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EDITORIAL COMMENTS

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RAPID DEVELOPMENTS REQUIRE RAPID RESPONSES

Hal Fox, Editor

In 1941 I remember reading an article in *Astounding Science Fiction*, the forerunner of *Analog*. The article was about nuclear energy developments. The closing of the article was the concept that events are moving too fast to follow in a monthly magazine, you'll need to follow this topic in your local newspapers. Years later, the editor reported that this article was followed by a visit from officials of the U.S. government and that no more such articles on nuclear energy would be published. The next public information about nuclear energy was received at our camp site on the island of Leyte in the Philippines, where our group was scheduled to ship out for an invasion of an unannounced major Japanese island. That information was, of course, the dropping of the atomic bomb on Japan.

Events in new forms of nuclear energy and in other new technologies that comprise some of the articles in this issue of the *Journal of New Energy*, are likewise developing too fast to follow in a quarterly journal. The development of low-energy nuclear reactions (unsupported by government funding) is one of these technologies that is rapidly developing. The development of an understanding of torsion fields is another technology that is almost unknown in North America and Europe but which has an extensive background of development in Russian-speaking countries. The article by George Miley is an example of the low-energy nuclear reactions and the three articles about torsion fields (Panov, et al.; Shakhparonov; & Akimov) are examples of important new technologies for which there are few, if any, peers in the United States.

Just as there were no peers that could really understand the implications of Stanley Pons and Martin Fleischmann's first article on "cold fusion", so also, are there no peers to comment adequately on the long history of the development of an understanding of torsion fields. Please note that Akimov's article has over 175 references, most of them in Russian.

Perhaps the most challenging concept that is a part of the torsion field technology is the experimental and theoretical demonstrations of field velocities that are orders of magnitude faster than the speed of light! While this claim will be met with immediate skepticism (and should be), those who would dismiss the theory and experimental evidence without investigation should examine the technical information before making public proclamations of the impossibility of such super-luminal velocities.

What can be done to help speed the dissemination of such important new developments? One approach is for this journal's readers to also subscribe to the monthly newsletter, *New Energy News*. This monthly newsletter is not required to use the sometimes lengthy peer-review process before publication. Therefore, each issue carries the latest publishable information about low-energy nuclear reactions and, hopefully, will be able to develop sources for monthly reports on such interesting topics as torsion fields, anti-gravity, and other novel developments.

At the present time, *New Energy News* is offering audio tapes of gravity waves. In addition, a gravity-wave detector (similar to the equipment used to make the audio tapes) is being offered for sale. It is this editor's judgement, that the so-called gravity waves and some of the torsion

fields represent the same phenomenon. The gravity-wave detector shows evidence of superluminal velocities, according to the inventors.

This journal plans to provide its readers with the latest information in our combined and continuing quest for a fuller understanding of Nature. To ensure timely publication, we will do our best to have quick responses in our peer-review process. In addition, the editor reserves the right to publish some items as "editor's choice". In addition, this editor will also invite papers on some topics that will be published to allow our readers to serve as peer-reviewers. We welcome reader's letters, constructive criticism, and suggestions. **We also welcome technical papers on new energy subjects.**

Theory papers, as well as experimental papers, are solicited. However, we prefer that this journal be more devoted to experimental evidence than to voluminous theory. For example, there are over 20 different theory papers on cold fusion none of which are entirely correct, according to peers. In our technical judgement, the paper by Ken Shoulders and Steve Shoulders explains more about the process of cold fusion than any of the other theoretical papers. (See Shoulders and Shoulders, "Observations on the Role of Charge Clusters in Nuclear Cluster Reactions", *J. of New Energy*, vol 1, no 3, pp 111-121.) Akimov's paper, in this issue, is an excellent example of a serious paper on a new (especially outside Russia) technology. Akimov has provided extensive references, has developed both the theoretical considerations, and has provided experimental and commercial device information. Furthermore, Akimov has addressed the unusual issue of explaining consciousness phenomena as well as physical phenomena.

If Akimov's (and others) report on the superluminal velocity of torsion fields is sustained by independent experimental evidence, then this new technology will provide extraordinary pressure for changes in the basic foundations of physics. It is worth noting that several conferences in Russia (some co-sponsored by French scientists) have strongly questioned the viability of special relativity in light of the scientific advances (including advances in torsion field technology). If this editor is correct then the following topics will be of increasing interest and re-evaluation:

1. There was no Big Bang.
2. Information can be transmitting at faster-than-light speeds.
3. Low-energy nuclear reactions are feasible.
4. The ground state of hydrogen is not the lowest state.
5. Energy can be extracted from space, anywhere.
6. A substitute for the aether will be found and studied.
7. Science will embrace heretofore ignored topics.

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New Energy Times

**POSSIBLE EVIDENCE OF ANOMALOUS ENERGY EFFECTS IN
H/D-LOADED SOLIDS — LOW ENERGY NUCLEAR REACTIONS (LENRS)
(Revised Paper)**

George H. Miley ¹

ABSTRACT

A growing body of experimental evidence is cited showing that low-energy nuclear reactions (LENRs) can occur under select conditions in solid lattices loaded with hydrogenous atoms. There appear to be various reaction regimes leading to different nuclear products. If this phenomenon continues to be verified, a radically different theory for the interaction and the subsequent reaction must be developed. None of the presently proposed theories have been adequately benchmarked. One key difficulty remains -- the irreproducibility of experiments, possibly due to yet to be identified variability of the solid state structure involved. To illustrate the LENR effect, recent experiments at the University of Illinois are discussed, where a large number of new elements are observed in thin films of various metals such as Ni undergoing electrolysis. A semi-empirical theory to interpret these results is also outlined. If LENRs are verified, this will lead to a breakthrough in nuclear physics understanding and also to a number of important potential applications, such as space power units.

INTRODUCTION

The phenomena of anomalous heating effects in deuterated metals gained worldwide attention through the famous S. Pons and M. Fleishman (PF) announcement of "cold fusion" in 1989. [1] Shortly after that, discrepancies in their first report were uncovered. Due to that and to difficulties in reproducing the experiment, the scientific community became skeptical. When the DOE ERAB committee commissioned to evaluate the situation released a negative report, skepticism accelerated. Despite this, a number of scientists worldwide have continued dedicated but low-key studies of such effects, and there have been numerous reports of positive results. Thus, in a recent review article, E. Storms [2] cites over one-hundred

	Hot fusion "P-F" type	
D-D	> 2keV	< 1eV
T + p	50%	< 0.1%
He-3 + n	50%	< 10 ⁻⁶ %
He-4 + gamma	< 10 ⁻³ %	99+%
	"NEW" LENRs	
p + metal	-----	fps
hydrinos	-----	x-rays

Conclusion: "New" LENRs are distinctly different from P-F type and both differ from normal hot fusion reactions.

positive experiments of various types reported by well-known laboratories around the world. While even these experiments are still plagued by nonreproducibility, the fact that this many definitive experiments have been reported provides rather convincing evidence that anomalous heating and/or nuclear effects can occur in a variety of materials loaded with high concentrations of hydrogen or deuterium. Most recently, a number of these experiments have identified nuclear reaction products that are attributed to hydrogen or deuterium interactions with the metal electrode, rather than the D-D-type fusion studied by P-F [3-6]. Consequently, workers have renamed this field as "Low Energy Nuclear Reactions (LENRs)." This work has used a variety of configurations and a

Fig. 1 LENR Characteristics vs. "Standard Reactions"

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variety of loading techniques giving reaction products ranging from Helium-4 and Tritium, to an array of heavy elements. Various theories have been advanced to explain these results, but they are usually restricted to a class of reaction products. In this paper, we will first briefly review some of the LENR experiments and theories reported by others and then concentrate on experiments by the author at the University of Illinois. [4,5]

LENR CHARACTERISTICS

As indicated in Fig. 1, the PF D-D-type reactions when observed experimentally, have shown characteristics that are quite different from normal hot fusion D-D reactions. [1]

The original PF concept is that if the compound He-4 nucleus formed by the D-D reaction is in a lattice, its excitation energy might transfer in a coherent transfer mode to the lattice structure. This would yield heat and helium as the main outputs instead of tritium and neutrons that normally occur by the fast decay of excited He-4. [7] The most recent LENR-type experiments have reported yet amazingly different major products ranging from tritium production to an array of isotopes with masses below and above the mass of the reacting metal. [3-6] Other experiments appear to funnel energy into X-rays through a collapse of ground-state hydrogen into a lower energy level leading to so-called hydrinos. [8]

These LENR reactions have been produced by a variety of techniques ranging from the more traditional electrolytic technique, on to electrical discharges in gases, electric arcs in water, high-pressure gas loading, and biological action. In view of this wide range of conditions, theoreticians are faced with a challenge in defining a common driving force of the reaction. One thought is that all of these phenomena basically involve nonequilibrium flows in the crystalline structure, but other investigators argue that the reactions themselves are so different that they may involve entirely different mechanisms.

Examples of the wide variety of experimental conditions and the variety of reaction products observed are outlined in Fig. 2.

Questions can be raised, but many of these reported results appear to definitively demonstrate that LENRs do occur. For example, T. Claytor's experiments at Los Alamos [9], employing a plasma discharge loading method, have achieved tritium levels that are orders of magnitude greater than background. Nuclear reactions appear to be the only way that tritium could be created in these experiments. The main issue that remains is reproducibility—tritium production occurs only in about 15% of the many experiments performed. This problem, a characteristic of most of the work in this field, is generally attributed to differences in crystalline structure of the solid being loaded. To date, however, a definitive identification

of the cause has not been made. Suggestive experiments by Srinivasan in India [10] exposed electrodes after a run to X-ray film and found a speckled pattern of bright spots. This observation and related experiments by others suggest that the lattice contains a scattered pattern of nuclear-active-sites, [1] but exactly what defines such a site and how to create one remains unknown.

KEY PHYSICS ISSUES

Assuming that, based on this data, LENRs occur, a number of key new physics issues must be tackled to understand the phenomenon. Basically, any theory must explain two key issues: how penetration of the Coulombic barrier between high reactants can occur, and then how a "non

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| <ul style="list-style-type: none"> ■ Electrolysis – PF, IMRA, SRI, CETI, etc. <ul style="list-style-type: none"> ◆ D₂O, Pd; fused salt..... heat, He-4 ◆ H₂O, Ni, Pd,heat, fps ■ Plasma discharge – Karabut, Dufour, Claytor <ul style="list-style-type: none"> ◆ D₂, Pd, ---tritium, fps ■ Proton Conductor – Mizuno, Oriani, Biberian <ul style="list-style-type: none"> ◆ Sr(Ce, ...) O₃, AlLaO₃, -- heat, (fps) ■ Ultrasonic, Gas loading – EQ, Piantelli, Fiat <ul style="list-style-type: none"> ◆ metals — heat, rad., fps |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Fig. 2. Examples of LENR Experiments

traditional" reaction occurs. Some of the many theories that have been advanced to explain these issues are listed in Fig. 3. [1,11] The majority of the theories involve, in some manner, a coherent wave structure in the crystalline host material. Others attribute the effect to formation of new particles such as hadrons or polyneutrons.

- *Chubb and Chubb* – ion band theory, wave overlap – critical crystal size – He4, *Bush* – resonant wave interactions
- *Preparata* – QED, coherent fields combine, x-rays
- *Bazhutov, McKibben* – hadrons, fractional chg pts
- *Miley & Hora* – SEL at thin film interfaces
- *Hagelstein* – energy transfer via phonon laser
- *Fisher* – polyneutron, - BSC condensate, nuclear rx
- *Mills, Dufour* – fractional energy levels in H
- *Kucherov* – phonon energy transfer to metals
- *Miley - RIFEX* – combines SEL and BSC condensate

- *Issue* – despite major differences, not fully accepted due to lack of benchmark

Despite the major differences among these theories, none have gained general acceptance. The reason is that there has not been an accepted benchmarking of the theories against experimental data. This is partly due to the problems of nonreproducibility of the experiments, and also to the inability to define a definitive benchmark experiment. Some progress is being made, e.g., initial steps towards benchmarking RIFEX theory with thin-film data are noted later, but much more work is needed to complete this effort and to evaluate other possible theories.

Fig. 3. Some Theories

SIGNIFICANCE

While the field of LENR remains somewhat ill-defined due to the issues noted above, it is clear that if LENRs are fully demonstrated in a reproducible manner, research will rapidly expand, and extremely important scientific and practical applications can be expected. The physics necessary to explain LENRs is so radically different from traditional nuclear reaction physics that it offers a whole new field of study, which has the potential of new breakthroughs. The field is quite interdisciplinary bringing together physics, chemistry, and materials science. Consequently, all three scientific areas stand to benefit from the new insights gained from this research. The conclusion of this research could lead to an extremely important new nuclear energy source, which would have far-ranging implications for both terrestrial and space technology. Other extremely important applications could involve isotope production and radioactive waste management. Additional applications are likely to emerge as more is learned about this remarkable phenomenon.

RECENT REACTION PRODUCT MEASUREMENTS AT THE UNIVERSITY OF ILLINOIS

G. Miley et al. recently reported [4,5] a series of unique measurements that employed various metallic (Ni, Pd, Ag, Ti,..) thin films (500 Å) coated on millimeter-sized plastic beads. These beads served as the cathode in a flowing, packed-bed electrolytic cell. One molar Li_2SO_4 in light water was used, with the objective of studying proton-induced metal reactions. Runs were carried out over a three-week period with a 0.1 W input and a measured output of 0.1-5W. Analysis of the beads was done before and after the experiments using high precision techniques including NAA, SIMS, EDX, and ICP-MS. A wide range of new elements were found in the metallic films following the runs. These "reaction products" had mass numbers ranging well below and above the base metal mass number. In several runs, very high yields of reaction products were obtained, the key products comprising approximately 40 atom % of

Some NAA Element Results for Run #8, Ni Film			
	Increase mg Per 10^3 beads	mg, 100 ml electrolyte	Ratio*
Ag	1.5	3×10^{-3}	500
Cu	1.1	8×10^{-2}	10
*mg increase/mg electrolyte			
Deviation from natural abundance, NAA on 10 bead sample			
Ag-107:	+3.9% ± 1.2	Ag-109:	- 4.3% ± 1.3
Cu- 63:	+3.6% ± 1.6	Cu- 65:	- 8.1% ± 3.6

Fig. 4. Large Yield of RPs in Film

metallic film following the run. The increase in mass of eight key elements appearing in the thin films (Al, Ag, Cr, Fe, Cu, V, Co, Zn) was measured by NAA in the film, electrolyte, and cell components before and after a run. As illustrated in Fig. 4, most elements increased in mass by an amount that was an order of magnitude or more greater than all of the corresponding impurity present in the cell electrolyte, the major source of impurities. Further, there was no evidence of a plating out, i.e., significant reduction of impurities in the electrolyte after a run. Further, the "new" element concentrations peaked in the film volume rather than at the film-electrolyte interface.

As also shown in Fig. 4, these elements typically exhibited a small but significant deviation from natural abundance. All of the facts provide strong evidence for production of these elements by nuclear reactions. A number of additional isotopes, up to seventy in some runs, were observed by SIMS to increase. However, this measurement uses a localized region on the bead and suffers from possible line overlaps, introducing added uncertainties compared to the NAA results. Further details of the experiments and the coated beads are provided in [4,5].

While these results were unique in that the combination of thin films and analytic techniques allowed a reasonably accurate measurement of the reaction product concentrations, several prior studies had reported a similar array of products. [6] The latter studies, however, typically used thick electrodes and the products were found micrometers beneath the surface in a thin zone, roughly a thickness of the

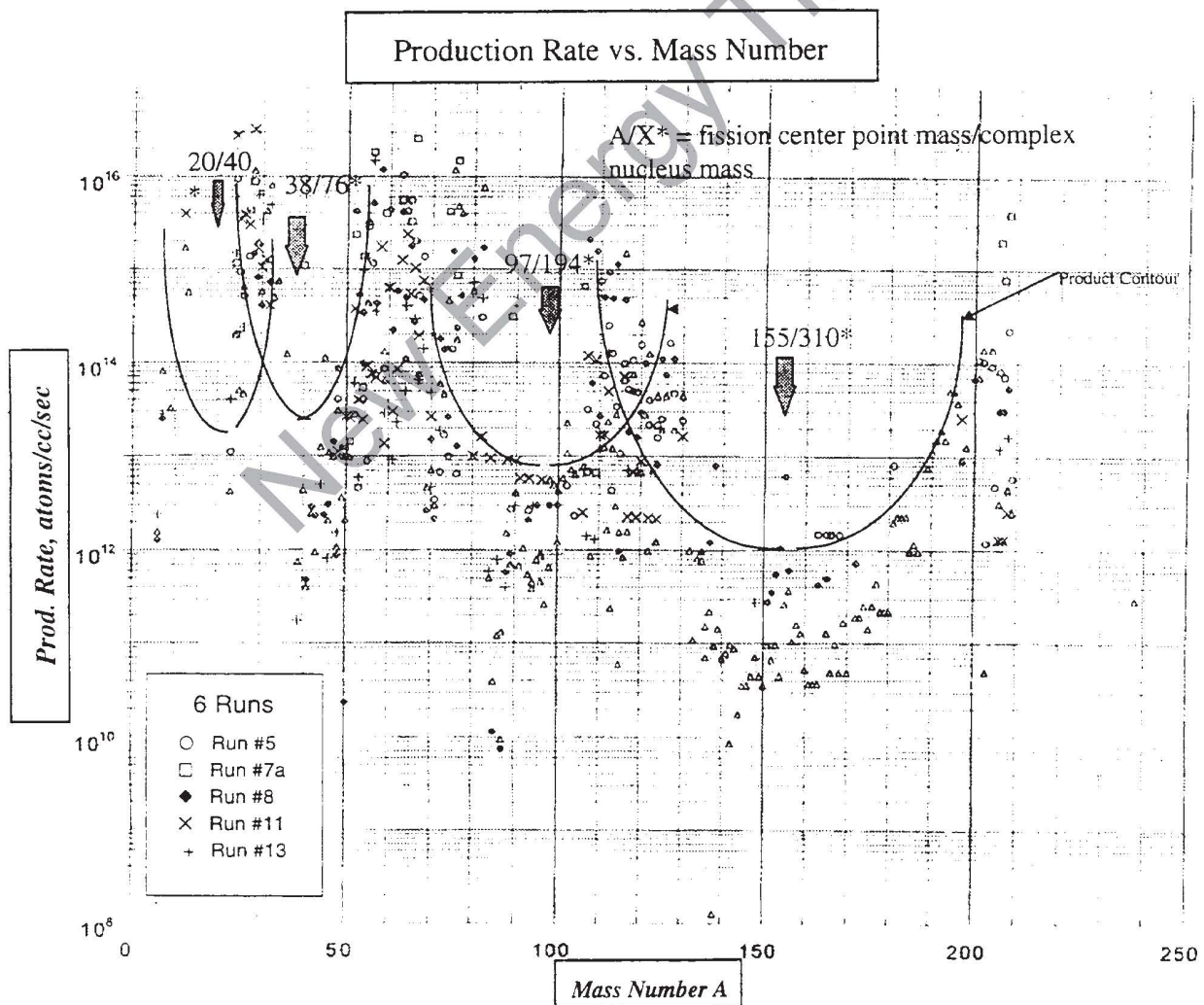


Fig. 5 Reaction Rate vs. Mass Number

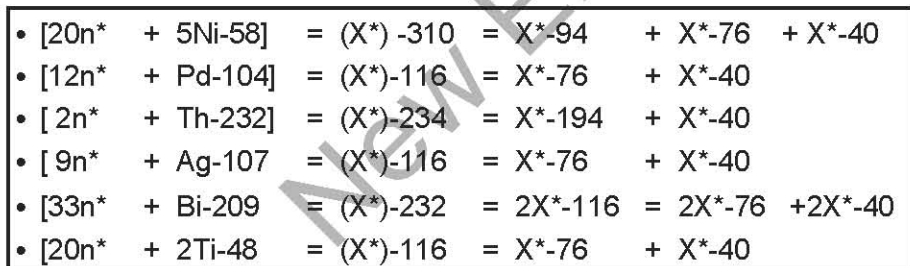
present thin films. Due to the “dilution” of the products by the base metal, absolute concentrations are difficult to obtain in such experiments, so the main focus was on non-natural isotope ratios.

The key characteristic of the reaction products found in the thin-film measurements as well as the earlier solid electrode studies cited, is a grouping of high-yield elements in roughly four “zones” of mass number. This pattern is clearly seen in Fig. 5.

Additional key experimental observations that appear to be characteristic of these reactions include a lack of high-energy radiation, the production of nearly stable elements, the observation of low-energy X-ray or beta radiation for beads following a run, and non-natural isotope ratios. Further, since reaction products have been observed consistently in twenty runs using various metal films at the University of Illinois, the thin-film configuration appears to be an effective method to “initiate” reactions. Also, unlike solid electrode experiments that appear to have local active regions, sometimes giving volcanic-like spots on the electrode surface, the thin films appear to react more uniformly. While the film surface is roughened during a run, no significant local artifacts have been observed from SEM studies. With these characteristics in mind, the author is working on a semi-empirical theory: RIFEX (Reaction in a film-excited complex) and this theory is briefly described next.

RIFEX THEORY

The RIFEX model is based on the observation that the yield pattern in Figure 5 resembles a fission spectrum with valleys of low yield lying at $A = 20, 38, 97,$ and 155 . This suggests that the corresponding compounding nuclei, lying at $A = 40, 76, 194,$ and 310 fission to produce the pattern of light and heavy products on each side of the valleys. These compound nuclei, termed complexes, designated X^* , are theorized to be created through BCS pairing of neutrons and protons. (This concept has some aspects similar to other theories that evoke compound nuclei to explain LENR effects, e.g., see [11-14].) The corresponding liquid drop model predicts that the observed complexes are marginally unstable to fission. The initial complex immediately breaks up into several lower mass complexes, which then undergo fission into an array of products. The fission fragmentation for this pairing and the corresponding reduced excess



energy is predicted to yield near-stable elements, in agreement with the experiment. The overall reactions involved are summarized in Fig. 6, where reactions involving Ni and Pd, corresponding to data from runs in Fig. 5, are shown along with various possible reactants (thin-film materials). The reactants generally “funnel” into the

Fig. 6. Illustrative Complex Nuclei Pathways

lowest mass quasi-stable complex available, in these cases $X^* = 116, 232$ and 310 . This in turn determines the “breakup” states. Again, a consistency with the experiment is observed because Ni (runs 8, 18c, Fig. 5) gives high yields in all four mass number regions; whereas, Pd has the highest yields at the two lower mass number regions. This is consistent with the predicted breakup of the respective postulated complex nuclei in Fig. 6. The predicted preference to form lower mass number complexes for reactions with Th, Ag, Bi, and Ti is also in general agreement with data for these materials reported by Gokul Narne [15] and by J. Patterson [16].

The penetration of the Coulombic barrier and subsequent formation of the complex nuclei in this model rely upon a combination of the swimming electron layer (SEL) theory for thin films, and subsequent coherent oscillation of the lattice nuclei, ultimately leading to the multibody reaction complex illustrated. While these events proceed sequentially, the overall result is the combination of a large number of virtual

neutrons, n^* , with the base metal nuclei, as shown in brackets in Fig. 6. The formation of the virtual neutrons follows from an electron-proton capture process such as proposed by Stoppini [17].

The RIFEX model is also in rough agreement with the overall energy balance observed experimentally. A comparison can be made by taking the sum of the products of all of the reaction products and their binding energies and subtracting the similar sum for the reactants. When this is done for Ni-based material, using the reaction product yields from Fig. 5 and the proton-Ni ratio from Fig. 6 to compute the reactants (assuming nucleon conservation), a power level of 0.9 W is predicted, vs. 0.1-0.5 W recorded experimentally. A similar calculation for Pd yields a somewhat higher power output, again consistent with the experiments. Some of the reaction energy is also carried off by neutrinos created during electron capture, but this fraction is relatively small in most cases.

In summary, while the RIFEX model predicts some of the important trends observed in reaction product experiments, it assumes various features such as SEL penetration, coherent oscillation collapse, and nucleon pairing which are radical departures from conventional nuclear physics. Thus it, or other contending theories, need much more study before a fully acceptable theory is possible. RIFEX is presented here, however, to illustrate the type of radical "new physics" that would be required to explain the observed phenomena. Other theories that also predict some features of these experiments include Kucherov's "slow excitation model" [13] and a recent unpublished modification of Fisher's original "polyneutron model" [12], and Preparata's QED model. [11] In each case, radical departures from traditional physics are involved which require verification. There are other important differences among the theories, e.g., Fisher's model does not involve complexes or fission, but relies on polyneutron propagation reactions to build up high mass elements.

CONCLUSION

Mounting data supports the reality of low-energy nuclear reactions in solid-state lattices loaded with hydrogenous gases under a variety of conditions. The situation is complicated, however, by the possibility that several different reaction regimes exist: e.g., D-D reactions in PF cells, hydrinos in Mills cells, tritium in Claytor's cells, and an array of fission products in the Miley-Patterson cells (cf. Figs. 1,2). One challenge is to find some commonality between the initiating and reaction mechanisms, which can tie together the seemingly disparate results. Before confidence can be gained in the area of LENRs and theories can be sorted out by benchmarking, it remains necessary to develop an experiment that provides good reproducibility. The thin-film experiments described here appear to be a step in this direction, but confirmation of this will depend on demonstrations of reproducibility by a number of independent laboratories. Should the existence of LENRs be verified, as anticipated in this paper, the implications are immense, both scientifically and practically. For example, the power densities reported in present cells are quite high, such that a simple volumetric scaling could be used to quickly develop 10-100 kW power units. In addition, there is no obvious fundamental block to going to yet much higher power levels, but new designs would be required to handle the extreme heat loads involved.

ACKNOWLEDGMENT

M. Millis is to be congratulated on organizing a meeting where phenomena like this could be discussed in a constructive atmosphere with due skepticism, but -- without the preconceived notion that it must be wrong because "conventional physics is (seemingly) violated." Only such free interchanges can foster 'breakthroughs.'

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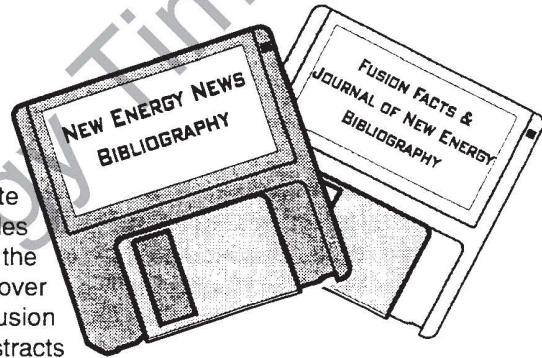
Editor's Note: It may be appropriate to add the explanation for cold fusion as advanced by Ken Shoulders to Fig. 3. See Shoulders & Shoulders, "Observations on the Role of Charge Clusters in Nuclear Cluster Reactions," *J. New Energy*, vol 1, no 3, Fall 1996, pp 111-121.

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Just updated and revised, the most complete bibliography of New Energy research papers and articles [predominantly cold fusion] is available again from the Fusion Information Center on disk [PC]. Containing over 2500 references, it traces the progress of cold fusion research since its beginning in 1989 through the abstracts and articles published in *Fusion Facts*, the world's first cold fusion newsletter/magazine, and abstracted from other scientific publications. *Journal of New Energy* material also on these discs. Specify WordPerfect v6.1 version, or ASCII version. 2 discs. \$15. post paid.

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INCANDESCENT Pd AND ANOMALOUS DISTRIBUTION OF ELEMENTS IN DEUTERATED SAMPLES PROCESSED BY AN EXCIMER LASER

Vincenzo Nassisi ¹

ABSTRACT

Incandescent deuterated palladium samples were obtained in experiments performed with an XeCl laser. After the processing, the sample surface was morphologically deformed and the transmutation of many elements, Al, Au, C, Ca, Cl, Cr, Fe, K, Mg, Na, Nd, Ni, O, S, Si, V and Zn, was recorded. The laser processing provided a screening effect of 14.2 due to the layers formed on the palladium surface. By the palladium cross-section analysis the Fe and O distributions inside the deformed parts were marked.

I. INTRODUCTION

In March 1989 two experiments announced that nuclear reactions taking place in metallic lattices at room temperature [1, 2]. In these experiments as well as in a lot of others experiments the technique chosen for charging the metals with deuterium was the electrolysis performed in cells containing heavy water or deuterated solutions [3]. Several experiments reported the generation of only amounts of heat [4, 5], instead others experiments reported the particle emissions without excess heat [6, 7].

The most effective fusion reactions involve two ${}^1_1\text{H}^2$ nuclei or the ${}^1_1\text{H}^2$ and the ${}^1_1\text{H}^3$ nuclei, and the energy released per nucleon is considerably greater than that released in the fission of heavy nuclei.

The fusion reactions observed at room temperature can be explained by the cluster formation. In fact, an interesting theoretical work studied the boson tendency to clump deuterons in palladium [8]. and it found that the attractive force supplied kinetic energy to deuterons moving toward the center of the cluster and for cluster that included 24 deuterons the results gave good fit to the experimental values published by Fleischmann et al [1]. When layers are formed on the host sample surface the atom absorbed become localized and clusters can be easily realized. To reach this aim a new technique, used for direct silicon nitridation, was proposed which consisted in UV laser irradiation of samples placed in cells containing gas [9]. The deuterium layers were formed by means of the plasma created near the palladium surface as a result of direct laser irradiation of the target in deuterium atmospheres. An XeCl laser with wavelength of 308 nm and a photon energy of 4.02 eV was suitable to dissociate deuterium or hydrogen atoms, via multi-photon processes.

The process causes the deformation of palladium and the transmutation of elements Al, Au, C, Ca, Cl, Cr, Fe, K, Mg, Na, Nd, Ni, O, S, Si, V and Zn as well as anomalous concentration of the atoms or molecules particularly of mass number 1, 2, 3 and 4. By the Pd cross-section analysis the Fe and O distributions inside the palladium were marked.

II. EXPERIMENTAL SETUP

The experiments were performed with stainless steel chambers connected to a vacuum system and a gas line. They were sealed with a quartz window in order to allow the laser irradiation. A locally built XeCl excimer laser (308 nm) provided the UV beam for the irradiation. Its characteristics have been described

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previously[10]. The output laser beam was 2×1 cm centered between the electrodes of 200 mJ, 20 ns (FWHM) pulse duration and 5 mrad divergence. The laser beam was led into the chambers by a 30 cm focal length lens, as can be seen from Fig. 1. A palladium wire was coiled and placed at the inner of chambers and supported by two small brass supports. The laser beam was focused into the chamber with the focus position very near to the palladium, with an energy density of 0.5 J/cm^2 and 2 Hz repetition rate. The laser beam did not produced sparks in the gas and did not provoke plasma on any chamber wall.

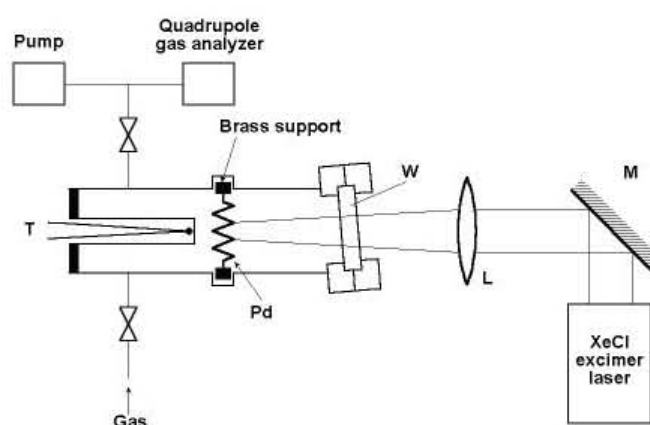


Fig. 1 Experimental setup. Pd: palladium sample, T: thermocouple, W: quartz window, L: lens, M: mirror.

A Victoreen Neutron Survey Meter 488A was utilized to measure the neutron emission while an Ametek quadrupole gas analyzer MA100 was used in order to measure the residual particles present in the gas chambers. During the gas analysis the chamber containing the palladium was connected to a turbo-molecular vacuum system. After the experiments, the Pd wires were analyzed by a scanning electron microscope (SEM) and an electron probe microanalyzer (EPMA) which detected the atoms generated.

III. EXPERIMENT RESULTS AND DISCUSSION

The experiments were performed with a palladium wire of 13 cm long and 1 mm in diameter (0.1 cm^3) in deuterium atmospheres. When the chamber was filled up to 2310 mbar deuterium, after a few days the pressure fell down beginning the loading process. After D_2 -loading for 30 days the atomic concentration D/Pd was about 0.77. Opening the chamber the palladium came into contact with air and its temperature only increased by less than 5°C . After a day the chamber was refilled again with deuterium at 2310 mbar and successively the palladium was irradiated with the laser beam of about 0.5 J/cm^2 per 60 min/day at a repetition rate of 2 Hz forming layers on its surfaces which localized the absorbed gas. After D_2 -localizing for 30 days the chambers were opened and some palladium samples became incandescent for about 30 s reaching a maximum temperature of 850°C . When the laser irradiation was applied on a new palladium sample (no-soaked) the total pressure did not change sensitively. This behavior can be due to the laser action that favoring the layer formation did not allow the deuterium to come inside the palladium. The maximum temperature value reached in these experiments remains very interesting as well as the role of the air. Similar behaviors were reported also in Ref. [4] when the used cathode came in contact with air. Temperature of about 475°C were found in experiments with D_2 -loaded nickel samples but with a 50 W heater power input[11].

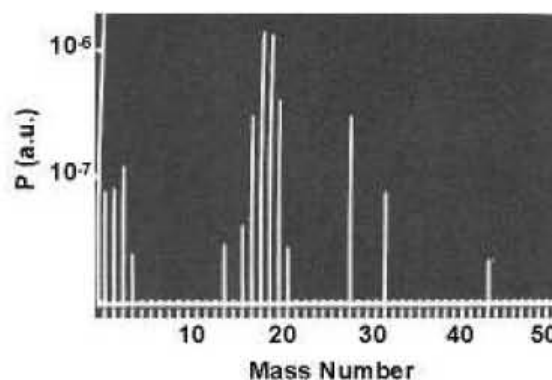


Fig. 2 Mass spectrometer results of the residual gas contained into exploded palladium sample with D localized.

Experiment with less than 30-loading and less than 30-localizing days were performed and in this case the palladium did not become incandescent. When the loaded palladium with D_2 for 30 days was not in contact with air but the chamber only was refilled with D_2 up to 2310 mbar and successively the laser beam action was applied for 30 days, no Pd-incandescence was observed when the chamber was opened. Other experiments were performed with 35 loading days, 1 day in contact with air and 35 localizing days. In this

case small explosions were observed when the chamber was opened. Several experiments were also performed with much more than 35 loading days and much more than 35 localizing days and only some palladium samples exploded when they came in contact with air.

The residual gas contained into the no-exploded palladium was analyzed by the quadrupole gas analyzer MA100. The chamber gas was pumped up to 10^{-7} bar by a turbo-molecular pump and its residual gas was successively analyzed. Fig. 2 shows the analysis of the residual gas after the run of an exploded sample and it is possible to observe the presence of particles of mass number 1, 2, 3, 4, 20 and 21. In order to understand the influence of the air, the residual gas of the Pd samples was analyzed after contact with only oxygen. Namely, 1 bar oxygen was put into the chamber containing the same Pd sample and after one hour the gas was analyzed and many particles were present. The percentages of the particles with mass number 3 and 4 were higher than the percentage of the mass number 1 and 2, see Fig. 3. This result could contribute to understand the role of the oxygen. The O reacted likely with the deuterium present on palladium surface causing the come out of particles present inside the target and/or it could induce a catalytic reaction between the metal and deuterium atoms[12].

The neutron emission measurements were performed during the night in order to reduce the noise influence due to electromagnetic irradiation from laser. Different values of emitted neutron were found from chambers having palladium loaded with D_2 (#1), from chambers having palladium with D_2 localized by layers (#2) and from chambers having only 2310 mbar of D_2 without palladium (#3). The run was repeated 6 times. The average counts were:

- #1 21.96 ± 0.48 n/h
- #2 22.56 ± 0.79 n/h
- #3 20.76 ± 0.73 n/h

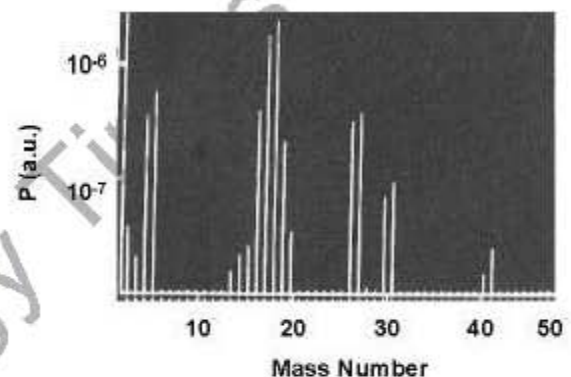


Fig. 3 Mass spectrometer results of the residual gas contained into exploded palladium with D localized after one hour of contamination by O_2 .

The neutron emission was very low but considering the experimental set up and the Victoreen neutron meter position, the total neutron emission from targets was 20 times higher than the measured values. However, even if the neutron flux was low the average values obtained were different. The result of experiment #3 was supposed to be due to the ambient neutrons. In this experiment the total ambient neutrons was not investigated as well as their energy. The value measured in the experiment #2 seems to be higher of about 1.80 ± 1.52 n/h than the value measure in the experiment #3, and the total neutron flux was estimated:

$$A = 430 \times 10^{-3} \text{ n/s} \quad (1)$$

This result can be ascribed to the screening effect which favored the tunnel process through the Coulomb barrier[13]. In fact, considering the total deuterium atoms absorbed, $D_i = 5.23 \times 10^{21}$, the classical collision frequency for deuterons was:

$$f = 1.4 \times 10^8 n_i / T^{3/2} = 1.75 \times 10^{17} \text{ s}^{-1} \quad (2)$$

where n_i ($5.23 \times 10^{22} \text{ cm}^{-3}$) is the deuteron density and T the temperature measured in eV. The probability for a fusion reaction[14] at the above frequency is $A / f D_i = 4.7 \times 10^{-40}$. This value is 34 times higher than the D-D fusion rate per second for D_2 molecules[2]. By the Boltzmann expression

$$\exp(-E/KT) \quad (3)$$

the above probability is reached at a room temperature of 0.026 eV with deuteron energy of 2.35 eV. From the power law the minimum distance for central collision is estimated to be 3 pm [13] and the energy is 476 eV. This result can be explained considering the screening factor which modifies the distance for getting collision, namely:

$$d = (1/S)^2 1.43 \times 10^{-11} / E \quad (4)$$

Therefore, by Eq. (4) a screening factor $S = 14.2$ was reached due to the layers formed on the palladium surface.

The maximum energy emitted from incandescent palladium was estimated using a high current power supply connected to a 13 cm long new palladium wire, see Fig. 4. Fixing the current at 30 A the temperature and voltage values were recorded. The initial voltage and temperature were 0.6 V and 25 °C, respectively. The sample became incandescent (850 °C) after 9 seconds and the voltage increased up to 1.4 V. To maintain the 850 °C temperature the current was lowered at 18 A and the voltage was established at about 1 V. From these data the minimum energy necessary to simulate the experiment was estimated to be about 810 J and then the specific energy emitted from palladium resulted of 8.1 kJ/cm³. However, this excess temperature for 30 s was not observed before.

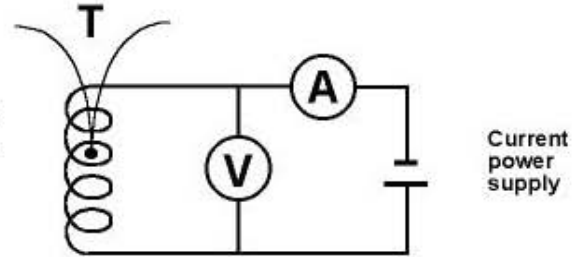


Fig. 4 Experimental circuit to determine the excess heat. V: V-meter, A: I-meter, T: thermocouple.

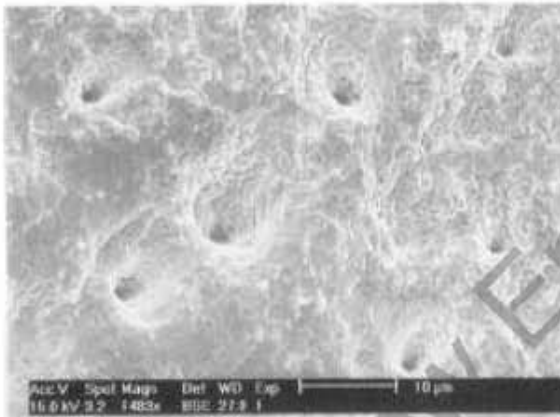


Fig. 5 SEM micrograph of D₂ processed palladium. The sample did not explode when it was put in air. Its surface was morphologically deformed and pits were formed.

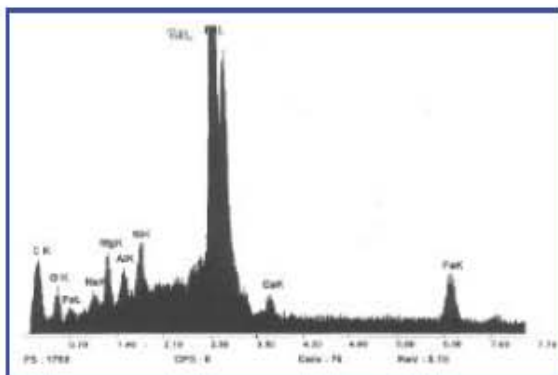


Fig. 6 EPMA spectrum of a processed palladium. The emission of the K and L lines of many elements are present.

All processed palladium samples that did not explode were analyzed with the SEM and the electron probe. By this investigation the samples processed with D₂ showed modifications of their surfaces. The deuterated samples showed in particular many pits and stress. Figs. 5 shows the SEM images of the deformed palladium. Aiming the electron probe on a pit the EPMA analysis was done. Fig. 6 shows the spectrum of the elements with Al, C, Ca, Fe, Mg, Na, O and Si while the Fig. 7 shows the spectrum of virgin palladium. Recently, transmutations of elements in solid cathodes but in experiments with liquid electrochemistry has been also observed [12, 15-19].

The present work report on the transmutation of elements in gas loading sample and on recorded transmutation of elements on the windows utilized to seal the chamber. Fig. 8 shows the EPMA analysis performed on the window. Au, C, Na, Ni, O and V were present. From all the analysis performed on Pd samples and windows the generated elements were: Al, Au, C, Ca, Cl, Cr, Fe, K, Mg, Na, Nd, Ni, O, S, Si, V and Zn. During these experiments the contamination of the samples was avoided.

Another investigation was the analysis of the sample inner. Then, the Pd sample was cut in correspondence of a pit and inserted in resin, Fig 9. Its surface was analyzed by the EPMA aiming only to the concentration of Fe and Si. The blue color shows the Fe distribution while the green color shows the Si distribution.

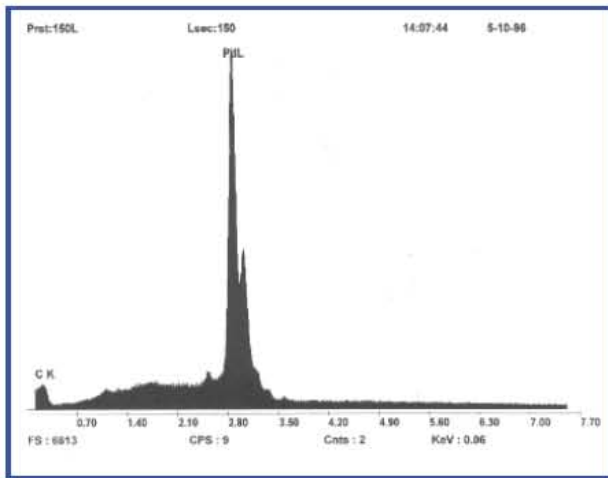


Fig. 7 EPMA spectrum of the virgin palladium.

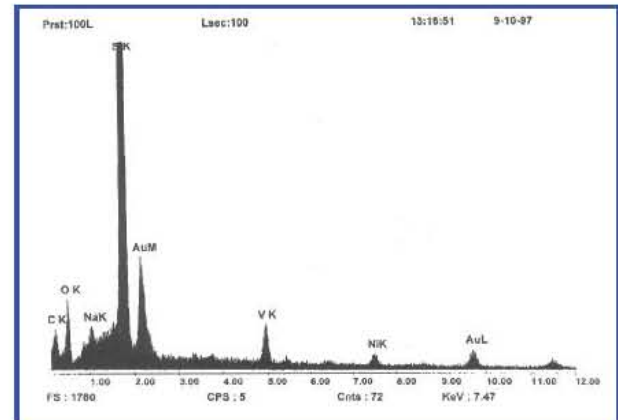


Fig. 8 EPMA spectrum of the window used to seal the chamber. The emission of the K and L lines of many elements are present.

From these figures it can be noted that the Fe distribution is present in the central part of the pit while the Si distribution is concentrated in the pit adjacent to the Fe atoms. This different distribution of elements marks that the transmutation process is different for the observed elements.

Fig. 10 shows the X-ray intensity recorded during the EPMA analysis. The X-ray intensity relative to the emission of found elements points out two distinct peaks at 12 and 26 atomic number. Thus, an indication for the results is that the peaks of Fig. 10 also represent the fission of compound nuclei, created in this case by proton-metal reactions [17].

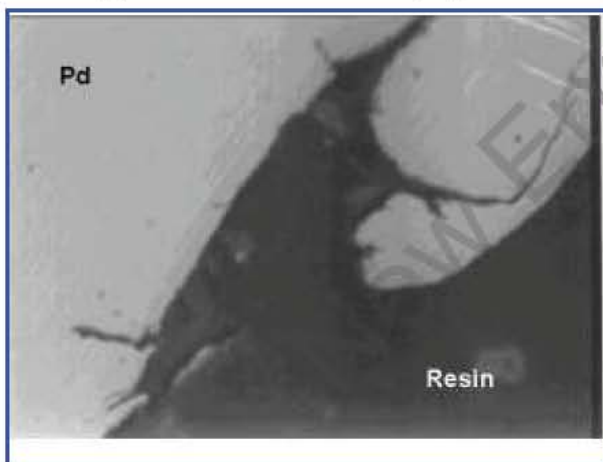


Fig. 9 SEM micrographs of a cut Pd sample in correspondence of a pit.

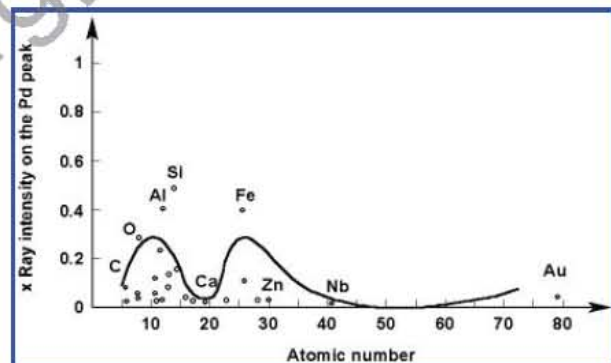


Fig. 10: X-ray intensity of the found elements detected with the EPDM. The intensity is relative to the Pd X ray.

In many experiments the neutron emission was observed with a rate of hours and for several days. In this experiment the window breaking off was observed and considering the window position, about 10-15 cm from the palladium sample, the new particles generated in palladium ought to get the energy to reach the windows and to justify the results. However, the window breaking off also could be due to the acoustic waves generated inside the loaded palladium. These waves could have favored the nuclear processes and to take in resonance mode the window reaching its breaking threshold. Work is in progress to investigate this effect.

IV. CONCLUSION REMARK

In this work new phenomena during cold fusion experiments have been observed using an excimer laser. The layers formed by laser action introduced a screening factor which reduced the Coulomb repulsion. The most singular phenomenon was the incandescence of the palladium and the transmutation of elements in gas loading instead of liquid electrochemistry. The new elements found were: Al, Au, C, Ca, Cl, Cr, Fe, K, Mg, Na, Nd, Ni, O, S, Si, V and Zn.

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DO THORIUM DAUGHTER PRODUCTS EXPLAIN LENT-1 EXPERIMENTS?

Hal Fox ¹

One tenth of a gram of thorium (from a freshly made mixture of thorium nitrate and distilled water) is introduced into the LENT-1 reactor. After thirty minutes of processing, following the protocols provided, the thorium is removed from the solution (in our lab before- and after-processing samples measured 4300 mg/liter and 9.3 mg/liter of thorium.) The disk electrode is radioactive (alpha, beta, gamma, but no neutrons) immediately after processing and gradually decays to less than one-half of the measured radioactivity within a few hours.

Here are the facts: Thorium-232 has a half life of 14 billion years. If the radioactivity were due to plating the thorium onto the electrode, the radioactivity of the thorium would provide the same level of measured radioactivity for months or years. The radioactivity of the disk electrode changes dramatically with time.

Therefore, **Some skeptics say that the radioactivity can be explained by selectively plating the thorium daughter products onto the electrode.** Is this a logical argument? Or, have the skeptics not considered the full experimental evidence?

One gram molecular weight of thorium contains 6.023×10^{23} atoms of thorium. The specific activity (the decay rate per gram per second) of the thorium is about 4071 atoms per gram per sec. resulting in the production of daughter elements. According to an expert, when you make thorium nitrate, "the thorium-228 follows the chemistry of the thorium-232." A handbook of physics and chemistry indicates that the intermediate elements radium-228 also has a soluble nitrate. The expert did not suggest what happens to the actinium-228 (however it has a short half life of 6.15 hours and then produces the thorium-228).

Here is a list of the original and the daughter products with their half life values:

TABLE I. THORIUM DECAY DAUGHTER PRODUCTS

Element	Half-Life	α (MeV)	β (MeV)	γ (KeV)
Thorium-232	1.4×10^{10} y	4.01, 3.95	--	59(w)
Radium-228	5.76 y	--	.039, .015	14(w)
Actinium-228	6.15 h	--	1.2, 2.1	911, 969, 338
Thorium-228	1.91 y	5.42, 5.34	--	84, 216, 132, 166
Radium-224	3.66 d	5.69, 5.45	--	240
Radon-220	55.6 s	6.29	--	550
Polonium-216	0.145 s	6.78	--	805(w)
Lead-212	10.6 h	--	.331, .569	239, 300
Bismuth-212	60.6 m	6.05	2.25	40, 727
Polonium-212	298 ns	8.78	--	--
Thallium-208	3.05 m	--	1.8, 1.28, 1.52	2615, 583, 511
Lead-208	stable			

SOURCES: Lapp et al., [3], Hunt [4].

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Radium-228, Actinium-228, Radium-224, according to the Handbook of Chemistry and Physics do not make highly-soluble nitrates. Radon-220 is a noble gas. Polonium-216, Lead-212, Bismuth-212, Polonium-212, and Thallium-208 also do not make highly soluble nitrates.

The author is not a skilled chemist. Can a skilled chemist tell us how many atoms of the daughter products will be **in solution**, after the thorium nitrate (very soluble in cold water) is dissolved and the solution decanted or filtered to remove any precipitates? I would suggest that by making a fresh batch of thorium nitrate, **after chemically separating the thorium from daughter products**, that the daughter products will be a very small percentage of the thorium for many months.

Even if we assume that there are thorium-daughter products in the solution, here is another hurdle that must be jumped by the skeptics. How does one selectively plate out daughter products (if present) using alternating current? Those experts I have asked suggest that nearly all alternating current is lop-sided and that one side is carrying more current than the other side, therefore plating can take place. Does this mean that with the many experiments that have been made in various parts of the U.S., the lop-sided a.c. always favors the disk electrode in the reactor? In the tests in our lab, we observe no difference in the **type** of post-processing radioactivity for either the disk or the cylinder electrode.

Here is another intellectual hurdle: The post-processing condition of both electrodes using the LENT-1 reactor is that considerable erosion takes place. The visual evidence is that there is some formation of an oxide layer interspersed with many pits which produces an eroded and rough surface. That does not appear to be any kind of plating that this author has ever seen. Also, if plating occurs, it would also be removed by the continued erosion of the electrode. If plated out, the thorium would then be in the precipitates. Our measurements find very little radioactivity in the precipitates. Only 3% of the input thorium was found in the precipitates.

Here is another hurdle: After thirty minutes of processing, almost all of the thorium is removed from the electrolyte. Now add another thirty minutes of processing time, consuming about 80 watts of input power (which appears to balance the power lost by radiation of the 375 F to 400 F reactor). After the reactor cools, the disk electrode is measured for radioactivity. The radioactivity is about twice as high as after a 30-minute processing time. This radioactivity peaks in a few hours and then diminishes quite rapidly over the next few days. The electrode shows further substantial erosion. Why aren't the daughter products eroded off? Where did the additional daughter products come from when the thorium in the solution had already been removed?

Here is another hurdle: In our lab we measured the radioactivity of the cylinder electrode **and then using a 400-grit sandpaper wrapped around a dowel**, removed considerable material from the inner surface. There were still many erosion pits visible. After washing, wiping, and rinsing with distilled water, the electrode was again measured for radioactivity. **The radioactivity measure by an alpha counter (with 31% efficiency) was slightly lower but within the error range.** This would suggest that the source of radioactivity was from the eroded pits and not from the surface that had been sandpapered. Plating is usually an area phenomena. Would one suggest that the erosion pits were the primary areas where daughter products are selectively plated?

Honest, open-minded skepticism is a valuable asset in scientific research. Dogmatic skepticism or intense struggles to protect an outmoded nuclear reaction model is a detriment to scientific research. Refusal to even consider the evidence is a sign of intellectual deprivation.

The obvious scientific approach is to submit a radioactive electrode to highly-sensitive measurements to determine what isotopes of what elements are present on the surface of the electrode. This process is expensive but is being accomplished.

A HIGH-SCHOOL LEVEL EXPOSÉ OF THE MISTAKE UPON WHICH THE ERAB REPORT IS BASED

Robert W. Bass ¹

I have already written a “Junior-College Level” or “Advanced High-School Level” exposition of the mathematical blunder upon which the Establishment academic opposition to the possibility of Cold Fusion’s reality is based. [Since many High Schools now have beginning calculus courses for college-aimed students, I have referred to that paper in the past as a “High-School Level” exposition; however, this one will be *far more elementary*.] That paper is 26 pages long, plus it is accompanied by 10 drawings, making a total of 36 pages.

For the benefit of those familiar with graduate-level Theoretical Physics, I have also condensed the main point down to *exactly one page* (involving understanding of the WKB solution of Schrödinger’s Equation). However, no one in the Establishment (or the DOE or the PTO) is paying any attention; they are standing pat on the ERAB Report.

There is a book out, by a reporter for *Science*, called *The Brain Bank of America*, which with the benefit of hindsight, proves painstakingly that ten (10) major reports by the National Academy of Science (NAS) to the US government on technical matters related to public policy were proved later by the march of events to be **dead-wrong** in each instance! The book’s author concludes that “no matter how eminent someone may be, he can be as pig-headed as me and thee!”

The real problem is that, as Caltech Prof. of Physics and Provost, David Goodstein chillingly concludes in his article on “Pariah Science” in the *American Scholar*, to quote his final sentence, is that “**Even if cold fusion is true, no one is listening.**” [Emphases added.]

I suspect that is why no one has paid any attention to my 36-page paper exposing the mathematical blunder underlying the ERAB Report’s dogmatic insistence upon a fatally flawed conclusion. The ERAB Report, and Huizenga, both in his book and private conversation, pretend that their main points are based upon experimental evidence. To the contrary, their main points have been demonstrated experimentally only in high-energy experiments *in vacuo* (and in almost equally high-temperature experiments in fusion plasmas), but they have NEVER been tested in or on the surface of a solid-state lattice!

Moreover, their dogmatic extrapolation of these results into *parameter-regimes* in which they have never before been studied is based upon **mathematical incompetence** which is so blatant that it can be understood by an advanced High-School Student (who has had elementary physics, elementary algebra, and beginning calculus).

Accordingly, I shall try once more.

The *very best* argument that I have seen in print to believe that Cold Fusion (CF) is inherently of such low probability as to be, for all practical purposes, impossible, is that contained in the 9-page section at the end of the first chapter of P.J.E. Peebles’ otherwise admirable book on *Quantum Mechanics* (QM), published by Princeton University Press.

Peebles makes two demonstrably blatant mistakes.

¹ Prof. of Physics & Astronomy, BYU [retired]

PEEBLES' FIRST MISTAKE

His first mistake is to assume that the problem is *local* rather than *global*. Using an accepted simplification of a 3-dimensional (3D) analysis in a crystal which is adequate to predict the Nobel-Prize winning (but stunningly surprising) Mössbauer Effect, I replace the 3D lattice by a 1D lattice, namely a straight line. And when I add up the effects of all of the other bound deuterons, including making the line electrically neutral by placing an *averaged-location* electron between every pair of bound deuterons (except those on the right and left of the line-segment of interest), I get a much-modified Coulomb potential affecting the excited (or "free") deuteron of interest. This is called a Madelung potential. Peebles sent me a private letter saying that he thought that my summation of these potentials in a closed form expression was interesting and publication-worthy, but that "Madelung forces" had "nothing to do" with the issue at hand. With all due respect to Peebles (who should have received a Nobel Prize for proposing a search for the cosmic background radiation before it was accidentally discovered by others), he is simply mistaken on this point, and I have proceeded to prove it, as follows.

The one flaw in my original model (that I sent to Peebles) was that the *central* segment, between the bound deuteron on the left at $r = -L$ and that on the right at $r = L$, was not electrically neutral, because I had not included three (3) electrons to balance the charges of the bound deuterons on the right and left and the free deuteron somewhere on the segment $-L < r < L$ between them. I finally learned how to do this by reading a pro-CF paper, printed in the *Proceedings* of the NAS, by Parmenter and Lamb (where Willis Lamb is the Nobel Laureate who, along with the late Nobel Laureate, Julian Schwinger, was [according to Huizenga's book] responsible for persuading Harvard University Nobel Laureate, Norman Ramsey [the only Nobel Laureate on the ERAB panel] to state publicly that he would *not* sign the final ERAB report unless there were included in its preface a sentence which essentially *retracted* and *nullified* the whole report's major conclusion). When the DOE and the Patent and Trademark Office (PTO) stand pat on Huizenga's summary of the ERAB Report, they are actually guilty of *ignoring* the most important sentence in the entire report!

What I learned from Parmenter & Lamb was the technique of augmenting my Coulomb-Madelung potential $V_{CM}(r)$ by a Fermi-Thomas/Mott potential, added only in the central segment $-L < r < L$, which was an attractive potential *quadratic* in r and which was multiplied by an exactly correct coefficient to make it correspond to a *cloud* of three (3) electrons smeared out evenly over the whole line segment $[-L, L]$. I then derived proof that my final Coulomb-Madelung/Fermi-Thomas/Mott potential $V_{CMFT/M}(r)$ was exactly correct, by deriving a theoretical formula for the Schwinger-Ratio based upon that potential.

VALIDATION BY PREDICTION OF THE EMPIRICAL SCHWINGER RATIO

Schwinger had conjectured that, for CF, the size of the Schwinger Ratio is all-important, and in my advanced papers I have derived a rigorous proof that his conjecture is true, namely that the *Spectrum* of Resonant Transparency Energy Levels of the alleged "Coulomb Barrier" is a function of *nothing* but the Schwinger Ratio! This ratio is the reciprocal of the ratio of the rms (root-mean-square) *amplitude*, say Λ , of the vibrations of a bound deuteron at *absolute zero* temperature (where it still fluctuates, according to the QM theory of Zero Point Fluctuations [ZPF]), to half of the potential well-width, L . This ratio $(\Lambda/L)^{-1} = (L/\Lambda)$ is a purely empirical number, because L is determined by crystallographers (e.g using x-rays), while the number Λ can be determined independently by either the size of a certain blur (vibration-width) on an x-ray photograph or from neutron-flux studies. Therefore (L/Λ) is a strictly *experimentally-measured* result.

In the case of a deuterium lattice inside of a palladium lattice, the Schwinger Ratio is known experimentally to be 28.275 . Now by using my closed-form expression $V_{CMFT/M}(r)$ for the potential, I derived a *first-principles* formula for the Schwinger Ratio which depends *only* upon the basic constants of physics and pure mathematics; but upon inserting these numbers and evaluating my formula, I came up with the experimentally measured value to within one-third of one percent!

I believe that this validates my $V_{\text{CMFTM}}(r)$ potential as well as could possibly be expected, and so I am justified in using this potential (and not the local potential $1/r$ used by Peebles).

PEEBLES' SECOND MISTAKE

The second mistake made by Peebles is a corollary of his first mistake. If he had treated the problem as *global* problem (rather than purely *local* problem) he would have run up against the fundamental theorem of QM in Solid-State physics, namely Bloch's Theorem. This theorem states that no solution of Schrödinger's Equation inside a periodic lattice is valid unless the solution's logarithmic derivative is spatially periodic of *exactly* the same period as the lattice. In the case at hand, since my potential is *periodic* of period $2.L$ on the straight line $-\infty < r < +\infty$, then no solution of the fundamental equation of QM is relevant unless it is also of period $2.L$ in the displacement r .

ELEMENTARY ANALOG TO EXPLAIN ERAB MISTAKES

I have thought of an analog to explain Peeble's (& so ERAB's) mistakes which is so clear and readily understandable that an advanced High-School Student can follow it.

The famous Schrödinger Equation is a generalization of Laplace's Equation, which is much easier to solve. Let $\phi = \phi(x,y)$ be a solution in the (x,y) -plane of

$$\nabla^2 \phi = 0$$

where, as usual, the operator

$$\nabla^2 = \partial^2/\partial x^2 + \partial^2/\partial y^2$$

denotes the sum of the second partial derivatives with respect to x and y . Suppose that we are interested in the solution mainly near the origin $(0,0)$, where $x = y = 0$. Suppose also that we want the solution and its first partial derivatives to vanish at the origin. Then by an elementary exercise in differentiation, the reader may verify that

$$\phi = (2.\pi/L)^2 .x.y$$

is such a solution. Let us call this the ERAB solution.

Now I blow the whistle and say, "Wait a minute; the solution which you want is:

$$\phi = \sin[(2.\pi/L).x].\sinh[(2.\pi/L).y]$$

which you may readily verify *ALSO* satisfies the required boundary conditions." The ERAB committee comes back and says "What's the difference? If you expand the trigonometric function $\sin(x)$ and the hyperbolic function $\sinh(y)$ in power series, then the two solutions agree up to joint FOURTH ORDER in the two small variables, so that for all practical purposes, when you are near the origin, the arithmetic difference between your solution and our solution is truly negligible."

This is the fallacy of believing that the *local* solution is the only solution, just because it gives excellent agreement with experiment when the variables are near the origin.

But now along comes a Solid-State physicist who says: "The (x,y) plane is not the right *domain* upon which to be solving the problem. You should cut a vertical line at $x = L$ and another vertical line at $x = -L$ and then discard everything except in the vertical strip containing the segment $-L < x < L$. Then roll up the strip into a *cylinder*, wherein points on the vertical line $x = L$ are conceptually *identified* with points on the line $x = -L$ which have the same y -coordinate.

Then the first, merely *local* solution fails miserably; but the second, *global* solution, which satisfies the *periodicity* required to be a point on the cylinder, is the *only* correct solution!

MESSAGE OF THE ANALOG

As long as they were dealing in a situation of collisions between particles in a vacuum (or in the near-vacuum of a tenuous fusion-plasma), the ERAB panel's strictly local solution of the Schrödinger Equation was adequate to give tremendously accurate results, which led them mistakenly into the complacent but false belief that they knew everything which is to be known.

However, when they started to deal with nuclear reactions inside of a *periodic lattice*, they overlooked not one but THREE (3) major differences:

1. With so many lattice particles in a fixed position (as for ions) or in an effectively averagable pseudo-fixed position (as the net result of the circulating electrons [which need be taken to be a probability-cloud only locally and not globally]), then the fact that electrostatic forces are *strictly additive* (and Coulomb forces are *long-range* forces) means that it is *physically incorrect* to use a *local* Coulomb potential (as in the usual Gamow-factor derivation of reaction-rate), one *MUST* use a *global* potential (like my closed-form Coulomb/Madelung/Fermi-Thomas/Mott potential) which misleadingly seems to be close to the Coulomb potential locally, but globally is very, very different.

Otherwise stated: For two isolated particles in a vacuum, the Coulomb potential is correct; for two colliding particles in a tenuous plasma, the other particles are not only distant but in randomly changing positions, so that their averaged net effect would be zero, and again the Coulomb potential is acceptable. But inside of a *rigid* lattice, the effect of all of the other particles is unchanging and does not average out to nullity, and so *MUST* be included for physical correctness. Therefore the Madelung forces *are* relevant!

2. Even using a correct global potential is not enough! One has to take into account the *periodicity* of the domain of definition and find a *periodic* solution of the wave equation in order to take into account the well-known optical phenomenon of *resonant transmission*, as clearly explained in a chapter of Bohm's classic book on QM.

3. Actually, even that is not enough! Sophisticated critics of the preceding two points, such as Rabinowitz and Worledge, and, independently, Jändel, have looked up Bohm's derivation and said, "Well, OK, we'll agree that there is a finite probability of a free deuteron 'leaking' (or QM-tunneling) through the Coulomb Barrier of a bound deuteron, leading to a fusion reaction, but if you calculate the uncertainty in the time, it will take several billion years to have a 50% probability of occurring!" However, I have rebutted that with an answer so solid that they have not replied: "Just include in the calculation the ZPF of the bound deuterons, and the concomitant uncertainty of the position of the bound deuterons, and then the uncertainty in the time of tunneling *reduces* from *eons* to *picoseconds*!"

CONCLUSION

The sad *fact* is, that the ERAB Report's conclusions are *fundamentally flawed*, at the most *basic* theoretical level, by errors so stark and so flagrant that they can be explained to an advanced High-School Student!

But the DOE (which, together with its predecessor AEC, as noted in a recent front-page major signed Editorial by the Editor of the *Las Vegas Sun*, Brian Greenspun, has a "45-year record of lying to the public") just repeats the *irrational* mantra "the consensus of the scientific community has been obtained by our usual procedure; so as Civil Servants we must respect the scientific community's consensus and not substitute our own private judgments until the scientific community as a whole agrees that a mistake has been made; and so, accordingly, the ERAB report *stands* as the position of the DOE and the question of

its validity will *not* be re-opened no matter how strong the arguments any one individual like you may make!"

APPENDIX: a letter

Subject: My allegations of two "Mistakes" in your QM book in the section purporting to prove Cold Fusion (CF) so unlikely as to be essentially "physically impossible."

To: Dr. Philip J. E. Peebles, Princeton U

You say you cannot follow my reasoning in my shortnote alleging to point out mistakes in your 9 pages on CF in your QM book, so I shall try to clarify my critique. There are two utterly unrelated senses in which you are mistaken to consider only the electrostatic potential $V(r) = K/|r|$ near a bound deuteron at $r = 0$, and therefore it may be that I am confusing you by discussion of "local" versus "global." The basic mistake you have made is in assuming that if an approaching deuteron is reflected by the electrostatic potential near $r = 0$, that is the end of the story. But suppose that the reflected deuteron bounces back from the Coulomb barrier of the next adjacent bound deuteron, with **exactly** the right energy level for Resonant Transparency of the Barrier? Read the chapter on this in Bohm's book on QM! If you want to think physically about a wave-function building up between two Coulomb barriers, one on the left and one on the right, you will see that there is a clear possibility that the amplitude may eventually become such that the probability of "resonant transmission" is much greater than 50%.

You did not ask to see my 36-page version (with 10 pages of printed drawings, several to scale, others schematic), much less my 100-page version [wherein I have rigorously generalized the Bohm criterion for resonant transmission of a particle through two potential barriers between which it might normally be seen to be trapped, to resonant transmission through **quadruple** potential barriers (because near $r = 0$ the Coulomb potential gets modified by the strong nuclear force and on the left and the right of $r = 0$ there are barriers that do **not** go to infinity [as would $1/|r|$] but are about 23 MeV in height [if my memory is correct]).

Anyway, several experts who have studied carefully the Resonant Transmission argument [such as Rabinowitz & Worledge, and, independently Jaendel] have **admitted** that there is a non-zero probability that the deuteron will QM-"leak" through the Coulomb barrier, but they claim that this is merely of academic interest, because if you use the computation in Bohm's book for the time that the leaking takes, then you get several billion years. However, I have rebutted this by including the ZPE uncertainty of the position of the bound deuterons, and then repeating the Bohm calculation, and get the leaking-time to be pico- seconds!!!

So the **FIRST** mistake you made is to assume that the problem is "local" rather than global, in that Resonant Transmission is a global process, but by mistakenly **assuming** that a local analysis [reflection by Coulomb barrier near $r = 0$] is adequate, you **ignored** the much more important question of whether or not Resonant Transmission through the Coulomb barrier is possible, which it most certainly is!

Another approach to this matter has been published by a Prof. of Nuclear Physics at Purdue, Yeong Kim, whose "optical theorem" shows that even if one ignores the lattice, but just starts the potential on the surface of a nucleon and goes outward locally, then [by analytic continuation] one can **prove** that among all possible solutions there is at least one which finds the Coulomb barrier completely transparent! (I keep challenging Dr. Kim to include the periodicity in the rest of the lattice, and predict that when he does that, his "optical theorem" solution will be found to be a more rigorous version of my approximate result based upon the WKB approximation.)

Indeed, although the answer won't be accurate, you can use the formula in Bohm's book for Resonant Transmission with the following **over-simplified** model of the potential. Consider only the line-segment between $r = -L$ and $r = L$, i.e. the interval $-L < r < L$.

Suppose the excited deuteron is somewhere on the above- stipulated line-segment of width $2.L$ Now if there is a bound deuteron at $r = -L$ and another lattice-bound deuteron at $r = L$, the excited deuteron sees the Coulomb potential of the two adjacent deuterons as

$$V(r) = K/|r + L| + K/|r - L| = 2.K.\{L/[L^2 - r^2]\}$$

and so you have a "potential well" on the interval $-L < r < L$, and you can use the formula in Bohm's book to compute the energy levels for Resonant Transmission.

Ignoring this possibility (which you should have remembered, since you discuss Breit-Wigner later on as I recall) was **Part A** of your First Mistake. **Part B** was in not summing up the potentials of all the other particles in the lattice in order to get a more accurate formula for the Potential Well in the region $-L < r < L$ of interest. In this I assumed that there are bound deuterons at $r = -n.L$ and at $r = n.L$ for every positive integer n . Then to make the line almost electrically neutral I place an electron at the mid-point between each bound deuteron [except in the interval of interest] because **on average** that is where the circulating electrons will be. This is my Coulomb-Madelung Potential; but it is still not accurate enough, because it omits the 3 final electrons needed for strict neutrality (one each near the bound deuterons at $r = -L$ and at $r = L$, and one somewhere between) and I did not know how to include them until I read the pro-CF papers by Parmenter & [Nobel Laureate] Willis Lamb which augmented the above potential well by a potential quadratic in r on the central interval with a coefficient to make it what would be produced by 3 electron-charges distributed **evenly** as a smeared-out charge-cloud on the entire central interval. (This is the improvement of my potential from a Coulomb-Madelung potential to a Coulomb-Madelung/Fermi-Thomas/Mott potential.)

Next I **proved** the accuracy of this potential by **predicting** the strictly empirical Schwinger Ratio within one third of one percent of measured reality! How much better could I check the validity of the theoretical potential?

Note that the potential is so far defined only on the central interval. It is necessary to include ALL of the distant electrical charges in the lattice, because (unlike in a plasma) the positions [of all but the central 3 electrons & the central excited deuteron] are **on average** sufficiently fixed that they do NOT cancel each other out, and therefore it is **physically incorrect** to ignore the Madelung forces (despite your contrary assertion). The further proof is that by including the effects of all of the long- range Coulomb forces in the entire lattice, I got a central well which is 40% deeper than in the simplified potential above, where it bottoms at $V = 2.K/L$, and it is precisely in this **NEW** and deeper part (which you won't get if you ignore the Madelung forces, and that I would not have found if I had accepted your dictum that "the Madelung forces are irrelevant") that I find the **lowest** energies of Resonant Transparency of Coulomb Barrier! (In fact, I have computed quite rigorously [using a slight improvement of the method in Koonin's book] the lowest 600 such energy levels, and find that this line-spectrum goes from about 6 eV to about 150 eV, which is so low that conventional nuclear physicists cannot comprehend it and declare Low Energy Nuclear Transmutations (LENT) to be an absurdity.

Your **second** Mistake was not to have made the potential on the central interval $-L < r < L$ into a periodic potential on the entire line from $-\infty < r < \infty$, in order to invoke Bloch's theorem and get a solution of the wave equation which is relevant inside a periodic lattice. (This same argument leads to the correct answer in the case of the Moessbauer Effect, as you can read in David Park's book on Classical & QM). This is just another approach to deriving the Bohm formula for Resonant Transparency. The bottom line of my **correction** of the CF analysis in your QM book is the following (which has an obvious wave-mechanical interpretation, as to whether or not the de Broglie wave-length of an excited deuteron has an odd or even number of waves to just fit within the potential barriers, as drawn clearly in a picture in Bohm's book), and can be derived **rigorously** from the WKB approximate solution of the wave equation in the case of all energy levels except the lowest few (at which WKB is not accurate enough). Here is my Patent-Pending CF criterion based on this:

The Schwinger Ratio depends on the ratio of the lattice period length L to the rms amplitude Λ of the Zero Point Fluctuations of the bound deuterons. The host lattice determines L ; however the particle mass (e.g. deuterons or protons) of the **embedded** lattice determines Λ . Empirically, for beta-phase deuterons in a palladium lattice, the ratio L/Λ is about 29.

Now the final criterion for Resonant Transparency of the Coulomb Barrier says that a particular host-lattice/particle pair will be suitable for CF **if and only if** the Schwinger Ratio divided by pi is closer to an **odd** than an **even** integer. (The "Bass Criterion for Quantum Resonance Triggering [QRT] of a phonon-mediated chain- fusion reaction.")

Consider host lattices of palladium and nickel, and consider embedded lattices of protons or deuterons. Then there are **four (4)** distinct possibilities. However, putting in the numbers, I find that the Bass QRT Criterion predicts that deuterons will work in palladium, but that protons will NOT! This is why Fleischmann & Pons were OK in using ordinary water as a control on their heavy-water experiments. This is a basic point which CERN's arch-critic of CF, Douglas R. O. Morrison, seems not to understand, because he is always wrongfully accusing pro-CF people of inconsistency in using ordinary water with nickel cathodes and yet taking it to be a control when working with palladium cathodes!

In other words, when I divide the mass of a proton in my formula for the Schwinger Ratio by two, to change from heavy water to ordinary water, the non-linearity in the criterion causes the criterion to jump from nearly an odd number to nearly an even number!

Thus "my" theory passes the "Rabinowitz Acid Test" which Rabinowitz had opined NO theory could pass! Now replace the host lattice by nickel, and you get the exact opposite results! This explains why ordinary water works in Patterson Power Cells, as well as the excess energy in Piantelli's hydrogen-nickel cells.

In his 1990 ICCF1 paper, and in some others of which 2 or 3 out of 4, but not all, were published in Germany, Schwinger had conjectured that what I call the "Schwinger Ratio" in his honor was all- important in the CF business. I have verified his conjecture by proving the THEOREM that the nth Energy Level in the Spectrum of Resonant Transparency Levels ($n = 1, 2, 3, \dots, 600$) is a function of NOTHING but the integer n and the Schwinger Ratio!

Around 1992 I sent a Nobel Laureate at the Cavendish Lab in Cambridge, Brian Josephson, a set of Schwinger's papers, and he sent me a FAX saying that in his opinion Schwinger was "cheating" by extrapolating the validity of a certain series beyond its radius of convergence. I have now made everything in the Schwinger paper rigorous and in the process have discovered the fatal errors in your QM book's treatment of CF alluded to above.

I am very puzzled by your statement that you are "content" with the analysis in your book and see no need to pay any attention to my alleged correction of its errors, since you "cannot follow" my arguments. I will send a copy of this to Brian Josephson and see if he thinks that in the QM analysis of CF I am as much in need of basic "tutoring" as you seem to think.

Please let me know if the preceding attempt to further explicate my short note makes my critique of your alleged "mistakes" more comprehensible.

Sincerely,

Bob Bass

TORSION FIELDS AND EXPERIMENTS

Vyacheslav F. Panov, Vladimir I. Kichigin, Gennady V. Khaldeev,
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ABSTRACT

A review of the theories of torsion field is given, generation and detection of torsion fields are considered. Experimental manifestations of torsion fields and torsion-based techniques are described. An account is given of the experiments with torsion fields conducted at Perm University. The program of research intended by the Perm scientists is presented.

THEORIES OF TORSION FIELDS AND PHENOMENOLOGICAL EFFECTS

Incompleteness (prediction of singularities, lack of a generally accepted interpretation of energy, the problem of gravitation field quantization) inherent in general relativity as well as the need for creation of a unified macroscopic model of all physical interactions stipulate more or less substantial departure from general relativity as formulated by Einstein. Taking into account both independent characteristics of matter, mass and spin, the theory of gravity with torsion is a natural generalization of general relativity [1]. Gravity with torsion, entering, at present, a new phase of advance, has a rather long history of development. The first steps in this direction were taken in 1922 by E. Cartan, who noticed that the metric structure is independent from the structure of connectedness and as a model for space-time proposed a smooth four-dimensional manifold with the metric $g_{\mu\nu}$ and non-symmetric affine connectedness $\Gamma^{\lambda}_{\mu\nu}$. Antisymmetric component of the latter Cartan defined as torsion: $Q^{\lambda}_{\mu\nu} = (\frac{1}{2})(\Gamma^{\lambda}_{\mu\nu} - \Gamma^{\lambda}_{\nu\mu})$. Being, apparently, under the influence of Cosserat's ideas about the representation of continuous medium as a manifold, Cartan proposed to link the torsion tensor to the density of intrinsic angular momentum of matter. (It is worth noting that the first to introduce the concept of torsion (of curve) into science in the XIX century was J. Frenet, a French mathematician).

However, Cartan's theory of gravity was not developed further at that time because of the absence from physics of spin, discovered by Uhlenbeck and Goudsmit in 1925. Another reason why Cartan's idea about torsion, a relatively novel concept and promising to physics geometric quantity, was for a long time left out of consideration by theoreticians is because Einstein's gravity (where space-time is twisted) -- the first geometrized version of physics -- left too many problems to be solved. Nevertheless, in the late fifties and sixties there have been persistent attempts to incorporate torsion into Einstein's theory of gravity, well-studied by that time. Thus, T. Kibble (1961) and D. Sciama (1964) were the first to point out to possible linkage between the space-time torsion and intrinsic angular momentum of matter. But it was not until the prediction of the first, and a sensational one - torsion effect, that the theory began flourishing. The works of the Krakow school theoreticians -- W. Kopczynski and A. Trautman have demonstrated convincingly that the torsion of space-time, expressing in geometrical terms the axial polarization of intrinsic momentum (spin) of matter particles, the source of gravitation field, can eliminate cosmological singularities in the non-stationary models of the universe. Here the importance of the works of the D. Ivanenko school (for example, [2]) for the development of the theory of gravity with torsion should be noted.

The impact of the discovery of the elimination of cosmological singularity with the help of torsion was so great that over a short period of time there have appeared hundreds of papers developing gravitational theory of spin-torsion interaction. Among the others, the so called Einstein-Cartan theory (ECT) enjoyed the highest popularity. In this theory relations for gravitation and torsion fields are inferred from Lagrangian

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of the simplest form - the density of scalar curvature of space-time with the metric affine connectedness. The ECT has two principal features [3]:

1. Torsion field equations present the algebraic linkage between torsion and its source - spin of the particles of gravitating substance. This means that torsion in this theory is nonpropagating.
2. Inasmuch as gravitation and torsion fields are derived from a unified Lagrangian (scalar curvature) with the unified connection (Einstein-Newton gravitational constant G), spin-torsion interaction turns out to be proportional to G and extremely weak since the smallness of the gravitational constant is greatly "aggravated" by the small value of Planck constant, the latter usually serving as a characteristic of the spin magnitude of a gravitation source in the classic (non-quantum) version of the theory.

General dissatisfaction with the limited potentialities of torsion in the ECT has led to the appearance in the seventies and eighties of a large number of modified torsion theories in which torsion could propagate in a vacuum and was far from always connected with the spin of substance. Besides, these theories were no longer purely gravitational ones: the Lagrangians contained up to a dozen of torsion constants in addition to the gravitational one. In [1,3] one can find comprehensive reviews of the existing torsion field theories. One of the trends, staying within the framework of metric affinely connected spaces, is the development of geometric theories where the role of potentials is played by tetrads, forming a mobile frame of reference in the centroaffine space tangent to the given manifold. Since the algebraic relation between the metric and tetrad vectors specified by scale factors (Lamé coefficients) is not uniquely defined, such a description of the geometry differs in general from the one operating with metric, connectedness, and holonomic transformations of coordinates. Following this trend is the Hayashi-Shirafuji theory of gravity [4] with propagating torsion, as well as the Shipov theory of physical vacuum [5] in which torsion field is characterized by the Ricci coefficients of rotation. In [6], for example, torsion in multidimensional geometry is considered. We note, finally, that the majority of the present theoretical works dealing with torsion are based on the well-established ideas about a space continuum having a specified number of dimensions and characteristics (the approach accepted in classical physics) or rely on the abstract mathematical apparatus of quantum physics. And yet, it is not improbable that there may be other ways of setting torsion properties of manifolds involving, for example, disruption of their topology and introduction of new algebraic and group structures.

The appearance of the new, different from the ECT, torsion theories brings into existence the problem of determination of the constant of torsion's connection with its source. It is most likely that the source of torsion is the intrinsic angular momentum of particles; in such a case there are, at least, two choices. One may either link torsion to the quantum-mechanical spin of elementary particles, measured in fractions of Planck constant (an almost universally accepted approach), or to any intrinsic angular momentum of gyroscopes and galaxies. Other candidates to act as the source are, of course, not excluded but, in any case, it is clear that the order of the constant (or function), connecting the torsion variable with a corresponding characteristic of the source, is small. The conventional way of estimating field interactions is through experiments with the motion of particles in the force field under study and comparison of experimental results with the theory predictions. Various theoretically calculated effects, taking place in torsion fields, are reviewed in [1,3]. It is to be noted here that the hypothetical torsion forces have been shown by several authors [3] to be repulsive ones, thus making it possible to put forward a hypothesis stating that space-time torsion can be the cause of the Yukawa-type deviations (taken with opposite sign) in the potential of Newton inverse squares law. This deviation, calculated from the Eotvos experiment and entering, together with its connection constant, the phenomenological relation for the potential, is referred to as "the fifth force."

As of now, a large number of works on torsion fields have been published. At the same time, the assumption of the spin-torsion interaction constants negligibility creates a kind of psychological barrier to carrying out comprehensive studies of torsion fields experimental manifestations in the world's leading physical laboratories (in contrast to the large-scale experiments aimed at detection of gravitation waves).

Due to this reason, it is accepted in the mainstream physics that torsion field has not been detected experimentally. On the other hand, a number of the known effects give reasons to believe that torsion fields do exist in nature. The last several decades have created a situation when researchers from different countries and in different fields of science reported about the observed effects, treating them phenomenologically for the most part since they were inexplicable based on the known interactions [7]. It is noteworthy that the majority of these effects were associated with the behavior of objects possessing spin or angular momentum. Here we cite some of the results. In the experiments performed in the seventies and eighties in Dubna, Protvino, and also in Brookhaven and Argonne National Laboratories it has been shown that protons with spins in opposition to the spins of target protonic polarization travel through target protons, as A. Krish put it, as if without interaction [8], whereas for identical orientation of spins of protons in the beam and target scattering occurs in satisfactory agreement with the theory. The unusual behavior of spinning particles was observed with particle accelerators of various types in many experiments. V.G. Baryshevski and M.I. Podgoretski have found experimentally that precession of neutrons occurs when they pass through a spin-polarized target, corresponding in magnitude to a field several orders of magnitude stronger than the magnetic field of the target nuclei [9]. R. Irabert discovered that circular-polarized electromagnetic wave deviates from the plane of incidence [10], the direction of the deviation determined by the spirality "sign". An experiment done by A.C. Tam and W. Happer [11] has demonstrated that in vaporized sodium, at a radiation frequency slightly above that of the sodium D_1 line, circular polarized beams of laser radiation attract if their polarization is the same and repel in the opposite case.

Taken together, the above results, as well as some other findings, give enough reasons to suggest the existence of interactions and fields of a particular kind with classical spins or angular momenta acting as their source. Spin acts as the source of torsion field in the same manner as electric charge and mass produce electromagnetic and gravitation fields, respectively. It is needless to say that comprehensive investigation of torsion fields in high-precision experiments is required. At the same time, it is to be stated unequivocally as to which theory to base on when describing torsion fields. Nevertheless, we stand for immediate application of torsion field effects, even before the above requirement is satisfied. A number of devices have been constructed [7], generating what appears to be torsion fields. The first devices of this kind were created in the USSR and were termed "torsion generators". Creation of torsion radiation generators and detectors by the CISE VENT (Center of Intersectoral Science, Engineering and Venture of Non-Conventional Technologies (Moscow, Russia)) and associate organizations in the eighties and nineties marked the beginning of studies aimed at detecting experimental manifestations of torsion fields. These studies were conducted by the Russian Academy of Sciences, higher educational establishments, sectoral scientific research institutes and supplied extensive experimental evidence. This has lead to a conclusion on the feasibility of development and application of torsion-based techniques in various branches of science and technology [8]. We note that now torsion generators of original design are constructed not only in Moscow, but also in Perm and Tomsk (Russia).

GENERATION AND DETECTION OF TORSION FIELDS

Unlike sources of electromagnetic and gravitation fields, producing central symmetry fields, sources of torsion field generate fields with axial symmetry (Fig. 1). Spinning object sets up polarization in two spatial cones, corresponding to the left, S_L , and the right, S_R , torsion fields [7]. As indicated by the currently available experimental evidence, not only spin, but also rotation of bodies gives rise to torsion fields [7]. In case of rotation, including classical spin, being stationary (constant angular frequency, rotating mass distributed uniformly with respect to the rotation axis), static torsion field is generated by the source. Non-stationary rotation gives rise to wave radiation. Tentative experiments have shown that torsion field extends over a fixed interval from the source and within this interval undergoes only slight variations with distance (Fig. 2), which may be attributed to the presence of space frequencies [7]. Limits, characteristic

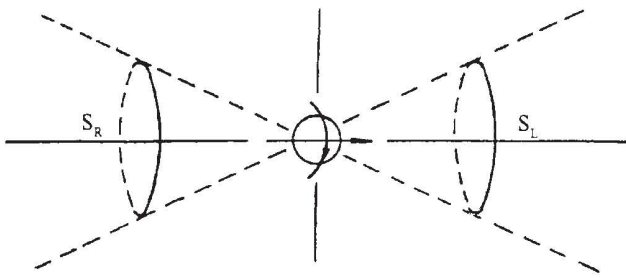


Fig. 1. Directionality diagram of static torsion field of an object with spin.

experimental evidence, to believe that the process underlying the so called "memory of water" is water spin-polarization with the intrinsic torsion field of the 7 molecules of dissolved substance [7]. The memory effect can be observed not only on dissolution of substances in water, but also over a distance as, for example, in Foll's technique of transferring the properties of medicine solutions to pure solvents (water) using electromagnetic radiation. (Akimov's model of the polarized states of physical vacuum [7] should be mentioned here.)

Classical wave fields as, for example, spinor and electromagnetic ones, constitute the natural source of torsion field. Gravitation and torsion fields manifest themselves "as they are," whereas electromagnetic fields always contain a torsion component and this is an essential fundamental fact [7]. Torsion field will appear in both electrostatic and electromagnetic radiation [7]. Inability to understand that has often been the cause of fruitless attempts to explain many of the phenomena related to sources of electromagnetic radiation in terms of purely electromagnetic phenomena [7].

New physical instruments - torsion field generators - are coming into broader use in Russia in recent years. They find application in physics, technology and various techniques. The heart of such a generator is a medium with polarized spins (usually those of electrons) controlled by means of electromagnetic fields. Torsion generators may be classified into four types [7,8]. We will not enlarge on this subject here.

Detection of torsion fields is effected by physical and physical-chemical methods of analysis [12]. It has been shown experimentally that not only qualitative description, but also quantitative treatment of spin-torsion effects is possible. Problems of providing metrological basis for experiments with spin-torsion interaction are discussed in [12]. It appears relevant to consider the problem of providing unification in the measurements of a selected torsion field characteristic through utilization as an immediate component in measuring instrument of, say, a calibrating quartz resonator. As a first step towards the desired accuracy of measurements it is justified to introduce "Hertz," a conventional unit of measurement of one of the characteristics of torsion field, related to the change in the free oscillations frequency of the quartz resonator in autogenerator of electric oscillations when the former is acted upon by torsion radiation. Reliability and accuracy in the measurements of the torsion field magnitude are ensured by the use of differential technique: to eliminate background drift, readings of the sensitive element (quartz sensor) are taken with field on and off. The period of the on-off cycles is 10 sec. and more. In actual practice, with the counting time of electronic frequency meter set at 10 sec., the total time of a measurement is no less than 1000 sec. [12]. The readings are written in two columns: "field off (background)" and "field on". In the simplest case, the magnitude of signal is taken as the averaged difference between the corresponding

of static torsion fields, have not been detected for torsion waves. Bearing in mind that the origin of torsion field is constituted by classical spin or angular momentum, it is clear that torsion field will influence objects with spin or angular momentum.

Owing to non-zero spin order of any body, all bodies have their own torsion fields, causing polarization of free space in the vicinity of bodies - torsion phantoms. (A technique developed by S.D. and V.Kh. Kirlian allows these phantoms to be recorded.) There are strong reasons, including those based on

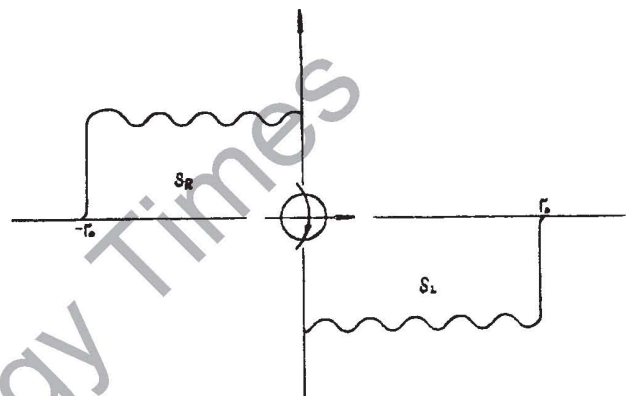


Fig. 2. Intensity of static torsion field of an object with spin plotted as a function of r .

values from the two columns. In the course of experiments it was found that the variation of the frequency difference decreases in the second half of night. Experience, gained from the exploitation of quartz generators, indicates that a considerable improvement in their parameters is observed after their prolonged (several days to several months) uninterrupted functioning (training). The phenomenon of quartz sensor saturation, resulting in temporary decrease in its sensitivity, may be regarded as an essential prerequisite for ensuring reliability of a measurement. After a time (determined experimentally) sensitivity is restored [12]. Practice shows that doses of torsion radiation with opposite polarization reduce the recovery time.

An alternative procedure for detecting and estimating torsion field has been proposed recently, consisting in measurement of natural radioactive background with some kind of ionizing radiation sensor [12]. Placing a pulse counting device (Geiger or solid-state scintillation counter) in the area exposed to torsion field one can obtain a corresponding estimate of the field. Sensitivity of ionizing radiation sensors is several orders of magnitude higher than that of quartz ones, but the latter are more stable as compared to sensors of all other types. The problem of increasing quartz sensors sensitivity is an immediate task. It seems likely that sensitivity is determined primarily by the type and area of the section relative to crystallographic axes of the crystal itself. It is worth noting that some of the mechanistic aspects of torsion radiation interaction with quartz crystal are still unclear (informational mode of the interaction is assumed).

Recent years have seen the development of radiographic techniques for detection of torsion fields [12].

According to [7], torsion generators constructed hitherto, made provisions for screening from electromagnetic radiation. This was done in order to eliminate the possibility of mistaking effects of electromagnetic origin for effects induced by torsion field in experiments investigating the action of torsion field on various objects. Besides, it was clear that prior to the experiments one was to make sure, using standard metrological equipment, that the generator itself, screened as described above, produced no electromagnetic radiation. Experiments were designed in such a way that one could expect to observe effects deemed impossible to be obtained using radiation of the known types, including electromagnetic ones. It was necessary to secure an experimental confirmation, if only a tentative one, of the spin (classical spin is implied here) nature of the radiation produced by the generators constructed [7]. The experiments have revealed [7], among other things, that no effects of torsion origin were observed when the beam emitted by torsion generator passed through two spin-polarized plates with orthogonally oriented intrinsic torsion fields. This is only possible in case of the spin nature and transverse polarization of the radiation produced by the torsion radiation generator.

It is reported [13] that the properties of torsion field differ markedly from the known properties in electromagnetism and gravity. The most important of them are listed in [13]. Needless to say that these properties of torsion fields should find confirmation in the world's leading physical laboratories.

One more remark needs to be made about torsion fields. One of the theorems in classical mechanics states that in an isolated mechanical system the momentum of the center of mass is conserved and cannot be changed by the internal forces in the system. Based on his theory of physical vacuum, Shipov in [5,13] considers the possibility of movement of a mechanical system driven by uncompensated inertial forces associated with torsion fields in his theory. He termed such mechanical system "four-dimensional gyroscope." The first operating "four dimensional gyroscope" seems to be the one constructed by a Russian engineer Tolchin [14], who gave it the name "inertioid." In our opinion, the attempt to explain macroscopic movement of inertioid by the action of torsion fields is questionable, though the final decision should be taken only after experiments, including those in space. At the same time, we accept the expediency of experiments to investigate the possibility of weak translational motion of "four-dimensional gyroscopes" (rotational-translational systems) caused by torsion fields. Similar devices and experiments with their weighing are covered by Vejník [15]. It is noteworthy that the experiments with vibrating gyroscopes were initiated by Kozyrev [16]. The known works [16,17] should be extended to include the case of oscillating rotating gyroscopes.

TORSION FIELDS AND VACUUM ENERGY

Over the last twenty years extraction of energy from vacuum has been the subject of theoretical and experimental studies of many researchers. Quantum gravitation gives an outline of the mathematical structure of vacuum in the quantum theory of gravity. Superspace incorporates all kinds of geometries with all kinds of characteristic curvature radii. The subset of geometries having Planck scale radii constitutes the set of the allowed states for quantum fluctuations of the metric with different topologies. These fluctuations have Planck scale dynamic parameters. For distances outside the Planck scale transition occurs from the vacuum of general relativity to the classical vacuum or even to the classical vacuum of special relativity. Therefore, dynamic parameters of the quantum vacuum in general relativity are beyond our reach. In this approach elementary particles are treated as geometric-dynamic vacuum excitons. Particles production from vacuum is predicted in all vacuum theories, including the vacuum of the quantum theory of gravity.

Vacuum is an independent physical entity. Therefore, we think that it is vacuum that constitutes the source of energy for the originating particles when vacuum is acted upon by an external field, the field energy serving only to excite it. In this case we do not have to worry about the fulfilment of the energy balance condition, i.e. that the total energy of particles must be equal to the energy vacuum "takes up" from the field plus the excitation energy. It is appropriate, therefore, to test for stability gravitation-torsion vacuum subjected to the action of torsion (torsion-informational) field and find out whether discompensation of vacuum (generation of large quantities of energy) can take place. In Akimov's opinion [8], the small amount of energy required for the spin-polarization of physical vacuum causes us to anticipate that through torsion perturbations it will be possible to liberate the energy of vacuum fluctuations. Needless to say that this conclusion requires thorough experimental testing. As shown by the discussion [8] of the relation between torsion field and vacuum energy, the above assumptions lend realism to the incredible 300-500% efficiency observed in the experiments of H. Nieper and others. Due to the weak interaction with vacuum, their rotational systems (typical torsion setups) could extract from it only minute amounts of energy.

In our opinion, vacuum power setups of the electromagnetic type should be designed with due regard to torsion effects and physics of open systems. From this it appears that the use of super-toroids [19] will strengthen the effect described in [20]. It is also important to study the yield of energy from vacuum when the latter is acted upon by torsion fields of various origins. We believe that the connection between the effects involved in the extraction of energy from vacuum and the possibility of the preliminary spontaneous breaking of vacuum symmetry with a high frequency electric field will be the object of future studies. In each specific case these ideas of Prof. V.F. Panov can be developed further.

And, finally, we point to a work by Shipov [21], focusing on the theoretical approaches to vacuum energetics. It is concluded in this work that *perpetuum mobile* device of the second type is a sort of a generator of particles having negative mass (or energy), the energy of such generator increasing through irradiation of negative mass particles.

VARIOUS TORSION-BASED TECHNIQUES

At present torsion fields are receiving acceptance in the following fields: study of materials, communication systems, minerals and oils prospecting, newly developed navigation techniques, protection of population against geopatogenic radiation, oil and gas pipeline damage diagnostics. Descriptions of the applications of torsion-based techniques in these fields are available in [8, 13] and we will not cover this subject in detail here. In short, [8, 13] report the results of experiments investigating the effect of torsion field on molten metals and alloys. It was established that physical-chemical characteristics of metals and alloys improve considerably after exposure to torsion radiation.

The promise offered by the use of torsion radiation in communication systems stems from the fact that a torsion wave cannot be screened and intensity of torsion signals does not decay with distance [8, 13].

Future applications of torsion fields include medicine, agriculture, ecology. It has already been established [22] that torsion radiation has considerable impact on plants; the response of the rootage of a plant to torsion radiation is opposite to that of the upper part.

It is to be mentioned that there has been an attempt of elucidating the nature of psi-phenomena basing on the concept of torsion field [23]. We do not rule out the possibility that a number of effects, ascribed to torsion field, should instead be treated as a manifestation of a new energetic-informational physical field with low energy, and torsion field is just one of its components.

The next section is devoted to the experiments with torsion fields conducted at Perm University under the supervision of Prof. V.F. Panov.

TORSION EXPERIMENTS AT PERM UNIVERSITY

On the Effect of Torsion Field on Electrochemical Processes at Metal-Electrolyte Interface

Of interest is the study of the effect of torsion field on various physical-chemical processes, including electrochemical processes taking place at metal-electrolyte interface (electrode equilibria, electrolysis, etc.).

Measurements of the electromotive force of a number of galvanic cells and hydrogen permeability of metal membranes during electrolytic evolution of hydrogen have been performed in the conditions of torsion generators action. Magnetic-mechanical torsion generator (type I), magnetic electric generator constructed in the Scientific and Industrial Center "Arsenal" (type II), and torsion field generator provided by the CISE VENT (type III) were used in the experiments.

Measurements of the electrode potentials in the systems Cu^{2+}/Cu ; Fe^{3+} , Fe^{2+}/Pt ; $\text{C}_6\text{H}_4\text{O}_2$, $\text{C}_6\text{H}_4(\text{OH})_2$, H^+/Pt were carried out in a variety of ways: changing positions of the measuring instrument (digital voltmeter) and reference electrode (saturated silver-chloride electrode) with respect to the torsion field generator; with and without screening (grounded steel screen) of the electrochemical cell.

The following behavior of the electrode potential E was typical for the electrode of the first kind (copper electrode in $x\text{M CuSO}_4 + 0.5\text{M H}_2\text{SO}_4$): after switching on the generator directed at electrode under study the potential shifted towards more negative values (by a maximum of 0.35 mV at $x = 1\text{ mol/l}$), then E would reverse to a stationary value, the latter, depending upon experimental conditions, being more positive or negative than the equilibrium potential before switching on the generator. No appreciable changes in E for the redox electrodes were detected.

Slow increase in the stationary hydrogen flow after switching the torsion generator on was found in the study of hydrogen permeability of annealed Pd membranes using Devanathan technique. Prolonged after action was observed after switching the generator off: hydrogen flow increased further for another 30 min.

It is suggested that the field changes the interaction potential in the electrochemical systems under study and affects crystal's phonon spectrum as well as spin orientation of reacting species. Torsion field effect is present in electrochemical systems forming adsorbed intermediates, 2D-structures in the mode of under-potential deposition, and in cooperative processes of hydrogen atoms movement in metals. These findings were published in [24, 25].

Overcoming the Coulomb barrier in bringing together low energy nuclei constitutes the principal theoretical problem of cold nuclear fusion. A solution to this problem, proposed by Shipov in [26], is to lower the Coulomb barrier employing torsion interaction in nuclear processes. It goes without saying that this hypothesis needs to be verified by physical experiments with nuclear spin polarization in external torsion field. We suggest that instead of trying to implement cold nuclear fusion one should tackle a more general

problem - nuclear transmutations in torsion fields. In nuclear reactions (including those probably taking place during electrolysis) energy is either produced or consumed, and it seems like there is a good reason to use for electrolysis radioactive electrodes in combination with the action of torsion field. At any rate, studies of the effect of torsion field on metastable nuclei show considerable promise, cooperative synergetic effects can take place here.

The Effect of Torsion Radiation on Mice

In the laboratory of radiobiology of Perm University we have investigated the effect of static torsion field on mice. Type III torsion generator was used in these experiments. A source of constant current with the output voltage of 150 V was employed as the power source. The effect of short duration exposures to torsion radiation being unclear, we conducted experiments with prolonged (up to 1 month) exposures to torsion radiation of animals subjected to lethal (10 Gr) dose of radioactivity. Continuous irradiation with static torsion field with right polarization has led to the increase in the mice survival (up to 33%) with complete perishment of the control animals.

The effect of the field was enhanced by the use of torsion generator constructed by Prof. V.F. Panov (Perm, Russia), employing a β -irradiator as the source of power. Previous experiments have shown that β -irradiator itself had no influence on the survival of the animals. However, incorporated into the source of torsion radiation, it increased the survival of animals up to 60-80%. It was also noticed that mice feel the onset of torsion field. The work [27] contains some of the results described here.

Investigation of the Effect of Torsion Field on the Primary Immune Response

The experiments were performed with mice of CBA line, 16-18 g in weight. Changes in the cellular and humoral parts of the immune system were taken as the indication of the torsion field impact on the primary immune system. Type III torsion generator, operating at a frequency of about 50 Hz, was used. Sheep red blood cells, introduced intraperitoneally 1 h. before exposing animal to torsion field, 0.5 ml of 10% mixture per mouse, were used as the antigen. Blood for analysis was taken on the fifth day after injection of the antigen. The response of the cellular part of the immune system was estimated from the change in the number of cells forming "rosettes" specific to T-dependent antigen, that of the humoral part from the content of antibodies.

The same amount of sheep red blood cells was injected to the control animals, not subjected to the action of torsion field.

The experiments have shown that torsion field has immune-stimulating effect showing itself in the activation of both cellular and humoral parts of the immune system. Being 53.3% for the control mice, the content of rosette forming cells was as high as 71.0% ($p < 0.001$) for the mice subjected to the action of torsion radiation. Appreciable differences in the response of the humoral part of the immune system for the unexposed and exposed mice were also detected: the titer of antibodies being 8.33 for the former and 11.70 for the latter.

Thus, it was shown that torsion field acts a stimulator of immune system. This allows one to consider the application of torsion fields for correcting immune system defects.

PERM PROGRAM OF INVESTIGATION AND APPLICATION OF TORSION FIELDS

1. Effects Involved in Extraction of Energy from Vacuum

Fundamental research objective - physical vacuum excitation and extraction of energy from vacuum.

General program of studies:

- ◆ Elaboration of theoretical approaches to the structure of physical vacuum.
- ◆ Applied aspects of energy extraction from vacuum. Physical vacuum excitation. Magnetic-gravitational effects.
- ◆ Theoretical development of the concept of **EH**-convertor as a means of energy extraction from vacuum.
- ◆ Working out of the design and construction of **EH**-convertor.
- ◆ Experimental study of energy extraction from vacuum through the use of **EH**-convertor.
- ◆ Theoretical studies and design of multipolar systems (with $n = 4$ and higher), including magnetic and magnetic-electric systems with "strained zero", and their application for physical vacuum excitation and extraction of energy from vacuum.
- ◆ Construction of models of multipolar devices and performance of physical experiments.
- ◆ Theoretical and experimental investigation of electromagnetic solitonic convertor (with the order of four and higher) and its application as a vacuum energy generator.
- ◆ Working out of the design and construction of electromagnetic solitonic convertor, search for an optimum version of the design.
- ◆ Search for vacuum energetic effects in electrodynamic system in the presence of torsion fields.

The work is a probing research and has no precedent in the Russian and world science. The group of researchers has been conducting studies in this field since 1991.

2. Chemistry, Physical Chemistry and Torsion Fields

Fundamental research objective - chemical reactions kinetics and self-organization of physicochemical systems in torsion fields.

General program of studies:

- ◆ Studies of chemical reactions kinetics in stationary and non-stationary torsion fields.
- ◆ Simulation of chemical reactions in torsion fields of various origins.
- ◆ Problems of chemical catalysis from the standpoint of torsion-based techniques, geometric-physical approach and multi polarity: estimating efficiency of various approaches, providing theoretical background, elaboration of know-how recommendations.
- ◆ Structure-phase transitions in physical-chemical system.
- ◆ Elaboration of a theory of the processes of self-organization in multi phase physical-chemical systems.
- ◆ Design of multi phase self-organizing systems.
- ◆ Applications of multi polarity in theory and practice.
- ◆ Simulation of the processes of self-organization in multi phase systems. Multipolar schemes and torsion fields.
- ◆ Crystal growth in self-organizing systems.

The work has no precedent in the Russian and world science. The group has been conducting theoretical and applied studies in this field since 1991.

3. Electrochemical Nuclear Transmutations in Torsion Fields and the Problem of Energy Extraction

Fundamental research objective - investigation of the changes in the kinetics of interface processes of hydrogen isotopes electrolytic evolution on catalytically active metals induced by the action of torsion field.

General program of studies:

- ◆ Development and construction of new types and modifications of torsion generators of various wavelength ranges.
- ◆ Theoretical calculations of the nature of torsion waves emitted by electrodynamic systems.
- ◆ Theoretical substantiation of the mechanism of torsion field action on the condensed media interface.
- ◆ Investigation of the effect of torsion field on the process of water (and heavy water) electrolysis and establishment of qualitative and quantitative regularities.
- ◆ Determination of the system stability conditions and conditions for its prolonged operation in the process of hydrogen isotopes evolution.
- ◆ Creation of facilities for sustained maintenance of the reaction.

The work has no precedent in the Russian and world science. The group of researchers has been conducting probing studies in this field since 1994; certain amount of data has been amassed. Some results have already been obtained and published.

4. Torsion Radiation and Biophysical Systems

Fundamental research objective - investigation of biological activity of torsion fields and development of biotorsional techniques.

General program of studies:

- ◆ Torsion fields as a biophysical factor.
- ◆ Biological-energetic-informational properties of torsion fields.
- ◆ Structural-informational transport in torsion fields.
- ◆ Medical aspects:
 - comprehensive biochemical studies of blood of mammals subjected to the action of torsion radiation;
 - stimulation of the immunity of organism and its systems and regeneration in torsion fields;
 - investigation of the recovering action of torsion fields on the organisms of animals exposed to large doses of radioactive radiation.
 - creation of new and unprecedented pharmaceutical preparations and recreation methods.

The work has no precedent in the Russian and world science. The group of researchers has been conducting studies in this field since 1995. First tentative results have been obtained and are in course of preparation for publication.

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KOZYREV-DIRAC EMANATION METHODS OF DETECTING AND INTERACTION WITH MATTER

Dr. I.M. Shakhparonov ¹

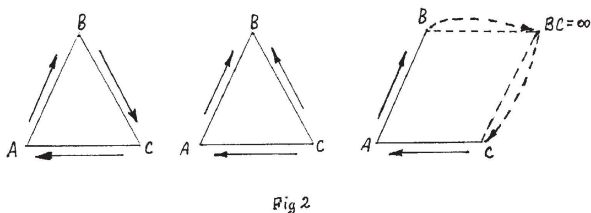
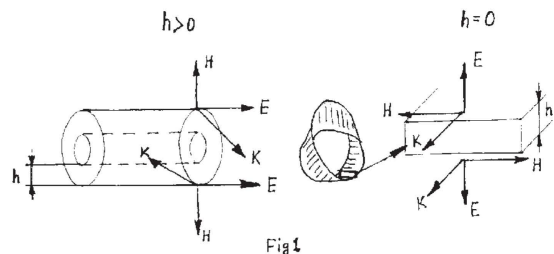
This report gives experimental data which allows us to conclude the existence of previously unknown emanations. Described are experiments and topological analyses. The effects of interaction of this new type of emanation with matter are described.

At present, theoretical physics does not attach significance to unoriented configurations and spaces. This situation is due to the fact that, even from the philosophic point of view, it was not possible to determine and locate in our world the province of the unoriented topological structures. For this reason we, representing eight scientific teams and joining our forces, needed more than 30 years in order to solve this problem by an experimental approach seeking out the correct way by trial and error.

The fundamental tenet of the casual mechanics elaborated by Kozyrev may be formulated as follows. There are two types of energy in the Universe. The positive, or **right** energy, acts as a factor increasing the entropy. The negative, or **left** energy, tends to decrease the entropy, i.e. it acts as a factor which regulates the entropy's increase. Through being spent, the **right** energy is transformed to the **left** one, and this fact may be interpreted as the passage of time from the past to the future. When the energy is transformed from the **left** form to the **right** form, the time is reversed. Kozyrev supposed [1], that through revolving a body together with a coordinate system along a circumference, the right coordinate system is transformed to the left one at the moment, when the body reaches the point situated on the opposite side of the diameter. For example, let us take a cylinder with a wall of the width h and let us move the right coordinate system represented by three vectors along the external surface of the cylinder. We can see, that in this case the mirror image cannot be obtained. (left side of Fig. 1)

Yet we can proceed with the same operation after having bisected the cylinder and then having rotated one of the edges of the obtained strip by an angle of 180° and having spliced it at the other end. The geometric figure obtained in such a manner is called the one-sided cylinder or the Moebius band (MB). In this case, we have achieved the full inversion of the vectors E and H without having changed the direction of the propagation (right side of Fig. 1).

This property of the MB results in the fact that, in contrast to the oriented cylinder (whose width $h > 0$), the wall's width of an unoriented cylinder is equal to zero ($h = 0$). In this manner the so called **short circuit** of the space is produced. Due to this property one can observe the phenomenon of superpermeability, in which one body penetrates into another body without interaction [2]. We may also expect that the signal sent from a point to another point under the condition that $h = 0$ will immediately reach the receiver. Now let us give an explanation of this a property in terms of nonorientability (Fig. 2).



Let us suppose that we are moving along the sides of a triangle ABC without changing the direction of motion; by moving in such a manner we obtain a closed loop. This loop will be destroyed if we introduce the counter-motion (motion in the opposite direction), such as, along the side CB. In this situation the loop can be restored through introducing the motion B to C, the latter being equivalent

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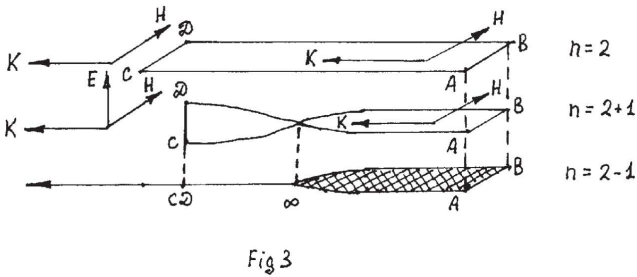


Fig 3

to the increase of the dimensionality of the space. Taking this into account we can conclude that nonoriented figures may be regarded as intermediary between 2 and 3 or 4 space dimensions, depending on the dimensionality of the initial nonoriented figure. The entrance into the 4th dimension automatically means the disturbance of the space metric and this must, in its turn, result in the advent of a gravitational field. On the other hand, in order to make the idea clear, let us proceed

with the operation which manufactures a MB step by step (Fig. 3)

At the start we have the initial strip ABCD. Let us turn CD around AB at the angle 90° and then project it on a surface. The rotation of the strip's edge automatically transforms the figure so that it enters in the dimension 2 + 1. The projection of the transformed figure has the dimension 2 - 1. The **density** of the straight line is considerably increased. If we proceed with the rotation of the strip we shall obtain a twisted figure. By projecting this twisted figure on the surface (Fig. 4) we shall demonstrate the inversion of a pair of vectors and having spliced the edges of the twisted figure we shall obtain a MB.

Having considered this design we can conclude that, if we work with real MB models, that electromagnetic fields with negative energy must appear. In such a case, it is possible to produce a magnetic monopole (Mon), which is the analog of the electric monopole (electron) in our **positive** space. In contrast to the cylinder, on whose surface one can move along spiral trajectories, nonoriented figures have trajectories which are transformed into closed knotted curves. The topology of such a field is presented in Fig. 5 [3]. If the field is magnetic, and this inevitably occurs, when the electric current is run in the surface layer of a conductive MB model, the topological construction obtained qualifies as a Mon. In appearance it resembles a dandelion with a dense central leg limb and in no way resembles a MB. That is why the MB can generate two types of formations namely: luminous (**positive** energy) and black (**negative** energy) ones.

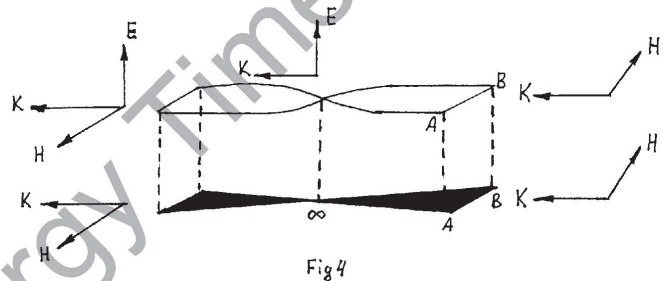


Fig 4

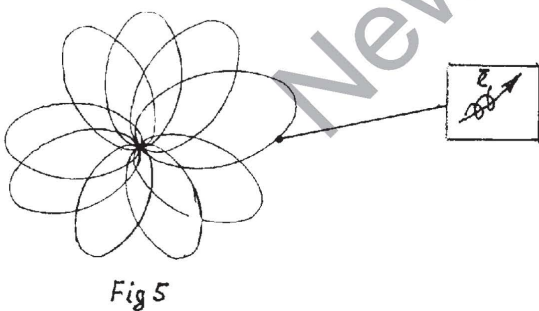


Fig 5

Because of the fact that the nonoriented figures are formed through the mutual (in pairs) cruciform conjunction of the opposite points, we notice, for example, that the one-sided torus – the Klein bottle – is formed from half of an oriented torus; the formation of the models of a projective plane is completed through the identification of the opposite points of spherical surfaces etc. This property can be explained if one supposes that the unoriented fields are primary and the oriented ones are secondary.

EXPERIMENT

The previous conductive MB models [4] can be applied to plasma formations which are identified as natural ball lightning. The experimentation strategy used the technologies of the manufacture of the MB and some results are given in work [5]. Fig. 6 shows the profiles of the image of a natural ball lightning (top of Fig. 6) and profiles of the formations obtained in laboratory (bottom of Fig. 6).

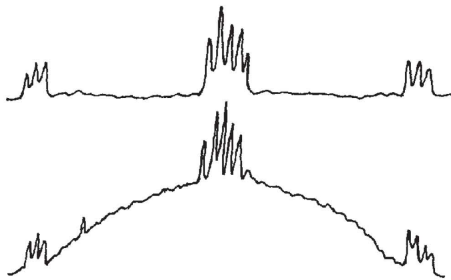


Fig 6

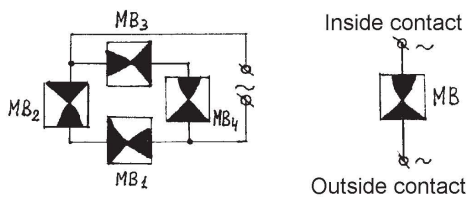


Fig 7

The more recent works were focused on revealing the factors which cause the formation of such objects. As a result of this investigation a radiation of a new type was discovered. Because a unique MB device generates a small amount of negative energy, we proceeded with the construction of assemblies of MB's. At present with the aid of the developed nanotechnologies, we have created industrial prototypes of powerful emitters of negative energy. Fig. 7 shows the scheme of an MB assembly and the key for the designation of individual unit elements in electric schemes.

In order to preserve the nonorientability of the assembly as a whole, one of the elements must be fabricated with a reversed twist or it must be connected in the circuit in series opposition. Because it was expected that the assembly can generate a gravitational wave of a rather large power, in the first experiments the detector we used was a single thermostatic quartz resistor shielded from electric and magnetic fields. Thanks to this quartz detector, the wave of a previously unknown nature was discovered. In this situation the

acoustic waves could be mistaken for gravitational ones. For the determination of the wave's nature, we carried out an experiment on the determination of its speed. It is well known that the speed of an acoustic wave in the air equals to 0.3 km/sec., depending on the density of the substance. The scheme of the experimental equipment is shown in Fig. 8. 2 quartz detectors are situated at the distance of 1 meter from each other. From the detectors, the signals were transmitted to the input of a double storing oscillograph. The measurements were carried out on the base of 5 meters. The results of the measurements are shown in Table 1.

Base (m)	Speed (km/sec.)
0	100
1	1000
2	5000
3	10,000
4	50,000
5	100,000

The values of the wave's speed allows us to conclude that this wave is gravitational in nature. The fact that the accelerated motion of the wave is in the direction away from the source is rather surprising. Such a behavior can be explained by the generation of a flow of very heavy particles, which cause the distortion of the space. Yet the wave's large speed cannot be regarded as an absolute proof of its gravitational nature. It is desirable to carry out an experiment, which would unambiguously determine the nature of the wave and its characteristics. Theory states that light will alter its frequency when approaching a gravitational field. A photon accelerates or **becomes a little more blue**, when moving towards a gravitational field, and **becomes a little more red** when moving away. Such an effect can be used as the general principle for such an experiment.

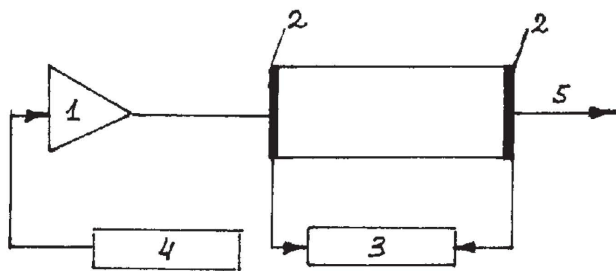


Fig 8

An important point is not to use intricate composite optical systems, because they can possibly cause side effects and it is difficult to take the latter into account. That is the reason why all the measurements must be made on the ray path. If we are able to do the conversion **frequency-amplitude** in the optic frequency band, the problem may be solved. One can use a light filter with a sharp characteristic curve compatible with the wave length of the light source (Fig. 9).

The scheme of the experiment is shown on (Fig. 10). Through measuring the characteristic as a function of the distance between the light filter and

the light source and the frequency of the pumping of the MB assembly, we may determine not only the gravitational potential, but also the value of the gravitational disturbance caused by the Mon beam. A rudimentary calculation shows [6], that the space disturbance is equivalent to the one caused by a body of the mass of 10^{32} g, i.e., a mass only 10 times smaller than that of the Sun. The experimental curves allowing us to make such a conclusion are shown in Fig. 11.

This experiment also revealed the effect of the excess of the light speed in vacuum (Fig. 12).

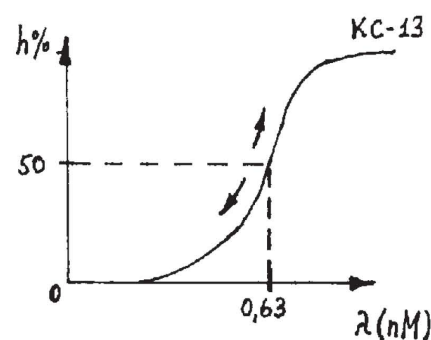


Fig 9

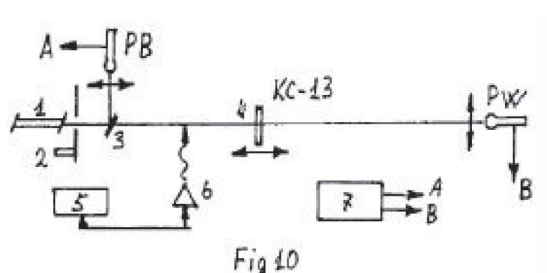


Fig 10

Distance PB - PW = 500 sm.
Silicic phototube bearing
Distance from translucent glass - PB = 10 sm.
Silicic phototube working

1. Laser 2. Mechanical grid 3. Translucent glass
4. Filter for light 5. Block feeder 6. Radiation Mon
7. Oscilloscope A. Abutment phototube B. Worker phototube

The speed was measured through the comparison of the location of the fronts of both the working and the basic (reference) pulses (left side of Fig. 12), as well as through 50% modulation of each of the pulses (right top of Fig. 12). From the comparison of the lengths of the measuring base and the reference base is drawn the conclusion that the pulse front propagates faster than light, which is in good agreement with the theory [7]. Besides, when the pulse under investigation was wholly biased relative to the reference pulse, there was no longer any modulation of the latter, and the pulse has changed its form (right top of Fig. 12), which is in good agreement with the theory. When the average power of the pumping of the MB assembly was increased up to 3 kW, what we observed allowed us to determine that the gravitational wave is a scalar wave [8]. As mentioned above, we assumed that the gravitational wave is not formed by itself, but is caused by the interaction between the space and the Mon flux. It was suggested, [9] that the interaction of Mon with matter causes considerable Mon ionization losses, yet by virtue of this fact, the Mon accelerates even in weak magnetic fields, it cannot manifest in thick layers of matter.

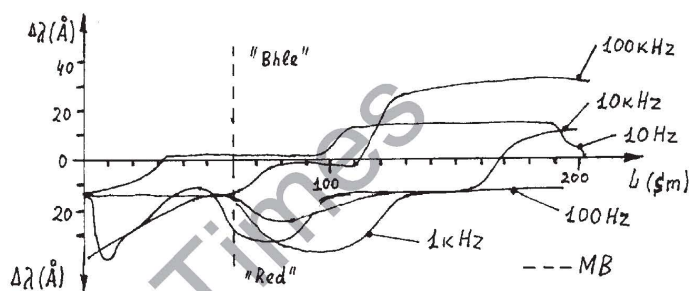


Fig 11

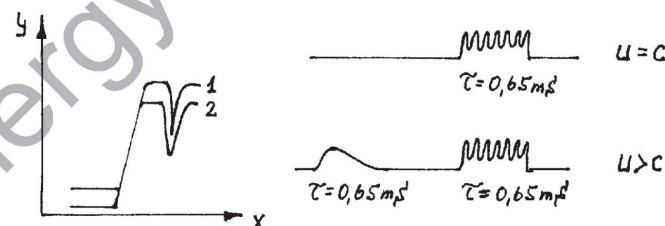


Fig 12

1. Segment of bench impulse
2. Segment of operator

In order to identify the magnetic nature of the flux of particles, we used a trajectory tracking device based on the interaction with iron. The principle of Mon detecting and recording its trajectory consists of the following. One records the harmonic signal of the frequency of 1000 Hz on a magnetic tape. The reel with the tape is exposed to the Mon flux and then inserted in the magnetic tape player. The output of the read head is connected to the input of a storage oscillograph and on the screen of the latter is displayed the information of each deviation on the tape. In the place, where the beam passed, we observed a distortion of the recorded signal counts in favor of the existence of a magnetic field of large intensity at the place of

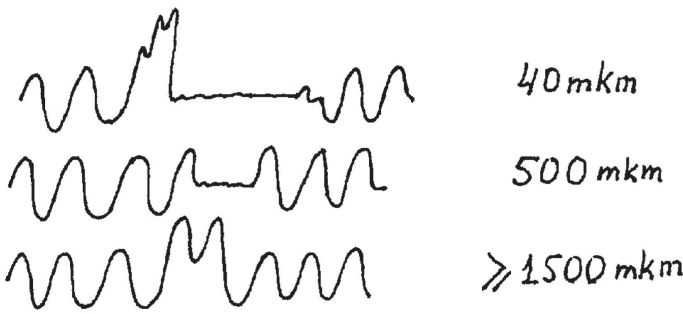


Fig 13

interaction (Fig. 13). The depth of the damages varies in the range from 1.5 to 150 cm. An estimated energy of the Mon-beam amounted to 18-1800 GeV or even more.

The Mon beam exerts some **action on different substances** and **radio components**. In particular, when a measuring resistor was used as an emanation detector, both the **increase and decrease of its resistance** were recorded. The increase of the resistance corresponded to the resistor's cooling, and the decrease to its heating. **The shielding of the detector by means of a thick iron layer resulted in the**

cooling as well. Because of the fact that the changes in the resistor's resistance last for prolonged periods and are interesting mainly for the purpose of demonstration, we **have fabricated a thermocouple detector for quick measurement** of the parameters of the Mon beam. The design of the detector and the experimental curves are shown on (Fig. 14).

Curve 2 demonstrates the cooling effect, when the beam is passed through an iron screen of the width 20 mm.

APPLIED INVESTIGATIONS

Since 1991 in conjunction with fundamental investigations, we also carried out applied investigations. This became possible thanks to the fact that powerful and reliable Mon sources were created. It was found that the Mon beam passing through an organic substance transforms the latter in such a manner that it **exhibits paramagnetic properties** in external magnetic fields of the intensity **1-1.5 T**. The new property is preserved for a long time [5]. We succeeded in revealing the fact that the element responsible for the exhibition

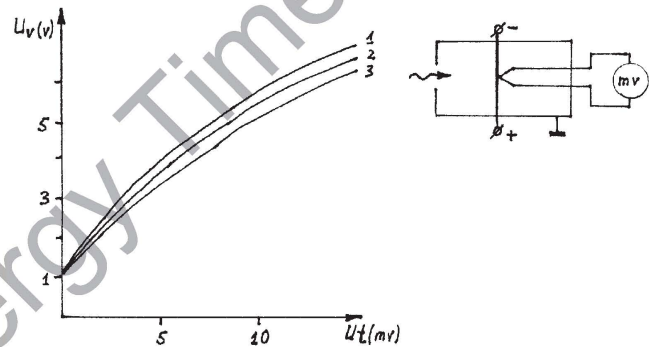


Fig 14

U_H Voltage of glow nichrome wire
 U_T Voltage on thermocouple

- Curving
1. No radiation
 2. Radiation through ferrous filter $h = 20$ mm.
 3. Radiation without filter

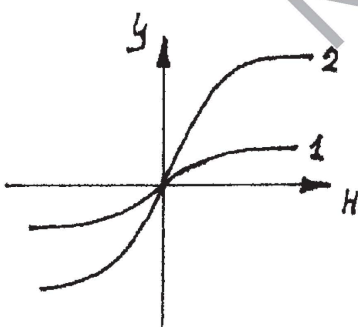


Fig 15

- Vibration magnetometer
1. Magnetization of carbon black.
 2. Same after adaption 15 min., distance 1.5 m.

of these new properties is carbon. The action of the Mon beam both on **carbon** (Fig. 15) and **diamond** samples counts in favor of the fact, that these samples exhibit new properties slightly different from each other. The carbon clearly showed a **soft magnetic characteristic**, yet the processed diamond exhibited magnetic properties only when it was attracted by a **steel needle** in a magnetic field (Fig. 16)

Soon after magnetizing the diamond, we observed the residual magnetism of the diamond, yet this property wanes and disappears **in several days** while the diamond remains paramagnetic. From a practical point of view it is quite interesting to identify chemical reactions taking place both in the field of the beam and in its surroundings. We succeeded in improving the quality of both juices and alcoholic drinks (wines, cognacs, brandies, liqueurs, vodkas, etc.). At the same time the properties of the processed alcoholic drinks are preserved for an indefinitely long time, the production expenditures and expenses being very small. Considerable success is also achieved in medicine. Investigations carried out with the use of the base of the Oncological Center at the Academy of Medical Sciences of the Russian

Federation showed that the Mon beam is absolutely harmless for living organisms and, at the same time, its emanation has positive effects when medically treating blood diseases. Oncological diseases may be treated both directly by the Mon beam or accompanied by other well known means. Attempts were also made [5] in order to develop methods of control of the decay of radio nuclides. The problem is important and the first positive results have already been obtained, even though the project hasn't been promoted or supported by the government.

CONCLUSION

Taking into account the following experimental data: the phenomenon of superpermeability, the generation of gravitational waves, the magnetizing of objects processed by the Mon beam, the considerable penetration capability of the beam, the phenomenon of magnetic cooling of matter by interaction with the beam, we think that the existence of the magnetic monopole may be regarded as proven. At the same time taking into account the relation between the energies of the particles and the energy required to produce them (300 eV) **we are forced to conclude, that the constructed devices do not create the Mon beam, but only serve to focus the emanations which already exist in nature.**

Taking into account that N.A. Kozyrev was the first who observed Mon-emanation in nature, and the existence of Mon was theoretically foretold by Dirac, we give the newly discovered emanation the following name: Kozyrev-Dirac emanation.

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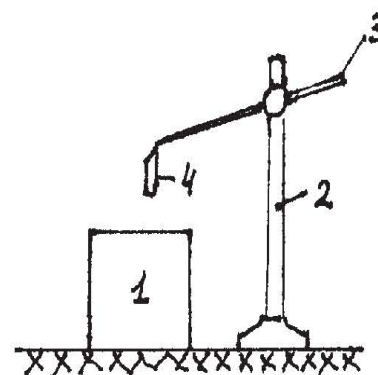


Fig16

- | | |
|---------------------|------------|
| 1. Magnetic Sm - Co | 2. Leg |
| 3. Aiguille | 4. Diamond |

THE ELECTRO-MAGNETIC WAVE MISNOMER

Norman Silliman¹

ABSTRACT

This paper considers the assumptions that light has electromagnetic properties. By a review of the history of the concept and experimental evidence, the electromagnetic nature of light is questioned.

Light waves get their name.

Light waves (and by extension all electromagnetic waves) are assumed to have undulating components of electric and magnetic fields, oscillating sinusoidally. Fig. 1 is the standard view of what a light wave would look like close up.

The problem, from my point of view, is that light waves are not known to have any interactions with magnetic fields. Nor are they known to be influenced by an electric field. So, why do they have the name, '**electro**' and '**magnetic**' waves?

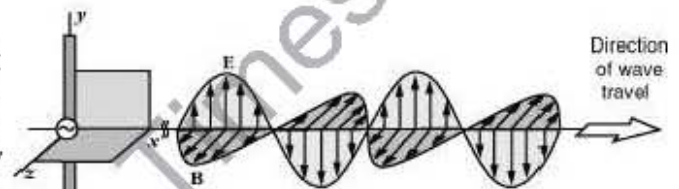


Fig. 1

We know that Maxwell predicted the existence of radio (long waves) radiation while he was providing us with the equations that describe the relationship between electric effects and magnetic effects.

Henry Boorse, in his book, The World of the Atom, Vol 1, 1966 tells us about some of James Clerk Maxwell's work:

First, his equations demonstrate that the speed of propagation of the electromagnetic field is exactly equal to the speed of light. He showed also that the propagated electromagnetic disturbance is at right angles (transverse) to the direction of propagation. In Maxwell's words, "This velocity is so nearly that of light, that it seems we have strong reason to conclude that light itself (including radiant heat, and other radiations, if any) is an electromagnetic disturbance in the form of waves propagated through the electromagnetic field according to the electromagnetic laws.

Second, Maxwell's equations demonstrate that the square of the refractive index of a medium is "equal to the product of the specific dielectric capacity and the specific magnetic capacity." These two results together show clearly the relationship of light to the electromagnetic field. [1]

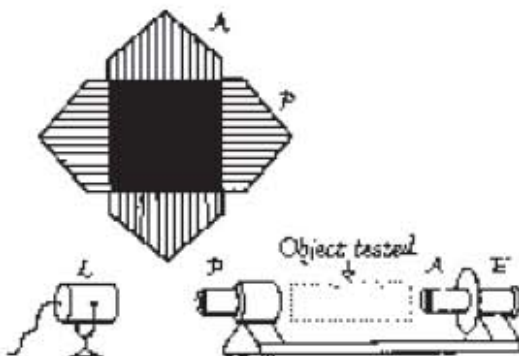


Fig. 2

But this is not where the original idea of light having a magnetic component came from. For the beginning of that mysterious relationship, we need to go back another 30 years, and to Michael Faraday.

Michael Faraday.

John Tyndall, in his book, Faraday as a Discoverer, 1868, tells us about the work of Faraday. "In November 1845, he

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announced his discovery of the "Magnetization of Light and the Illumination of the Lines of Magnetic Force." This title provoked comment at the time, and caused mis-apprehension. [2]

What was this discovery that Faraday made? Tyndall reports that Faraday discovered that (Fig. 2) "a piece of this (his own manufacture of heavy) glass, about two inches square, and 0.5 inch thick, having flat and polished edges, was placed as a **diamagnetic** between the poles (not as yet magnetized by the electric current), so that the polarized ray should pass through its length; the glass acted as air, water, or any other transparent substance would do; and if the eyepiece were previously turned into such a position that the polarized ray was extinguished, or rather the image produced by it rendered invisible, then the introduction of the glass made no alteration in this respect. In this state of circumstances, the force of the electromagnet was developed by sending an electric current through its coils, and immediately the image of the lamp flame became visible and continued so as long as the arrangement continued magnetic. On stopping the electric current, and so causing the magnetic force to cease, the light instantly disappeared. These phenomena could be renewed at pleasure, at any instant of time, and upon any occasion, showing a perfect dependence of cause and effect." [3]

Did Faraday show that the magnetic field affected the light, by rotating its plane of polarization? Or did he show that his "heavy" glass, (and 150 and more aqueous solutions) [4] had the ability of switching from non-polarizing to polarizing with the aid of a magnetic field. The side bar lists the known related effects. [5]

Tyndall says, "Manysubstances possess the power of turning the plane of polarization without the intervention of magnetism. Oil of turpentine and quartz are examples:" [6] Thin sheets of the mineral tourmaline were used by Faraday to polarize light used in his tests. [7] "In fact Faraday had notions regarding the magnetization of light which were peculiar to himself, and untranslatable in the scientific language of the time." [8]

Faraday appeared to be so sure that the magnetic field was central to the process of crystals interacting with light that he even tested the diamagnetic crystal bismuth.

"He (Faraday) looks at the crystal acted upon by the magnet. From its mass he passes, in idea, to its atoms, and he asks himself whether the power which can thus seize upon the crystalline molecules, after they have been fixed in their proper positions by crystallizing force, may not, when they are free, be able to determine their arrangement? He, therefore, liberates the atoms by fusing the bismuth. He places the fused substance between the poles of an electromagnet, powerfully excited; but he fails to detect any action. I think it cannot be doubted that an action is exerted here, that a true cause comes into play; but its magnitude

Photo-elasticity.

In 1816 Brewster discovered that transparent isotropic materials become optically anisotropic when subject to mechanical stress.

Faraday Effect

In 1845 Faraday investigated the transmission of plane-polarized light through a block of glass in the presence of a magnetic field.

The Kerr Effect

In 1876 J. Kerr showed that many isotropic substances, when placed in an electric field, behaved like a uniaxial crystal with the optic axis in the direction of the line of force.

Cotton-Bouton Effect

In 1905 Cotton and Bouton discovered a magneto-optical effect closely analogous to the Kerr electro-optical double refraction.

The Pockels effect

In 1906 F. Pockels discovered an electro-optical effect similar to the Kerr Effect but only in crystal that are also Piezoelectric. This effect has switching times (picoseconds) an order of magnitude faster than the Kerr effect switching time.

is not such as sensible to interfere with the force of crystallization, which, in comparison with the diamagnetic force, is enormous. "Perhaps," adds Faraday, "if a longer time were allowed, and a permanent magnet used, a better result might be obtained. I had built many hopes upon the process." [9]

He then examined gases; but all his efforts to produce any sensible action upon the polarized beam were ineffectual." [10]

"M. Verdet has since discovered that if a paramagnetic body, such as solution of perchloride of iron in ether, be substituted for the diamagnetic body, the rotation is in the opposite direction." [11]

Source of the misnomer.

This table summarizes the results that Faraday reported to the scientific community.

tourmaline	heavy glass	crystalline bismuth	pure water	various gases	vacuum
No magnetic field	Using a magnetic field	Using a magnetic field	Using a magnetic field	Using a magnetic field	Using a magnetic field
Yes polarized light	Yes polarized light	No polarized light	No polarized light	No polarized light	No polarized light

So, in the face of the fact that the magnetic field by itself did not cause any effect on the polarization of light, Faraday proclaimed that light could be magnetized, based solely on the results of the heavy glass experiment.

For ten years Faraday ran experiment after experiment that showed electricity and magnetism intrinsically linked together. So when he decided that light had a magnetic component, he automatically assumed that light must also have an electric component.

Maxwell had developed his equations that showed magnetism and electricity linked. So he perpetuated this same assumption.

But static electricity flows on the surface of materials, and has no associated magnetic fields. A simple experiment will show this. Using a magnetic compass as a primitive gauss meter to detect magnetic fields, and transparent tape as a source of static electricity, let us do a test. Striping a segment of tape off of a roll of transparent tape is a simple way to generate a large static field with common household materials. Place the compass on a flat surface, away from all metals. On either the East or the West side of the compass, pull a strip of tape off of the roll, while the roll is within a few (1 to 2) inches of the compass. (Close but not touching.) If there was a magnetic field generated during the creation of the static field, the compass would have reacted.

The compass will not tell us how strong the magnetic field is, but will distinguish between none and some.

So, the movement of surface (static) electricity has no magnetic field, while the movement of bulk (current) electricity does. This experimental result says that the magnetic field is associated with the bulk conductor metal, and not the electricity.

The flow of electricity triggers the bulk metals to generate a magnetic field, exactly like a lodestone does naturally. And, the magnetic field triggers the heavy glass to polarize light, exactly like tourmaline does naturally.

Was Faraday's conclusion justified?

On the basis of this evidence, can we accept Faraday's conclusion, that light has a magnetic and electric components?

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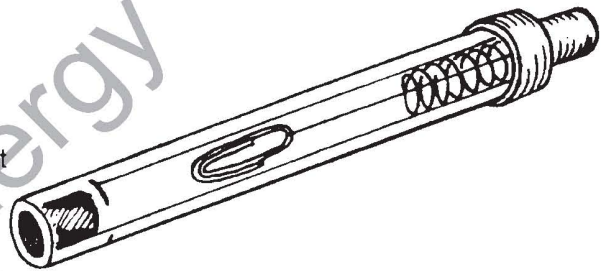
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DEVELOPMENTS IN RECHARGEABLE BATTERIES (A Review)

Atul Bhadkamkar

ABSTRACT

The consumer demand for electric watches, cellular phones, calculators, personal CD players and other microelectronic based devices have propelled significant developments of rechargeable batteries [1]. The electric vehicle market and developments in industrial traction and military applications demand batteries with high energy densities and high power. The energy and power requirements for various applications span several orders of magnitude: from 100 mWh for a button cell to 20 kWh for an electric-car battery and from 25-100 μ W for a cardiac pacemaker to 50 kW for military thermal reserve battery. The varied application requirements make specific battery chemistries, cell design, and materials preferable for certain applications [1]. This paper surveys the new battery field.

DISCUSSION

Recently, significant advances have been made in traditional aqueous-electrolyte batteries and in cells based on lithium anodes. The cadmium in the nickel-cadmium cells has been replaced by hydrogen absorbed in a metal alloy. PolyPlus Battery Company has reported the development of an advanced lithium-polymer rechargeable battery based on proprietary S-type polymeric film as the cathode. The peak power density of 3000 W/kg and high energy density of 500 Wh/kg are significantly higher than other rechargeable battery technologies [2].

A table comparing the various rechargeable battery technologies appears in an article by Pnina Dan [3], and is presented in Table I.

Dr. Pnina Dan [3] is the director of research and development for rechargeable lithium batteries at Tadiran Battery Division. The two lithium-based systems available today that are discussed in the article are lithium ion and lithium metal. The comparatively high voltage of 3.6 volts per lithium-ion cell is an advantage because fewer cells are required. The disadvantages are the high cost/performance ratio, low volumetric efficiency (as compared to the lithium-metal cell), and nonlinear discharge characteristic. For example, an AA-sized lithium-ion battery, discharging at a rate of 250 mA will drop from 4.3 volts to 3 volts in about 90 minutes and after 90 more minutes will drop off rapidly to 2 volts. In contrast, a lithium-metal battery will maintain a voltage of 2.8 volts for more than 3 hours before dropping off to 2 volts. According to the author the newly developed lithium-metal ($\text{Li/Li}_x\text{MnO}_2$) batteries offer energy density of 140 Wh/kg and volumetric efficiency of 300 Wh/liter; unmatched by any other battery type. The self-discharge rate is the lowest of all batteries. A typical lithium-metal battery stored at room temperature maintains 85% of its capacity after 1 year. Table I summarizing the results appears on the following page.

A comparison between Ni-MH and Li-Ion batteries, used in portable computers, is made by D. Blake Frye of Energizer Power Systems [4]. Portable computing especially with the advent of color display, outgrew the ability of the traditional NiCd batteries to provide the acceptable runtimes of greater than 2 hours. The Ni-MH chemistry provides a 40% greater energy density than the NiCd batteries. The lithium batteries have a working voltage almost triple that of nickel-based batteries and hence have triple the power. However, cycle life is a prominent concern for lithium batteries. The 1998 Li-Ion cells are predicted to have 60% more weight based on energy densities, than the Ni-MH cell. However, the volumetric energy density is only 10% greater than Ni-MH cell and the Lithium-ion cell remains significantly more expensive on a

dollar per watt-hour basis as compared to the NiMH cell. Ni-MH batteries find applications in the popularly priced models whereas the longer run time Li-ion batteries find use in the high-end models.

TABLE I BATTERY COMPARISON

Characteristic	Types				
	Sealed Lead-Acid	Nickel* Cadmium	Nickel metal hydride*	Lithium ion	Lithium metal*
Average operating voltage (V)	2	1.2	1.25	3.6	3.0
Energy density (Wh / kg)	35	45	55	100	140
Volumetric efficiency (Wh / liter)	85	150	180	225	300
Cost (\$ / Wh)	.25 to 0.5	.75 to 1.5	1.5 to 3.0	2.5 to 3.5	1.4 to 3.0
Memory effect?	No	Yes	No	No	No
Self-discharge rate (% month)	5 to 10	25	20 to 25	8	1 to 2
Temperature (°C)	0 to 50	-10 to 50	-10 to 50	-10 to 50	-30 to 55
Environmental concerns	Yes	Yes	No	No	No

*= based on AA-size cell

Taylor Moore summarizes the expert review conducted by the CARB (California Air Resources Board)-appointed advisory panel on the future of EV batteries [5]. The graph presented by Moore and reproduced as Fig. 1, compares the specific energy, peak specific power and cycle life for the various battery technologies. The United States Advanced Battery Consortium long term goal for specific energy is 200 Wh/kg. The General Motors Ovonic battery is expected to attain 90 Wh/kg by 1998 and the company expects that the advanced electrode compositions will give Ni-MH batteries the high specific energy levels of 120 -140 Wh/kg that are projected for lithium-ion and Na-S systems. The long-term USABC goal of volumetric energy density is 300 Wh/L and most of the battery technologies are projected to approach this goal. The peak specific power is another key performance parameter and USABC midterm goal of 150W/kg for a time period of 30 seconds during discharge down to 80% depth of discharge is already surpassed by lead-acid and nickel-cadmium systems. However, the charging and discharging of the batteries significantly reduces the peak specific power and hence it is recommended that the peak specific power be measured towards the end of the battery life. Long cycle life reduces the life-cycle cost of the battery. The sodium-nickel chloride, lithium-ion, NAMH, and nickel-cadmium batteries are expected to exceed the long term cycle life goal of 1000 cycles by the year 2000. An advanced battery manufacturer will have to invest between \$50 million to \$100 million in a plant to produce between 10,000 to 40,000 battery packs a year to realize economies of scale. Such investment is still considered very risky considering that the market for EV's is not well established. Major automakers, however, are making progress towards commercializing EVs. General Motors began leasing the EV1 in 1997. Chrysler displayed its EPIC electric minivan at the end of 1995. Ford has announced plans to market an electric conversion of its Ranger pickup.

C.C. Chan [6] gives an overview of the power electronics in electric vehicles. Table II [next page] is reproduced from his overview of the latest EV batteries. The specific power is recorded at 80% depth-of-discharge (DOD) and cycle life is at 100% DOD. C.C. Chan [6] mentions that a number of researchers are excited by the idea of coupling electrochemical batteries with electric flywheels or ultracapacitors which can deliver surges of power.

Recently, an ultra highspeed flywheel has been reported to deliver 5000-10000 W/kg, which is orders of magnitude higher than the power an internal combustion engine can deliver.

John K. Erbacher et al.[10] have evaluated commercially available Ni-MH batteries to check the feasibility of replacing the currently used Ni-Cd and sealed Lead-Acid batteries in aircraft. The incentive being the restrictions placed by the EPA on manufacturing batteries using hazardous materials and OSHA efforts to reduce worker exposure to hazardous materials. The characteristics tested were the manufacturer's rating verification (MRV), a C/10 and a 2C/5 capacity test (CT), self-discharge (SD), constant discharge current (CDC) and constant charge current (CCC). Representative AB_2 and AB_5 Ni-MH batteries were tested. The MRV charge was close to the manufacturer's rating. The cylindrical and prismatic AB_5 production cells show a self-discharge rate of 1-1.5% per day, which is in close agreement with the manufacturer's ratings. The two AB_2 cells manufactured by licensees of Ovonic Battery Co. shows great discrepancies. The difference could be due to the fact one of them is manufactured using the latest AB_2 technology. Above 49°C, the prismatic cells retained capacity twice as much as the cylindrical cells and the AB_5 cells had a much higher capacity retention as compared to the AB_2 cells at higher temperatures. One prismatic AB_5 cell and one cylindrical AB_5 cell maintained a 75% discharge capability at 5.75 Capacity discharge rate and one cylindrical AB_5 cell maintained a 75% discharge capability at 4.25 Capacity discharge rate. The two AB_2 cells based on Ovonic battery Co.'s technology have a 75% capacity retention at a maximum discharge rate of 2.25C. The two AB_5 prismatic cells and one cylindrical AB_5 cell show a charge retention greater than 90% at a 2C charge rate. The cylindrical AB_5 cell gave a good performance at a charge rate of 3.5C which is marginally acceptable for room temperature aircraft applications. In conclusion Erbacher states that the AB_5 technology which is more advanced than the AB_2 technology would require further development to increase the discharge and charge current capability to 10C and 5C respectively; and extend the low temperature limit to at least -20°C.

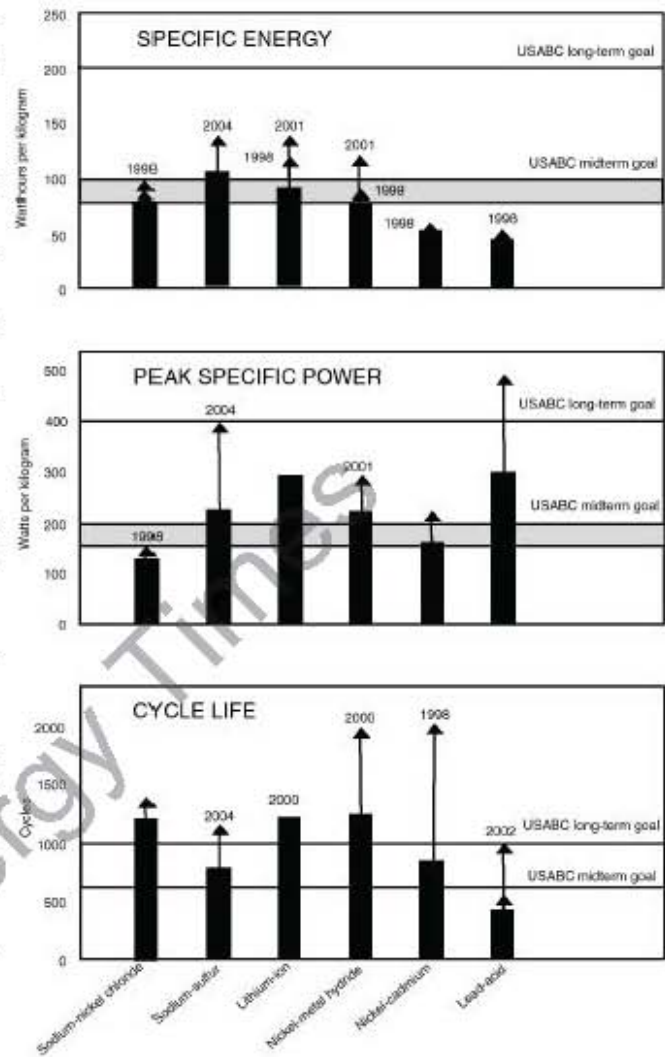


Fig. 1 Battery Comparison

TABLE II COMPARISON OF LATEST EV BATTERIES

	Mfgr.	Model	Weight (kg)	Capacity (Ah)	Specific energy (Wh/kg)	Specific power (W/kg)	Cycle life
Pb-Acid	Johnson Controls	GC 12550	18.6	37	23.7	120	500
Pb-Acid	Sonnenschein	DF 6V 180	30.2	150	29.3	80-100	700
Pb-Acid	Electro-source	Horizon	27	112	50	>300	900
NiCdSAFT	STM	23.2 5.140	136	45.3	260	2000	
Na-S	ABB	B-11	253	238	81	152	600
Na-S	Silent Power	PB-MK3	29.2	292	79	90	800
Ni-MH	Ovonics	OBC	17.1	100	80	245	1000
Ni-Fe	Eagle-Picker	NIF 200	25	203	51	99	920
Zn-Br	Sea	ZBB-5/48	81	126	79	40	350

Brown et al. [11] discusses the design factors for improvements in the Ni-MH battery. In conventional Ni electrodes the valency of Ni changes by one, from +2 to +3; giving a charge transfer per mole equivalent of Ni as 96,500 coulombs or 26.8 A-hr. The negative metal-hydride electrode alloy of type AB₅ where 'A' is the hydrogen absorption alloy and 'B' is the nickel alloy. Six hydrogen atoms are absorbed per the equivalent six metal atoms. Hence six equivalents or 6 x 26.8 = 160.8 ampere-hours (Ah) can be stored per mole or 436 grams. This gives an upper theoretical limit of 215 wh/kg. Some nickel-titanium alloys NiO.4 TiO.6 can have an upper bound capacity of over 500mAh/g. Ovonic Battery Company has claimed that nickel can be cycled from α - Ni(OH)² to K(NiO₂)³ yielding a change in the oxidation state from +3.67 to 2.00 or a 1.67 electron transfer per nickel atom. Taking into account these new materials a theoretical upper bound of 312 watt hours/kg is achieved.

Coates et al. [7] of Energy Research Corporation has presented a Nickel-Zinc battery which can deliver over 60 Wh/kg and more than 450 W/kg at the 12C rate. The main problem that stalled the progress of the nickel-zinc cell in the past was its very short cycle life due to zinc dissolution and shape change associated with it. A technology which reduced the solubility of the zinc has solved this problem. The formation of the soluble zincate intermediate reaction product is reduced by using calcium hydroxide as an additive to promote formation of calcium zincate which is insoluble in the electrolyte. This passivating layer at the electrode/electrolyte interface reduces zinc dissolution. A doping of conductive metal oxides like PbO or Bi₂O₃ on the electrode helps in the electronic conduction through the passivating layer. Amongst all the nickel based cells, zinc provides the highest specific energy, lowest cost and the least environmental impact. Even the nickel-metal hydride batteries have heavy metals and are relatively expensive. These nickel-zinc cells are capable of 600 cycles at a 80% depth of discharge.

Olson [8] describes the progress made at Optima Advanced Technologies, which is currently developing a high power (600 W/kg) spiral wound lead-acid battery for use in hybrid electric vehicles where the fuel-fed engine is downsized and the battery provides the high power for acceleration. The sealed spiral wound technology was first developed by Gates Rubber Company in the mid 1970's. The advantages of such a design are high power due to the thin plates, long cycle life resulting from the compressed plates, effective volume utilization, case integrity, and low self discharge rate. The high discharge and regenerative braking requires the battery to have a faster cooling rate. Fortunately, the high intercellular spaces provide a high surface to volume ratio and subsequently higher cooling rates. The lead-acid cell is the only cell wherein the discharged state of both the electrodes is the same chemical compound, namely $PbSO_4$. Hence after the cell is fully discharged a continued discharge results in cell polarity reversal. Tests show that repeated over-discharge does not show a significant reduction in capacity and cycle life.

Nelson [9] of Boulder Technologies Corporation presents the thin metal film technology used to develop valve-regulated, lead-acid batteries with ultra high rate discharge performance. These cells are of the spirally wound configuration with plate thicknesses and spacings of the order of 0.2 to 0.25 mm and are capable of delivering specific power levels of 4.4 kW/kg. This is useful in pulsing applications such as hybrid electric vehicles, power tools, and engine start.

Electric vehicles, aircraft, military applications and communications needs are promoting the continued progress in rechargeable battery technology. Portable microelectronic devices such as cellular phones and laptops are encouraging development of paper thin batteries similar to the ones being developed at Oak Ridge National Laboratory, where solid state rechargeable lithium batteries less than 15 micrometers thick have been developed. The development of new alloys for the Ni-MH batteries has increased the cycle life of the cells. Developments are being made on all the frontiers in battery technology and improvements in competing chemistries mean that the right choice of a battery depends on the specific application need.

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HEURISTIC DISCUSSION OF THE PROBLEM OF FINDING LONG RANGE INTERACTIONS, EGS-CONCEPTS

A. Akimov ¹

ABSTRACT

Most of theoretical and experimental physical investigations carried out in various countries over the recent decades by researchers from different professional areas indicate observable or theoretically predictable effects that may be regarded either as phenomenology, or as problems that cannot be accounted for by known processes. Notably, many effects are associated with the behavior of objects featuring spins or angular momenta. This paper (with 177 references) surveys the developing torsion field technology with its faster than light velocities.

DISCUSSION

It seems that Ch. Oxley from Rochester University was the first to discuss the unusual behavior of spinning objects as exemplified by the anomalous difference in neutron scattering in the ortho- and para-hydrogen [1].

Neutron scatter with the para-hydrogen molecules (singlet state) was demonstrated experimentally to be thirty times as strong as that with the ortho-hydrogen molecules (triplet state). As was detected in the 1980's, the spin polarization of atomic hydrogen prevents its merging into molecules [2].

The experiments carried out in the recent years in the Brookhaven and Aragon Laboratories demonstrated that protons with spins oriented opposite to spins of a proton polarized target pass through the target protons according to the descriptive expression of A.D. Krish as if without any interaction [3], whereas for identical orientation of bundle and target protons, scatter is in good compliance with the theoretical concepts. Unusual behavior of spinning particles was observed in various experiments on different accelerators [175].

As V. Barishevsky and M. Podgoretsky established experimentally, neutron passage through a spin polarized target causes neutron precession as large as if precession-inducing field is several orders of magnitude stronger than the magnetic field created by the target nuclei [4]. Experiments with ³He established dependence of helium-thermal conductivity on the states of nuclear spins [5-8] that were first predicted theoretically for gases [9, 10], and then for solids [11]. Using the installation for measuring Lamb shift, Yu. Sokolov established unusual traits of hydrogen interference in the ²S_{1/2} and ²P_{1/2} states [12-14] that cannot be explained by the traditional concepts.

It might be well to point out the important areas such as nuclear spin waves [15, 16] and pseudo magnetism [17, 18] that recognize the spin nature of observed phenomena, but are unable to explain them exhaustively within the framework of the phenomenological approach.

Finally, a wide scope of experiments should be mentioned including mental ones that are associated with quantum non-locality such as, for example, the Aaronov-Bohm effect or the paradox of Einstein-Podolsky-Rosen [19] that are still the object of heated controversy, although there exists a quantum mechanical

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explanation [20-22]. The fact that objects with spin are quantum non-locality is fundamental to the range of phenomena under consideration. Some of the above experimental results were jointly considered in [51] as manifestations of the spin phenomenology.

Besides the experiments with microscopic objects, long-range effects or phenomena were sometimes observed at the macroscopic level. Ch. Imbert found that the circularity polarized electromagnetic wave is shifted from the plane of incidence [23], in the direction defined by the helicity sign.

A. Tam and W. Kapper observed repulsion and attraction of circularly polarized laser beams [24]. If one considers the relation between circularly polarized vector modes and spin [25], these experiments seem consistent within the range of phenomena under consideration.

Of independent interest are the experiments demonstrating the so called "gyroscope effect" [26-29] that is disputed by some researchers [30, 31]. According to [27], the experiments might be indicative of the interaction of spinning bodies.

K. Perebeinos et al. demonstrated as early as in 1966 an experimental system for transmission of data through massive screens where the transmitter and the receiver were built around mechanical rotating systems [32].

Astrophysical effects associated with objects such as stars or black holes are usually considered in the MQJ-mass, charge, torque-parameter system [33, 34]. In particular, R. Wald demonstrated that black holes with SJ torque interact with particles having spin so that: $\delta \times J = \sigma \times S$ and $\sigma = 1$ if the torque and spin are of the same direction, which corresponds to repulsion, or $\sigma = -1$ if torque and spin have opposite directions, which corresponds to attraction. There are approaches to the phenomena usually associated with the "hidden mass" of the Universe explaining them through interaction of the galaxies. The longstanding observations by S. Shnol et al. [35] of different processes demonstrated their existence, even at long distances, by observing correlation of polymodal histograms.

As has been already stated, there is something common to all these examples although they are heterogeneous in appearance - in all cases the subjects of inquiry or observed natural phenomena demonstrate spin (meaning the classical spin [36-41]) or angular momentum.

Formally, these examples produce initially an impression of being put together for joint consideration in a somewhat artificial and arbitrary manner. It might be well to recall here that seemingly different processes and phenomena, such as Coulomb scattering of charged particles, light diffraction, tunneling, radio communications, electric motors, etc. are united by the fundamental properties of electromagnetism. **If the classical spin is recognized as a classical manifestation of the matter (like charges and masses), emotional clashes and psychological rejection of the proposed approach are easily removed.**

Joint analysis of the above mentioned results provides reason enough to suppose the existence of specific interactions and fields generated by the classical spins or angular momenta. As follows from the examples, if these fields do exist, their properties are indicative of the fact that they are as universal as the electromagnetic and gravitational ones, which are manifested at both micro- and macro levels.

In the wake of the studies of H. Tetrode, A. Fokker and Ya. Frenkel [42-45] in the 20's and those of J. Wheeler and R. Feynmann [46, 47] in the 40's, recent decades have witnessed efforts in quest of new long-range actions (see, for instance, [48-51]). The experiments carried out so far leave many white spots on the map of long-range actions. As was noted [52], the existence of non-Abelian long-range actions cannot be regarded as excluded.

The studies of F. Jordan and I. Thiry [53, 54] in the domain of scalar fields that gave rise to the Jordan-Brans-Dicke scalar-tensor theory [55, 56], also lie within the mainstream of studies on new fundamental fields. The tensor field concept by V. Marusyak [57] is also of interest. With these ideas, a categorical opinion was also stated that no long-range actions can exist but electromagnetism and gravitation (see, for example, [58, 59]).

The guess of Cartan about fields generated by angular momentum density, formulated as early as the beginning of this century, seems to be the first indication to the existence of a special torsion-generated field. Concurrently with Cartan studies but without any relation to them, a member of the Russian Physical and Chemical Society, Prof. N. Myshkin experimented with torsional devices and in fact discovered natural manifestations of long-acting fields caused by torsion [60, 61]. In the 70's V. Belyaev carried out similar experiments. Prof. Myshkin's investigations seem to have foreshadowed by many decades the discovery of the so called "fifth force" [62, 63]. The nature of the "fifth force" that is usually associated with the baryon charge goes back to the paper of T. Lee and C. Yang [64]. Yet even theoretically the interaction caused by the baryon field must be weaker by a factor of 10^9 than that caused by gravitation [59], which rules out any possibility of observing it.

The studies carried out by E. Cartan and A. Einstein in the 20s has laid the groundwork of a theory that later was named the Einstein-Cartan theory (ECT) (see, for example, [65-67]). This theory constitutes a part of the wider theory of torsion fields.

Assumptions were made earlier that the "true" fields (non-commutative gauge fields, or in R. Utiyama terms "first-class" fields) are associated with Physical Vacuum [68, 69]. It seemed reasonable from this point of view to try to get insight into the mechanisms of interactions related to the classical spin, at least on the level of simplistic models.

Some preliminary remarks are due. We consider Physical Vacuum as a material medium filling isotopically all the space (both free space and substance), featuring quantum structure and non-observable (in the average) in non-disturbed state. This Vacuum is described by the operator $\langle 0|$ [70]. Violations of vacuum symmetry and invariance [71] causes different states. In particular cases of observing various physical processes and phenomena, the observer creates usually adequate models of the Physical Vacuum. Today astrophysics is characterized by using various constructive Physical Vacuum models such as θ -vacuum, Urnu vacuum, Boulevard vacuum, Hartie-Hocking vacuum, Rindler vacuum, etc.

In modern interpretation, Physical Vacuum is represented as a complicated quantum dynamic object manifesting itself via fluctuations. The theoretical approach dwells upon the concepts of S. Weinberg, A. Salam and S. Gleshow.

As will be seen from further analysis, it was deemed reasonable to return to a somewhat modified Dirac electron-positron model of Physical Vacuum. Use of the Dirac model will be justified in spite of its drawbacks and contradictions, if it enables conclusions that do not follow directly from the modern models.

Also, taking into account that Vacuum is a state without particles and relying upon the model of classical spin as circular wave package [39] ("circulation energy flow" according to the Belinfante terminology [41]), we consider Vacuum as a system of circular wave packages of electrons and positrons rather than of electron-positron pairs proper.

One can readily see that under these assumptions, electrical neutrality of the electron-positron Vacuum will be satisfied by a state where the circular wave packages of electrons and positrons are imbedded in each other. If in doing so the spins of the imbedded packages are opposite, such a system will be compensated not only in charges, but also in classical spin and magnetic moment. This system of

imbedded circular wave packages will be identified as phyton (Fig. 1). Dense package of phyton [72] will be regarded as a simplified model of Physical Vacuum (Fig. 1).

It might be well to note that, as in the supposed phyton model, the effects observed in the experiments by A. Krish [3] are equivalent to demonstrating the plausibility of imbedded, although dynamic, states in systems with opposite spins. Another point must be indicated corroborating at least the permissibility of the phyton model. According to the J. Bjorken model [73-75], one can construct, electrodynamics relying only on the interacting electron-positron field and without recourse to the notion of photons. (This model is not without drawbacks). The concept of quanta as electron-positron pairs was used by M. Broido [76] independently of G. Bjorken. Simultaneously, Ya. Zeldovich demonstrated [68] that presence of an electromagnetic field in Vacuum results in generation of electron-positron pairs, thus producing nonzero Vacuum energy regarded as field energy. Relation between electromagnetism and Vacuum fluctuation was also noted by L. Rivlin [166]. Previously, similar ideas were formulated for the gravitation field by A. Sakharov [69].

Formally, if photons are spin-compensated, their mutual orientation in the ensemble, the Physical Vacuum, may be arbitrary. But there is an intuitive feeling that Vacuum is an ordered structure with linear package as shown in Fig. 1. The idea of ordered Vacuum seems to belong to A. Kirzhnits and A. Linde. It would be naive to regard the constructed model as a true structure of Physical Vacuum because one cannot expect more from a model than artifacts can provide.

Consider some important cases of Physical Vacuum disturbance by various external sources. Possibly, this would allow us to appreciate the realism of the approach being developed.

1. Let a charge " q " be the disturbance source. If Vacuum has phyton structure, the charge action would manifest itself in charge polarization of the Physical Vacuum as is shown conventionally in Fig. 2. This case is well known in quantum electrodynamics [77]. The Lamb shift, in particular, is explained traditionally by the charge polarization of electron-positron Physical Vacuum [1]. If one also considers the above-mentioned G. Bjorken model, the concepts of Ya. Zeldovich [68] and [73], the state of Physical Vacuum charge polarization can be interpreted as an electromagnetic field (the E-field in Fig. 2).

2. Let a mass " m " be the disturbance source. Unlike the above case where we met with a well known situation, a hypothesis will be formulated here. Physical Vacuum disturbance by the mass " m " would manifest itself in symmetrical oscillations of phyton elements along the axis directed to the center of the disturbance object as shown conventionally in Fig. 3. This Physical Vacuum state may be characterized as longitudinal spin polarization interpreted as gravitation field (G-field). As mentioned above, A. Sakharov introduced the concept of gravitation field as Physical Vacuum state [69], which corresponds to the presented model of gravitation. The polarization states of gravitation are discussed in [59].

Since, according to the constructed model, the gravitation field is represented as longitudinal waves, one cannot screen from it. Disregarding the gravitation mechanism, but assuming that gravitation waves are longitudinal waves in elastic Physical Vacuum, V. Bunin [78] and V. Dubrovsky [79] demonstrated that these waves have speeds of the order of 10^9 c. [times speed of light].

Physics usually gives no consideration to theories dealing with speeds that are faster than light. This is due to the fact that many mental experiments would violate the cause-effect relations. It is, however, possible, that at a higher level of knowledge the "super-light catastrophe" would be overcome as the "ultra-violet catastrophe" was overcome earlier.

The suggested interpretation of the gravitation mechanism is not something exotic. The induced gravitation theory [80] regards the gravitation field as a result of vacuum decompensation arising at its polarization [68, 69, 81].

G. Butorm [82, 83] and also B. Bershadsky and A. Mekhedkin [84, 85] estimated the oscillation frequency characteristic of gravitation. The spread of estimates, however, is very high and varies from 10^9 to 10^{40} cps. There is ground to believe that the frequency domain 10^{20} to 10^{40} cps is more realistic.

If the gravitation mechanism is really associated with longitudinal spin polarization of Physical Vacuum, one has to admit that the nature of gravitation is such that there exists no anti-gravitation.

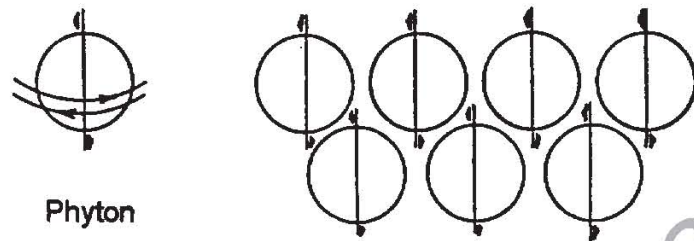


Fig.1.

Phyton structure of Physical Vacuum

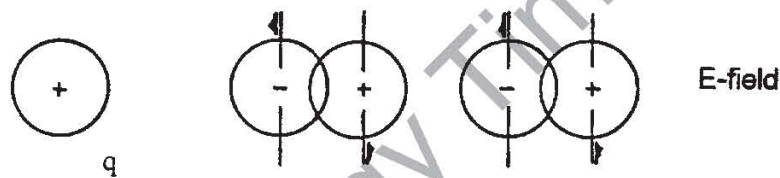


Fig.2.

Charge polarization of Physical Vacuum

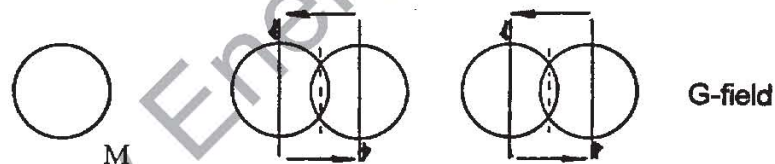


Fig.3.

Longitudinal spin polarization of Physical Vacuum

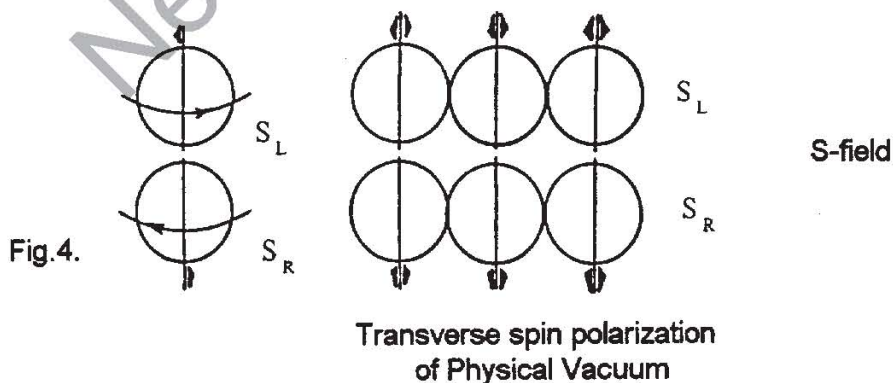


Fig.4.

Transverse spin polarization of Physical Vacuum

Figs. 1-4 Diagrams of polarization states of Physical Vacuum.

3. Let the classical spin be a disturbance source. Assume that it acts upon the Physical Vacuum as follows. If the source has spin oriented as shown in Fig. 4, the phyton spins oriented like the source spin keep their orientation. The phyton spins opposite to the source spin undergo inversion under the effect of the source. As a result, Physical Vacuum transits into the transverse spin polarization state. This

polarization state can be interpreted as spin field (S-field) that is a field generated by the classical spin. The formulated approach is in accord with the concept of torsion field as a condensate of fermion pairs [150].

The polarization spin states S_R and S_L are contrary to the Pauli prohibition. According to the M. Markov concept [86], however, for densities of the order of Plank ones [59, 87], the form of fundamental physical laws may be different. For such a specific material medium as Physical Vacuum, rejection of the Pauli prohibition seems not less permissible than for the quark concept.

In conformity with the above approach, one can assert that the unique medium, Physical Vacuum can be in different phase (polarization, to be more precise) states, or EGS-states. In the charge polarization state this medium manifests itself as electromagnetic field (E). In the longitudinal spin state it manifests itself as the gravitation field (G). Finally, the same medium (Physical Vacuum) in the transverse spin polarization state manifests itself as a spin field (S). Thus, EGS-fields correspond to EGS-polarization states of Physical Vacuum.

Generated by independent kinematic parameters, all the three fields are universal or, in R. Utiyama nomenclature, first-class ones. They appear at both micro- and macroscopic levels. It is pertinent to recall here the words of Y. Pomeranchuk: "All Physics is Vacuum Physics." **The ideas developed above enable one to attack at least the problem of universal fields from some common ground.** In the proposed model it is the Physical Vacuum that plays the role of unified field whose polarization (phase) states manifest themselves as EGS-fields. The modern nature needs no "unions." It has only Vacuum and its polarization states, "unions" reflecting only the degree of our understanding of interrelations among fields.

Many publications use the general form of the notion of phase state and polarization states of Physical Vacuum (see for example, [33]). As was repeatedly noted in previous publications, the classical field may be regarded as the Vacuum state [68, 69]. However, attention to the actual fundamental role of Physical Vacuum polarization states was insufficient.

Usually it was not stated which Vacuum polarization's were meant. With this approach, Vacuum polarization by Ya. Zeldovich [68] is interpreted as a charge polarization (electromagnetic field). Vacuum polarization is interpreted, according to A. Sakharov [69], as longitudinal spin polarization (gravitation field). For torsion fields, polarization is interpreted as transverse spin polarization.

The presented opinions correspond to the R. Utiyama concept of "informational A-fields" stating that to each independent parameter (and again, kinematics parameter, as was indicated with good reason by L. Dadashev) of particles "ai" its own material field "Ai" is determined by which particles corresponding to this parameter interact. In contrast to the second-class fields associated with space symmetries, the first-class (calibration) fields are associated, as noted by R. Utiyama, with field-generating particles through a fundamental principle without any arbitrariness. The EGS-concept suggests the idea of the Physical Vacuum polarization states, as such to be a general principle.

As one cannot assert that no polarization states are possible besides the three considered above, there is no convincing reason to discard *a priori* the possibility of other long-range actions. It is possible that the concept of A-fields and Physical Vacuum polarization states (Physical Vacuum phase states) would start a breakthrough into the area of new long-range actions.

It would be possible to interpret the universal fields generated by the classical spin [72] as long-acting spinor ones. Theoretical consideration was given to spinor long-range actions by researchers of the D. Ivanenko school [67]. If one takes into consideration that a torsion field can be expressed by means of a pair of spinor fields, this interpretation is not in conflict with the preceding point of view. As was pointed out by M. Markov, "from the very appearance of spinors in physics, there arose and still exists an idea of

fundamentality of precisely spinor fields that, possibly, define structurally all other fields" [95]. Most interesting publications on spinor analysis and spinor fields are the references [88 through 94]. It might be well to recall, in the context of M. Markov ideas, the thought of J. Wheeler that the physical super-space also should involve the spin structure parameters [87], which has been demonstrated by the present publication.

Some recent fundamental publications indicate directly to the spin nature of torsion fields [96-100]. As was previously noted, the concept of torsion fields dates back to the ideas of E. Cartan and A. Einstein and, in the last decades, to the studies of W. Kibble [65] and D. Sciama [66]. **The analytical review of A. Yefremov [167] discusses in detail the development of the torsion field concept.** Additionally, the reviews [101, 102] can be recommended. G. Shipov [103] introduced torsion fields by means of the Physical Vacuum theory.

Return to the models of Physical Vacuum polarization states. Attention is drawn to the fact that within the framework of the constructed models both the gravitation and torsion fields are associated with spin by polarization states. The gravitation field is associated with the longitudinal spin polarization, and the torsion one - with transverse polarization. It is pertinent to recall in this connection that concepts relating gravitation nature to spin, formed one of the research domains in gravitation. Later torsion (torsion field) was considered as an independent physical reality generated by the classical spin (see, for example, [150]). The relation of spin to gravitation and torsion fields created within the framework of previous concepts is a contradictory situation. In the developed approaches this contradiction is eliminated by relating gravitation and spin to different spin polarization states.

Also, closeness of the polarization states of gravitation and torsion allows one to assume that there may be close or identical properties of the gravitation and torsion fields that differ essentially from electromagnetic fields. As noted by some researchers, both torsion and gravitation fields are not screened off by natural media, but owing to different reasons. If one keeps to the constructed models, gravitation field is not screened because it is regarded as longitudinal oscillations in Physical Vacuum. Torsion field is not screened in virtue of specific spin effects related to the classical spin. (Such a situation was discussed by L. Okun [52, page 122]). However, as will be shown, the knowledge of the fact that the torsion field is associated with transverse spin polarization suffices for designing sufficiently simple torsion radiation screens. We will return to this point below, and here only remark that **the insight into the physical principles of torsion field screening and ability to design torsion screens played a key role in solving many fundamental issues.**

Some more properties of torsion fields that are noted are important for the following analysis. In contrast to the electromagnetic and gravitation sources creating central-symmetry fields, the torsion sources create

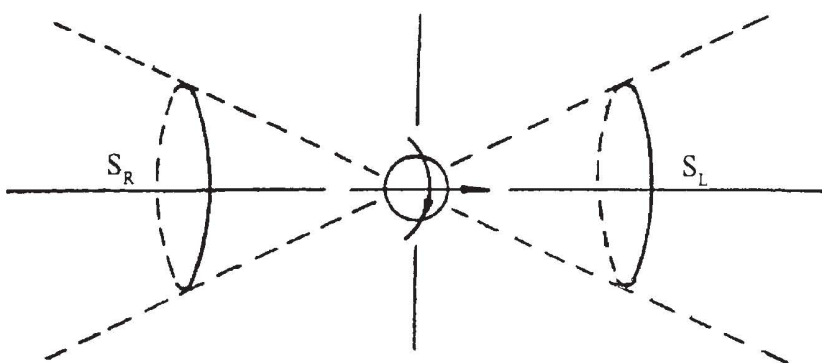


Fig. 5 Direction diagram of static torsion field of spin object.

axial-symmetry fields as shown in Fig. 5. The spinning objects create polarization in two spatial cones corresponding to the left and right torsion fields S_R and S_L respectively. A. Trautman and V. Kopchinsky [99, 100] were the first to point out the axial nature of polarization by torsion sources.

The experiments we are familiar with suggest that torsion fields are generated not only by spin, but also by body rotation. The latter fact

does not follow from the well known torsion theories, but bears out the correctness of E. Cartan's ideas. If rotation, classical spin including, is stationary (angular rotation frequency does not vary, rotating mass is distributed uniformly along the rotation axis, there is no precession, nutation, etc.), the source generates a static torsion field. If rotation is non-stationary, the source generates wave radiation.

Preliminary experimentation is indicative of the fact that a static torsion field exists over a fixed interval beginning from the source, and that within this interval field intensity undergoes with distance only minor variations that could be characterized as availability of spatial frequencies (Fig. 6). No boundaries were found for torsion waves, as is true for static torsion field. The issue of torsion field variation with distance is still open.

Experiments with torsion waves have not yet produced positive results about field intensity vs. distance. Informational rather than energy nature of torsion actions could make it difficult to draw conclusions about torsion radiation intensity vs. distance. Here it is difficult to explain why no difference in action is observed at different distances -- either because of field independence of distance, or because of negligible power consumption on attaining one or another result of torsion action, or in virtue of the fact that the action is similar to a "trigger mechanism." Taking into account that torsion field is generated by classical spin or angular momentum, it will affect objects with spin or angular momentum.

The opinion that Physical Vacuum behaves as a super-fluid liquid is commonly accepted. **There are also researchers who believe that Physical Vacuum behaves as an elastic solid, precisely as aether was regarded at the times of I. Newton.** In the traditional approach these two points of view are mutually exclusive. According to the concepts of Physical Vacuum polarization states, super-fluidity corresponds to its charge polarization. There are reasons to believe that in the spin polarization state Physical Vacuum manifests properties of an elastic medium.

The above points of view are not contradictory, but correspond to different states of the Physical Vacuum. From this standpoint, the conclusions of V. Bunin [78] and V. Dubrovsky [79] do not seem absolutely contradictory to Nature.

Taking into account that transverse spin polarization states of the Physical Vacuum, that is states where it appears as a medium of ideal elasticity, correspond to torsion fields, it would be only natural to assume that the torsion signal propagates with speed much exceeding that of light. **The studies of N. Kozyrev [104, 109] on registration of true positions of stars in the stellar sky provide an experimental evidence in favor of this assumption.** Since what N. Kozyrev called "time flow" had, as he believed, the features of "left" and "right," one may assume that the experiments registered proper star torsion radiation. References to N. Kozyrev's experiments would be plagued by their obvious weak sides that were noted by himself, had not they been repeated successfully on a stricter basis by the team of I. Yegonova under the direction of Academician M. Lavrent'ev [105]. Positive results were obtained in 1991 by A. Pugach from the State Astronomical Observatory of the Ukrainian Academy of Sciences [106]. These are not, of course, definite proofs, but they provide a good reason for regarding this problem with the attention it deserves.

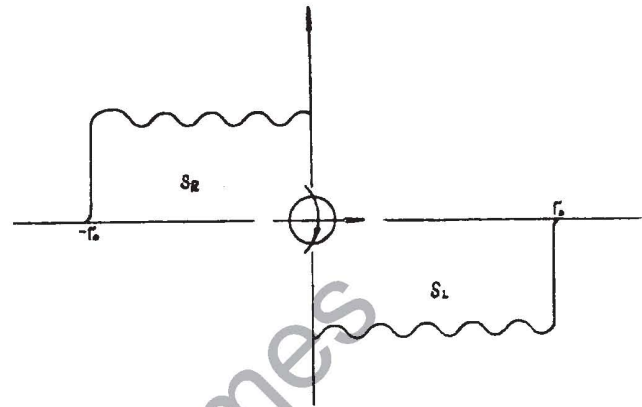


Fig. 6 Intensity of static torsion field of spin object as function of "r".

It would be of interest to mention the unusual behavior of the object 3C395 moving with speed evaluated as exceeding the speed of light [107], although attempts are made to account for these observations within the framework of standard theories.

Another feature of torsion fields must be mentioned. Just as a magnet produces residual magnetization in a ferro-magnet, the torsion source creates "residual" polarization through acting upon the classical spin both at the levels of substance and the Physical Vacuum. [This may explain the "Aspden Effect," see *New Energy News*, vol 2, no 10, Feb. 1995. –Ed.] Then, the spin polarization states are metastable. A torsion field of given spatial structure can be written by means of torsion generators (sources) at the levels of substance and Physical Vacuum.

Taking into consideration that all bodies have quite evident nonzero spin ordering, they have inherent torsion fields polarizing the free space in their vicinities and, thus, creating torsion phantoms. (The phantoms can be recorded by the techniques developed by S. and V. Kirlian [108] and modified by N. Belomestnykh.)

Under certain conditions, the induced torsion field is fixed at the substance level. There is good reason to believe that inherent torsion fields are recorded on the conventional photographs by emulsion spins. Unusual behavior of photographs (films) seems to be used for the first time as early as 50 years ago by A. Abrams [109], and later by T.C. Hieronymus, C. Upton, W. Knuth, De La Warr, et al.

There is good reason (also experimental) to assume that the so called "water memory" is realized owing to water polarization through action upon the classical spin by inherent torsion field of molecules of dissolved substance [110]. (In fact, the process of appearance of memory in water is much more complicated than is presented here [176].)

When analyzing theoretically a special case of water structuring by biopolymers, N. Bul'enkov introduced the notion of "dispersion module" of water [111] or water fractal repeating biopolymer's structure. In the torsion model, the "Bul'enkov module" is a water cluster whose spatial spin polarization imitates biopolymer spatial spin structure, and not an abstract fractal copy of the biopolymer. Such water spin clusters appear under the action on water of any molecules whose inherent torsion field is more intensive than that of water molecules. That is why it is impossible to observe the water memory effect for many low-molecular compounds. The water memory effect can be observed not only at solving substances in water, but also remotely as happens in the case of medicine rewriting by R. Voll technique.

The model of Physical Vacuum polarization states enabled the establishment of one important fact. As was already mentioned, the torsion field is registered in the cases where Physical Vacuum passes into the transverse spin polarization state. Relying upon the synergetics criteria, a still more general approach can be formulated. Assume that torsion fields are always registered where Physical Vacuum is in a spin non-equilibrium state.

In this connection, return to Fig. 2. One can readily see that at the charge polarization of Physical Vacuum the charge fission of phytons results in spatial spin fission. As a result, spins are not compensated, which is equivalent to the appearance of torsion component in the electromagnetic field. If the gravitation and torsion fields manifest themselves in a "pure" form, the electromagnetic one always has a torsion component, which is an important fundamental fact. The torsion field will be observed both in the electrostatic field and electromagnetic radiation.

The failure to understand this fact often led to unsuccessful attempts to account for many processes generated by electromagnetic sources as due to electromagnetic phenomena. Here one should mention studies by V. Kaznacheev [112], Ziang Kanchen, Hideo Uchida [113, 114], et al. In H. Uchida's experiments, for instance, his device with screened monitor and metallic cap at the waveguide

output responded to switching on a 13.0 Gcps generator. This phenomenon can be explained only if one knows that the electromagnetic signal in the waveguide excites at a torsion signal of the same frequency that cannot be screened off. It is pertinent to note also that bio-location operator response to electromagnetic radiation [172, 173] seems related to this ability of the electromagnetic field to generate the torsion component. Many researchers investigating electrostatic systems (D. Kelly, H. Nieper et al., [155, 117]) failed to provide a convincing explanation of the observed effects because they did not understand the role of spin phenomena and their relation to electromagnetism.

The science of this century has met rather often with manifestations of various aspects of the torsion fields. As the researchers didn't understand the spin nature of the observed processes and phenomena, each of them would name or declare the fields and radiations responsible for them. (Some authors worked when spin was not even discovered). Among them it seems we should cite pseudo magnetism [17, 18]; "fifth force" [62]; "empty waves"; significant part of Tesla phenomenology; "radiation energy" by H. Moray; "tachyon fields" by Fienberg; "free energy" by Kelly; Nieper's "gravitation field energy"; "space energy" by Schaffranke and Harris [116]; "unified field" by Mahareshi-Jagelin [117]; "emptiness energy" by Reichenbach; "vital magnetism" by Messmer; "bio-cosmic energy" by Hieronymus; Mumia by Paracelsus; X-force by Eemen; N-radiation by Blondlot [118]; "ponderomotoric forces" by Myshin [60, 61]; "radiation energy" by Abrams [155]; O-radiation or Orgone by Reich [159]; M-field (morphogenetic field) by Schaldrein and B. Haeim [158]; Z-ray by Cbizhevsky; "radiesthetic radiation" and "form field" [119]; ϕ -fields or ϕ -radiations [120]; "bipolar fields" by Kroppa; "bioelectric gas" of Liacurase ?; D-field by Deev; the basic component of "mitogenetic rays" by Gurvich [122]; the main factor in "mirror cytopathic effect" of Kaznacheev [112]. This list might be extended further. A common physical reality behind the diverse phenomenology was guessed by various writers, in particular, in a more complete form by D.A. Kelly in 1986 and Antwort Schema in 1989.

The variety of approaches to constructing torsion field theory [167] points to the fact that it has not yet reached sufficient perfection. Its power has yet been proved in some important domains. Exact solution of nonstationary cosmological models from which it followed that a singularity can be eliminated if spin-torsion interactions are taken into consideration [99, 100], seems the first serious success of torsion theories.

A theoretical substantiation was given to the above by unusual interaction of the beam and target protons polarized through acting upon spins [123]. The experts in physics of elementary particles know numerous experiments where unusual behavior of spin-oriented particles has been observed [174]. In these situations a potential is usually introduced phenomenologically to enable results in good compliance with the experiment. Just as for polarized protons, these experiments need evaluation from the standpoint of spin-torsion interactions (interactions with respect to classical spin). Torsion field theory enabled one to explain attraction and repulsion of laser beams in A. Tam and W. Happer [124-126] experiments, which was impossible within the framework of traditional ideas. The approach to interpretation of the so called "fifth force" as a manifestation of spin-torsion interactions proves to be sufficiently effective [127]. These experiments are discussed in [51] as proof of real manifestation of long-range action within the concept of torsion fields. V. Panov and Yu. Sbytov demonstrated that the observed Barch anisotropy can be attributed to cosmological rotation.

For some experiments, a possibility was raised of explaining them at the process level, rather than using a phenomenological description. In particular, a new approach became possible to interpretation of the above mentioned experiments bringing about the EPR paradox [128]. Let annihilation of pair e^- & e^+ proceed according to the following scheme: two γ -quantums (at two-photon annihilation) fly out from the annihilation point in opposite directions. Owing to their spins, the quantums spin-polarize Physical Vacuum in some σ -vicinity and during their motion leave spin-polarized pinches along their trajectories. The pinches constitute an ideal torsion communication channel between the flying away quantums. Variations of the polarization angle of one quantum produce torsion disturbance transmitting action from one quantum

to another via the torsion channel, spin-polarized Physical Vacuum (S-channel). This action is real provided that our above assumption about the torsion signal propagation speed is true. Thus, one can consider quantum non-locality as a manifestation of "hidden parameters" [22] in the form of the torsion field.

As it becomes a serious theory, that of torsion field has demonstrated its high predictiveness. All the obtained experimental data had been first predicted theoretically. It is planned to realize some experiments in the near future, mostly fundamental (for example, [101, 102]).

The assertion that torsion effects cannot be observed because the content of spin torsion interactions is of the order of 10^{-49} to 10^{-50} is the usual argument against considering any experimental results that could attest in favor of manifestations of torsion fields and spin-torsion interactions. This assertion, however, has a well known flaw. An extremely small constant appears only in the Einstein-Cartan theory (ECT), the torsion theory without torsion propagation using for gravitation and torsion fields a common Lagrangian with a unique bond constant proportional for spin-torsion interactions not only to "G", but also to "h", which defines its smallness.

In passing from ECT to theories allowing for torsion propagation, the Lagrangian involves besides "G" many torsion bond constants. Then, references to the ECT constant seem to be intolerably arbitrary. Within the framework of theory of torsion with propagation, the theoretical constants of spin-torsion interactions proposed by different authors differ by dozens of orders of magnitude. It should be recognized, therefore, that in torsion theories outside the scope of ECT the issue of spin-torsion interactions is left open, and discussion of torsion effects not only is justified, but remains extremely topical. Moreover, it is the experiment that would determine the actual spin-torsion interaction constant.

Some of the experiments cited at the beginning of this publication may be regarded as bearing out real manifestations of torsion fields and spin-torsion interactions. They include: difference in neutron scatter on ortho- and para-hydrogen [1]; anomalous precession of neutrons at passing through a spin polarized target [4], unusual change in hydrogen interference intensity in the states $^2S_{1/2}$ and $^2F_{1/2}$ [12-14]; shift of circularly polarized electromagnetic wave from the incidence plane, depending on the helicity sign [23], variations in gyroscope weight in non-stationary (non-equilibrium) state [26-29], astrophysical effects due to "hidden mass"; some phenomena in the dynamics of Solar system, including Sun-Earth relations, etc. Theoretical studies, however, are required for these experimental results and phenomena, as it was done first by F. Naik and T. Pradhan [124] and then by Yu. Obukhov, P. Pronin and I. Yakushin [125, 126] for the experiments of A. Tam and V. Happer with laser beam interactions.

Besides the particular conclusion made during presentation, the above analysis allowed one to draw some basic conclusions. First, there are sufficient grounds to assume that, as mentioned above, the diverse phenomenology of spinning objects, discussed in the beginning of this publication, is possibly due to specific long-range interactions of spin nature where transversely spin-polarized Physical Vacuum plays the role of material medium, or carrier of interactions.

Second, it was assumed that the constructed model of transversely spin-polarized Physical Vacuum interpreted as S-field, may be identified with torsion fields. In particular, the fundamental fact that transverse field-polarization of Physical Vacuum is caused by spin, speaks in favor of this assumption. As was already mentioned, many researchers also believed that the nature of torsion fields is related to the classical spin.

Third, insight into the principles of torsion generator (torsion source) design is an important consequence of the constructed models. Four classes of generators can be mentioned.

FOUR CLASSES OF TORSION GENERATORS

1. Just as in electricity, the elementary particle charges are the primary sources of field, the elementary particle spins are the primary sources of torsion field ("as a rule," one could add for the sake of correctness, because γ -quanta also can be primary sources of torsion field). It might be well to remember that torsion field can also exist in the absence of spinning objects.

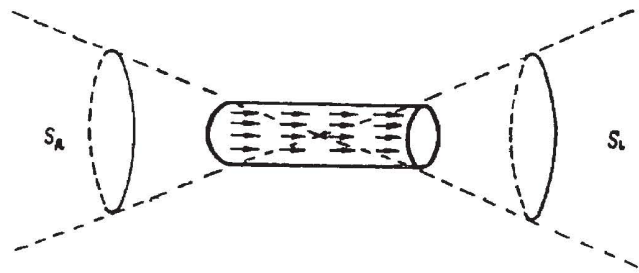


Fig. 7 Directivity diagram of collective torsion field of spin-polarized body.

In the domain of torsion one deals with collective torsion field of spin-ordered systems in much the same manner as electricity, one often deals with collective electrical fields generated by systems of electrical charges (nuclei, atoms, charged bodies, etc.). Any nuclear spin target is a source of torsion field. The spatial structure of their torsion field is depicted in Fig. 7.

A body having any kind of spin ordering (nuclear, atomic or molecular) will have the same torsion field. Magnetization of a ferro-magnet produces spatial orientation of molecular currents creating primary magnetic fields. This ordering results in a collective magnetic field. The ordering of magnetic moment orientation automatically orders the classical spins generated by electron motion in circular molecular currents. As a result, collective torsion field appears. Any permanent magnet, thus, has a torsion field in addition to the magnetic one (Fig. 8).

Without any recourse to the notion of torsion field, but proceeding from the unusual nature of objects with spin, A. Peres [175] pointed out the specific feature of permanent magnets as polarized macroscopic bodies. This fact allows one to account for variations in biological activity of water (distiller as well) after its exposure to a magnet that is known as "water magnetization". From the traditional point of view, there is no sense to expose distiller that is diamagnet to magnet; but the effect is observed stably and may be registered instrumentally. The nature of this phenomenon becomes clear if one takes into account that the magnet has torsion field ordering the spin structure of water. It is the torsion field and not the magnetic one that changes properties of water under the action of a magnet.

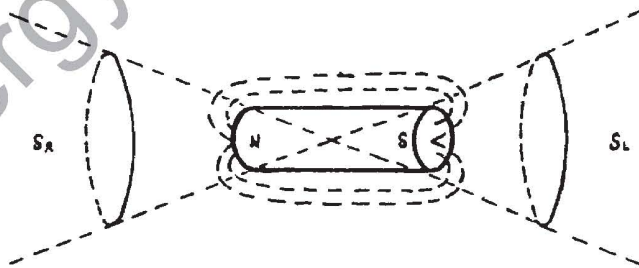


Fig. 8 Directivity diagram of collective torsion field of magnet.

The above mentioned property of a magnetic field, to generate torsion field, seems to be one of the most important factors accounting for the capability of bio-location operators (dowser) to react to magnetic fields [168 -171]. The bio-location operator presumably responds more to the torsion component of magnetic field than to the field itself.

2. As was noted before, the electromagnetic field generates the torsion one. It immediately follows that the major part of instrumentation used in electric and radio engineering, as well as in radio electronics, are sources of torsion radiation and can be used as torsion generators. It is only natural that devices producing high voltage potentials causing intensive static fields are especially effective. For example, there are radio engineering devices involving circular or spiral electromagnetic processes from coils to traveling wave tubes and magnetrons. There exists a variety of radio engineering and radio electronic instruments that could be used as torsion radiation generators. However, one must understand clearly what is generated by the sources - static or wave radiation; what is the spatial structure of these fields and

radiations; what is their (wave and spatial) frequency spectrum; etc. Sometimes the Tesla transformers prove to be a convenient source of torsion radiation, which possibly gives clue to Tesla's words that "... mistaken are those who think that my system transmits electrical power."

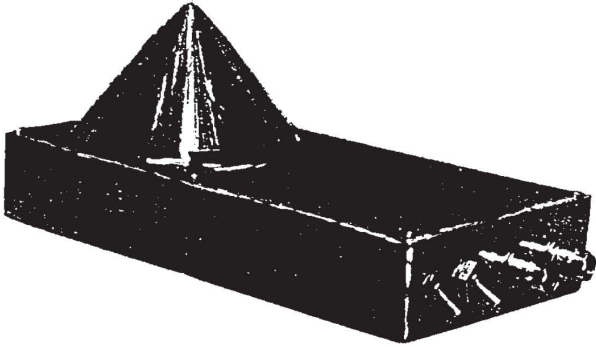


Fig. 9 Exterior view of torsion generator of medium functional capabilities and wide directivity diagram. Generates static torsion fields and torsion radiation at torsion frequencies up to 100 Mcps in S_R and S_L modes

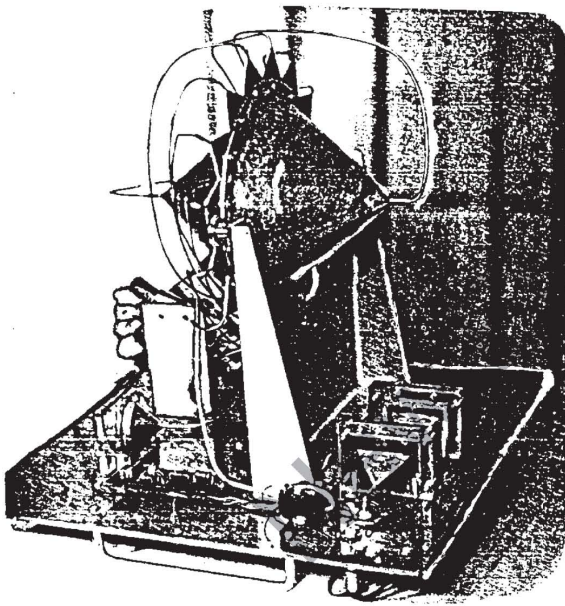


Fig. 11 Interior view of torsion generator of high functional capabilities: generation of static torsion field and torsion radiation ; smooth adjustment of torsion frequencies; all kinds of external modulation; modulation by two-dimensional spin matrices; address radiation mode; smooth intensity adjustment of torsion output; operation in modes S_R and S_L .

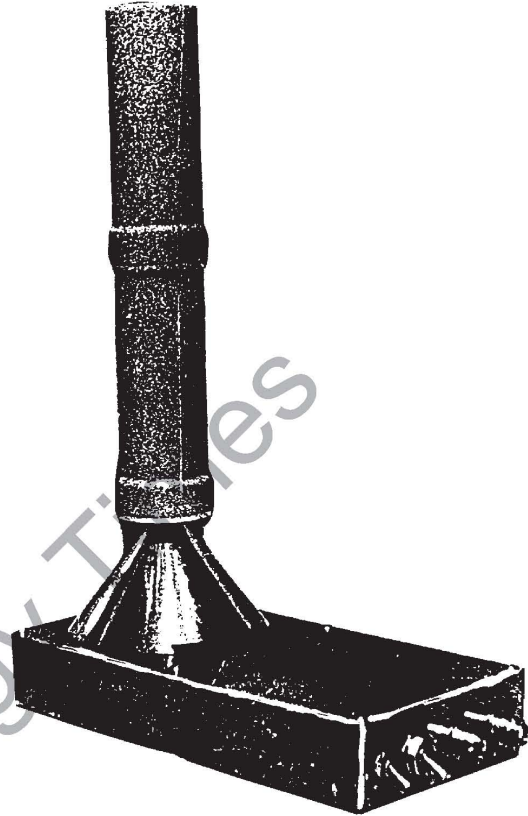


Fig. 10 Exterior view of the torsion generator of Fig. 9, augmented with directivity diagram "pinch" focuser.

Recently, some researchers in this country and abroad designed some torsion generators relying upon elements of electro- and radio engineering, although different authors called their designs differently. Among them may be listed the generators of A. Befidze-Stokovsky who employed cavity resonators and various crystals; Dr. G. Sergeev who used flat and volume capacitors with special filling agents; N. Federiko, D. Deev; E. Pronin; S. Tarakhtin who used devices like Helmholtz coils; and A. Bobyr. The list of national designers could be further extended.

3. Generators dwelling upon specially organized spin ensemble or rotation of material medium (field of body). The generators of K. Perebeinos with rotating masses and V. Yurovitsky with rotation magnetic field (patented) seem to be the first torsion sources of this kind. (V. Yurovitsky was the first to formulate the idea of using spinor long-range interaction for accounting for some physical phenomena.) A variety of torsion generators have been designed and manufactured in Russia. They offer smooth adjustment of torsion frequencies, various modulations, generation of right and left torsion fields, smooth output power regulation, etc. Two types of commercially

produced torsion generators are shown in Fig. 9, 10 and 11. Different generators make use of different media for rotating objects such as electron flows, plasma, massless fields, etc.

4. Devices based on various geometrical and topological forms constitute a special class of torsion generators. They produce the same effects as other torsion radiation sources, but their operation cannot yet be explained within the framework of the existing torsion theories. Theoretical studies are under way in this area and assumptions can be made at the phenomenological level.

As was noted above, possibly phytons in Physical Vacuum are interacting, and owing to their spin properties and axial symmetry the phyton structure of the Physical Vacuum makes up a Euclidean space where phytons have linear lamination. Insertion of a geometrical or topological object into such a medium should introduce into this linear medium a geometrical or topological disturbance. Non-equilibrium (disturbance) in Physical Vacuum results in rearrangement of torsion potentials in some vicinity of the object. As a result, this domain remains self-compensated with respect to the external space. (In further research, one has to explain why topological disturbance of Physical Vacuum results in rearrangement of torsion and not electromagnetic or gravitation potentials.) The spin polarization states of topological nature manifest themselves as torsion fields. It is expedient, therefore, to consider bodies of various forms as sources of static torsion fields. In doing so, one should highlight the fact that the torsion fields can actually be generated only by form. Such spin polarization states (static torsion fields) are equally generated by a monolithic cone (independently of material), and a hollow one with arbitrarily thin walls.

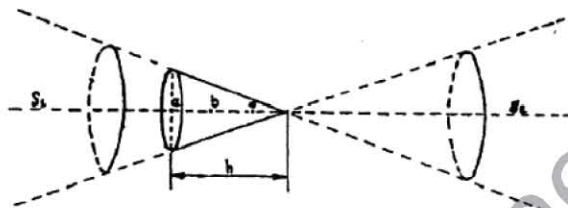


Fig. 12 Directivity diagram of cone-generated static torsion field.

Examples of torsion field configurations in the vicinities of cones and cylinders are shown, respectively in Fig. 12 and 13. One can easily see that topological disturbance leads to appearance of sign-balanced torsion fields S_R and S_L . Sign of the field may be determined through figure action upon different objects: for example, [130] describes action of cone torsion field upon crystallization of micellar structures.

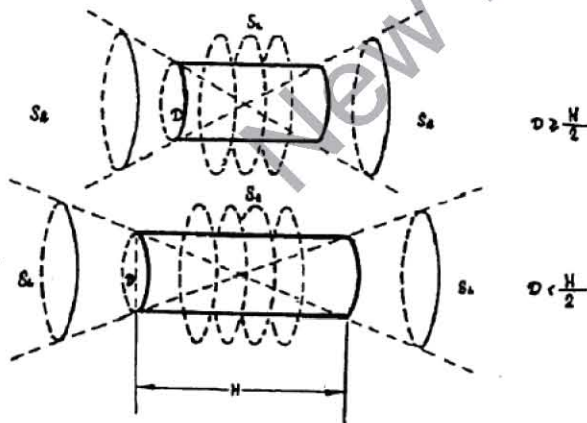


Fig. 13 Directivity diagram of cylinder-generated static torsion field.

The maxima of left torsion field inside the cone were experimentally demonstrated, to lie along its height in the points dividing it into three equal parts (points "b" and "c" in Fig. 12). It was also proved experimentally that the ends of "short" cylinder ($D > H/2$) create polarization zones with right torsion field, and those of a "long" one ($D < H/2$) with left torsion field.

Having no insight into the physical nature of the effects arising around bodies of different forms that cannot be explained by the existing physical concepts, they called them "form field", "form radiation" or "radiesthetic radiation". Extensive literature exists in this area [119, 131, 132] and also many patents, [133, 134].

The pyramids in Egypt and elsewhere as well as spires and cupolas of churches and mosques seem to be the first form effect-based torsion generators. Apart from ancient times, the first radiation source using the form effect were the generators of A. Beridze-Stokovsky. The formulated approach allowed one to approach at physical level some known

phenomena, in particular, to understand the effect of empty and honeycomb structures discovered by S. Grebennikov [135, 136].

5. It is only natural that devices built around a combination of the principles underlying the above four classes of generators constitute a wide class of torsion generators. We cite as vivid examples only two cases, Y. Yurovitsky and later V. Bobyr proposed torsion generators with mechanically rotated magnets.

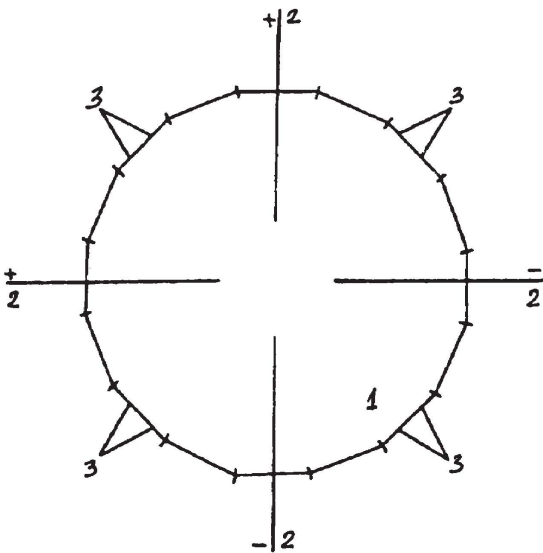


Fig. 14 Diagram of torsion generator with electromagnetic excitation and topological resonator.

1 - prism, 2 - electrodes, 3 - ovoid.

Patent [137] describes a device that, judging from its design, is a torsion generator where torsion field is excited through a combination of the topological effect (torsion generators of Class 1) and electrical polarization (Class 2). According to the patent (Fig. 14), two pairs of orthogonal electrodes (2) under 300 KV voltage are inserted into a hexadecagonal prism (1) whose sides are partially made as a Mobius band. Cones or ovaloids (3) are put on some sides. The constant electric voltage generates primary intensive torsion field owing to the form effect. According to the authors, diverse effects were observed at generator operation within the radius of 10 m. **For example, salt solubility doubles, chemical reactions were running with reduced amount of catalysts if any, gravitation decreased down to 10%.** As it should be under torsion action, the created static field induces spin polarization of the Physical Vacuum preserved as a metastable state, which was mentioned before. **Therefore, with this torsion generator, many effects were observed during the four days after switching it off.**

The patent of W. Kroppa describes a generator where the working medium was placed between magnet poles. Electromagnetic radiation was applied orthogonally to the magnetic lines of force (according to W. Kroppa, within the range of cps through Gcps) to act on the working medium. With such a combination of magnetic field and electromagnetic radiation, the Kroppa generator may be regarded as a torsion one. The working medium was then used for medical purposes or production of medical preparations.

The device designed by Ziang Kanchen provides another example of a combined torsion generator (the author regards its operation as "bio-super-high frequency communication"). The generator is a three-dimensional figure consisting of plane pentagons (1) (see its cross-section in Fig. 15). The output signal is fed out by pipes (5). There are standard-signal generator (2) and matrix object (3) inside the figure. The object was subjected to generator signals at frequency of about 11.0 Gcps. The torsion component of electromagnetic signal excited torsion radiation of (3) at its proper characteristic torsion frequencies. The torsion field is amplified due to the effect of forms (1) and (4). Torsion radiation is focused on the vertices of

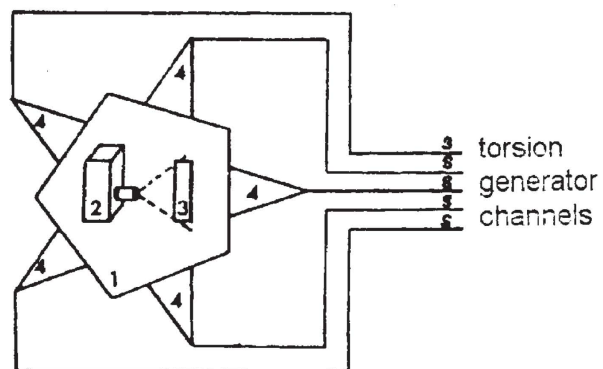


Fig. 15 Torsion generator of Ziang Kanchen.

cones (4) and is output by hollow waveguides. (Mistakenly assuming that its device has electromagnetic nature, the author employed waveguides.)

There is no difficulty in understanding that the count of possible combinatorial torsion generators is extremely high. The coming of torsion generators offers strong possibilities for carrying out fundamental, applied, and engineering experiments discussed in general in [72].

Here, it would be reasonable to dwell only on the fundamental issues. First, to eliminate any possibility of mistaking electromagnetic actions for torsion ones during experiments where torsion actions were anticipated, all the generators have screening against electromagnetic radiation. Moreover, prior to the experiments, it was required to confirm by means of conventional instrumentation that such a screened generator produces no electromagnetic radiation.

Second, experiments were chosen where effects were anticipated such that these effects cannot be produced by traditional action, among them electromagnetic ones.

Third, it was necessary to get at least preliminary experimental confirmation of the spin (in the classical understanding) nature of radiation of designed generators.

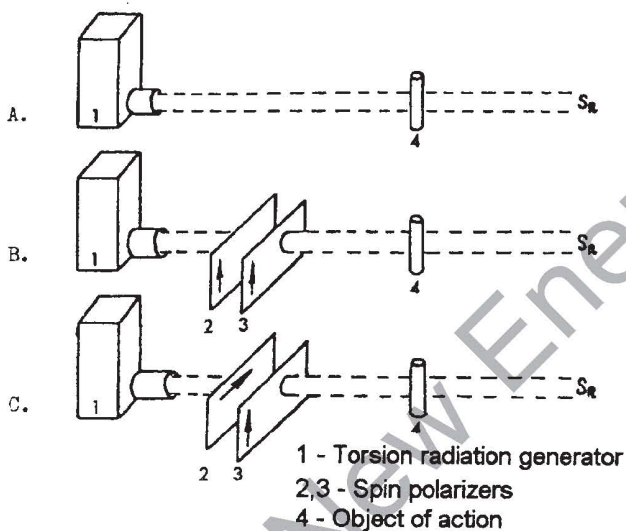


Fig. 16 Diagram of torsion polarizer experiment.

The following scheme of experiments was suggested and realized to this end. The torsion generator (1) (Fig. 16A) creates narrow-beam torsion radiation S_R . Action is detected through variations in the characteristics of action object (4) at switching on the torsion generator. Next, a material with spin-ordered molecular structure is taken. As the collective field of molecular spins, a plate of such a material has an oriented torsion field. In the next experimental phase, the torsion generator beam is crossed by two plates of this material having identical orientation of their proper torsion fields (Fig. 16B). Here, the same torsion generator action is registered as with the absence of torsion polarizing plates.

Finally, (Fig. 16C), the torsion generator beam is crossed by two spin-polarized plates having orthogonal orientation of their proper torsion fields.

In this case, no torsion effect is observed. This could happen only in the case of spin nature with transverse polarization of torsion generator radiation. The observed effect is defined by interaction of the transverse polarized spin (torsion) field and orthogonally crossed fields of torsion polarizer plates. (A. Deev was the first to employ crossed polarizers as shut-off in one of his generators.)

Comparison of this method with numerous Western patents suggesting various waves for reducing the influence of the so called geopathogenic zones reveals that many of the approaches had correct guesses such as the use of linearly structured materials [156], but inability to understand the spin nature of radiations prevented all of them from making the decisive step to using the crossed structures. (Preliminary experimental testing of the screening action of polyethylene films was accomplished by A. Samokhin in 1989 in his study of erythrocyte sedimentation. The effect of torsion radiation, also at using screening films, upon the membrane of erythrocyte and lymphocyte cells was studied methodically in 1990 by the team of V. Alabovsky with participation of Yu. Petrov.)

The above experiments may be implemented using a stricter methodology as show in Fig. 17. The study employs a torsion generator (1) radiating torsion in opposite directions. In contrast to Fig. 16, the objects of action (4) are placed symmetrically to the right and left of the generator. Torsion polarizers (2 and 3) are placed between the generator and the objects so as to cross the torsion radiation cone. Then, if the polarizers have the same orientation of their torsion fields, the objects are affected as if there is no polarizer. If any polarizer is oriented orthogonally to another plate, there is no action upon both objects, from the right and left. (This scheme was tested experimentally for the first time by V. Pronin.) Thus, a phenomenon is observed that can be interpreted as closing of the spin polarized space between the plates (2) and (3) as though it behaved like a solid.

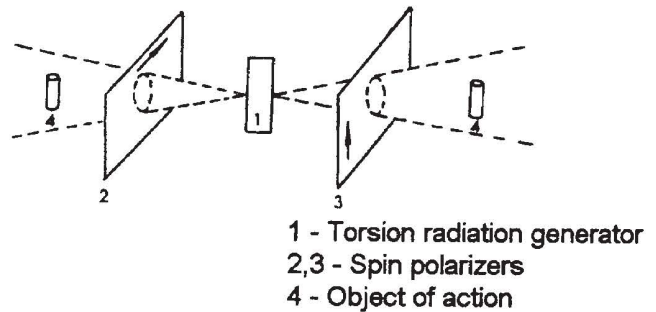


Fig. 17 Advanced diagram of Fig. 16 experiment.

There were important experiments for determination of the nature of torsion fields. The natural torsion field sources such as crystals with polarized nuclear spins were usually used as nuclear targets (Fig. 7) or ferromagnets having a torsion component owing to ordered molecular currents in closed loops (Fig. 8), make up a spatial structure of collective torsion field that satisfies the traditional concepts. Spins as torsion field sources generate two cones S_R and S_L of the torsion field directivity diagram going in opposite directions, which corresponds to the concept of classical spin.

We have a similar situation in the case of the so called passive torsion generators relying on the "form effect" (Figs. 12 and 13). But it is reversed if active torsion generators are used where torque is produced by an external source of energy. As show in Fig. 18, depending on one or another torque direction with respect to the generator, there appears either right-, or left-handed screw field.

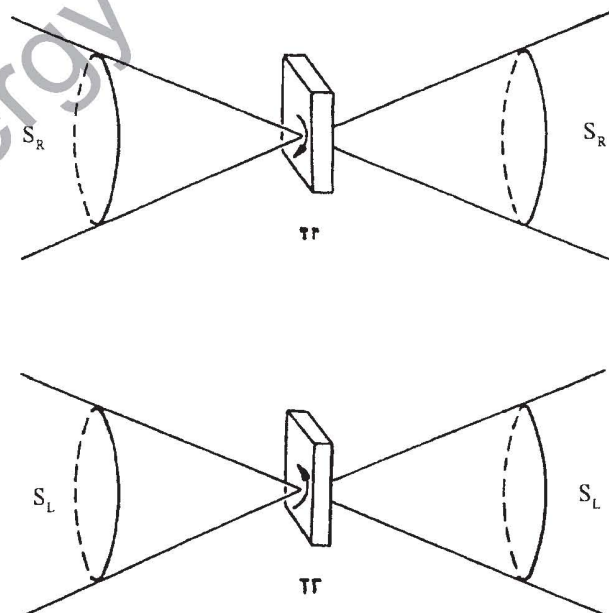


Fig. 18 Directivity diagrams of torsion field generator (TГ).

Such a field diagram cannot be created by the classical spin. It is only helicity that can generate a field in this case. Experiments point out the identity of actions of "spin" and "helical" sources (generators), but availability of "spin" and "helical" sources creates a theoretically nontraditional situation. Intuitively, it seems that torsion fields can, in fact, be the collective manifestation of close, but not identical, entities.

Design and commercial production of torsion generators enabled comprehensive studies of feasibility and effectiveness of torsion methods and means in various domains such as design of new power sources, transport, materials with new properties, data transmission, biotechnology, medicine, agriculture, etc. A task was formulated of creating a sum of technologies (S-technologies) that could offer a material basis of new 21st century technology. Concurrently, a program was developed of fundamental theoretical and applied (experimental) studies in the domain of torsion fields.

There is reason to pay attention to two important independent avenues of research such as principles of torsion computer design and biophysical consequences of the torsion paradigm. The prospects of computer development were discussed in many recent publications that permanently mentioned that we are approaching the physical limits in improving characteristics of computer facilities [138]. At the same time, interpretation of torsion fields as metastable states of spin-polarized Physical Vacuum allows one to formulate a basically new approach to quantum (torsion) computers. The elements of Physical Vacuum, phytons have at least two metastable states S_R and S_L , therefore they are binary elements. Phytons seem to have parameters of the order of Planck ones-switching time 10^{-44} s and size 10^{-33} cm. Design of computers based on such elements would be more than just a breakthrough into the domain of a new generation of electronic computers. No matter how fantastic this project looks, it is plausible, but would require overcoming multiple scientific and engineering barriers. In torsion computers (TC), it is Physical Vacuum that provides the material medium for design. There will be two major problems. First, how to program a volume of space so that its structure corresponds to that of a torsion computer? (Approaches to this problem were investigated from different positions by L. Porvin and, independently, R. Avramenco and V. Nikolaeva.) Programming of the Physical Vacuum may dwell on static structure, or dynamic architecture, or adaptive architecture. The latter two variants are practically impossible with the conventional computers. Second, it is necessary to know the principles and have facilities for operator (user) interaction with such a Physical Vacuum-based computing system.

The latter fact is directly related to the second area of research, biophysical consequences of the torsion paradigm. W. Little pointed out the similarity between neuron networks and a magnetic system [139, 140], and J. Hopfield demonstrated that these networks with symmetrical relations are equivalent to spin glasses. As a result, this gave rise to the possibility of constructive modeling of brain mechanisms. Of importance is the analogy between the multiple connections of each neuron with other neurons and the long-range action in spin glasses where each spin is related simultaneously to many other spins.

As soon as one abandons understanding of spin as a magnetic movement, these ideas open ways to a new approach, which, in its turn, allows one to regard the spin glass as an ensemble of objects with classical spins. The glass, then, seems to be a system where arbitrary spatial spin configurations are possible for generating torsion field. At the same time, the external torsion field can form in spin glass spatial spin structures.

The constructed model suggests that for each act of conscience there exists in the brain its corresponding spin structure that causes appropriate characteristic torsion radiation. Simultaneously, under each external characteristic torsion radiation there will occur in the brain its spin structure corresponding to certain perception in Conscience.

This allows one to draw some conclusions. First, comparison of the parapsychological, extra sensory phenomenology [120, 143, 144, 151] with the torsion field concept enables formulation of effective approaches to its substantiation on a strictly physical basis [145] and to employ these substantiations in experiment

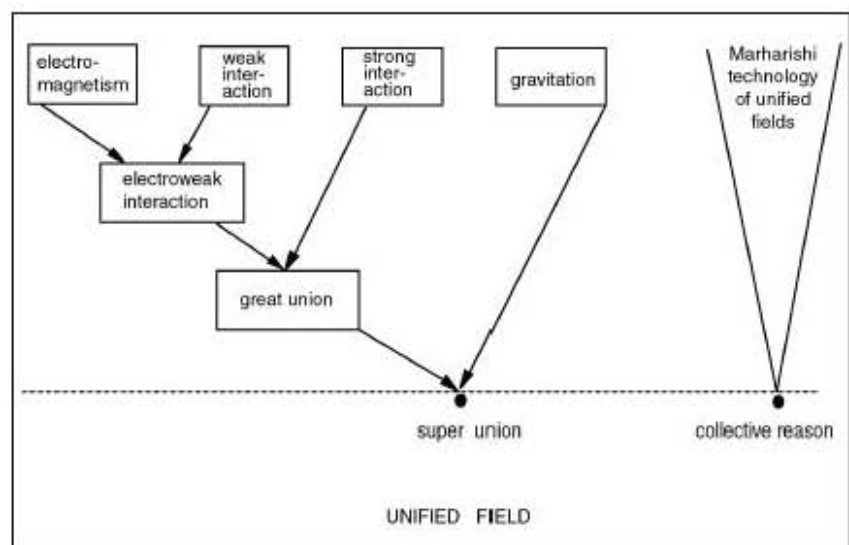


Fig. 19 J.S. Hagelin unified approach to the four fundamental interactions and human factor – collective reason.

design. Interesting studies in this area have been carried out by N. Lyubimov, V. Stralets, S. Lytaev, A. Khiunovsky, et al. All of the above concepts give one a good reason to assert that the parapsychological phenomenology relies upon the micro world laws and the fundamental interactions, and needs no specific biological principles like biofields, radiestethic radiation, etc., to account for its existence.

Second, a possibility occurs to assign a material carrier in the form of torsion fields to Conscience and Thinking. The ideas of J. Hagelin [109, 146, 156] were conceptually close to these notions, but correct understanding of the role of Unified Field in Conscience processes did not extend to identifying it with the Physical Vacuum, and they were not completed by the ideas of the fundamental role played by spin systems and torsion fields.

The essence of J. Hagelin ideas is schematized in Fig. 19, where the left side represents the points of view existing in theoretical physics of the Unified Field theory. The right side is a novelty that essentially implies that the domain of Conscience and Thinking has a material basis in the form of Unified Field, one could understand the physical nature of Conscience, Thinking and Corrective Reason. J. Hagelin's approach provokes no basic objections, although his rather formal comparison of the Vedic concepts with the theory of super strings, which J. Hagelin regards as a physical basis of the Unified Field, is doubtful.

If one takes into account the already existing ideas about the role of torsion fields in physical nature of Conscience and Thinking, the J. Hagelin scheme could be remade as show in Fig. 20. This version shows that Conscience, Thinking and Collective Reason are not simply related to the Unified Field (it is unknown through what mechanism), but related via torsion fields. (The quantum approach to the mechanisms of Conscience was investigated by R.G. Jahn and W.J. Linn [144, 177]).

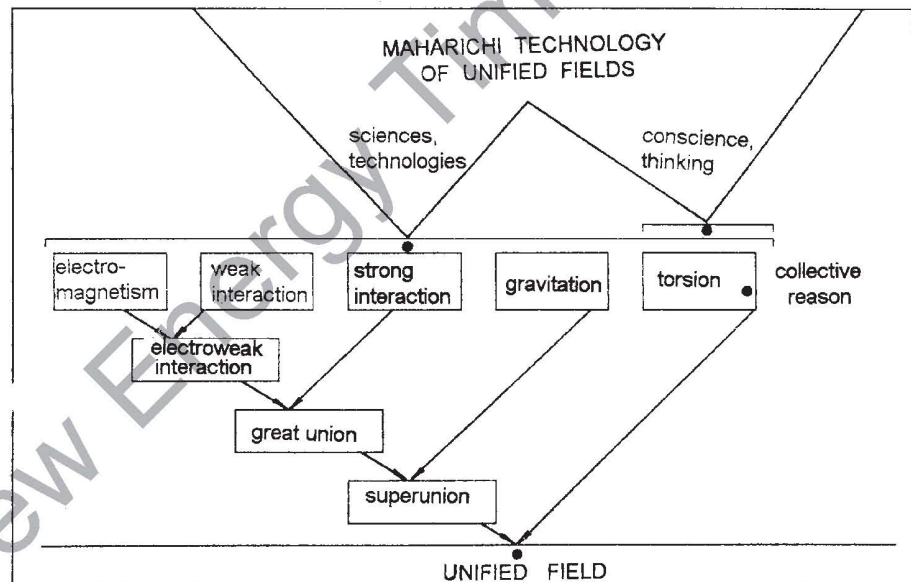


Fig. 20 Unified approach to the J.S. Hagelin scheme with allowance for torsion and its role as material carrier of conscience and thinking.

The concepts of Conscience and Thinking as spin polarization states of Physical Vacuum and identification of the Unified Field with Physical Vacuum (EGS-concepts) seem to be more substantiated. Their points of view are reflected in the Meta-structure of interrelation between Nature, Knowledge and Man shown in Fig. 21. It seems excessive to introduce into this structure various unifying theories because they reflect only individual steps in our understanding of Nature. In the constructed model all fields are directly representable by Physical Vacuum polarization states. According to the views set forth above, Conscience and Thinking, also Universal Reason at the limit, are represented as spin polarization states of Physical Vacuum (Unified Field) through its concrete physical entity, torsion fields, and not in abstract form.

Third, assignment of Physical Vacuum polarization states (torsion fields) to Conscience and Thinking, removes as senseless the question of what is primary, matter or conscience because they are intrinsically inseparable. (It seems that M. Levin was right that "some new type of conscience with no barrier between

rational and mystical is being shaped. There will be no contra position of science and religion in the future culture.")

Returning to interaction with Physical Vacuum-based torsion computer (TC), one may assume that operator's Conscience that is spin by nature and manifests itself through torsion fields would have direct access without any periphery because the torsion computer also manifests itself through the same medium. Relying upon any initially chosen protocol, the operator would be able to "build himself in" the torsion computer without any interface and to interact directly even with the central processor via a torsion data link. With such an approach, Conscience as a specific adaptive torsion computer and Physical Vacuum-based computer would operate as something unique and not as a modular system.

Their conclusions give rise to a pair of new problems. Considering Conscience as a biocomputer implemented with organic spin glass, we have to recognize that this biocomputer is implemented with molecular elements. If one also considers the concepts developed recently by some authors [147] and asserting that at the molecular level information is coded not only in structure of molecules, but also in the structure of circum-molecular space, and assumes that this spatial information is related to spin polarization of the Physical Vacuum, that is to torsion fields, one can suppose justly that Conscience as a functional structure comprises a spin biocomputer, that is the brain as spin glass, and its external part, torsion computer comprising spin-polarized Physical Vacuum in the space around brain. The above ideas should be regarded only as a formulation of a problem that requires deep investigations, especially if one takes into account the limitations of the spin glass model for description of the brain mechanism operation.

Another problem following from our conclusions is associated with the exotic idea of the Universe as a Super computer. Without plunging deeply into the history of this idea that seems to date back to the ancient Vedic Knowledge and that was elaborated upon later (e.g., by F.W. Schelling), at the modern level one could cite the study of S. Lam [148] and a more recent publication of R. Penrose [149] and associated papers [150-154] of some other writers. If one takes into account that in the existing theories the time of interaction between the opposite parts of the Universe is commensurable with its age, there would be no reason to consider the Universe as something integral and interrelated within the framework of the traditional ideas. If, however, one takes into consideration that all Universe is penetrated by a medium, Physical Vacuum featuring, according to V. Ablakov et al., as was mentioned above, holographic attributes and those of spin system (the role of torsion fields with their unusual features), one can consider the Universe as an integral system; and the ideas of field (torsion) computers enable one to discuss concretely the quantum approach to the problem of Universe as Super computer (Absolute), the approach looked for by H. Penrose [149]. (In this context, Plato's "world of ideas," self-developing spirit of Hegel, "collective unconscious" of Jung, Newton's "Absolute," "semantic Universe" of Nalinov, and "Noosphere" of Vernadsky in its extended understanding can be assigned to an Absolute [reality] Constructiveness of joint consideration of these concepts was marked by Yu. Sheredenko.)

If one adopts the assumption of torsion (spin) nature of this Super computer (Absolute) and recalls the above concept of the torsion nature of Conscience, it become evident that Conscience is part and parcel of the Super computer (Universe) built in most naturally by virtue of generality of physical laws.

CONCLUSION

The fundamental, applied and engineering studies in the domain of torsion fields are at the beginning. As any new area in science and technology, they are vulnerable to criticism because there are more questions than answers. Moreover, inertia and conservatism puts barriers across new concepts as has happened in the past centuries. One could cite numerous examples. It suffices to mention how stubborn was Lavoisier in his negation of meteorites, or that Pauli called the idea of spin as formulated in the papers of Ulenbeck and Gaudsmith "stupid", which did not prevent him from formulating later one of the basic principles of quantum mechanics named after him. Anyway, the available theoretical and experimental basis of the torsion field paradigm allows one to consider them as real as electromagnetism and gravitation and instills confidence in the future of this new and exciting scientific domain.

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ELECTROMAGNETIC INDUCTION WITHOUT MAGNETIC FIELD

by Christian Monstein ¹
(translated from the German by Donald Reed, Sept. 1997)

ABSTRACT

By the simple experiment described here, the existence of a time or space variation of a magnetic field in a conductor fragment, is not a necessary prerequisite for the induction of an electric potential. Thus, in general the perceived Faraday-Maxwell flux law is not valid in the following described experiment.

1. Introduction

In generator systems, one commonly takes into consideration the "Lorentz-force" named after Hendrik Anton Lorentz (1853-1928), as the driving force for conductor current. The engineer explains it by the "Left-Hand-Rule," that is, for the formula (1) to be correctly utilized, the vectors \mathbf{F} , \mathbf{v} and \mathbf{B} must be orthogonal [1].

$$\mathbf{F} = Q (\mathbf{E} + \mathbf{v} \times \mathbf{B}) \quad (1)$$

The empirically established Faraday induction law says that when the magnetic flux within a closed curve is varied in time, the flux change is proportional to the induced voltage. In order to calculate the induced voltage, one must first calculate the magnetic flux density \mathbf{B} and the magnetic flux ϕ .

$$\phi = \int \mathbf{B} \cdot d\mathbf{A} \quad (2)$$

Under a time variation of the magnetic flux one has the following:

$$\frac{\partial \phi}{\partial t} = \frac{\partial}{\partial t} \int \mathbf{B} \cdot d\mathbf{A} \quad (3)$$

This induced voltage along a curve can also be described as a line integral:

$$U_{\text{ind}} = \oint \mathbf{E} \cdot d\mathbf{s} \quad (4)$$

In view of Lenz's Law, there then results the induced voltage (Electromotive force - EMF- or "back"-voltage). This variant of induction voltage is also described as "back"- voltage of rest (Ruhe) [2]:

$$U_{\text{ind}} = -N \cdot \frac{\partial \phi}{\partial t} , \quad (5)$$

where N = number of coils spread over the region with surface area \mathbf{A} .

Analogously, there exists a "back" voltage EMF from movement, an alternate derivation from the induction laws:

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$$U_{ind} = - Z \cdot L \cdot (B \times v) , \tag{6}$$

where Z = number of conductors, L = conductor length perpendicular to B and v , and v = velocity of the conductor motion. Equations (5) and (6) are chiefly used in operation. We have shown only two particular cases of a much generalized situation. These general situations are brought about in the "Hooper-Monstein Experiment" [3, 4, 5, 6, 7] (see Fig. 1, which was taken from [7]).

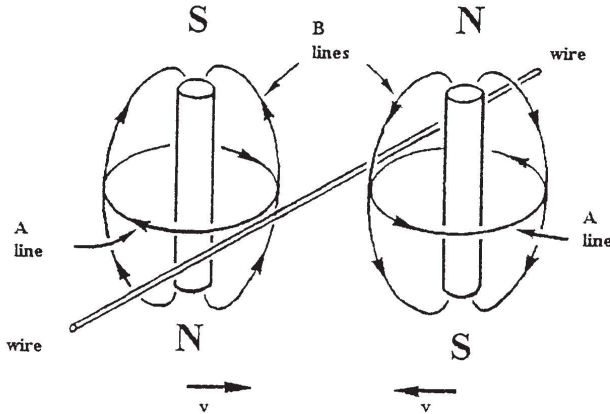


Fig. 1

EXPERIMENT

At equal distances from and perpendicular to a wire with an active length of 150 mm are arranged two identical permanent magnets each with a pole surface flux density of around 50 mT. The magnets are aligned so that opposite poles are facing directly across from each other. As a result of this positioning, where the wire is at the center the total magnetic field intensity is zero. The two drawn field lines which symbolize the display of the magnetic fields indicate two opposite arrow directions in the proximity of the wire. A simple check of this can be

made with a Hall-Sonde (probe). The velocity v of each magnet as well as the wire, in an indicated direction are detected by an individual pulse (stepping) motor. The external control for four stepping motors is provided automatically by a PC (computer) with external hardware, seen below in Fig. 2.

The complete detailed mechanical structure with cradles (Schlitten), motors, stock, mounts, etc., was realized in this instance and provided to order by my friend Hans Peter Benz. My share was limited to the control PC, the control software, as well as the circuits and the analysis (interpretation).

Region of movement

With this convenience of operation is brought the possibility of many types of motion combinations and variants of moving the wire and magnets near to each other. For all the movements of interest in our experiment, where the wire is in the center, the magnetic flux density is zero and stays (remains) at zero. For all the following tests, velocity v is constant and held at 2.64 mm/sec. This is the same for all tests. This particular velocity is chosen due to the maximum elementary frequency derived for the step-motors on the one hand, and on the other hand from the maximum possible traversed path (Verfahrweg) Δs .

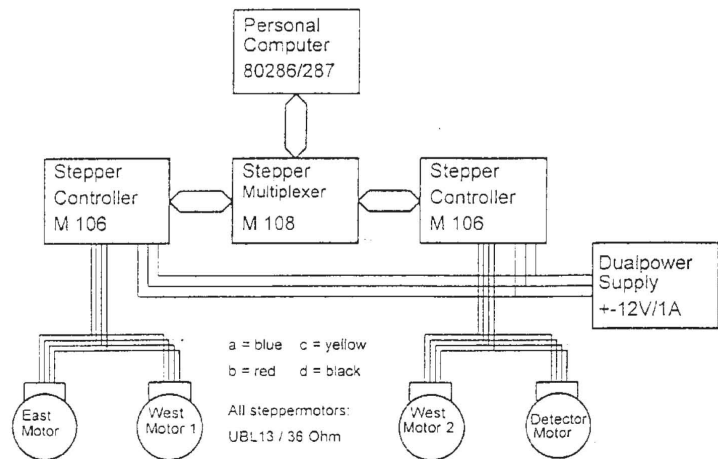


Fig. 2 Control System

The traversed path Δs results from the maximum number of position-steps, $n_p = 240$ multiplied by the total amount (Betrag) of position-steps δs . A single position-step $\delta s = 0.022$ mm results inevitably from the (motor) gearbox (Spindeltriebe) and the number of active windings on the linear step-motors. The

maximum possible measured path with respect to the traversed path $\Delta s = n \times \delta s$ is around 7.92 mm. This traversed path is carried out in each of the tests from the "left" and/or from the "right" magnets and/or from the wire. One example of the variants carried out are compared in the Table I.

Measuring Instruments

The actual measuring instrument in this experiment is a sufficiently sensitive XY-recorder with a range of 5 mV per 100 mm y-variance (Auslenkung). The x-axis is realized on a local appliance (gerateinternen) deflection oscillator with a range of 3 seconds per 100 mm x-variance (Auslenkung). The wire can be electrically cut-off (abgetrennt) and be replaced with a calibrated wiring. This calibration circuit is accomplished with a battery and realized with an exterior ohmic (ohmschen)

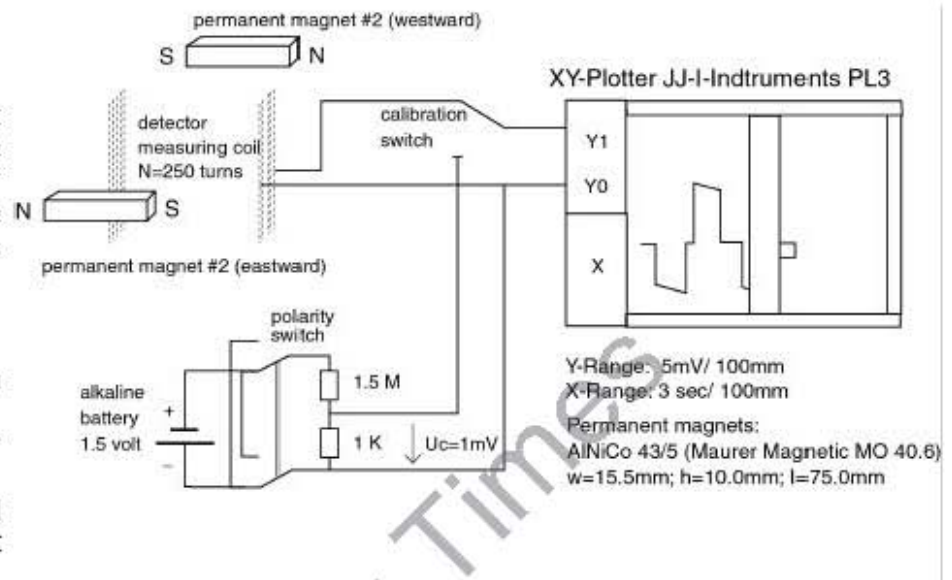


Fig. 3 Measuring Systems

voltage divider and produces a constant potential of around 1 mV. The circuit wire schematics is given next in Fig. 3. Additionally, the polarity of the calibration circuit is inverted (reversed). For highest sensitivity, there is not a single wire but a frame-winding coil (Rahmenwicklung) with $n = 250$ turns utilized. The values given in Table Fig. 4 can then certainly be traced back (zurückgerechnet) to a single wire. There were three tests conducted.

(East) Magnet Moved

In the first test only one of the two magnets is moved towards the wire, while both the other magnet and the wire are stationary. This is the "normal" case, where the induction law in its familiar form holds in approximation, since in this case $B \neq 0$. By having the magnet approach the wire, B increases non-linearly. Along the wire the average magnetic flux density B is about .8 mT, measured with a Hall-Sonde KSY10. This permits the expected induced voltage in the wire to be assessed by the calculation: $/U/ = BLv = (0.8 \text{ mT}) (15 \text{ cm}) (2.64 \text{ mm/sec}) = .3 \mu\text{V}$. This is naturally much too small a value, since the actual part of the magnetic fluxes of both permanent magnets is already mutually compensated. Measured voltages are 1.2 μV , 1.6 μV , in case movement is from the east towards the west, and 1.3 μV , 1.8 μV in case the movement is from the west towards the east.

Both Magnets Moved

In the second test, both magnets are simultaneously moved toward the wire, and' after a short pause, they are moved away from the wire. Both magnets have exactly the same velocity v and brought back through the path s . In the center, the resultant (total) magnetic field is exactly zero. Thus, according to the equations (5) and (6), no voltage is induced. Then $B = 0 \text{ mT}$ as well as $\phi = 0 \text{ Vs}$; these are at every time and each point on the wire equal to zero. In actual fact, in this case the measured voltage is **double** that of the first test, namely 2.4 μV , 3.6 μV . This is a glaring travesty (krasse Verletzung) for decades in the interest of finding a correct induction law! This test shows quite clearly, that the induction law in the form

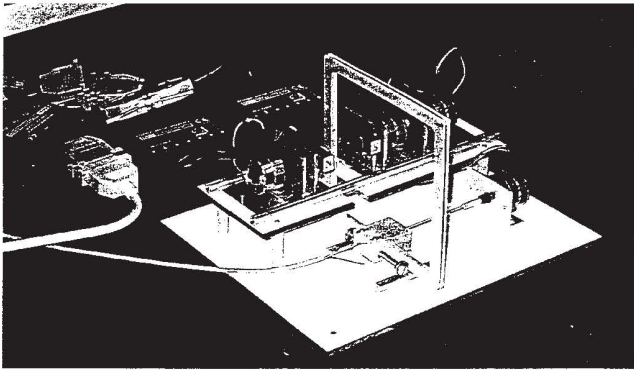


Fig. 4

magnet is then moved with double velocity to the right towards the wire. Simultaneously, the wire itself is moved with velocity v to the left in the direction toward the stationary magnet. The distance between wire and magnets remains the same at all times. This combination (verbunden) is again a compensation of the magnetic fluxes at each position of the wire at each time. Here as well, the induction formulas (5) and (6) fail to account for the double voltage of $2.6 \mu\text{V}$, $3.6 \mu\text{V}$, similar to the results in Test 2. In this case, the relativity of motion plays no role in the final result, whether the wire or the magnets are moved.

MEASUREMENT RESULTS

All voltages maintained are average values in most tests. The accuracy (Messunsicherheit) of measurement of voltage is $\pm 0.12 \mu\text{V}$ for all part of the experiment. In both columns to the right on the outside of Table Fig. 4, two voltage values U and U' are each given. Namely that at the beginning (U) and that at the end (U') of the traversed path Δs . Since the magnetic vector potential is space-dependent (taken radially from the outside), which also amounts to (via a constant linear velocity) a space-dependent induction voltage. Together with the above tests conducted, 10 further variants were carried out. They are not shown here since they do not change the final result. It is a fact and remains so that the magnetic vector potential A and not the magnetic flux density is the basis for the induced voltage.

Table I

Parameter \Rightarrow	Rotational Speed $v = 2.64\text{mm/sec} \pm 0.01\text{mm/sec}$			Magnetic Flux	Voltage $\pm 0,12 \mu\text{V}$ Measurement coil $L=15 \text{ cm}$	
Test # \blacktriangledown	Magnet (Left)	Detector measure- ment coil (Ctr.)	Magnet (Right)	Permanent Magnet	at Beginning x_0	at End $x_0 + \Delta s$
0	0	0	0	w/o Magnet	$0,0\mu\text{V} = 0$	$0,0\mu\text{V} = 0$
1a	v	0	0	$B \neq 0$	$1,2\mu\text{V} = U$	$1,6\mu\text{V} = U'$
1b	0	0	v	$B \neq 0$	$1,3\mu\text{V} = U$	$1,8\mu\text{V} = U'$
2	v	0	v	$B = 0$	$2,4\mu\text{V} = 2U$	$3,6\mu\text{V} = 2U'$
3	0	v	$2v$	$B = 0$	$2,6\mu\text{V} = 2U$	$3,6\mu\text{V} = 2U'$

INDUCTION VIA CHANGE OF THE MAGNETIC VECTOR POTENTIAL

A correct formula for calculating the induced voltage thus does not proceed from the magnetic flux B , but must be derived from the magnetic vector potential A as well as its time and spatial derivatives must be taken into consideration. The situation where the magnetic vector potential changes in time leads to an electric field intensity, which different authors [5] have described as "motional-transformer electric

that everyone knows cannot be correct. It also shows that the magnetic flux density B is not responsible for the induced voltage. On the contrary, it is namely the magnetic vector potential A which is not zero in the above described situation, but is doubled (indicated in Fig. 1 through the vector-arrow "A" line).

(West) Magnet and Wire Moved

A further interesting variant is the third part of the experiment. Here the left (Eastern) Magnet remains stationary, and is not moved. The right (Western)

intensity".

$$\mathbf{E}_{\text{mtr}} = \frac{-\partial \mathbf{A}}{\partial t} \quad (7)$$

Thus the induced voltage can be determined by a line integral over the conductor curve. When, for instance, the velocity \mathbf{v} of the magnets is linear, then equation (7) can be formulated as:

$$\begin{aligned} \mathbf{E}_{\text{mtr}} &= -(\mathbf{v} \cdot \text{grad}) \cdot \mathbf{A} \quad \text{or} \\ \mathbf{E}_{\text{mtr}} &= -(\mathbf{v} \cdot \nabla) \cdot \mathbf{A} \end{aligned} \quad (8)$$

In the case where the magnets are stationary and the wire moves another outcome results for the induced field intensity. In [5] this field intensity is described in distinction as "motional electric intensity".

$$\begin{aligned} \mathbf{E}_{\text{mot}} &= \mathbf{v} \times \text{rot } \mathbf{A} \quad \text{or} \\ \mathbf{E}_{\text{mot}} &= \mathbf{v} \times (\nabla \times \mathbf{A}) \end{aligned} \quad (9)$$

Combining both of the above equations to obtain the "global" electric field intensity we get:

$$\begin{aligned} \mathbf{E}_{\text{global}} &= \mathbf{E}_{\text{mot}} + \mathbf{E}_{\text{mtr}} \\ \mathbf{E}_{\text{global}} &= \mathbf{v} \times (\nabla \times \mathbf{A}) - (\mathbf{v} \cdot \nabla) \cdot \mathbf{A} \end{aligned} \quad (10)$$

Therefore, now we can calculate the effective induced voltage in the circuit:

$$U_{\text{ind}} = N \cdot \oint [\mathbf{v} \times (\nabla \times \mathbf{A}) - (\mathbf{v} \cdot \nabla) \cdot \mathbf{A}] \cdot d\mathbf{s} \quad (11)$$

(N = number of coil windings)

In many physics books the magnetic flux \mathbf{B} is established as real and the magnetic vector potential is considered as purely a mathematical artifice. On the basis of the current experiments one must turn this statement around. The magnetic field intensity is pure fiction and \mathbf{A} is real.

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EDITOR'S CHOICE

**THREE-DIMENSIONAL CRYSTALLIZING π -BONDINGS,
 π -FAR INFRARED RAYS AND N-MACHINE**Hung-Kuk Oh ¹**ABSTRACT**

The N-machine produces very low voltage and high current. Any space energy is absorbed when the N-machine is rotating at a very high velocity. Laws of electromagnetics verify that normal conduction is due to the electrons moving from one three-dimensional, crystallizing π -bonding orbital to next. The π -far infrared rays are generated from the resonance and rotation of the electrons on the orbitals of three-dimensional crystallizing π -bonding atoms.

Material in universe is composed of π -rays, which have alternative outward electric field. If the alternative outward electric fields of the π -rays are resonant with each other they make attraction force, which is gravity. The collection of space energy is due to a attraction force between the radially alternating electric field and the π -far infrared rays in the space. Electrons flow by absorbed density difference of π -far infrared rays along a conduction wire, which also verifies that normal electron conduction is due to a flow from one three-dimensional crystallizing π -bonding orbital to next.

PRESENT TECHNOLOGICAL SITUATIONS OF N-MACHINE

Around the year 1970, De Palma in California tried to elevate the voltage of Homopolar Induction with rotating metal plate adapted by permanent magnets. It has been reported that above 3000 rpm it produced more than input energy, which can not be explained by modern science and is then called as N-effect. The effect was proportional to the rotating velocity. Through many verifying experiments he concluded that any space energy is absorbed when the N-Machine is rotating at a high velocity.

Tewari in India and Inomata in Japan tried to elevate the output voltage in order be applicable for practical use because the machine produces very low voltage and too high current. Tewari used an iron plate and Inomata used superconducting magnets and a copper metal plate. The latest improved N-machine produces 10KW output by using 25cm diameter copper plate [1].

LAWS OF ELECTROMAGNETICS AND THREE-DIMENSIONAL CRYSTALLIZING π -BONDINGS

Electrical conduction is mainly due to the metallic bonding orbitals, which are localized superconducting rotational electron-pairs formed by three-dimensional crystallizing π -bondings (Fig. 1 following paper).

The centrifugal Coulomb forces and rotational electrons on the orbitals in the transverse array of the conducting wire make the magnetic field of right hand rule in law of Ampere (Fig.2). Any increased magnetic flux loaded in the loop of the coil (Fig.3) makes the balancing magnetic fluxes outside the wire unbalanced and produces induced current (Fig.4), which is Faraday's law [2].

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GENERATION OF π -FAR INFRARED RAYS FROM THREE-DIMENSIONAL CRYSTALLIZING π -BONDINGS

The outer-most electrons of metal atoms and the remaining valence electrons of any molecular atoms make three-dimensional crystallizing π -bondings. The three-dimensional crystallizing π -bondings have many kinds of the π -bonding units as in Fig. 5 [3, 4]. The electrons on the π -bonding orbitals rotate clockwise and counter-clockwise as in Fig. 6 and they make electro-magnetic waves between atoms on the orbital because electrons move between positively charged ions. The one-dimensional Kronig-Penny model is the simplified quantum mechanical model of the three-dimensional crystallizing π -bonding orbitals Fig.7 [5]. Fig. 8 are the variation of energy band structure with potential barrier thickness and also the π -far infrared ray, which is produced on the π -bonding orbitals by the rotating electrons and a particular energy dissipation mechanism of the crystallizing π -bondings. It can be remarked that the π -far infrared ray has a gravitational field and the gravitational field is one of the electro-magnetic fields which have alternative outward electric field. If the alternative outward electric fields of the π -rays are resonant to each other, they make an attraction force, which is the gravity. Fig.9 and Fig. 10 are the crystallized simple cubic and face-centered cubic structure but many solid state structures are going on crystallizing with the π -bonding orbitals as in Fig 5c. The evidence of the π -far infrared rays are referred to in many experiments [5] with finger's force tester, Meridian and Quantum Resonance Spectrometer (Table I).

Table I. QRS index (offered by QRS, Inc.)

Material	QRS index	Material	QRS index
NASUCON	+ 17		
AP-24 (NuSkin cosmetic)	+ 13		
HAND PHONE	(-) 124	HAND PHONE + NASUCON	(+) 13
B.B.	(-) 20	B.B. + NASUCON	(+) 14
NASUCON RING	(+) 8		
NATURAL WATER	(+) 103	NATURAL WATER + NASUCON	(+) 117
TOBACCO	immeasurable (-)	TOBBACO + NASUCON	immeasurable (-)

* NASUCON: Electro-magnetic wave protector made by particular chinese medicals (offered by Jin Soo Park)

GRAVITY AND π -RAYS

Material is composed of the π -rays [6], which have an alternative outward electric field. If the alternative outward electric fields of the π -rays are resonant each other, they make attraction force, which is the gravity. Because π -rays are circular and the electric fields are directed radially, the attraction force directs at the center of the circle. It is as if the universal gravitation of any planet comes out from the center of it. Universal attraction force can be calculated easily.

$$F = q_2 E_1 = q_2 \frac{q_1}{4 \pi \epsilon_0 R^2} \quad (1)$$

where q_1 and q_2 are the resonating charges between two masses and ϵ_0 is permittivity constant. Because m_1 and m_2 are proportional to q_1 and q_2 as in Fig. 11,

$$F = G \frac{m_1 m_2}{R^2} \quad (2)$$

where G is a proportional constant.

COLLECTION OF SPACE ENERGY AND PRINCIPLES OF N-MACHINE (FLOW OF π -FAR INFRARED RAYS)

A radially alternating electric field, which can be produced from rotating permanent magnets facing to opposite poles, attracts π -far infrared rays in free space (Fig. 12).

The π -far infrared rays also have alternating radially outward electric field and then resonantly produce an attraction gravity force with the alternating electric field of N-machine. A number of the π -far infrared rays are collected and absorbed in the outer part of the rotating metal disk. If a conduction wire is connected between the outer part and inner parts of the rotating disk, the π -far infrared rays flow through the wire, which induce current as in Fig. 13 because electrons in higher energy state in three-dimensional crystallizing π -bonding orbitals flow through the lower energy state [2] as in Fig. 14. This current produces very low resistivity because the π -far infrared rays transfer electrons when the rays go over from one orbital to next, which means that the resonance states of the orbitals are not broken at the electrons' transfer. It is called cold current, while normal current by electric potential is called hot current.

CONCLUSIONS

- (1) Any space energy is absorbed when the N-machine is rotating at a very high velocity.
- (2) Laws of electromagnetics verify that normal conduction is due to electrons moving from one three-dimensional crystallizing π -bonding orbital to next.
- (3) The π -far infrared rays are generated from the resonance and rotation of the electrons on the orbitals of three-dimensional crystallizing π -bonding atoms.
- (4) Material in universe is composed of π -rays, which have alternative outward electric field. If the alternative outward electric fields of the π -rays are resonant with each other they make an attraction force, which is gravity.
- (5) The collection of space energy is due to an attraction force between the radially alternating electric field and the π -far infrared rays in the space.
- (6) Electrons flow by absorbed density difference of π -far infrared rays along a conduction wire, which also verify that normal electron conduction is due to a flow from one three-dimensional crystallizing π -bonding orbital to next.

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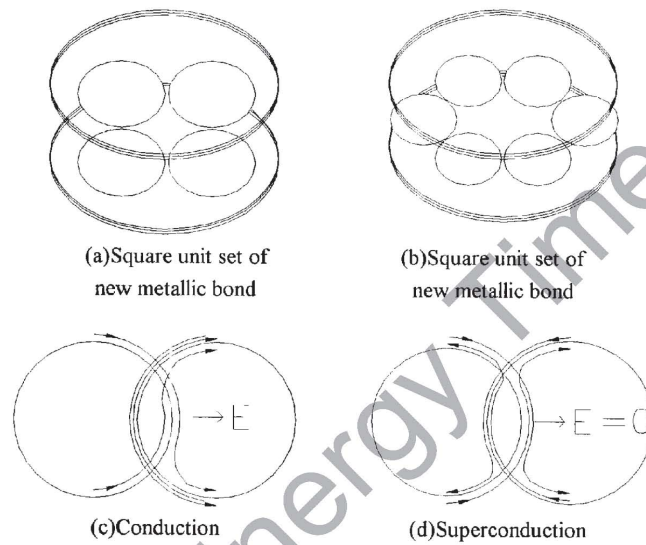


Fig. 1 Mechanism of Conduction and Superconduction between One New Metallic Bonding Orbital and the Next

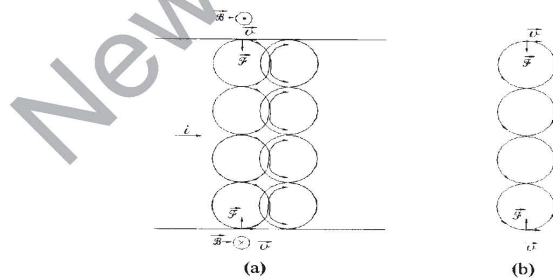


Fig. 2 Cause of magnetic field B by Coulomb forces and moving charges in the conducting wire; (a) Transverse array of the localized interatomic superconducting orbitals along the wire; (b) Cross-sectional array of them.

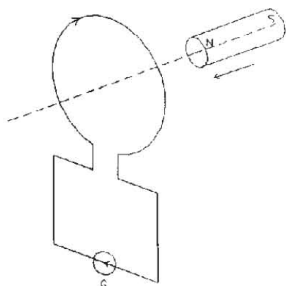


Fig. 3 Galvanometer G deflects while the magnet is moving with respect to the coil.

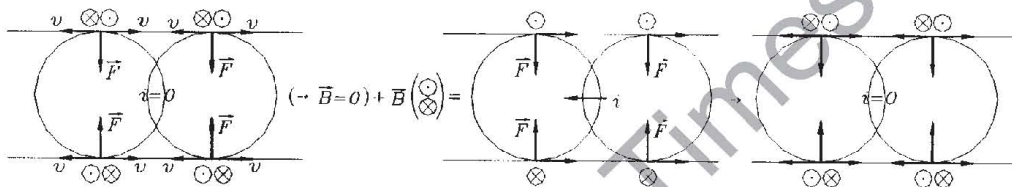
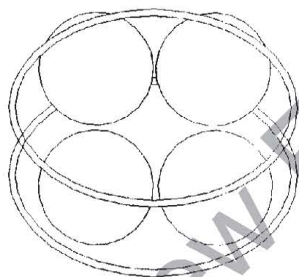
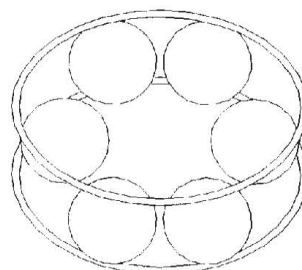


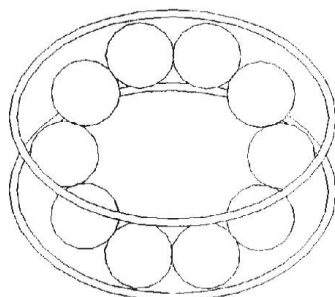
Fig. 4 Trans-orbital moving of electrons induced by any change of magnetic flux (Faraday's law of induction).



(a)Crystallized square π unit



(b)Crystallized hexagonal π unit



(c)Crystallizing π unit

Fig. 5 Three-dimensional crystallizing π -bonding unit.

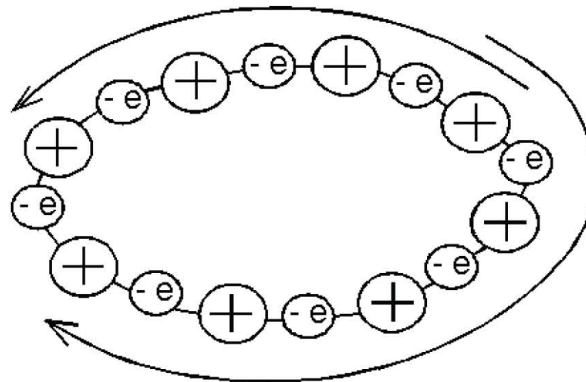


Fig. 6 Electron's rotation on the π orbital and generation of the π far-infrared rays.

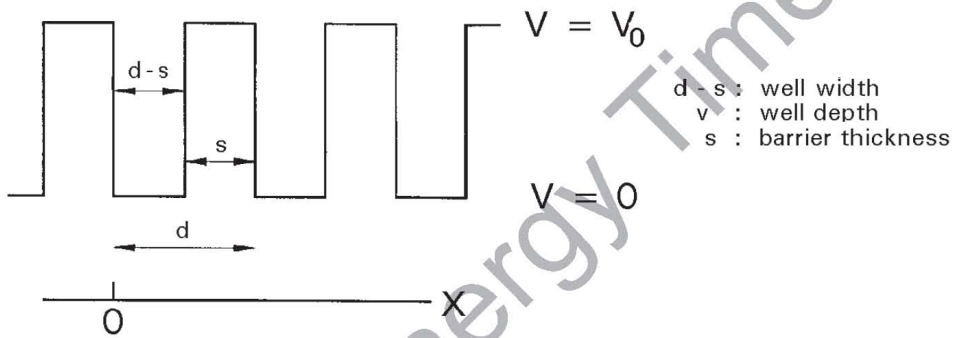
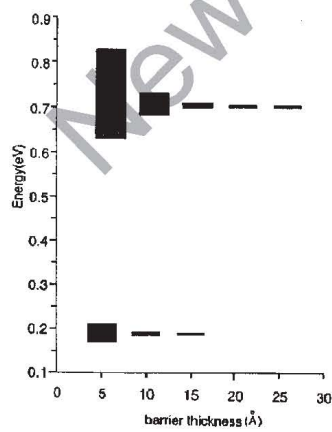
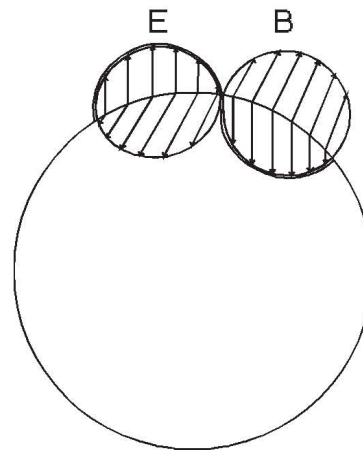


Fig. 7 One-dimensional Kronig-Penny Model.



(a) Energy band



(b) π -far infrared ray

Fig. 8 Energy Bands and π -far infrared ray.

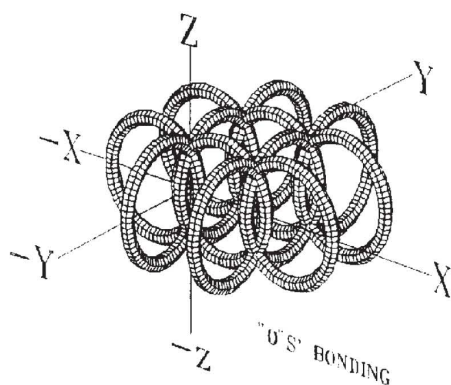


Fig. 9 Simple cubic crystal structure of three-dimensional crystallizing π -bonding orbitals.

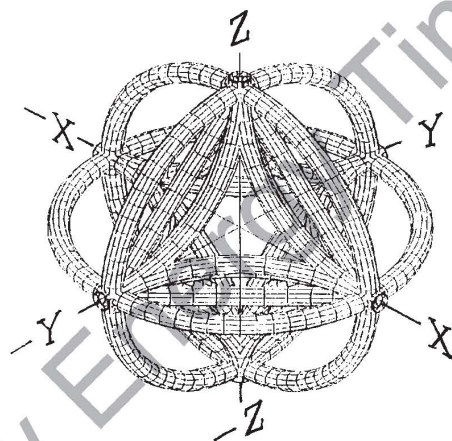


Fig. 10 Face centered crystal structure of three-dimensional crystallizing π -bonding orbitals.

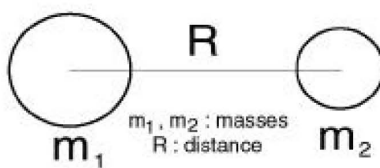


Fig. 11 Universal attraction force.

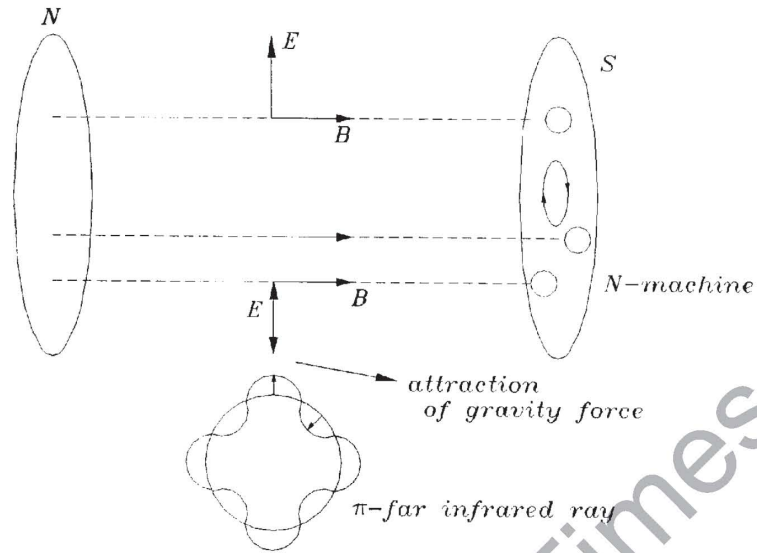


Fig. 12 Collection of space energy in N-machine.

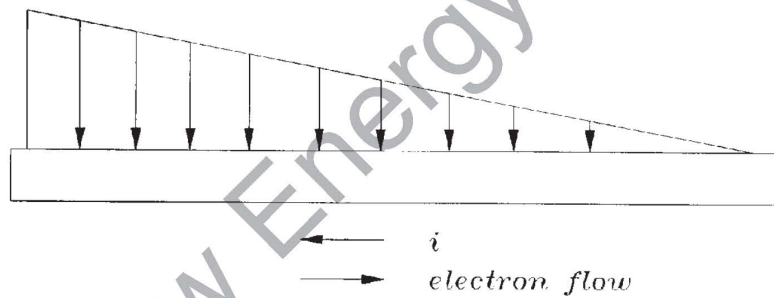


Fig. 13 Absorbed density distribution of π-far infrared rays and current flow along the conduction wire.

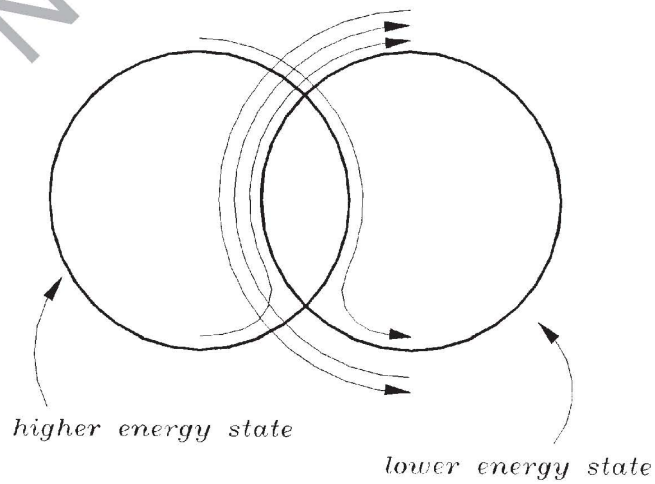


Fig. 14 Electron flow by absorbed density difference of π-far infrared rays along a conduction wire.

**THE 21st CENTURY –
WILL IT BRING A NEW QUANTUM PICTURE
OF THE UNIVERSE AND NEW ENERGY SOURCES?**

By Professor Lev G. Sapogin ²
(Translated from Russian [26])

ABSTRACT

An essay which proposes that the fundamental particle attributes of charge and mass have cyclical magnitudes interacting with the "vacuum." The cyclical nature of these attributes leads to an explanation of excess heat in "cold fusion"-type experiments, nuclear transmutation by way of reduced Coulomb barriers, and the phenomenon of quantum tunneling.

DISCUSSION

It is obvious that the existence of our civilization would be impossible without sources of energy. Unfortunately, our seemingly prosperous energy life is nearing its end. According to the evaluations of experts the present-day resources of hydrocarbon fossil fuel will be exhausted by 2025 and the world will face a severe energy crisis. In fact, conventional nuclear reactors could solve this problem, since the existing thorium and uranium deposits would last for millions of years. Yet, from the ecological view-point the current varieties of classic nuclear-fission reactors are the "delayed-action land mines," threatening mankind with periodic Chernobyl-type explosions and accumulated radioactive contamination.

Theoretically, deuterium and lithium-based thermonuclear fusion reactors could also solve the energy problem as the natural deuterium and lithium deposits are practically unlimited. There are two classic ways to solve the nuclear fusion problem: either by means of plasmic fusion in the Tokamak type installations or with the help of laser fusion. All the programs for controllable nuclear fusion are based on crude heating and squeezing of the reactive material. In spite of the progress achieved in this field, Dr. Alan Gibson, the head of the nuclear research in England, said that it would probably take no less than 50 years to build the first practical demonstration model of the reactor. Note, that such a reactor would be extremely sophisticated, expensive and harmful to the environment. In this connection one faces another social problem – that of a "thermonuclear lobby," which for the last 40 years spends annually up to a billion dollars for nuclear research, making periodic oaths to their governments that the unlimited energy source will be found in the near future. Curiously enough, every time somebody within the lobby tries to talk about the lack of any prospect in this field he finds himself fired or being transferred to another post, the fact which guarantees the system its long-term funding tenacity. This political process proves the old truth that the creative life-time of any scientific idea is in direct proportion to the number of researchers employed and the money spent.

No classic approach to this energy problem has hitherto given any positive results despite billions of dollars spent and the enormous number of research workers and other personnel (physicists, engineers, managers, laboratory staff, etc.). It is only natural that such a huge army of scientific workers should challenge any other alternative nuclear fusion project. Nevertheless, it now seems that the solution to one of mankind's most essential global problems (energy) has been found on quite different grounds. Lately, a decision was made in the USA to close the hot nuclear fusion program. In 1900, at the turn of the

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century, a challenge to conventional Newtonian motion in science had started and the quantum theory took its place being able to explain brilliantly the mysterious phenomena of the atomic world, which the old science had not done. At the end of this century, history seems to repeat itself. Cold nuclear fusion was first discovered by M. Fleischmann and S. Pons, the phenomenon itself being actually impossible in terms of the conventional quantum theory. Note, however, that the author had predicted cold nuclear fusion as far back as 1983 on the basis of the new Unitary Quantum Theory [11]. It was this theory which had enabled the author to calculate the electron charge value and the fundamental fine structure constant [8,9], and also to predict an absolutely new energy generation process [12-15]. This phenomenon was initially reported at the ICCF-1995 in Monte-Carlo [12] and theoretically developed in [13]. This energy generation process turned out to be a surprise for everybody.

Recently, some striking results were reported by physicists A. Samgin (Russia, Ekaterinburg) [16,17] and T. Mizuno (Japan) [18]. In their experiments, the researchers had used special proton conducting ceramics which, when being acted upon by the electric current, produce a thousand times more heat energy output than input. In some of the experiments, this value had even exceeded the figure of 70,000! The origin of such quantities of excess heat energy in terms of conventional science is quite unaccountable; one can ascribe it neither to nuclear or chemical reactions nor to the phase transitions.

One is impressed by the CETI Power Cell built by James Patterson (USA) [19], in which electrolysis of specially prepared nickel microspheres takes place in an electrolyte using ordinary distilled water. This event was reported by American newspaper *Fortune Times*, no 85, 1995. On December 4, 1995 a team of independent experts from five American Universities tested the work of a new energy source with a steady heat power output of 1.3 kW. The electric energy consumed was 960 times less. All the experts noted that the excessive heat produced is of a mysterious origin inexplicable from the viewpoint of chemical or phase transitions. On February 7 and 8, 1996 the American ABC TV shows, "Nightline" and "Good Morning America," gave coverage of the Patterson Power Cell which produces a hundred times more energy than it consumes. It was once again stressed that the origin of the excessive heat remains inexplicable. Curiously enough, it has been rumored that the American Motorola Company had tried to buy out the CETI Power Cell Patent from its author for a large amount of US dollars, but Patterson refused to sell it. It is obvious that before any corporation made such a proposal, the company surely ought to have carried out some research of the product.

Some other types of heat generators exist, such as from James L. Griggs [21] and Karl Schaefer [inc. in 22] - USA, and Yu. Potapov - Moldova [20]. Within these devices a lot of cavitation bubbles are produced in ordinary circulating tap water with resulting excessive heat – the ratio of the input and output energy amounted to more than 1:5. Again, the reactions taking place in these experiments (heat generators) have yet to be explained in chemical or nuclear terms. Moreover, the Potapov's system is now being produced by the thousands for heating homes.

Likewise enigmatic is the sonoluminescence phenomenon when some liquids start glowing under the impact of weak ultrasonic emissions. This now well-established phenomenon, discovered in 1933 by a Moscow University professor S.N. Rzhevkin, had never had any satisfactory explanation, and according to the Nobel prize winner professor Julian Schwinger, sonoluminescence should not exist, but it does [23].

Even more mysterious seems the well-known energy shortage problem being observed in a number of bio-chemical reactions with enzymic participation. For instance, the well studied reaction of the polysaccharides breakdown in the presence of lysozyme involves the following:

- the polysaccharide molecule gets caught into a specific cavern within the big lysozyme molecule, the remains of the former being thrown out after some time. In so doing, the energy of the polysaccharide chemical bonds' rupture is of the order of 5 eV, whereas the heat movement energy does not exceed 0.025 eV. It is absolutely unclear where the lysozyme takes energy from to break the polysaccharide. No

satisfactory mechanism to explain this type of reactions (which are rather numerous) had been proposed and all these phenomena, as physicists say, have been simply "swept under the rug."

Most intriguing is the fact that in all these cases the excessive energy can be explained neither by chemical reactions nor by phase transitions. If nuclear reactions do take place (which in fact is deemed impossible), they could be responsible only for a fraction of the generated excessive heat. Doubtless, all these phenomena belong to "new physics," being unaccountable in terms of the conventional science.

In the United States the reaction of the public to these events was typical. Soon after cold nuclear fusion was discovered, a luxurious journal appeared under the title of *Cold Fusion*, but when other mysterious excessive energy generation processes came to light, this journal was split into two, the one with the old name and the other titled *Infinite Energy*, discussing new energy generation problems. Still, it was Japan and not the United States that appeared to be most progressive in pursuing this new technology. This country even finances some of the US research institutes dealing with the above problems. The total expenditure of Japan for this kind of research amounts to an estimated \$200,000,000 annually. It should be no surprise to the reader that in Russia not a penny had been allotted for this program, and all the research carried out by Russian scientists was based on pure enthusiasm.

The Unitary Quantum Theory (UQT) developed in 1970-1988 by the author [3-11] explains all these seemingly unrelated effects. The validity of the theory is proven by the fact that at the limit transitions from this theory result both in the Dirac's equation (the main equation of the quantum theory) and the relativistic equation of Hamilton-Jacobi (the most complete equation of classic mechanics). With this theory, any quantum particle is not a point source of field, as is the case in the conventional quantum mechanics, but represents some wave packet of a certain unitary field. However, the basic UQT equation happens to be very sophisticated. This system of 32 non-linear integral-differential equations will require some new mathematical approaches for its solution. Yet, proceeding from this equation system, and using certain approximations for small energies, one can derive the particle motion equation with oscillating charge, which was recently obtained by the author as a direct consequence of the Schroedinger equation. This result was published in *Infinite Energy*, no 5 and 6, 1996 [14].

In the UQT, it is the wave function phase which plays the most important role, having been viewed as a redundant parameter in the conventional quantum theory. Proceeding from the UQT there follows an approximate equation for the model of a particle with an oscillating charge. This equation allowed us to predict cold nuclear fusion and also a new energy generation mechanism (1983). Let us consider the way in which the oscillating particle equation explains the main difficulty in the nuclear fusion: the overcoming of the Coulomb repulsion of the nuclei at very low energies. The solution of this equation for two colliding nuclei shows that the distance to which the nuclei can approach each other is dependent not only upon the energy but also upon the wave function phase [1,2,13]. If the particle approaches in such a phase, when its charge is very small, then it can approach the other nucleus very closely and take part in a nuclear reaction. At other wave function phases, when the charge is large, the repulsion takes place. In the same way one can explain the tunnel effect, mysterious from the viewpoint of common mechanics, when a particle easily passes the potential barrier not having sufficiently enough energy to climb over the barrier.

In future reactor models for cold nuclear fusion (CNF), in contrast to all existing "hot" nuclear fusion projects, only a very small part of all deuterons will react simultaneously, their automatic selection being carried out by phase correlations. This process will result in the production of small quantities of energy within a rather long period of time until the reacting light nuclei source exhausts itself. Such kind of nuclear fusion could be rightfully defined as "controllable". The future of really controllable nuclear fusion systems is not in the primitive heating and squeezing of the material (the existing programs for thermonuclear fusion are also defined as "controllable", though in reality there is no control as such, only special provision is made to take the reacting material in extremely small portions), but in collision of small energy nuclei with their wave function phases being fine and properly adjusted.

The numerous phenomena of anomalous excessive energy production described above can also be explained in terms of the Unitary Quantum Theory in the following way: within the systems involved there is a great number of small caverns of the order of a few tens of angstrom - it may be a micro-bubble in water, a micro-crack in nickel (Patterson Power Cell) or a very small cavity in the proton-conducting ceramics, etc. The particle, for example proton, gets into this cavern. In this case such a situation in physics is called a "potential well." From the viewpoint of the classic mechanics the potential well represents a parabolically shaped container with an oscillating micro sphere inside it; the latter may possess energy of any value predetermined by the initial conditions. In the quantum theory the situation is different: such a micro sphere may possess energy only of some certain value. By contrast, in the UQT there are two more solutions in addition to the described standard one:

1. The particle performs complex oscillations with a diminishing amplitude. At this point the particle's charge and mass approach zero, and after some relatively long period of time the particle disappears completely at the bottom of the potential well. The energy, which the particle had, does not disappear but is transferred to the vacuum. This process is not surprising, because in the UQT the particle is defined as a periodically emerging and disappearing wave packet. Its complete disappearance means that the packet's harmonic constituents separated from each other so far that the packet itself has ceased to exist and its energy is given away to the vacuum; further, the wave packet was smeared throughout the entire space, and manifests itself only in the form of vacuum fluctuations. Let us call this solution a "crematorium."

2. The particle performs complex oscillations with an increasing amplitude. At this time the particle energy can increase infinitely if the potential well parameters do not change. In terms of physics this means that the particle takes energy from vacuum fluctuations. Let us call this solution a "nursery." From a purely aesthetic viewpoint it is desirable that the quantity of energy (matter) emerging in the "nursery" should be equal to the energy in the "crematorium." But we are not yet in a position analytically to prove or disprove this point.

If the system contains a lot of identical wells then all the stationary energy solutions for the wells will be identical, and that is the reason why the discrete energy levels are easily traced out experimentally. But there will be no discrete levels for the type of solutions 1 and 2, because each specific decision will possess its own individuality. The availability of these solutions can be perceived only through integral effect -- the energy release -- which is a very specific phenomenon.

Let us take a closer look at the intriguing solutions 1 and 2. I knew about them as far back as 5 years ago, but it was not easy to discuss the matter openly in publications in the absence of reliable experimental data. However, the situation has since changed and one can now say with certainty that within the UQT in quantum processes, the energy conservation law (ECL) has evolved from a local to a global law, i.e. in individual processes energy is not conserved, rather it may be taken from or given away to the vacuum. Nevertheless, there exists some range of phases when the energy is preserved locally (for an individual particle), the case also known to conventional quantum mechanics for the stationary phenomena. On the other hand, if we sum up the energy and impulse throughout all phases for a large number of particles, the resulting energy and momentum will be also conserved as is shown by calculations.

In all the experiments, the local energy and impulse conservation law in individual quantum processes is being well observed at high energies. But the same is not true at low energies, at least on account of the ambiguity correlation and probabilistic character of all predictions of the quantum theory. Anyway, the idea of the global (rather than local) energy conservation law is threading through entire quantum mechanics, and it is by no means a new idea. From a physical viewpoint it simply means that in stationary solutions with fixed discrete energies (conventional quantum mechanics), the velocity of a particle reflected at the wall is equal to that of the impacting one. If the particle speed decreases upon each reflection, this corresponds to the "crematorium" solution; in case it increases, we face the "nursery" alternative. The

course of events is fully dependent upon the particles initial wave function phase and energy.

There are not any analogues to the solutions 1 and 2 at low energies in conventional quantum physics. The "nursery" solutions (2) have been proven by reliable experimental data, and the potential well part can be played by any very small cavity or crack in a metal or ceramic sample, as well as by a sufficiently small water bubble containing the enclosed free particles. At certain phase and energy values the particle, upon each reflection at the wall, will obtain a greater velocity than that of the impacting one (this phenomenon complies with the ambiguity correlation). Having been repeatedly reflected at the wall, the particle will assume sufficiently high energy that will manifest itself in the form of heat or produce radiation at the well destruction. This solution can readily explain both sonoluminescence and energy production in ceramics [16-18], in nickel by electrolysis (CETI Power Cell) [19], water bubbles in heat generators [20], extra energy in enzymic reactions, etc. The theory predicts for the samples to crack due to increasing pressure exerted on the walls because of the energy growth, which is true because in the experiments both the ceramic samples and nickel spheres eventually collapse into powder. It is also known that any metal containing much hydrogen enclosed in its lattice becomes brittle and is easily destroyed. The produced emitted excessive energy is taken from the vacuum, but this does not occur for nothing, because formally some of the particles (i.e. part of the matter) should disappear from the neighboring wells. Naturally these processes do not occur simultaneously and are not causally related to each other. In other words, one is under the impression that evidently a new mechanism for the direct conversion of matter into energy and vice versa has been discovered in the Unitary Quantum Theory.

Because of a relatively small number of experiments carried out, one cannot yet say definitely what particles are able to produce excessive energy in the wells. Besides, even for an electron to disappear, the depth of the well is required to be of the order of 0.5 MeV, whereas, in a solid body the well depth is of the order of mere several eV. The fact, that for such a process to take place the potential wells should be very deep, and in a solid body there are no such conditions, does not alter the essence of the issue. Therefore, in normal conditions, it is the "nursery" solution that is being fulfilled. Naturally, these processes do not take place simultaneously and are not casually connected to one another. This type of energy generation is environmentally entirely pollution-free (the soft gamma-radiation can be easily screened off). It is obvious that the excessive energy is taken from the vacuum. (But one should not think that the process entails cooling of the Universe. It is only dispersion of the vacuum that is diminishing, which is a different thing, and the Carnot principle is not breached.). Probably this energy generation effect will eventually offer more potential successes for future power engineering, than that of nuclear fusion. Time will show whether it is so.

And now a little philosophy. The Local Energy Conservation Law (LECL) in individual processes follows directly from Newton's equations under the condition of time uniformity. It would be naive to think that its local definition will remain forever unchanged. Likewise erroneous is the trend to transfer the ECL out of Newtonian mechanics without any alterations to quantum processes as the latter are more fundamental. References to the first law of thermodynamics are, strictly speaking, groundless, as it is a postulate. For instance, the well-known Academician N. Luzin wrote in his letter to an inventor: "The first law of thermodynamics is a result of mankind's fruitless attempt to build a perpetual engine, and, strictly speaking, it follows from nowhere".

The characteristic trend in modern physics nowadays is to treat the ECL, especially in theory, as a conclusion of secondary importance from the motion equations (integrals of motion). Some physicists confine the ECL to the limits of the first law of thermodynamics; others, for example, D. Blokhintsev [25], believe that "it is highly probable that the development of the new theory will influence the ECL to alter its form." F. Engels wrote in his *Nature Dialectics*: "...no physicist regards essentially the ECL as an eternal absolute law of Nature, the law of spontaneous transformation of matter motion forms and of the quantitative stability of this motion throughout all its transformations".

But many researchers are of a different opinion, as, for example, M. Bronstein in his book The Matter Structure, writes: "ECL is one of the fundamental laws of Newtonian mechanics. Yet Newton himself had never ascribed to his law any uniform character, which it possesses in reality. The reason for such an erroneous treatment of ECL on Newton's part is extremely interesting..." It is now clear, in view of the material presented above, this attitude was not at all erroneous. It may be recalled that Newton foretold many non-trivial things, the quantum theory among them in his "assault theory."

The idea to treat the ECL in quantum mechanics as equal to the second law of thermodynamics, like a statistic law, being true only in average cases and unsuitable for individual particles and situations, goes back to E. Schroedinger and later to N. Bohr, H. Kramers, J. Slater and G. Gamov. L. Landau had even called it a "beautiful Bohr's idea". Yet later these authors had denounced this concept, besides it did not follow from the quantum theory equations. But a brilliant idea remains a brilliant one, even being rejected by the person to whom it had occurred. In fact, it may simply turn out to be premature. Eventually, all the cosmologists dream of a process explaining why in the Universe there are some places where energy emerges, being taken from other places in which it is extinguished. Any philosophically minded person may ask this question looking into the clear night sky. Note, please, that solution 2 gives an opportunity to set a very small initial fluctuation, which later will accumulate energy and turn into a particle. All this opens up breathtaking possibilities for advancing science.

It is most curious that if the magnetic momentum oscillates alongside with the electric charge (which, of course, must take place according to UQT), then the solution of the problem of their orientation is reduced to similar equations and thus it makes possible to obtain energy from vacuum with the help of permanent magnets. Japan long ago had a special governmental program for the study of this problem. The reason is an impression that these phenomena are also observed by Japanese researchers in their experiments with electric motors based on magnetic ceramics, their efficiency amounting to more than 318% (!). It is claimed that the Japanese had developed a scooter and a motoroller equipped with such an electric motor and even successfully tried them out [24].

If Nature is actually so designed that there are no energy conservation laws for an individual particle, but there is one for an assembly of particles, then the generation of pollution-free energy may be viewed as a relatively simple task both from theoretical and technical viewpoint as compared to the thermal nuclear fusion. Thus, mankind will be saved from energy shortages forever and it will be the heat pollution of the environment that will constitute the main obstacle on the way to further development of our civilization. The near future will prove if this statement is true.

One has to accept the truth regardless of its source. Therefore, we conclude with the words of F. Engels from his Nature Dialectics: "But when the Solar system completes its life-path and shares the fate of everything finite, when it falls victim to death, what then? Thus we come to the conclusion that the heat emitted into the Space should have an opportunity, by some miraculous way, which it will be the task of future science to define, to turn into some other form of motion, in which it can be accumulated again and start functioning. In this case the main difficulty would become obsolete, the one obstructing the reverse change of dead suns into hot nebulae."

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EDITOR'S CHOICE

**SCIENCE OF CONSCIOUSNESS AND NEW SCIENTIFIC WORLD-VIEW
WE ARE IN THE MIDST OF THE SECOND COPERNICAN REVOLUTION**Shiuji Inomata ¹ [1]**ABSTRACT**

For about a quarter century, since early 1970s, various consciousness phenomena, such as metal-bending, came to our attention. I tried to explain these phenomena by using conventional physics theories. However, it has turned out that it is impossible. That is, by Western science we could not understand these phenomena. And I realized that, in order to solve the problems, we should return to Newton's age, some 300 years ago, and entirely reorganize Western science.

Since then, besides the consciousness phenomena, new phenomena such as high temperature super-conductivity concerning ceramic materials and cold fusion which could not be understood by contemporary mechanistic physics have been discovered. And finally, a revolutionary energy machine, such as an N-machine which violates the energy conservation law of conventional physics, that is $E = MC^2$, has come onto our scene.

The N-machine is still in its experimental stage. But the research and development for a practical N-machine would result in the final solution of the energy problems facing mankind. Ironically however, the realization of the practical N-machine means the eventual collapse of contemporary physics. We are confronting the serious alternatives whether we take the final solution of the energy problem, or we take Western science or physics.

This [paper] explains the basic idea which has led [the author] to this new paradigm of science.

DISCUSSION

The new paradigm was formulated on 1 January 1983, after ten years of intense research efforts. In Oct. 1987, I published a book, *Paradigm of New Science – Principia for the 21st Century*, from Gijutsu Shuppan Pub. Co. in Tokyo. The next year, in April, I was invited to Switzerland and I lectured at ETH Zurich, which is the alma mater of Albert Einstein, to professors and researchers of energy. The lecture paper was published in the initial issue of the Funai series, in April 1995, by Business Publication Co., in Tokyo.

The new paradigm of science relates to the problem of incorporating the category of consciousness to the contemporary scientific paradigm which contains only mass-energy categories. Dr. W. Harman, president of the Institute of Noetic Sciences, California, U.S.A., of which Dr. M. Schlitz is the research director, studied the philosophical assumptions underlying Western science. He concluded these are objectism, positivism and reductionism. He pointed out that mind, or consciousness, should be included in new science to come. He also pointed out that the fundamental stuff of this universe is not the mass-energy categories but the consciousness category and that this physical world is the manifestation of the consciousness. And he predicted that the science will be reorganized in that line in the future.

Conventional scientific world-view is that matter existed first and it has developed to yield the consciousness. So, the above view is the up-side-down to the conventional thinking and it is akin to

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G: Shadow (imaginary) electrical charge, Consciousness, Ki
 E: Energy
 M: Mass
 G: Gravitational Constant
 C: Light velocity

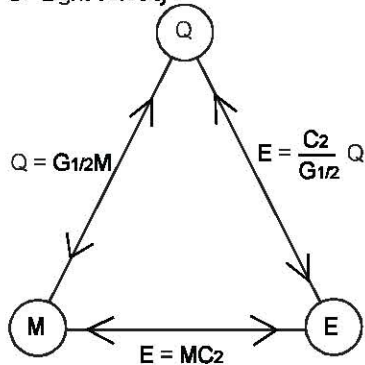


Fig. 1. Consciousness, Mass, Energy triangle

ancient Indian philosophy rather than to modern Western philosophies. Thus, old science is the mass-energy science, but new science is mass-energy-consciousness science. The fundamental principle is the conversion formulae between consciousness, mass, energy, or Inomata's triad. Fig 1.

Now at this time, if one asks what is the original problem with Western science, I cannot but answer that it is Sir Isaac Newton's very failure to disclose the primary cause of the gravitation. According to my thinking, the primary cause of the gravitation is the pulling force between the shadow electrical charges contained in matter. The shadow electrical charge is the same thing as "panpsychic consciousness," or "Ki" in Eastern philosophy. And the present confusion in science dates back to the fact that Sir Isaac Newton could not disclose the above mechanism of the gravitation. Furthermore, contemporary physics considers matter mechanistically. Matter is matter, nothing more than that.

New science considers matter to be composed of a matter ingredient and a consciousness ingredient and the later is the primary cause of the gravitation. So, in annihilating matter, there are two courses in which the matter ingredient and the consciousness ingredient both annihilate and also the matter ingredient annihilates but the consciousness ingredient survives and escapes.

In this line of thought, we obtain the consciousness-mass energy triangle, Fig 1. In conventional physics we have only the mass-energy relation, $E = MC^2$. In new science, the parameter Q makes the relations a triangle. In old paradigm, we have only mass-energy equivalence. But, in new paradigm, we have in addition, consciousness-energy equivalence and consciousness-mass equivalence.

Nuclear energy uses the mass-energy equivalence, $E = MC^2$. There arises a new possibility to use the consciousness-energy equivalence $E = (C^2 / G^{1/2})Q$, such as in an N-machine.

Should the consciousness-mass-energy triangle be valid, all physical theories are destined to be reorganized. If the consciousness is the shadow or imaginary electrical charge, the present electromagnetic theory is thought to be incomplete and should be reorganized. After the reorganization, we obtain the complexified EM theory. Should the triangle be valid, we have to reorganize the thermodynamic theory, also.

E. Schrödinger pointed out that we, living things, eat "negative entropy" to defy the second law of thermodynamics. From where does "negative-entropy" come? It does not come from food but from the surrounding space itself. So, we need new thermodynamic theory which considers consciousness or shadow energy from space. This is the complexified thermodynamic theory which I developed.

Returning to the triangle, the energy conservation law of conventional physics $E = MC^2$ is extended. So, the energy conservation law of conventional physics can be violated. Because of the equivalence of consciousness and energy, the second law of the conventional thermodynamics can be also violated. The energy conservation law and the second law of thermodynamics are the central dogmas of contemporary conventional physics. So, when it comes that the two central dogmas should collapse, we cannot but say that contemporary physics collapses.

That is, Western science/physics is sinking. We have to embark on the new science paradigm as soon as possible. I addressed this to the international audience at the New Energy Symposium, in Denver, Colorado, U.S.A., in 1994.

Now look at the New versus Old paradigm Table. EM theory becomes real EM and Shadow EM in the new paradigm. The shadow EM is actually gravitational field. And the complexified EM is the unified form of EM and gravity. As everybody knows, A. Einstein tried to unify EM and gravity in the line of his general relativity, but he failed in the end. The complexified EM is a unified theory of EM and gravity. In other words, physics has taken a wrong track and now it is in a deadlock situation.

We should also reconsider quantum physics. According to Eastern philosophy, vacuum is a balanced sea of Ki or shadow energy of both Yin (negative) and Yan (positive) polarities. The vacuum concept of conventional physics is different, and in the new paradigm, it was reorganized in the line of Eastern philosophy. And the vacuum is represented by the shadow Dirac equation.cf. the New versus Old Paradigm Table. Also, it should be questioned whether "neutrino" is a matter particle as W. Pauli envisaged or a consciousness particle.

As to space-time – conventional physics considers 4-dimensional space-time: space, three dimensions, time, one dimension. The new paradigm introduces 4-dimensional shadow space-time; shadow space, three dimensions, and shadow time, one dimension and it represents the consciousness world. Real space-time and shadow space-time are thought to be in mirror relation with each other. By considering 8-dimensional space-time, in total, we can explain remote-viewing, near-death experiences and consciousness-remote therapy phenomena.

Finally, I want to talk about the experimental verifications of the theory of complexified EM. The complexified EM theory predicts that gravitational mass of an electrical condenser changes when it is charged with the shadow electrical charge or Ki. Also, the flow of shadow electrical charge or Ki creates the gravitational vortex. On the other hand, M. Faraday performed various experiments on electricity and magnetism. He believed that electro-magnetism relates to gravity. But he could not show it experimentally.

I performed as a "contemporary Faraday" and did various experiments on EM and gravity. The complexified EM theory predicts that the gravitational vortex generates in a coil when the shadow electrical current, i.e., consciousness/Ki flows in it. In the experiment, I used an air-core coil, in which insulated copper wire of 0.06 mm diameter was wound a quarter million turns and I used a tooth-pick to detect the gravitational vortex. And this experiment has been known as the "toothpick and coil experiment." The coil was electrostatically shielded, so that an electrostatic force may not interfere.

In case 1 in Fig 2, when real electrical current flows, the tooth-pick deflects and we notice that the gravitational vortex is generated. However, case 2 is really astounding. In case 2, no electrical current flows, and for the deflection of the tooth-pick, the connection of both terminals of the coil only is necessary. Cases 3 and 4 are also fantastic phenomena comparable to Faraday's electro-magnetic induction.

These experiments need quiet air and a quiet desk. The thread which hangs the toothpick must be a silk thread. All metal objects should be removed from around the experimental devices. On clear days, the phenomenon is stronger than on cloudy and rainy days when the humidity in the air is higher. In the experiments where the DC electrical source is not utilized, the coil of a quarter million windings is not necessary. **This is a simple experiment everybody can try.**

If we ponder on this experiment, we cannot but conclude that the present EM understanding encompasses only half of the reality of EM phenomena. And there exists the shadow EM and that is nothing but the gravitational field. This is the message and lesson that the idea of the complexified EM gives us. Especially, the gravitational induction phenomenon where there is no electrical current, is important for the following two reasons.


First, it can be said that the terrestrial gravitational communication, which has not been attained in the line of general relativity, has been realized even in the short distance of 15 cm. **Second**, the energy

necessary for the communication comes from the vacuum or space. Thus, "no-energy communication" is realized. And, it can be concluded that Einstein's special relativity of the year 1905, which stipulates that there is no non-material aether or Ki, is definitely premature.

In this way, the new paradigm in science will bring about revolutionary break-throughs in energy technology and in communications technology. In the new scientific world-view, Western science, in which mass-energy is the ultimate substance of the world, is turned around 180 degrees and the consciousness/Ki is regarded as the ultimate substance of the world.

In the 17th century, there was a conversion from Ptolemaic to Copernican cosmology. We are now in the midst of the second Copernican revolution. That is, matter is not the origin of this world. Rather, the consciousness existed first and from it material world manifested itself. This is the new scientific world-view which I propose for the next century.

[This is the English translation of the author's speech at the 1st Int. Symp. on Consciousness, New Medicine and New Energy, 1996, Japan. Published by the Business Publication Co. Ltd. Tokyo, March 1997.]



New Energy News

Monthly Newsletter of the Institute for New Energy

SPECIAL EDITION THIRD INTERNATIONAL SYMPOSIUM NEW ENERGY

The Institute of New Energy

In its grand plan to create a series of Institutes of New Science, the International Association for New Science (IANS) encouraged the formation of the Institute of New Energy (INE) as a non-profit, membership organization. Thereafter, INE's board of directors instructed the officers to create a non-profit organization and provide bylaws for the members.

Under the guidance of INE's president, Dr. Patrick Bailey, and with the assistance of Hal Fox, (a member of the board and the appointed editor of INE's monthly newsletter) this assignment from the board was finally completed by the end of 1995. Thanks to the input from many members, we believe that INE has an excellent set of bylaws to guide its further growth and development.

Although a quarterly newsletter was suggested at the founding of INE, the newly appointed editor (Hal Fox) assured the board that there would be more news than could be accommodated with just a quarterly newsletter. **Since the first monthly issue of *New Energy News* in May 1993, every**

issue has had 16 to 24 pages of information for its members.

With the consistent help of INE members, the *New Energy News* has grown to encompass a world-wide list of subscribers with over 400 copies of *NEW* now being distributed every month, **without any funds being spent for advertising this publication!**

Of course, a great deal of credit must be given to Dineh Torres and Robyn Harris for their valiant efforts to get every issue out every month. The editor is pleased to report that he has received many letters proclaiming that *NEW* is the best publication of its kind in the world.

In case you are interested, it will require about 2,000 subscribers before *NEW* is self-supporting. But we believe that **with the help of its dedicated members, that this goal will soon be achieved!** Thank you all for all of your support!

Hal Fox, Editor

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Gravitational Vortex and Induction

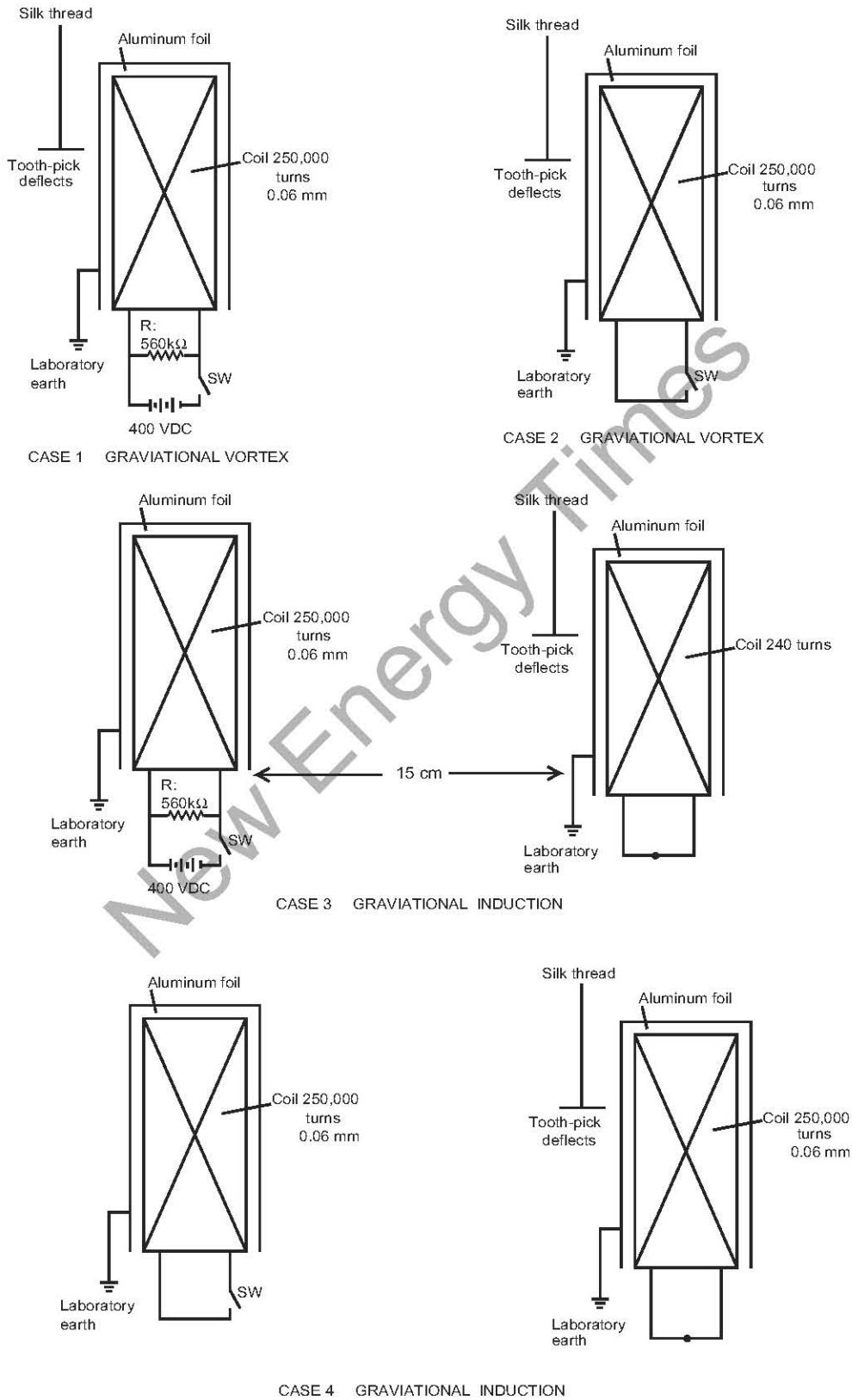


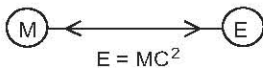
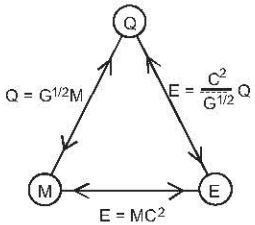
Fig. 2 Phenomena with Coils

Appendix I:

Table. Old vs. New Paradigms

Old Paradigms	New Paradigms
<p>Newton's Mechanics</p> <p>1st Law: law of inertia 2nd Law: equation of motion $\frac{dP}{dt} = F(P=mv, m, \text{inertial mass})$ 3rd Law: law of action & reaction</p> <p>Gravitation $f = \frac{GM_1M_2}{r^2}$</p>	<p>Newton's Mechanics</p> <p>1st Law: law of inertia 2nd Law: equation of motion $\frac{dP}{dt} = F(P=mv, m, \text{inertial mass})$ 3rd Law: law of action & reaction Above laws are effective only if there is no consciousness function</p> <p>Gravitation $f = \frac{Q_1Q_2}{r^2}$</p> <p>$Q_1 = iG^{1/2} M_1$ $Q_2 = iG^{1/2} M_2$</p>
<p>Electromagnetic equation (CGS unit in vacuum)</p> <p>$\nabla \cdot E = 4\pi \rho_e$, $\nabla \times E = (-)\frac{1}{c} \frac{\partial H}{\partial t}$ $\nabla \cdot H = 0$, $\nabla \times H = \frac{1}{c} \frac{\partial E}{\partial t} + \frac{4\pi}{c} J_e$</p>	<p>Electromagnetic-gravitational equation (CGS unit in vacuum)</p> <p>$E = E_1 + iE_2$, $H = H_1 + iH_2$ $\nabla \cdot E_1 = 4\pi \rho_e$, $\nabla \times E_1 = (-)\frac{1}{c} \frac{\partial H_1}{\partial t}$ $\nabla \cdot H_1 = 0$, $\nabla \times H_1 = \frac{1}{c} \frac{\partial E_1}{\partial t} + \frac{4\pi}{c} J_e$</p> <p>The above equations indicate electromagnetic field</p>
	<p>$\nabla \cdot (iH_2) = 4\pi i \rho_m$ $\nabla \times (iH_2) = \frac{1}{c} \frac{\partial (iE_2)}{\partial t}$ $\nabla \cdot (iE_2) = 0$, $\nabla \times (iE_2) = (-)\frac{1}{c} \frac{\partial (iH_2)}{\partial t} + \frac{4\pi}{c} iJ_m$</p> <p>Above equations indicate gravitational field</p>
<p>General representation</p> <p>$\square \phi = -4\pi \rho$ $\square A = -\frac{4\pi}{c} J$ $\square = \Delta - \frac{1}{c^2} \frac{\partial^2}{\partial t^2}$ Lorentz condition $\nabla \cdot A + \frac{1}{c} \frac{\partial \phi}{\partial t} = 0$</p>	<p>General representation</p> <p>$\square \phi = -4\pi \rho$ $\rho = \rho_e + i\rho_m$ $\square A = -\frac{4\pi}{c} J$ $J = J_e + iJ_m$ $\square = \Delta - \frac{1}{c^2} \frac{\partial^2}{\partial t^2}$ $\phi = \phi_1 + i\phi_2$ Complex Lorentz condition $\nabla \cdot A + \frac{1}{c} \frac{\partial \phi^*}{\partial t} = 0$</p>
<p>Integration theory of electromagnetism and gravity</p>	<p>Integration theory of electromagnetism and gravity</p>
<p>none</p>	<p>$\square \phi = -4\pi \rho$ $\square A = -\frac{4\pi}{c} J$ $\square = \Delta - \frac{1}{c^2} \frac{\partial^2}{\partial t^2}$ $\rho = \rho_e - G^{1/2} M_2 + i(\rho_m + G^{1/2} M_1)$ $J = J_e + iJ_m$ $M = M_1 + iM_2$, complex mass.</p>
<p>Thermo-dynamics</p>	<p>Complex thermo-dynamics</p>
	<p>Complex temperature, $T = T_1 + iT_2$ Complex heat quantity $Q = Q_1 + iQ_2$</p>

Table (cont.) Old vs. New Paradigms

<p>Entropy</p> $\Delta S = \frac{\Delta Q}{T}$	<p>Entropy</p> $\Delta S = \Delta S_1 + \Delta S_2$ $\begin{cases} \Delta S_1 \frac{\Delta Q_1}{T_1} \\ \Delta S_2 \frac{\Delta Q_2}{T_2} \end{cases}$
<p>Quantum mechanics/elementary particle theory</p>	<p>Quantum mechanics/elementary particle theory</p>
<p>Schrödinger Equation</p> $i \frac{\partial}{\partial t} \psi = H \psi$	<p>Schrödinger Equation</p> $i \frac{\partial}{\partial t} \psi = H \psi$ <p>Shadow Schrödinger Equation</p> $- \frac{\partial}{\partial t} \psi = i H \psi$
<p>Klein-Gordon equation</p> $- \frac{\partial^2 \psi}{\partial t^2} = (-\nabla^2 + m^2) \psi$	<p>Klein-Gordon equation</p> $- \frac{\partial^2 \psi}{\partial t^2} = (-\nabla^2 + m^2) \psi$ <p>Shadow Klein-Gordon equation</p> $\frac{\partial^2 \psi}{\partial t^2} = (-\nabla^2 + m^2) \psi$
<p>Dirac equation</p> $i \frac{\partial \psi}{\partial t} = (-i \alpha \cdot \nabla + \beta m) \psi$ <p>Dirac neutrino</p> $i \frac{\partial \psi}{\partial t} = -i \alpha \cdot \nabla \psi$ <p>(natural unit)</p>	<p>Dirac equation</p> $i \frac{\partial \psi}{\partial t} = (-i \alpha \cdot \nabla + \beta m) \psi$ <p>Shadow Dirac equation</p> $- \frac{\partial \psi}{\partial t} = (-i \alpha \cdot \nabla + \beta m) \psi$ <p>Shadow Dirac neutrino</p> $- \frac{\partial \psi}{\partial t} = -i \alpha \cdot \nabla \psi$ <p>(natural unit)</p>
<p>Yukawa equation</p> $\square \phi_1 - \mu^2 \phi_1 = 0$ <p>(strong interaction)</p>	<p>Yukawa equation</p> $\square \phi_1 - \mu^2 \phi_1 = 0$ <p>(strong interaction)</p>
<p>(CGS unit)</p>	<p>Shadow Yukawa equation</p> $\square i \phi_2 - \beta^2 i \phi_2 = 0$ <p>(weak interaction)</p> <p>(CGS unit)</p>
<p>Space-time</p>	<p>Space-time</p>
<p>x, t</p>	<p>x $x_1 - i x_2$</p> <p>t $t_1 - i t_2$</p>
<p>Conversion formula: inertial mass and energy</p>	<p>Conversion formula: consciousness, mass and energy</p>
<p>E - Mc²</p> 	
	<p>As to the meaning of symbols, please confer with reference</p>

EDITOR'S CHOICE

THE TRUTH ABOUT TIME-DILATION EXPERIMENTS

Robert L. Henderson ¹

ABSTRACT

Certain so-called "time-dilation" experiments have been performed which are interpreted to confirm that time rate-of-flow varies as a function of a reference frame's relative velocity, as hypothesized by special relativity. However, since time - by its rational definitions - is uniform throughout the universe, these experiments do not confirm that time rate-of-flow is a variable, but rather have been misinterpreted as to their true meaning due to the misunderstanding of "time" as it is presently assumed to be defined by "clocks."

DISCUSSION

Ever since the general acceptance of Einstein's Special Theory of Relativity, the belief that time rate-of-flow varies as a function of a reference frame's relative velocity has become prevalent within the scientific community. In fact, certain so-called "time-dilation" experiments have been performed that are interpreted to confirm this belief.

However, since time - by its rational definition - is uniform throughout the universe, these experiments do not confirm that time rate-of-flow is a variable, but rather have been misinterpreted as to their true meaning due to the misunderstanding of "time" as it is presently assumed to be defined by "clocks." The following explanation of the difference between the phenomenon of "time," and the function of "clocks," will clarify this misunderstanding:

As perceived by the human mind, the passage of time is the relationship that exists in the sequence of occurrence of events. Now, in order for events to take place, things must move: thus if there were no motion of physical objects anywhere in the universe, then no events would take place and the concept of time would have no meaning (there would be no motion even of time-keeping devices). Therefore, it may be said that time, as perceived by the human mind, is a consequence of the existence and motion of physical matter; and, since physical matter in motion is the elementary definition of "energy", we may say that "time" is a consequence of the existence of energy.

In addition, in accordance with rational perception, time is a non-physical phenomenon, purely a product of the human mind, as deduced from the following understandings:

When considering the character of time, it is perceived as a continuum that flows from the past, through the present, and into the future. [One could hypothesize that time flows from future into present.] The past covers the vast period from the unknown beginning of time up to the present; the future covers the equally vast period from the present out to the unknown end of time; however, the present covers no period of time at all: it is infinitesimal in duration and exists as the dividing line between the past and the future. However, although the present - which may also be referred to as the instant of "now" - has no measurable interval associated with it, all physical matter always exists in that infinitesimal instant: things in the past exist only as memories within the human mind, while things in the future exist only within the human mind as anticipations. Therefore, since everything physical always exists in the present instant of "now," it is

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only through the processes of memory within the human mind that events in the past are remembered so as to establish the non-physical concept of the passage of "time."

Now, the salient property of the infinitesimal instants of "now" is that they are each perceived to occur everywhere throughout the universe at the same instant of time: when it is "now" at an observer's local location, it is rationally perceived to also be that same instant of "now" at every other location in the universe. Furthermore, it is this all-pervasive property of the instants of "now" which mandates that the passage of time is uniform throughout the universe, as perceived through the following thought process:

At any instant of "now" at an observer's local location, let the observer contemplate a remote location as it exists at that same instant of "now." Now let the observer contemplate the remote location at various other instants of "now." Through this process, then, we see that for every instant of "now" which occurs at the observer's local location, a simultaneous instant of "now" occurs at the remote location: no extra instants of "now" occur at the observer's location that do not occur at the remote location, or visa-versa. For this reason, then, the passage of time - which consists of the passage of successive instants of "now" - is the same throughout the universe, since all instants of "now" occur simultaneously everywhere.

Perhaps this perception of the uniformity of the passage of time can be better understood by considering the following example:

Consider a stationary observer at some local point in the universe who launches a rocket ship at an enormous velocity into the outer reaches of space, whereupon the ship turns around and returns. During the rocket ship's trip, at every instant of "now" at the observer's location the rocket ship can be contemplated by the observer as it exists in its remote location at that same instant of "now": no extra instants of "now" occur at the observer's location that do not occur at the rocket ship's location, or visa-versa. (If one were to assume that an extra instant of "now" occurred at the observer's location which did not occur at the rocket ship's location, one would have to explain why that instant did not occur at the remote location: did the rocket ship cease to exist for that instant?) We see, then, that when the rocket ship returns, it will have traveled throughout the universe, experiencing exactly the same number of instants of "now" as the local observer, and will therefore have experienced exactly the same passage of time as did the local observer. This will be true no matter how fast or how far the rocket ship traveled, and regardless of the unknown environments it encountered.

For these reasons, then, it can be seen that the passage of time is uniform throughout the universe, based solely on the rational concept that all instants of "now" occur everywhere simultaneously. However, this understanding of the uniformity of the passage of time becomes confused when the measurement of the passage of time through the use of "clocks" comes into play. To understand how this confusion comes about, let us review how clocks are used in the measurement of time:

Now, there is no fixed, standard scale for measuring the passage of time. The scale of time is established purely on a comparison basis with any convenient, uniform, cyclic phenomenon: we count the number of cycles as a measure of the passage of time. For example, two rather coarse scales that are used to measure time are the cyclic rotation of the earth around the sun, the period of which is called the "year;" and the rotation of the earth on its axis, the period of which is called the "day." In addition, if we wish to identify either points in time, or intervals of time, within finer increments than the day, we use the faster cyclic intervals generated by man-made devices to subdivide the day into hours, minutes, and seconds. There is, in fact, no limit to the fineness of the increments into which one may subdivide time: the only practical limit arises from the ability to devise a cyclic device capable of generating [and counting] the desired infinitesimal increments. Now, all of these cyclic devices, whether natural occurring or man-made, are referred to as "clocks." And, to facilitate the keeping of time and to generate the many different increments into which time may be divided, man-made clocks exist in many different forms, such as pendulum clocks, mechanical clocks, electro-mechanical clocks, electronic clocks, and the most stable and accurate of all - the atomic clocks.

Now, there is no "rate" associated with the uniform passage of time: it is correct only to say that time exists (due to the motion of physical matter) and that its passage is uniform throughout the universe (due to the rational fact that all instants of "now" occur everywhere simultaneously). However, when considering the use of "clocks" as a means of measuring the passage of time, the term "rate" does come into play.

For example, time is measured with clocks in an orderly manner starting with the coarsest measurement - as for example the year - and subdividing it into ever smaller increments, as for example into days, hours, minutes, seconds, milli-seconds, micro-seconds, nano-seconds, etc., ad infinitum. Now, with the clocks used to generate these increments, the term "rate" comes into play: each of the clocks must operate at a fixed "rate" with respect to the next higher clock in the chain. For example, a seconds clock must cycle at a "rate" of exactly 60 cycles per cycle of the minute clock: the minute clock must in turn cycle at a "rate" of 60 cycles per cycle of the hour clock: the hour clock must in turn cycle at a "rate" of 24 cycles per cycle of the day clock: the day clock must in turn cycle at a "rate" of 365 cycles per cycle of the year clock, etc. From these relationships, then, comes the concept of "rate" as associated with the passage of time. Although the passage of time is uniform throughout the universe, the "clocks" that are used as convenient means of establishing a reference scale for the passage of time are required to operate at specific "rates" in order to maintain their synchronization (and therefore their usefulness) with each other.

From this discussion, then, it should be understood that no clock defines a "rate" for the passage of time (oftentimes erroneously referred to as a "rate-of-flow of time"): clocks - due to their internal motions - only confirm that time is passing, and each denotes its passage by producing uniform cycles in its own particular way. In addition, every clock - including the atomic clock - will alter its cyclic rate due to variations in its surrounding environment. For example, if a large meteor were to strike the earth in the right spot, it would slow the rotation of the earth about its axis and the length of a day would increase; however, this would not mean that time had slowed down on the earth but only that the rotation of the earth had slowed, and thus there would be fewer days in a year. If mechanical, electro-mechanical, or electronic clocks are subjected to variations in temperature, they will slow down or speed up: however, this does not mean that the passage of time slows down or speeds up in the vicinity of the clocks, but only that the timing "rates" of the clocks have changed. Gravity operated pendulum clocks will stop when located in a space ship orbiting the earth; however, this does not mean that the passage of time ceases on the space ship, but only that the timing mechanism of the pendulum clock has stopped. Likewise, if the rate of energy shift within the rate-determining atom of an atomic clock is found to vary for any reason, it is not an indication that the passage of time has changed in the reference frame of the atom, but only that the atom's "cyclic rate" has changed.

Now, with this understanding of the meaning of the term "rate" as it applies to the operation of "clocks," let us return to the time-dilation experiments which are presently interpreted to verify that the passage of time is a variable.

Perhaps the two most notable time-dilation experiments are the "Ives-Stillwell Study of the Rate of a Moving Atomic Clock," performed in 1938; and the "Hafele-Keating Around-the-World Atomic Clock Experiment," performed in 1971. (Although there have been other experiments of a similar nature performed to ostensibly verify the time dilation predicted by relativity, they all involve the same principle as these two, well-known experiments.) These two experiments were performed as follows:

The Ives-Stillwell experiment consisted of the measurement of the changes in frequency of light emitted by positively charged hydrogen atoms that were accelerated to high velocities in a vacuum tube. In this study, the frequency of the emitted light was found to decrease with increasing velocity of the atom. Now, since the frequency of the light emitted by an atom is related to the rate of energy shift within the atom - said energy shift being used as the rate-determining element in atomic clocks - it was assumed that the decrease in frequency was an indication that time rate-of-flow itself had slowed in the reference frame of the moving atom.

The Hafele-Keating experiment consisted of the flight of cesium-beam atomic clocks around the world on commercial jet flights - once eastward and once westward - to test whether time would slow down in moving reference frames with respect to a stationary frame, as hypothesized by special relativity. Since this experiment revealed that the atomic clocks did - in fact - change their rates when flown around the earth, as compared with an atomic clock stationary on the earth, it was assumed that this was an indication that time rate-of-flow had changed in the reference frames of the moving atomic clocks.

It can be seen, then, that in all experiments which ostensibly verify that time rate-of-flow is a variable, atoms are moved with respect to the earth and the changes noted in their rates of energy-shift are interpreted as changes in time rates-of-flow in the reference frames of the moving atoms, as predicted by special relativity. Furthermore, as also hypothesized by special relativity, it is assumed that these rate changes are caused only by the abstract relative velocity between the atom and an assumed "stationary" reference frame, said stationary frame being the earth in the Ives-Stillwell experiment, and an assumed reference frame located in space above the north pole in the Hafele-Keating experiment. However, as we have previously explained, changes in the "rates" of "clocks" - including atomic clocks - do not constitute changes in the universal, uniform passage of time, but only changes in the rates of the time keeping devices. Therefore, these experiments do not in any way confirm the time-dilation phenomenon hypothesized by special relativity.

The rational explanation for the changes that occur in the cycle rates of moving atoms is - in fact - of much more significance to the rational progress of science than the erroneous assumption that they confirm relativistic variations in time rates-of-flow due to abstract "relative velocity." Since all clocks vary their cycle rates due to variations in their surrounding environments, it is the physical cause of the rate changes that take place within the moving atoms which is the scientifically significant factor, and "relative velocity" in the abstract is not a phenomenon capable of entering into physical cause-and-effect relationships. Therefore, since the environment surrounding the atom is the universal, light-conducting medium, it can only be the interaction of the atom with this medium that produces the rate changes. It should be noted that when atoms are moved with respect to the earth (as was done in these time-dilation experiments), they are also moving through the universal medium which envelopes the earth. Therefore, changes in the cycle rates of atoms that occur when the atoms are moved with respect to the earth can be seen to be a type of Doppler effect, caused by the interaction of the moving atoms with the universal medium which envelops the earth (where the term Doppler effect in this case is interpreted to mean any effect produced by the motion of a cycle-generating device through its surrounding medium).

It should be understood, then, that the variations in the cycle rates of atoms caused by their motion, rather than confirming that "time-rate-of-flow" is a function of a reference frame's abstract "relative velocity," are, in truth, scientifically significant in two respects: First, they mandate the existence of a universal medium, and second, they define one facet of the interaction of the medium with physical matter: a relationship which must be used in defining the intrinsic nature of the medium.

Furthermore, not only would the acknowledgment of the existence of the universal medium provide the only rational explanation for the cycle-rate changes which occur within atoms when the atoms are moved, but it would also provide the missing ingredient required to resolve substantially all the other problems yet facing the physical sciences: the medium from which to develop the rational explanations for the phenomena of light waves, gravity, nuclear energy, the nuclear binding force, electric and magnetic field forces, radioactivity, the Higgs boson, the Higgs field, the origin of matter, the missing mass of the universe, and the macroscopic configuration of the universe as well. In addition, it would provide the medium required to generate both the "zero-point energy," and the compressive force about every point in space called the "cosmological constant," which are the two hypothesized phenomena required to provide quantum mechanics with its long-sought, rational foundation.

[The author is encouraged to read Akimov's paper in this issue. – Ed.]

EDITOR'S CHOICE

MECHANISM OF INTERACTION IN OBJECTS OF THE UNIVERSE

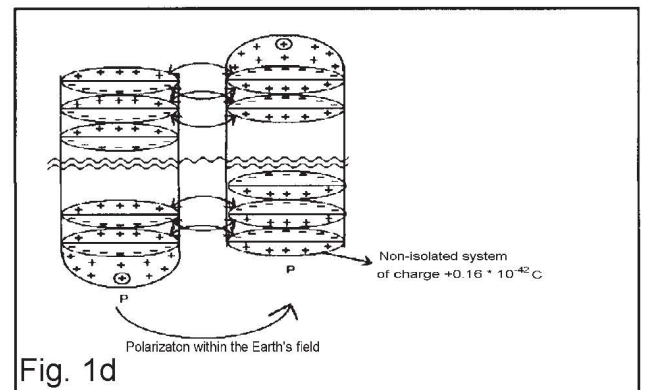
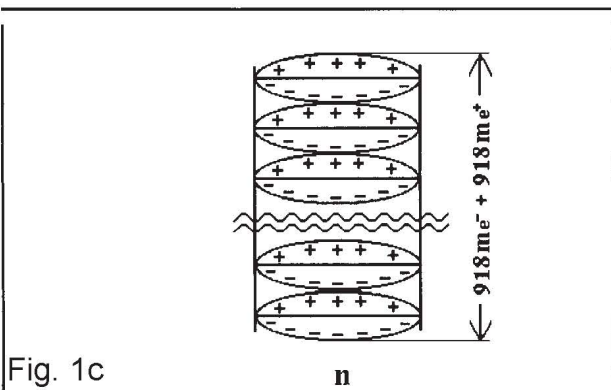
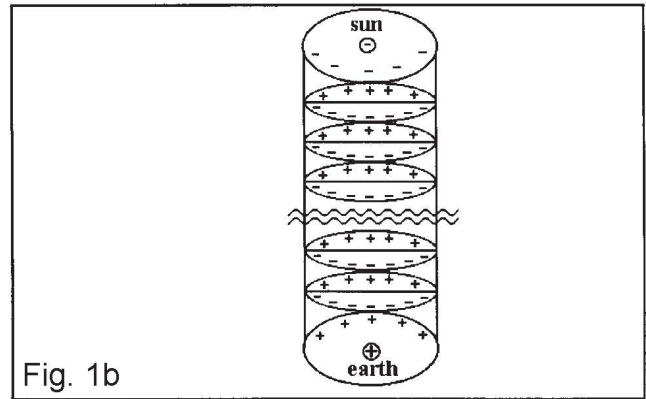
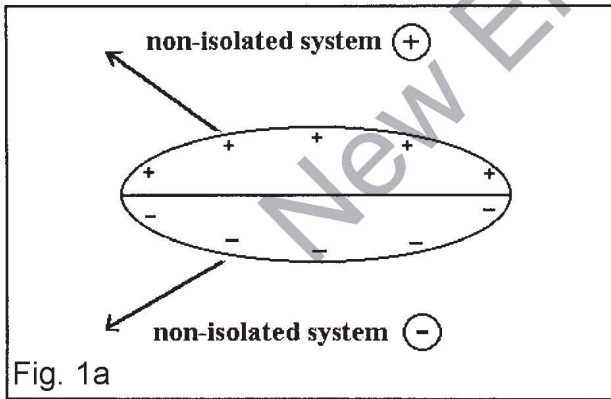
George Rabzy

ABSTRACT

The conducted research has shown that *corpus delicti* presented by scientists to the cold fusion test cell has not been corroborated. There were no fusion phenomena in the cell. Let me proceed with the demonstration that will prove my position. In my previous works [1,2] I have shown theoretically and experimentally the possibility of utilizing the fundamental forces of nature, identical to the forces acting inside of atoms in the objects. This allows us to explain accurately the mechanism of origin and operation of all kinds of transmutations in micro and macro universes. This also permits us to examine, by means of the proof and by using the new fundamentals of physics, those questions that were not given reliable answers, in accordance to the laws of constant net electric charge of an isolated system.

DISCUSSION

Let me remind you of basic principles leading into the new physics. Atoms, objects of the Universe, self-emerge from the biggest and unexterminable specific charges of electrons e^- and positrons e^+ . They are held together by the greatest among the elementary particles force of attraction, $F = 1.373 \times 10^{52} N$. They form an electron-positron pair = matter = neutrino with surface micro charges $q_v = \pm 0.16 \times 10^{-42} C$. Micro charges of neutrino (Fig. 1a) form the single constant non-isolated system in the Universe. Therefore, from these pairs self-assemble electric field lines, which begin at the positive charge of the Earth and end at the negative charge of the Sun. An isolated system of electric field lines is generated



(Fig. 1b). The interaction of neutrino micro charges - 0.16×10^{-42} C of the electric lines with the positive charge of the Earth, forms the inseparable whole, moving with the speed of 30 km/sec. The electric lines make up material, resilient medium filling the Universe. In it occur all the interactions and transmutations of material objects. Figures 1a through 1f show the sequence of self-generation of an atom.

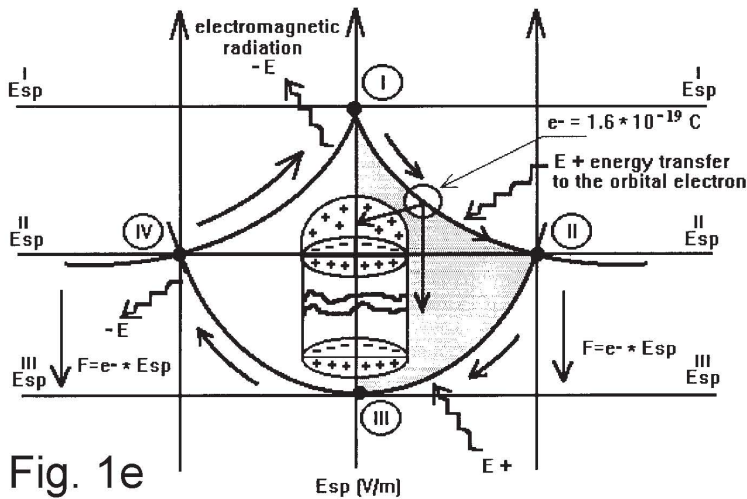


Fig. 1e

Figure 1e E_{sp}' , E_{sp}'' , E_{sp}''' - equipotential (equal in intensity) field surfaces. $E_{sp}' < E_{sp}'' < E_{sp}'''$; therefore the electron shifts from point I with lesser intensity, E_{sp}' , to point II with greater intensity, E_{sp}'' , and further to point III with intensity E_{sp}''' . In the section of trajectory I-II-III electron gains energy (shaded area), $+E$, or more accurately the electron derives energy from the field and accelerates. In the section of trajectory III-IV-I the same field takes energy away from the electron. The electron, contacting the electric field lines, compresses them giving rise to a wave. Electromagnetic oscillations of the electric field lines arise. $+E = -E$ as the force on the right and on the left is $F = e^- \times E_{sp}$. The section of trajectory I-II-III is accelerating - electron gains energy. The section of trajectory III-IV-I is decelerating - electron emits energy.

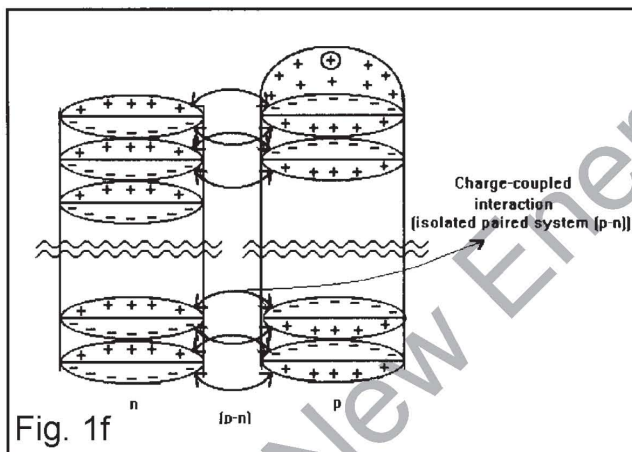


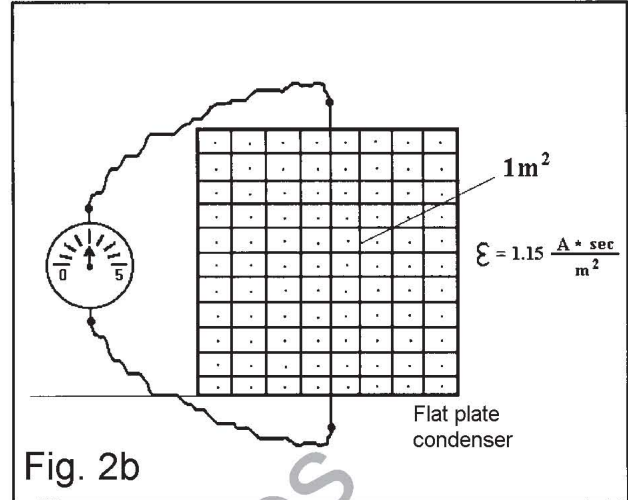
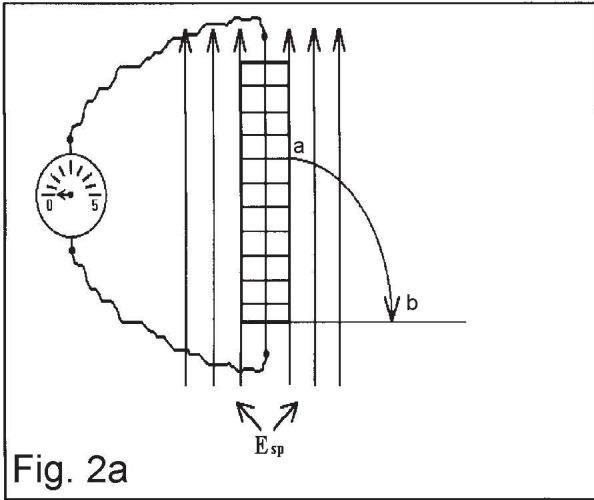
Fig. 1f

The self-generated atom (Fig. 1e) can only exist as a dynamic structure. Thus interactions of an electron (as a general rule $\sum_{act} e^-$) with a nuclear proton's positron and the spatial electric field of the Earth, E_{sp} [V/m], will cause the atom to move **clockwise** following a curved trajectory formed by sections of 3 parabolas. In the section of trajectory I-II-III, the electron accelerates, moving against the direction of the field and deriving energy from it. In the section of trajectory III-IV-I, under the influence of the field, the electron decelerates, emitting energy into space.

The mechanism of origin of the energy emission is the following: local contact of the moving electron (electric current) with the electric field lines causes their compression and decompression, giving rise to a wave, as a companion of the electron. The wave is accompanied by a magnetic field, originating in a plane perpendicular to the direction of field lines and electric current. Electromagnetic oscillations of the electric field lines arise, which affirms the absence of particle dualism.

The nuclear proton's positron interacts with the field and also moves according to the law of sections of 3 parabolas, but following the directions of electric field lines **counterclockwise**. The movement of proton-neutron pairs (p-n) of the nucleus in the electric field of the Earth, generates positronic current of protons and electronic current of the atom. These currents create corresponding magnetic fields and nucleon moments. Factors that ensure the movement, as the basic property of objects, are the electric charges of atoms interacting with electric lines of the field E_{sp} [V/m].

Figure 2 provides the diagram of an experiment which demonstrates the reality of electric force lines carrying constant charge of neutrino and generating constant impulse of current. The flat plate condenser, composed of 2 metallic screens with an area about $1m^2$, can rotate around a horizontal axis (Fig. 2b). The vertically installed condenser, parallel (a) to the electric field lines E_{sp} [V/m], shifts into horizontal position



(b) (Fig. 2b). With every rotation, there is an increase in the number of local contacts of orbital electrons of the screens' atoms $\sum_{act} e^-$ [C] with the charges of neutrino $q_0 = \pm 0.16 \times 10^{-42}$ C forming electric field lines, which generates impulse of current. Near the Earth's surface, the average value of the impulse is 1.15×10^{-9} A x sec/m² [3].

From Equation

$$F = E_{sp} \times \sum_{act} e^- = e_{earth} / R_{earth}^2 \times \sum_{act} e^- = 1.405 \times 10^{-8} \times \sum_{act} e^- \tag{1}$$

follows that at $E_{sp} = 130$ V/m = $e_{earth} / R_{earth}^2 = 1.405 \times 10^{-8}$ C/m², the voltage in a unit of spatial field 1 V/m carries a charge created by electric lines from pairs of neutrino. The charge is displayed by impulse $\epsilon_{imp} = 1.15 \times 10^{-9}$ C/m².

Impulses confirm that the spatial field of the Earth is an inexhaustible source of energy derived from atomic systems of objects. It is noteworthy to mention that the spatial charge value of 1 V/m forms the experimentally obtained impulse. This confirms the existence of electric force lines, formed from pairs of neutrino. The reality of electric lines, as material force occupants of spatial field, and in the derived Equation (1), serves as the origin of any interaction with acting charge of orbital electrons $\sum_{act} e^-$. This forms the **unified electric relation**. It neither requires nor permits the use of empirical "fundamental constants", values of which do not follow from understanding of the theory. This relation contains the minimum of symbolic means, which affirms **not an approximate theory** and its balancing, but its authenticity, easily verified universality and wide scope of applications.

A convincing example is the use of Equation (1) for establishing the natural mechanism of gravity, as a local contact attraction of $\sum_{act} e^-$ of an object with electric field lines of the spatial field. This leads to the attraction of an object toward the Earth, against the direction of electric force lines.

$$F_{grav} = G (m_1 \times m_2 / r^2) ;$$

$$F_{grav} = (\sum_{act} e^- \times E_{sp}) / r^2 = (1.405 \times 10^{-8} \times \sum_{act} e^-) / r^2 \tag{2}$$

Notice that in the Newtonian equation, the masses of objects are defined as a measure of the quantity of substance. This is unreliable for atomic structures, and therefore, for all objects.

From Equation (2) and Figure 1 it follows that, in the Universe:

a) The 4 types of interactions (gravitational, weak, electromagnetic, and nuclear) do not exist. There is

- only one - interaction of electric charges.
- b) Neutrons and protons are structures formed from identical quantity of neutrino $U\downarrow$ and antineutrino $U\uparrow$.
 - c) Neutrons, with their micro charges $q_{\nu i} = -0.16 \times 10^{-42}$ C, interacting with the Earth's field, display gravitational component toward Earth. Qualitative analysis (using electrical neutrality of microscopic volume of gas) gives the value of neutron's charge $q_n = 10^{-22} \times e = 10^{-22} \times 1.6 \times 10^{-19} = 0.16 \times 10^{-42}$ C. This experimentally confirms that the micro charge of a neutron is -0.16×10^{-42} C. Neutrino is actually the closing part of a neutron determining its negative charge. Free neutron has an unbalanced negative charge and thus represents a non-isolated system.
 - d) Process of self-generation of 104 elements of the Periodic System in spatial field of the Earth as a constant temperature, $T_{sp} = \text{Constant}$, confirmed, that it carries in itself an actual harmonic structure of nuclei, in which it is easy to calculate forces and establish hidden and always ready for action low-temperature transmutation. It starts with an increase in temperature leading to ionization of atoms. Indestructibility of the atomic nucleus in spatial field is a result of the shielding of the nucleus by orbital electrons. Each electron is attracted to a nuclear proton's positron.
 - e) Nuclei of all the elements of the Periodic System, except isotopes, are composed only from proton-neutron to the proton-neutron pair (p-n). Isotopes are formed by addition of a neutron to the proton-neutron pair (p-n) as shown in Fig. 3a.
 - f) Mass defect of a proton-neutron pair in and out of the nucleus can be explained (Fig. 3b).
 - g) Vast constant half-lives of the elements, $T_{1/2} = \text{Constant}$, and mass defect, $\Delta m = 0.001 = \text{Constant}$, are determined by the constancy of the spatial field of the Earth, $E_{sp} = \text{Constant}$, and its temperature, $T_{sp} = \text{Constant}$, at which the atoms are preserved as isolated, non-transmutating systems.

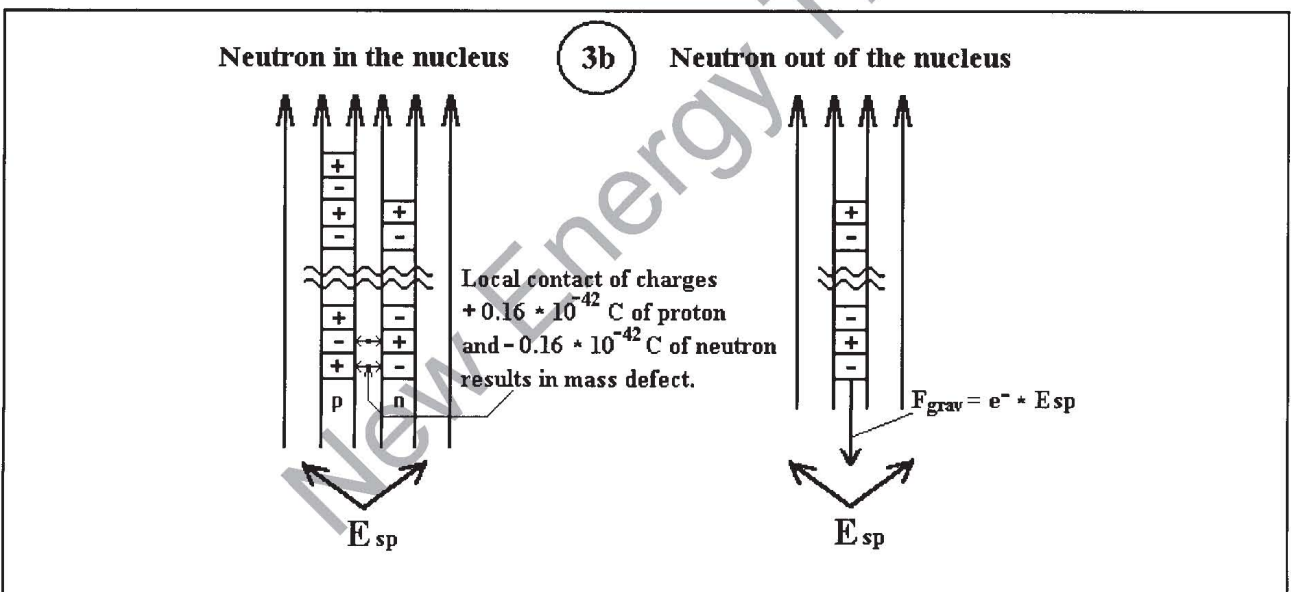
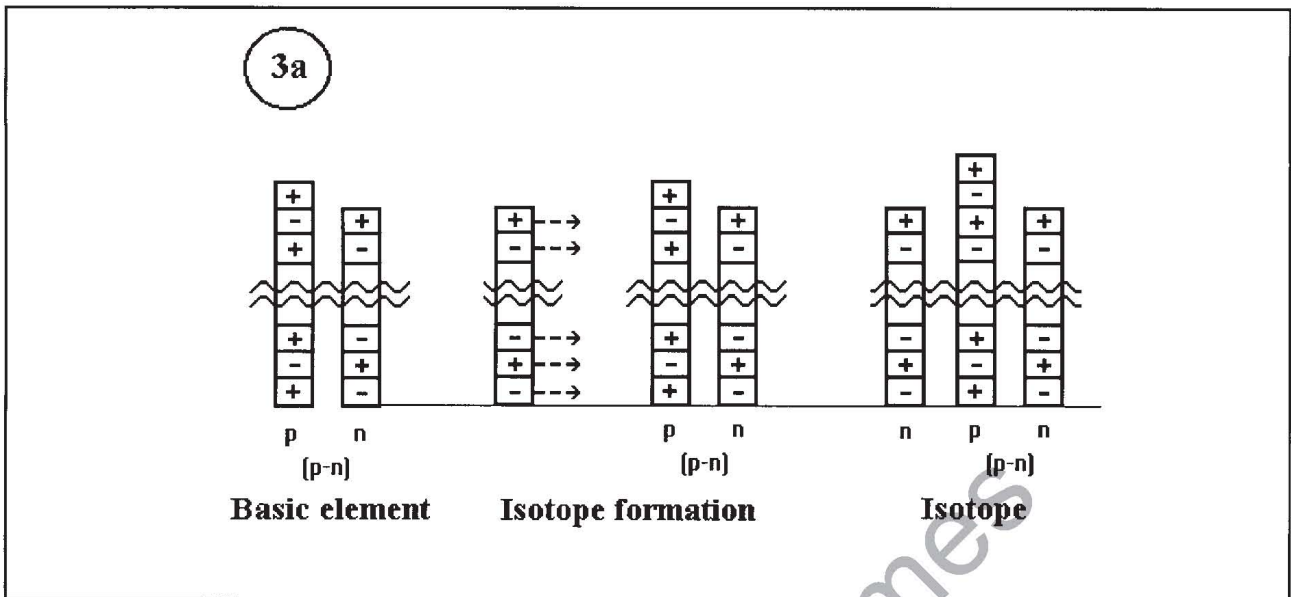
The list of the examples can be much longer.

Now let us discuss the complex material structure composed of separate parts. Their connection is carried out by the single type of interaction -- attraction or repulsion of their electric charges acting locally. Such an understanding of the reality of objects is much more reliable than statistical and contradictory formulations of quantum and special theory of relativity. Therefore, in all the parts of any objects within the Earth's spatial field, even with a little increase in temperature of the space and all the participating bodies within the object, low-temperature transmutation takes place. This transmutation is the first and continuously shown factor causing local processes of interaction of parts within the object.

The given examples and reasons bring about the necessity to analyze the processes within the cold fusion test cells. It is necessary to determine whether fusion phenomena can take place in the cell. Such a cell is composed of an external current source and calorimeter containing the anode, the cathode, and the electrolyte. Their atoms are isolated systems. The atoms, as a rule, do not interact since they are located at a point in the space of constant intensity, $E_{sp} = \text{Constant}$, and temperature, $T_{sp} = \text{Constant}$.

Atoms of the anode, cathode, and electrolyte are repelling electronegative systems, because the acting charge of orbital electrons, $\sum_{act} e^-$ C, preponderates in every one of them. The bringing of heat from the current source causes the rise of energy, $\sum_{act} e^-$, in the anode, cathode, and electrolyte.

The heating current creates electric and magnetic fields of one or the other form, intensity and direction. These fields (not controlled by researchers), being subtracted or added to the Earth's spatial field, weaken or intensify the ionization of atoms of the anode, cathode, and electrolyte. Their heating beyond the $T_{sp} = \text{Constant}$ intensifies ionization. In that part of the test cell where the attraction of electrons $\sum_{act} e^-$ to the nucleus is particularly weakened, the atoms become non-isolated systems. Transmutation occurs in this part of the test cell, new lighter elements are formed that are now isolated systems with more stable orbits. This process of formation of stable elements is always accompanied by liberation of energy of atomic and nuclear decay.



Inside the cold fusion test cells, merging of the ionized atoms of like charges cannot occur. In these atoms transmutation takes place and restores the unbroken law of the constancy of the electric charge of an isolated system.

Everything stated above affirms that inside of any test cell fusion cannot occur, as with an increase in temperature, there emerges and continues low-temperature transmutation programmed inside the atoms. There can be no other way!

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Free Energy: The Race to Zero Point

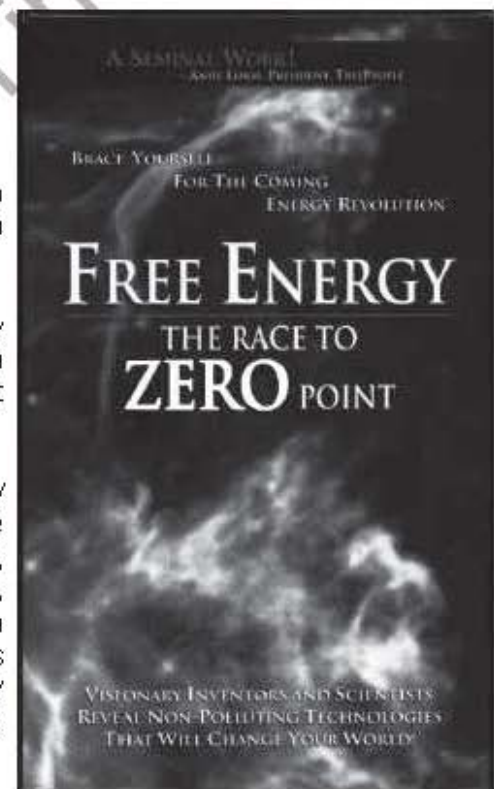
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EDITOR'S CHOICE

An Experiment for Readers

A MOMENTUM PRODUCING MACHINEDean Troyer ¹**ABSTRACT**

Momentum has been produced in the laboratory from two simple pendulums hung side by side and connected near the top with a light weight shaft. In some ways, this arrangement is similar to a ballistics pendulum except that the objects never touch and the incoming missile is on the end of a string. In the coupled pendulum the motion is reversible; the two objects in motion can place all that motion into one object. The most obvious difference is that the ballistic pendulum conserves momentum and the coupled pendulum does not.

DISCUSSION

The Law of Conservation of Momentum would be true if you could take the motion of two equal mass objects and place that motion into one of those objects. If these two objects had the same original velocity, the object receiving all the motion would then have twice its original velocity.

The coupled pendulum takes the motion of two objects and places the motion in one of those objects. I have timed the motion with photogates and a microprocessor accurate to fifty microseconds. Momentum is not conserved. I can easily get a 30% increase in momentum. This appears to be a violation of the Law of Conservation of Momentum, it may make $F = ma$ invalid as well (at least in some situations).

The coupled pendulum system is extremely accurate (see diagrams). Sometimes the dual pendulum system yields data from different runs to the same millionth of a second.

The mathematics and physics concepts are fundamental. The momentum of the two objects that start the motion will be equal to the momentum of the one object that remains in motion. Velocity is distance divided by time. Velocity times mass equals momentum.

The operation procedure for the coupled pendulum is as follows. Let the pendulum bobs and the tube come to a complete rest position. Extend both air cylinders to the full open position. They touch the shaft ends but do not move it. Displace one bob, in the same plane, about 25 to 30 degrees away from the other bob. A fixed trigger release is used to deliver the bob from a precise point each and every time. Trigger your release and let the one bob swing toward the other. As it swings away, retract the near side cylinder. When it swings back retract the other cylinder.

I usually start by releasing one bob which then shares its motion with the other bob. The motion can just as well be started by releasing the two bobs. Then the motion will isolate itself into one bob. I have done this many times, but the procedure is far more difficult than releasing one bob. The difficulty is that the two bobs have to be released at precisely the right moment, first one and then the other. An advantage is that the coupled pendulum cycles back and forth; first the left bob is in motion with the right bob stopped, then both bobs are in motion, later the right bob is in motion with the left bob stopped. This allows some creativity as to where the experimenter starts the machine.

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The following three pages are a more in depth description of how the data was collected. It includes data from two experiments. Some of the descriptions are answers to questions people have asked.

Two types of measurements were taken of the machine. The first type was the use of photogates and a microprocessor. With this method you measure the time it takes a 6.25 mm shaft to pass by a photogate. The 6.25 mm shaft is a piece of a graphite arrow shaft and is called a photogate flag. This flag is attached to the bottom of each pendulum bob.

The photogate is placed at the lowest point of the swing and records the period of time that the flag interrupts the light beam of the gate. The low point can be found by letting the bob hang motionless and placing the gate so that the motionless flag interrupts the beam.

The distance (6.25 mm) divided by the time (.003566 sec.) gives you the instantaneous velocity at the down swing position. However; you do not want the velocity of the shaft at the photogate, but the velocity of the center of mass of the pendulum bob. To get the velocity of the center of mass you must multiply by a correcting factor, which is the pendulum length divided by the distance from the top of the pendulum to the point where the photogate is reading the flag. $1.100 \text{ m} / 1.175 \text{ m} = .936$

$$(.00625 \text{ m} / .003566 \text{ sec.}) \times .936 = 1.64 \text{ m/sec.}$$

This is the velocity of the bob that was responsible for the input momentum. The mass of that bob was 4.106 kg. Therefore the input momentum is 6.73.

After the input bob is in full motion, the air cylinder rods are retracted and the transfer of momentum is allowed to occur for about 6 swings. Then the pneumatic cylinder rods are extended to stop all transfer of motion, and the photogates are employed again. The two photogates measure the velocities of both bobs as they share the motion. This gives us two more quantities of time to put into our equation.

$$(.00625 \text{ m} / .006030 \text{ sec.}) \times .936 = .970 \text{ m/sec.}$$

$$(.00625 \text{ m} / .004768 \text{ sec.}) \times .936 = 1.23 \text{ m/sec.}$$

Multiply each of these velocities with the appropriate masses and you have input and output momentum.

$$4.106 \text{ kg} \times 1.64 \text{ m/sec} = 4.106 \text{ kg} \times .970 \text{ m/sec} + 4.124 \text{ kg} \times 1.23$$

$$\begin{aligned} 6.73 &< 3.98 + 5.07 \\ 6.73 &< 9.05 \text{ by } 34.5\% \end{aligned}$$

The second method of measurement is to determine the distance that the pendulum bob drops by photographing the high point of the swing. We know that the pendulum length is 1.100 m. To determine the distance dropped, the only thing we need to find is the angle of displacement. The camera is used to record the wire's maximum angular displacement.

After a number of runs, you can determine where you wish to photograph the wire. The camera is placed at the appropriate height, and the plane of the lens is parallel with the plane of pendulum motion.

Open the shutter of the camera for about 1 sec. (half a second for one bob) so that the bobs swings up to and back away from the high point of the swing. Of all the points of the swing, the greatest amount of time is spent at the high point position. This allows the film to record a light streak at maximum displacement (see photos). A perpendicular is formed by placing a weight at the end of a white string, and putting this string near but not obstructing the view of the maximum displacement.

We know that one angle in this triangle inscribed on the film is a 90 degree angle, (the horizontal line drawn from the perpendicular to the wire). This line is found at the top edge of the picture.

We now have a right triangle in our picture that can be evaluated. Measure the lengths of the sides of the triangle. By placing the lengths of any two sides of the triangle in the appropriate trigonometric function we can find the other two angles, one of which will be the displacement angle. This smaller triangle is similar to a larger triangle whose hypotenuse is the length of the pendulum, and whose adjacent side is equal to the cosine of the maximum displacement angle times the hypotenuse. The rise of the pendulum bob is equal to the hypotenuse minus the adjacent side. This quantity is the rise of the bob and will be referred to as distance; abbreviated S. From the distance formula we can determine the velocity of the drop. $S = V \times V / 2a$. Or the square root of $(S \times 2a) = V$. Remember; Galileo proved that a straight drop velocity is equal to a swing down velocity.

I get 17.3 and 17.6 degrees for the displacements of the shared motion, and 26.1 degrees for the input motion. The hypotenuse is always 1.100m.

$$1.100 \text{ m} - (\cos. 26.1 \text{ degrees} \times 1.100) = .1122 \text{ m}$$

$$\text{Square root of } (.1122 \times 19.6 \text{ m/sec}) = 1.48 \text{ m/sec}$$

$$1.100 \text{ m} - (\cos. 17.3 \text{ degrees} \times 1.100) = .0498 \text{ m}$$

$$\text{Square root of } (.0498 \times 19.6 \text{ m/sec}) = .988 \text{ m/sec}$$

$$1.100 \text{ m} - (\cos. 17.6 \text{ degrees} \times 1.100) = .0515 \text{ m}$$

$$\text{Square root of } (.0515 \times 19.6 \text{ m/sec}) = 1.005 \text{ m/sec}$$

Multiply by the appropriate masses and you can again compare the input momentum with the output momentum.

$$1.48 \text{ m/sec} \times 4.106 \text{ kg} = .988 \text{ m/sec} \times 4.106 \text{ kg} + 1.005 \text{ m/sec} \times 4.124 \text{ kg}$$

$$6.09 < 8.20 \text{ by } 34.6 \%$$

The pneumatic cylinders that are at the ends of the light weight shaft always have their rods extended when measurements are being made and their rods retracted when a motion transfer is required. The right cylinder prevents the shaft from moving to the right, but does not prevent it from moving to the left, and likewise for the left cylinder.

Here is an example: Start with both cylinders rods extended and the shaft locked in-between. When the pendulum has its mass swung over to the left side, you can retract the rod of the right cylinder. This will allow the shaft to swing to the right, and when it does you can retract the rod of the left cylinder. Now you have the shaft swinging freely. When the cylinders rods are retracted, a transfer of motion occurs from one bob to the other.

About six swings later, the shaft is locked again. You start the locking process by extending the rod of the right cylinder when the shaft is swung over to the left. When the shaft swings up against the right cylinder rod the left cylinder rod is extended. The rod comes out and jams the shaft between the two extended cylinders. If the experimenter is careful, no energy is added to the shaft by the cylinder motion.

Now you have the shaft locked again and no motion transfer can occur. Each pendulum maintains its down swing velocity until friction brings it to a stop. The largest amount of friction is probably air resistance.

The two bobs do not achieve high point swing at the same time. The shaft is always locked when measurements are being made, so one bob can not be giving motion to the other bob after the first bob

achieves its high point. Each is maintaining its own momentum, independent of the other bob.

I don't know the time difference between the high point swing of one bob and then the other. I would guess about one half second, because I can catch both bobs top swings with a shutter open for 1 second. Also, I assume that the one bob is behind the other by $1/4$ period because the motion is started at a point where one bob is fully down and in full motion, and the other bob is fully down and stopped. I believe the period of a 1.100 m pendulum is 2.105 sec, that brings us again to about $1/2$ sec. for a $1/4$ period. But, these are just guesses. I think there is a setting on the microprocessor to determine this time period. Maybe in the future I can answer this question.

One possible problem is that the energy is being absorbed elastically and then given back as motion, but tests have failed to show significant elastic storage (stretch). Both the sixty pound wire and the fiberglass cord show very little stretch.

I don't believe that the cylinders are adding energy to the system. The locking right cylinder opens or extends into mid air and is fully extended before the shaft comes into contact with it. I know of no way to get energy out of a fully extended cylinder. Its power stroke is already complete and is not capable of delivering energy to any system. The left cylinder extends when the tube is being pushed against the right cylinder, which means that the left cylinder can not accelerate the tube because it has nowhere to go. Neither cylinder extends past the static rest position of the tube and are carefully designed to never push the tube. Further; if energy were being given by the cylinders it would be accidental and undoubtedly would not be in uniform quantities. That would give widely different data, instead of very precise quantities.

The following is a more detailed description of the materials used in the experiment.

I will start by listing the essential components of the one particular experiment from the largest and first machine.

1. A level solid steel (5/8 in. x 32 in.) bar is affixed six feet off the ground, by using the frame in part 7.
 - a. To this bar are attached two (1 1/2 inch long) straight wires bent in a 3/32 inch half circle near their center. ____ _____. They can be attached with heavy nylon thread.
 1. These half circles provide two points of attachment for size 4 interlock snaps (sporting goods store). These wire attachments are 24 in. apart, and face down on the bar.
2. Two seven strand wires (60 lb. test-sporting goods store) 4 inches long (total length) that have a size 4 interlock snap attached on both ends, are used to suspend the arrow shaft in part 4.
3. Two longer wires as in 2 above, are used to suspend the bobs center of mass to 1.100 m., from the arrow shaft.
4. To a 6.3 mm (actually 6.25 mm) graphite arrow shaft are affixed four wires as in (1. a.) above. The wire attachments are set one above another and 24 inches apart. The arrow shaft is 26 inches long and has nothing mounted on either end.
5. Two solid pieces of bar steel (three inches in diameter and 4 1/2 inches long) are used to provide two cylindrical bobs with masses of around 4 kilograms each. These bobs have 3/16 in. tapped holes in the top center and 1/4 in. tapped holes in the bottom center. The large bars can be found at a steel supply company, and/or machine shop. The bobs are spray painted flat black for photographic purposes.
 - a. Two 3/16 in. eye bolts (1 inch long treads) are placed in the top of the bobs to provide a point of attachment for the snaplocks on the long wires.
 - b. Two 1/4 in. bolts (1 inch long, fully treaded) are placed in the bottom of the bobs, and to the heads of the bolts are glued 3 in. long pieces of 6.3 mm arrow shafts. This provides a photogate flag that has a breakaway point at the glue (in case of accident).

- c. A wire as in (1.a.) is attached horizontally to each bob with a white (spray painted) hose clamp, this provides a point of attachment for a trigger release apparatus. The white is for photos.
6. A bow string release is used for a mechanical release of the bob. The trigger release must be solidly affixed to the frame or the ground so that the bob can be released in the same plane with the same displacement each and every time.
- a. Cut the barb off of a size 1 (sproat) fish hook, so that it just barely holds the wire that was attached to the bob. Tie a string to the hook eye, and tie a loop in the other end of the string. Place the loop through the trigger release. Position the hook upside down in the bob's wire, this allows the hook and string it to fall away when released.
7. The top of the frame is welded 3 inch C-channel, and measures 29 by 22 inches (outside). The legs are bolted to the long ends, and angle away at 30 degrees. This top half stands 32 inches high, and is bolted to the bottom half with half inch bolts. The bottom half is 23 inches deep, 42 inches high, and 96 inches wide. It is made of 2 inch square tubing with 3/16 inch thick walls. Some important things about the frame are; it must not tip over on observers (bolt it to a table or wall); it must provide a 30 degree displacement for both bobs, and it must not vibrate.
8. Two air cylinders (1 ½ in bore, 2 inch stroke) are placed at the ends of the arrow shaft. They are properly placed and equipped with valves to lock and unlock the shaft. They do not move the shaft at any time, they only touch it. This is necessary to stop the momentum transfer (for measurement or photography) from bob to bob. Other jamming systems can be used but the cylinders allow the experimenter to run the microprocessor or camera and the cylinders from the same seat. This is very important when you start taking hours of data while surrounded by expensive and delicate equipment

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<http://www.geocities.com/CapeCanaveral/Lab/2201>

Cost: Steel prices have really jumped the last year, material alone will probably cost \$300, not to speak of what machine shops charge. Hopefully your university has photogates with a microprocessor (\$300). Cylinders and valves are \$100. Arrow releases are around \$30, and other miscellaneous stuff would be under \$50.

Editors Comments

Can you explain these results obtained by Troyer?

I believe that momentum is conserved if one takes into account the motion (momentum) of the shaft to which the bobs are attached. When the motion of the shaft is stopped, doesn't the momentum get transferred to the bob?

After careful reading, the shaft does not swing until released.

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FUSION FACTS to continue reporting on papers published in other venues

T.C. Kaushik, L.V. Kulkarni, A. Shyam, M. Srinivasan (Neutron Phys. Div., Bhabha Atomic Res. Ctr., Trombay, Bombay, India), "**Experimental investigations on neutron emission from projectile-impacted deuterated solids,**" *Phys. Lett. A*, vol 232(5), pp 384-390 (English) 1997.

AUTHORS' ABSTRACT

Deuterated polycrystalline solids (LiD, TiD₂ and PdD₂, etc.) were impacted by nylon projectiles of <1 km/s velocity to look for and characterize possible neutron emissions from fracto-fusion type reactions. Emission of <100 neutrons from impacted 6-8 mm size lithium deuteride samples is inferred by monitoring signals from a bank of BF₃ detectors in various ways.

A. De Ninno, A. La Barbera, V. Violante (ENEA/ERG/FUS/Divisione Tecnologie Speciali, Centro Ricerche Frascati, Rome, Italy), "**Deformations induced by high loading ratios in palladium-deuterium compounds,**" *J. Alloys Compd.*, vol 253-254, pp 181-184 (English) 1997.

AUTHORS' ABSTRACT

The strong concentration gradients produced during the loading process in palladium hydride are responsible for the known difficulty in obtaining high loading ratios (H(D)/Pd \approx 1). Experiments on electrolytic loading

of palladium with deuterium were carried out in which the loading ratio was monitored through a four wire resistance technique. Preliminary results show that dynamic loading strongly affects the maximum ratio achievable.

T. Senjuh, H. Kamimura, T. Uehara, M. Sumi, S. Miyasita, T. Sigemitsu, N. Asami (R & D Ctr. for New H. Energy, Inst. Appl. Energy, Sapporo, Japan), "**Experimental Study of Electrochemical Deuterium Loading of Pd Cathodes in the LiOD/D₂O System,**" *J. Alloys Compd.*, vol 253-254, pp 617-620 (English) 1997.

AUTHORS' ABSTRACT

The electrochemical loading behavior of Pd cathodes in the LiOD/D₂O system was studied experimentally. The preparation conditions of Pd cathodes significantly affect the D/Pd loading ratios. The D/Pd ratio is affected by the current density profile, current increasing pattern and anodic treatments. The major treatments were (1) a vacuum annealing to release the stress, to recrystallize and to clean the surface by thermal etching, and (2) a surface treatment to remove surface defects and to clean the surface. Higher annealing temps. (~1000°) result in a higher D/Pd ratio. Etching in aqua regia proved to be a better surface treatment than polishing. Using the pre-electrolysis treatments resulted in higher D/Pd ratios. The electro-

lysis current pattern and anodic treatment cycles likewise affected the D/Pd ratio. The effects are also discussed in detail.

Kenichiro Ota, Taichi Kobayashi (Dep. Energy Eng., Yokohama Natl. Univ., Japan), "**Cold fusion and calorimetry,**" *Netsu Sokutei*, vol 24(3), 1997, pp 138-145. (Japanese)

AUTHORS' ABSTRACT

A review with 17 refs. Eight years have passed since the announcement of cold fusion in 1989. During this period, many works were done and many reports were published including both negative and positive results. These results were summarized mainly from the heat measurement or the calorimetry. Although many results showed that something happened especially for excess heat, the results can not be connected to fusion reactions. Further study is necessary for this phenomena.

A. M. Gabovich (Inst. Phys., Nat. Acad. Sci., Kiev, Ukraine), "**Possibility of cold fusion in palladium deuterides: screening effects and connection to superconducting properties,**" *Philos. Mag. B*, vol 76(1), 1997, pp 107-118. (English)

AUTHOR'S ABSTRACT

The conditions for the fusion d-d reaction in Pd are discussed, taking into account the ion-core repulsion. The lattice expansion of Pd after introduction of deuterium atoms results in strong Coulomb field screening. This phenomenon may lead to detectable nuclear reaction rates. The appearance of superconductors in deuterated samples due to weakening of the Coulomb repulsion may serve as an indication of the fusion possibility.

Naoto Asami, Toshio Senjuh, Hiroshi Kamimura, Masao Sumi, Elliot Kennel, Takeshi Sakai, Kenya Mori, Hisashi Watanabe, Kazuaki Matsui (R D Centre New Hydrogen Energy, Inst. Appl. Energy, Sapporo, Japan), "**Material characteristics and behavior of highly deuterium loaded palladium by electrolysis,**" *J. Alloys Compd.*, vol 253-254, pp 185-190 (English) 1997

AUTHORS' ABSTRACT

Studies on several kinds of palladium cathodes have been conducted in electrochemical cells using LiOD/D₂O electrolyte to determine necessary and sufficient conditions for attaining high deuterium loading. Comparative observations of the microstructure and analysis of surface impurities have been carried out on palladium specimens with various pre-electrolysis treatments and post electrolysis. From the observations and analyses of various processed and treated Pd specimens, the material characteristics of a Pd cathode achieving high loading ratios (D/Pd > 0.85) are discussed.

P. P. Khramtsov, O. G. Martynenko (Inst. Teplo- Massoobmena im. Lykova, Belarus), "**Cathodic dispersion during electric discharge through interface between heavy water-saturated vapor,**" *Inzh.-Fiz. Zh.*, vol 69(5), 1996, pp 721-725 (Russian)

AUTHORS' ABSTRACT

An experimental study was made of an electrical discharge in the atmosphere of heavy water vapors. The surface of the heavy water served as the cathode. The anode was made from tungsten. Under predetermined discharge conditions, intense neutron emission induced by the discharge was observed. The dependence was measured of the intensity of neutron production on the magnitude of the current in the discharge.

Fritz G. Will (EPRI, Palo Alto, CA, USA), "**Hydrogen+oxygen recombination and related heat generation in undivided electrolysis cells,**" *J. Electroanal. Chem.*, vol 426(1-2), 1997, pp 177-184 (English)

AUTHOR'S ABSTRACT

This paper presents a mathematical analysis that allows the rate of H₂+O₂ recombination and related heat generation in single-compartment electrolysis cells to be calculated as a function of current density and temperature. The analysis employs electrochemical kinetics and gas evolution-enhanced mass transfer theory. Recent calorimetric results of others during the electrolysis of K₂CO₃+H₂O solutions in the low current density range from 0.5 to 4 mA cm⁻² are in good agreement with the theoretical predictions. The fraction of O₂ recombining with H₂ decreases significantly with increasing current density. As much as 27% of the O₂ recombines at 0.5 mA cm⁻², but only 4% at 100 mA cm⁻². The heat generated by H₂+O₂ recombination comprises a significant fraction of cell input energy only at low current densities. At 0.5 mA cm⁻², heat due to H₂+O₂ recombination is 120%, but it decreases proportionally to $j^{-1.5}$, with values of 18% at 4 mA cm⁻², 0.8% at 40 mA cm⁻² and only 0.03% at 400 mA cm⁻². The analysis also predicts quantitatively the observed enhancement of

recombination by O₂ gas sparging and its elimination by N₂ sparging. From their results at low current densities, a group of researchers recently concluded that H₂+O₂ recombination is the source for the 'excess heat' reported by other groups and attributed by some to 'cold fusion'. However, reported excess heat values, ranging from a low of 23% at 14 mA cm⁻² to a high of 3700% at 6 mA cm⁻², are much larger than can be explained by recombination. Whatever the explanation for the large amounts of excess heat reported by various groups, H₂+O₂ recombination must be rejected as a tenable explanation.

M Srinivasan (Phys. Group, Bhabha Atomic Res. Cent., Mumbai, India), "**Cold fusion: promising new source of energy from water,**" *Phys. News* (Mumbai, India), vol 27(1), pp 48-52 (English) 1996 A review with no refs.

Hideo Kozima, Kaori Kaki, Tohru Yoneyama, Seiji Watanabe, Masahiro Koike (Department of Physics, Faculty of Science, Shizuoka Univ., Japan), "**Theoretical verification of the trapped neutron catalyzed model of deuteron fusion in Pd/D and Ti/D systems,**" *Rep. Fac. Sci., Shizuoka Univ.*, vol 31, pp 1-12 (English) 1997.

AUTHORS' ABSTRACT

Theoretical estimation of factors assumed in the model proposed before are presented. The assumptions made in the model are almost verified by the calculation to support the interpretation of the Cold Fusion phenomena as the trapped neutron catalyzed fusion of deuterons in solids.

Katsuichi Nakamura, Takashi Kawase, Isao Ogura (Kinki Univ. Atm. Energy Res. Inst., Osaka, Japan), "**Possibility of element**

transmutation by arcing in water,"
Kinki Daigaku Genshiryoku
Kenkyusho Nenpo, vol 33, pp 25-31
(Japanese) 1996

AUTHORS' ABSTRACT

The authors searched a possibility of element transmutation causing by the action of the D generated from D_2O electrolysis. The electrolysis was caused by a discharge of electricity in D_2O . Experiments were performed in a completely closed vessel with He atmosphere. Analysis of the atmospheric gas by gas-chromatography revealed that the possibility of the element transmutation from C to N was large. Excess heat was 1.21 times larger than consumed electric power.

Peter L. Hagelstein (MIT, Cambridge, USA), "**New lattice-nucleus coupling mechanisms and possible energy production.**" *IEEE/NPSS Symp. Fusion Eng.*, 16th (vol 2), pp 1617-1621 (English) 1995

AUTHOR'S ABSTRACT

Two new basic phys. mechanisms involving lattice-nuclear coupling have been recently proposed: (1) neutron hopping in crystals (in analogy with electron hopping); and (2) anomalous energy exchange by frequency shifting of highly excited phonon modes. Elastic neutron hopping has been predicted to occur in crystals containing nuclei $(A+1)Z$ with an outer s-shell valence neutron and parent nuclei AZ , under conditions where the r.m.s. vibrational motion of these nuclei greatly exceeds the Lindemann rule for melting. Hydrogen and deuterium nuclei in metal hydrides can satisfy this criterion. Neutron hopping to other nuclei can occur under conditions that the lattice dissipates the energy excess via the anomalous energy transfer mechanism. These effects are of interest for their possible application to the problem of nuclear energy generation.

E. Cerron-Zeballos, I. Crotty, D. Hatzifotiadou, J. Lamas Valverde, M.C.S. Williams, A. Zichichi (LAA Project, CERN, Geneva, Switz.), "**Investigation of anomalous heat production in Ni-H systems.**" *Nuovo Cimento Soc. Ital. Fis., A*, vol 109A(12), 1645-1654 (English) 1996

AUTHORS' ABSTRACT

Anomalous heat production in a nickel rod loaded with hydrogen has been reported by S. Focardi et al. (1994). We have investigated this phenomenon by repeating the experiment. We found the results previously published to be consistent with our observations; namely we measured higher temperatures for the same input power when hydrogen is absorbed during a heating cycle. Nevertheless this temperature rise does not appear to correspond to an increase in heat production. We have added a temperature sensor to the container of the experiment. The temperature of the container follows the same temperature with input power curve irrespective of whether there is an anomalous absorption of hydrogen or not; therefore we have no evidence that this temperature increase corresponds to another source of heat. In conclusion, we have observed all the effects discovered by Focardi et al., but our results imply that there is no production of power associated with the absorption of hydrogen by nickel.

Hideo Kozima (Dep. Physics, Shizuoka Univ., Japan), "**The behavior of neutrons in crystals.**" *"Cold Fusion,"* issue 18, pp 17-21 (English) 1996

AUTHOR'S ABSTRACT

A thermal neutron in a crystal behaves like a wave traveling in space. The neutron has three ways it can escape: (1) running out, (2) fusion with a nucleus, and (3) transformation into a proton by β decay. If these three are prevented

from taking place, the neutron is stable in the crystal. Conditions for the stabilization of a neutron in a crystal is shown with its probable effects.

A.V. Smilga, V.P. Smilga (Inst. Teor. Eksp. Fiz., Moscow, Russia), "**A small physical effect [in cold fusion].**" *Russ. Khim. Zh.*, vol 40(3), pp 122-126 (Russian) 1996

AUTHORS' ABSTRACT

A review with 5 refs. is presented giving both an optimistic and a pessimistic view of the observed effect in so-called cold fusion of deuterons.

Yoshiaki Arata, Yue-Chang Zhang (Osaka University, Japan), "**Helium (4He, 3He) within Deuterated Pd-black.**" *Proc. Jpn. Acad., Ser. B*, vol 73B(1), pp 1-6 (English) 1997

AUTHORS' ABSTRACT

Authors have clearly proven for the first time that deuterium nuclear reaction was continuously generated inside a highly deuterated solid by showing both of the excess energy and corresponding amount of helium as the reaction product generated simultaneously. Whenever there is a nuclear fusion reaction inside a metal, helium generated is unable to escape to the surroundings and is trapped in a frozen state inside that metal. The concentration of the helium within the metal will rise with increasing rate of reactions. Pd-black is under such state as the sample used and sealed within the "closed QMS" developed by the authors (closed vessel including the Getter pump and the QMS). It is completely separated from the surroundings and the internal gases are removed to create super-vacuum. When the "closed QMS" works under the above mentioned-state, it was clarified that the "ash" or the reaction product of this fusion reaction within a solid is $4He$ and

^3He and their ratio is ≈ 4 . The main reaction product is ^4He and it is created directly as an inherent feature of the solid-state nuclear fusion. Authors think that the reaction process responsible for the creation of ^3He may be a different one from that creates ^4He . One of which is the Rutherford reaction process and the other occurs based on the specific properties of solid, similar to the case of ^4He . The existence of ^3T will be required that the process is responsible for the generation of ^3He as the Rutherford reaction. The proof for the existence of ^3T within the "closed QMS", however, was not obtained in this experiment.

Roman E. Sioda (Inst. Indust. I Org. Chem., Warsaw, Pol.), "**Cavity in metal (hohlraum) limited-radiation effect and law**," *Curr. Top. Electrochem.*, vol 3(2), pp 349-355 (English) 1994

AUTHOR'S ABSTRACT

A possible mechanism of cold fusion, according to the "hot spot plasma" hypothesis, is discussed from the point of view of heat flow properties of the system. The system is simplified by assuming the heat transfer from plasma by Stefan-Boltzmann law, and in the metal - by conduction.

Xinqi Song, Jianbo Liu (Dep. Chem., Qinghua Univ., Beijing, Peop. Rep. China), "**Cold fusion and its lessons**," *Huaxue Tongbao*, (1), pp 54-58 (Chinese) 1997

AUTHORS' ABSTRACT

A review with 6 refs. is given on the definition of cold fusion, hypothesis proposed by C. Walling and J. Simon for explaining the experimental results of Fleischmann and Pons and rough experiments, and enlightenment of cold fusion.

Suhe Chen, Dalun Wang, Gaoxian Cui, Mei Wang, Yibei Fu, Xinwei Zhang, Wushou Zhang (Beijing Inst. Appl. Phys. Computational Math., Beijing, Peop. Rep. China), "**X-ray diagnostics in gas discharge**," *Hewuli Dongtai*, vol 12(3), pp 58-60, 39 (Chinese) 1995

AUTHOR'S ABSTRACT

X-rays were observed in the anomalous phenomenon in a metal loaded with deuterium studied by the gas-discharge method. The x-ray energy spectra were measured by the absorption method, the specific x-ray approach and the NaI scintillation counter, and the x-ray intensity was estimated by using ^7Li thermoluminescent foils. The x-ray average energy measured by the absorption method is 27.6 ± 2.1 keV, which agrees with the 26.0 ± 2.4 keV monoenergetic x-rays measured by the NaI scintillation counter.

Hideyuki Yuki, Takehiko Sato, Tsutomu Ohtsuki, Tetsuhiko Yorita, Yuka Aoki, Hirohito Yamazaki, Jirohta Kasagi, Keizo Ishii (Nucl. Sci. Lab., Tohoku Univ., Sendai, Japan), "**Measurement of the D(d,p)T reaction in Ti for $2.5 < E_d < 6.5$ keV and electron screening in metal**," *J. Phys. Soc. Japan*, vol 66(1), pp 73-78 (English) 1997

AUTHORS' ABSTRACT

In order to study the electron screening effect on low-energy nuclear reactions in metals, the D+D reaction in Ti was investigated. Measured were thick target yields of protons emitted in the D(d,p)T reaction from the bombardment of Ti metal with deuteron energies (E_d) between 2.5 and 6.5 keV. The obtained yields were compared with those predicted by using the parameterization of cross sections at higher energies. The reaction rates in Ti are slightly enhanced over those of the bare D+D reaction for $E_d < 4.3$ keV, and the enhancement can be interpreted as

caused by the electron screening. The electron screening potential in Ti is deduced for the first time to be 19 ± 12 eV.

Yubo Piao, Xuezhi Wang (Inst. Nucl. Res., Lanzhou Univ., Peop. Rep. China), "**Progress in study of anomalous nuclear reactions in solids**," *Hewuli Dongtai*, vol 13(3), pp 34-36, 18 (Chinese) 1996

AUTHORS' ABSTRACT

A review with 4 refs. The status and future research trends in the study of anomalous nuclear reactions in solids is presented.

Tadahiko Mizuno, Koich Inoda, Tadashi Akimoto, Kazuhisa Azumi, Masatoshi Kitaichi, Kazuya Kurokawa, Tadayoshi Ohmori, Michio Enyo (Hokkaido Univ, Sapporo, Japan), "**Anomalous γ peak evolution from SrCe solid state electrolyte charged in D_2 gas**," *Int. J. Hydrogen Energy*, vol 22(1), pp 23-25 (English) 1997

AUTHORS' ABSTRACT

A proton conductor, the solid state electrolyte, made from an oxide of strontium, cerium, niobium and yttrium can be charged in a hot D_2 gas atmosphere. Anomalous radioisotopes were detected in all samples charged with an alternating current with voltages ranging from 5 to 45 V, at temperatures ranging from 400 to 700°C. No radioisotopes were detected from the sample treated in a H_2 gas atmosphere. The radioisotopes may be induced from a catalytic reaction between the metal and oxide interface to deuterium atoms.

C. Ferrari, F. Papucci, G. Salvetti, E. Tognoni, E. Tombari (IFAM/ CNR, Via del Giardino, Pisa, Italy), "**A calorimeter for the electrolytic cell and other open systems**," *Nuovo Cimento Soc. Ital. Fis., D*, vol 18D(11), pp 1333-1346 (English) 1996

AUTHORS' ABSTRACT

A calorimetric method and the construction details are presented of a differential calorimeter useful for studying the reactions in an electrolytic cell and more generally slow chemico-physical processes occurring in thermodynamically open systems. The method allows measurements of the heat balance of the cell, from which the enthalpy change of the process under study can be calculated. The theoretical description of the calorimetric cell and the results of several studies planned to describe the performances of the instrument up to the boiling point of the electrolytic solution are reported. The features of this calorimeter fulfill most of the requirements of cold fusion experiments, where the heat production is the fundamental and controversial aspect. By controlling both the heat and the matter exchanged, the calorimeter can be used also to study bioenergetic processes, e.g., fermentation, microbial metabolism and biodegradation, and liquid phase chemical reactions, involving gases as reactants and/or products.

V.S. Bushuyev, V.B. Genodman, L.N. Jerikhina, S.P. Kuznetsov, Yu.A. Lapushkin, I.P. Matviyenko, A.I. Nikitenko, A.D. Perekrestenko, N.P. Saposchnikov, S.M. Tolokonnikov, A.M. Tzkhovrebov (USA), "**Experiments on detection of nuclear radiation at heavy water electrolysis**," *J. Opt. Res.*, vol 4(2/3), pp 171-179 (English) 1996

AUTHORS' ABSTRACT

Cold fusion from the detection of nuclear radiation at heavy water electrolysis is discussed. Neutron and γ -ray detection is considered from heavy water electrolysis with palladium electrode.

V.I. Sugakov (Ukraine), "**Conditions for inducing, dynamics, and manifestation of atom acceleration in nonequilibrium crystals**," *Ukr. Fiz. Zh.*, vol 41(9), pp 834-839 (Ukrainian) 1996.

AUTHOR'S ABSTRACT

The conditions are discussed of inducing, dynamics, and experimental manifestation of atom acceleration in a system characterized by a double-well potential along a crystal row. A numerical modeling of atomic collisions in such system is carried out. An analysis of the energy losses, which affect the energy of accelerating atoms, is given. The possible existence is shown of a double-well potential in the vicinity of a dislocation core at high external mechanical loads; the dislocation motion is accompanied by a creation of high-energy atoms (accelerons). Using the conception of accelerons, different anomalous phenomena in crystals are explained: luminescence of metals under strong mechanical load, acoustoluminescence of semiconductors and dielectrics, anomalous mass transfer under impulse loading of metals, and cold nuclear fusion.

M. Teshigawara, K. Konashi, T. Yamamoto, H. Kayano, Y. Aratono, K. Furukawa, E. Tachikawa (Oarai Branch, Inst. Mat'ls. Res., Tohoku Univ., Japan), "**Heavy ion induced D-D fusion in deuteride solid**," *JAERI-Res.*, vol 96-011, pp 55-56 (English) 1996.

AUTHORS' ABSTRACT

An experimental search was made for the enhancement of D-D fusion in titanium deuteride by heavy ion ($17+$) bombardment. From a comparison with Monte Carlo simulations, it was concluded that there was no enhancement.

Fu-Sui Liu (Phys. Dep., Beijing Univ., Peop. Rep. China), "**The phonon mechanism of the cold fusion**," *Mod. Phys. Lett. B*, vol 10(23), pp 1129-1132 (English) 1996

AUTHOR'S ABSTRACT

The longitudinal acoustic phonon can induce a time-dependent hopping rate of deuteron in PdD, and leads to the cold fusion.

Makoto Okamoto (Res. Inst. Nucl. Reactor Eng., Tokyo Inst. Technol., Japan), "**Normal temperature condensation phase nuclear reaction**," *Hoshasen Kagaku* (Tokyo), vol 39(9), pp 325-330 (Japanese) 1996

AUTHOR'S ABSTRACT

A review with 7 refs. is given on nuclear reactions in the ultra-low energy (temperature) region, detection of excess heat in electrolysis of D_2O containing LiOD electrolyte using a Pd cathode and a Pt anode, and the abnormal phenomenon a nuclear phenomenon.

Xiangliu Jiang, Lijun Han (Dept. Appl. Math. & Phys., Beijing Univ. of Aeronautics and Astronautics, Peop. Rep. China), "**Non-equilibrium conditions of electrolysis and abnormal nuclear phenomena**," *Yuanzihe Wuli Pinglun*, vol 14(2), pp 111-113 (Chinese) 1997

AUTHORS' ABSTRACT

The pin-point effect and the magnetic self-pinch of electrolysis are suggested to be important factors in producing conditions that are far from equilibrium and essential for cold nuclear fusion. Further studies of the structural and electronic properties of D in bulk Pd, the behavior of electrochemical double layers, and the localized emission sites on surface protrusions of the electrode should

be carried out to understand the mechanisms of cold nuclear fusion.

Notoya, R. (Catalysis Res. Ctr., Hokkaido Univ., Sapporo, Japan), "**Cold fusion arising from hydrogen evolution reaction on active metals in alkali metallic ions' solutions,**" *Environ. Res. Forum*, 1-2 (Chem. & Energy), pp 127-139 (English) 1996

AUTHORS' ABSTRACT

The hydrogen evolution reaction on porous nickel and platinized platinum in 0.5 mol/l potassium and sodium carbonates solutions and 0.1 mol/l cesium sulfate solution was causative of some nuclear reactions. These solutions of light and heavy water in the thermally open cells were electrolyzed for a given period galvanostatically. Analysis of the electrolytes by use of ICP-MS, a flame photo-spectrometer, liquid scintillations spectrometer and a germanium γ -ray spectrometer, revealed that the products of nuclear changes were generated during electrolysis, for example, from potassium and proton to calcium, from cesium-133 and neutron, proton and so forth to some species of mass numbers of 132-140 amu, from sodium-23 and neutron to sodium-24, as well as tritium, which were accompanied by an extraordinary large heat evolution. The reaction mechanisms for the cold fusion caused by electrolysis were proposed, in which the intermetallic compounds between alkali metals and cathode materials played an important role, on the basis of the mechanism for the hydrogen evolution reaction in alkaline solutions on active metals.

Yoshiaki Arata, Yue-Chang Zhang (Osaka Univ., Japan), "**Presence of helium (4He, 3He) confirmed in highly deuterated Pd black by the new detecting methodology,**" *Koon Gakkaishi*, vol 23(3), pp 111-118 (Japanese) 1997

AUTHORS' ABSTRACT

Development of both the "closed QMS" system and the "Vi-effect" methodology are vital to finally prove the presence of He generated by the nuclear fusion of D within highly deuterated Pd black. Therefore, to confirm the existence of He atoms generated from D in samples of Pd black, the authors simply employed the "sample heating" process (room temp. to 1500°C), but carried it out using both a "QMS" system and an ultra-high vacuum favorable "getter pump" inside a totally sealed vessel. They termed this methodology "closed QMS," and developed a related discrimination method which applies an opportunely changing voltage to the anticipated elements present inside the "closed QMS" environment. Measurements were then taken as the applied voltage was both increased and decreased between 70 to 20 [V] (here the range being detected by the ionization potential V_i [eV] for He series elements). Using this principle, which they call the "Vi-effect", in brief, they were able to conclusively confirm the presence of both 4He and 3He atoms, as well as their relative ratio.

Lev G. Sapogin (Dep. Phys., Tech. Univ., Moscow, Russia), "**Energy generation processes and cold nuclear fusion in terms of Schrodinger equation,**" *Chin. J. Nucl. Phys.*, 19(2), 115-120 (English) 1997

AUTHORS' ABSTRACT

The energy generation processes are analyzed in terms of Schrodinger equation, the formalism of which may account for both the cold nuclear fusion phenomena and the anomalous excessive energy occurrences of a mysterious origin observed, in experiments.

Hideo Kozima, Seiji Watanabe, Katsuhiko Hiroe, Masahiro Nomura, Masayuki Ohta (Dept. Phys., Fac. Sci., Shizuoka Univ., Shizuoka, Japan), "**Analysis of cold fusion experiments generating excess heat, tritium and helium,**" *J. Electroanal. Chem.*, vol 425(1-2), pp 173-178 (English) 1997

AUTHORS' ABSTRACT

The experimental data of the cold fusion phenomena, including the first data of Fleischmann et al., in 1989, which disclosed the existence of nuclear reactions in a solid at room temperature, were investigated with the trapped neutron catalyzed fusion model. The surprisingly large excess heat and comparatively small amount of T and few neutrons measured in the first experiment, and the subtle observation of 4He made later, have been explained consistently by nuclear reactions in a Pd cathode surrounded by a surface layer of Li metal and/or PdLi_x alloy. The density of the assumed neutron in the model was detected numerically from the experimental data. The possibility of an explosive event, as reported in an earlier paper, was recognized as having a very small probability.

M. Srinivasan (Phys. Group, Bhabha Atomic Res. Cent., Mumbai, India), "**Cold fusion: promising new source of energy from water,**" *Phys. News* (Mumbai, India), vol 27(1), pp 48-52 (English) 1996. A review with no refs.

Hal Fox, Robert Bass (Fusion Info. Ctr., Salt Lake, UT, USA), "**Cold versus hot fusion deuterium branching ratios,**" *IEEE/NPSS Symp. Fusion Eng.*, 16th (vol 2), pp 1622-1625 (English) 1995

AUTHORS' ABSTRACT

A major source of misunderstanding of the nature of cold nuclear fusion has been the expectation that the

deuterium branching ratios occurring within a palladium lattice would be consistent with the gas-plasma branching ratios. This misunderstanding has led to the concept of the dead graduate student, the 1989's feverish but fruitless search for neutron emissions from cold fusion reactors, and the follow-on condemnation of the new science of cold fusion. The experimental facts are that in a properly loaded palladium lattice, the deuterium fusion produces neutrons at little above background, a greatly less-than-expected production of tritium (the tritium desert), and substantially more helium-4 than is observed in hot plasma physics. The experimental evidence is now compelling (800+ reports of success from 30 countries) that cold nuclear fusion is a reality, that the branching ratios are unexpected, and that a new science is struggling to be recognized. Commercialization of some types of cold fusion devices has already begun.

Dejun Li (Dep. Phys., Jishou Univ., Hunan, Peop. Rep. China), "**Principle and experimental method for the measurement of the cold fusion reaction cross section,**" *Jishou Daxue Xuebao, Ziran Kexueban*, vol 17(3), pp 65-68 (Chinese) 1996

AUTHORS' ABSTRACT

The principle and experimental measuring method of the cold fusion reaction cross section, which provides a possible way to verify the existence or not of cold fusion, are discussed. The principle and method discussed in the paper can be applied to some practical problems in electrochemistry.

Qingfu Zhang, Qingquan Gou, Zhenghe Zhu, Fusheng Liu, Jiaoming Luo, Yue Sun (Inst. Appl. Phys., Sichuan Union Univ., Chengdu, Peop. Rep. China), "**The relationship of crystal structure**

transition of Ti-cathode and 'excess heat' of cold fusion,"

Yuanzi Yu Fenzi Wuli Xuebao, vol 13(3), pp 257-261 (Chinese) 1996

AUTHORS' ABSTRACT

The crystal structure transition of Ti-cathode material in the electrolysis of NaOD-heavy water due to "excess heat" was studied. The crystal structure transition of Ti-cathode after "excess heat" from hexagonal to face-centered cube structure was observed by x-ray structure analysis. On the contrary, if there is no "excess heat," no changes can be observed. This phenomenon is interpreted as cold nuclear fusion.

Xinqi Song, Jianbo Liu (Dep. Chem., Qinghua Univ., Beijing, Peop. Rep. China), "**Cold fusion and its lessons.**" *Huaxue Tongbao*, (1), pp 54-58 (Chinese) 1997

AUTHORS' ABSTRACT

A review with 6 refs. is given on the definition of cold fusion, hypothesis proposed by C. Walling and J. Simon for explaining the experimental results of Fleischmann and Pons and rough experiments, and enlightenment of cold fusion.

Runbao Lu (Inst. Appl. Phys. & Comput. Math., Beijing, Peop. Rep. China), "**X-ray emission and cold nuclear fusion in glow discharge process of a kind of gas,**" *Hewuli Dongtai*, vol 12(1), pp 44-46 (Chinese) 1995

AUTHORS' ABSTRACT

The existence of cold nuclear fusion was explained based on experimental results on the glow discharge process in D/metal systems in which x-rays, neutrons and γ -rays are measured. A charge-dipole model was introduced to solve the Schrödinger equation. There were some bound states with energy about 14 keV in (D+D)

system. As length of nuclear force was about 0.5×10^{-13} (cm), the rate of x-ray emission was about 3.7×10^4 times the of rate of neutron emission. It is predicted that x-rays are emitted in H and He gases (including their isotopes) or mixture of them under the conditions of discharge process and cold nuclear fusion.

Dalun Wang, Suhe Chen, Yijun Li, Mei Wang, Yibei Fu, Xinwei Zhang, Zhang, Wushou (Inst. Nucl. Phys. Chem., Chengdu, Peop. Rep. China), "**Research and progress of nuclear fusion phenomenon at normal temperature,**" *Hewuli Dongtai*, vol 12(4), pp 31-32 (Chinese) 1995

AUTHORS' ABSTRACT

The fundamental results on nuclear fusion research at normal temperature at the CAEP Institute of Nuclear Physics and Chemistry are reviewed and described briefly. The anomalous phenomenon in metal loaded with deuterium has been studied by using gas-discharge, electrolysis and the cycle method of temperature and pressure. About 10^4 n/s and x-rays of a single energy (27 keV) were found. The production of neutrons and x-rays is repeatable. 8 Refs.

V.S. Bushuyev, V.B. Genodman, L.N. Jerikhina, S.P. Kuznetsov, Yu. A. Lapushkin, I.P. Matviyenko, A.I. Nikitenko, A.D. Perekrestenko, N.P. Saposchnikov, S.M. Tolokonnikov, A.M. Tzkhovrebov, (USA), "**Experiments on detection of nuclear radiation at heavy water electrolysis,**" *J. Opt. Res.*, vol 4(2/3), pp 171-179 (English) 1996

AUTHORS' ABSTRACT

Cold fusion from the detection of nuclear radiation at heavy water electrolysis is discussed. Neutron and γ -ray detection is considered from heavy water electrolysis with palladium electrode.

Jiefu Yang, LiJun Tang, XiaoMei Chen (Hunan Normal Univ., Changsha, Peop. Rep. China), "**Possible nuclear process in deuterium-metal system,**" *Changsha Dianli Xueyuan Xuebao, Ziran Kexueban*, vol 11(3), pp 289-295 (English) 1996

AUTHORS' ABSTRACT

This paper further points out some problems in the traditional idea and new physics in "abnormal" nuclear phenomena and explores the process, product and conditions before the cold fusion; and discusses the dineutron.

Yoshiaki Arata, Yue-Chang Zhang (Osaka Univ., Japan), "**Deuterium nuclear reaction process within solid,**" *Proc. Jpn. Acad., Ser. B*, vol 72B(9), pp 179-184 (English) 1996

AUTHORS' ABSTRACT

In a series of studies, a significantly large amt. of helium ($4\text{He}/\text{D}_2 \times (0.2^{-1}) \times 10^{-2}$ and $4\text{He}/3\text{He} \times 4$, D_2 : "fuel" helium: "ash") was clearly detected with a quadrupole mass spectrometer (QMS) as the deuterium nuclear reaction product ("ash") released from the highly deuterated Pd host-solid (Pd-black distributed 0.02 - 0.06 mm: av. 0.04 mm) that had produced large amounts of anomalous excess energy ($200 - 500 \text{ MJ}/\text{cm}^3$) over a long period (5000 h), when it was heated in a high vacuum ($\times 10^{-8}$ torr) at high temp. ($\approx 1000^\circ\text{C}$). On the other hand, a simultaneous measurement by another QMS captured a signal of the existence of 3He , while it is considerably less than that observed for the existence of 4He . In comparable measurements from non-deuterated samples, no He or D were detected. This means that there exists no well-known Rutherford type as a main reaction of the D nuclear reaction within a Pd host-solid, and an inherent feature of solid-state with an electron cloud, such as in the case of Pd, presents

a circumstance for a new type of D nuclear fusion reaction which directly produces 4He as the main reaction product. Because the helium (4He , 3He) was observed only after each sample had been heated in a high vacuum, in each case, the laws of physics require that this He could not have diffused from any outside source other than the Pd metal sample. Also because He was observed only after the sample was heated to a relatively high temperature, in each case, it must have been trapped inside the sample. Because there is no known process that can account for the diffusion of the large amounts of He inside the various samples at the levels that were measured, the only possible explanation for the He being trapped in this fashion is that it was trapped within each sample after it was first produced as the nuclear ash from an electrolytically induced (cold fusion) D nuclear reaction. To understand these results, the authors have constructed a theory, based upon a coherent process that is believed to be induced in highly deuterated Pd black crystals. In this theory, it is postulated that cold fusion is initiated through the formation of a strongly coupled plasma ("SC-plasma"), reminiscent of the SC-plasmas that are found within stellar interiors. This postulate is consistent with the assumption that a D nuclear reaction is initiated in a localized zone within a host solid, and it is indispensable that the D be transformed coherently for at least a few picoseconds into a SC-plasma, which the authors refer to as a D "coherent plasma" within the solid-state. It is also postulated that this "coherent solid-state plasma fusion" is initiated through a violent, localized vibration of the lattice, which the authors refer to as a "latticequake". This "latticequake" is essentially accompanied by both an intense electromagnetic turbulence and by a violently shaking electron cloud under a many-body effect in the coherent state.

A. Bertin, M. Bruski, V.M. Bystritskii, A. Vezzani, S. Vechchi, M. Villa, A. Vitale, Ya. Voznyak, D. Galli (Ob'edinennyi Institut Yadernykh Issledovaniy, Dubna, Russia), "**Absence of the tritium yield in the metal-deuterium systems,**" *Yad. Fiz.*, vol 59(6), pp 976-980 (Russian) 1996

AUTHORS' ABSTRACT

No tritium yield from the low-temp. nuclear d-d fusion reaction was found within measurement error in titanium of different modifications and intermetallic compds. ZrNbV , LaCo_5 , $\text{LaNi}_{4.5}\text{Al}_{0.1}$, $\text{MM}_{0.7}\text{Ti}_{0.3}\text{Mn}_2$ [sic]. The upper limit estimates for the rate of d-d fusion reaction with tritium production in titanium and intermetallic compounds are found at the 90% confidence level:
 $\lambda_f(\text{Ti}) \leq 2 \times 10^{-23} \text{ s}^{-1} (\text{d-d})^{-1}$; $\lambda_f^{\text{eff}}(\text{Ti}, \text{intermetallic}) \leq 6 \times 10^{-24} \text{ s}^{-1} (\text{dd})^{-1}$.

K. Konashi, T. Shibayama, M. Teshigawara, H. Kurishita, H. Kayano (Oarai Branch, Inst. Mats. Research, Tohoku Univ., Japan), "**Production of helium in iron by proton irradiation,**" *Sci. Rep. Res. Inst., Tohoku Univ., Ser. A*, vol 45(1), pp 111-114 (English) 1997

AUTHORS' ABSTRACT

The d-t fusion reactions produce neutrons with energies up to 14.1 MeV. These neutrons in addition to producing atomic displacement damage, will induce nuclear transmutation reactions. In particular, He will be generated at high rate in materials. Since He is a potent agent in nucleating cavities, the mechanical properties of materials may be affected significantly. It is important, therefore, to detect experimentally the He accumulation effect on radiation damage of materials under conditions similar to those in a fusion reactor. Proton beam experiments are a useful tool to study radiation damage by fast neutrons in fusion reactor. Productions of both at. displacement damage and He in materials were

simulated by computer code. Energy deposition in target materials is also estimated to consider the heating problem. The transmutation calculations indicated that the proton beam experiments imitate satisfactorily the ratios of transmutation rates to displacement rates calculated for the 1st wall of fusion reactor. Consistent concentration of accumulate He can be achieved across the target thickness. Cooling of target of 1 mm thickness could be handled without experimental difficulty in samples in the case of irradiation of 0.1 mA/cm² proton beam.

V.V. Kozlovskii (Nauchno-Issled. Inst. "Girikond", Russia), "**Transmutation doping of semiconductor materials under the effect of charged particles.**" *Izv. Akad. Nauk, Ser. Fiz.*, vol 59(10), pp 167-174 (Russian) 1995

AUTHOR'S ABSTRACT

A review with 31 refs. on transmutation doping of semiconductors by charged particle beams.

T. Thedein (Cent. Safety Res., Royal Inst. Technol (KTH), Stockholm, Swed.), "**Transmutation of nuclear waste: safety aspects.**" *Radiat. Soc.: Comprehending Radiat. Risk, Proc. Int. Conf.*, 1994, vol 2, pp 422-423. International Atomic Energy Agency: Vienna, Austria. (English) 1996. A review with 1 ref.

Mitsutane Fujita, Misako Utsumi, Tetsuji Noda (Nat. Res. Inst. Metals, Ibaraki, Japan), "**Retrieval system of nuclear data for transmutation of nuclear materials.**" JAERI-Conf, 97-004 (Proc. of the First Internet Symp. on Nucl. Data, 1996), 208-217 (English) 1997

AUTHORS' ABSTRACT

A database storing the data on nuclear reaction was built to

calculate for simulating transmutation behavior of materials. In order to retrieve and maintain the database, the user interface for the data retrieval was developed where special knowledge on handling of the database or the machine structure is not required for end-user. Using the database, the possibility of He formation and radioactivity in a material can be easily retrieved though the evaluation is qualified.

T. Ohmori, T. Mizuno, H. Minagawa, M. Enyo (Catalysis Res. Ctr., Hokkaido Univ., Sapporo, Japan), "**Low temperature nuclear transmutation forming iron on/in gold electrode during light water electrolysis.**" *Int. J. Hydrogen Energy*, vol 22(5), pp 459-463 (English) 1997

AUTHORS' ABSTRACT

Quantitative analysis and isotopic quantification of Fe atoms which appeared to be produced during the electrolysis with Au electrodes in Na₂SO₄ light H₂O solutions were made. The electrolysis was performed for 7 days with a current of 1 A. After the electrolysis the elements on/in an electrode were analyzed by AES. In every case, a notable amount of Fe atoms, at 1.0 x 10¹⁶ - 1.8 x 10¹⁷ atoms/cm², were detected together with the evolution of a definite amount of excess energy. The isotopic abundances of the Fe atoms were measured by SIMs, which were 6.5, 77.5 and 14.5% for 54Fe, 56Fe and 57Fe, respectively, at the top surface of the Au electrode, which were obviously different from the natural isotopic abundances.

Hideo Kozima, Masayuki Ohta, Masahiro Nomura, Katsuhiko Hiroe (Dep. Physics, Shizuoka Univ., Japan), "**Another evidence of nuclear transmutation in cold fusion experiments.**" *Cold Fusion*, issue 18, pp 12-16 (English) 1996

AUTHORS' ABSTRACTS

Experimental data of a cold fusion experiment measuring excess heat, neutron emission and distribution of minor atoms D, Li, Si and Al in Pd cathode are analyzed on the trapped neutron catalyzed fusion (TCNF) model. A consistent explanation of the data is given, including nuclear transmutation of Al into Si by absorption of the trapped thermal neutron.

Hideo Kozima (USA), "**4th Russian conference on cold fusion and nuclear transmutation (RCCF-NT4).**" *Cold Fusion*, 18, 4-11 (English) 1996 A review of cold fusion with 5 refs.

Bernhard Kienzler, Juergen Roemer (Inst. fuer Nukleare Entsorgungstechnik, Forschungszentrum Karlsruhe, Germany), "**Comparison between transmutation and direct disposal strategies: chemical aspects.**" *Tagungsber. - Jahrestag. Kerntech.*, pp367-369 (English) 1996 INFORUM Verlags- und Verwaltungsgesellschaft

AUTHORS' ABSTRACT

Release scenarios are compared for the long-term deterministic radiation impacts of geological waste disposal in view of partitioning and transmutation options. The comparison relies on the amount of spent fuel generated in Germany in the near future.

E.T. Cheng, R.J. Cerbone (TSI Res., Inc., Solana Beach, CA, USA), "**Prospect of nuclear waste transmutation and power production in fusion reactors.**" *Fusion Technol.*, vol 30(3, Pt. 2B), pp 1654-1658 (English) 1996

AUTHORS' ABSTRACT

A small tokamak-based fusion reactor can be attractive for actinide waste transmutation. Equilibrium

concentrations of transuranium isotopes were estimated in a molten-salt based fusion transmutation reactor. Nuclear performance parameters were derived for 2 types of fusion-driven transmutation reactors: Pu-assisted and minor actinides-only systems. The minor actinide-only burning system appears to be the ultimate fusion transmutation reactor. Because such a transmutation system can destroy the minor actinides generated in 35 LWRs, each of which produces the same thermal power as the transmutation reactor. However, a Pu-assisted transmutation reactor may achieve the same thermal power at a lower fusion power because of the higher energy multiplication in the blanket. It can therefore be developed as a shorter-term technology to demonstrate the viable long-term solution to nuclear waste.

H.E. Puthoff (Inst. Adv. Studies at Austin, Texas), **"Can the Vacuum be Engineered for Spaceflight Applications?"** NASA Breakthrough Propulsion Physics Workshop, August 1997, NASA Lewis Research Ctr., Cleveland, Ohio.

AUTHOR'S ABSTRACT

Quantum theory predicts, and experiments verify, that empty space (the vacuum) contains an enormous residual background energy known as zero-point energy (ZPE). Originally thought to be of significance only for such esoteric concerns as small perturbations to atomic emission processes, it is now known to play a role in large-scale phenomena of interest to technologists as well, such as the inhibition of spontaneous emission, the generation of short-range attractive forces (e.g., the Casimir force), and the possibility of accounting for sonoluminescence phenomena. ZPE topics of interest for spaceflight applications range from fundamental issues (where does inertia come from, can it be controlled?), through laboratory

attempts to extract useful energy from vacuum fluctuations (can the ZPE be "mined" for practical use?), to scientifically-grounded extrapolations concerning "engineering the vacuum" (is "warp-drive" space propulsion a scientific possibility?). Recent advances in research into the physics of the underlying ZPE indicate the possibility of potential application in all these areas of interest.

Scott R. Chubb, Talcott A. Chubb (Oakton Intl, Corp, Arlington, VA), **"Small Crystals Aid Cold Fusion,"** 1997 *Am. Phys. Soc. Bull.*

AUTHORS' ABSTRACT

The 1996 world meeting on cold fusion in Hokkaido, Japan (ICCF6) provided strong evidence that the nuclear product of radiationless cold fusion in a lattice is He-4. Arata and Zhang at Osaka University observed He-4 in thermal desorption studies of deuterated Pd powder that had produced 5 kWh/g excess heat; non-deuterated powder showed no He-4. Gozzi et al. at the University of Rome observed He-4 correlating with excess heat power over a thousand hour time period in the gas flow from an open-cell D₂O electrolysis cell, using a bundle of 150 0.25-mm Pd wires as the cathode. Arata and Zhang used a "double structure" cathode consisting of a Pd-metal bottle, evacuated and filled with Pd black (0.4 micron powder). They have recorded excess heat from 6 out of 6 cathodes. We attribute the cold fusion successes to use of small Pd grains. Deuterons coherently occupying ordered regions in a metal matrix are predicted to produce heat a higher power density with decreasing crystal size.

Scott R. Chubb, Talcott A. Chubb (Oakton Intl, Corp, Arlington, VA), **"Paired-Particle Coherence in a Lattice,"** 1997 *Am. Phys. Soc. Bull.*

AUTHORS' ABSTRACT

The many-body wave function $\Psi(r_1, \dots, r_n)$ for non-interacting band state particles in an ordered solid preserve lattice symmetry: $|\Psi(r_1+R_n, r_2+R_j, \dots)| + |\Psi(r_1, r_2, \dots)|$ for arbitrary lattice vectors R_n and R_j . These states manifestly exhibit a form of coherence with respect to outside perturbations that preserve order. When two, initially non-interacting band state particles are allowed to interact with each other, it is possible for their mutual Coulombic repulsion to be constrained in a manner that also preserves periodic order. Implications associated with the resulting coherence are discussed.

Scott R. Chubb, Talcott A. Chubb (Oakton Intl, Corp, Arlington, VA), **"2-Deuteron Wave Function,"** 1997 *Am. Phys. Soc. Bull.*

AUTHORS' ABSTRACT

The 2-particle wave function describing electrostatically interacting deuterons in an external field is a 6 degree-of-freedom function, describable in center-of-mass r_{cm} and separation r_{12} vector coordinates. Consider the case where the external field is periodic and r_{cm} and r_{12} can be treated as separable. Then, $Y(r_{cm}, r_{12}) = F(r_{cm})g(r_{12})$. The function $g(r_{12})$ can be called a dimming function since, when r_{12} approaches 0, $|Y(r_{cm}, r_{12})|$ approaches a minimum value. $g(r_{12})$ has a cusp in separation space at $r_{12} = 0$. When $Y(r_{cm}, r_{12})$ has lattice symmetry, $|F(r_{cm}+R_n)| = |F(r_{cm})|$, where R_n is any lattice vector. The question to be answered is whether lattice symmetry also requires $|g(r_{12}+R_m)| = |g(r_{12})|$, where R_m is any lattice vector, i.e., whether $g(r_{12})$ has a cusp in every unit cell in separation space. It can be shown that if $g(r_{12})$ has Bloch symmetry for band state deuterons in a metal crystal lattice and if the Coulomb repulsion interaction vanishes outside a screening radius r_{sc} less than half the edge of a unit cell, then the energy-minimizing 2-deuteron

wave function provides d-d overlap and there is no Coulomb barrier to fusion.

Scott R. Chubb, Talcott A. Chubb (Oakton Intl, Corp, Arlington, VA), **"Ion Band States, Many-Body Effects, Implications for Cold Fusion (CF),"** 1996 *Am. Phys. Soc. Bull.*

AUTHORS' ABSTRACT

We have developed a model illustrating how the Coulomb barrier between deuterons can be overcome, based on known properties of hydrogen in metals. The N-body D⁺ wave function is studied at N = 2. The separation dependency in the 2-D⁺ wave function has cusps like those in the 2-electron wave function of the helium atom. Unbroken lattice symmetry requires a Bloch function "center-of-mass" wave function with coherently-kinked cusps in each unit cell. When electron screening is present, the energy-minimizing cusp amplitude varies as (Ncell)^{exp-1}, implying CF possibility at large Ncell. Unbroken lattice symmetry in fully-loaded PdD (defined by $x \rightarrow 1$ in PdDx) trigger CF heating, requires CF energy release in each unit cell, and prevents de-excitation by energetic particles or gamma's. Change in the quantum of mass from 2 AMU to 4 AMU redistributes positive charge through occupation of ion band state He-4⁺⁺, initiating lattice shrinkage with generation of phonons. Ion band state helium with its neutralizing Bloch electrons is exothermically ejected from the lattice.

Scott R. Chubb, Talcott A. Chubb (Oakton Intl, Corp, Arlington, VA), **"Overlap Properties of D⁺ Ion Band State Matter: Implications for Cold Fusion,"** 1996 *Am. Phys. Soc. Bull.*

AUTHORS' ABSTRACT

Although the "Barrier Penetration" paradigm forbids significant overlap between D⁺ within Pd or PdD, it explicitly excludes many-body effects resulting from coherence between D⁺ pairs, solid state effects, and the possibility of discontinuous changes in momentum that are permitted (through wave-function cusps) in bound state systems. By using an alternative framework, involving the occupation of ion band states, which is consistent with quantum diffusion of H and D in transition metals, and using estimates of screening parameters that apply to fully-loaded PdD, we have performed variational calculations that include the effects of cusps in the separation dependence between two D⁺ ions but treat their center-of-mass dependence, using ion band state occupation. Our results show that overlap is affected by crystal size; when the number of unit cells Ncell < 10^{exp4}, negligible overlap occurs; for Ncell > 10^{exp4} increased overlap occurs. Experimental results consistent with a number of the predictions of the underlying theory are presented.

Mitch Swartz (JET Energy Technology, Wellesley Hills, MA), **"Consistency of the Biphasic Nature of Excess Enthalpy in Solid-State Anomalous Phenomena with the Quasi-One-Dimensional Model of Isotope Loading into a Material,"** *Fusion Technol.*, vol 31, no 1, 1997, pp 63-74.

ABSTRACT

Electrochemical experts, using nickel cathodes in light water solutions, were used to examine the enthalpy generated by electricity driving each electrode pair compared with ohmic controls contained within the same solution. For nickel wire cathodes, the peak power amplification (Π_{Ni}) was in the range of $1.44^{\pm 0.58}$. For spiral-wound nickel cathodes with platinum foil

anodes, Π_{Ni} was $2.27^{\pm 1.02}$. By contrast, neither iron nor aluminum cathodes demonstrated excess heat. Driving these nickel samples beyond several volts, however, produced an exponential falloff of the power gain. This biphasic response to increasing input power may be consistent with the quasi-one-dimensional model of isotope loading and may contribute to the difficulty of reproducing these phenomena.

V.S. Bushuyev, V.B. Genodman, L.N. Jerikhina, S.P. Kuznetsov, Yu.A. Lapushkin, I.P. Matviyenko, A.I. Nikitenko, A.D. Perekrestenko, N.P. Saposchnikov, S.M. Tolokonnikov, A.M. Tzkhovrebov (USA), **"Experiments on Detection of Nuclear Radiation at Heavy Water Electrolysis,"** *J. Opt. Res.*, vol 4, no 2/3, 1996, pp 171-179 (Eng.); Nova Science Pub.

ABSTRACT

Cold fusion from the detection of nuclear radiation at heavy water electrolysis is discussed. Neutron and γ -ray detection is considered from heavy water electrolysis with palladium electrode.

C. Ferrari, F. Papucci, F. Salvetti, E. Tognoni, E. Tombari (IFAM/CNR, Italy), **"A Calorimeter for the Electrolytic Cell and Other Open Systems,"** *Nuovo Cimento Soc. Ital. Fis., D*, vol 18D, no 11, 1996, pp 1333-1346 (Eng.), Editrice Compositori.

ABSTRACT

A calorimetric method and the construction details are presented of a differential calorimeter useful for studying the reactions in an electrolytic cell and more generally slow chemophysical processes occurring in thermodynamically open systems. The method allows measurements of the heat balance of the cell, from which the enthalpy change of the process under study

can be calculated. The theoretical description of the calorimetric cell and the results of several studies planned to describe the performances of the instrument up to the B.P. of the electrolytic solution are reported. The features of this calorimeter fulfill most of the requirements of cold fusion experts, where the heat production is the fundamental and controversial aspect. By controlling both the heat and the matter exchanged, the calorimeter can be used also to study bioenergetics processes, e.g., fermentation, microbial metabolism, and biodegradation, and liquid phase chemical reactions, involving gases as reactants and/or products.

Jiefu Yang, LiJun Tang, XiaoMei Chen (Hunan Normal Univ., People Rep. China), "**Possible Nuclear Process in Deuterium-Metal System**," *Changsha Dianli Xueyuan Xue-bao, Ziran Kexueban*, vol 11, no 3, 1996, pp 289-295 (Eng.); Changsha Dianli Xueyuan Xuebao Bianjibu.

AUTHORS' ABSTRACT

This paper further points out some problems in the traditional idea and new physics in "abnormal" nuclear phenomena and explores the process, product and conditions before the cold fusion and discusses the dineutron.

David L. Morgan, Jr., John L. Perkins, Scott W. Haney (Lawrence Livermore Natl. Lab., Livermore, CA), "**Antiproton-Catalyzed Fusion**," *Hyperfine Interact.*, 1996, 101/102 (Muon Catalyzed Fusion), pp 503-509 (Eng.), Baltzer.

ABSTRACT

Because of the potential application to power production, it is important to investigate a wide range of possible means to achieve nuclear fusion, even those initially appearing infeasible. In antiproton-catalyzed fusion, the negative antiproton

shields the repulsion between the positive charged nuclei of hydrogen isotopes, allowing a much higher level of penetration through the repulsive Coulomb barrier and greatly enhancing the fusion cross section. With their more compact wave function, the more massive antiprotons offer much more shielding than negative muons. If the antiproton could exist in the ground state with a nucleus for a sufficient time without annihilating, the fusion cross sections are so enhanced at low energies that at room temperature values up to about 1000 barns (d + t) would be possible. Unfortunately, the cross sections or antiproton annihilation with the incoming nucleus is even high. A model giving an upper bound for the fusion to annihilation cross section ratio for all relevant energies indicates that each antiproton will catalyze no more than about one fusion. Since the energy to make one antiproton greatly exceeds the fusion energy released, this level of catalysis is far from adequate for power production.

H. Kozima (Dept. Phys., Fac. Sci., Shizuoka Univ., Japan), "**Cold Fusion Phenomenon (A Review)**," to be pub. in *Internl. J. Soc. Mats. Engr. for Resources*, vol 6, no 1 (1998).

AUTHOR'S ABSTRACT

Present status of cold fusion research is reviewed after almost nine years of its discovery. It is recognized that the events of the cold fusion phenomenon occurring at from room temperature up to about 3000°C include not only initially supposed excess heat, neutron and tritium generations but also helium and gamma ray generations and the nuclear transmutation of the heavier nuclei. The experimental evidences of these events have been almost confirmed and primitive application devices have been worked out but theoretical explanation of the phenomenon is not accomplished yet. A trial of consistent explanation

for the whole experimental data is introduced in the final section.

William C. Mitchell, "**Big Bang Theory Under Fire**," *Physics Essays*, vol 10, no 2, 1997, pp 370-378, 26 refs.

AUTHOR'S ABSTRACT

The very old big bang (BB) problems (of the singularity, smoothness, horizon, and flatness) and the failed solutions of inflation theory; newer BB problems relating to missing mass (as required for a flat inflationary universe), the age of the universe, radiation from the "decoupling" ("smearing" of blackbody spectrum), a contrived BB chronology, the abundances of light elements, and redshift anomalies; and problems, newer yet regarding inconsistencies of redshift interpretation, curved space, inflation theory, the decelerating expansion of a BB universe, and some additional logical inconsistencies of BB theory are presented.

PATENTS

JP 97 15,210; "Method for identifying nuclides that can be produced in cold nuclear fusion;" Tetsuo Yuhara, Hiroshi Futami (Mitsubishi Heavy ind. Ltd., Japan); 17 Jan 1997; Appl. 29 June 1995; 4 pages (Japan). To make it easy to discriminate chemical species whose mass numbers are very close, chemical species containing the nuclide to be identified is irradiated with a characteristic wavelength of light for selective ionization, thereby the nuclide thus produced is identified. The ionized species is then further processed for identification.

RU 2 073 964; "Production of neutrons and gamma-rays from a metal saturated with deuterium under action of a shock wave;" Viktor L Brilev, Viktor E. Panin, Yuriy A. Khon; Aleksandr E. Yakubov (Rossijskij Materialovedcheskij Tsentri; Firma "fiton-Kholding Ltd." Russia); 20 Feb 1997; appl. 19 Sept. 1994. From: Izobreteniya 1997, (5), 262. (Russia). Title only translated.

JP 97 197 077; "Electrodes for cold fusion and methods for manufacturing radioactive and nonradioactive elements and noble metals using the nuclear transitions;" Reiko Notoya (Japan); 6 pp.; 31 Jul 1997, appl. 11 Jan 1996. (Priority: JP 95 335 615 16 Nov 1995). Materials which can bring about nuclear transitions are used as the electrode materials. The electrode materials contain 1 element whose atomic number is in the vicinity of rare elements (elements whose amount in the natural world is very little) and noble metals. Examples of the element whose atomic number is in the vicinity of rare elements include W, Mo, Tc, Re, Ag, Cd, Hg, In., Tl, Sn, and Pb. The electrodes contain radioactive elements. Electrodes which contain materials which can bring about nuclear transitions are used to manufacturing noble metals or rare elements. Compared with nuclear reactors and charged particle accelerators, the present method can manufacture the desired materials with more accuracy and easiness.

JP 97 113 661; "Method and apparatus for cold nuclear fusion;" Yotaro Hashimoto (Eiwa K. K., Japan); 2 May 1997; 5 pp.; appl. 19 Oct 1995. A mixture of CH_2Cl_2 and H_2O (and optionally, surfactant) is heated (50-140°) to produce vapor of CH_2Cl_2 and steam, an electrode which can bring about cold fusion is put in a gas chamber which is filled with the CH_2Cl_2 and steam, and cold fusion is promoted. A supercritical fluid condition is produced to induce cold fusion thereby the frequency of cold fusion is increased and the reproducibility is increased.

EP 766 260; "Hydrogen nucleus storage method and hydrogen nucleus storage unit," Toichi Chikuma (Japan); 2 Apr 1997, 8 pp; appl. 17 Sep 1996. (Priority: JP 95 270 690). A H occlusion member, coated in advance with an insulation layer capable of preventing penetration of H nuclei, is inserted, only at a portion thereof which is not coated with the insulation layer, into a reactor vessel so that H nuclei are occluded into the H occlusion member, and then the portion of the H occlusion member is removed from the reactor vessel. Thereafter, also the portion which is not coated with the insulation layer is [then] coated with an insulation layer, and the H occlusion member is accommodated into and kept in a protective case if necessary.

JP 97 015 210; "Method for identifying nuclides that can be produced in cold nuclear fusion;" Tetsuo Yuhara, Hiroshi Futami (Mitsubishi Heavy Ind Ltd, Japan); 17 Jan 1997, 4 pp., appl. 29 Jun 1995. To make it easy to discriminate chemical species whose mass numbers are very close, chemical species containing

the nuclide to be identified are irradiated with a characteristic wavelength of light for selective ionization, thereby the nuclide thus produced is identified. The ionized species is then further processed for identification.

JP 08 313 663; "Method for nuclear fusion, nuclear fusion engine, and a mechanical system containing it;" Takeshi Hatanaka (Japan); 29 Nov 1996; 11 pp.; appl. 22 May 1995 (Japan). The method comprises the steps of (1) feeding heavy H gas to a nuclear fusion chamber containing an electrode with mirror surface after the chamber was evacuated, (2) forming plasma of the heavy H by the discharge of the electrode, and (3) compressing the plasma by the mirror surface while heating and increasing the density of the plasma to generate nuclear fusion reaction. The electrode is equipped with a cathode containing nuclear fusion elements which is made of $\frac{1}{2}$ of H₂-absorbing alloy and heavy fermion compound. The engine is equipped with (1) an engine housing containing an operating chamber filled with heavy H gas, (2) a compressor which is connected to the operating chamber, (3) a nuclear fusion means which is connected to the operating chamber and the compressor and brings about nuclear fusion of the heavy H by the plasma to generate a high-pressure dynamic gas, (4) a turbine to output mechanical power, and (5) a means for circulating the unreacted heavy H gas to the compressor. The mechanical system comprises a machine and the nuclear fusion engine. The manufacturing and running cost is low, the engine can be operated for a long time, and no environmental pollution is generated.

WO 97 20 319; Solid fuel for cold nuclear fusion reactors; Ubaldo Mastromatteo (Sgs-Thomson Microelectronics S.R.L., Italy); 5 Jun 1997, 15 pp; appl. 26 Nov 1996. (Priority EP 95-830498) This invention relates to a solid fuel for cold nuclear fusion reactors. A reactor suitable for such fuel comprises a quantity (MA) of an absorbing material capable of absorbing H, and of generating in consequence thermal energy, has the form of a cylindrical container and comprises a quantity (CO) of a fuel capable of releasing H put in touch with the inner walls of container (MA), and comprises a thermal element (ET) located in the inside and in touch with fuel (CO) to heat it. The fuel according to this invention is constituted by a solid compn. including at least one of the chemical elements belonging to the groups III, IV, V of the periodic system, or at least a compound obtained by combining to one another at least 2 of such elements, and including an effective quantity of H.

WO 9 735 324, "Method for preparing highly radioactive materials for transmutation and/or burnup," Claude Fuchs; Serge Fourcaudot, Karl Richter, Joseph Somers (Europäische Atomgemeinschaft (Euratom), Luxembourg), 25 Sep 1997, 12 pp, appl. 10 Mar 1997. (Priority: LU 96-88727) A method is described for preparing highly radioactive materials (such as Pu, Am, Np, Cm, and other actinides), as well as fission products such as Tc for transmutation and/or burnup by irradiation in a nuclear installation. The materials are first converted into liquid form by melting or chemical dissolution and a porous carrier material, which is essentially insoluble in the liquefied materials, is impregnated with the liquefied materials and then heated in such a way that the materials are converted (e.g. by sintering) into the finally required chemical form (e.g. pellets as oxides, carbides or nitrides), density, etc.

LETTERS TO THE EDITOR

TRANSMUTATION RESULTS

In *New Energy News*, vol 5, no 7, Nov. 1997, I read about the difficulties to be believed about Thorium.

As a matter of fact radioactive measurements are "indirect" small remnants of Thorium "before" and "after" the reactions. A total mass balance is much better. Therefore, to fight "skepticism" and "refusal," I am sending you the results of two "independent" tests, concerning Thorium and Uranium, made in Italy, and the abstract of my communication to ICCF-7.

If you want you can publish them in *New Energy News*.

Best Regards From
Roberto A. Monti'

R.A. Monti (Istituto TESRE-CNR, Italy, Burns Developments, Canada), "Nuclear Transmutation Processes of Lead, Silver, Thorium, and Uranium."

AUTHOR'S ABSTRACT

The possibility to cause nuclear transmutation of stable isotopes by means of ordinary chemical reactions [1] suggested the possibility to cause nuclear transmutation of unstable isotopes [2].

A first series of experimental tests was made from 1993 to 1995 with positive results [3].

In 1996, an industrial reactor was built in Canada and sent to Italy for a new series of independent tests at ENEA (Italian national Laboratories), In these tests the production of Silver from Lead was used as a driver of the nuclear transmutation of Thorium and Uranium [4].

After the positive results of these independent test (1997) a second series will be performed at the ENEA Laboratories, starting October 1997. Detailed quantitative results of all these experiments and a description of the industrial reactor will be reported at ICCF-7.

References

- [1] G.H. Lin and J.O'M. Bockris, *J. New Energy*, vol 1, no 3, 1996, p 100.
- [2] R.A. Monti, *J. New Energy*, vol 1, no 1, 1995, p 119.
- [3] R.A. Monti, *J. New Energy*, vol 1, no 3, 1996, p 131.
- [4] L.E.T. Project, INEA Reports, vol 2, no 3.

Element	TOTAL IN Firing mix (g)	Element	Slag (g)	OUT Copel (g)	Water (g)	TOTAL OUT Sum (g)	
Sh	0.94	Sh	0.35	0.13	0.03	0.51	
Pb	314.36	Pb	53.66	199.05	12.03	264.74	-50g
Bi	0.40	Bi	0.05	0.05	0.00	0.11	
Rh	0.63	Rh	0.01	0.01	0.01	0.03	
Al	0.18	Al	0.06	0.05	0.00	0.11	
Ru	0.37	Ru	0.01	0.00	0.01	0.02	
Au	0.14	Au	0.00	0.00	0.00	0.00	
Tl	0.22	Tl	0.02	0.08	0.00	0.10	
Mg	0.26	Mg	0.14	0.00	0.02	0.16	-88%
Th	2.26	Th	0.24	0.00	0.04	0.27	(-2g)
Cu	2.06	Cu	1.18	0.83	0.04	2.05	
Ag	89.61	Ag	12.60	167.60	0.00	180.20	+91g
Pd	0.20	Pd	0.01	0.00	0.00	0.01	
Ni	0.49	Ni	0.03	0.03	0.07	0.13	
Sc	0.00	Sc	0.00	0.00	0.00	0.00	

Element	TOTAL IN Firing mix (g)	Element	Slag (g)	OUT Copel (g)	Water (g)	TOTAL OUT Sum (g)	
Sb	0.94	Sb	0.28	0.12	0.03	0.43	
Pb	314.83	Pb	32.12	165.79	6.04	203.95	-111g
Bi	0.41	Bi	0.03	0.05	<0.01	0.08	
Rh	0.63	Rh	<0.01	0.01	0.03	0.04	
Al	0.19	Al	0.03	0.04	<0.01	0.07	
Ru	0.37	Ru	<0.01	<0.01	0.02	0.02	
Au	0.15	Au	<0.01	0.11	<0.01	0.11	
Tl	0.23	Tl	0.01	0.03	<0.01	0.04	
Mg	0.26	Mg	0.09	<0.01	<0.01	0.09	
Th	0.25	Th	0.17	<0.01	<0.01	0.17	
Cu	2.07	Cu	0.83	0.78	0.03	1.64	
Ag	89.84	Ag	1.42	174.46	<0.01	174.83	+85g
Pd	0.20	Pd	<0.01	<0.01	<0.01	<0.01	
Ni	0.49	Ni	0.02	0.03	0.20	0.25	
Sc	<0.01	Sc	<0.01	<0.01	<0.01	<0.01	
U	4.20	U	2.81	0.03	0.12	2.96	-1.2 hg (-30%)

EXPERIMENT REQUEST

The elementary particles can be accelerated to superluminal velocities. But I am physicist-theorist and I can not do such experiment. Therefore I suggest to carry out the superluminal acceleration for investigators, which have necessary accelerators facilities. I send you my appeal to physicists-experimenters.

Can you publish it in the New Energy News?

Sincerely yours

Prof. Joseph J.Smulsky.
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APPEAL TO PHYSICISTS-EXPERIMENTALISTS

Dear Friends!

I should like to call your attention to the possibility of accelerating elementary particles to superluminal velocities.

There are no objective reasons why such velocities could not be attained. The generally accepted view that particles cannot move at superluminal velocities because such velocities are not allowed by the special relativity theory (SRT) is incorrect. The reason why it is incorrect is as follows.

Electromagnetic interactions between bodies depend not only on distances between the bodies but also on relative velocities of the bodies. The SRT seeks to reduce interactions between moving bodies to interactions between the bodies at rest and vice versa. Relativistic transformations (Lorentz transformations) make this reduction possible.

However, if the interactions between moving bodies are described in the first place as functions of relative velocities of the bodies, then the relativistic transformations of space, time, and mass are not needed.

Moreover, the creators of the SRT, being preoccupied with the world ether, became victims of a mistaken belief that, instead of building a theory of interactions between bodies, they were creating a world in which material bodies experience changes in accordance with relativistic relations. And since relativistic transformation equations become imaginary at superluminal velocities, such velocities became forbidden in the SRT.

And yet, a relativistic description of interactions is not the only possible one, other descriptions are possible. Elementary descriptions based on classical physics have been published by G. I. Sukhorukov and co-authors (Russia), T.G. Barnes and co-authors, C.W. Lucas, Jr. (USA), and many others.

Oleg D. Jefimenko, Professor of Physics at West Virginia University (USA) in his book "Electromagnetic Retardation and Theory of Relativity" (Electret Scientific, Star City, 1997) has presented

a method of retarded fields, whose origin can be traced to Oliver Heaviside, which is capable to replace completely the SRT.

In the course of my investigations [1, 2] I have developed a force-based method of describing interactions between bodies as functions of distance and velocity only.

Motions with superluminal velocities exist in nature: streams of matter and fragments of galaxies in the distant cosmical space move with velocities many times greater than the velocity of light; cosmical particles enter the Earth atmosphere at superluminal velocities. I propose to obtain superluminal motions here on Earth.

I invite organizations and individual scientists to participate in this endeavor. Many organizations have everything that is essential in order to accelerate particles to superluminal velocities in accordance with the method proposed in my articles [2, 3]. If necessary, the method can be modified and adapted to the available conditions.

I also propose to make use of the methods that I have developed for designing accelerators and nuclear transmutations. My methods are more accurate and precise than those based on the SRT.

Why do we need to create superluminal motions?

1. For developing new engines for interstellar explorations.
2. For developing a powerful weapon for antiasteroid protection.
3. For creating new technologies.
4. For establishing new goals and perspectives for the mankind.

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Yours sincerely,

Joseph. J. Smulsky, Doctor of Physical and Mathematical Sciences, Chief scientist, IEC SO RAN

Address: Prof. Joseph J. Smulsky

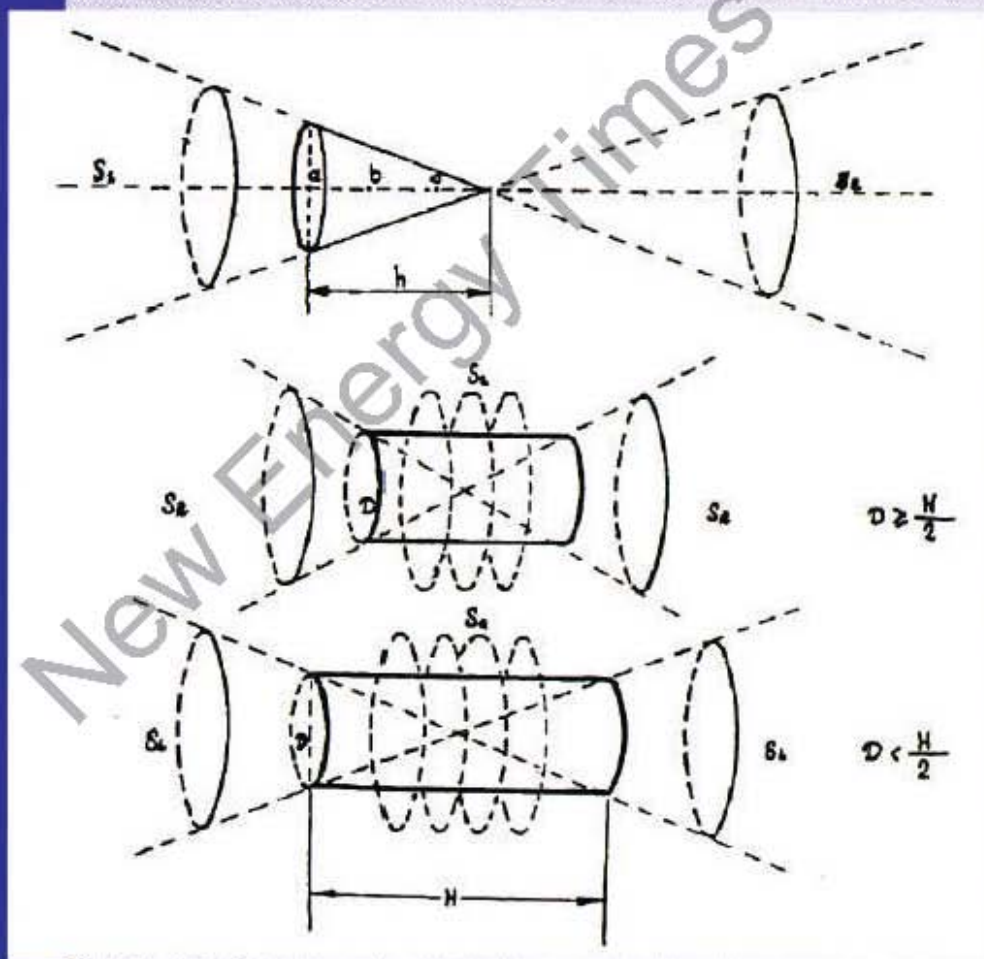
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