

# FUSIONfacts

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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### 4th INTERNATIONAL COLD FUSION CONFERENCE

December 6-9, Maui, Hawaii

*Fusion Facts* will publish a report of the conference  
and abstracts of papers given at the ICCF-4  
in its December and January issues.

## A. THE NEXT STEPS IN COLD FUSION RESEARCH

By Hideo Ikegami

Translated by Jed Rothwell from

*Oyou Butsuri* (Journal of the Japanese Society of Applied  
Physics), vol 62, no 7, July 1993, p 717.

Skepticism and curiosity drive scientific progress. Recent remarkable results show that both nuclear reactions and excess heat are generated in what is known as the cold fusion reaction, and these results prove beyond any doubt that this reaction is real. The 100% reproducibility demonstrated in solid state tungsten bronze work, and other new evidence which has recently emerged is moving this field into the mainstream of physics research.

The question to be addressed now is: how should this research proceed... what are the next logical directions for advanced research? The obvious answer is to improve reproducibility and to establish complete control over the reactions.

"Excess Heat" -- the excess of output heat compared to input energy -- is a central issue in this field. When a reaction is not occurring, recent calorimetric techniques show a balance of zero to within 1%. To achieve a reaction, the following four conditions are necessary:

1. Current density must be  $\geq 0.2\text{A/cm}^2$  of the palladium cathode surface.
2. The ratio of deuterons absorbed into the palladium; the D/Pd ratio must be  $\geq 0.85$ .
3. Appropriate surface modification of the palladium is needed.
4. The temperature of the palladium must be  $\geq 80^\circ\text{C}$ .

In early experiments in this field, researchers ignored these essential conditions, and merely performed electrolysis with uncontrolled, random factors at large, so naturally they did not achieve any level of reproducibility or control.

Let us examine these four essential conditions more closely. The difficult condition to achieve is the high loading ratio;  $\text{D/Pd} \geq 0.85$ , which can only be insured by

items 1 and 3; current density and appropriate surface modification. At these loading levels, absorption of additional deuterons becomes an endothermic reaction, so loading should increase even above the 0.85 level as the temperature of the cathode is increased (per item 4), but this has not been proven experimentally yet.

Let us try to envision what occurs inside the palladium lattice as conditions 1 through 4 are met. As the temperature rises, some deuterons are diffused to the surface of the lattice, and are ejected from the surface area. Items 1 and 3 prevent sudden de-loading of the deuterons at high heat, but on average, throughout the entire volume, the D/Pd ratio declines. However, when deuterons are freed up and diffused from most sites, in some localized domains where D/Pd ratio is already  $\geq 0.85$ , deuterons are trapped and become even more concentrated. The uneven loading becomes even more pronounced. This model is based upon my assumptions and it has not yet been experimentally confirmed. It is expected that such uneven loading and localized concentration of deuterons can be detected with SIMS, with neutron scattering and with other techniques, so I hope that someone undertakes this type of experiment in the near future.

**"Nuclear Reaction"** How should research to elucidate the nuclear processes at work proceed? The answer is shown in research already under way, using an orthodox nuclear experimental setup, a vacuum.

If the cold fusion phenomenon can be considered a "solid state reaction," then it should be possible to observe some of the effects by irradiating palladium deuteride foils with deuteron beams from accelerators. The palladium deuteride target can be produced by electrochemical means before being placed in front of the accelerator.

It has become difficult to draw firm conclusions about the reaction simply on the basis of neutron detection studies. Obviously, if we had complete control over the reaction, it would be a different story. The material is highly permeable to neutrons, so they are convenient markers to establish the relationship between the heat and the nuclear processes.

In a recent experiment, when a high electric current was passed through a palladium deuteride wire, neutrons, tritium and helium-4 was detected. Any process that simultaneously generates neutrons, tritium and helium-4 must be judged a nuclear process.

The tritium production must be labeled "anomalous" because the neutrons to tritium production ratio is so low;  $T/n \sim 10^7$  have been observed. If we postulate that this so-called cold fusion is a two body D-D fusion reaction that

occurs only in a low energy limit, then this imbalance is a gross violation of the symmetric interaction between the neutron and the proton, which is a drastic conclusion indeed. So, we must make every effort to reach a conclusion about the anomalous tritium generation as soon as possible.

NTT's Basic Research Laboratory has conducted experiments with a mass spectrometer on palladium loaded with deuterium gas. They have confirmed that heat generation and helium-4 occur simultaneously. In addition, they have detected alpha particles with up to 5MeV of energy, and 3MeV protons which are thought to be a product of D-D fusion reactions. **This alpha particle production is particularly anomalous, because in order to satisfy basic physics, a third particle must play a role in a reaction.** In other words, cold "fusion" must be something different from D-D fusion.

When a high energy particle is created, and it passes through a palladium lattice, a 20 keV X-ray should be emitted. X-ray detection studies are essential to establishing the causal connection between the excess heat and the nuclear reaction.

For detailed information on the latest results in this field, see the proceedings of the Third International Conference on Cold Fusion, which was held in Nagoya last October. [1]

#### Reference

[1] H. Ikegami, ed., *Frontiers of Cold Fusion*; Proc. 3rd Int. Conf. Cold Fusion, Nagoya, 1992, (Universal Academy Press, Tokyo, 1993.)

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## B. ICCF-4 THE TURNING POINT?

By Hal Fox

It is unreasonable to remember that Hal Fox has proclaimed every international conference on cold fusion as the **turning point**. Soon after the University of Utah March 23, 1989 press conference, where Pons and Fleischmann made their famous announcement, detractors proliferated. By February, 1990 (ICCF-1) executives of the American Physical Society were driving nails in the coffin of cold fusion and proclaiming the conference as a wake for the dead. By July 1991, at the Como conference, skeptics labeled the group as last vestige of a twitching corpse. By November 1993, at Nagoya, skeptics could find no experiments that were replicated. However, for each of these conferences Hal Fox proclaimed "a turning point" in the acceptance of cold fusion. And for some, each conference was a turning point, but not for the science community in general.

Will the Hawaii ICCF-4 in December, 1993 be the turning point around which the science community suddenly accepts cold fusion? Probably not, but it will be the turning point for some persons, some companies, some university departments, and some prominent individuals. The question then is, **"What evidence will be required to convince the skeptics that nuclear reactions can take place and be controlled within or near the surface of a metal lattice?"** Probably, the science of cold fusion will advance from "funeral to funeral" (as stated years ago by someone else concerned with the advance of science.)

**The most convincing evidence in favor of cold fusion will be a demonstration of a cold fusion device that obviously exceeds any known chemical means for generating heat.** In the video presentation "The Secret Life of Cold Fusion," aired throughout Canada on June 23, 1993, Pons was shown stating that they would have such a demonstration unit within a year. That demonstration, or an equivalent demonstration, will be the turning point for cold fusion. As we now know, it is not sufficient that we show cold fusion electrochemical cells "turning on" and boiling off their contents, as was shown at the Nagoya conference over a year ago.

Until now the skeptics have been fighting a straw man. The rallying cry has been, "No neutrons, no fusion." Meanwhile there is increasing experimental evidence that most of the nuclear reactions that occur are aneutronic. Another weakness of the skeptics is their concentrated attack on the heavy-water, palladium, lithium cold fusion cells. The several additional ways by which nuclear reactions appear to be catalyzed in the presence of metal lattices have not been attacked. **The evidence for controlled nuclear reactions in or on a metal lattice is so widespread that it is now up to the skeptics to provide an alternative explanation!**

Perhaps one of the most interesting, if not compelling, announcements for the ICCF-4 will be the large number of presenters of cold fusion papers that are affiliated with one commercial company, ENECO (formerly Future Energy Applied Technology). In the absence of corporate believers, ENECO has acquired some of the best cold fusion technology from both U.S. and foreign countries. This corporation, and its financial backers, have made a firm declaration of the believed reality of cold fusion. **They have put their money where their mouth is.** They are not just talking about cold fusion technology, they are buying cold fusion technology and preparing to market such technology to the world. **That declaration by ENECO will be a "turning point" for corporate America in becoming seriously interested in the new science of cold fusion.**

## C. NEWS FROM THE U.S.

### CALIFORNIA - UNITING COLD FUSION

Robert T. Bush (Dept. Phys., California State Polytechnic Univ., Pomona, California), "Will the Light Water Excess Heat Effect Lead to a Unification with Cold Fusion?" *21st Century Science and Technology*, vol 6, no 3, fall 1993, pp 75-79, 10 refs, 2 figs.

#### SUMMARY

Dr. Bush has hypothesized a unification of the heavy water and light water excess heat effects as essentially two sides of a coin, with cold nuclear reactions within, or at the surface of, a metal lattice constituting the common coin. In experiments that further explored the light water work begun by Randell Mills in 1990, Dr. Bush and his colleague Dr. Robert Eagleton have noted higher levels of excess heat production than in heavy water experiments. This has proven true for most light water researchers, Bush states. Some light water critics contend that this result is due to normal amounts of D<sub>2</sub>O in light water.

In a recent experiment "two identical light water electrolytic cells were run in series. The only difference between them was that the electrolyte of one employed ordinary light water and that of the other employed deuterated light water (from Aldrich), which had only 1 percent of the D<sub>2</sub>O contamination; that is, 1 out of every 555,000 molecules was D<sub>2</sub>O. The fact that the deuterated water cell evidenced essentially the same average excess power within the limits of error ( $\pm 10\%$ ) as the ordinary light water cell over a significant period of time is strong evidence against the contamination hypothesis. Without a doubt the light water excess heat effect involves protons, while the heavy water excess heat effect involves deuterons."

...According to Dr. Bush's "Cold Alkali Fusion" hypothesis, "the light and heavy water excess heat effects are associated with a metal-lattice-catalyzed cold fusion reaction in which the nucleus of an alkali atom (hydrogen, sodium, potassium, rubidium, cesium,...) accepts a proton to achieve increased nuclear stability. The excess energy would be predictable from Einstein's mass-energy relation and the Law of Conservation of Mass and Energy applied to the reaction."

"It appears that we are seeing an important unification of the light water and heavy water work that vastly expands the earlier horizons of cold fusion. It would be an unbelievable surprise in itself if there are no additional major surprises left in this enterprise. And, finally, in

view of the history of science and technology, the odds that practical applications for the betterment of mankind will follow from this new science strike this observer as overwhelming."

#### EDITOR'S COMMENTS

Dr. Bush points out that there are apt to be major new surprises yet to come in the developing science of cold fusion. *Fusion Facts* has grown over the past four and one-half years reporting such surprises. We not only expect new surprises but we expect that some of them will come from the further work of Drs. Bush and Eagleton from Cal Poly at Pomona, California.

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#### CALIFORNIA - H & D DIFFUSION ON NICKEL

Courtesy of Samuel. P. Faile

A. Lee, X.D. Zhu, A. Wong, L. Deng (Dept. Phys., Univ. Cal., Davis) and U. Linke (Inst. of Surface Research & Vacuum Physics, Jülich Research Ctr., Germany), "Observation of Diffusion of H and D on Ni(111) from Over-barrier Hopping to Nonactivated Tunneling," *Phys. Rev. B*, vol 48, no 15, 15 Oct. 1993, pp 256-259, 32 refs, 2 figs.

#### AUTHORS' ABSTRACT

We measured the diffusion coefficients for hydrogen and deuterium on Ni(111) from 108 to 154 K. We observed nonactivated tunneling following thermally activated hopping at around 125 K for both isotopes. The nonactivated tunneling rates show weak isotope dependence. Our observation confirms an early report by Lin and Gomer (*Surf. Sci.* vol 225, no 41, 1991). The nonactivated tunneling is analyzed with both a modified polaron model, which includes adatom-phonon couplings varying quadratically in phonon coordinates, and the conduction electron model. The weak isotope dependence is understood as a result of a large WKB (Wentzel-Kramers-Brillouin) tunneling matrix element on Ni(111).

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#### CALIFORNIA - NEW MATH SOLUTIONS

Jaromir A. Maly and Jaroslav Vávra (Applied Science Consultants, Los Altos), "Electron Transitions on Deep Dirac Levels I," *Fusion Technology*, vol 24, no 3, pp 307-318, 17 refs, 13 tables.

#### AUTHORS' ABSTRACT

The original solutions of the Schrödinger relativistic equation and the Dirac equation for hydrogen-like atoms

were analyzed for the possible existence of some other electron levels, which were not originally derived. It was found that besides the known atomic levels, each atom should also have the deep Dirac levels (DDLs). The electron transition on such DDLs would produce large amounts of atomic energy (400 to 510 keV per transition depending on the Z of the atom). A possible explanation is given for the excess heat effect observed recently in the electrolysis of lithium or potassium ions, based on existing Dirac quantum theory. The same calculation technique is applied to atoms formed from elementary particles such as  $e^-e^+$ ,  $\mu^+\mu^-$ ,  $\tau^+\tau^-$ ,  $e^-\mu^+$ ,  $e^-\tau^+$ ,  $\mu^-\tau^+$ , etc.

#### AUTHORS' PRELIMINARY CONCLUSIONS

The theory presented here shows that the electrons bound on the  $E2S(-)$  Schrödinger levels or the  $E2D(-)$  Dirac levels should exist for all elements of the periodic system. The tables of electron levels can be similarly calculated as shown in Tables I and II for all elements and all quantum numbers  $n$ .

The result of electron-positron annihilation should be reevaluated using the calculated DDLs for positronium. The DDL could also exist in the elementary particles that are forming "atoms" (two elementary particles bound by electrostatic forces). The DDL mechanism could help in understanding the annihilation sequence of particle-antiparticle.

The atoms with electrons on the DDL formed in the universe could have important applications in cosmology. If this model is proven correct experimentally, it could explain the outstanding problem of dark matter in the universe.

A single-electron atomic transition on the DDL should produce a very large energy release, in the region of 400 to 510 keV per transition. If such transitions could be made on the surface of the earth, it could produce an enormous amount of energy, which could be used practically.

The energy release in the DDL transitions could occur in a number of small quanta that together will give the binding energy of  $\sim 500$  keV, similar to synchrotron radiation of an electron. This released energy could be practically observed as some form of heat energy.

An atom ( $A, Z$ ) with one electron bound on the DDL will have one of its nuclear charges screened by this electron (which is very close to the nucleus). This means that such an atom will chemically behave like element ( $A, Z - 1$ ), i.e., like a lighter element with  $Z - 1$  electrons, which is its neighbor in the periodic table. The alkali metal atoms with

one electron on the DDL, created in electrolysis, will behave like their lighter neighbors, noble gases, and should escape with the electrolytic gases. These "alkali-noble gases" could be determined by mass spectrometry.

The recently observed excess heat release in the electrolysis of LiOD in D<sub>2</sub>O or the excess heat release observed in the electrolysis of K<sub>2</sub>CO<sub>3</sub> and Rb<sub>2</sub>CO<sub>3</sub> in H<sub>2</sub>O could be caused by electron transitions on the DDLs. The lithium has DDLs with an energy -505 keV, and potassium and rubidium have -475 and -441 keV, respectively. Transitions of the electrons on those levels (and other observable (-) levels shown in Tables I and II of the paper) could cause the excess heat release observed in the electrolysis of alkali metals.

The hydrogen or deuterium atoms with an electron bound on the DDL would behave almost like neutron particles with a Coulomb repulsion radius of 3 to 5 F. They would penetrate rather freely through a crystalline lattice and through the electron shells of atoms forming such a lattice. Such atoms could then participate in nuclear reactions with hydrogen, deuterium, lithium, or palladium.

#### EDITOR'S COMMENTS

It is suggested that this new solution be compared with the concept by Dr. Randell Mills and later evaluated by Dr. J-P. Vigié that there is a chemical method by which some heat is produced by the collapse of the hydrogen atom below its ground state. *Fusion Facts* would welcome readers comments on whether this solution is related to or replaces the concept of smaller hydrogen atoms.

#### CALIFORNIA - D + D REACTION

Alden E. Park (Ridgecrest, California), "Some thoughts on a Simple Mechanism for the  $^2\text{H} + ^2\text{H} \rightarrow ^4\text{He}$  Cold Fusion Reaction," *Fusion Technology*, vol 24, no 3, pp 319-323, 8 refs, 2 figs.

#### AUTHOR'S ABSTRACT

A speculative mechanism for the creation of  $^4\text{He}$  using cold fusion is proposed. The nuclear transformation can be made by the fusion of two excited rotating ground states of deuterium into a highly excited rotating ground state of  $^4\text{He}$ . Under compression and relatively stable conditions, the formation of such a bound, stretched-out *pnp* state of  $^4\text{He}$  would be favored (with respect to Coulomb repulsion) over other nuclear ground states without as much angular momentum. The reaction likely occurs at the surface of palladium. A more descriptive name for this reaction is compressed-rotational-shielded (CRS) fusion. Potential

experimental conditions for enhancing the initiation of CRS fusion are discussed.

#### AUTHOR'S SUMMARY

A preliminary mechanism for the nuclear transformation of deuterium into  $^4\text{He}$  during CRS fusion has been presented in this technical note. Rotations of deuterium ground states can allow (a) more penetration of the Coulomb barrier (by neutrons and neutral virtual mesons) and (b) a high-angular-momentum stretched-out *pnp* excited ground state of fused  $^4\text{He}$ . Such a high fractional  $\hbar$  angular-momentum ground state of  $^4\text{He}$  may release its energy through interaction with large numbers of low-energy photons. The formation and decay modes for highly excited ground states of  $^4\text{He}$  need further study.

The CRS fusion of rotating ground states is likely a surface reaction because the surface is (a) the location of the largest magnetic fields, assuming cylindrical palladium cathodes, (b) the location of the greatest concentration of excess electrons for charge-shielding purposes, and (c) the location where the deuterium atoms may separate slightly at times of greater temporary Coulomb repulsion. The surface site for CRS fusion may be near the center of three mutually touching hexagonally close-packed surface palladium atoms.

Experimental procedures for enhancing the initiation of CRS fusion may include one or more of the following:

1. Use a higher temperature black-body radiation spectrum to enhance the likelihood of increasing the internal angular momentum for the deuterium (while being compressed against another deuterium).
2. Align as many local palladium close-packed surface normals as is practical so that they are perpendicular to the local surface magnetic fields.
3. Use cylindrical cathodes with small radii to have larger surface pressures, magnetic fields, and charge densities.
4. If there is an appreciable amount of tunneling, and assuming that the charge shielding can somehow be estimated, then use the surface magnetic field  $B$  that provides the external deuterium nonfused angular frequency that allows proper angular momentum matching prior to tunneling so that at fusion (after compression and tunneling), the internal and external deuterium angular frequencies will be identical.

Electron wave functions during CRS fusion need to be theoretically investigated to explore the possible sling effect of electrons being thrown inward (prior to fusion because

protons become neutrons via charged meson transfer), thus increasing the charge shielding of the protons.

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### CALIFORNIA - METALLIC GLASS

A. Peker and W.L. Johnson (W.M. Keck Laboratory of Engineering Materials, Calif. Inst. Tech., Pasadena), "A Highly Processable Metallic Glass:  $Zr_{41.2}Ti_{13.8}Cu_{12.5}Ni_{10.0}Be_{22.5}$ ," *Appl. Phys. Lett.*, vol 63, no 17, 25 Oct. 1993, pp 2342-2344, 12 refs, 3 figs.

#### AUTHORS' ABSTRACT

We report on the properties of one example of a new family of metallic alloys which exhibit excellent glass forming ability. The critical cooling rate to retain the glassy phase is of the order of 10 K/s or less. Large samples in the form of rods ranging up to 14 mm in diameter have been prepared by casting in silica containers. The undercooled liquid alloy has been studied over a wide range of temperatures between the glass transition temperature and the thermodynamic melting point of the equilibrium crystalline alloy using scanning calorimetry. Crystallization of the material has been studied. Some characteristic properties of the new material are presented. The origins of exceptional glass forming ability of these new alloys are discussed.

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### CALIFORNIA - ELECTRON SCREENING

*Chemical Abstracts*, Oct. 18, 1993  
Courtesy of Samuel P. Faile

T.D. Shoppa, S.E. Koonin, K. Langanke, R. Seki (W.K. Kellogg Radiat. Lab., Cal. Inst. Tech., Pasadena), "One- and Two-electron Atomic Screening in Fusion Reactions," *Phys. Rev. C: Nucl. Phys.* 1933, vol 48, no 2, pp 837-840.

#### AUTHORS' ABSTRACT

Recent laboratory experiments have measured fusion cross sections at center-of-mass energies low enough that the effects of atomic electrons are important. To extract the cross section for bare nuclei from these data (as required for astrophysical applications), it is necessary to understand these screening effects. A model is presented in which the evolution of the electron wave function is treated dynamically in the time-dependent Hartree-Fock scheme, while the motion of the nuclei is treated classically. The authors have calculated screening in the  $d + {}^2\text{H}$  [sic] and  $d + {}^3\text{He}$  reactions and give the effective screening energy

$U_e$  at small internuclear separations as a function of  $E$ . The resulting  $U_e$  values do not exceed the previously established adiabatic limits, and thus cannot explain the higher screening energies derived from experiments.

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### MINNESOTA - COLD FUSION THEORY

David D. Moon, *A Cold Fusion Theory*, self-published, may be ordered from him at No. 104, 4020 East 52nd Street, Minneapolis, MN 55417.

#### AUTHOR'S INTRODUCTION

A model of deuteron behavior in deuterium or titanium is presented. A single description of the deuteron dynamics, that of a collective, coherent oscillating train of deuteron waves, is proposed to account for a number of interactions between deuterons and the metal's nuclei or electron cloud. These interactions are then proposed to explain most of the variety of nuclear signatures being measured, including energetic charged particles, tritium, helium-4, low-level neutrons, gamma radiation and isotopic shifts of elements.

The theory makes a prediction that metals with isotopes having large thermal-neutron absorption cross sections will react better with deuterons in the lattice (for example, cadmium alloyed with palladium or titanium). Ideas for test cells are offered.

An attempt is also made to relate this theory of coherently oscillating deuterons to the phenomenon of sonoluminescence and acoustically driven fusion. In addition, a prediction is made of fission of heavy metals in some cold fusion experiments.

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### NEW YORK - BUSINESS WEEK

Summary by Dineh Torres

Mary Beth Regan (Washington), "The Sun Shines Brighter on Alternative Energy," *BusinessWeek*, Nov. 8, 1993, pp 94-5.

In a two-page article on alternative energy, people got a broad taste of the types of energy production that will be available in the future, but they are still in the dark about cold fusion research. Such alternative methods as wind, solar, biomass and photovoltaic power generation were discussed as potential contributors to the world electricity pool. Although these methods are still more expensive than coal or gas to generate electricity, and their efficiency

is lower, they are still contenders because they are renewable and nonpolluting.

Now, nearly 55% of the U.S. generated electricity comes from coal, 22% from nuclear reactors, 13% from oil and natural gas, and about 9% is hydroelectric. Less than 1% is derived at present from wind and solar power. Federal spending on energy research is on the upswing, it will be up 37% (\$347 million) in fiscal 1994 for renewable energy.

New designs of windmills and turbines have made wind power cheaper by being able to utilize higher wind force instead of running at one set speed, regardless of wind speed. These new designs will be commercially available, and selling electricity to major power grids both here and in eastern Europe.

Solar power is not doing quite as well, since it is farther behind research-wise. Two thin-film technologies are now converting sunlight to electricity at rates of 15.5% to 29.5% conversion. Photovoltaic cells made of silicon are still being developed, though at present they operate at an 8.5% efficiency. They could be incorporated into roof shingles, to generate energy in addition to electricity from the local grid. But this technology is proving to be much more expensive than the other alternative forms, costing around 18¢ per kwh or more.

[It does not seem odd that cold fusion and zero point energy are not even mentioned, since the media has kept most people in the dark about their research and development. Ideally, either of these technologies could produce electricity at much lower cost than any of the above methods, when they have been developed to commercially viable levels. Time will tell.]

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#### NEW YORK - MOON ENERGY?

"The Moon is Made of... an Unlimited Energy Source?" *Business Week*, 8 Nov. 1993, p 99.

<sup>3</sup>He would be the ideal fuel for nuclear fusion (hot) if it wasn't too comparatively rare. But Japan's MITI is looking at a new source--the moon--which scientists believe abounds in the rare isotope. Now the problem is to go harvest it and bring home the bounty. To brainstorm this possibility, MITI has gathered 20 major companies' help. Even so, Japan will probably need NASA's experience in space to master the task. This plan is barely a feasibility study yet, but if all goes well, will be happening before 2020, with a possible price tag of around \$250 million.

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#### VIRGINIA - DIFFUSION THEORY

*Chemical Abstracts*, Sept. 20, 1993

Courtesy of Samuel P. Faile

D.J. Abbott, J.B. Kraiman, R.T. Siegel, W.F. Vulcan, D.W. Viel, C. Petitjean, A. Zehnder, W.H. Breunlich, P. Kammel, et al. (Coll. Wm. & Mary, Williamsburg), "Diffusion of Muonic Deuterium and Hydrogen Atoms," *Muonic At. Mol., Proc. Intl. Workshop 1992*, pp 243-249.

#### AUTHORS' ABSTRACT

The analysis of an extensive PSI experiment on the diffusion of muonic H ( $\mu p$  and  $\mu d$ ) atoms in H and D gas is described. The present state of theoretical calculations of the scattering cross-sections for such atoms has progressed such that the analysis of the  $\mu d$  scattering can now present a good statistical fit to the data, although certain physical anomalies remain. The  $\mu p$  analysis still does not yield a good fit, but current development of the scattering theory offers prospects of improved fits to the data. The initial velocity distributions of the muonic H atoms, defined when the atoms reach the 1s state, are fitted to the diffusion data, and indicate mean energies for the  $\mu d$  and  $\mu p$  of  $\sim 1$  and 2eV, respectively. Results of the diffusion experiments are expected to detect the pressure conditions under which the study of muon capture in a statistical mixture of singlet and triplet of  $\mu p$  atoms can be measured, as well as providing information about epithermal effects in muon catalyzed fusion at low temperatures.

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#### WASHINGTON D.C. - SELECTIVE REPORTING

Carol White (Editor-in-Chief), "The Fleischmann-Pons Cell Boiloff: Is it Moonshine?" *21st Century Science and Technology*, vol 6, no 3, fall 1993, pp 70-74+.

#### SUMMARY

This article is a commentary on the recent Fleischmann-Pons paper published in *Physics Letters A*, May 3, 1993, and on the criticism it has attracted. *New Scientist* author William Bown wrote an article appearing in the May 1 issue of that magazine, that deprecates the detailed research reporting of the F-P boiloff experiment, and quotes data from only day one of an eighteen day experiment. With such patently inaccurate information, it is no wonder that Bown's article is discarded by the author as "blatantly dishonest."

Also discussed was Douglas Morrison's "selective and biased reporting" in a critique of the F-P experiment which he aired on e-mail, and has submitted to *Physics Letters A*, also. The critique was filled with misquotes and inconsistencies, as well as obvious ignorance of the reports in the same F-P paper of comparisons with blank cell experiments. Fleischmann and Pons have written a rebuttal to Morrison's attack, in which they answer each accusation or inaccuracy with experimental facts and clarifications of results and techniques.

## D. NEWS FROM ABROAD

### ARGENTINA - TACHYON PROPAGATOR

Courtesy of Samuel P. Faile

D.G. Barci, C.G. Bollini and M. Rocca (Dept. Phys., Fac. Exact Sci., Univ. Nat. de La Plata, Argentina), "The Tachyon Propagator," *Il Nuovo Cimento* 1993, vol 106 A, no 5, pp 603-609, 10 refs.

#### AUTHORS' ABSTRACT

Following the canonical quantization procedure for a tachyon field, the usual Hamiltonian and the creation and annihilation operators are obtained. The observation that the mass hyperboloid  $p^2 - m^2 = 0$  is one-sheeted, as opposed to the case of bradyons where  $p^2 - m^2 = 0$  is two-sheeted, as opposed to a base which is unbounded for negative as well as for positive energies. There is a zero-energy eigenfunction from which all other states can be constructed by repeated application of decreasing or increasing operators; within this Fock space the vacuum expectation value of the chronological product of field operators is shown to coincide with Cauchy's principal-value Green's function.

### AUSTRALIA - SFC ANALYSIS OF Pd CATHODES

*Chemical Abstracts*, Sept. 20, 1993

Courtesy of Samuel P. Faile

Carolyn T. Dillon and Brendan J. Kennedy (Dept. Inorg. Chem., Univ. Sydney), "The Electrochemically formed Palladium-Deuterium System. I. Surface Composition and Morphology," *Aust. J. Chem.*, 1993, vol 46, no 5, pp 663-679.

#### AUTHORS' ABSTRACT

Surface analysis of Pd cathodes after prolonged electrolysis in D<sub>2</sub>O electrolytes shows evidence for the electro-deposition of Pt, Zn, and Cu. The Pt comes from the Pt anode used in the work, whereas Zn and Cu are present in the D<sub>2</sub>O. SEM studies of cast Pd cathodes reveal a diverse surface topology with no single feature present. The effect of electrode pretreatment on the appearance of the micro-crystallites is discussed, and evidence for a palladized overlay is presented.

#### EDITOR'S COMMENTS

The appropriate treatment for a palladium or palladium alloy to be used as a cold fusion cathode is still unclear. This article may provide some insight as to the conditions on the surface of a successful cathode.

### AUSTRALIA - PALLADIUM DEUTERIDE

*Chemical Abstracts*, Oct. 18, 1993

Courtesy of Samuel P. Faile

Carolyn T. Dillon, Brendan J. Kennedy, Margaret M. Elcombe (Dept. Inorg. Chem., Univ. Sydney), "The Electrochemically Formed Palladium-deuterium System. II. In situ neutron diffraction studies," *Aust. J. Chem.* 1993, vol 46, no 5, pp 681-692.

#### AUTHORS' ABSTRACT

An in situ neutron diffraction study of the electrochemical formation of  $\beta$ -PdD<sub>x</sub> in 1M LiOD at room temperature is described. Electrolysis at relatively high overpotentials for over 200 h gave  $\beta$ -PdD<sub>0.59</sub> (@ 4.0422 Å), with no evidence for the formation of a bulk phase with higher D content or occupancy of the tetrahedral sites on the face centered cubic lattice. The formation of a thin layer on the surface of the cathode with  $x > 0.59$  could account for the observation of gas evolution once electrolysis is stopped. Evidence for hysteresis in the re-formation of Pd by oxidation of  $\beta$ -PdD<sub>x</sub> is also presented.

### CANADA - MUONIC D & T

*Chemical Abstracts*, Sept. 20, 1993

Courtesy of Samuel P. Faile

G.M. Marshall, J.L. Beveridge, J.M. Bailey, G.A. Beer, P.E. Knowles, G.R. Mason, A. Olin, J.H. Brewer, B.M. Forster, et al. (TRIUMF, Vancouver, BC, Canada), "Hot Muonic Deuterium and Tritium from Cold Targets," *Muonic At. Mol., Proc. Intl. Workshop* 1992, pp 251-260.



## AUTHORS' ABSTRACT

Experiments are described which use a solid H layer to form muonic hydrogen isotopes in vacuum. The method relies on transfer of the muon from protium to either a deuteron or a triton. The resulting muonic D or muonic T will not immediately thermalize because of the very low elastic cross sections, and may be emitted from the surface of the layer. Measurements which detect decay electrons, muonic x-rays, and fusion products have been used to study the processes. A target has been constructed which exploits muonic atom emission in order to study the energy dependence of transfer and muon molecular formation.

**CHINA - POSITRON ANNIHILATION**

*Chemical Abstracts*, Oct. 18, 1993  
Courtesy of Samuel P. Faile

Xihui Luo (Fushun Res. Inst. Pet. Petrochem., Peoples Rep. China), "Recent Approach of PASCA in Catalysis Study," *Shiyou Xuebao, Shiyou Jiagong*, 1992, vol 8, no 2, pp 77-84, a review with 22 refs, in Chinese.

## AUTHOR'S ABSTRACT

PASCA (Positron Annihilation Spectroscopy for Chemical Analysis) is a newly developed surface technique, which is based on the chemical reactions of the probe atom, o-P (ortho-positronium), whose lifetimes and intensities depend upon the electron d. and the structure of surface active sites of porous materials. In the last few years, PASCA has been extended to the studies of heterogeneous catalysts and their supports, and more experimental results have been obtained, which include: (1) studying the interaction between metal and its support, which strongly affects the surface properties; (2) characterizing the surface structures (formation of surface complexes or compounds); (3) correctly determining the dispersity of metal (Pt, WO<sub>3</sub>, MoO<sub>3</sub>, and NiO) on catalyst surface and judging its dispersion state; and (4) studying the synergism between zeolites and matrixes. All these indicate that PASCA is a sensitive, accurate and effective technique for catalysis study.

**CHINA - IMPACT FUSION**

*Chemical Abstracts*, Oct. 4, 1993  
Courtesy of Samuel P. Faile

Zhungying Pan (Fundan Univ., Shanghai, Peoples Rep. of China), "Cluster-impact Fusion Experiments and Collision Acceleration Mechanism," *Hejishu* 1993, vol 16, no 3, pp 146-151, in Chinese.

## AUTHOR'S ABSTRACT

The collisional interaction of heavy-water clusters with a TiD target has been studied. Deuteron spectra have been detected by an analysis method and the molecular dynamics simulation. The maximum deuteron energy can exceed six times their initial energy due to the wide-angle scattering between deuterons and moving heavy atoms.

**GERMANY - HEAVY-ION COLLISIONS**

*Chemical Abstracts*, Sept. 20, 1993  
Courtesy Samuel P. Faile

Oliver Graf (Fachbereich Phys., Johann Wolfgang Goethe Univ., Frankfurt/Main), "Collective Model for Describing Low-Energy Heavy-Ion Collisions," *GSI-Rep.* 1993, GSI-93-25, 140 pp, in German.

## AUTHOR'S ABSTRACT

A collective description is given of heavy-ion collisions near the Coulomb barrier. Mass transfer between the colliding ions was studied. A formalism was conceived to make possible a calculation in 3 collective coordinates: the distance R between the centers of the colliding nuclei, the mass asymmetry  $\eta$ , and the neck degree of freedom  $\epsilon$ , which represents a measure for the thickness of the neck which is formed in the case of contact between 2 nuclei. Additional topics discussed are the classical equations of motion, the collective Hamiltonian operator, the potential energy surface, the mass tensor, fixation of the friction parameter for calculating classical trajectories (e.g., U86Kr + <sup>166</sup>Er and <sup>208</sup>Pb + <sup>208</sup>Pb), solution of the Schrödinger equation for mass asymmetry, and dynamic treatment of the neck degree of freedom (e.g. in the <sup>238</sup>U + <sup>238</sup>U collision). These studies should lead to a decisive statement concerning the possible existence and possibility of detection of the e<sup>+</sup> peak in the case of spontaneous decay of the quantum electrodynamic vacuum in supercritical heavy-ion collisions.

**GERMANY - ATOMIC CASCADE**

*Chemical Abstracts*, Sept. 20, 1993  
Courtesy of Samuel P. Faile

F.J. Hartman (Phys. Dept., Tech. Univ. Muenchen, Garching), "The Exotic-Atom Cascade," *Muonic At. Mol., Proc. Intl. Workshop* 1992, pp 157-165.

## AUTHOR'S ABSTRACT

The atomic cascade of exotic particles is described from the start after Coulomb capture to the end by particle decay or nuclear capture. A new way of taking electron depletion and refilling during the exotic-particle quantal cascade into account is proposed.

## ITALY - WORKSHOP ON COLD FUSION

Proceedings of the Rome Workshop on the Status of Cold Fusion in Italy, Università di Roma III, 14-16 Feb. 1993, a bilingual (mostly in Italian) collection of the papers presented at the workshop. Abstracts of the English papers are included in this issue. The remainder will be included next month.

## ITALY - NUCLEAR ASHES

B. Stella<sup>1,2</sup>, F. Celani<sup>3</sup>, M. Corradi<sup>2</sup>, F. Ferrarotto<sup>2</sup>, N. Iucci<sup>1</sup>, V. Milone<sup>2</sup>, A. Spallone<sup>3</sup>, G. Villoresi<sup>1,4</sup> [ 1) Dip. Fis., Univ. di Roma III; 2) INFN Sezione di Roma I, at Dip. di Fisv., Univ. "La Sapienza"; 3) Lab. Naz. INFN di Frascati; 4) Ist. Fis. Spazio Interplanetario - CNR Frascati (Roma).], "The FERMI Apparatus," Proc. Rome Workshop on the Status of C. F. in Italy, Università di Roma III, 14-16 Feb. 1993, pp 25-41, 4 refs, 11 figs, 2 tables.

## AUTHORS' INTRODUCTION

Unambiguous detection of "nuclear ashes" (neutrons, protons, tritium and gamma rays) is fundamental in cold fusion studies. FERMI is an apparatus to detect neutrons and gammas (plus tritium off-line) coming from cold fusion phenomena. To minimize the neutron background the detector has been placed inside the INFN Gran Sasso underground laboratory at Assergi (AQ), where 1200 m. of solid rock shield it from cosmic rays, reducing the neutron rate by about  $10^3$  times respect to normal external conditions.

The name FERMI means (in Italian) "Electrochemical Fusion with Interdisciplinary Dedicated Research" and refers to the collaboration of specialists in different branches (particle and nuclear physicists, chemists, material engineers).

Relevant features of the apparatus are: high efficiency, pulse shape acquisition and good time resolution (sensitivity

to neutron bursts); it can also perform a good statistical reconstruction of the average neutron energy by comparison with a full simulation.

FERMI detects neutrons by 7 BF<sub>3</sub> and 2 <sup>3</sup>He proportional counters, after they have been thermalized in a big polyethylene structure (which acts both as a moderator and a mechanical support) covering about 99% of the total solid angle.

Gamma rays are detected by one big NaI crystal with low intrinsic background phototube and amplifier placed at one end of the neutron detector near the experimental sample.

The electronics system is highly redundant and uses fast scalers, pulse height ADCs and Flash ADCs measurement separately for all counters, for a better check of spurious and systematic effects. A full automatic acquisition is performed, including timing for each event.

## ITALY - THE TOFUS EXPERIMENT

E. Botta, T. Bressani, D. Calvo, and F. Iazzi (Inst. Naz. di Fis. Nuc., Torino, Italy), "The TOFUS Experiment: Results and Future Developments," Proc. Rome Workshop on the Status of C. F. in Italy, Università di Roma III, 14-16 Feb. 1993, pp 83-92, 10 refs, 9 figs.

## AUTHORS' INTRODUCTION

The D<sub>2</sub> gas loading technique in Ti and Pd metals had its birth and growth in parallel with the electrochemical loading technique in cold fusion experiments. The methodology developed for this technique is the answer to the request for fast metal loading in order to achieve the maximum atomic ratio D/Pd (Ti).

Furthermore, it gives the opportunity of investigating the nuclear origin of the cold fusion phenomena by the detection of 2.5 MeV neutrons, as an unambiguous signature of fusion events, with high accuracy in the energy evaluation.

Other significant features of the gas loading technique are: 1) good cleaning of the sample obtained by degassing; 2) the sample is not in contact with the atmosphere since the circuit is completely sealed; 3) good monitoring of the thermodynamic variables, like pressure and temperature.

This latter information allows evaluation of the time evolution of the loading (defined as the ratio between the

number of monatomic gas moles in the metal and the metal moles) and to follow the time evolution of the Ti(Pd)/D system in the phase diagram.

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### ITALY - TRITIUM PRODUCTION

M. Alessio, M. Corradi, F. Croce, F. Ferrarotto, S. Improta, V. Milone, and B. Stella (INFN Roma and Dip. di Fisica e Chimica, Univ. "La Sapienza," Rome), "Measurement of Tritium, Neutrons, and Gamma Rays Produced in an Electrolytic Pd-D Experiment," Proc. Rome Workshop on the Status of C. F. in Italy, Università di Roma III, 14-16 Feb. 1993, pp 93-109, 3 refs, 8 figs.

#### AUTHORS' ABSTRACT

A D<sub>2</sub>O-LiOD electrolysis with Pd cathode has been realized with emphasis on the cleanliness of all components. D<sub>2</sub> and O<sub>2</sub> produced gases were recombined using a room temperature catalytic converter and the resulting water was usually monitored twice a day for tritium content; the same sampling was done for the electrolytic solution.

Loading the Pd with variable currents, an elongation of 130 μm (with much larger radial broadening) was observed in the first few days, accompanied by a 60-100% tritium excess detected in the recombined water. The measured neutron rate in the same period was consistent with the background (95% confidence upper limit of 13x10<sup>-3</sup> neutrons/s), giving an upper limit of 10<sup>-6</sup> for the ratio neutrons/tritium. A careful analysis of the measured γ rays spectrum and rate gives a 95% c.l. upper limit of 1.5x10<sup>-3</sup> relative possible excess respect to the measured background in the range 160 KeV - 7.5 MeV in the same period of the observed cathode elongation and tritium excess.

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### ITALY - NEUTRON EXCESS

M. Corradi, F. Ferrarotto, N. Iucci, V. Milone, B. Stella (Univ. Roma III and INFN Roma 1), G. Villoresi (Ist. Fisica Spazio Interplanetario), F. Celani and A. Spallone (INFN Frascati - Roma), "Excess of Neutrons Coming out of Deuterated Palladium Samples Irradiated by Prevalently Thermal Neutrons," Proc. Rome Workshop on the Status of C. F. in Italy, Università di Roma III, 14-16 Feb. 1993, pp 110-125, 4 refs, 6 figs, 2 tables.

### AUTHORS' ABSTRACT

In order to study the effect of palladium lattice in cold fusion, to realize the local non-equilibrium situation, metallic deuterated Pd specimens have been irradiated with partly moderated Am/Be neutrons and the resulting neutron intensity has been measured by the FERMI apparatus, an efficient and sophisticated detector from moderated neutrons.

Once subtracted the vessel + (empty) Pd effect measured in "blank" runs, an excess of  $14.7 \pm 0.6$  neutrons per sec. ( $\approx 4\%$  of the total measured rate) has been detected. We find 1 MeV average energy of the excess and the reconstructed rate would correspond to several outgoing neutrons for every neutron impinging on the Pd-D samples. Similar measurements with Cadmium absorber gave lower effects. We don't observe any excess with pressurized gaseous deuterium (as expected by MC simulation). Systematic errors due to the slightly movable position of the source cannot be excluded.

The repetition of this experiment with the same Pd samples in somewhat different conditions and with fixed source gave a much lower excess. The distribution of the time interval between subsequent neutron pulses was also independently studied, giving hints for the real effect.

The possible systematic errors in the first experiment do not seem to be a likely explanation for the whole of our results. The underlying process can be preferentially interpreted as d-d fusion in a Pd-D<sub>x</sub> lattice perturbed by neutrons. The excess, predominantly due to quasi-thermal incident neutrons, would demonstrate that the palladium lattice strongly increases the probability for d-d fusion even almost at rest, addressing a key issue of solid state fusion.

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### ITALY - EXCESS HEAT, NO NEUTRONS NOR T

Daniele Gozzi<sup>1</sup>, P. Luigi Cignini<sup>2</sup>, Riccarda Caputo<sup>1</sup>, Massimo Tomellini<sup>3</sup>, Giovanni Balducci<sup>1</sup>, Guido Gigli<sup>1</sup>, Evaristo Cisbani<sup>4</sup>, Salvatore Frullani<sup>4</sup>, Franco Garibaldi<sup>4</sup>, Mauro Jodice<sup>4</sup>, and G. Maria Urciuoli<sup>5</sup> [ in Rome: 1) Dip. Chim., Univ. La Sapienza; 2) CNR - Centro di Termodinamica Chimica alle Alte Temperature, Dip. Chim., Univ. La Sapienza; 3) Dip. di Scienze e Technologie Chim., Univ. Tor Vergata; 4) Lab. di Fisica, Ist. Sup. di Sanità; 5) INFN sez. Sanità.], "Experiments with Global Detection of Cold Fusion Byproducts," Proc. Rome Workshop on the Status of C. F. in Italy, Università

di Roma III, 14-16 Feb. 1993, pp 126-138, 16 refs, 6 figs, 3 tables.

#### AUTHORS' ABSTRACTS

On the line of the previous experiments carried out in a multicell electrochemical system, we will present the results obtained with an improved experimental apparatus recently assembled. In the present experimental configuration, we have a 60 <sup>3</sup>He tubes neutron counter from Jomar/Canberra (Los Alamos, NM) in which the ten cells system is located. In this way the efficiency of the neutron detection has been increased from  $5 \times 10^{-5}$  to 0.22. The sixty tubes are divided in twelve groups to localize which cell is generating neutrons owing to the counting of the twelve separate scalers. <sup>4</sup>He determination by mass-spectrometry is another feature recently added to our experiment.

Results confirm what we already obtained and presented at ACCF2 in 1991 and ICCF3 last year in Nagoya. They are essentially the production of excess heat up to 43% without any appreciable neutron and tritium excesses compared to the respective backgrounds. At the present meeting we will show part of the results already presented in the Proceedings of the Nagoya Conference and the considerations given by the first author during the round table discussion. These considerations showed both the non-chemical nature of the cold fusion and <sup>4</sup>He recovery aspects during a cold fusion experiment.

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#### ITALY - COLD FUSION THEORY

Giuliano Preparata (Dip. Fisica, Univ. Milano and INFN, Sezione di Milano), "Towards a Theory of Cold Fusion Phenomena," Proc. Rome Workshop on the Status of C. F. in Italy, Università di Roma III, 14-16 Feb. 1993, pp 179-204, 10 refs, 7 figs.

This is the text of a lecture given by Dr. Preparata at the conference. It contains many of the equations involved in putting together his theory, as well as figure illustrations.

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#### JAPAN - H<sub>2</sub>O WITH THIN NICKEL FOIL

Takaaki Matsumoto (Dept. Nuc. Eng., Hokkaido Univ., Sapporo), "Cold Fusion Experiments with Ordinary Water and Thin Nickel Foil," *Fusion Technology*, vol 24, no 3, pp 296-306, 17 refs, 9+ figs.

#### AUTHOR'S ABSTRACT

Cold fusion experiments with ordinary water and thin nickel foils are described. The temperature variation and the surface condition of the foils are examined. It has been proven that ordinary water can produce excess heat. Furthermore, reaction products are recorded on nuclear emulsions. Charged particles, electrons, protons, and deuterons, are observed. Micro-explosions caused by gravity decay of neutron nuclei are also recorded. Many traces indicating tiny black holes and white holes are clearly observed. The mechanisms of cold fusion with ordinary water are discussed in terms of the Nattoh model.

#### FURTHER QUOTES

The Nattoh model is based on only one hypothesis - that hydrogen clusters, consisting of more than two hydrogen atoms, that are trapped in tiny cavities, such as grain boundaries, defects, and interfaces in metal, compress themselves to induce hydrogen-catalyzed fusion reactions when the hydrogen pressure exceeds some critical value under electrical current flow.

When a metal with lower hydrogen permeability, such as nickel, is used for cold fusion experiments, hydrogen clusters might be formed on the surface of the metal to induce cold fusion by the overpotential of the electrolysis.

The excess heat with the pin anode is higher than that with the helical wire anode.

#### AUTHORS' SUMMARY

It seems difficult to accept that gravity decay takes place on the neutron nucleus because the gravitational force is 40 orders of magnitude less than the comparably weak electromagnetic force. It should not be understood that the gravitational force predominantly works itself to collapse as soon as the neutron nucleus is produced. On the birth of the neutron nucleus, the ionic mesh covers it up so that it would not scatter neutrons, and it compresses the nucleus to destroy its nuclear structure. As the shrinking of the nucleus progresses, the gravitational force effectively begins to work on it. Finally, gravity decay takes place. As micro-explosions of neutron nuclei without an iton were found, the compression process can somewhat be maintained initially after the breakup of the ionic mesh. Recently, traces of the white holes have been reproduced in an experiment involving alternating current charging with titanium bolts. Tiny sparks have been observed and

the traces resulting from the sparks are very similar to those found in the white holes observed in this experiment.

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### JAPAN - ONE-POINT COLD FUSION

Takaaki Matsumoto (Dept. Nuc. Eng., Hokkaido Univ., Sapporo), "Experiments of One-point Cold Fusion," *Fusion Technology*, vol 24, no 3, pp 332-339, 13 refs, 12 figs.

#### AUTHOR'S ABSTRACT

Experiments of one-point cold fusion have been performed by electrical discharging in ordinary and heavy water mixed with 0.6 mol/l potassium carbonate. A platinum pin anode was located perpendicular to a copper plate cathode. After discharge, the surfaces of the copper plates were examined by an optical microscope. Many ring spots caused by gravity decay of single and di-neutrons were separately distributed on the plates. Furthermore, several kinds of traces that might be produced by ionic hydrogen clusters and by tiny black and white holes were observed. The mechanisms of cold fusion by electrical discharge are also discussed in terms of the Nattoh model.

#### AUTHOR'S DISCUSSION

Recently, Mills and Kneizys reported that in their experiments with a thin nickel foil, excess energy could be enhanced by employing radio-frequency fluctuation. The optimum was determined to be ~ 500 Hz. This means that surface reactions might occur in bursts for ~ 2 ms.

When low voltage is applied, the compression effect is weak so that hydrogen clusters with many hydrogen atoms cannot completely be compressed. The catalyzed fusion reactions are limited to hydrogen clusters with a small number of hydrogen atoms. Therefore, fusion products such as single and di-neutrons and protons are emitted. The di-neutrons are "fermented" and covered with ionic mesh so that they undergo gravity decay and explode. Ring spots are caused by those explosions. The single neutrons also under gravity decay.

With high voltage, on the other hand, hydrogen clusters with many hydrogen atoms can be compressed by the electrical discharge. Various reactions can take place in extremely compressed clusters. For example, more than two fusion reactions can simultaneously occur, or multibody fusion reactions can produce heavy elements. Most remarkable is the production of tiny black and white

holes that are caused by the gravity decay of heavy hydrogen clusters. These were predicted by the Nattoh model, and traces suggesting these events were successfully observed on nuclear emulsions. When the compression is completely symmetrical, tiny black and white holes can be produced. However, the compression of large clusters is not always complete, or alternatively, several fusion reactions precede and release energy. Then, the ionic hydrogen clusters are broken down. As mentioned earlier, it has been proven that cold fusion can be induced by electrical discharges in water. Explosions during electrolysis have been regarded simply as hydrogen gas explosions so far. However, they may initially be induced by cold fusion reactions and followed by gas explosions. To avoid explosions, the distance between the electrodes should be chosen properly. Even if the electrolysis is maintained continuously with low voltage, there might be local and small discharges that would enhance energy release.

Lastly, an important suggestion should be added. During cold fusion, hydrogen-catalyzed fusion reactions and gravity decay both contribute to the excess heat production, more or less. Their relative contributions significantly depend on the applied voltage. By increasing the voltage, the ring traces caused by the former disappear, and tiny black and white holes are produced by the latter that are more effective for transforming mass to energy. Therefore, it is possible to obtain more excess energy by increasing the voltage used in the electrolysis.

#### EDITOR'S COMMENTS

It is suggested that theorists should take a careful look at the results obtained with one-point cathode in an electrochemical solution as compared to a similar device used in deuterium gas plasma experiments such as done by Dufour of France. See also the letter to editor from Dr. Dufour.

Also, in the "Letters to the Editor" column, "Comments on 'Experiments of One-point Cold Fusion'" by Hal Fox is written to compare some of the effects described in the paper to the EVs or high-density charge clusters of Ken Shoulders' U.S. Patent no. 5,018,810. Following that letter is a response from Dr. Matsumoto, discussing the comparison. [*Fusion Technology*, vol 24, no 3, pp 347-8]

## JAPAN - LIGHT WATER EXPANSION

Tadayoshi Ohmori and Michio Enyo (Hokkaido University, Catalysis Research Ctr., Kitaku, Sapporo), "Excess Heat Evolution During Electrolysis of H<sub>2</sub>O with Nickel, Gold, Silver, and Tin Cathodes," *Fusion Technology*, vol 24, no 3, pp 293-295, 9 refs, 2 figs, 4 tables.

### AUTHORS' ABSTRACTS

Excess heat evolution was measured on nickel, gold, silver, and tin in aqueous K<sub>2</sub>CO<sub>3</sub>, Na<sub>2</sub>CO<sub>3</sub>, Na<sub>2</sub>SO<sub>4</sub>, and Li<sub>2</sub>SO<sub>4</sub> solutions under galvanostatic electrolysis conditions. Steady evolution of excess heat in various electrode-electrolyte systems, but not in Ni/Na<sub>2</sub>CO<sub>3</sub>, Ni/Na<sub>2</sub>SO<sub>4</sub>, and Ni/Li<sub>2</sub>SO<sub>4</sub>, was observed for at least several days. The largest excess heat observed was 907 mW on tin in K<sub>2</sub>SO<sub>4</sub>.

The largest amount of excess heat was observed on the tin electrode whose surface was mechanically abraded; the value reached after 65 hours of polarization was 26%, as compared with the input power of  $(4.95-1.48) \times 1 = 3.47$  W.

Excess heat evolution on nickel was observed only in K<sub>2</sub>CO<sub>3</sub>. On silver and tin, it was greater in K<sub>2</sub>CO<sub>3</sub> than in Na<sub>2</sub>CO<sub>3</sub> or Li<sub>2</sub>SO<sub>4</sub>. On gold, no large difference was observed among these electrolytes. These results may suggest that [certain] reactions all occur in general, but the degree of the progress of each reaction depends on the nature of the electrode material, surface and bulk conditions of the electrode, adsorbed or underpotential deposited species, etc.

### EDITOR'S COMMENTS

We commend the authors on this fine addition to the science of cold fusion where the use of cathodes is extended to gold, silver, and tin. Theorists, please note. What is the nature of tin that improved results are found. Is this a condition of surface catalysis and tin is the better catalyst?

## JAPAN - COLD FUSION VERIFICATION?

Courtesy of Jed Rothwell

### *Oyou Butsuri* (JJAP) Articles

People interested in cold fusion who read Japanese will definitely want to see six articles in the most recent issue of the *Oyou Butsuri*, vol 62, no 7, July 1993 (Journal of

the Japanese Society of Applied Physics). This is one of the most authoritative, respected physics journals in Japan.

The articles are grouped together in the table of contents under the heading "Has Cold Fusion Been Verified?"

\*"Production of Neutron, Tritium, and Excess Heat," Akito Takahashi.

\*"Emission of Energetic Charged Particles," Jirohata Kasagi and Keizo Ishii.

\*"Helium-4 Production and its Correlation with Heat Evolution," by Eichi Yamaguchi and Takashi Nishioka.

"Critical Points for the Evaluation of Measured Results on Cold Fusion," [the Japanese adds: "Evidence of Nuclear Reactions"], Tokushi Shibata (Inst. for Nuclear Study, Univ. of Tokyo).

"Key Points in the Evaluation of Experimental Results (the Excess Heat)," Michio Enyo (Catalysis Research Center, Hokkaido Univ.).

"Next Step to Promote Cold Fusion Researches," Hideo Ikegami (NIFS).

\* abstracts in this issue of *FF*.

## JAPAN - CHARGED PARTICLE EMISSION

Akito Takahashi (Dept. Nuc. Eng., Osaka Univ.), "Production of Neutron, Tritium, and Excess Heat," *Oyou Butsuri* (JJAP) 1993, vol 62, no 7, pp 707-709, in Japanese.

### AUTHOR'S ABSTRACT

Major results obtained up to now in cold fusion experiments are introduced for neutron, tritium and excess heat generation. Neutron spectra show a 2.5 MeV peak and a 3-10 MeV continuous component. An anomaly is also shown in the  $n/T$  ratio of  $10^{-4}$  to  $10^{-9}$ . The production of excess heat has been confirmed in many laboratories.

## JAPAN - ENERGETIC CHARGED PARTICLES

Jirohata Kasagi and Keizo Ishii (Tohoku Univ.), "Emission of Energetic Charged Particles," *Oyou Butsuri* (JJAP) 1993, vol 62, no 7, pp 710-711, in Japanese.

### AUTHORS' ABSTRACT

Energetic charged particles were measured in the 150 keV deuteron bombardment on highly deuterated TiD<sub>x</sub>. Protons with energies up to 17 MeV were observed; they cannot be

explained as products of the usual D+D reaction. The detailed analysis of the energy spectra gave the following conclusions: (1) An anomalous concentration of  $^3\text{He}$  was found in only a few samples of  $\text{TiD}_x$ . The concentration was inferred to be the result of nuclear transmutation during  $\text{D}_2$  gas loading into Ti rods. (2) Nuclear reactions, in which three deuterons react sequentially, occurred during the bombardment. In addition, the possibility of an unusual reaction in which three deuterons react simultaneously was suggested.

#### JAPAN - HELIUM-4 AND HEAT

Eiichi Yamaguchi and Takashi Nishioka (NTT), "Helium-4 Production and its Correlation with Heat Evolution," *Oyou Butsuri* (JJAP) 1993, vol 62, no 7, pp 712-714, in Japanese.

#### AUTHORS' ABSTRACT

Using our "in vacuo" method with a hetero-structure of deuterated Pd (Pd D) at low temperatures below  $300^\circ\text{C}$ , we have detected "in situ"  $^4\text{He}$  production. The real-time observation has been performed by high-resolution quadrupole mass spectroscopy (0.001 amu at 4 amu). The signal attributable to  $^4\text{He}$  production appeared when the samples exhibited a sudden increase in temperature. The system of H-loaded Pd (Pd-H) hetero-structure, on the other hand, produced no  $^4\text{He}$ . This result indicates that a new class of nuclear fusion occurred in condensed matter.

#### KOREA - DISLOCATIONS PREFERRED

*Chemical Abstracts*, Sept. 20, 1993  
Courtesy of Samuel P. Faile

Won Il Koh, Young Ku Yoon, Yong Ki Park (Korea Adv. Inst. Sci. Technol., Taejon, S. Korea), "Palladium-Hydrogen Interaction Studied by the Positron Annihilation Technique," Pacific Rim International Conference on Advanced Materials Technology, *Proceedings 1st 1992*, pp 421-426.

#### AUTHORS' ABSTRACT

The behavior and interaction of H atoms with defects in H-charged Pd electrodes were studied using the positron annihilation (PA) method. Lifetime results from PA measurements of the Pd electrodes indicated that H atoms could be trapped at dislocations and vacancies in the electrodes and that dislocations were slightly more

preferred sites than vacancies. It was also inferred from R parameters that the formation of hydrides was accompanied by generation of mostly dislocations. Doppler broadening results from Pd electrodes also indicated that lattice defect sites where positrons were trapped first increased and then decreased, and this cycle was repeated as electrolysis continued. It can be inferred from PA measurements of the cold-rolled Pd and the isochronally annealed Pd hydride specimens that microvoid-type defects existed in the H-charged electrode specimen.

#### RUSSIA - MUONS AND FUSION IN $\text{D}_2 + ^3\text{He}$ GAS

*Chemical Abstracts*, Sept. 20, 1993  
Courtesy of Samuel P. Faile

D.V. Balin, V.N. Baturin, Yu.A. Chestnov, E.M. Maev, G.E. Petrov, G.G. Semenchuk, Yu.V. Smirenin, A.A. Vorobyov, N.I. Voropaev (St. Petersburg Nucl. Phys. Inst., Gatchina, Russia), "Muonic Atom Formation, Muon Transfer and Nuclear Fusion in a  $\text{D}_2 + ^3\text{He}$  Gas Mixture," *Muonic At. Mol., Proc. Intl. Workshop 1992*, pp 25-33.

#### AUTHORS' ABSTRACT

In the gas mixture  $\text{D}_2 + ^3\text{He}$  the probability of  $d\mu$ -atom formation in the ground state was detected,  $W=0.535 \pm 0.017$ , and also the rate of molecular muon transfer  $\lambda_{d3\text{He}} = (1.24 \pm 0.05) \times 10^8 \text{s}^{-1}$  and the upper limit of the nuclear fusion rate in the  $^3\text{He}\mu\text{d}$  molecule,  $\lambda_f < 7 \times 10^7 \text{s}^{-1}$ , by means of registration of charged fusion products of  $d\mu$  catalysis and muon capture in the ionization chamber. The experiment was done at the muon channel of PNPI at a gas pressure of 87 atm. and an atmospheric concentration of  $^3\text{He}$  of 11%.

#### RUSSIA - NUCLEAR FUSION IN SOLIDS

Gennady V. Fedorovich (Theoretical Problems Dept., Rus. Acad. Sci., Moscow), "A Possible Way to Nuclear Fusion in Solids," *Fusion Technology*, vol 24, no 3, pp 288-292, 33 refs, 3 figs.

#### AUTHOR'S ABSTRACT

The proposal for an experiment to investigate a new physical object (called the "E-cell") is presented. The E-cell can be used as an appropriate "catalyst" for nuclear fusion reactions in solids. The E-cell is a radiation defect of a crystalline lattice of some light metal ( $^6\text{Li}$ ,  $^7\text{Be}$ ,  $^{10}\text{B}$ ) hydride that is formed after a fission (as a result of a

thermal neutron capture) of a metal atom nucleus. If the pressure in the crystal is in the megabar range, the following two features of the E-cell are of interest:

1. The average density of free electrons in the central region of the E-cell exceeds  $10^{24} \text{ cm}^{-3}$ ; this results in a large suppression of the Coulomb barrier between hydrogen nuclei; the value of the screening parameter exceeds  $\approx 10^9 \text{ cm}^{-1}$ .
2. The potential energy of the preliminary compressed crystalline lattice can be transformed into the kinetic energy of the collision of a pair of hydrogen nuclei. This energy can reach some hundreds of electron-volts, and it provides the possibility of an approach between hydrogen nuclei to a distance of  $\leq 10^{-9} \text{ cm}$ .

The summary result is the effective catalysis of hydrogen nuclear fusion to a detectable rate. The experimental investigation of the E-cell can lead to the creation of conditions for the effective enhancement of the fusion rate to values that are of practical interest.

#### RUSSIA - MUON TRANSFER

*Chemical Abstracts*, Sept. 20, 1993  
Courtesy of Samuel P. Faile

S.S. Gershtien (Inst. High Energy Phys., Protvino, Russia), "Muon Transfer Processes. Old and New Problems," *Muonic At. Mol., Proc. Intl. Workshop 1992*, pp 169-186.

#### AUTHOR'S ABSTRACT

The observed transfer rates of muons from mesic H atoms to the nuclei of heavier elements as well as the isotopic exchange in the excited states of mesic H atoms and their Coulomb de-excitation, are explained satisfactorily by the crossings or quasicrossing of molecular terms, discovered earlier. But still, the precision measurements done over recent years at meson facilities require that a natural development of the quasiclassical theory, related to quantum oscillations and retardation processes of mesic H atoms in medium, should be made.

#### RUSSIA - POSSIBLE MECHANISM

*Chemical Abstracts*, Sept. 20, 1993  
Courtesy of Samuel P. Faile

B.F. Lyakhov, A.G. Lipson, D.M. Sakov, A.A. Yavich (Inst. Fiz. Khim., Moscow), "Anomalous Heat Evolution in a Palladium/Palladium Monoxide System Electrolytically Saturated with Hydrogen," *Zh. Fiz. Khim.*, 1993, vol 67, no 3, pp 545-550, in Russian.

#### AUTHORS' ABSTRACT

An anomalously high pulsed heat evolution was detected in electrolytically H-saturated heterostructures of Pd/PdO. A possible mechanism is proposed for the effect, based on a hypothesis of the existence in the defective surface layer of portions of a metastable phase of quasi-metallic H. Applications to cold fusion research are indicated.

#### RUSSIA - EPITHERMAL EFFECTS

*Chemical Abstracts*, Sept. 20, 1993  
Courtesy of Samuel P. Faile

V.E. Markushin (Kurchatov A. Energy Inst., Moscow), "Kinetics of Muon Catalyzed Fusion in Hydrogen/Deuterium/Tritium Mixtures," *Muonic At. Mol., Proc. Intl. Workshop 1992*, pp 267-273.

#### AUTHOR'S ABSTRACT

The results of kinetics calculations of muon catalyzed fusion in H/D/T mixtures at low D and T concentrations are presented and characteristic features of the dt branch of the  $\mu\text{CF}$  cycle are discussed. The importance of the epithermal effects in the dt $\mu$  cycle is demonstrated and the theoretical framework for future experimental data analysis is outlined.

#### RUSSIA - LATTICE FIELD THEORY

*Chemical Abstracts*, Oct. 18, 1993  
Courtesy of Samuel P. Faile

M.A. Zubkov, M.I. Polikarpov (Inst. Teor. Eksp. Fiz., Moscow), "Aharonov-Bohm Effect in Lattice Field Theory," *Pis'ma Zh. Sksp. Teor. Fiz.*, 1993, vol 57, no 7-8, pp 443-445, in Russian.

#### AUTHORS' ABSTRACT

The production functional of the Abelian Higgs model is represented as the sum over the universal surface of the Nielson-Olsen string. There exists a nontrivial topological interaction corresponding to the Aharonov-Bohm effect in field theory.



**RUSSIA - TIME-TEMPERATURE DYNAMICS**

V.I. Visotsky, R.N. Kuzmin (Moscow State Univ., Phys. Dept, Moscow), "Time-Temperature Dynamics of Cold Nuclear Fusion in Crystals Based on Quantum Barrierless and Micro-cumulative Mechanisms," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 6-13, 4 refs, 3 figs.

**ABSTRACT**

The possibility of deuteron condensation in small  $\sim 10 \text{ \AA}$  pores in the metal is considered theoretically. If deuterons are condensed, their density in the pores is increasing and deuterium fusion probability goes up. The deuteron energy gain at pore wall destruction is estimated.

**RUSSIA - CONDUCTION BAND SCREENING**

N.Yu. Lebedev, A.L. Samgin, V.I. Tsidilkovski (Ural branch Russian Acad. Sci, Inst. Electrochem., Urals Polytechnical Inst.), "Conductance Band Screening in Low-energy Cold Fusion," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 14-16, 4 refs, 2 figs.

**ABSTRACT**

The theoretical estimation of conductive band screening by electron states near Fermi level is performed. The assumption is made that narrow peaks of electron density can exist in transition metal hydrides. These peaks can appear at phase transitions.

**RUSSIA - TEAR-OFF REACTIONS**

Yu.I. Sorokin (Russian Acad. Sci., Nuclear Research Inst.), "Tear-off Reactions in Polycrystals," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 17-21, 3 refs.

**ABSTRACT**

The possibility of  $d(d,p)t$  tear-off reactions in palladium is discussed. Destructive role of internal magnetic field which tends to align magnetic momentum of the deuterons,

thus effecting anti-paralleled states of deuterons is discussed.

**RUSSIA - ERZION CATALYSIS**

Yu.N. Bazhutov (Erzion Research Ctr.) and G.M. Vereshkov (Phys. Research Inst., Rostov State Univ.), "Cold Nuclear Fusion Model Based on the Erzion Catalyses," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 22-28, 24 refs.

**ABSTRACT**

A new hypothetical particle with  $\sim 100 \text{ Gev.}$  mass and with nuclear catalyzing ability is introduced. This particle originates in cosmic rays and being quite stable is accumulated in the earth's crust surface to a density of  $\sim 10^7 \text{ cm}^{-3}$ . The properties of the particle and its replication on CNF are discussed.

**RUSSIA - ERZION-INDUCED COLD FUSION**

Yu.N. Bazhutov (Erzion Research Ctr.) and G.M. Vereshkov (Phys. Research Inst., Rostov State Univ.), "The Possible Role of Erzion-induced Cold Nuclear Fusion in Solar and Planetary Physics," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 29-32, 7 refs.

**ABSTRACT**

The assumption is made that Erzion particle is reproducible for some of the solar fusion reactions and Jupiter excessive radiation over solar energy absorption-radiation equilibrium. High catalyzing ability of the erzion particle can increase cold nuclear fusion role in heat balance of the sun and planets.

Yu.N. Bazhutov, A.B. Kuzhetzov (Erzion Research Ctr.) and G.M. Vereshkov (Phys. Research Inst. of Rostov St. Univ.), "Cold Fusion Experimental Results Interpretation Based on Palladium Isotopic and Chemical Composition Change by Erzion Catalysis Model," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture,

Non-Conventional Technologies, Moscow, 1993, pp 33-36, 5 refs, 1 fig.

#### ABSTRACT

On the basis of D.R. Rolison and W.E. O'Grady's work on isotopic and elemental composition change in Pd cathode before and after electrolyses of heavy water, an attempt was made to explain these results by catalytic ability of a new hypothetical particle--the erzion. Erzion is believed to be a combination of mesons or it can be in a form of a baryon. Its consequent interaction with palladium nuclei can transmute isotopes.

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#### RUSSIA - NEUTRON & TRITIUM RELEASE

Yu.V. Grigoriev, Yu.V. Lizichkin, A.G. Novikov, I.S. Prokhorov, P.P. Scheobinin, E.L. Tadrovksi (Inst. Power Engineering, Obninsk), "Neutron and Tritium Release During Cold Fusion Reactions," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 37-40, 2 refs, 1 fig.

#### ABSTRACT

The results of 1989 experiments are presented. Electrolytic cell filled with 0.1 M KD + 0.9 M D<sub>2</sub>O was used. Palladium-platinum or titanium-titanium electrodes were used. Tenfold increase of tritium concentration in the electrolyte was observed by liquid scintillation. No neutrons could be detected.

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N.S. Bikivkov, B.V. Zhuraulev, M.G. Kobozev, S.P. Simakov, V.A. Talalayev (Inst. of Power Engineering, Obninsk), "Search for Neutrons at Cold Nuclear Fusion Reaction," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 41-44, 2 refs, 2 figs.

#### ABSTRACT

Neutron detection system with neutron pulse shape discrimination was used in electrolytic experiments. The results are negative.

#### RUSSIA - MECHANICAL EMISSION

B.V. Deryagin, A.G. Lipson, V.A. Kluev, Yu.P. Toporov, D.M. Sakov, M.A. Kolobov (Inst. Phys. Chem., Russian Acad. Sci.), "Mechanical Emissions and Cold Nuclear Fusion," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 45-48, 14 refs.

#### ABSTRACT

At destruction of solids, high energy electrons can be obtained with energy up to 100 KeV. The results obtained by this group of authors in 1984-1990 are reviewed. Different mechanical treatments were tried on deuterium-containing solids with neutrons (~S backgrounds) and tritium (1.5 - 2 background) detection.

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B.Ya. Guzovski (Sci. Research Inst. for Exp. Phys.), "Looking at the Cold Nuclear Fusion Experiments," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 49-52, 4 refs.

#### ABSTRACT

A 4n-neutron counter with ~20% efficiency was used to measure neutron flux during heavy water electrolysis with Ti and Pd cathodes. The bursts correlated with cathode sample temperature rise. Tritium concentration in the electrolyte was measured. Tritium to neutron ratio is estimated as 10<sup>8</sup>.

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#### RUSSIA - PHASE TRANSITION

V.K. Baranov, B.Ya. Gujovski, N.A. Protopopov, Yu.A. Sorov'ev, V.I. Tikhonov, A.A. Yukhimchuck (Sci. Research Inst. for Expm. Phys.), "On the Question of Cold Nuclear Fusion," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 53-56, 10 refs.

#### ABSTRACT

The possibility of local deuterium concentration increasing due to phase transition is suggested. Vacancies role is stressed.

**RUSSIA - NEUTRONS FROM VANADIUM**

A.A. Yuhinchuck, V.I. Tikhonov, S.K. Grishechkin, N.S. Ganchuck, B.Ya. Gujovski, Yu.I. Plotnikov, Yu.A. Soloviev, Yu.A. Khaberov, A.B. Levkin (Sci. Research Inst. for Expm. Phys.), "Neutron Registration at Vanadium Deuteride Thermal Cycling," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 57-63, 1 ref, 6 ifgs.

**ABSTRACT**

Loading and thermocyclins of vanadium at high pressures (up to 10 Kbar) was studied with  $4\pi$ -neutron detector. Neutron bursts were registered. The number of KMeV neutrons was too small to explain tritium production, or it means that tritons are produced with energies  $E < 1$  MeV.

**RUSSIA - NEUTRON DETECTION**

I.I. Novikov, A.N. Borsaik, V.V. Sukharevski, A.A. Baikov (Inst. of Metallurgy, Rus. Acad. Sci.), "Deuterium Cold Nuclear Fusion," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 64-69, 8 refs, 4 figs.

**ABSTRACT**

Some neutrons were detected at electrolyses of 0.5 N. solution of  $D_2SO_4$  in  $D_2O$ .

**RUSSIA - TRITIUM FROM ELECTRODES**

Yu.N. Vershinin, R.V. Bilin, V.G. Kisovskikh, V.G. Gorodetski, T.A. Rech (Electrophys. Inst of Urals branch of Rus. Acad. Sci.), "Tritium Registration in Heavy Water Nanosecond High-voltage Breakdown Products," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 70-71, 4 refs, 1 table.

**ABSTRACT**

Tritium registration in  $D_2O$  after 220-240 KV breakdown with different metal electrodes was connected. The results show that electrodes are the source of tritium contamination.

**RUSSIA - TI-LiD GAS PHASE**

V.I. Sannikov, V.G. Gorodetski, E.M. Sulimov, V.Ya. Hydiakov, B.G. Polosukhin, S.O. Cholakh, V.Ya. Arbusov, R.V. Emlin (Electrophys. Inst. of Urals branch of Rus. Acad. Sci.), "Gamma-Quants Emission at Electrolyses in the System Ti-LiD Gas Phase," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 72-75, 5 refs, 2 figs.

**ABSTRACT**

Titanium-made crucible was filled with LiD, heated in gaseous  $D_2$ . The voltage varied from 500 to 1400 V with combination electrolysis-discharge going on. High energy gamma-quants (2.2 - 2.6 MeV) could be observed, probably related to 208 Tl isotope. The enhancement of radiation intensity at this energy is unclear.

**RUSSIA - COLD FUSION MODEL**

Yu.N. Bazhutov, A.B. Kuzentsov, Yu.P. Chertov, (Erzion Research Ctr.), V.A. Zhirnov (Cent. Inst. Mech. Eng.), E.I. Savnin, A.A. Khodiakov (Inst. Phys. Chem., Rus. Acad. Sci.), "Experimental Investigation of Cold Nuclear Fusion Model," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 76-78, 4 figs.

**ABSTRACT**

Simultaneous electrolysis and X-ray irradiation of LiOD solution in  $D_2O$  was tried consequent tritium registration. Some increase in tritium concentration was detected.

**RUSSIA - NUCLEAR BEAMS**

Yu.N. Bazhutov, V.P. Koretski, E.V. Pletnikov (Erzion Research Ctr.), G.M. Vereshkov (Phys. Research Inst. of Rostov St. Univ.), "Initiation of Cold Nuclear Fusion Reactions with Nuclear Beams," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 79-81, 3 refs, 1 fig.

## ABSTRACT

The experiment with accelerated Pd-ion beam is suggested.

## RUSSIA - CNF INITIATION

Yu.N. Bazhutov, Yu.P. Chertov (Erzion Research Ctr.), V.V. Orlov (NPO "Composit," Moscow Region), E.I. Savnin, A.A. Khodiakov (Phys. Chem. Inst., Rus. Acad. Sci.), "Calorimetric Experiment for CNF Initiation," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 82-83, 2 refs, 1 fig.

## ABSTRACT

No results are presented.

## RUSSIA - PERSISTENT SIGNALS

M.I. Martinov, A.I. Meldianov, A.M. Cherepovski (Kurchatov Atomic Energy Inst.), "Investigation of Anomalous Nuclear Events in Metals Saturated with Deuterium," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 84-91, 6 refs, 9 figs.

## ABSTRACT

Silicon surface barrier detectors of charged particles (SSB), slow neutron counters and polymer bubble detectors were used in experiments with H and D ion beams and Ti target. With D beams signals from SSB could be seen for hours after beam is switched off. Up to  $10^5$  neutrons per second were registered with distinctive after-action.

## RUSSIA - TRITIUM PRODUCTION

V.A. Romodanov, V.I. Savin, M.V. Shakhunin (Research Inst. of SIA "Lutch"), Ya.B. Skuratnik (Karpov Phys. Chem. Inst.), "Tritium and Other Products of Low-energy Fusion Reaction Registration in Solids," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 92-96, 6 refs, 1 table.

## ABSTRACT

$10^5$  -  $10^7$  tritium/second formation was detected in a gas during glow discharge experiments.

## RUSSIA - SURFACE TRITIUM

R.N. Kusmin, A.P. Kuprin, P.O. Revokator, E.M. Sakharov, B.N. Shvilkin (Phys. Dept., Moscow St. Univ.), "Nuclear Reaction Products Study in Metal-Deuterium Systems," Cold Nuclear Fusion, Centre of Intersectoral Science, Engineering and Venture, Non-Conventional Technologies, Moscow, 1993, pp 97-102, 2 refs, 6 figs.

## ABSTRACT

Ti and Pd deuterated samples were measured for tritium beta-decay on the surface. Etchings of the surface showed tritium location in the surface layer  $\sim 1000$  Å.

## SPAIN - DEUTERIUM IN TITANIUM

Courtesy of Carlos Sánchez

J.F. Fernández, F. Cuevas and C. Sánchez (Dept. Fís. de Mat. C-IV, Univ. Autónoma de Madrid), "Deuterium Concentration Profiles in Electrochemically Deuterated Titanium and Their Evolution After Electrolysis," to be published in *J. Alloys & Compounds*, 26 pages, 22 refs, 7 figs, 1 table.

## AUTHORS' ABSTRACT

Deuterium concentration profiles in electrochemically deuterated titanium plates have been obtained by using Elastic Recoil Detection (ERD) and Rutherford Backscattering Spectrometry (RBS) techniques. Measurements were done several months after finishing electrolysis. Experimental results are analyzed in the light of the Wagner model. Conclusions from this analysis are compared with those obtained by other authors in Ti and similar metals like Zr. Finally, the relevance of these data in relation to some electrolytic "cold fusion" experiments recently accomplished is also discussed.

## SWITZERLAND - MUON TRANSFERS

*Chemical Abstracts*, Sept. 20, 1993

Courtesy of Samuel P. Faile

K. Lou, C. Petitjean, T. Case, K.M. Crowe, W.H. Breunlich, M. Jeitler, P. Kammel, B. Lauss, J. Marton, et al. (Paul Scherrer Inst., Villigen, Switzerland), "Direct Measurement of Sticking in Muon Catalyzed Deuterium-Tritium Fusion and Physics of 'Hot' Muonic Tritium Atoms." Muonic At. Mol., Proc. Intl. Workshop 1992, pp 147-155.

## AUTHORS' ABSTRACT

New results are reported from a recent PSI experiment about the fusion reactions  $d\mu t \rightarrow \mu + \alpha + n$  and  $d\mu t \rightarrow \mu\alpha(\text{sticking}) + n$ . The apparatus consisted of a high pressure ionization chamber to detect charged particles directly and of an array of neutron counters to measure the fusion neutrons. The principal and performance of the experiment are described as well as a detailed study of its systematics by using a new Monte Carlo code. The preliminary results for the probability  $\omega_s$  of final dt sticking are  $(0.50 \pm 0.06)\%$  from a reanalysis of a 1989-run and  $(.47 \pm 0.06)\%$  for the recent 1991-run, nearly 3 standard deviations lower than the theoretical calculations. The initial time distributions of the neutrons at various low deuterium and tritium concentrations of the H/D/T mixture are presented providing new insights of the fast non-thermalized transfer of the muon from the  $\mu d$  to the  $\mu t$  atom.

## SWITZERLAND - MORE ON MUON TRANSFERS

*Chemical Abstracts*, Sept. 20, 1993  
Courtesy of Samuel P. Faile

Herbert Schneuwly (Inst. Phys., Univ. Fribourg), "Muon Transfer to Elements with  $Z > 1$ ," *Muonic At. Mol., Proc. Intl. Workshop 1992*, pp 209-215.

## AUTHOR'S ABSTRACT

A series of measurements of muon transfer rates from muonic H to elements with  $Z > 1$  yielded unexpected discrepancies. In the light of muon transfer results to heteroatomic molecules, these discrepancies have to be taken more seriously than they have been up to now. Even if muon transfer to He proceeds via a molecular state, it belongs probably to the same problematics.

## TAIWAN - Pt &amp; Si DEPOSITS ON Pd

C.J. Lihn, C.C. Wan, C.M. Wan, and T.P. Perng (Nat. Tsing-Hua Univ., Hsinchu, Taiwan), "The Influence of Deposits on Palladium Cathodes in  $D_2O$  Electrolysis," *Fusion Technology*, vol 24, no 3, pp 324-331, 18 refs, 15 figs.

## AUTHORS' ABSTRACT

Platinum and silicon have been found deposited on the palladium cathode during the electrolysis of a 0.1 M LiOD solution with a platinum anode in a glass cell. Various techniques including surface analysis, cyclic voltammetry, and electrochemical permeation were used to study the

surface deposits, electrochemical deuterium-sorption behavior, and permeation rate of deuterium into palladium, respectively. It was shown that palladium cathodes were contaminated by platinum and silicon deposits after a certain period of electrolysis. These deposits could affect the electrochemical processes during electrolysis. The contamination may be a cause of the sporadic results reported in "cold fusion" research.

## AUTHORS' CONCLUSION

Platinum and silicon were found deposited on the palladium surface during electrolysis in  $D_2O$ . Cyclic voltammetry showed that they could cause a change in the electrolytic processes. Effective diffusivities of deuterium in the contaminated palladium sheets were reduced. The deposits might explain the poor reproducibility of the cold fusion phenomenon.

## F. LETTERS TO THE EDITOR

## LETTER FROM JACQUES DUFOUR

I have read with much interest the summary of the RCCF that you have published in the October issue of *Fusion Facts*; it shows the great amount of work that is done in the field, which is, on the one hand, very encouraging for the future of cold fusion, but on the other hand, requires critical examination of the facts reported. In that respect, I cannot agree with the statement that is made about the work done by Savvatimova and Karabut, "The replication of Karabut, Kucherov, and Savvitamova's initial discoveries by Defour in France and the continued similar work by Romodanov et al., is a substantial and important contribution to the growing evidence that the cold nuclear fusion science is rich in new phenomena" (p 2, last paragraph, I make the assumption that Defour should read Dufour). [FF extends its apology for the improper spelling of Dr. Dufour's name. --Ed.]

For the sake of clarity, I shall first recall some milestones in the use of plasmas in cold fusion. The idea of replacing the liquid electrolyte of Jones, Fleischmann and Pons by a gaseous isotope of hydrogen, was proposed as early as May 1989 (D. Ruzic, K. Schatz, and P. Nguyen: "A Novel Apparatus to Investigate the Possibility of Plasma-assisted Cold Fusion," *Fusion Technology* vol 16, Sept. 1989). As in Kucherov et al. ("Nuclear Product Ratio for Glow Discharge in Deuterium," *Phys. Let. A*, vol 170, 255, no 4, Nov. 1992), the plasma used was a low pressure deuterium plasma (a few torr). In May 1989, I started a work using a high pressure deuterium or hydrogen plasma (sparks at atmospheric pressure) and filed a patent on this approach in July 1989 (published 24 Jan 1991). The

difference in the plasma pressure is very important, as I explained in the publication of my work ("Cold Fusion by Sparking in Hydrogen Isotopes," *Fusion Technology*, vol 24, Sept. 1993, p 224, VIII.B) and to my knowledge, I was the first to propose and implement this idea (only using steady state experiments).

But there is an even more important reason, to clearly make a difference between results obtained at low pressure from those obtained at high pressure: the use of low pressure plasma may lead, when the experiments are not correctly designed, to artifacts that can have considerable impacts on the results. This is due to the presence of high amounts of atomic deuterium and/or hydrogen, which at low pressure (a few torr) have 2 well documented properties: they can diffuse on long distances in the gas phase and they recombine mainly on the reactor walls. If these walls are made from a metal that catalyzes the recombination (such as palladium, molybdenum,...), the recombination is very fast, leading to a very high heat transfer coefficient at the surfaces that see the atomic hydrogen. A careful examination of the work of Kucherov et al. above mentioned, shows that this leads to a dramatic overestimation of the excess energy production they have measured in their experimental set-up: the measurements are made in the transient regime and excess heat is measured when the electrical power to the discharge is increased. In fact, these results can very well be explained by considering that the resulting increase of atomic deuterium concentration in the gas phase in the reactor, leads to a very fast increase of the temperature of the metal walls of the reactor that looks to the discharge, thus causing a high but transient heat gradient in this metal. This leads to an over-estimation of the excess heat produced by a factor that could only be correctly estimated by carrying out careful steady-state experiments. In the transient regime, it is very likely that the catalytic properties of the palladium and the molybdenum present in the reactor, together with their heat conduction coefficients, play a major role.

I hope not to have been too long in my technical explanations, but I think that the credibility of cold fusion requires a critical examination of experimental data.

Sincerely, /s/ Jacques Dufour

[FF is pleased to publish this important communication concerning aspects of deuterium gas plasma research and development. Thank you, Dr. Dufour. --Ed.]

## LETTER FROM LELAND HOSFORD

...Your September 1993 *Fusion Facts* contained an article about "Cold Fusion by Sparking." One thing that I know happens, whenever there is a spark, is that electromagnetic interference is produced throughout the EM spectrum. What if some of that electromagnetic "noise" is close enough to the resonant frequency of the metal lattice of the experiment mentioned to make the lattice "ring" at its resonant frequency and to generate harmonics which are at a resonant frequency of the hydrogen atoms of the water in (or near) the lattice. The energy that it would add could very well be the trigger of the nuclear reaction that seems to be occurring.

I don't think it would be terribly difficult or expensive to determine what the resonant frequencies of a block of metal are -- you may even be able to derive them (depending upon how well the configuration of the lattice is known). And what harmonics are produced by a given waveform is very well understood. A determination of whether or not any of the harmonics would be at resonant frequencies of a hydrogen atom could probably also be made (depending upon the configuration of the hydrogen atom).

Sincerely, /s/ Leland Hosford

## FRENCH DISINFORMATION

A letter from Dr. Peter Glück to the Editorial Office of the French magazine *La Recherche*, translated from the French by Eva Call.

Dear Sirs,

I am writing in regards to your article "Cold Fusion Continues", *La Recherche* 256, July-August 1993, p 786. I do not have the intention to argue with you on the subject of the "reality" of cold fusion. I recommend that to find that out you ask your staff to take the relevant articles and abstracts from *Chemical Abstracts* and *Physics Abstracts*.

The article has been published under the caption "Brief Information". It is indeed "brief", but its informational character is arguable, at least with respects to two aspects:

a) You write that "F(leischmann) and P(ons) are publishing an article after a long silence". In truth, after their first article, the enclosed papers have appeared, which were published in very prestigious magazines like *Chemical Abstracts*, *Physics Letters A*, *Current Contents* (a total of 98 pages), not to mention the several conferences that were accessible to the media.

b) The statement "Pons is currently working in a private laboratory close to Nice" reminds me, justifiably or not, of the statement by André Gide "The most detestable lies are the ones that are the closest to the truth." It is not a private laboratory belonging to a millionaire that has been deceived by F and P, but IMRA Europe, Inc. (IMRA stands for the French name of Minoru Institute of Advanced Research), of the firm Technova, a scientific subsidiary of the gigantic Toyota. This new laboratory cost 6 million dollars, has an area of 4,200 m<sup>2</sup>, 40 normal pressure electrolysis cells and several elevated pressure ones, money for the visiting researchers, etc., etc. The image that you try to convey by suggesting "the dying cold fusion that is trying to come back to life" is very different from the real one and that is independent from the purpose of this story.

I hope you would address S. Pons, J. P. Vigier, J. Dufour, M. Rambaut, who are in your own country, in order to obtain the correct image concerning cold fusion, and that you will publish an objective article.

I will end by telling you that your magazine has been, and still is, an extremely precious source of information for me. I have always regarded the professionalism of your collaborators very highly. That is why I consider the article concerning cold fusion, about which I am writing to you, to be a single and unfortunate exception.

Best regards, /s/ Peter Glück

## G. MEETINGS AND MISCELLANEOUS

### 4th INTERNATIONAL CONFERENCE ON COLD FUSION December 6-9, 1993 Hyatt Regency Maui, Hawaii

Participation is open to all interested scientists and technologists. In particular, the following are encouraged to attend: nuclear and solid-state theoreticians, advanced energy technologists and long range utility planners. There will also be an exhibit of scientific instruments and supplies by various manufacturers.

The proposed agenda is as follows: Morning sessions will be devoted to one keynote presentation and a number of shorter, invited presentations. Afternoon presentations will be divided into a number of subject-organized parallel sessions. Papers reporting the results of simultaneous measurement of different kinds are particularly encouraged. Subject areas to be covered include: Materials and Fundamentals, Calorimetry, Nuclear Measurements, Solid-state Theory, Electrochemical Studies, and Safety Issues.

The co-chairs are Dr. T.O. Passell (EPRI) and Dr. M.C.H. McKubre (SRI) who can be reached at (415) 855-2070 and (415) 326-6200 respectively, for technical information.

The registration fee of \$300 covers conference proceedings, continental breakfasts, three luncheons, and an evening reception. To register, contact Linda Nelson, Conference Coordinator (EPRI) at (415) 855-2127 or Fax (415) 855-2041. Hotel reservations can be made with the Hyatt Regency Maui (mention ICCF-4 conference to obtain the special group rate), call for information: (808) 661-1234 or Fax (808) 667-4499. Reservation deadline Nov. 6, 1993.

**NOTE:** If you need last minute help to get rooms for the conference, Call Diana Smith, 360 Hoohana Street, Kahului, HI 96732, 1-800-432-5151.

She is a travel agent who is intimately acquainted with the area and can help you get inexpensive accommodations.

## MINSK COLD FUSION CONFERENCE - MAY 1994

A bilingual, international conference on cold nuclear fusion and affiliated energy systems will be held in Minsk, Republic of Belarus during the last week of May, 1994. Papers accepted will be published in English and Russian editions of proceedings that will be provided to attendees at the start of the conference. Presentations of the papers can then concentrate on the latest developments and the answering of questions. The proceedings are expected to provide a tutorial overview of the new science of cold nuclear fusion for a multi-disciplinary audience and provide the latest experimental and theoretical findings.

**Abstracts** for papers should be in as soon as possible, but not later than Dec. 10, 1993. Russian language papers should be sent to Dr. Filimonov V.A.

14 Leningrad St., Research Inst. of  
Physical and Chemical Problems  
Minsk - 80, 220080  
Belarus.

Papers in English may be submitted to Hal Fox, P.O. Box 58639, Salt Lake City, UT 84158. Notification of acceptance will be sent by Jan. 2, 1994. Papers must be received by Jan. 31, 1994.

\$250 Conference attendance. Authors of accepted papers must include the check for the conference when submitting the paper. Page costs for pages in excess of 6 pages (including figures) will be \$100 per page. A total of about 70 papers will be selected and published in the

proceedings. Translation costs, if handled by the organizing committee staff, will be \$20 per page. Authors are urged to submit their papers in both English and Russian. Words on figures may be in English.

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