the exchange of virtual particles. The exchange of virtual pi-mesons made up of a quark and antiquark has been considered one way to look at the binding energy of the nucleus. The exchange of itons could be involved in stabilizing a collective string-like cluster of like charges or at least in maintaining special collective dissipative structures by a screening-like action. The model of Bostick, involving loops of string-like structures for fermions, could be extended to the electron and nuclear polymer structures where the loops are joined to form an extended filamentary structure. The iton enhanced filamentary structures unlike the deterministic-chaos dissipative structures could be metastable catalysts which access energy releases not normally available. In many cases non-virtual itons could be generated due to the collective quantum action of many particles of like charge in a "sparking of the vacuum" field effect. This would be more likely where the vacuum fluctuations had been altered by an intense exchange of virtual particles that was stabilizing clusters of opposite electric charges or ones with some opposite color force character. Transient energetic electrons could be produced and then consumed during the formation and decay of clusters as the degree of "polarization" of the vacuum changed during intense iton exchange yielding excess energy from a special process involving rapid sparking and de-sparking of the vacuum during the Mayer-type (pat. 4,826,581) experiments. One of the major sources of itons would be from the collapse of a mixture of polymer-like electron and nuclear structures that underwent gravitational decay. These itons would play a major role with the EV entities (U.S. pat. 5,018,180) in producing more tangled string-like structures that would collapse and release more energy and itons through gravitational decay and fusion processes. The role of itons could help produce excess energy as string-like proton clusters are produced in the Mills-type experiments. The iton-maintained clusters where each consists of many like charges could have N-space free-energy release effects if rapid rotation occurred with a large magnetic field in a manner similar to the DePalma and Tewari energy machines. The clusters could also help release zero-point energy.

The many insights involving itons would not have been possible without their detection by Dr. Matsumoto. It appears that additional information might be gained if the other experimenters tried to find iton effects on nuclear emulsions. Even if the iton work of Matsumoto is not verified or does not pan out, this essay illustrates in some ways how one would try to make sense out of many energy-producing processes by hypothesizing the action of a new particle.

Reference:

[1] Takaaki Matsumoto (Hokkaido Univ), "Observation of Quad-Neutrons and Gravity Decay During Cold Fusion", *Fusion Technology,* Vol 19, No. 4, pp 2125-30, July 1991, 7 refs. (Also reviewed in *Fusion Facts,* June 1991, p 27.

EDITOR'S COMMENTS

Dr. Faile is an almost daily contributor to *Fusion Facts* and we would like to ask both he and Dr. Matsumoto to carefully consider the zero-point fluctuations or zero-point energy as a possible source of energy in the production of the itons. We commend both of these scientists for their challenging thoughts and experimental work.

F. LETTERS TO THE EDITOR

In a letter from Mr. Jed Rothwell, Atlanta, Georgia, he reports that Dr. Ikegami considers the October, 1991 cold fusion meeting in Fukuoka as being a minor cold fusion conference. Ikegami informed Jed Rothwell that he is planning to hold an important cold fusion meeting in December 1991. See also the information about the 1992 ACCF3 conference toward the end of this newsletter.

[I'm sure Jed Rothwell will keep us informed as more details of the Dec. 1991 meeting are made available. Ed.]

ERROR IN FF SEPTEMBER 1991 ISSUE

Courtesy of Prof. Ikegami

"I have just gone through the September issue of *Fusion Facts,* and found two mistakes:

One in the last paragraph of page 16 "Dr. Ikegami says..." must be changed to "Dr. McKubre said...," "He adds: 'Of course cold fusion is ...'", is my words, so it must be "Ikegami added, 'Of course cold fusion is ...'"
The second mistake is in the last paragraph of page 17 which is taken from a rather private mail between Jed [Rothwell] and myself. There the amount of $5 million **does include everything** and would need detailed complicated explanation, otherwise it is totally misleading."

[I wish to apologize to Professor Ikegami for these two mistakes on the part of *Fusion Facts.* It is our policy to present facts and not hearsay. I personally apologize for using information that was intended as "private mail". Thank you, Prof. Ikegami, for correcting our errors.
A corrected page is enclosed with this issue of *Fusion Facts*, please replace the page 16 in your September 1991 issue. Hal Fox, Editor-in-Chief.]

LETTER FROM INDIA

Courtesy of M. Srinivasan

Mr. Subbiah Arunachalam of Delhi drew my attention to the May 1991 issue of *Fusion Facts*. I was delighted to learn that my letter title "Whither Cold Fusion?" had been reproduced in toto in the same! I also note that the same issue contains a reference to my *Current Science* article [M. Srinivasan, "Nuclear fusion in an atomic lattice: An update on the international status of cold fusion research", *Current Science*, Vol 60, No 7, pp 417-439, 18 figs, 174 refs, 10 April 1991.] (I am enclosing herewith a couple of copies of the printed version of the same as it appeared in the journal.)

Your short Article section in the May 1991 issue titled "Tritium Production from Spar Parts" by Dr. Dennis Cravens refers to some of the work done at BARC. I am happy to note that Dr. Cravens has obtained some interesting autoradiographs similar to ours. As I do not have the full address of Dr. Dennis Cravens I shall be obliged if you could let me know the laboratory/research centre where he has carried out this experiment so that I can communicate with him.

It was indeed a pity that I could not attend the Como meeting. I feel totally cut off from the world as regards developments in cold fusion. . . . I shall appreciate if you would be kind enough to send me any reports you may have on the technical content of the Como meeting. It would also be nice to receive a copy of the June 1991 special issue which was distributed to all the participants of the Como meeting.

With best wishes to all,
/s/ M. Srinivasan

[*Fusion Facts* is pleased to fill your request. We all missed you at Como. See you in Japan. Ed.}

FINE PARTICLES OF PALLADIUM ADSORB RATHER THAN ABSORB MOST OF THE HYDROGEN by Dr. Samuel P. Faile, July 11, 1991

In a chemistry textbook it said that palladium black takes up 1200 times its volume in hydrogen while the small colloidal particles take up 3000 times its volume. In the *Electrochemical Acta* article "Electrochemical Properties of Ultra Fine Palladium Particles..." by Tateishi, et. al., the absorption actually decreases with smaller size. Apparently the overall larger take up of hydrogen by the nano-sized particles is due to the larger surface area. The article said that decreasing size did not affect the adsorption amount per unit surface area. Thus it appears that the higher densities of hydrogen or deuterium are achieved on the surface.

MANY THEORIES INVOLVING THE ELECTRON BY VARIOUS RESEARCHERS by Samuel P. Faile, July 27, 1991.

Puthoff and Shoulders have studied condensed electron clusters, for which there may be five or more theories. Mr. Stanley Meyer of Water Fuel Cell says that electrons are consumed releasing energy. DePalma and Tewari believe that energetic electrons can be coaxed from space or the vacuum with a net production of energy. Dr. Tewari believes that the vortex void in the center of the electron when rotated will cause energy to be generated from space. Dr. Bostick believes that the electron mass has a string structure upon which a negative charge circulates. Dr. Mills believes the electron can take the form of a planar wave when free or the form of a sphere when in a quantum state near an atomic nucleus. Dr. Fred Mayer believes the electron in a deuterium atom can assume a transient bound state with a proton only a few fermis across. Dr. Matsumoto believes an electron, a positron and a neutrino can comprise a special cold-fusion particle--the iton. The energy machine researcher Joseph Newman believes electrons are made of gyroscopic particles.

This great diversity of thought could be an indication that basic electromagnetism is not well understood. People are still perplexed at the original findings of Faraday, where it was found that a conducting disk could be rotated about the polar axis of a permanent magnet to cause a voltage from the center to the edge of the disk. However, no voltage was generated when the disk was stationary and the magnet rotated. Even more perplexing was the finding that the voltage would be produced in the disk when the disk and the magnet were rotated at the same

speed. This latter configuration became the basis of the homopolar machines. Dr. DePalma and the Mars Mission people believe there is something like a hyperdimensional gate that can be accessed for energy release during rotation of a material body such as a disk on a drive shaft or rotation of a planetary body. If rotating-inertial fields are the missing ingredient as DePalma claims, it may be of interest to see what would happen to a cold-fusion experiment near a rapidly spinning conducting flywheel. If the rotating body is drawing energy from ordinary space the excess energy production could appear to slow down. On the other hand, if the inertial (rotational) field was tapping energy from elsewhere, the cold fusion experiment could produce more excess heat by some sort of activation or promoter process. Perhaps Dr. DePalma has some predictions for cold fusion experiments.

G. CONFERENCES, PAPERS & MISC.

LETTER FROM JAPAN
From Professor Hideo Ikegami

ANNOUNCING: THE 3rd INTERNATIONAL CONFERENCE OF COLD FUSION (ACCF3)

Date: October 21 (Wed) - October 25 (Sun), 1992
Place: Nagoya Congress Center, Nagoya, Japan

The conference will cover the broadest topics relevant to the cold fusion phenomena in the broadest research fields including nuclear physics, electrochemistry, and solid-state physics.

The tentative dead lines are:
Preliminary Registration: 15 March 1992
One-Page Abstract: 15 June 1992
Final Registration: 1 September 1992

The First Announcements with a preliminary registration form will be circulated in November. The succeeding announcements will be mailed solely to those who return the preliminary registration form by 15 March 1992.

The final registration form and a hotel reservation card will be enclosed with the 2nd and 3rd Announcements which will be sent in April and July 1992, respectively.

Nagoya is the fourth largest city in Japan and is located between Tokyo and Kyoto on the Pacific coast of the main island and has many tourist sites. By bullet train, it takes two hours from Tokyo and 50 minute from Kyhoto, though many international flights are directly available to Nagoya International Airport.

For further information contact the Conference Chairman:
Professor Hideo Ikegami
National Institute for Fusion Science
Nagoya, Japan 464-01
Phone: 052-781-5134 (office)
Fax: 052-781-9564
E-Mail: ikegami@nifs.ac.jp

Fusion Facts will continue to publish the latest information about this conference to keep you informed. Prof. Ikegami states, "The next cold fusion conference in Japan will be a crucial and exciting one."

FREE COPIES OF FALL ISSUE OF 21ST CENTURY SCIENCE AND TECHNOLOGY

"The Cold Fusion Revolution" is the cover story of the Fall 1991 issue of *21st Century Science & Technology* magazine, which features Pons & Fleischmann on the cover and a 32-page report on the Como conference. *21st Century* is printing 100,000 copies -- double the usual number -- in order to distribute copies on college campuses and to the science community. The magazine is willing to ship issues to any scientist or researcher in cold fusion who will get them out on campus, etc. If you are interested in receiving bulk copies, call or write to: *21st Century,* P.O. Box 16285, Washington D.C. 20041, phone (703) 777-7473 or FAX (703) 771-9492 Attn. M. Hecht.

NEW FROM *FUSION FACTS - Fusion Briefings*

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FUSION CONCEPTS - A computer-based tutorial.

If you know someone who is interested in learning about cold fusion, "Fusion Concepts" may be the best way to teach over eighty concepts associated with cold fusion. If cathode and anode are meaningless and confusing as you read about cold fusion developments, then "Fusion Concepts" can help clarify what the difference is and how they are used. "Fusion Concepts" is interactive courseware that takes an individual through the physics and chemistry background that makes up cold fusion, but controls the learning by allowing the student to progress only after the student demonstrates that he understands each concept. "**Fusion Concepts**" is a two-diskette IBM-compatible software package for $95.00, and comes on either 3.5" or 5.25" diskettes. The second diskette include **INFOFIND**, a search and retrieval program that allows the user to enter any non-trivial word(s) and be positioned in the text material at any selected line where that word(s) occurs.

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ELECTRON BEAD PATENT ON DISKETTE

We found the Kenneth R. Shoulders' patent, "Energy Conversion Using High Charge Density" so important and so full of information on electron bead formation, manipulation, and conversion that we **put it on diskette.**

The 80 columns of patent description was so informative that we have indexed all of the words using our **INFOFIND** search and retrieval program. The **INFOFIND** program plus all of the patent written words are combined onto IBM-compatible diskettes (specify either 5 1/4 of 3.5 inch diskette.)

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The goal of *Fusion Facts* is to present the latest information on enhanced energy devices in **the shortest possible time**. Therefore, we use only our local staff, correspondents, and scientist friends in making acceptance decisions on submitted articles.

We are especially interested in any new discoveries that improve the replication of cold fusion electrochemical cells or of other devices that provide excess energy. We are also interested in simply-stated summaries of your theories or models, especially as they pertain to improvements of devices that produce excess energy.

Brief **Letters to the Editor** are also welcome. Topics of interest include latest business developments related to cold fusion, patent information, and your constructive criticism of any cold fusion concepts. We especially welcome news of any **enhanced energy devices** that have been reduced to practice.

Remember to keep your written material simple but precise. A large fraction of our subscribers do not have English as their primary language.

Send your contributions to Hal Fox at:

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