FUSION Facts

A Monthly Newsletter Providing Factual Reports On Cold Fusion Developments

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

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A QUOTE FROM PETER GLÜCK

"One of the marvels of creation is the infinite capacity of the human brain to withstand the introduction of knowledge." Theodore Roosevelt

LATE NEWS FLASH!

As this issue of *Fusion Facts* went to press, we received word that three scientists, two in the U.S. and one in Japan, have had initial successes (measured excess heat) in the replication of the important new experiment performed by Prof. Akito Takahashi of Osaka University in Japan. See Section D of this issue, page 8, for a report on Takahashi's visit to MIT and Texas A & M.

A. LETTER TO FUSION ENERGY ADVISORY COMMITTEE

(Prepared for presentation during the May 20-21, 1992 meeting of the Fusion Energy Advisory Committee, UCLA.)

DoE COMMENDED FOR PLAN TO RESOLVE LONG-TERM ENERGY CRISIS

The DoE should be commended for its activities in the search for improved energy sources. However, the former advisors to the DoE who flagrantly disregarded experimental verification of cold fusion deserve no commendation. It is generally accepted that commercial hot fusion is not expected until well into the next century. However, due to the lack of DoE leadership in seriously following the rapid progress of cold fusion, the energy policy of the United States is dramatically failing in its mission to help solve the near-term energy crisis.

CONTINUING NATIONAL NEED FOR HOT FUSION

Cold fusion should not be considered as a threat to the continued development of hot fusion. Regardless of the impact that the imminent commercialization of cold fusion will have on the world's production and use of energy,

there will **always** remain a hard core of technical applications for which hot fusion is viable. Specifically, hot fusion is needed (a) in applications demanding tremendous energy density (megawatts per cubic centimeter), and (b) in applications demanding great thermodynamic efficiency (hence, via Carnot, a great temperature drop). Such applications for hot fusion especially pertain to the missions of the DoD or NASA and involve national projects; therefore, there will always be a legitimate **NATIONAL NEED** for perfected hot fusion power generation.

COLD FUSION SUCCESSES IN DoE-FUNDED LABS.

Although some of the advisors to DoE have launched emotional verbal attacks on cold fusion and even on the integrity of Professors Pons and Fleischmann, several teams of scientists in DoE-funded national laboratories have successfully demonstrated the reality of cold fusion. Two groups in Oak Ridge, three groups in Los Alamos, and one scientist in Brookhaven have demonstrated the production of nuclear by-products in cold fusion experiments. One of the best summaries of the cold fusion work up to mid-1990 is the excellent paper by the former Los Alamos National Laboratory scientist Dr. Edmund Storms [1]. This report should be used to replace the blatantly negative report provided to DoE by the ERAB committee [2].

COMMERCIALIZATION OF COLD FUSION

DoE funds are not required for the development of cold fusion. Funds from enlightened industrial organizations will suffice. Over $20 million has been pledged for the further development of cold fusion by U.S. Industrial groups. The Electric Power Research Institute (funded by America's electric power utilities) has announced a budget of $12 million over the next three years for continuation of its cold fusion research. Eden-Barn Industries has pledged $10 million over the next two years for development of cold fusion heat-energy systems, and several independent companies and a few venture capital companies are seriously investigating the funding of the commercialization of cold fusion. **DoE funds are not sought.**

SUGGESTED ROLE FOR DoE

With the rapid advances being made in the development of cold fusion (several experiments have shown excess heat from 100% to over 400% [3]) DoE should include this new science in its energy policy. Unfortunately, it appears that the panel of DoE energy advisors on cold fusion (ERAB) were selected mainly from scientists favoring hot fusion and that these advisors appeared to be intent on discouraging possible competition for funds. Therefore, it is suggested that DoE adopt a policy that no funds except those annually allocated for the study of alternative energy resources be allocated to cold fusion research. This policy would then protect the DoE-chosen advisors and/or their hot-fusion friend from the threat of loosing their cherished annual funding for hot fusion research. This removal of the threat of competition should mean that DoE would then receive unemotional scientific advice about the new science of cold fusion.

THE INTERNATIONAL IMPACT

As recently reported by some science editors in Japan, "There are no longer any cold fusion skeptics in Japan." The dramatic evidence recently presented by Dr. Akito Takahashi in Japan, at MIT, and at Texas A&M has dramatically demonstrated the reality of cold fusion. The result has been the announcement of a consortium of Japanese companies to increase funding for cold fusion development. Tech Nova, a Japanese company, has been funding research work by Drs. Pons and Fleischmann in Nice, France at a Japanese-owned research laboratory. The lack of an unbiased evaluation of cold fusion by the DoE ERAB cold fusion panel has largely prevented the acceptance of the reality of the new science of cold fusion. Because of the negative report by the ERAB cold fusion panel, the business and science media of the U.S. have largely ignored the positive developments in cold fusion. The end result is that the U.S. has again defaulted on the development of its own technology and allowed other nations to forge ahead of the U.S.

DoE POLICY MAY COST BILLIONS IN TRADE IMBALANCE

It may be appropriate to assume that the ERAB Panel on Cold Fusion had neither time nor funds to make an adequate investigation of cold fusion when most of their investigation ended in July, 1989 (only four months after the University of Utah announcement of the work by Pons and Fleischmann.) The host of positive results that were announced after July, 1989 (many from DoE-funded national laboratories) should have resulted in a new evaluation of this new science. If the flawed advice of the ERAB Panel on Cold Fusion [2] is not replaced, the DoE lack of attention to alternative energy sources (particularly cold fusion) could result in the outflow of billions of dollars to purchase new energy systems from foreign corporations. The Secretary of Energy, **from default of delegated advisors,** would then receive the undistinguished honor of explaining why the world's most heavily funded energy group missed out on the most important energy development of the century. The same lack of information provided to the President of the United States could prove to be dramatically embarrassing especially in an election year.

A NEW HEARING ON COLD FUSION

This presentation is made not to encourage DoE to abandon hot fusion research but to encourage the DoE to impanel a committee to investigate the new science of cold fusion as it has developed over the past three years. It is strongly advised that this panel consist of DoE-funded scientists who have been successfully involved in the development of cold fusion. In addition, it is urged that the panel include scientists from other U.S. departments who have also been successful in furthering the new science of cold fusion. Specifically, several agencies under the Department of Defense (especially the Navy) have helped advance the technology of cold fusion [1,3].

We thank the committee for this opportunity to report on the rapid development of an exciting new alternative energy resource.

/s/ Harold L. Fox, CEO, Fusion Energy Applied Technology and members of the Science Advisory Board.

REFERENCES

[1] Edmund Storms (Los Alamos National Laboratory), "Review of Experimental Observations About the Cold Fusion Effect", *Fusion Technology*," *Fusion Technology*, Vol 20, Dec 1991, pp 433-477, 363 refs. Reviewed in the May 1991 issue of *Fusion Facts*.

[2] John W. Landis (Chairman, ERAB), John R. Huizenga (Co-Chairman, Panel on Cold Fusion), "Report of the Cold Fusion Panel," November 1989, A Report of the Energy Research Advisory Board to the Department of Energy.

[3] Bressani, Del Giudice, & Preparata, editors, The Science of Cold Fusion, 1991, published by Societa Italiana di Fisica, Conference Proceedings of the Second Annual Conference on Cold Fusion, 527 pages, 57 positive papers from 14 countries, in English.

B. HOT FUSION VS. COLD FUSION

Some have cited evidence of deliberate attacks on the new science of cold fusion by those whose livelihoods were devoted to the development of hot fusion. While this approach to political control of funds is acceptable for labor unions, it does not seem to be an acceptable approach for scientists. In any case, there is considerable evidence that both parties have some strong scientific facts on their side.

THE CASE FOR HOT FUSION

There is certainly strong experimental evidence that in the realm of plasma physics, deuterium does not fuse by being closely spaced. There is a well reported branching ratio for the fusion of two deuterium ions and about equal production of neutrons and tritium with a one-in-a-million production of helium-4. These nuclear events are expected when high velocity (temperature) particles collide.

THE CASE FOR COLD FUSION

Numerous experiments have now shown that a small amount of tritium can be produced in a deuterium-palladium-lithium system and an even smaller amount of neutrons. This evidence is now overwhelming [1] and cannot be dismissed by any scientific scholar who has taken the time to attend the scientific meetings or to review the peer-reviewed literature.

THE PRODUCTION OF EXCESS HEAT

Many cold fusion experimenters report continuous heat or bursts of heat of such an amount that it cannot be explained by any known chemical reaction. The hot fusionists proclaim that unless nuclear byproducts can be shown to exist, then these numerous measurements must be due to inadequate experimental techniques. The cold fusion experimenters and theorists consist, in general, of scientists who are at least as skilled in their technical areas as the hot fusionists. They normally agree that there is **new science** but that the phenomenon is not, as yet, fully explained.

THE THEORETICAL APPROACH

Many of the theoretical papers have calculated a number of ways in which various particles, screened and unscreened, can **penetrate the Coulomb barrier** and therefore **tunnel**, collide, or fuse. As is shown in the article on page 17, the application of the Coulomb barrier (a somewhat static view of the world) is not relevant in a dynamic electric environment that is capable of producing electron beads (each of which is a semi-stable cluster of 100 million to over a trillion electrons). The discussion of the former Coulomb barrier needs studied review. What kind of screening would one expect from a micron-sized bead of 10^8 electrons rambling through a lattice?

A much more interesting explanation for the source of the excess heat in cold fusion has been expressed by Dr. Kiril Chukanov, a former Bulgarian scientist who is now working in the U.S. In a formidable book Chukanov explains such diverse phenomena as superconductivity, ball lightning, the interstellar production of cosmic rays, and the source of excess energy in cold fusion. The

manuscript is written in Bulgarian. The book will soon be translated into English and steps are being taken to make this challenging work available to all interested scientists. It is of interest to note that one of the references to background evidence cited in Kenneth Shoulders electron bead patents [2] is work done in Bulgaria by Dr. Chukanov.

THE EXPERIMENTAL EVIDENCE

Recently, Dr. Chukanov has shared his theory, his world-famous work in ball lightning, and cold fusion experiment with *Fusion Facts*. As soon as the experimental evidence can be published it will be shared with our readers. However, we can report that by using his theory, Chukanov has demonstrated some significant developments in cold fusion. The excess energy observed is related to the excess energy that Chukanov gets from his ball-lightning experiments. The source of the excess energy from both ball lightning and cold fusion are the same, according to Dr. Chukanov's theoretical work.

AN OUTLINE OF CHUKANOV'S THEORY

The real world in which the laws of quantum dynamics prevail, and can be used to explain most of our scientific findings, is bounded. These boundaries can be expressed and plotted on a length/energy coordinate system (see Figure 1). For the explanation of cold fusion (and ball lightning) the y-axis can be considered to be in centimeters and the distance between two deuterium atoms (for example) at a known temperature can be plotted (such as at point A). Assume that some isothermal experimental means is employed that greatly reduces the distance between two such deuterium atoms (plotted at point B.) Note moving from point A to point B is done at the same temperature or energy level. If we can further close the distance between the hypothetical deuterium atoms such as trying to continue to point C on the graph, one will note that the boundary must be reached (or crossed) to get to point C.

According to Dr. Chukanov, point C lies outside the region in which the normal laws of science are valid. The new laws that apply are not necessarily defined but can be, we expect, determined by experimental efforts. If we assume that matter as we know it cannot exist across the boundary, then the only feasible explanation is that the matter is forced to follow the boundary. Thus the hypothetical reduction of distance between the deuterium ions could track along the boundary to point D. Because the equations and the graph are depicting the x-axis as energy (or temperature), we reach the point D at which the distance as determined at point C is achieved but (according to the graph and the theory) the point D is characterized by an increase in energy or temperature.

If this theory of Chukanov is correct, then our experiment to reduce the distance between the deuterium atoms ends up with excess energy or heat. Where did this excess heat come from? **That is the key question.** The answer by Chukanov is, "It is a gift of Nature." When Shoulders demonstrates that a small amount of energy creates an EV (his designation for an electron bead) which can then drill a 20-micron hole through several millimeters of a ceramic dielectric he is convinced (and teaches us in his patents [2]) that this excess energy comes from ZPE (zero-point energy).

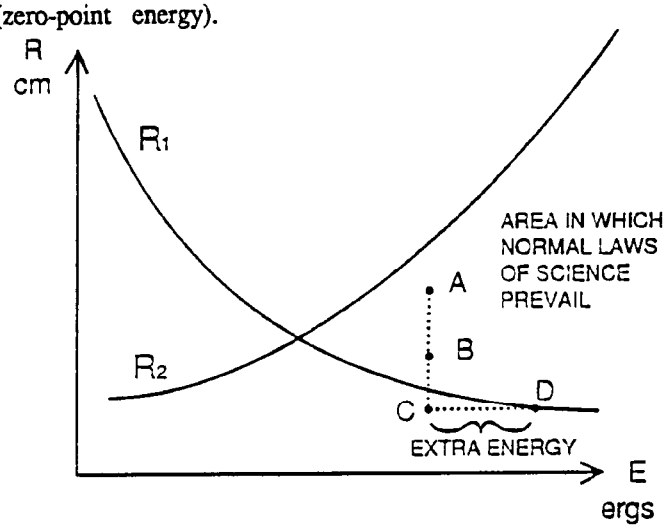

Figure 1. A Portion of the Chukanov Map of the Bounded Universe of Science.

Equations: $R1 = (2 \times 10^{-16}) / E$
$R2 = \text{sq rt } (E) / (0.91 \times 10^{-8})$
Source: Kiril Chukanov's forthcoming book.

For a complete explanation of this figure and the derivation of the boundary equations, the reader is referred to Dr. Kiril Chukanov's forthcoming book. Correspondence to Chukanov should be addressed c/o Fusion Facts.

CONCLUSIONS

First: A good theory should be predictive. From the results obtained by Chukanov in his very early experiments with cold fusion, his theory has led him to rapid achievements. This story will continue as rapidly as appropriate protection of Chukanov's intellectual property can be achieved. Second: There should not be **"hot"** versus **"cold"** fusion. There should only be teams of dedicated scientists sharing mutual respect and working to pry new secrets from Nature.

REFERENCES

[1] Edmund Storms, "Review of Experimental Observations About the Cold Fusion Effect", *Fusion Technology*," *Fusion Technology*, Vol 20, Dec 1991, pp

433-477, 363 refs. Reviewed in the May 1991 issue of *Fusion Facts*.

[2] Kenneth R. Shoulders, U.S. Patents 5,018,180 (May 21, 1991); 5,054,046 (Oct 1, 1991); 5,054,047 (Oct 1, 1991) with respective titles "Energy Conversion Using High Charge Density", "Method of and Apparatus for Production and Manipulation of High Density Charge", and Circuits Responsive to and Controlling Charged Particles."

C. PRESENTATION BY Dr. Eugene Mallove

"Statement on Cold Fusion for the Subcommittee on Energy and Water of the House Committee on Appropriations," By Dr. Eugene F. Mallove, of Starbound Engineering, Bow, New Hampshire, representing Cold Fusion Research Advocates. April 1, 1992.

Chairman Bevill and Respected Colleagues:

It is my privilege to speak on behalf of over three hundred-fifty citizens, two-thirds of whom are scientists and engineers, both American and foreign, including physics Nobel laureate Julian Schwinger, engineer and author Dr. Arthur C. Clarke, and top scientists from India, Italy, Japan, and Russia. In the past few years we have witnessed outrageous assaults on an emerging and potentially spectacular cold fusion energy technology. Tragically, the U.S. Department of Energy has followed the pack and rejected cold fusion in favor of its established programs. So in the fall of 1991, we joined together to petition the House Science, Space, and Technology Committee, but that body has not moved to hold such hearings.

The hearings will probably not occur this season. But if there is no airing now, hearings will ultimately be forced on the Congress as a "post mortem" to the scandal of neglect by DoE of this new science and technology. The rest of the world, especially Japan, will by then be far ahead of us.

If we act now, however, the American people could soon begin to save $500 million annually on hot fusion research, which is aimed at an elusive goal in the 21st Century, in favor of cold fusion energy technology that can and will be developed this decade by private industry with the cost-effective assistance of federal research facilities. Beyond that, the economic benefits of absolute energy independence through cold fusion power would be virtually incalculable.

We realize that it is the 11th hour for critical FY '93 funding from DoE for cold fusion research. But there is still time to shift a modest amount of money from the hot fusion budget toward much-needed cold fusion research by federal laboratories, universities, and small private groups. This could be the seed money that would ignite the cold fusion revolution in the U.S., not too many months behind the one that is poised to take off in Japan. Not all of our members agree on how much money the Federal Government should spend toward that end, but we all agree that something must be done and done soon.

A majority of us believe that it would require initially at least $10 million a year for U.S. scientists to study this vital new area of science. Cold fusion research is not "Big Science" -- it does not need massive multibillion-dollar installations. It does, however, require the talents of top scientists and engineers, combined with sophisticated analytical instrumentation. Such funding could easily be found by postponing or eliminating portions of the hot fusion budget. In particular, we suggest that these funds could come from the inertial confinement fusion budget (ICF), which many believe is really a weapons simulation program in disguise. Alternatively, the unjustified scheduled 5% increase in hot research could be assigned to cold fusion.

What matters most is that the Department of Energy be forced to abandon its war against cold fusion. This war began with the publication of its negative, untenable, and now obsolete November 1989 report on cold fusion to the Energy Research Advisory Board. Curiously, the Co-Chairman of the panel which prepared that report, Professor John Huizenga of the University of Rochester, will be publishing a book titled, Cold Fusion: Scientific Fiasco of the Century. This, at a time when the Japanese scientific community has been electrified by recent dramatic cold fusion experiments at Osaka University and elsewhere, when the Electric Power Research Institute in the U.S. has authorized $12 million to fund its multi-year cold fusion research program, and after an international conference last summer in Como, Italy, provided ample evidence that cold fusion is, indeed, real and revolutionary. For the economic and environmental well-being of the nation, we ask you to become aware of the facts about cold fusion and help us fund American research. Thank you for giving us the opportunity to bring this crucial energy technology initiative to your attention.

Continuation of prepared remarks:

Since the 1989 announcement in Utah, cold fusion phenomena -- including spectacular excess energy generation -- has been verified by hundreds of scientists worldwide, and at five top U.S. federal laboratories. It is clear now that cold fusion, though still incompletely understood, is likely to be a source of abundant, clean,

and cheap energy from forms of hydrogen in water. Almost "too good to be true," but it *is* true!

In Japan, the government and major news magazines agree that cold fusion is real -- and important. Well-supported research is underway there at every major national university laboratory. Cold fusion researchers are represented at major scientific conferences in Japan; cold fusion is now an accepted part of physics there. A major Japanese corporate consortium has hired the original discoverers, Drs. Pons and Fleischmann, and given them carte blanche research and development funds. They now have cold fusion cells that reach boiling -- electric power generation from steam cannot be far off. Leading experts in the field predict that compact reactors may be ready in two to five years. Some very limited private development funding has been emerging in the United States, but DoE has arrogantly decided not to fund work of this kind. The DoE is currently doing nothing about cold fusion research, except to talk about "monitoring developments."

Here in the U.S., where cold fusion was first discovered, no DoE or state money is now being spent on cold fusion. Expert physicists and chemists at our top national laboratories have verified that cold fusion is real, but they cannot get funds to study it. While the Japanese media talk about the future of this important discovery, and Japanese industry plans for a whole new generation of products, in the U.S. our government, industry, and media ignore or belittle it.

For decades, the hot fusion establishment has tried to mimic one of nature's best tricks -- the release of energy when the atomic nuclei of light elements like hydrogen fuse or combine. Stars do fusion easily, but here on Earth the promise of multi-million degree fusion always seems to be just twenty or thirty budget cycles away -- decades.

Many experts, including notable former hot fusion researchers, have come to believe that the kind of hot fusion reactors now being developed will never be viable commercially. Yet DoE is bent on spending roughly $500 million annually on its two approaches to fusion, magnetic fusion and laser (ICF) fusion. Having consumed billions of dollars already, the program has become a behemoth that every year fights tooth and nail for its existence.

In the process, the hot fusion monolith has trampled many new fusion ideas that have crossed its path. Promising concepts, ones that require tens of millions of dollars to test, not billions, have been brushed aside. But hot fusion has tangled with its last victim, and this time hot plasmas will not win. The much-maligned Drs. Pons and Fleischmann, whose continuing impressive research is now being sponsored by a powerful Japanese firm [Technova] in France, have discovered a table-top end-run to nuclear energy from sea water -- even though their process is certainly not fusion in the traditional sense.

One might have missed continuing rumbles about cold fusion -- reports of successful cold fusion experiments at various laboratories, as well as the human melodrama. You might have wondered what was really happening in those electrochemical cells with palladium and platinum electrodes dipped in heavy water and energized by a low voltage battery. Given the limited coverage of the subject in the general press -- brow-beaten as it is by mainline scientific publications, you would have every reason to believe that smart scientist at major universities and laboratories, not to mention DoE, honestly put cold fusion to rest long ago. Nothing could be further from the truth.

Hundreds of scientists the world over continue to work in the field, most often bootlegging research time and equipment from other assigned projects. One third of articles published in the journal of the American Nuclear Society, *Fusion Technology*, continue to be on cold fusion. Cold fusion is *far* from dead. In dozens of laboratories in the United States and in numerous foreign research centers, its promise burns brightly.

The most important evidence for cold fusion is the excess heat energy -- much more heat coming out than electrical energy being fed in. In this respect, cold fusion is decades ahead of hot fusion. Sometimes this power comes out in bursts, but it has also appeared continuously in some experiments for weeks or months on end. When this power is added up to give *kilowatt-hours*, the inescapable conclusion is that much more energy is being released than any possible chemical reaction could yield. The continuing wonder is that it is apparently a very clean process that gives negligible neutron radiation, yields low levels of radioactive tritium, and produces byproduct atoms that have been difficult to identify with scant funding. Several intriguing theories now may be able to account for cold fusion.

In the early days of the cold fusion controversy, it was possible to question whether these experiments were sound. It is now virtually impossible to assail many of them -- **except by ignoring them!** That is precisely the tactic that the prestigious and powerful scientific opponents of cold fusion have chosen. They also set up a straw man: "Cold fusion must work roughly like hot fusion; because it evidently doesn't, power-producing cold fusion doesn't exist. It's all a big mistake."

At present over 100 laboratories around the world have obtained positive results of one kind or another. At the international Second Annual Conference on Cold Fusion held in Como, Italy, last July, much more positive evidence for cold fusion emerged. There were impressive

heat results, first from the definitive experiment by Dr. Michael McKubre's group at SRI International. In work funded by the Electric Power Research Institute, McKubre achieved reproducible excess power with four different palladium electrodes. His group now understands the conditions necessary to produce excess heat **at will**. Dr. McKubre stated categorically that the excess energy cannot be explained by chemistry. Dr. Robert T. Bush and his colleagues at California Polytechnic Institute achieved one of the highest recorded levels of power **density** production for cold fusion. In a thin film of palladium that was deposited on a silver electrode, almost three kilowatts per cubic centimeter came out. This is 30 times the power density of the fuel rods in a typical fission nuclear reactor! The cell produced several watts of excess power for almost two months, non-stop.

Drs. Fleischmann and Pons, in 10 out of 11 electrodes made of silver-palladium alloy were able to boil away their electrochemical solution is less than an hour -- after a gestation period of days to reach boiling. Given steam, can power generation be far away?

It is true that cold fusion effects have not always been easy to reproduce, but that does not make them any less real. The difficulties with reproducibility are rapidly disappearing as researchers discover the conditions required to provoke the phenomena.

When conventional (low temperature) superconductivity was discovered accidentally in 1911, there was no physical theory that could explain it, nor was there a theory for a half century. The much discussed high-temperature superconductivity, which appeared in 1986-1987, still has no satisfactory theory to explain it. Yet industries and governments are bent on developing and commercializing it. The same should be true for cold fusion.

Is it possible that a revolutionary energy technology has been suppressed? Indeed, that seems to be exactly what has happened, as scientific and engineering developments will increasingly show. If cold fusion is, as we claim, a scientific wonder that has been validated beyond reasonable doubt, what can be done to hasten its commercialization? Savvy enterprises are already springing up to bring it to market as soon as possible. But to pave the way, measures are needed to overcome the obstacles to a potential revolution in the making. Federal seed money could unleash a tidal wave of research that could help resolve the cold fusion enigma and pave the way to rapid commercialization of revolutionary energy technologies. Michael Faraday, the great 19th century scientist who was virtually the father of the electrical revolution, unwittingly anticipated our time. He had a message about the science of his day that rings true for cold fusion. He said, **"Nothing is too wonderful to be true."**

EDITOR'S COMMENTS

The above statement includes an excellent summary about the background for the development of the new science of cold fusion. Together with the documentation provided to the subcommittee, the presentation provides a convincing argument that cold fusion is an acceptable new science. *Fusion Facts* had earlier adopted a policy regarding government funding that is different than that proposed by Dr. Mallove. The policy of *Fusion Facts* is that the agencies of the U.S. government should not fund cold fusion except to support university research and research in support of the mission of various agencies, such as Army, Navy, Air Force, Coast Guard, and NASA. **However, U.S. government agencies should not be involved in denying scientific reality.** *Fusion Facts* has contacted several DoE officials and has found that the duties of their assignments leaves little time for them to study and evaluate a flood of energy information. Therefore, they depend on the counsel of advisors, such as Professor John R. Huizenga (former co-chair of the Cold Fusion Panel of the former Energy Advisory Committee). As strongly shown in his new book, Huizenga appears to be incapable of accepting any scientific evidence contrary to his already-formed judgement. (See page 11, this issue for a review of Huizenga's book.) The DoE position in regard to cold fusion is, apparently, still strongly influenced by the strong-willing Huizenga's manipulation of the Cold Fusion Panel and its final report. (In at least one case, a panel member threatened to resign unless Huizenga softened his obstinate anti-cold fusion position.)

Fusion Facts has repeatedly stated that **the entry level cost of becoming involved in cold fusion research and development is less that $100,000, an amount that can be furnished by even small corporations. Therefore, there is no compelling reason for DoE nor for any other government agency to fund the further research and the commercialization of cold fusion. In fact, the multitude of government requirements that come with funding are much too onerous for a small business and would hamper the development of cold fusion.** The greatest contribution that the nation's Department of Energy can make is to recognize that cold fusion has been successfully demonstrated in several of the DoE-funded national laboratories (and in several other agency laboratories) and **then encourage private industry to develop and commercialize this new science.** Regardless, of the position taken by DoE or by its advisors, American industry will commercialize cold fusion. The DoE can be a leader or recognize the commercialization of cold fusion after the fact. The decision made by the managers of DoE should be carefully weighed by the next Appropriations Committee.

D. REPORT & MEDIA RESPONSE TO PROFESSOR TAKAHASHI

TAKAHASHI AT MIT

Professor Akito Takahashi presented the details of his now famous cold fusion experiment at MIT on April 16, 1992. Verbal reports reaching *Fusion Facts* state that Takahashi made a creditable and detailed explanation of the details of his experiment; that his presentation was well received [with the possible exception of the professional anti-cold fusion experts: e.g., Morrision and Petrasso]; that he was very open with all of the details of his experiment; and that he survived "being eaten alive."

TAKAHASHI AT TEXAS A&M

By invitation from Professor John O'M. Bockris, Chemistry Department, Texas A & M, College Station, Texas, Professor Akito Takahashi of Osaka University, Japan met with about twenty cold-fusion scientists and two members of the news media on Monday, April 20, 1992. About three hours were spent by this group mainly delving into the specific experimental details of Takahashi's now famous experiment. Professor Bockris chaired the discussion. The following is a summary of questions, answers, and discussions:

Note: Unless specifically stated the use of "hydrogen" should apply for all hydrogen isotopes. Comments within [] are my attempt at clarification. Ed.

Q. How do you achieve a high ratio of D/Pd? Takahashi: Apparently the hysteresis loop [of high current low current in the form of a saw-tooth wave with 20 minute cycle] is favorable for loading. It was mentioned that too much fracturing of the Pd lattice would allow hydrogen to escape and that much loading into voids in the Pd can be mistaken for high loading. One measure of loading is the amount of excess oxygen gas for which there is not suitable amount of hydrogen to combine back into water.

Bockris asked about cracking of the lattice. Takahashi said he wasn't sure because the Pd cathode had not been analyzed yet. Comments: With higher surface current, the D/Pd ratio at the surface must increase. If the D/Pd ratio is greater than 1.0 at the surface that may be where the action is located or begins. With the transport of the hydrogen toward the interior, the surface and bulk loading is only a difference of time. If both loading and deloading occur it would be highest at the surface of the Pd.

Bockris and Storms: Pd expands during loading but does not necessarily contract during deloading so that excess volume can always be observed even if the hydrogen has deloaded. The amount of excess volume is expected to improve loading. When tritium in present 96% of the T is in the gas phase. The tritium tends to follow the deuterium. T ions would have to buck D ions into the Pd so instead the T goes into the gas phase. Where ions become gas [on deloading] the ion to gas transition takes place in the lattice. Deloading gas comes from same spot as H & T bubbles during loading. Many voids [that help in loading/deloading] are too small to see with microscope. The grain boundaries can be seen but not all of the voids at this stage. It is not known [by this group] why the Pd does not contract. The hydrogen gas recombines inside the Pd and makes it way to the surface.

Bockris: Let's turn our attention to inside the Pd. Comments: If voids are greater than K [some measure of percent voids] then the Pd will never load. If voids are present then cracks will form and then the Pd will easily deload. An active electrode was examined metallurgically before and after loading and no difference was observed. Takahashi noted that he tries never to deload but only to have high and low loading rates. [The current is always flowing so that electrolysis is taking place at the Pd surface but the rates differ with high and low current.] The first loading gives 3 to 5 percent volume increase.

Bockris: In summary loading and unloading processes are important to get to the stage where excess heat can be observed. [Perhaps this should be stated in terms of high/low rates of loading -- surge loading?]

Comments: It is sometimes desirable to run the cathode anodically for a short time to remove any undesired species from the surface of the Pd. Rothwell noted that there is a published paper about hydrogen embrittlement and current cycling. There has been noted some small volume change in the cathode with loading/unloading.

Takahashi was asked about optimum cycle time and replied that for the loading they concluded that 10 to 30 minutes would be appropriate and chose to use 20 minutes. After loading the six hour period was tried but no optimization studies have been performed. It was suggested that a two-hour period might be just as effective.

Bockris mentioned that when a cell was producing tritium that the tritium production would stop when D_2O was added. Also after mechanical vibration, tritium production stopped. This was thought to be related to vibration changes in the dendrite structure on the cathode surface. Takahashi noted that the power level decreases immediately upon adding D_2O.

Fleischmann was asked if he used a separate cathode to plate out metal ions before running an experiment and was quoted as saying, "You are stepping on my toes."

Takahashi stated that symmetry was very important but the degree of importance has not been experimentally confirmed. A careful examination of the photographs of the Takahashi experiment showed that there was considerable distorting in the winding of the Pt wire. It was later mentioned that Mallove had obtained too short a piece of Pt for the anode and that he may not have a successful operating cell because of that change. Another scientist stated that "Geometry is absolutely critical and that cell changes in geometry will severely impair the ability to load. Having the anode longer than the cathode improves loading."

[The importance of the geometry has been stressed. And yet in Schoessow's patent he uses an cup-shaped anode which differs markedly from others. No papers that I have read have discussed the importance of current distribution between cathode and anode. Nearly all experiments in which the anode is connected at the top will produce a non-linear current distribution between top and bottom of the electrodes. Therefore, the electromagnetic field distribution from top to bottom of the electrodes is not symmetrical. Ed.]

Bockris noted that copper impurities cause a change in the cathode inner pressures. The Cu occupies surface sites and causes changes in diffusion and changes in loading.

Comments: A silver-palladium cathode became impervious to loading after it was used briefly as an anode. With a platinum anode Pt is uniformly distributed in the Pd cathode to a depth of 25 to 50 Angstroms. If energy is coupled to the lattice so that X-rays are produced then damage to the cell occurs. If the energy is coupled to the lattice so only heat is produced then there is no damage.

Takahashi reported that his cell had produced 50 MegaJoules in 2 weeks of excess energy. The Pd used has not been ion-implanted with He. Nate Hoffman reported that they had found that some Pd had been He implanted when the user was sure that such was not the case. It was reported that Johnson Matthey does use a helium atmosphere in some of its Pd processing.

Takahashi discussed his multi-body theory. One important concept was that three geometrically adjacent lattice sites (octahedral) for hydrogen could be caused to dump their deuterons into a fourth site (tetrahedral) to cause a four-body collision. His theory also states that when the D/Pd ratio = 1 all octahedral sites in the Pd are filled. When the ratio = 2 then the tetrahedral sites are filled. The trigger for the multi-body collision could be vibrational excitation. The tetrahedral site is deemed to be a deeper well than the octahedral sites. The measured nuclear byproducts are neutrons, tritium, and heat. The n/t ratio was measured and the spectrum of energy of the neutrons was measured.

Bockris asked why the three deuterons would all want to leave together. Takahashi talked about compressed electrons clouds around the Pd sites and therefore produce a high gradient field in the lattice. Takahashi's drawings and his comments provide a clearer explanation based on three-dimensional D-wave functions and harmonic oscillators. [See Takahashi's paper which will be published soon in its English version.]

Ed Storms suggested that the process cannot be a high energy process because if it were then increase tritium production would greatly increase heat production.

Bockris introduced Joe Champion to the group. Champion explained some of his work using a 9 liter cell, d.c. current, and a simultaneous use of 2 different high frequency r.f. (somewhere in the range of NMR frequencies.) After about five minutes of operation his cell would produce radioactive gas. His cell used 20% heavy water. In over 100 tests [without sufficient equipment to monitor all of the byproducts and/or their energy spectrums] he always found that alpha particle were being emitted. When using a Ni cathode instead of Pd he also gets a radioactive gas. Hoffman suggested that if Radon gas is "always an alpha-emitter". Champion said that the radioactive gas would continue for about 20 minutes [after turning off current and r.f., I think.] before migrating out of the cell solution. The alpha emission was done through sampling the air near the cell. The electrode assembly was pulled out of the cell for monitoring. If he changed the frequency of either of the two r.f. coils then there was no radioactive gas produced. The $5,000 cost of changing the electrolyte caused some difficulties in running all the experiments that he would like to run.

Takahashi showed a slide with the reactions H+D, H+D+H, D+H+D, H+D+H+D, and H+D+D+D and indicated that several are alpha particle producers.

Takahashi was asked about neutron production, that few cold fusion experiments had shown both neutrons correlated with excess heat. Answer: By integrating the six hour neutron production data for high and low currents showed that a bit more neutron production occurred during the low current. The n spectrum plot showed energy levels that Takahashi explains by multi-body events. He also discussion recoiled proton energy data.

It was noted that the water circulation through the Takahashi cell removed heat such that there was a 0.3 C temperature rise for 200 Watts of cell-produced power at 10 liters/min flow. The open cell electrolyte volume goes from 700 ml to 450 mil after one week of operation.

However, the experimental instrumentation can read as little as one watt change. Hoffman noted that with a 0.3 Molar LiOD some glasses will dissolve and coat the cathode with silicon. It was noted and agreed by Takahashi that the calorimetry cold be improved. He stated that this was the first experiments in which they had tried to measure excess heat and that future plans included improved calorimetry.

Note: There were about 20 persons present including some eminent scientists who have been successfully working with cold fusion. Obviously, I am not sufficiently skilled that I could report on this three-hour discussion without errors, therefore I have omitted most names of those making comments so as not to embarrass them with my errors. Each of them and all readers are requested to inform me of corrections that should be made and these will be duly published in the next issue of *Fusion Facts* after receiving the corrections. However, in keeping with our policy of making information available as soon as possible, these notes have been provided for your consideration. Hal Fox, Ed.

THE MEDIA RESPONDS

The response of the Japanese media to Professor Akito Takahashi's recent cold fusion successes have strongly reduced the level of scientific skepticism to cold fusion. As the result of Dr. Takahashi's visit to MIT and Texas A&M, there has been some favorable media response as indicated in the following selections:

Jacob Schlesinger (with contributions from Jerry Bishop), "Physicist to Report Cold Fusion Findings From Japan at MIT's Bastion of Skeptics," *Wall Street Journal*, April 15, 1992, page B8.

The article cites a letter to Takahashi from a fellow U.S. scientist saying, "I'm afraid they will eat you alive at MIT." But the reality was that Takahashi did not prove to be that consumable.

(AP Story), "Japanese Cold Fusion Physicist Finds New Hampshire Believer," *Manchester Union Leader*, April 16, 1992.

This article reports on the Takahashi presentation at MIT and cites Dr. Eugene Mallove as being totally convinced that neutrons have been observed. The story includes some discussion of Mallove's attempt to duplicate the Takahasni experiment.

David L. Chandler, "Making the case for 'cold fusion'", *The Boston Globe*, Friday, April 17, 1992, pg 7, picture of Professor Takahashi.

The article's subtitle is, "At MIT, Japanese scientist describes test; some say he made a good case." Philip Morrison is quoted as saying that he is quite convinced that there is a source of excess heat but that it is not fusion. Petrasso is quoted has saying there is a one in a trillion chance that the claims of cold fusion are correct.

Richard Stradling, "Cold fusion diehard searches for answers in his basement," *Concord Monitor*, April 18, 1992, pictures of Mallove and his experiment.

This article centers less on Takahashi's presentation at MIT and more on the story of Dr. Eugene Mallove's experimental effort with the financial help of "Jed Rothwell, a wealthy computer scientist from Atlanta ..." This is one of six attempts to replicate Takahashi's experiment. Other scientists in Japan and two in Italy are also involved in the attempt at replication.

Editorial Staff, "Cold-Fusion Findings Justify Research," *Atlanta Constitution*, Sunday, April 19, 1992, page G/4.

This editorial supports the concept that the cold fusion phenomenon ought to be fully explored. The editor states, "The U.S. government, scared off by the discrediting of the original cold-fusion researchers, has shied from funding such research. That decision ought to be reconsidered. Obviously, this editorial was influenced by the new information brought to the attention of the media by Prof. Takahashi's report on his cold fusion experiments.

David H. Freedman (free-lance writer), "A Japanese Claim Generates New Heat," *Science*, Vol 256, No 5056, April 24, 1992, page 438.

The author observes that "die-hards around the world have continued churning out reports of excess heat when an electric current is run through chunks of palladium immersed in heavy water." Among the "die-hards" is Prof. Akito Takahashi. He concludes his article with the statement, "For now, Takahashi and hundreds of other researchers keep laboring over their (gently, they hope) bubbling cells, recording their provocative output and trying to ignore the chorus of voices saying they are wasting their time." [We think that science writers are better when they report facts and spend less talent on the use of emotion-laden words. If scientists followed the advice of the chorus of voices who argue that they are wasting their time, the journals of science would not have published many interesting reports.]

Terry Newfarmer (Editor), "Cold fusion could easily become hot topic again," *FYI ...a faculty/staff newsletter*, Vol 3, No 20, May 8, 1992, University of Utah.

[Reprinted in full.] The U. of U. hasn't heard the last of cold fusion. Electrochemists B. Stanley Pons and Martin Fleischmann, who made the controversial announcement of a room-temperature sustainable nuclear fusion reaction at the U. 1989, are continuing their work in France.* Japanese physicist Akito Takahashi recently made headlines with data he presented at MIT which seem to verify the Pons/Fleischmann claims of excess heat production, but most scientists remain unconvinced that any supportable evidence of a nuclear reaction of this type yet exists. Meanwhile, the University is taking what actions are necessary to protects cold-fusion-related patent applications.

Eugene F. Mallove, author of Fire From Ice, will inaugurate the Marriott Library's Science and Technology Archives Lecture Series May 21, 1992 at 7 p.m. in the Olpin Union Ballroom, with the lecture "Cold Fusion: Real and Revolutionary." Mallove is the former chief science writer at MIT, and is now co-founder of a national organization that seeks to prompt the U.S. government to fund cold fusion research.

**The Chemistry Department faculty voted not to renew Drs. Pons and Fleischmann's annual appointments as research professors for 1992-93.*

[Readers must wonder why the Chemistry Department faculty would vote 14 to 1 against a renewal of Drs. Pons and Fleischmann's appointments. *Fusion Facts* suggests that it is lack of communication from Pons and Fleischmann and too much communication from the mistaken science media. The attorneys handling patent applications for the U. of U. threatened Pons and Fleischmann in early 1989 that if they discussed their work then some patents or some claims may not be allowed in some countries and that this could have serious economic consequences for the University and for Pons and Fleischmann. In addition, some professors at the U of U in the fall of 1989 received telephone warnings from Washington D.C. that if any graduate students were working on cold fusion that it might result in no government contracts from Washington. Although one of the world's centers of cold fusion information rents offices in the University of Utah Research Park, no U of U department has subscribed to *Fusion Facts* except the National Cold Fusion Institute.

E. BOOK REVIEW - HUIZENGA FIASCO

By Hal Fox

John R. Huizenga (Univ of Rochester), COLD FUSION: The Scientific Fiasco of the Century, copyright by author 1992, published by University of Rochester Press, 3 pictures, 4 Tables, 259 pages.

AUTHOR'S PREFACE - (SELECTIONS)

In the spring of 1989, two electrochemists promised the world an energy utopia - clean, cheap and abundant energy without harmful side effects to the environment. B. Stanley Pons of the University of Utah and Martin Fleischmann of Southampton University announced that they had successfully created a sustained nuclear fusion reaction at room temperature in a small jar on a laboratory tabletop. They had duplicated the process powering the sun. Their reported accomplishment has eluded [hot] fusion scientists for several decades, in spite of the fact that these scientist were experimenting with extremely high temperatures and large machines, and spending billions of dollars in [hot] fusion research. Fleischmann and Pons indeed made heady promises, which if fulfilled, are the stuff of Nobel prizes.

. . . In the early euphoric days of cold fusion, disbelief in the new energy dream was unpopular and viewed almost as an unpatriotic act. . . . However, with over four decades of experience in nuclear science, I was skeptical, as were most of my immediate colleagues, of Fleischmann and Pons' spectacular claims. . . .

Even so, many of us moved quickly to participate in the verification process. Surprises do occasionally occur in science. In scientific research it is always important to be on the lookout for an unexpected or surprising result. Our research group at the University of Rochester had state-of-the-art neutron detectors and associated electronics. . . . Experimentation is the final authority in science and experimental groups around the world immediately attempted to verify test-tube fusion on a bench top as viewed on the evening news. . . .

Early in April, 1989 I received a telephone call from John Schoettler, Chairman of the Energy Research Advisory Board (ERAB), asking me to serve as chairman of an ERAB panel on cold fusion. . . . A few days later, following discussions with colleagues at the spring meeting of the National Academy of Sciences, I agreed to co-chair the DOE/ERAB panel. . . .

For the next six months, I was completely immersed in the study of cold fusion. . . . The amount of material was voluminous. Teams of panel members also made visits to selected laboratories working on cold fusion. Our panel completed its interim report in July, 1989 and final report

in November, 1989. **On speaking to a number of different groups and organizations about our panel's conclusions and recommendations, I learned firsthand that many people had a deep curiosity about the whole cold fusion episode and wanted to learn more about it. This motivated me to write this book on "cold fusion".** . . .

The first six chapters deal with events through the second month of the cold fusion saga. Once the promise of room temperature fusion had been announced by press conference, without first passing through the normal processes of scientific scrutiny, the verification process entered the public arena. . . .

The second group of chapters (VII to X) describe and evaluate some of the pertinent scientific data. The University of Utah in its original press release called the experiment "extremely simple." In opposition to this, definitive calorimetric experiments turned out to be very difficult. . . . The positive reports were plagued by experimental uncertainties, inadequate controls and improper assessment of errors. . . .

If fusion of deuterium is occurring there must be tell-tale fusion products. The detection sensitivity for fusion products is orders of magnitude larger than that for excess heat. Therefore, searches for neutrons, tritium, helium, etc. are the key experiments to validate cold fusion. **These are described and analyzed in some detail. Proponents agree with skeptics on at least one aspect of the cold fusion saga. Namely, that there is an extremely large disparity between the claimed amounts of excess heat and fusion products even as reported by proponents.** . . . The proponents claim of "new physics in solids" has added intrigue and hype to the cold fusion saga, but unfortunately, it has in the final analysis led to confusion, scandal and deception. Fleischmann and Pons' underlying reason for investigating room temperature fusion was flawed from its very inception. They mistakenly asserted that the pressures attained during electrolysis were sufficient to drive deuterium nuclei close enough to fuse. The National Cold Fusion Institute has closed, careers have been damaged and many tens of millions of dollars have been squandered in time and resources. **Still no verification.**

. . . **On the basis of the sheer number of positive claims, it is tempting to conclude, as many believers have, that there must be some truth to cold fusion. Numbers of unproven claims alone, however, are not definitive in science.** Hundreds of papers were published in support of both N rays and polywater, both classic examples of pathological science, which was defined by Irving Langmuir, Nobel laureate in chemistry, as "the science of things that aren't so."

The cold fusion fiasco illustrates once again that the scientific process works by exposing and correcting it own errors.

John R. Huizenga, Rochester, New York.

[Emphasis mine. Ed.]

EDITOR'S COMMENTS

As can be determined by reading the whole of the preface, this book was written not so much to educate as to influence. The author provides in Appendix III a "Chronology of the Cold Fusion Saga" with 62 events with 45 of them during 1989 and the rest up to June 30, 1991 (closing of National Cold Fusion Institute). The events in this chronology were apparently chosen to support the thesis of the book that cold fusion is "confusion, scandal, and deception." This list should be compared to the more extensive chronology in *Fusion Facts*, March 1992, pp 1-5 (99 events to summarize a three-year history).

In support of the thesis that cold fusion is pathologic science (the title of chapter VII), Huizenga shows in Table 4 (page 171) that of 38 papers presented at the First Annual Conference on Cold Fusion, 32 papers were from U.S. scientists and 6 from abroad. Although the author mentions the II Annual Conference on Cold Fusion, he does not cite that of the 55 papers presented (and published) 18 were from U.S. scientists and 37 were from scientists in many other countries. Nor does Huizenga relate the fact that nearly all papers at the Como conference were positive. Rather Huizenga notes "International Advisory Committee was made up of well-known strong believers in cold fusion." (page 248).

In Chapter VIII, (Where are the Fusion Products?), Huizenga provides a table of four different possible nuclear reactions: D+D, p+D, p+T, and D+T to show that all of them produce measurable neutrons, tritium, or helium. In all cases these are exothermic nuclear reactions that produce energy. The table does not list D + ^{6}Li --> ^{4}He + energy. This latter reaction may be the primary energy producing reaction in cold fusion that allowed Bush, et al (J Electroanal Chem, **304**, 271, 1991) to measure heat and ^{4}He without also measuring ^{3}He or T. On page 212, Huizenga dismisses this work of Bush et al. as follows: "First, no evidence for the commensurate intensity of the 23.9 MeV gamma rays was presented. **Secondly, no ^{3}He was observed as required. Its absence requires a miraculous alternation of conventional low-energy D + D fusion.**" Here, Huizenga makes the same mistakes that have been much over stated, that the world of cold fusion must only follow his experience in nuclear physics. Fleischmann and Pons did not make that mistake. They specifically stated in their first peer-reviewed respected journal article: "The most surprising feature of our results however, is that reactions (v) and (vi) are only a small part of the overall reaction scheme

and that the bulk of the energy release **is due to an hitherto unknown nuclear process or processes presumably due to deuterons)."** The deuteron-lithium reaction does not require the production of ^{3}He nor of tritium.

Again in Chapter VIII, Huizenga cites the report from a large collaboration of French scientists [D. Aberdam et al., *Phys Rev Lett* 65, 1196, 1990] that they reported no evidence of neutron emission following electrochemical and gas-loading experiments. However, Huizenga fails, as he does throughout the entire book, to cite positive evidence. For example, Srinivasan reported that the autoradiography of deuterium-gas loaded Ti chips showed that only 4 chips out of about 1,000 showed evidence of tritium. Huizenga, in the preface properly reports that the idea of the experiment being "extremely simple" is not true, it is extremely difficult. Huizenga fails to understand that this difficulty to replicate has been responsible for many of the negative reports on cold fusion.

Huizenga gives lip service, in the Preface, to the importance in science "to be on the lookout for an unexpected or surprising result." After two years (covered by Huizenga's book) many peer-reviewed articles published in responsible journals from dozens of teams of noted scientists working in many countries have reported that they have replicated Pons and Fleischmann's work. Further, these scientists have reported that they have collectively measured neutrons, tritium, gammas, and excess heat unexplained by chemistry. Even so, Huizenga remains not just unconvinced but unconvincible.

This book is on a par with Frank Close's book and repeats much of the same prejudices. By contrast, Dr. Eugene Mallove's book, Fire from Ice: Searching for the Truth Behind the Cold Fusion Furor, (1991, Wiley) is by far the most balanced report (pro and con) about cold fusion. If you haven't read Mallove's book, spend the money you might spend on Huizenga's book to buy and read a balanced report on cold fusion. Huizenga's book is recommended for the history buff. This book of prejudice will likely prove to be a great embarrassment to Professor John R. Huizenga, who himself may become labeled as the scientific fiasco of the century for his studied failure to avoid recognition of an important new science in the making.

F. NEWS FROM THE U.S.

IDAHO - COSMIC WORMHOLES

Courtesy of Dr. Samuel Faile

Barry Parker (Prof of Physics and Astronomy, Idaho State Univ.), "Tunnels Through Time," *Astronomy*, June 1992, 8 pages.

[This article in a popular magazine may be of some interest to cold fusion experimenters. It is listed mainly because of the one or two cold fusion experimenters who have suggested (speculated) that some cold fusion events are related to gravitation and/or time phenomena. See short article from Dr. Samuel Faile in this issued. Ed.]

NEW YORK - SCIENTIFIC? AMERICAN

Courtesy of several correspondents

John Horgan, "Japan, Cold Fusion and Lyndon LaRouche," *Scientific American*, May 1992, page 53, 1/2 page, in depressed journalese.

EDITOR'S COMMENTS

In a recent issue of the Japanese translation of the *Scientific American*, the Japanese editors inserted a two-page article about Prof. Akito Takahashi's extraordinary experimental results with cold fusion. With this *Scientific American* article and many other Japanese-language articles reporting on cold fusion developments in Japan, one Japanese editor remarked, "There are no more cold fusion skeptics in Japan."

The scientific response in America by the formerly prestigious *Scientific American* is a half-page, half-truth article by John Horgan. Horgan states, "Cold fusion has been dismissed as "pathological science" by the vast majority of scientists . . ." which is not true. "But the undeniably attractive idea of limitless energy from battery-like cells still has its believers." True but it is strange to call cold fusion scientists "believers" when over 200 positive peer-reviewed papers from over 25 countries have been published. Horgan continues, "On paper, the Japanese effort in cold fusion does sound impressive. It involves some 100 Japanese scientists from 40 academic and industrial institutions..." True. Further, Horgan after quoting Ikegami's comments that the funding level in Japan is not important, "...Ikegami's own employer, the National Institute for Fusion Science in Nagoya, 'has never supported and will not support research into cold fusion', he said." Horgan did not relate that cold fusion work is being supported by many Japanese corporations, that nearly every university in Japan has a cold fusion team that is being supported, and that a new consortium of Japanese corporations have pledged further support of cold fusion research. Horgan then tells of the remarkable "claimed" results in cold fusion by Akito Takahashi and writes, "Yet Takahashi's results remain unreproduced by other researchers and unpublished in a peer-reviewed journal." Horgan fails to also cite the several peer-

reviewed and published papers by Takahashi, that his work was presented in a peer-attended technical professional meeting in Japan in January, and that several workers were just beginning to replicate the results. Horgan cites that Fleischmann confirms support from the Japanese corporation Technova and notes that Fleischmann says that "...'good information' on cold fusion can be found in *21st Century Science & Technology*, a journal published by followers of Lyndon H. LaRouche." Now the final logical coup de grace to cold fusion administered by the hand of John Horgan, **"LaRouche, . . . has previously claimed the existence of an international drug cartel run by the Queen of England."**

In view of so many twists of truth in Horgan's epistle, we checked with Washington sources and found the following: In 1982 an NBC newsperson (Mark Nykanen) traveled to Washington to interview LaRouche. Nykanen asked LaRouche why he said that the Queen of England was pushing drugs. LaRouche replied, "That is not what I said," and explained the possible misinterpretation. The book Dope, Inc. c1978 published by Benjamin Franklin Co. reviews the history of the English monarchy and the English banks role in the China Opium Wars. Regardless of the explanation, an edited version of that interview was aired in Chicago where the quote was attributed to LaRouche. It was relatively easy for *Fusion Facts* to determine the facts about Horgan's statement. Why would *Scientific American* not take the time to check its story before publication? It is strange that *Scientific American*, that published an early article about cold fusion (Jones and Rafelski, "Muon-Catalyzed Cold Fusion", July 1987 pp 84-89) are so remorse with the success of cold fusion that they now stoop to a strange logical tangle of facts and falsehoods to link cold fusion with the historic drug-dealings by prominent English institutions of years past. The attackers of cold fusion have some strange bed fellows. In case Horgan would like to reply, we hasten to state that none of the associates of *Fusion Facts* are followers of LaRouche, but I don't know what that has to do with cold fusion. John Horgan, please study the quote on page one of this issue.

NEW YORK - CLUSTER FUSION

Courtesy of Dr. Samuel Faile

Ivan Amato (Staff writer), "Cluster Fusion: Close But No Cigar," *Science*, Vol 256, No 5054, April 10, 1992, pg 178.

EDITOR'S COMMENTS

This one page article reports on new evidence from Brookhaven National Laboratory with the team of Robert Beuhler, Lewis Friedman, and Gerhart Friedlander. These researchers report that experiments done during the last several months with collaborator Y.K. Bae showed that some small ionized artifacts in their beam were responsible for much of the cluster fusion results. The beam was run through a magnetic field which deflected some of the ionized artifacts out of the beam (to the extent that the beam lost about half of its mass). The fusion rate dropped to less than one percent of the previous results. Their latest results have been published in an erratum in *Physical Review Letters* in the March 30 issue. While Friedman accepts the newest results as a setback, he is quoted as saying, "it's premature to say there's nothing left." Unfortunately, these negative results will be cited by the cold-fusion detractors as some kind of evidence that cold fusion experimental results will have the same or similar problem.

NEW YORK - MORE PHASE DIAGRAMS

Courtesy of Dr. Samuel Faile

A. Nash & P. Nash, "Nickel-Palladium Binary Phase Diagram," in Binary Alloy Phase Diagrams, Vol 2, American Society for Metals, pp 1741-42, c1986. See also J.L. Murray, "Ni-Ti Phase Diagram" pp 1763-1768 in same volume.

EDITOR'S COMMENTS

With the increased interest in using Ni in both light- and heavy-water electrochemical cells, Dr. Faile sent in the copies and information on the latest phase diagrams for Ni-Pd and Ni-Ti systems.

NEW YORK - PERSISTENT CURRENTS

Courtesy of Dr. Samuel Faile

Barbara Goss Levi (Senior Associate Editor), "Experiments remove resistance to the notion of persistent currents," *Physics Today*, Vol 45, No 4, April 1992, 2 figs, 8 refs.

AUTHOR'S INTRODUCTION

. . . Theories have predicted, and recent experiments have now indicated, that isolated rings of normal metals threaded by a magnetic flux can support persistent equilibrium currents. But this surprising phenomenon can occur only when the wave-functions of the electrons remain in phase around the circumference and restricts experiments to micron sized rings even for the cleanest of metals. . . . One group working at AT&T Bell Labs two years ago, enhanced the minuscule signal from a single ring by sensing the magnetic response of any array of 10^7 disconnected copper rings. And this December, researchers at IBM reported their measurements of the magnetic response from a solitary gold ring. . . .

[The metal lattice gets even more complex. There is seldom a month elapses without some new surprising results being reported on new discoveries in or on the surface of metal lattices. Why should the experimental observation of nuclear reactions continue to be a surprise to nuclear scientists? Ed.]

WASHINGTON, D.C. - CF STILL TICKING
Courtesy of Jed Rothwell

Ron Dagani, "Cold fusion takes a licking, but keeps on ticking," *Chem & Engr News*, April 6, 1992, page 6.

EDITORS'S COMMENTS

This article reports on the press conference held in Washington, D.C. by Eugene Mallove and Giuliano Preparata (Univ of Milan, Italy). Dagani calls these two scientists, "two of the staunchest advocates" of cold fusion. The article notes Preparata's claim that Pons and Fleischmann will have a demonstration device to be unveiled by the end of the year.

WASHINGTON, D.C. - EPRI FUNDS
Courtesy of Dr. Samuel Faile

Richard Stone, "Propping up Cold Fusion," *Science*, Vol 256, No 5053, page 28.

EDITOR'S COMMENTS

This article reports on the authorization by the Electric Power Research Institute (EPRI) of an Additional $3 million in funding of cold fusion at SRI International. This amount is reported to be a 50% increase from last year. The article notes that EPRI shuns the name "cold fusion" and prefers "excess heat production in electrolytic experiments involving palladium as the host metal for deuterium." Others like to say, "anomalous effects in a palladium-deuterium-lithium system."

G. NEWS FROM ABROAD

FINLAND - HYDROGEN BANDING
Courtesy of Dr. Samuel Faile

Risto Nieminen (Lab of Physics, Helsinki Univ of Technology), "Hydrogen bands band together," *Nature*, Vol 356, No. 6367, 26 March 1992, pp 289-91, 2 figs, 7 refs.

EDITOR'S COMMENTS

In the introductory paragraphs Nieminen states, "Electrons moving through a crystal have their energies divided up into different bands, separated by band gaps. Whether a material is insulating, semiconducting, semimetallic or metallic depends on the nature of these bands, on the band-gap separation between them and on the way they are populated. The bands and gaps arise because the traveling electrons are diffracted by the crystal lattice, and transmission is completely impossible for electrons of certain energies." The author writes about the strength of binding and the resultant quantum-mechanical zero-point motion. He cites that in a crystal the zero-point energy may overcome the binding energy. With the small mass of the hydrogen atoms, quantum behavior is not totally unexpected. "In fact, hints of unusual (that is, nonclassical) properties have accrued over the years. [Such as nuclear reactions. Ed.] The author points out that with hydrogen on surfaces, proton motion has a component of quantum-mechanical tunnelling instead of classical hopping. This effect may influence catalysis in the sense that their mobility is much larger than one would expect. [Could this effect influence the catalysis of nuclear reactions? Ed.] The article concludes, "Surface hydrogen is thus a candidate for an interesting, strongly correlated quantum liquid, intimately coupled to the underlying surface and its excitations. . . ." This article provides new information about hydrogen and metal lattices and should be carefully studied to see if there might be some correlation with experimental observations in cold fusion.

FRANCE - COULOMB SCREENING
Courtesy of Dr. Samuel Faile

M. Rambaut "Double screened Coulomb barrier accounts for neutrons production in cluster and other fusion experiments," *Physics Letters A*, Vol 164, No 2, April 13, 1992, 6 Figs, 17 Refs.

AUTHOR'S ABSTRACT

In a dense fully ionized medium, containing fusible nuclei, a collision between two nuclei is accompanied by an electron concentration around them. By this, rate of tunneling is tremendously increased. The experimental results are in agreement with the calculations, the number of displaced electrons being typically in the range of one to two thousand.

AUTHOR'S CONCLUSIONS

[Extracted from conclusions.] 1. It would be important in a new study to start calculating those high electron density screening effects and thus also compulsory to handle higher dimension matrices.

2. The slopes of the straight lines in a logarithmic diagram, with a constant number of clouding electrons, is between 1.5 and 2, according to the root value. Those values are not far from the slopes which are in ref 1 [author's previous paper], from experimental results, the production term being approximately proportional to a current law between I^6 and I^{16}. It is interesting to underline that the model discussed here is in rather good agreement with the Z-pinch experiments. [Note that it is highly unusual to find physical laws or relationship where the exponent is so high. The highest known to me relates to the lifetime of certain electric light filament under changing I where the exponent is 9! Ed.]

3. . . . According to the model, the ionized deuterons must have a translational motion. This motion is given by the electrodynamic forces. They are lying in the same direction during the growing phase of the current; but as soon as the current begins to decrease [in Z-pinch effect], this decreasing evidently initiates a chaotic motion. It seems possible to calculate the behavior of the system by assimilating the ions to harmonic oscillators submitted to a variable strength as a function of time according to the modern concepts of chaos. This chaos is thus the origin of collisions. . . .

4. Fusion is possible by the process proposed here, not only for very light nuclei like deuterons and tritons, but also for many heavier nuclei, like the ones considered in astrophysics.

5. One can infer from those results that we now have both a theoretical and an experimental confirmation that an electric current passing through a dense non-ideal plasma is not a simple process. The distribution of the electrons and ions is evidently submitted to a variable chaotic motion . . . In fact on a macroscopic level, one observes only an average effect, even if locally there are electron clouds and potential pedestal changing effects, which involve thousands of particles and more.

6. This study has been limited to the non-relativistic case, but one can infer from the proposed model that it is no longer possible to ignore that the conventionally called thermonuclear plasmas are in fact and above all relativistic plasmas. In such a plasma relativistic electrons play a role which one has to understand better to predict its evolution. . . .

EDITOR'S COMMENTS

In the introductory paragraph the author notes, "It has been shown that a possible correlation exists between three kinds of observed fusion experiments, the so-called cold fusion experiments, the capillary fusion experiments and the cluster fusion experiments. This correlation was interpreted in terms of turbulence caused by longitudinal Ampere forces combined with Coulomb screening and quantum tunneling processes. The aim of this paper is to present a more detailed numerical computational justification of this model."

For his computations, the author makes the following assumptions: 1. The conducting media is fully ionized, i.e. made up of two mixed gases, one an ion gas, the other an electron gas. 2. As a consequence of the great electron mobility in comparison with that of the ions, one can assume that there are two spatial distributions, one for the ions, the other for the electrons. 3. The ion spatial distribution is governed by a Poisson process. 4. The specific dimension of the volume which contains one ion on average is typically of the order of 10^{-8} cm. Two deuterons will be a candidate for Coulomb barrier penetration if they are close enough together. The author also points out that more parameters must be considered than in thermodynamic hypotheses because it is required that the Coulomb barrier penetration is both a quantum and an electrodynamic phenomenon. From the resulting equations the author infers that the nuclear reaction rate must be proportional to the barrier transmission factor.

In the author's Figure 4 he plots the fusion production factor as a function of the deuteron energy on a logarithmic scale. Using experimental data in which the number of electrons per cloud ranges from 342 to 50,000, the author plots straight lines. Obviously the fusion production factor is larger at lower deuteron energies for the case of the larger number of "screening" electrons. It would be of great interest to consider the case of an electron bead being formed (minimum of 10^8 electrons in a micron-size region) and its probable effect on the fusion production factor. Because of the newness of the Shoulders-Puthoff work with electron beads, there are no known publications that consider the screening effect of an electron bead. [See references in this issue at the end of the article beginning on page 17.]

The author states: "One can thus assert that in the various kinds of experiments, the cause of the observed fusion reaction is essentially the same: i.e. the simultaneous screening effects of the electron clouding around two approaching deuterons and the corresponding change of the electric potential pedestal in the environment of those two deuterons." This article is recommended to theorists to consider for possible modification of other theories, especially those theories in which a Maxwellian velocity distribution has been assumed.

JAPAN - PARADIGM OF NEW SCIENCE
Courtesy of Dr. Samuel Faile

Shiuji Inomata (President of Japan Psychotronics Institute), "Paradigm of New Science," Talk given at ETH, Zurich.

AUTHOR'S INTRODUCTION (EXTRACTS)

As we look back to the past 15 years we have to acknowledge that we have gone through and are still going through an "abnormal age" for science and technology. The reason for this, among others, is that so-called "paranormal" phenomena, which do not fit into the "normal" paradigm, have been experienced, appreciated, and reported by an increasing number of persons across all global societies/cultures and government and private research institutions have started to investigate and to seriously study this area. As a consequence or rather parallel to the aforementioned there was and continues to be an increasing awareness with the public at large on the "limits" of our existing world-view. . . .

The "new paradigm science", by contrast, is organized by introducing the new parameter of consciousness into conventional physics, which hitherto included no conceptual categories except "matter" and "energy". And Psychotronics is defined as the systematic discipline which is devoted to the technical application of this new science. We foresee, in the long run, completely new technological breakthroughs in the field of Energy, Resources, Medicine, Information Technology and Agriculture and most important in the area of philosophy of science based on this new paradigm science. . . .

[After discussing the "consciousness, mass, energy triangle", the author makes the following statements:] In modern physics, the laws of conservation of mass and conservation of energy are unified by the relation $E = MC^2$, where C represents the velocity of light, i.e., 3×10^{10} cm/sec. From the viewpoint of psychotronics, when a vast amount of energy is released in accordance with the equation $E = MC^2$, the mass and the corresponding quantity of panpsychic consciousness Q are annihilated simultaneously. On the other hand, there are exceptional cases with respect to the relations $E = MC^2$, that is, the annihilation of the mass M and the liberation of the corresponding quantity Q of panpsychic consciousness are not accompanied by the emission of a huge amount of energy; the gravitational collapse of start is regarded as a concrete example of this case. Considered from this viewpoint, the ultimate source of atomic energy, contrary to common belief, is not the mass M but rather the "shadow charge" Q. Thus, if one requires that the quantity of energy resulting from the direct transformation of "shadow energy" into energy is equal to that resulting when the "shadow charge" is liberated and subsequently reconverted into energy (the super-law of energy conservation) then the simple calculation, deleting "i" for the sake of simplicity, yields the transformation formulae shown in Figure 1 (see below). Whereas present science regards "mass" and "energy" as the basic entities, **the psychotronics adopts a 180-degree change of viewpoint, with "consciousness" being considered as the fundamental entity, from which come the mass-energy manifestation.**

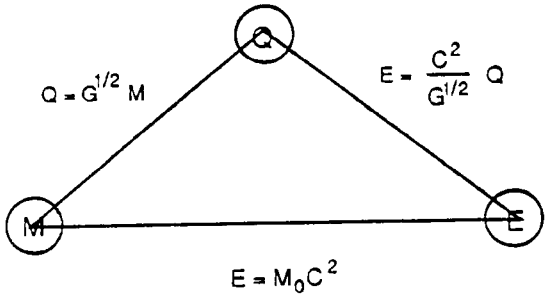

Figure 1. THE Q-M-C TRIANGLE

EDITOR'S COMMENTS

Some years ago, I read a book which purported to show that in the extreme some of the concepts of philosophy (religion) and science came to essentially the same area of investigation. This paper by Shiuji Inomata represents the first time that I have seen some of these considerations treated in a mathematical context. The equations that are developed in the paper show some interesting overlap between electromagnetism and gravitational fields. If these equations represent reality then an electrical capacitor when charged could change its gravitational mass by the following amount:

delta $M = G^{-1/2 \text{ rho } m}$.

Inomata claims to have performed this experiment using a 0.011 microfarad capacitor with a 16 Kv rating and weighing 75 grams. Upon charging with 15,000 volts, the capacitor weight changed by 10 milligrams. The author also discusses some aspects of the energetic vacuum and ways in which this energy may be tapped.

To those of our readers that may want to delve into this mathematical treatment of consciousness, matter, and energy, further information may be obtained from Japan Psychotronics Institute, c/o Electrotechnical Laboratory, 1-1-4 Umezono, Tsukuba-shi, 305 Japan, Telephone: 0298-58-5835.

H. SHORT ARTICLES FROM READERS

COLD FUSION AND EVs

(The following information has been derived in large part from three patents of Kenneth Shoulders plus a lengthy conversation with Shoulders in Austin, Texas.)

WHAT HAPPENED TO THE COULOMB BARRIER?

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

There has been a considerable number of scientists, both pro- and con- cold fusion, who cite the Coulomb barrier as being the piece-de-resistance that must be overcome for cold fusion to be acceptable. In some historic sense (and repeated in many high school and college demonstrations) a pair of pith balls can be charged with electrons and shown to repel each other. We all know **that in the static case,** like charges repel. This is a fundamental part of our science **belief structure** that we are taught to accept. In our chosen scientific manner, we now express the Coulomb barrier (the barrier faced by two charged particles that are to be moved close together), in a neat equation form. When the like charges do get together we call it **tunneling** (the term, to me, is devoid of causitive explanation, but scientists like to name the things we don't understand.)

Ken Shoulders has taught us [1] that electron beads can be formed and further that the electron beads can retain some sort of space-bound cluster identity over many feet without being "blown apart" by the Coulomb forces. Further, Shoulders has shown us that much of the current filaments in a variety of electrical discharges from vacuum discharges to lightning consists of electron beads (EVs for Electrum Validum, as labeled by Shoulders). EVs are easily made. If you make a spark, you probably create one or more EVs. Shoulders, in his patent, teaches us that one method to create an EV is to use a sharply pointed cathode directed toward the surface of a strong dielectric. Under proper conditions of low vacuum, one or more EVs can be produced by a very short negative pulse delivered to the cathode. Voltages ranging from 500 to 4,000 volts are suitable.

The EV or string of EVs that are created have the following properties:

1. They travel along the dielectric at about 1/10th the speed of light.
2. They have the same charge to mass ratio as an electron.
3. They contain from 10^8 to 10^{13} electrons.
4. They retain their identity within a space measured by a few microns in diameter but will travel over a distances of several centimeters (even a few meters under good conditions).
5. They lose their structural identity in the presence of a conductor and can create a measurable current flow (which is an indication of the size of an EV or string of EVs).
6. When launched through a space into a conductor, X-Rays are often produced.
7. The EV has the capability of "drilling" through a ceramic material and leaving a long hole of uniform diameter of a few microns.
8. The EV can produce light under a variety of conditions.
9. The most peculiar characteristic is that the EV apparently is regenerated as it travels in a groove or over the surface of a non-conductor and at the same time can radiate a considerable number of electrons and thus produce a "light" track.
10. Under some conditions, it can be shown that an EV can return more energy than it took to produce the EV.

In most of the characteristics displayed by an EV, the Coulomb Barrier is not a problem. One explanation is that an EV consists of an intensely dynamic structure in which the static laws of electricity no longer hold.

IS THERE EXPERIMENTAL EVIDENCE FOR EVS IN COLD FUSION?

For one familiar with the experimental literature of cold fusion there is some evidence that EVs may be the cause of certain experimental effects. Here is a partial list:

"6. When launched through a space into a conductor, X-Rays are often produced." X-rays have been measured in some cold fusion experiments [2].

"7. The EV has the capability of "drilling" through a ceramic material and leaving a hole measuring a few microns." Small diameter holes in palladium (deuteride?) have been observed in a cold fusion cathode [3].

"8. The EV can produce light under a variety of conditions." Reports of light in the vicinity of a cold fusion cell near the electrodes has been reported.

"9. The most peculiar characteristic is that the EV apparently is regenerated as it travels in a groove or over the surface of a non-conductor and at the same time can radiate considerable number of electrons and thus produce a light track." The regeneration appears to be coupled to the EV's ability to "drill" through material bodies but also seen as "blue light" around electrodes, and observed in some particle-tracking materials [4,5].

"10. Under some conditions, it can be shown that an EV can return more energy than it took to produce the EV." The excess energy reported in many cold fusion experiments may be, in part, linked to the production and disintegration of EVs. Ref [6] gives many experiments in which excess heat is produced.

HOW DO I KNOW IF EVs ARE BEING PRODUCED?

Nearly all EVs will radiate energy over a considerable spectrum unless carefully shielded. Therefore, one can use a small transistor radio, tuned away from a broadcasting station (to get maximum gain) and hold the radio close to

an operating cell. You would expect to hear crackling similar to those produced by sparks if EVs are being produced.

HOW GOOD ARE THE COLD FUSION THEORIES?

If a typical cold fusion cell is producing excess energy and the "expected" nuclear byproducts are not being measured, then our current theories need to be re-evaluated in the light of what we are now being taught about EVs. **Now that we know that the Coulomb Barrier does not prohibit the formation of electron beads, we should include in our theories the potential for the creation and dissolution of EVs.** A cold fusion theory or a calculation of the occurrence of nuclear events based on the probability of "tunneling" through the Coulomb Barrier can now be seriously questioned. It is no longer sufficient to calculate highly dynamic events from equations based on static observations.

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Note: Ken Shoulders writes: "One of the biggest mysteries in my life is how such a thing [EVs] could have gone undetected for so long. They show **Justice** as a blindfolded lady holding a **balance**. **Science** should be shown as a doddering, old blind man carrying a **grudge**.

UNDERSTANDING REPRODUCIBILITY: TOPOLOGY IS THE KEY.

by Dr. Peter Glück

Profoundness has to be concealed. Where? At the surface! (Hugo von Hoffmannstahl)

The surface was created by the devil. (Wolfgang Pauli)

Lack of reproducibility was a kind of original sin and a rich source of troubles, despair and skeptics from the start of the cold fusion story. Now the situation is much improved, but the progress has resulted mainly from trial and error experiments and not from cause-effect considerations, principles, models or theories. This statement is valid even for the newly born light-water excess energy experiments [1]. The most developed theories, e.g. the T.R.M. model of Bush [2] must be combined with purely empirical descriptions of know-how and engineering data as those of Cravens [3] for electrochemical cells. Scaramuzzi [4] for gas-metal systems, Mills [5] (the experimental part) and Mallove [1] for light water experiments. An example of spectacular irreproducibility was obtained by the scientists of the Bhabha Atomic Research Center [6,7]: "not only are the anomalous fusion reactions found to take place in only a very few chips (obtained from the same piece of titanium) but even in those chips, tritium production is restricted to a small number of selected localized 'hot spots' only..."

Theory or analysis can do only a little for solving such practical problems like the choice of a working electrode [3]. The situation reminds me of a saying of the famous Spanish painter Salvador Dali: "The only difference between a madman and me is that I am not mad." A statement like, "a good electrode is an electrode which is good" is not a tautology but a research report.

In my opinion, this "lack of reproducibility" is actually nothing else than an extremely high, mimosaceous SENSITIVITY of the cold fusion phenomena, which can be triggered, delayed, perturbed or stopped by some hyperfine, immeasurably small causes such as sub-parts-per-billion level impurities or "esoteric" metallurgical factors. This sensitivity is intrinsic to these phenomena and for this reason it seems inappropriate to correlate cold fusion to some ordered features of the systems like electron screening, crystal or lattice structure, even defects of these or to any other easily controllable factor.

In the following, I intend to prove my belief that the experimental facts and ideas generated by the scientists working in this emergent scientific field have attained such a "density" that a global vision and a continuous logical network of certitudes can be created and these can be used to solve the central puzzle of the field.

DEFINING COLD FUSION PHENOMENA

Cold fusion phenomena are extremely sensitive and much varied nuclear processes appear to take place at localized areas on the surface of some metallic hydrides. The phenomena are generated and stimulated by dynamic factors. Due to their common topology which is not sufficiently controlled at the present, all the phenomena having different mechanisms, appear as chaotic, non-linear, non-predictable.

Cold fusion phenomena must be considered as sui-generis heterogeneous catalytic processes and the modern concepts regarding active sites have to be applied in order to understand and direct the reactions.

MORE ABOUT SENSITIVITY

* Monomolecular layers of heavy metals change the surface/interface properties of electrodes considerably. On this basis, Schlapbach et al [8] have developed an analytical method with sensitivity better than 1 part-per-trillion.

* A remnant soap film can inhibit the light water process, wherein the electropolishing of the nickel cathodes is also a condition of success [1].

* Both the outer and inner impurities have to be considered; it has been shown that some impurities (Rh, Ag) are migrating toward the surface of the palladium electrodes [9].

* The usual construction materials of the electrochemical cells - i.e. glass and platinum - seem to be good reservoirs of impurities when exposed to long term corrosion. Perhaps it is not accidental that one of the best cells, that of Takahashi [10] is made of polyacrylate plastic.

THE VARIETY OF COLD FUSION PHENOMENA

The data presented in the two excellent, complementary surveys published in 1991 [7, 11] is impressive. More information was published later on light water excess heat reactions [5] considered to be actually alkali-hydrogen fusion [12], multi-body fusion [10] as well as on a newly discovered low energy intensity emission characteristic for palladium loaded with hydrogen or deuterium [13].

The similarities and differences between the processes carried out in the three main systems: palladium, titanium and nickel (as well as their alloys) are not clear at the moment.

THE SURFACE IS THE LOCUS FOR THE COLD FUSION REACTIONS...

* Newly created surfaces can trigger nuclear reactions - see fractofusion and the co-deposition procedure of Szpak [14].

* The light water excess heat process is clearly localized on the very surface of the nickel cathode, impenetrable for the alkaline metal participant/component [5,12].

* Cold fusion in thin films works well [15].

* Implantation, even at high density seems to have a moderate efficiency.

* Tritium formed in the electrolytical experiments goes into the electrolyte [11], only a very small fraction of helium remains in the electrode [11].

BUT ONLY IN RESTRICTED AREAS – ACTIVE SITES!

* Neutrons and tritium are released in bursts; bursts are temporal just because they are local, suggesting some sort of "cascade reaction or micronuclear explosion" [7].

* The point effect (the fusion reactions occur on the isolated tiny areas of the surface, due to the directed moving deuteron flux) was postulated by Jiang et al [16].

* There are many data regarding nonuniform distribution of tritium in the electrodes.

* Hot spots on electrodes can be visualized by infrared techniques [3].

* Post-electrolysis cathodes present tiny spot defects suggesting cold fusion in grain boundaries.

COLD FUSION IS STIMULATED BY DYNAMIC EFFECTS

* It is interesting to remark that different D/Pd ratios are necessary in order to trigger the emissions of neutrons, tritium or heat. But in all these cases a long and rather unpredictable induction period is required suggesting "a waiting time for removing an obstacle," not just "swelling of a network." Some abundant emissions of neutrons result from a barrier-breaking process, see e.g. the work performed at NTT-Tokyo [18] and our study [19].

* Many researchers consider pulsing current a critical factor.

* High temperature (i.e. high mobility) like in molten salt experiments [10] is advantageous for the heat release.

* The same effect is obtained by high voltage discharges.

* The ever growing patent literature presents many dynamic methods for the enhancement of cold fusion: different forms of excitation energy-mechanical (i.e. vibration), electrical, magnetic, supersonic, optical irradiation, heating, pressure waves, etc.

* In spite of the expectations, very high pressure is not a stimulating factor [21].

* Cluster impact fusion - the nearest neighbor of cold fusion is obviously also based on dynamic effects (and is a surface process too). [See new evidence, page 14.]

SURFACE MOBILITY OF METAL ATOMS IS KEY

Surface mobility of metal atoms is the key both for heterogeneous catalysis and for cold fusion.

One of the modern and successful Russian schools in the field of heterogeneous catalysis [22] considers that surface dynamics is the determining factor for the existence of active centers. Motion of both isolated atoms and clusters of noble metal atoms have to be considered. Chaotic motions of surface atoms can be now directly observed. Surface dynamics and especially the rapid gas-surface energy transfer are emphasized as important factors for catalysis in the review of Somorjai [23]. Actually, the study of catalytic surface phenomena in operating conditions is very difficult, given that the most modern analytical methods must work under high vacuum conditions. The mobility of hydrogen atoms on the surfaces of noble metals is very high, including quantum effects.

(Due to the limitation of my information sources, I am not current on latest publications regarding surface dynamics of Pd, Ti and Ni hydrides - the considerations are usually restricted to the motion of hydrogen atoms.)

In my opinion, the cold fusion phenomena are localized at active sites (similar to catalysis), and characterized by intense surface dynamics. This is the unique possibility to justify their hypersensitivity which needs a "sufficiently" chaotic factor. It is intuitive to imagine how a few foreign atoms e.g. silicon or zinc are restraining the motion of the topmost layer of the metal atoms. A minimal quantity of organic matters adsorbed here when touching the electrode with a hand not protected by a glove can have the same catastrophic effect.

In order to have a theory, you need reliable facts; emissions of neutrons, tritium, heat etc. are not reliable, on the contrary, lack of reproducibility is reliable, it's rock-solid and reproducible! **This means: paradoxically, lack of reproducibility has an amazingly great informational value.** When understood, generously unmasking itself, it gives us the solution how to destroy it... and to understand what actually cold fusion is. The low energy emissions from palladium loaded with hydrogen or deuterium, recently discovered by BARC scientists [13] cannot be unambiguously correlated to chemical reactions, lattice phenomena or cold nuclear fusion. I suggest that this form of radiation is caused by the peculiar surface dynamics of the Pd hydrides/deuterides and is a precursor of cold fusion.

DISCUSSION

* A new concept regarding cold fusion has been presented, for the sake of brevity we shall name it the SURFDYN concept (from surface dynamics).

* This concept is only a part of a theory. It has to be combined with reactions, mechanisms for two and multi-body fusions, quantum and electric field effects etc. in order to solve the other puzzle of the field: variety. **This is not the task for one man.**

* There have been elaborated many surface models of cold fusion in the past e.g. [24, 25]. These can be now revived and adapted.

* SURFDYN is fusion on the lattice and not in the lattice. Theorists wouldn't like it. How is the Coulomb barrier penetrated? Perhaps by dynamic quantum effects: cooperative motions of deuterons, protons, metal atoms of the topmost layer and alkaline metal atoms (ions). What about energy transfer? Or T/n production ratio? If the lattice isn't the locus for the nuclear reactions, is it a competitor for hydrogen/deuterium? High D/Pd values have been considered as essential, this concept remains valid but for an other reason -- to assure high surface mobility. In my opinion, multi-body fusion is more easily conceivable on the surface than in the lattice. (Will Dr. Bush return to the two-dimensional TRM?)

* What the nature, rise and dynamism of the active sites are, is an open question. A very rapid and massive information influx from the field of science and technology of catalysis could be useful to get the answer(s).

* It is possible that surface dynamics could be used to explain some special events like cells out of control (explosion at SRI) or electrochemical cells producing heat without current (Wolf, Mizuno).

* The process used by our Japanese colleagues for producing "cold fusion quality" electrodes, according to the technical folklore, can confirm or contradict the SURFDYN concept.

* More extended comparative studies of the surface dynamics of Pd, Ti, Ni, alloys vs. their behavior and efficiency will contribute to the metamorphosis of "compelling evidences" in "certitudes."

I hope that the SURFDYN concept will prove to be no more but no less than the (now missing) link between the theory and the practice of cold fusion.

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TIME CONTRACTION?

"Does Use of Free Energy Unscreen Wormholes Leading to Time Contraction?" By Samuel P. Faile, April 29, 1992.

It appears the cosmological constant is nearly zero implying that the vast reserves of the vacuum state free energy is balanced by a negative energy factor. Coleman of Harvard and Hawkings of the UK believe that wormholes in the fabric of space-time have enough negative energy to balance out the energy in the quantum vacuum state. Some type of imbalance may occur. One imbalance could be a relative speed up in time in the zone where the free energy process is occurring. A concentration of slightly unscreened wormholes could make the free energy process more difficult but a speed up in time may at least temporarily give the active zone an appearance, as measured from the surroundings, of producing large amounts of energy. At some point there could appear to be a quenching of the process as the slightly unscreened wormholes reconfigured disrupting the process with explosive or antigravitational effects. The wormholes could be considered to have effects opposite to black holes. The black holes produce, in the zone close to them, time dilation and gravitational increases.

There are new geometric factors when one considers groups of either black holes or partially unscreened wormholes. According to general relativity, some really bizarre phenomena can occur for rapidly moving concave configurations of black holes. Likewise, there could be bizarre phenomena near a rapidly moving reconfiguration of slightly unscreened wormholes especially for a zone adjacent to the convex arrangement of the wormholes. Time reversal for a zone near these wormholes could give the external appearance of a quenched process.

Cold fusion might provide a means for smoothing out some of the free energy process and a combination process might even help smooth out the cold fusion process. Dr. Matsumoto's work (Hokkaido Univ, Japan) that suggests that tiny black holes can be produced during cold fusion which observation indicates there could be a technology to access the 10^{-33} cm. scale of the wormhole. A free energy inventor might want to have wormhole imbalances compensated for in the active zones. By superimposing a cold fusion process the formation and evaporation of black holes could provide the range of energies and the right scale to compensate for the slightly unscreened wormholes.

One may ask, "Why mess with free energy at all if one has cold fusion?" The advantage of many of the [purported] free energy devices is that they produce electricity or mechanical power instead of heat. In a combination process much of the heat of cold fusion might not occur and yet the process could be producing electricity.

[Dr. Faile is a correspondent for *Fusion Facts*, and provides us with many of the peer-reviewed journal articles. In addition, he also provides us with information from sources that the scientific community does not count among their literature. These sources provide some interesting speculation about free energy. This short article with considerable speculation makes an attempt to establish a link between Coleman, Hawkings, Matsumoto, and the world of our understanding. For more about wormholes see page 13. Ed.]

I. LETTERS TO THE EDITOR

LETTER FROM ROMANIA

From Dr. Peter Glück, Romania, April 24, 1992

Dear Hal,

It seems good days are here for cold fusion, both heavy water and light water type. I was very pleased to read in FF and in the papers of Dr. Bush and Rout et al. I got second-hand information ref. pro-cold fusion symposia in Italy and Japan. Perhaps the bad guys and the skeptics wouldn't change soon but they cannot stop the progress in our field. **Quotation: One of the marvels of creation is the infinite capacity of the human brain to withstand the introduction of knowledge. – Theodore Roosevelt.**

There are no good days for me, our postal services are dreadful. . . . I wrote a letter to Prof. Ikegami, ACCF-3 [Third Annual Conference on Cold Fusion], describing my idea for a motto of this conference, the letter came back for unknown reasons. In my opinion these ACCFs are and will be milestones in the history of cold fusion.

Conclusion

ACCF-1 in Utah: "Cold fusion is a reality."
ACCF-2 in Como: "Cold fusion is a science."

ACCF-3 in Nagoya: "Cold fusion will be a technology." ACCF-4 in ?: "Cold fusion is a source of energy, working..."

The motto of ACCF-2 at Como was: "The puzzle of cold fusion is still with us." This statement remains valid but I believe that ACCF-3 Nagoya needs another, more optimistic and genuine Japanese motto. If hot fusion is a sun (or star), cold fusion can be considered a man-made bonsai sun (bonsai is the name of those miniature trees raised by an ancient Japanese art)...

I got the invitation for Hungary, Debrecen - for three conferences for May 25-28. The first conference will be on cold fusion - a confrontation with the greatest skeptic, Dr. Gyula Benese, a theoretical physicist, he is very clever and aggressive, but I am used to fights. (One of the best exercises I made were the discussions regarding quality specifications of different products, when I worked at the chemical factories, sometimes we discussed more than 14 hours per day, 2-3 days..)

The other conferences are related to the subject - "Modes of thinking in research," and "Progress of chemical technologies." (The third is merely a round table discussion.) I shall send you a good report. I hope to find some new (fresh) papers e.g. *Fusion Technology* at Debrecen, because my sources are very scarce. A nice fellow of Italy, Bill Collis, who knows *Fusion Facts*, has sent me some interesting papers and information. Otherwise the situation is catastrophic... But I am used to it.

[A note to fellow scientists: If you want to help a friend in need, please send Dr. Peter Glück copies of your papers. His address is: Institute of Isotopic and Molecular Technology, R-3400 CLUJ-NAPOCA, P.O. Box 700, ROMANIA. Ed.]

LETTER FROM PISA, ITALY
From Dr. Carlo Bauer (& Roberto Morelli & Moreno Paolini):

Dear Editor,

Thank you for your letter of March 23, 1992 announcing (and enclosing) the publication of our article on Tritium evidence for cold fusion.

We greatly appreciated the form in which the article was presented and particularly the story of its refusals by *Nature*. Surely, if we shall prepare other articles, we will send you timely their abstracts.

Sincerely, /s/ Carlo Bauer.

COLD FUSION UPDATE NO. 2
Letter from Lawrence P.G. Forsley

Lawrence Forsley has begun summarizing and privately circulating a cold fusion update. He sent a his 4-page April update to us. Most of the materials has been covered in *Fusion Facts*, but we found the following of interest:

OTHER FRONTS
I have been working with an ex-administrator of a US national fusion laboratory on a suitable organization to seek funding and support research in cold fusion. I will circulate a white paper on this matter shortly. In the meantime, I welcome experimental or theoretical white papers of one page in length with a one page budget. I am deeply concerned that the cold fusion efforts of many, like Bockris at Texas A&M and Liaw at the University of Hawaii, will be lost as these researchers are forced to pursue other, funded research. Those experimental techniques developed during the past three years will be tragically lost. One early researcher, Dr. Robert Huggins of Stanford, is now reportedly engaged in lithium battery research in Germany.

I am awaiting a promised review copy of John Huizenga's book on cold fusion. It was due back from the printers two weeks ago, and is now expected within two weeks. He spoke during a talk show interview with Bob Smith of WXXI in Rochester, NY on February 17th, 1991:

"No chance it [the search for cold fusion] will be improved with better equipment... [One] must have certain amount of energy to overcome the Coulomb barrier... Nuclear physics [has been] studied for fifty years but the probability is so small [of cold fusion] one shall give it up." [See pg 18.]

I talked with him two months ago, and his views during our discussion could be summarized as:

"Quantum mechanics was invented over 50 years ago... There isn't any room for cold fusion."

Huizenga is right. Quantum mechanics was invented more than 50 years ago, but whether or not the phenomena called cold fusion is cold fusion, quantum mechanics will require a larger, newer home to hold it.

PERSPECTIVES: The Neutron Derby

I spent 13 years working in hot fusion in laser-initiated inertial confinement fusion at the Laboratory for Laser Energetics (LLE), as a visiting scientist at the Max Planck Institut fur Plasmaphysik working on the ASDEX tokamak, and as a consultant to Lawrence Livermore's Mirror Fusion program. Although my professional interest was command, control and diagnostic systems, I

developed a growing interest in the observed physical phenomena, as well as the military, political, financial and human factors which drove this research.

The antipathy with which the idea of cold fusion has been greeted, and the polarization it has caused, are beyond my previous experience, but only in degree, not in kind. My laboratory was considered the bastard child of fusion research, funded in part by the US Department of Energy, which also funded production, the making of nuclear weapons and Lawrence Livermore National Laboratory, which designed those weapons. One general, the then undersecretary of DOE, referred to the LLE program as:

"The pimple on the boil of the ass of production."

The boil was Livermore. There was no love lost among the Laboratories. For many years during the late 70's and early 80's we participated in the so-called neutron derby. Microballoons filled with deuterium and tritium were shot at by lasers to induce thermonuclear fusion. The lasers caused the microscopic shells holding the hydrogen gasses to implode, or explode inward, and neutrons were measured in proportion to the number of fusion events produced. Unfortunately, neutrons weren't a good measure of the major problem in laser fusion: implosion uniformity. Although higher neutron yields signaled increased thermonuclear fusion, they also indicated greater non-uniformity, bigger hot spots where fusion occurred, and a poor experiment.

But as Lord Kelvin would have been pleased to note, they were numbers. Sound familiar? It should. These are the same people clamoring for cold fusion neutrons.

If, as it appears, cold fusion is aneutronic, then looking for neutrons is less significant here than in laser fusion.

There is no point in doing well that which should not be done at all.

[In re Huizenga's comments on the Coulomb barrier, see page 18 for a discussion of the former Coulomb barrier and what happened to it. Ed.]

READ OLD BOOKS

A Letter from Henry P. Dart, III

In the April, 1992 issue of *Fusion Facts*, we reviewed an old article by Carl Hering that was republished in *Deutsch Physik*. Henry Dart shares the following from his personal acquaintance with Stefan Marinov who is the publisher of Deutsch Physik:

Stefan is a brilliant, ... man ... Nevertheless, Stefan has developed certain ideas on electro-magnetism which I feel sure have great merit. He speaks Bulgarian (which is the Russian mother tongue), German, Italian, English, and French fluently ... He has a fairly good sense of humor, and he has some quaint sayings, such as: "If you want to learn new things, read old books". That is why he published the 1923 paper which was reviewed in *Fusion Facts* for April.

[Henry Dart also sent a copy of an article by John Maddox published in *Nature*, Vol 316, July 18, 1985, "Stefan Marinov wins friends". The lead-in states, "The suggestion that there are systematic departures from the strict requirements of special relativity has been persistently put forward by Dr. Stefan Marinov. There is a case for repeating his experiment." The experiment referred to measuring the speed of light in a rotating framework. Ed.].

ROTHWELL REPLIES TO HORGAN

Dear Mr. Horgan [Scientific American writer]

Your May 1992 article "Japan, Cold Fusion, and Lyndon LaRouche" was a masterpiece. You have outdone yourself again.

I attach some press coverage of the Takahashi visit [at MIT], but this material pales beside your article. If you had actually attended the lecture, the way these reporters did, it might have let you round out your material, it might have given you greater understanding, but I fear it might also have dampened the imaginative flights of fancy, and cramped your free association: Japan - Fusion - LaRouche - the Queen of England. James Joyce could not have done it better. Your's is not science journalism, it is poetry! It would be a shame to mix it with the tedious dross of mere facts: what is a watt, a megajoule, what are redundant neutron detectors, recoil proton energies or pion exchange forces, compared to this? Each individual statement in your article was true [not so, Ed.]; but since only a few statements had anything to do with science, the totality of these remarks creates an imaginary impression of cold fusion worthy of any screenwriter.

THE PATENT HARMONIZATION ACT

Dr. Robert Bass has asked that we call our readers attention to the following:

The Patent System Harmonization Act of 1992.

On April 9, 1992 Bill H.R. 4978 was introduced into the House of Representatives of the United States Congress. This bill, in part, seeks to change our patent system so that the first person to file a patent is recognized as the true inventor of the subject matter filed. This is a change

from the current system which recognizes the true inventor as h/she who actually first invented the subject matter. Many believe that this change in our patent law will cause great financial hardship to the small business and independent inventor, will help to undermine American initiative, and will further invite well-financed foreign based, big-business takeovers within the United States. It may encourage greatly increased amounts of industrial espionage.

[Taken, in part from the Orange County Inventors Forum Newsletter, May 1992 issue.]

Dr. Samuel P. Faile also sent the following article on the same subject:

John R. Emshwiller (Staff Reporter) "Patent-Law Proposals Irk Small Inventors," *Wall Street Journal*, April 30, 1992, page B1.

This article reports that independent inventors are furious at the proposal to change the patent law from favoring the true inventor to favoring the first one to file on an invention. Apparently, much of the rest of the world's protection of intellectual property is based on "first-to-file". The executive director of the Inventors Workshop International of Camarillo, California suggests, "The rest of the world should go to first-to-invent."

J. MEETINGS ETC.

FUSION [HOT] ENERGY ADVISORY COMMITTEE

The DoE's Fusion Energy Advisory Committee will meet at the University of California in Los Angles on May 19-21, 1992. The meeting will be held at the Sunset Canyon Recreation CEnter on Tuesday, May 19, 1992 and at the Morgan Center for the following two days. The following blocks of time are set for **PUBLIC COMMENT:**

Tues May 19, 5:15 to 5:30 p.m.
Wed May 20, 12:00 - 12:15 p.m.
Wed May 20, 2:15 - 3:15 p.m.
Wed May 20, 5:15 - 5:30 p.m.
Thur May 21, 10:15 - 10:30 a.m.
Thur May 21, 3:00 - 3:15 p.m.

[Note: It is assumed that this committee will be considering the expenditure of funds for hot fusion research. Using the average of $500 million per year that has been spent on hot fusion in previous years, the public is scheduled time to comment at the rate of $3,700,000 per minute. We will attempt to get copies of this issue of *Fusion Facts* handed out to the committees and the press in attendance at this meeting. Ed.]

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