12th International Workshop on Anomalies in Hydrogen Loaded Metals

Abstracts

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Workshop Patrons

Effect of Supporter Material on Heat Evolution from Ni-based Nano-Composite Samples under Exposure to Hydrogen Isotope Gas

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Hydrogen isotope absorption by palladium and nickel-based nanocomposite samples has been examined as a collaborative work using the experimental apparatus installed at Kobe University and Tohoku University in order to share scientific understanding of the anomalous heat effects both at room temperature (R.T.) and elevated temperatures (E.T.). The following samples have been tested so far at Kobe Univ. :

a) $Pd_{0.044}Ni_{0.31}Zr_{0.65}$ with ZrO_2 beads filler; PNZ3, PNZ4, PNZ5
b) $Cu_{0.044}Ni_{0.31}Zr_{0.65}$ with ZrO_2 beads filler; CNZ5
c) $Cu_{0.008}Ni_{0.079}$ supported by mesoporous SiO_2 powder; CNS3
d) Pd nanoparticles embedded in mesoscopic SiO_2 balls; PSf1

The samples a) PNZ and b) CNZ were amorphous mixture of the metal elements prepared by melt spinning method, and calcined in air at a temperature of 450 °C for 100 hr ~ 60 hr, during which preferential oxidation of Zr to ZrO_2 is expected with a consequent formation of binary-nanoparticles of Pd/Ni or Cu/Ni embedded in it. The results of the D (or H) absorption and heat release experiments were presented at ICCF20 last October, and will be published in Proceedings of ICCF20.

The sample c) CNS3 was synthesized in a solution of nickel chloride and copper chloride containing the mesoporous silica (mp-silica) powder as a suspended material to adsorb Ni and Cu in nano-pores or on the surfaces. The sample d) PSf1, fabricated at Kyushu University, consists of Pd nanoparticles embedded in silica balls. Comparison of the results of the absorption/heat measurements of the sample c) and d) are going to be presented and discussed at JCF17 Meeting this March. The main conclusions are:

(1) In the E.T. phases, excess heat is observed in the runs with binary nanocomposite samples, while no excess heat is observed with single-element nanoparticles.
(2) In the CNS3#2 run, the excess heat amounts to 29 MJ/mol-Ni or 0.11 GJ/mol-H without any observable change in the sample composition, which cannot be explained by any chemical process.

In the present paper, the D (or H) absorption and heat release characteristics will be discussed with a focus on the effect of the supporter material, ZrO_2 and SiO_2.

Model Mechanism for AHE by Nano-Metal and H(D)-Gas

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Burst like heat at room temperature and long lasting anomalous heat effect (AHE) at elevated temperature have been observed by D(H)-gas phase experiments with Ni-based nanocomposite metal samples by Technova-Kobe collaboration and 6 Japanese group collaboration works as reported at ICCF20, by A. Takahashi et al [1], A. Kitamura et al [2] and Y. Iwamura et al [3]. Observed AHE has been considered to be explainable by some nuclear mediated reactions with catalytic nano-composite condensed matter physics, as reviewed in Session-4 of ref. [1].

Presentation will be of model mechanisms based on the TSC theory. Surface catalytic and molecular physics models are reviewed and discussed first. Formation of SNHs (sub-nano-holes) on surface of modelled nano-composite sample, Ni-core + incomplete Pd (or Cu) shell, is a key idea of sites for TSC formation. After the TSC state is formed, it will make very rapid (ca. 1-2 fs) condensation-collapse motion getting into strong/weak nuclear interaction range for 4 protons (or deuterons) + 4 electrons system (the 8 body system dynamics) to generate specific nuclear ash (He-4, He-3, d). Mechanism of AHE by D-gas or H-gas phase will be discussed by the present model.

[1] A. Takahashi, A. Kitamura, K. Takahashi, R. Seto, T. Yokose, A. Taniike and Y. Furuyama: Anomalous Heat Effect by interaction of nano-metals and H(D)-gas, Proc. ICCF20 to be published in JCMNS

[2] Akira Kitamura, Akito Takahashi , Koh Takahashi, Reiko Seto, Yuki Matsuda, Yasuhiro Iwamura, Takehiko Itoh, Jirohta Kasagi, Masanori Nakamura, Masanobu Uchimura, Hidekazu Takahashi, Tatsumi Hioki, Tomoyoshi Motohiro, Yuichi Furuyama, Masahiro Kishida: Collaborative Examination on Anomalous Heat Effect Using Nickel-Based Binary Nanocomposites Supported by Zirconia, Proc. ICCF20 to be published in JCMNS

[3] Y. Iwamura, T. Itoh, J. Kasagi, A. Kitamura, A. Takahashi and K. Takahashi:
Replication Experiments at Tohoku University on Anomalous Heat Generation Using Nickel based Binary Nanocomposites and Hydrogen Isotope Gas, Proc. ICCF20 to be published in JCMNS

Erzion Interpretation of Rossi & "Lugano" Experiments with "Hot E-cat" Cell & Our Plasma Electrolysis Experimental Results

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There are presented the main results of Rossi and Sweden-Italian "Lugano" group experiments with the hydrogen loading of nickel on the "hot E-cat" cell. Also short review of our Cold Nuclear Transmutation investigation in plasma electrolysis is presented. For their interpretation it is proposed to use the Erzion model for theoretical explanation of excess heat generation, new chemical elements & isotopes production and radiation registration in these experiments. For such explanation Erzion model takes into consideration the Spin and Parity Preservations Laws.

Patents in the Land of LENR

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Interested observers of developments in the field of LENR were awakened by the first publication and issuance of a US patent to Leonardo Corporation, based on an invention by Andrea Rossi, on August 25, 2015. That US patent has its special story as to the procedure followed before the US Patent Office. It was processed in secret without the normal publication that occurs after 18 months from a first patent filing. This patent has some relevance. But it has now been followed by the publication of a corresponding, enhanced, PCT application. The more interesting issue is: Will these or any other patent filings eventually have a controlling impact on developments in the field of LENR?

This paper provides a concise review of key patent principles which should be understood by everyone concerned about this issue. Misconceptions abound. It is important that anyone wishing to understand the possible impact of patents on the development of LENR understand correctly what patents can and cannot accomplish.

Patents are referenced in a legal action commenced before the United States Federal District Court in Florida, filed on April 5, 2016. This action was commenced by Leonardo Corporation and Andrea Rossi against Industrial Heat, some of it is some related corporations and key individuals associated with these companies. This action will not likely come to a trial until sometime in 2017 at the earliest. It could also settle at any time. That action is essentially an effort to collect US$89 Million arising out of an agreement made between Industrial Heat and Leonardo Corporation in 2012. The status of those proceedings as of the beginning of October, 2016 will be reviewed.

Industrial Heat is accused of having improperly filed for two applications on its own both naming Andrea Rossi as at least a co-inventor. Apparently, based on the allegations in the lawsuit this happened without the consent of Andrea Rossi. How this could happen will be reviewed. However, equally significantly, these two patents will be examined for the apparent thinking and understanding that existed within Industrial Heat when these patents were first prepared 2 1⁄2 years ago.

Reference will be made to several other US patents that have issued in this field, and others that have been refused by the US Patent Office. Reference will also be made to selected patents that have been processed before the European Patent Office, including in particular the original patent that issued in Europe based on the work of Fleischman and Pons.

The paper will conclude with a projection as to the impact that prospective future patents in the LENR field may have on commercialization of LENR around the world.

Forgotten effects and inventions of LENR

George Egely

Most researchers of LENR think that history started with Pons and Fleischmann. Not so. Some important but scarcely documented inventions, like Nicola Tesla's „carbon button lamp", go back as early as the 1890's. Henry Moray demonstrated his plasma-based electric energy generator from the 1920's. Hungarian-born Joseph Papp demonstrated his „noble gas" engine in the 1960' – 1980's. The Correas' (husband and wife) demonstrated and patented their plasma-based electric energy generator in the 1990's. The Russian V. Chernetzky demonstrated and published several articles about their arc discharge based device, which produced excess electric energy.

Other inventions like Shoulder's "heavy electron" discharge mechanism falls in the same category.

All of the above inventions work in transient plasma with discharge between metal electrodes, which erode during the process. Thus in fact transient dusty plasma is the base of all these excess energy generating devices.

The inventors had no clue to the nature of the excess energy generating effects; all of them stumbled into an interesting effect by accident. There were at least a dozen more but less clearly documented inventions, as transient dusty plasma is easy to generate. All underwater transient discharge experiments automatically belong to this branch.

Arguably hydrogen isotopes are behind all of these effects, that is, there is a wide unrecognized area of LENR, which is unknown to researchers working in LENR.

Obviously not only bright and lucky tinkerers, backyard inventors stumbled into this area, but physicists, too. Steven B. Krivit has compiled an eye-opening volume of these important, but ignored discoveries. All of them were in the area of transient discharges between metal electrodes, which in turn yield dusty plasma. Thus as early as 1907, W. Ramsay, and independently of him F. Soddy demonstrated the unexpected appearance of He and Ne in the discharge of hydrogen.

Several other LENR effects were discovered – and forgotten, neglected in the coming decades.

It is high time to relate them and find the physical mechanism behind these interrelated effects.

"Road Map" for Developing Engineering Applications of LENR Technologies

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The results of experimental research of LENR phenomena that have become evident of late are making urgent to start active works in the field of developing engineering applications of LENR technologies.

The presentation stipulates to demonstrate several major technologies that can be fulfilled to be implemented in the near future. Those technologies incorporate the following directions: Generating ecologically clean and safe heat; Generating ecologically clean and safe electricity; Complete neutralizing radioactive waste and spent nuclear fuel; Cheap and ecologically clean desalinating sea water; Neutralizing war gases and toxic hazardous waste products; Producing precious and rare metals out of cheaper materials; Producing new special materials and alloys; Using LENR-radiation for technical and medical needs.

The power point slides will exhibit to demonstrate technical and commercial parameters of 11 projects including: 100 kW water heating unit; 5 MW electric power generator; 120 kW fuelless electrical generator; 10 MW power installation; Technological complex for deactivating radioactive waste and spent nuclear fuel; Technology for economically effective distillation of sea water; Ecologically safe desalinating sea water; Detoxification of poisonous materials and war gases; Equipment for manufacturing stable isotopes; Reactor for manufacturing gold and special alloys; Technology for producing Xenon gas; Unit for generating and implementation of TM-radiation for medical purposes.

The video presentation will contain 45 slides illustrating the design of the technologies proposed, main technical characteristics, and projects parameters.

An Improved Differential Calorimeter to study the Synthesis of an Iron Pico-Hydride. Characterization of the Iron Pico-Hydride

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The differential calorimeter used to carry out the Iron Pico-hydride synthesis has been improved:

-The supports of the inner alumina tube of the calorimeter are now outside the heater, resulting in the 2 alumina tubes facing each other with nothing in the heated zone. The thermal signal used to measure the enthalpy of formation is thus easier to understand.

-The calibrating constant of the calorimeter is now measured by the melting of a copper mass in the reference cell of the calorimeter.

As regards the characterization of the Iron Pico-hydride, a scan of the absorbance (by Absorption Spectro-Photometry in the UV VIS range) has been made. Two solutions 200mM in HCl 10N of the Iron used for the synthesis and of the resulting mixture Iron/Iron pico-hydride after synthesis, have been washed 3 times with diethyl-ether. A clear difference between the two spectra of the washed samples has thus been evidenced: the maximum of absorbance of the Iron pico-hydride is shifted by 16 nm (towards UV) compared to the maximum of absorbance of the Iron.

The consequences of this observation, combined with the ICP-MS results will be discussed.

A LENR view after SSICCF20 and ICCF20

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At SSICCF20 and ICCF20 we have presented several paramount results which we quickly summarize here.

1- If we use the same math as quantum physicists, then a straightforward application of the Banach-Tarski [1] theorem to the Hamiltonian of an isolated system in classical statistical thermodynamics brings to the non-conservation of energy.
2- If we start physics, in a trial to get a new global approach, through the theorem of Curie basically saying that for an event to occur in any physical system we need to have a dissymmetry and that systems evolve from a dissymmetric state to a symmetric one, we proved that symmetry means disorder whereas dissymmetry means order on the contrary of common intuition. This brought us to consider a new mathematical view of what symmetric means and we elaborated the notion of symmetry from a point of view which can be inside a figure or outside. And this results in entities which are, say, symmetric from the inside and dissymmetric from the outside.
3- We pushed the traditional argument of evolution of any closed system towards a state of maximum entropy to its limits by extending the notion of what order means in any physical system and showed that in such a new model there is a theoretical way to make an artificial fuel which will give more energy when combustion occurs than what we needed for its manufacturing and this without contradicting the first and second principles of thermodynamics.
4- We also showed that it is possible to extend thermodynamics which is limited in its formalism to closed systems, to open systems in general and the whole universe in particular.
5- According to these results we suggested that LENR reactions could be not “cold fusion” but new kind of reactions, “above” chemistry. This is a strong conviction linked to previous work presented at New3-SC with a new model of the atom which justifies what some experiments already have detected! However, we shall show in this paper that our model based on symmetries can perfectly explain why and under which conditions cold fusion could occur. We will even show a way to master it!

Most of these theoretical results, which we think are of importance, were presented at LENR conferences, but we did not explain how to use them to make LENR working systems. In this paper we are going to try to give some more concrete indications of how to do this.

S. Wagon, The Banach-Tarski Paradox, Cambridge University Press, 1985.

News about symmetries in physics

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In this paper we are going to present the theory we began developing in SSICCF20 about symmetries. Basically, we start from Pierre Curie's theorem as the basis. This implies developing new mathematics and in particular revisit what the notion of symmetry is. We shall mathematically define what a mathematical symmetry is. This definition is consistent with the currently known one, but adds an ingredient: the point of view we look at a figure.

So, basically, considerations in physics bring to elaborating new mathematical concepts. Then we push up the mathematical concepts to apply them to the initial physics. This results, when adding to Curie's view the one of Einstein, to the justification of a non-Archimedean universe. In the meanwhile this approach shows that the fields we deal with must follow functions like $1/r^{\alpha}, \alpha > 0$. We are therefore very near the well-known electromagnetic and gravitational fields. We also mathematically prove that motion is a necessity for having a symmetric system, hence stability or equilibrium.

This theory gives clues of how to manage and build a LENR device. More details on this are provided in another paper of ours.

Deepening Questions about Electron Deep Orbits of the Hydrogen Atom

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In a previous work [1] we summarized arguments for and against the deep orbits, as discussed in published solutions. The most complete of such works, Maly and Va'vra [2], indicates an infinite family of EDO solutions of the Dirac equation when using a Coulomb potential modified by taking into account a finite size nucleus. We analyzed, verified, and improved their method of computing the EDO mean radius, in particular, by using a more complete ansatz and we extended their results by varying some contextual parameters. Moreover, in [3] and under a more detailed form in [4], we revealed the essential role of Special Relativity as source of EDOs with high binding energy, due to the quadratic expression of the relativistic total energy, and as leading to a dynamic correction of the original Coulomb potential. We also showed, from a well-known analytic method of solution of the Dirac equation, that the *EDOs have a positive energy E*.

When including the magnetic interactions near the nucleus, we observed a breakthrough [5] in how to satisfy the HUR requirement for electrons confined near the nucleus in a radial zone of only a few fm. Indeed, when considering only the electric Coulomb potential, the deep-orbit-electron kinetic energy is of order several keV to a few MeV (with a correspondingly low momentum). However, with magnetic interactions, preliminary computations indicate such energies in the hundred MeV range.

We continue our study here by examining the Special (e.g., Thomas precession) and General Relativity effects [6] at the MeV level and by including magnetic interactions (e.g, spin-spin) in the highly relativistic regime of electrons (~100 MeV). It is seen that the Thomas precession, already included in the relativistic equations, may play the same role in the deep orbits that the de Broglie wavelength plays in the atomic-electron orbits. We noted previously that Special Relativity tends to mix energy parameters, while generating further terms, because of its non-linear features; so one can no longer simply add the potentials. A full relativistic treatment requires full covariant methods from QFT techniques, such as e.g. two-body Dirac equations of constraint dynamics, to avoid the Currie-Jordan-Sudarshan "non-interaction problem" [7]. Moreover, radiative corrections are certainly very strong in the nuclear zone, so we have to analyze and adapt to this zone, small effects well-known for the atomic electrons. This can imply changes in the regularization processes required for closed loops and also requires Effective Field Theory [8] which considers a layered structure of energy levels. It appears that in solving the cold fusion problem, new insight into the physics of the nucleus and its multi-energy structures may become available.

[1] Paillet, J.L., Meulenberg, A., "Electron Deep Orbits of the Hydrogen Atom". Proc. 11th Internat. Workshop on Hydrogen Loaded Metals, Airbus Toulouse, 15-16 Oct. 2015, J. Cond. Matter Nucl. Sci. 22, (2016).

[2] Maly J.A., Va'vra J., "Electron transitions on deep Dirac levels II," Fusion Science and Technology, V.27, N.1, pp.59-70 (1995), http://www.ans.org/pubs/journals/fst/a_30350

[3] Paillet, J.L., Meulenberg, "Relativity and Electron Deep Orbits of the Hydrogen Atom", Proc. of the 1st French Symp. RNBE-2016 on CMNS, Avignon, 18-20 March. Journ. CMNS 21, 40-58 (2016).

[4] Paillet, J.L., Meulenberg, A: "Special Relativity, the Source of the Electron Deep Orbits", Foundations of Physics, 47(2),256-264,Springer (2017).

[5] Paillet J.L., Meulenberg A., "Advance on Electron Deep Orbits of the Hydrogen Atom". presented at ICCF20, 20th Intern Conf. on CMNS, Sendai, 2-7 Oct 16, 2016, Sendai (Japan)

[6] Burinskii, A. "Complex Kerr Geometry, Twistors and the Dirac Electron," J. Phys. A, 41:164069, 2008 arXiv:0710.4249v2

[7] Currie D.G., Jordan T.F., Sudarshan E.C.G., Relativistic invariance and Hamiltonian theories of interacting particles, Rev. Mod. Phys. 34 (1963) 350–375.

[8] Hartmann S., Studies in History and Philosophy of Modern Physics, **32B**, 267-304 (2001).

Re-analysis of an Explosion

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An electrochemical cell operated with a hollow palladium cathode in heavy water led to a very strong explosion. The glass calorimeter was shattered into small pieces thrown at several meters. (ref.: Unexplained Explosion During an Electrolysis Experiment in an Open Cell Mass Flow Calorimeter - JCMNS 2 (2009) 1-6). In order to find out if the explosion could result from a chemical reaction, a reanalysis of the experiment is presented.

The explosion mechanisms of the mix of H_2 and O_2 are reviewed based on the literature. Depending on the conditions, the reaction might take the form of a deflagration, a detonation or a super-detonation (also known as strong detonation). A detonation has a much larger damaging power than a deflagration. A super-detonation is even more damaging, but the conditions of occurrence of this type of explosion are said to be difficult to obtain.

Explosion tests were performed in 25mm diameter, 200 mm long glass tubes under various conditions, the reaction being triggered by a hot wire or by a spark. Deflagrations and detonations were obtained, but the glass tube was not fractured during these tests. Other experiments were performed in closed steel tubes with a setup making it possible to evaluate the damaging power exerted on the tube ends. Values ranging from 10 bars to 30 bars were obtained.

A series of experiments were made in 25mm diameter glass tubes. The igniter was a 2mm internal diameter copper tube placed along the glass tube axis. The copper tube was connected to a pre-chamber where the explosion was triggered. In several cases a super-detonation occurred and the glass tube was shattered into small debris, mimicking the event observed in the original cell.

The small diameter ignition tube seems to play an important role in the development of a super-detonation. In the original cell, the hollow palladium cathode may have provided this role. This hypothesis is discussed based on the known theories of gaseous explosion.

This reanalysis leads to the conclusion that a fast reaction is initiated within the hollow cathode, for a reason that is not clear at this stage. The explosion wave propagated along the palladium tube and resulted in the super-detonation.

Other similar explosions have been reported in the LENR research field. They are reviewed in the light of the present investigation.

Isotopic and Elemental Composition of Substance in Nickel-Hydrogen Heat Generators

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Results of the analysis of isotopic and elemental composition of the fuel before and after work in Rossi heat generators, as well as in similar nickel-hydrogen reactors are shown. As a result of Rossi reactor operation (excess heat 5800 MJ) a dramatic change both the elemental and isotopic composition of the fuel was happened. Our nickel - hydrogen reactors with excess heat to 700 MJ strong changes of the elemental composition have occurred, but equally strong as in Rossi reactor changes of lithium and nickel isotopic composition were not found.

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Verification of the results of G. L. Wendt and C. E. Irion experiment on electric explosion of tungsten.

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G. L. Wendt and C. E. Irion study suggests that alpha-decay of tungsten occurs during the electric explosion. The authors of the present work decided to check G. L. Wendt and C. E. Irion results by using modern diagnostic methods and relying on modern theoretical concepts. Gas phase formed in the chamber after the electric explosion was carefully studied in the experiments. The results of the study do not contradict with the results of the experiment G. L. Wendt, C. E. Irion experiments.

Keywords: electrical explosion of conductors, gas phase analysis, optical spectral lines, gas mass-spectrometer, alpha-decay, alpha- beta-decay.

Interaction of Erosive Metal Clusters with Hydrogen Atoms in Heterogeneous Plasmoid

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We studied the physical parameters and properties of a long-lived heterogeneous plasmoid (plasma formation with erosive nano-clusters) created by combined (high frequency+ DC) discharge in high-speed swirl flow in our previous papers [1-5]. This work is a continuation of these previous works. Interaction of metal nano-clusters with hydrogen atoms was studied in a vortex plasma reactor with argon- water steam gas mixture [2-5]. Metal nano-clusters in electric discharge region were created by nickel cathode's erosion. Hydrogen atoms were obtained by water steam dissociation in electric discharge region. These hydrogen atoms interacted with metal nano-clusters. In a result of this interaction, a stable heterogeneous plasmoid was created in swirl gas flow. The typical diameter of this spherical plasmoid is 10 mm. Electric potential of this plasmoid measured by electric probe is about of 2-4 kV. Plasmoid's structure and its dynamics were studied by high-speed camera. It was revealed that a heterogeneous non-equilibrium plasmoid creates intensive soft X-ray radiation. We determined that excited and charged cluster particles are responsible for this soft X-ray radiation creation (with quantum energy about 1–4 keV). Plasma parameters of this plasmoid (electron concentration N_e, electron temperature T_e, vibration and rotation temperatures T_V, T_R) were measured by optical spectroscopy method. It was obtained that there is a high non- equilibrium plasmoid in vortex plasma reactor: - $T_e > T_V >> T_R$. We determined that there is extra power release in heterogeneous plasmoid created by combined discharge. The measured COP of this plasmoid is about 2–10. We suppose that this extra power release in heterogeneous plasmoid is connected with LENR. The obtained experimental results (COP, optical spectra, soft X-ray spectra, chemical composition of dusty particles) prove our suggestion.

References

1. Klimov A., Vortex Plasmoids Created by High-Frequency Discharges, Atmosphere and Ionosphere: Dynamics, Processes, Monitoring, Springer, Berlin, 2013, P.251-273
2. Klimov A., Evstigneev N., Moralev I., et.al., Vortex Control by Combined Electric Discharge Plasma, AIAA Paper 2013-1046, 51th AIAA Aerospace Sciences Meeting, Dallas, Texas, 2013, P.15
3. Klimov A., Calorimetric Measurements in Vortex Plasmoid, Proc. 12th Conf. RCCNT and BL, M. 2005, C.246
4. A. Klimov, A. Grigorenko, A. Efimov, et.al., High-energetic Nano-Cluster Plasmoid and Its Soft X-ray Radiation, J. Condensed Matter Nucl. Sci, 19, P.1-10
5. A. Klimov, A. Grigorenko, A. Efimov, et.al., Optical and X-radiation Spectra of Heterogeneous Plasma, Proc. AIS-2016, Kaliningrad 2016, P.287-293

LENR - What we must do to complete Martin Fleischmann's undertaking

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More than 28 years have elapsed since the public announcement by Martin Fleischmann and Stanley Pons on March 23rd 1989 of the observation of anomalous thermal effects with possible nuclear fusion implications associated with the super-loading of deuterium into palladium by electrochemical means. This announcement triggered widespread attempts to replicate these measurements especially in the USA, Japan, Italy, Russia and other former states of the USSR, India, and latterly France. While a majority of replication attempts failed, several groups (inclusive of SRI and BARC groups) indeed reported observation of tritium and He^4 (SRI, Melvin Miles and others) in Pd-D_2O electrochemical cells; the cumulative yield of He^4 produced was nearly commensurate with the integrated excess heat energy released, clearly pointing to the "anomalous" occurrence of nuclear fusion of the deuterium, catalysed within the Condensed Matter environment of the Pd lattice. A noteworthy feature of these observations was the absence of penetrating radiation from the cells, suggesting the operation of new nuclear physics. Although replicated in a number of laboratories around the world, the reality of LENR has still not been accepted by the broader scientific community primarily because the nuclear processes that occur within the solid state environment are quite different from what happens in free space. The essential findings of this new field were recently reviewed in a special issue on LENR of the Journal **Current Science** (issue dated 25th Feb 2015) published by the Indian Academy of Sciences. This issue has also discussed various theoretical models put forward to explain how such anomalous reactions could be taking place in metal-hydrogen systems. An exhaustive survey of the present international efforts in the field, as of early 2017 labeled as "LENR ecosystem" is available at www.anthropoceneinstitute.com/LENR.

The CMNS community is aware that the problem of non-recognition of LENR by the mainstream scientific community needs to be addressed to register further progress. Most experimental efforts to date have not been well-enough resourced, staffed or focused, primarily because of inadequate funding support. To move forward it is obvious that 1. Unmistakable and irrefutable scientific proof must be provided that nuclear effects do take place in condensed matter by means, at rates and with products different from nuclear reactions in free space and 2. Demonstration must be made of a practical application of the energy so created. Since industrial devices would have to operate at elevated temperatures, emphasis is increasingly shifting to gas based systems wherein nano powder complexes composed of mixtures of various compounds are exposed to either hydrogen or deuterium at high temperatures. While consistent excess heat has been reported, the magnitude of the obtained COP is not yet at levels which can attract venture capital, although some forward looking private entities are quietly bank rolling development efforts, as listed in the Anthropocene Inst survey mentioned above. Also at least a handful of Academic Institutes are pursuing basic studies on a variety of metal hydrogen configurations. The six-Institute collaborative effort in Japan involving four Japanese Universities and two Industrial houses supported by the Japanese government under their NEDO program is noteworthy. The talk will present a brief resume of the status of the field, emphasizing the need for a more proactive role by public and private sector authorities given the potential of LENR to serve as a source of clean and compact source of Energy for the future.

Cold Nuclear Transmutation Study of Various Atomic Nuclear Structures

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Excess heat occurrence is no longer to demonstrate. Nevertheless, two main problems are still facing us. The one is the reproducibility of the cold fusion process, the other concerns the possibility of nuclear transmutations which generate that excess heat. The work presented deals with the issue of transmutation at low temperature, i.e. LENR. The structure of the nuclei is addressed as being the basis for understanding the process of transmutation.

The hypothesis I develop founds its background in the structure of the neutron and the proton I proposed in my document posted on the internet one finds under http://www.philippehatt.com/

I proposed there a distribution of mass within the neutron and the proton and hence a distribution of mass within the alpha particle and as consequence its binding energy.

The issue is to see if that structure is verified in the case of other nuclei and at which conditions.

I will first consider the case of the n alpha nuclei: Be8, C12, O16, Ne20 etc. till Ca40.

In a second part I will take the case of their isotopes.

It will be shown that binding energy of the n alpha nuclei is composed out of a multiple of the binding energy of alpha particle with addition of some bonds linking the several alpha particles. These bonds are called NN, NP (= BE of Deuterium), NPP (= BE of He 3) and NNP (=BE of Tritium), NN bond being a part of alpha bond.

Similarly, the binding energy of their isotopes is constituted with the same number of alpha particles and the same type of bonds, nevertheless more numerous.

According to the hypothesis developed the nuclei of the various elements are constituted out of alpha particles and other nucleons grouped in order to form sub nuclei bound together by four types of bonds, NN, NP, NNP, NPP.

These bonds are strong, nevertheless less strong than that one of alpha particle, and are reversible as they are present in positive or negative value, the final value being positive in the case of stable nuclei. They are also flexible as they are oscillating between them.

These properties could explain the LENR process.

Structure of the Neutron and Proton

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1. The objective of the work is to determine a structure for the neutron, the proton and hence for the various nuclei of the table elements. This will help to understand the process of LENR. Indeed, knowing the structure of the element at the beginning of the LENR process as well as the structure of the element obtained by transmutation is of primordial importance to understand the LENR process.
2. To understand my theory on the nucleon structure it is necessary to assume that a particle X is entering our space time and acquiring a mass (nude mass, without charge). It lasts one (Planck) instant in our space time before leaving it. Hence it loses its mass acquired when entering our space time. There will be instead a hole of mass I called an antimass. So, this particle acquires first a positive mass and after an instant a negative mass, a mass "down" when coming into the space time, a mass "up" when leaving it, these two "masses" being in opposition, hence the term of mass and antimass.
3. When a second particle enters our space time it also acquires a mass. So, there are a mass for particle B and an antimass + a mass for particle A. There is a conjunction of mass and antimass as well as a new mass linked to one particle. There is one particle for three quantic states. We will see that mass + antimass are modified in a negative electromagnetic charge. In other terms, if the particle B is for instance a "nude" electron it has acquired a mass of one electron as well as one electronic charge which results from the transformation of the former electron into one charge.
4. The process is explained on my website, especially on pages 110 and following of my first document. The schemas of the process are displayed there. One will notice that the process described is similar to the Fractional Quantum Hall Effect. Indeed, the particle will, on average, be found on a particular site only 1/3 of the time. The average electron number per site is thus 1/3. However, the value of the measured mass or charge is always an integer. Two thirds of the time one measures zero mass and one third of the time one measures unity mass. For the charge, it will be an integer charge made up of two masses (one mass and one antimass). The accepted interpretation is that there are fluctuations. My interpretation is the following (see page 113):

   The particle had a mass, lost it after an instant and an antimass challenging the mass was created. So, there is a mass loss of two (2/3 of time) and a mass rest of one, integer mass but only 1/3 of the time. The same happens with the charge as the charge is mass + antimass. Each time the positive and the negative mass or charge are challenging, with a slight advantage for mass over antimass and for the negative charge over the positive one, as far as neutron is concerned. For proton, it is partly the contrary, hence the slight loss of mass and the positive magnetic moment.
5. At page 115 on the schema about direct and indirect electromagnetism ,one notices that indirect electromagnetism is constantly changing sense, being negative then positive and again negative according to the progression of mass and direct electromagnetism .So each line is once negative ,once equal to zero as if in that case the electromagnetism was missing .The series are 1/3 and 2/3,2/5 and 3/5 ,3/7 and 4/7 etc .As said before the charge is always a integer multiple of the electron charge as far as the column concerns 10 minus 2 .If one

considers the other columns the integer numbers are each time a multiple of 1/100,1/10000, etc. At the end of the process one observes that the result is equivalent to the dipolar magnetic moment of the neutron. Please look at schemas 2and 3 of the annexes to part one of the document.

6. To summarize my theory matter is composed with:
   -mass and antimass, the resultant mass being the mass one observes in our space time,
   -mass and antimass combine to create the electron charge, negative in the case of mass + antimass, positive in the case of antimass + mass,
   -negative and positive charges combine to create pure energy.
   The last assumption is known, the two others are still to be discovered.
7. Mass and antimass are also partially combining to create binding energy. Knowing the mass structure of neutron and proton enables us to determine the deuterium and alpha particle binding energy, as well as that one of tritium and He3. These are enough to determine the binding energy of all elements of the table.
8. My theory is coming to the following results as far as neutron is concerned:
   -mass of neutron in electron masses conforms to the experimental measurement,
   -its dipolar magnetic moment also,
   -the structure of neutron I propose enables to determine the binding energy of any nucleus.

Recent Progress on Transmutation Experiments induced by D_2 gas permeation

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Nuclear transmutation - Cs->Pr, Sr->Mo, Ba->Sm - induced by D_2 gas permeation through nano-size Pd/CaO multi-layer complex, was reported by Iwamura et.al.[1]-[2] and replicated by Hioki et.al.[3]. Our team is conducting research on nuclear transformation by gas permeation from the following two viewpoints.

The first is to reconfirm Pr transmuted from Cs by a different method not reported so far. There is a criticism that the mass of the nucleus was not identified, since the employed mass spectrometry, such as ICP-MS, cannot exclude possibilities of chemical compound objects. Therefore, we employed the Rutherford Backscattering Spectroscopy (RBS) to identify ^{141}Pr for direct nuclear mass assignment.

Experiments were performed at the Cyclotron and Radioisotope Center of Tohoku University. Several pieces of Cs doped Pd/CaO multi-layer foil with/without D_2 gas permeation were bombarded by 128 MeV $^{40}Ar^{7+}$ beam obtained from the K110 AVF cyclotron. For some samples, we could identify the ^{141}Pr events as well as ^{133}Cs, although the statistics is not enough. In addition, a signal indicating the existence of a nuclide with mass number around 192 was obtained. This observation is very interesting, since there is a possibility that the impurity W in Pd/CaO multi-layer complex was transmuted into the elements of mass 192. Details will be reported in the conference.

The second is to confirm transmutation in nuclides other than transmutation observed so far, such as Cs, Ba, Sr[1][2], and to get the knowledge on the mechanism of this phenomenon. Therefore, we study to clarify the following points: (1) Does reaction of transmutation occur or not? (2) What is a target element to be transmuted? (3) Are radionuclides generated in our transmutation process or not?

We started Rb transmutation experiments in last year. Samples are prepared as follows: The Pd/CaO complex is composed of bulk Pd on the bottom, alternating CaO and Pd layers, and a Pd thin film on top [1]. Rb is doped into Pd/CaO complex using electrochemically plating. We set these samples in experimental device and carried out after D_2 gas permeation for about 100 hours. Element and mass analyses on the Pd complexes were carried out by XPS (X-ray Photoelectron Spectroscopy) and ICP-MS (Inductively Coupled Plasma Mass Spectrometry). We compared the results on foreground samples with those without D_2 gas permeation. In XPS analysis, weak signals of Zr and Mo were detected on samples after D_2 gas permeation. We will report on the results in detail.

Acknowledgements

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[1] Y. Iwamura et al., Jpn. J. Appl. Phys. 41 (2002) 4642.
[2] Y. Iwamura, T. Itoh and S.Tsuruga, Current Science, VOL.108, NO. 4, 25, 2015.
[3]T. Hioki et al., Jpn. J. Appl. Phys. 52 (2013) 107301.

On the Heat Transfer in LENR Experiments

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Thermal conduction is considered in deuterated palladium. We assume that the energy released in a single LENR event thermalizes in a region that has a typical dimension of the order of hundred nanometers. Then it is shown that the thermal conductivity enables the heat transfer of the energy released in repeated events without causing the lattice to melt. Consequently, a continuous power is possible. It is argued that a power up to about 0,5 W can arise from a single nuclear active environment, NAE. Both the experimental and theoretical consequences of the results are discussed.

Chemical and nuclear catalysis mediated by the energy localization in crystals and quasicrystals

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Catalysis is at the heart of almost every chemical or nuclear transformation process, and a detailed understanding of the active species and their related reaction mechanism is of great interest. We propose a catalytic mechanism based on the energy localization, manifested as *localised anharmonic vibrations* (LAVs) and *phasons*. In the former case, one deals with a large amplitude (~ fractions of an angstrom) time-periodic oscillations of a small group of atoms around their stable positions in the lattice, known also as *discrete breathers* [1, 2], which can be excited either thermally or by irradiation [3] in regular crystals as well as in quasicrystals (QCs). On the other hand, phasons are a specific property of QCs, which are represented by very large amplitude (~angstrom) collective oscillations of atoms between two quasi-stable positions determined by the geometry of a QC, which is neither crystalline nor amorphous [4]. Among many surprizing properties of QCs is their high catalytic activity [5].

Large amplitude atomic motion in LAVs and phasons results in *time-periodic driving* of adjacent potential wells occupied by hydrogen ions (protons or deuterons) in case of hydrogenated materials. As shown in [6, 7], this driving may result in the increase of amplitude and energy of *zero-point oscillations*. Based on that, we demonstrate a drastic increase of the D-D or D-H fusion rate with increasing number of modulation periods evaluated in the framework of Schwinger model [8], which takes into account suppression of the Coulomb barrier due to the lattice vibrations. We present atomistic simulations of LAVs in crystals and phasons in QCs and a model *of chemical* and *nuclear catalysis* that is mediated by the energy localization. Experimental verification of this model can open new ways towards engineering materials containing *nuclear active environments* based on the catalytic properties of LAVs and phasons.

Results of new experiments on the interaction of hydrogen isotopes with Ni powders and melt spun $Nd_{90}Fe_{10}$ alloy are discussed in the framework of the proposed model.

[1] V. I. Dubinko, P. A. Selyshchev, and J. F. R. Archilla, Reaction-rate theory with account of the crystal anharmonicity, Phys. Rev. E 83: 041124 (2011).

[2] V.I. Dubinko "Quantum tunneling in gap discrete breathers," Letters on Materials, 5 (2015) 97-104.

[3] V. I. Dubinko, Radiation-induced catalysis of low energy nuclear reactions in solids**,** J. Micromechanics and Molecular Physics, 1 (2016) 165006 -1-12.

[4] E. Abe, S.J. Pennycook, A.P. Tsai, "Direct observation of a local thermal vibration anomaly in a quasicrystal", Nature (London), 421, (2003) 347-350.

[5] S. Kameoka, T. Tanabe, F. Satoh, M. Terauchi, A.P. Tsai, "Activation of Al–Cu–Fe quasicrystalline surface: fabrication of a fine nanocomposite layer with high catalytic performance" Sci. Technol. Adv. Mater., 15 (2014) 014801.

[6] V.I. Dubinko, D.V. Laptev "Chemical and nuclear catalysis driven by Localized Anharmonic Vibrations", Letters on Materials 6 (2016)16-21.

[7] V. I. Dubinko, D. V. Laptev, A. S. Mazmanishvili, J. F. R. Archilla, "Quantum dynamics of wave packets in a nonstationary parabolic potential and the Kramers escape rate theory", J. Micromechanics and Molecular Physics, 1 (2016) 1650010 -1-12.

[8] J. Schwinger, "Nuclear Energy in an Atomic Lattice I," Z. Phys. D 15 (1990) 221-225.

Peculiarities of hydrogen interaction with Ni powders and melt spun $Nd_{90}Fe_{10}$ alloy

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Hydrogen interaction with Ni powders has provoked a lot of excitement and controversy due to the works of Rossi, Parkhomov and others, who claimed to produce excess heat in their experiments that could not be explained by conventional chemical reactions [1]. Yet, there is no reliable 100% evidence of the effect up to date, and some of subsequent experiments produced less [2] or *zero* [3, 4] effect as their measuring accuracy increased. Unfortunately, the claimed evidence often depends on indirect calorimetry methods and as such it does not produce an ultimate proof. We present an experimental setup that allows accurate measuring of the main parameters controlling the reaction: hydrogen pressure, temperature inside the fuel and at the heater, the difference between which can provide direct evidence of the excess heat. Our program pursues two goals: (i) verify the previous results and (ii) test our facility in a wide range of parameters to be used in experiments with novel types of fuel that we plan to create in future.

One of the new materials tested in our reactor was a melt spun $Nd_{90}Fe_{10}$ alloy with a large degree of amorphous or quasicrystalline phase. A fierce exothermic reaction was detected in $Nd_{90}Fe_{10}$ films upon filling them with *hydrogen* or *deuterium* and heating up to ~300 C, which resulted in the melting of the samples and the Cu foil, in which the samples have been wrapped. Quantitative analysis have shown that the amount of heat produced in large $Nd_{90}Fe_{10}$ samples in our experiments is 80-100 kJ per g of hydrogen, which is an order of magnitude higher that that recorded by a differential scanning calorimetry method in small $Nd_{90}Fe_{10}$ samples in the same temperature range. Possible reasons for the discrepancy are discussed including low energy nuclear reactions taking place at the *initial stage* of hydride formation when 80÷90% of the material is in amorphous or quasicrystalline phase that facilitates the energy localization, which triggers LENR as has been argued in refs. [5-8]. Subsequently, the disordered phase transforms to crystalline hydrides NdH_2 and $Nd_2Fe_{17}H_{4.8}$ (observed by XRD analysis), where the energy localization becomes more difficult, which stops the LENR.

[1] A.G. Parkhomov, Ni-H reactors created after the Lugano Report, International Journal of Unconventional Science, 11(4), (2016) http://www.unconv-science.org/n11/parkhomov/ .

[2] A.G. Parkhomov, Long-term tests of Ni-H thermal generators in flow calorimeter, International Journal of Unconventional Science, 12-13(4), (2016) http://www.unconv-science.org/n12/parkhomov/

[3] Jean-Paul Biberian, Replication attempts of the Parkhomov experiment, Proc. 11th International Workshop on Hydrogen Loaded Metals (October 15-16, 2015).

[4] K.P. Budko, A.I. Korshunov, Calorimetric investigation of anomalous heat production in Ni-H systems, Proc.11th International Workshop on Hydrogen Loaded Metals (October 15-16, 2015).

[5] V. I. Dubinko, "Low-energy Nuclear Reactions Driven by Discrete Breathers," J. Condensed Matter Nucl. Sci. 14 (2014) 87-107.

[6] V. I. Dubinko, Radiation-induced catalysis of low energy nuclear reactions in solids**,** J. Micromechanics and Molecular Physics, 1 (2016) 165006 -1-12.

[7] V.I. Dubinko, D.V. Laptev "Chemical and nuclear catalysis driven by Localized Anharmonic Vibrations", Letters on Materials 6 (2016)16-21.

[8] V. Dubinko, D. Laptev, K. Irwin, Catalytic mechanism of LENR in quasicrystals based on localized anharmonic vibrations and phasons, presented at ICCF20, Sendai, October 2016, to be published in JCMNS.

Anomalous Excess Heat Generation by the Interaction between Nano-structured Pd/Ni surface and D_2/H_2 gas

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A new experimental setup based on the Mizuno's work [1]-[2] was introduced in our lab in order to confirm the existence of the anomalous heat effects and to reveal the nature of the effects. Similar experiments to Mizuno were done at Tohoku University and their experimental results are described.

At first, temperature measurements were performed using a non-fabricated Pd wire with 7W and 40W heater input powers under few Pa and 250 Pa as blank runs. The temperature was measured by a thermocouple built in a heater rounded by the non-fabricated Pd wire. We fabricated nano-structured material composed of Pd and Ni by glow discharge on the heater located in the center of a vacuum chamber. And then, the nano-structured Pd/Ni was filled with D_2 or H_2 gas (~250Pa) for more than 10 hours. After the nano-structured Pd/Ni material absorbed D_2 or H_2, electrical power was applied to the heater covered with nano-structured Pd/Ni while evacuating the chamber, and observed the heater temperature behavior. Excess heat was estimated by comparing the heater temperatures for the nano-structured and blank experiments. Next, we introduced D_2 or H_2 gas about 250Pa to the chamber while keeping the heater input. And then, temperature measurement was performed and the excess heat was estimated.

For all the cases except for an insufficient nano-structured Pd/Ni case, significant temperature increases compared to the blank experiments were observed. In particular, in experiments with 7 W input, we observed 123℃ heater temperature increase compared to the blank experiment. It would be possible to say that we successfully replicated Mizuno's work.

Since the heater was covered with nano-structured material, there was a concern that emissivity change affected heater temperature measurement. Numerical calculation was conducted to estimate the effect of the change of the surface emissivity. It is concluded that even if the emissivity would drop extremely from 0.7 to 0.3 due to the coating of the nano-structured Pd/Ni, the temperature rise would be only 70℃ at the most. The postulated emissivity change cannot be explain the observed temperature increase 123℃.

These experimental and numerical results strongly suggest that anomalous excess heat was generated by the interaction between nano-structured Pd/Ni surface and D_2 or H_2 gas. Elemental analysis for the nano-structured Pd/Ni will also be presented at this workshop.

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References

[1] T. Mizuno, “REACTANT, HEATING DEVICE, AND HEATING METHOD”, Patent Application, WO2015/008859 A2.

[2] H. Yoshino, E. Igari and T.Mizuno, Presentation at 2014 CF/LANR Colloquium at MIT, March.21-23, 2014, Massachusetts Institute of Technology, Cambridge, MA, USA.

Anomalous Heat Generation Experiments Using Metal Nanocomposites and Hydrogen Isotope Gas

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Anomalous heat generation experiments using metal nanocomposites and hydrogen isotope gas based on Kitamura and Takahashi paper [1] have been performed at Kobe University and Tohoku University as a collaborative work in order to confirm the existence of the anomalous heat effects and to reveal the nature of the effects. In this paper, we describe experimental results obtained at Tohoku University.

Heat generation experiments using the following metal nanocomposites with hydrogen isotopes have been done at Tohoku University:-

1) $Pd_{0.044}Ni_{0.31}Zr_{0.65}$ with ZrO_2 beads filler; PNZ
2) $Cu_{0.044}Ni_{0.31}Zr_{0.65}$ with ZrO_2 beads filler; CNZ
3) $Cu_{0.008}Ni_{0.079}$ with mesoporous SiO_2; CNS
4) Pd nanoparticles embedded in mesoporous SiO_2; PS

These samples 1), 2), 3) were fabricated at Kobe University and 4) at Nagoya University. Similar experiments were conducted at Kobe University using the metal nanocomposites that have identically the same compositions as those at Tohoku University.

Results so far are as follows:-

1) Anomalous excess heat generations were observed for all the samples at elevated temperature (150℃-300℃), except for the Pd nanoparticles embedded in mesoporous SiO_2.

2) Integrated excess heat reached more than several MJ/mol-H(D) which could NOT be explained by any known chemical process.
3) Coincident burst-like increase events of the pressure of reaction chamber and gas temperature, which suggested sudden energy releases in the reaction chamber, were observed many times for an experiment using the $Cu_{0.044}Ni_{0.31}Zr_{0.65}$ sample.
4) Qualitative reproducibility between Kobe and Tohoku experiments was good.

Reference

[1] A. Kitamura and A. Takahashi et. al, Current Science, vol. 108, no. 4, pp. 589-593, 2015.

Demonstration of Large Excess Heat in Ecological Plasma Electrolysis

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We present the variant of installations Fakel-D2ST series (Demonstration 2 Small Thermostat) for ecological demonstration of plasma electrolysis in public auditorium. Demonstration of large excess heat, using evaporation calorimetry, was performed by comparison water evaporation of installations Fakel-D2ST & standard thermos electro heater (TEH) at equal power. For nuclear control "Sosna" β-dosimeters, neutron and β-radiometers were used. We show about 3 times excess heat generation in Fakel-D2ST installations.

Simulations & Measurements of the Thermal Behaviour of an Electrochemical Cell

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Lattice Enabled (or Low Energy) Nuclear Reactions (LENR) provide a new way to produce clean nuclear energy free of damaging prompt radiation, radioactive waste and greenhouse gases. Electrochemical means are being used in attempts to generate LENR by the interactions of protons with nickel. The protons are produced by the electrolysis of water in cells with tubular nickel cathodes. Following experiments in the early 1990s with the Ni-H system, which reported excess heat production, we are using carbonate electrolytes of Li, Na, K and Rb. The thermal behaviour of our cells due to electrical heating must be understood. It will serve as the basis on top of which LENR might be produced. Thermocouples are used to measure temperatures at two points, one in the cell and the other in the nearby air. While invaluable, such limited measurements are insufficient to understand the overall thermal behaviour of the cell.

To acquire more detailed information, the electrical and thermal modules of COMSOL are being used to simulate the generation and redistribution of heat in the cells. Included sequentially are the geometry, materials, voltages, fields, currents, resistive heating and heat redistribution of the cells as a function of the applied voltages and chemical composition of the electrolytes. Conductive, convective and radiative transfers of heat are all considered. Meshing of the simulations is an important consideration, which determines run times. The simulations are benchmarked by comparison with the measured temperatures.

Results of the simulations provide details far beyond what can be measured. For example, the spatial distributions of temperatures are obtained at any time after initial application of voltages. They will be compared with thermal images from an infrared camera. And, the time histories of the temperatures at any spatial point within the cells are available. They are compared with the measured time variations of temperatures in the centre of the cells, including the time constant for the temperature rises and the asymptotic temperature increases. The latter are achieved when the conductive, convective and radiative power losses are equal to the input electrical power.

The combination of simulations and measurements helps to determine the relative importance of thermal power losses (a) to the air surrounding the cells and (b) through the nickel cathode, platinum anode wires and the aluminium base plate, which holds the cells. Work to date has involved steady input electrical currents. A future goal will be to simulate and measure the results of pulsed electrical input profiles. The current simulations and measurements provide the baseline for later quantification of LENR power.

Can the use of rare isotopes help establish a working LENR theory?

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This paper presents the results obtained during experiments made by the Martin Fleischmann Memorial Project (MFMP) where carefully selected and sourced naturally rare isotopes were used in experiments designed to test claims made by various researchers as to the underlying processes in LENR.

Experiments were conducted using the isotopes ^{62}Ni, ^{18}O and ^{2}H to enrich fuel components in Ni+Hydrogen tests without changing the elements used. Lithium was added in some tests. Observations with a number of neutron detectors, including BubbleTech, ^{6}LiI and ^{3}He were made. Observations of gamma were made with a NaI spectrometer and a Geiger counter. Observations of muons and electrons caused by Compton scattering were made using a webcam and software designed to track cosmic ray incidence.

The design of the reactors was based on previous experiments in the MFMP *GlowStick* series as reported in 'Investigations of the Lugano HotCat Reactor' [1]

Reference

[1] Mathieu Valat, Alan Goldwater, Robert Greenyer, Robert Higgins and Ryan Hunt; **Investigations of the Lugano HotCat Reactor**, *J. Condensed Matter Nucl. Sci.* 21, (2016), p 81 www.iscmns.org/CMNS/JCMNS-Vol21.pdf

Synthesis of helium as result of interaction of deuterium with palladium

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Investigation of interaction of deuterium gas with palladium at room temperature in vacuum is presented. Deuterium gas targeted a palladium sheet in vacuum and it was observed generation of helium gas as result of this interaction as the amount of the helium was much bigger than the amount of the deuterium after the interaction, i.e. significant conversion rate deuterium into helium had place. It was observed increase of the temperature of the palladium sheet holder during this interaction. Also it was observed correlation between variation of this temperature and the variation of the amount of the observed helium. The experiment is repeatable. Theoretical explanation of the observed results based on interaction of deuterium nuclei with heavy d-electrons in the crystal lattice of palladium is presented.

Rubidium carbonate electrolysis with a fibrex nickel cathode

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In 1993 Bush and Eagleton reported excess heat, transmutation to strontium and copious gamma rays on electrolysing Rb_2CO_3. This brief paper reports on an attempt to monitor the gammas from such cell with the object of identifying the nuclides and reactions responsible.

The fibrex nickel cathode was unused material manufactured for use in rechargeable batteries and was generously donated by Eneco, Inc. in 1996. This is almost certainly the same material used by Bush and Eagleton who were also supported by Eneco. The fibrex nickel was easily cut into a rectangle, of 60 cm^2 and a nickel wire was welded to it. XFS showed the only impurities to be Fe and Co.

The electrolyte was 0.57 M Rb_2CO_3 dissolved in dissolved in natural deionized H_2O. The anode was platinum wire (0.5 mm diameter). A current of 60 mA was applied (1 mA cm^{-2}). These details closely follow the original 1993 experiment(s).

Gamma rays were monitored using a NaI gamma ray spectrometer and we expected to see gamma ray counts many orders of magnitude above background. However no anomalies were observed after weeks of electrolysis.

ENP (Exotic Neutral Particle) theories predict conversion of rubidium into gamma emitter(s).

References

[1] Bush R., Eagleton R. **Calorimetric Studies for Several Light Water Electrolytic Cells With Nickel Fibrex Cathodes and Electrolytes with Alkali Salts of Potassium, Rubidium, and Cesium**, *Proc. ICCF4* **2**, (1993), p 199 www.lenr-canr.org/acrobat/EPRIproceedinga.pdf

[2] Bush R., Eagleton R. **Evidence for Electrolytically Induced Transmutation and Radioactivity Correlated with Excess Heat in Electrolytic Cells With Light Water Rubidium Salt Electrolytes**, *Proc. ICCF4* **3**, (1993), p 27 www.lenr-canr.org/acrobat/EPRIproceedingb.pdf

[3] T.Itoh, J. Kasagi, Y.Iwamura, S.Tsuruga, **Recent Progress on Transmutation Experiments induced by D_2 gas permeation** in this workshop.

Observation of *Zener-like* behavior, in air of Constantan sub-micrometric wires after D_2-Xe loading-deloading and related AHE

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In the framework of LENR studies, especially devoted to get Anomalous Heat Effects (AHE), since 2011 we have performed experiments based on the use of the Constantan (alloy of $Cu_{55}Ni_{44}Mn_1$, in the following *CNM*). We selected such alloy, quite unusual in the field of LENR research, because of the extremely large value of catalytic energy (of the order of 3 eV) that it can provide for the dissociation of Hydrogen gas from molecular to atomic state ($H_2 \rightarrow 2H$). A similar behavior, expected also for Deuterium gas, was found by us.

Moreover, in order to increase the surface area of *CNM*, usually shaped as long (l = 1 m) and thin wires (□□= 200 □m), we applied to them several hundred electric pulses (typically with a duration of 50 ms) at quite large peak power (15-20 kW/g) to reach a surface temperature of 800-1000 °C: we obtained, thanks to Oxygen in the air, both the oxidation of the starting material and the production of mixed different materials (*CNM*, Cu_xO_y, Ni_wO_z) at *sub-micrometric dimensionality*. Key point: the native *CNM* is the substrate were sub-micrometric materials are located. They have reduced self-sintering problems, being closely interconnected to each other. Aiming to increase AHE, in the further development of such material we added Fe (mixed oxides) at the surface together with K (as a dissociation promoter) and Mn in order to stabilize the effect. We inserted the wires inside borosilicate sheaths, which have specific proprieties as concerns *atomic* Hydrogen absorption (as discovered by Nobel Laureate I. Langmuir in 1928). Detailed discussions about it are reported in ICCF20 proceedings (in press) and previous papers of the same Authors.

Recently, since January 2017, we have decided to further increase the AHE values, aiming to a practical application of the effects found, especially in the high temperature regimes (> 500 °C).

For such purpose, we have increased the number of wires from 1 to 4, keeping constant the total weight (0.3 g). We achieved it by just reducing the wire diameter from 200 to 100 □m. As a bonus of the new geometry, the total number of wire knots (internal hole diameter <200 □m), previously around 70, has increased to about 300. In conclusion, the apparent wire surface results twice and the number of knots 4 times larger. The main drawback is that, at constant input power, the wire temperature is lower with respect to a single 200-□m wire, because of the larger dissipating surface. Finally, we studied in deeper details the effect of Xe gas, which has the ability, according to Prof. Eng. Horst Preußker (DE), of promoting a sort of new type of solid state fusion (in short, $2D^+ + 2D^+ \rightarrow {}^4He$) when ionized Deuterium flows into a capillary glass tube.

Because of the reactor-assembling constraints, in the latest preparation we have not been able to put the glassy sheaths, saturated by nitrate of Sr and Fe (added with a solution of highly reactive $KMnO_4$), all dissolved in D_2O, inside a high-temperature furnace to dry-up water and decompose nitrate to oxides. In other words, some residual D_2O was still present in the glassy sheaths (made by micrometric fibers).

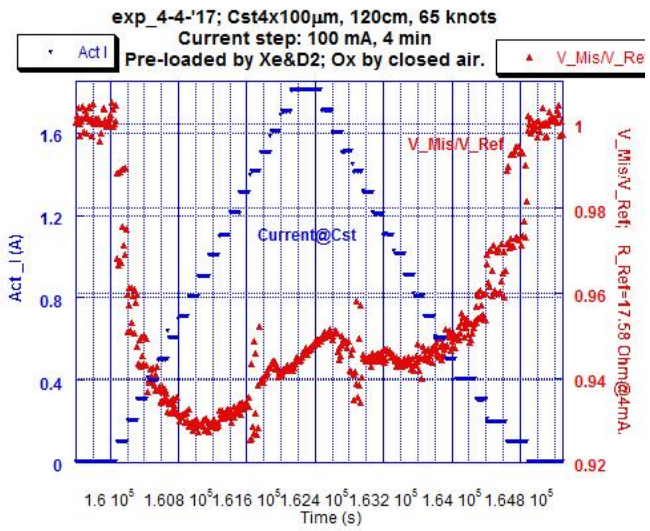

Figure 1: In blue, the applied current as a function of time. Each step has a width of 100 mA and a duration of 4 min. In red, the voltage (calculated as the measured resistance times the applied current) is normalized to its reference value at 4 mA.

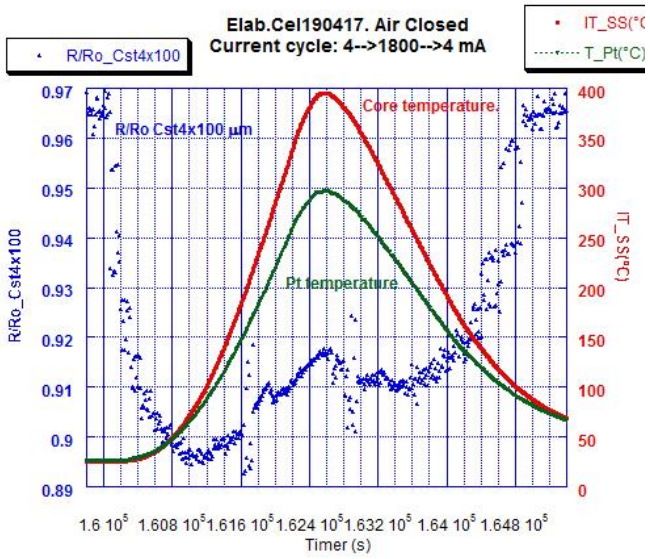

Figure 2: Behavior of resistance of CNM wires with time (blue) compared with that of temperature for the reactor core (red) and Pt wire (green).

Surprisingly, we have observed that the AHE started since the beginning of operations, during the cycle of conditioning of the reactor by vacuum treatments at high temperatures (giving power to the Pt wire used usually as a calibrator). We have also noted a reduction of the value of *CNM* resistance, meaning Deuterium absorption. Moreover, when the power was applied to the *CNM*, at the end of power cycles (90 W down to 10 W, step 10 W, He atmosphere) the value of resistance at minimum current (4mA) was ***HIGHER*** than that at usual 750mA (giving about 10 W of input power). Such effect was present *only* when the power was applied to the *CNM* (i.e. direct heating), not to the Pt (indirect heating of *CNM*).

Further studies have shown that such effect is magnified when *CNM* undergoes surface partial oxidation, i.e. when some residual Deuterium is still present into the wire.

In short, increasing the current applied to *CNM* (up to 700 mA), we observe a *reduction* of the resistance. In Figure 1 we show the behavior of wire voltage for increasing applied current (step 100 mA, duration 4 minutes), normalized to its value at minimum current used (i.e. 4 mA). The phenomenon of *resistance decreasing* with *current increasing* (and vice-versa) is similar to the well-known ***Zener diode*** effect in the region of voltage self-stabilization. The effect reduces then with the increase of temperature (Figure 2), for currents larger than 700 mA. It is quite surprising that a local effect (few micron of dimension), like Zener, can be effective even in the length of meters, i.e. 1 billion times larger than usual. Perhaps, some long-range coherence, or "confinement" induced by voltage (or current), can arise at values of loading extremely large, as predicted/observed (sometimes) since 1996 by Prof. G. Preparata and E. Del Giudice in Pd-D system.

Further work is in progress to cross-correlate the effect with aimed larger values of AHE, our key target.

Transmutation of heavy stable and radioactive isotopes in growing biological systems

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In the report the prehistory, current situation and possible mechanism of effective accelerated transmutation of both stable and radioactive isotopes during growth of pure microbiological cultures and combined biological substance (aerobic and anaerobic syntrophic associations) are presented and discussed. Special attention in the report is paid to the problem of the use of biotechnology for accelerated transmutation of both heavy stable isotopes and most dangerous reactor radionuclides to stable ones.

During our last successful experiments we have made substantial progress in the understanding of these processes and their optimization.

In our earlier experiments [1] the typical rate of nuclear transformations (including transmutation of stable nuclei and deactivation of radionuclides) was about $\eta \approx 10^{-8}\ s^{-1}$ (transmuted nuclei per s and per single initial nucleus). In the case of transmutation of reactor isotopes (e.g. $Cs^{137} + p = Ba^{138}$) it was equivalent to a decrease of the lifetime of Cs^{137} from the natural value 30 years to 270 days.

Currently, a greater understanding of the physical and biophysical processes [2-4] and the improvement of technology has led to an increase the experimental rate of transmutation in our last experiments to $\eta \approx 10^{-6} \div 5.10^{-7}\ s^{-1}$ for both stable and radioactive isotopes. In the case of transmutation of Cs^{137} reaction isotope it is equivalent (taking into account the peculiarities of the process of biochemical metabolism of growing biological systems) to a decrease of the lifetime from 30 years to 50-70 days.

According our theoretical investigations the mechanism of giant acceleration of the probability of nuclear reactions in growing biological systems is the same that takes place in general LENR problem and is, most possible, connected with the formation of coherent correlated states (CCS) of interacting particles (e.g. protons) [5-7] in very numerous natural intracellular and intercellular non-stationary potential nano-wells in growth zones of biological substance. During such self-similar process of CCS formation the phenomena of the giant increase of very low barrier transparency $P \approx 10^{-100} \div 10^{-550}$ for "usual" LENR with participation of light, intermediate and heavy isotopes (including $Cs^{133} + p = Ba^{134}$ and $Cs^{137} + p = Ba^{138}$ reactions) to $P \approx 10^{-1} \div 10^{-15}$ takes place, that is in good agreement with our experimental data of last time.

1. V.I. Vysotskii, A.A.Kornilova. *Nuclear fusion and transmutation of isotopes in biological systems*, Moscow, "MIR" Publishing House, 2003.
2. V.I. Vysotskii, A.A.Kornilova. *Nuclear transmutation of stable and radioactive isotopes in biological systems*, India, Pentagon Press, 2009.
3. V.I. Vysotskii, A.A.Kornilova. Transmutation of stable isotopes and deactivation of radioactive waste in growing biological systems. Annals of Nuclear energy, v.62, 626-633, 2013.
4. V.I. Vysotskii, A.A.Kornilova. Microbial Transmutation of Cs-137 and LENR in growing biological systems Current Science, v.108, No.4, 142-146, 2015.
5. V.I. Vysotskii, M.V.Vysotskyy. Coherent correlated states and low-energy nuclear reactions in non stationary systems. European Phys. Journal. A , v.49, issue 8: 99, p.1-12, 2013.
6. V.I.Vysotskii, S.V.Adamenko, M.V.Vysotskyy. Acceleration of low energy nuclear reactions by formation of correlated states of interacting particles in dynamical systems Annals of Nuclear Energy, v.62, 618-625, 2013.
7. V.I.Vysotskii, M.V.Vysotskyy. Coherent correlated states of interacting particles – the possible key to paradoxes and features of LENR. Current Science, v.108, No.4, 30-36, 2015.

Generation of undamped high frequency temperature waves and nuclear transmutation of isotopes under the action to target of shock waves generated at cavitation of water jet

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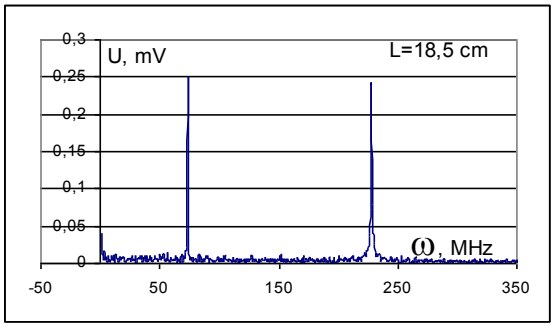
In the report the anomalous thermal and transmutation processes associated with cavitation are discussed.

1. For a long term, in heat conduction problems only classical Fourier's hypothesis were used, the one states that heat flux is proportional to a module of temperature gradient. We examined in detail the problem [1-4] and came to paradoxical results, which are then confirmed in specially experiments [5-7]. Modeling of temperature impulse propagation was performed according to dispersion relations obtained from modified heat transfer equations with delay τ (*G* is the coefficient of thermal diffusivity)

$$\partial T(x,t+\tau)/\partial t = G\partial^2 T(x,t)/\partial x^2$$

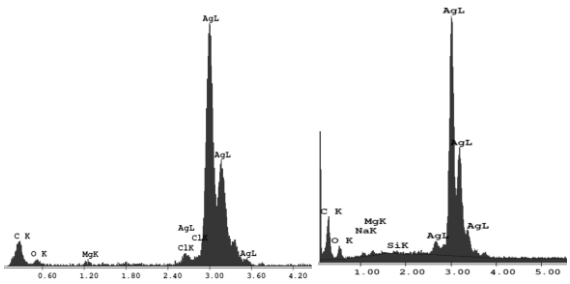
The solutions of this equation are thermal waves $T(x,t)$ with damping coefficient $\delta = \sqrt{\omega/2G}\cos\omega\tau/\sqrt{1+\sin\omega\tau}$.

Undamped thermal (temperature) waves with $\delta = 0$ can exist only in environments with sufficiently large (nonzero) time of the local thermal relaxation τ and their frequencies $\omega_n = (n+1/2)/\pi\tau$ are determined by τ. In the report the features of the formation and propagation of undamped thermal waves in air with specific frequencies $\omega_n \approx 80\,MHz,\ 240\,MHz,\ldots$ are presented and discussed. For metals and semiconductors $\tau \approx 0.01 \div 1\,ps$ is small and undamped wave frequencies ω_n are very high for observation.



One of the possible methods of such waves excitation is connected with pulse heating of the medium. We have conducted a lot of specially designed experiments on generation and detecting of these undamped waves. In the report the pulse heating through the use of shock waves generated during cavitation water jet was used. The spectrum of thermal wave registered in air at L=18.5 cm from source by distant acoustic detector is presented on Fig.1. Approximately the same spectrum of undamped waves is observed at much large distance (up and more 2 m). For comparison, the mean free path of usual hypersonic with the same frequency in air is 10-20 microns!

2. Another abnormal result at water cavitation is connected with observation of nuclear transmutation on the outer surface of the target (inverse to the place of falling of cavitating water jet). According to our analysis the process of transmutation is associated with the formation of coherent correlated states with further LENR realization during interaction of shock waves with the surface of the target atoms [7]. During our prolonged experiments we have observed creation and sharp increase in the concentration of previously absent (e.g. Si and Al) or impurity (e.g. Mg) of chemical elements on the back surface of the target made of pure Ag. The possible LENRs $C^{12}+O^{16}=Si^{28}$, $C^{12}+C^{12}=Mg^{24}$ and $Mg^{26}+p=Al^{27}$ of its creation are stimulated by cavitation induced shock waves. Fig.2 shows the chemical composition of the outer surface of thick target (Ag with 99.99 % purity) before shock wave action (left) and after the 5 hours action (right).



1. V.I.Vysotskii, V.B.Vassilenko, A.O.Vasylenko. Bull. of Shevchenko National Univ. of Kiev, Ser. Radiophys.,No.1,11,2013.

2. V.I.Vysotskii, V.B.Vassilenko, A.O.Vasylenko. Ibid, Ser. Mathematics and Physics., No. 2 (2013) 255.

3. V.I.Vysotskii, A.O.Vasilenko and V.B.Vassilenko. J. Surf. Invest. v.8, 367, 2014.

4. V.I. Vysotskii, A.O. Vasilenko, V.B. Vassilenko, M.V.Vysotskyy Inorganic Materials: Applied Research, v.6, 199, 2015.

5. V.I.Vysotskii, A.A.Kornilova, A.O.Vasilenko,V.I.Tomak. J. Surf. Invest. v.8, 1186, 2014.

6. V.I.Vysotskii, A.A.Kornilova. Current science, v.108, 608, 2015.

7. V.I.Vysotskii, M.V.Vysotskyy. Journal of Experimental and Theoretical Physics, v.121, 559, 2015.

Design and Initial Testing of the Least Action Nuclear Process [LANP] Computer Model of the Cold Fusion Process

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The cold fusion dream seems close at hand. But, a careful look at the current landscape reveals broad areas of uncertainty, where the only navigable path is trial-and-error experimentation. And what makes this observation all the more striking is the realization that there has been very little change in the theoretical portion of that landscape over the last 28 years. Indeed, when we look at the last 10 years, nearly all of the scientific advances have been in the experimental domain; and a considerable portion of that work has focused on electrode design.

There is good reason for this. The Fleischmann-Pons effect appears to be related more to the electrode composition than any other factor. For years we witnessed this in the way that experimentalists sought out preferred suppliers whose wires and foils were known to produce positive excess heat results. No one knew why, but the spoken or unspoken understanding held that electrode composition was the key to those ten-fold Coefficients of Performance that were periodically reported. Those experiments clearly showed what was possible. We needed to figure out what characteristic of the electrode was so important. Then we needed to replicate it. But still, the one obstacle to effective electrode design continues to be our failure to understand cold fusion at the level of its physics fundamentals.

There are also reasons for this. First, we have no idea what kind of physics we are looking at. Cold fusion behaves like no other physical process that we have ever encountered. Experimental results do not appear to be deterministic or reproducible. In the most extreme case there is randomness even in the presence or absence of excess heat. This behavior is unprecedented in physics. And it doesn't stop there. There are several other unexplained process characteristics that confound reproducibility. These include:

1. The non-reproducible, and seemingly random time history of excess heat,
2. Heat's cessation and renewal during a single experiment,
3. Heat evolution even after electrolysis power is turned off, and
4. The inevitable, but unpredictable termination of the excess heat response.

The need for a cohesive theory becomes more important as engineers attempt to develop commercial prototypes. It is in the absence of theoretical understanding that development has to default to trial and error experimentation in search of a magic formula or an accidental breakthrough.

The Least Action Nuclear Process[LANP] model (2) of cold fusion is a predictive tool that offers an explanation for several cold fusion anomalies. For example, it provides a sound theoretical explanation for the randomness in the excess heat response. It finds that both endo-thermal and exo-thermal nuclear reactions occur, and that it is the predominance of one over the other that produces excess heat or no excess heat. It is only the sign of the heat change that is random.

The theory also holds that no deuterium-deuterium fusion occurs. Instead the nuclear ash in Mizuno and Miley's experiments is the result of much higher energy nuclear reactions that occur in a very slow progressive manner that is stepwise, precise, and absolutely deterministic. These are realistic theoretical foundations. After all, if we are going to fit cold fusion into a theory context within physics, there is no alternative to 'precise' and 'absolutely deterministic'. This is how all laws of physics work, and there is no reason to think otherwise now.

This paper will use the LANP theory to illustrate how an electrode will ultimately be designed. In particular, it describes a computer model that simulates the physical laws described in LANP theory. The program begins by calculating the broadest range of nuclear reactions that can occur given the initial electrode composition. It then calculates the unique Least Action decay sequence for each of those initial reaction products, and orders the positive and negative heat responses from smallest to largest. Inspecting this tabulation, we find the order in which new stable isotopes appear in that particular electrode. We also find that those nuclear transmutations that are considered 'least likely', are systematically removed from consideration. The calculations are precise even though the heat response appears to be random. However, it is this seemingly random heat response that is exactly reproducible.

The LANP program is almost complete. It currently predicts the decay sequence for any initial nuclear transmutation. The calculation accounts for even the small mass changes occurring during β^- and β^+ decay steps, and outputs the one stable Least Action product that ultimately occurs from that transmutation. I have begun building a front end for this program that will allow us to add or subtract elements or even specific isotopes to see the predicted changes on excess heat response or specific isotope production. I hope to use my workshop presentation to 1) describe the use of this model in analyzing George Miley's transmutation data, 2) illustrate the utility of the program as an electrode design tool, and 3) following the presentation, to allow workshop participants to try their hand at electrode design (assuming that the programming is far enough advanced by that time).

Toward this end, the paper has four parts. In the first, we will show how using excess heat as the primary experimental variable is of little or no benefit in understanding the fundamental physics of cold fusion. In the second, we will look at the source of the seemingly random variability in our experiments, and endeavour to find its source. Third, it will be necessary to identify deficiencies in the current data set, and develop an experimental program to collect the data required to calibrate a cold fusion model, and prepare it for electrode design. The fourth and final part of this paper will illustrate how the LANP theory can be used as an electrode design tool to optimize commercial heat generation or specific isotope production, and even to design an electrode with Mars Mission reliability.

Summary of Tritium Evolution from Various Deuterided Metals

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Here we summarize tritium production from various experiments primarily using, gas loaded, deuterated Pd. Many experiments have shown that tritium is produced when Pd is loaded with deuterium (D) or mixtures of D and Hydrogen. While critics have variously ascribed this tritium to contamination of metals or another radioactive species, our work has refuted each point and at this juncture it is certain that low levels of tritium are produced insitu by a process that is uncertain but can be elicited by a number of methods that have a common feature in that a flux of deuterium is present. Tritium detection is undoubtedly the most sensitive method for the detection of activity in an LENR system since ~ 10^8 atoms can be detected easily with a scintillation system or in a gas ion chamber. In contrast to neutron detection, tritium builds up over time and therefore the signal can be enchanted by extending experimental runs. In has been found that tritium production in an LENR system is sensitive to material alloy and metallurgical condition as well as the excitation method. All of the data summarized here was obtained by gas loading and the loading ratios are low compared to that routinely found using electrolytic methods. Thus, while excess heat may require high deuterium loading, the production of detectable tritium is not so constrained. In addition, when excess heat is observed, the production of tritium is many orders of magnitude less than that of the He4 channel.

Development of a Sensitive Detection System for the Measurement of Trace Amounts of He^4 in Deuterium or Hydrogen

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Many LENR systems seem to generate helium 4 from deuterium but there are few systems that can detect trace amounts of He4 in the presence of D_2. Most commercial magnetic sector systems are large and expensive (like the Finnigan 270 located at LANL) and while they have excellent Δm/m resolution, they still require a getter system to achieve mediocre ppb sensitivity. We have developed a lower cost and compact system that allows us to measure He4 down to sub 100 ppb levels in D_2. This system utilizes a column of activated carbon at LN_2 temperature that effectively absorbs everything but Helium. Post absorption, the system uses a MKS microvision and a SRS 100 RGA to check for helium purity. The helium eluted from the column is quantified by a small magnetic sector mass spectrometer tuned to mass 4. A typical sample size required to achieve low ppb sensitivity to He4 is 50 cc at 50 torr. Calibrations have been done with air, He4 in D_2 at various concentrations and show a 3% variation from standard sample to standard sample. We will discuss the typical operation of this instrument and show results from various calibrations using different carrier gases.

The reasons and mechanism of giant LENR optimization at pulse formation of coherent correlated states of interacting particles

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Among numerous LENR problems the most important one is connected with overcoming the Coulomb potential barrier during the interaction of low energy charged particles. "Standard" approach of nuclear physics lead to very small probability of the tunnel effect and can't solve this problem.

In the report the possible applications of coherent correlated states (CCS)[1-8] of interacting particles for solving of main LENR problems and paradoxes are discussed:

a) giant increasing of transparency of Coulomb barrier for light, intermediate and heavy charged particles at low energy;

b) suppression of “radioactive” channels of LENR (including the total absence of radioactive ash);

c) sharp suppression of intensity of gamma-ray radiation during LENR.

In our previous works [1-7] methods of CCS formation and LENR realization during grows or squeezing of microcracks in metal-hydrides [2-6], during grows and development of biological systems [2] as well as the THz-resonance and low-frequency [7-9] modulation of the potential well parameters were discussed and calculated.

In the paper the methods of CCS formation at electric discharge in gas and at action of shock wave in condensed matter are considered for the first time.

The action of high-current electrical discharge in a gas leads to the formation of a strong pulsed azimuthal magnetic field $\vec{H}(t)$, in which the motion of a charged particle corresponds to nonstationary harmonic oscillator. This process leads to the formation of CCS with a correlation coefficient $r(t)$ that depends on the magnetic field $\vec{H}(t)$ parameters and the position of a particle (distance from discharge area). Formation of CCS leads to giant increase of fluctuations of virtual kinetic energy of low energy interacting particles $\delta E_{ccs} = \delta E / \sqrt{1-r^2} \equiv G\delta E$ up to $\delta E_{ccs} \geq 10 \div 50\, keV$. This fluctuation can exists for a long time $\delta t_{ccs} = \delta t / \sqrt{1-r^2} \equiv G\delta t$. These processes have been investigated based on actual dephasing action of environment to CCS formation.

It was shown that at action of electric discharge pulses with typical parameters (e.g. $J_{\max} \approx 0.5 \div 10\, kA$ and duration $\tau \approx 0.1 \div 1 \mu s$) we have $G_{\max} \approx 200 \div 1000$, that lead to increase of very low barrier transparency $P_{G=1}$ for $d+d$, $d+C^{12}$, $d+N^{14}$, $d+O^{18}$ interactions by $10^{100} \div 10^{200}$ and more times up to $P_{G\geq 100} \approx 0.1 \div 0.01$. This mechanism explains the course of nuclear reactions, observed in many laboratory experiments (including experiments of Randal **Mills)** and generation of fast neutrons observed during natural lightning.

The similar effect takes place at action of acoustic shock wave on the atoms situated in condensed matter in a field of neighboring heavy atoms. Such the system at action of shock wave is similar to the same nonstationary harmonic oscillator in which the process of CCS formation leads to giant increase of barrier transparency and the possibility of LENR. This mechanism explains and allows to calculate the nuclear processes that have been observed during cavitation, electrical explosion of wires in the liquid and in other processes.

1.V.I.Vysotskii, S.V.Adamenko. Technical Physics, v.55, 613, 2010.
2.V.I.Vysotskii, S.V.Adamenko, M.V.Vysotskyy. Annals of Nuclear Energy, v.62, 618-625, 2013.
3.V.I.Vysotskii, M.V.Vysotskyy. European Phys. Journal. A , v.49, issue 8: 99, p.1-12, 2013.
4.V.I.Vysotskii,M.V.Vysotskyy,S.V.Adamenko. J.of Experiment. and Theor. Phys.v.114, 243, 2012.
5.V.I.Vysotskii,S.V.Adamenko,M.V.Vysotskyy. J.of Experiment. and Theor. Phys.,v.115, 551,2012.
6.V.I.Vysotskii, M.V.Vysotskyy. Journal of Experimental and Theoretical Physics, v.118, 534, 2014.
7.V.I.Vysotskii, M.V.Vysotskyy. Journal of Experimental and Theoretical Physics, v.120, 246, 2015.
8.V.I.Vysotskii, M.V.Vysotskyy. Journal of Experimental and Theoretical Physics, v.121, 559, 2015.
9. V.I.Vysotskii, M.V.Vysotskyy. Current Science, 2015, v.108, No.4, p. 30-36

Expectations of LENR Theories

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There are dozens of theories about what causes LENR. Many are incompatible with other LENR theories. Theories are ultimately in competition with each other. Assessing the character and status of each theory is a major first step toward down selecting theories.

There have been two previous broad overviews of LENR theories. The first was in a 1994 paper, which reviewed more than 25 "CF" models [1]. It stated "We conclude that in spite of considerable efforts, no theoretical formulation of CF has succeeded in quantitatively or even qualitatively describing the reported experimental results." The second was in the proceedings of ICCF-14 [2]. It included a matrix of the 22 theoretical papers given at that conference versus characteristics of the theories, for example, how they treated the Coulomb Barrier.

This paper is a related, but different, approach to the dozens of LENR theories. It is not a review or evaluation of LENR theories. Rather, it offers questions, the answers to which would enable people interested in LENR to understand the *characteristics* and *status* of various theories. The questions are addressed to LENR theoreticians, as follows:

1. How is your theory connected to LENR?
2. What is the key idea or concept of your theory?
3. What is (are) the foundation(s) of your concept?
4. Does your mechanism involve only one step or more than one step?
5. Are the equations that embody your concept written out?
6. If the equations are available, have they been evaluated, that is, reduced to numbers?
7. What time histories and reaction rates are (quantitatively) predicted?
8. How does your mechanism involve or relate to experimental observations?

Some of these questions have ancillary questions. For example, the question about mechanisms involving more than a single step raises the issue about which one of the steps is rate limiting.

Theory has only two functions: to explain the past or to predict the future. There is a large volume of data from LENR experiments, which begs quantitative, or even qualitative, understanding. Design of experimental tests of theories is a time-honored and useful approach in the sciences. Very few LENR theoreticians have designed experiments.

Almost all extant LENR theories fall short of what is desirable, and actually necessary, in terms of their completeness. This is a remarkable situation after almost three decades of vigorous considerations of the basic mechanisms that cause LENR.

[1] V. A. Chechin *et al.* "Critical review of theoretical models for anomalous effects in deuterated metals" www.lenr-lanr.org/acrobat/ChechinVAcriticalre.pdf
[2] D. J. Nagel and M. E. Melich, https://www.iscmns.org/iccf14/ProcICCF14b.pdf, page 476

LEAP: The LENRIA Experiment and Analysis Program

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Melvin H. Miles and M. Ashraf Imam

We have planned and are preparing for a multi-laboratory experimental program aimed at reversing the negative scientific and public perceptions about the legitimacy and promise of LENR.

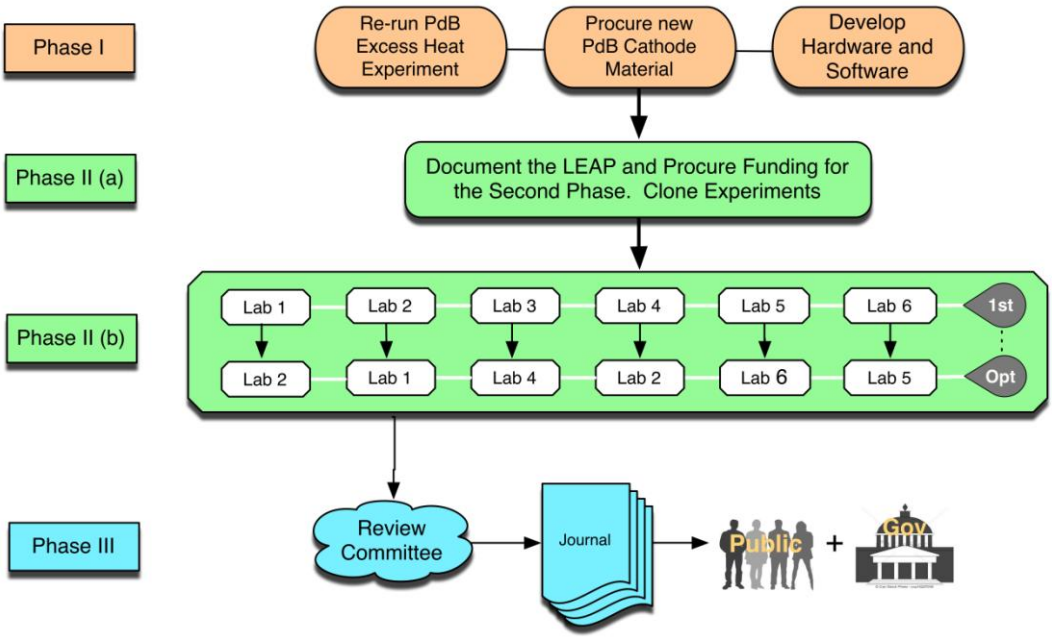
As indicated by the title above, the program is called LEAP. We will serve as managers of the effort with responsibilities for funding of the first phase of the program, obtaining funds for the second phase, coordinating and monitoring all program activities, preparation of publications, coordination with journals, and reportage to mass media. Dr. Mel Miles will serve as the expert on electrochemistry, and Dr. Ashraf Imam rounds out the core team as the expert on materials.

There has not been broad scientific acceptance of the existence of LENR. This is due to many factors. The LEAP program is designed to reduce the number of variables associated with achieving LENR reproducibility by delivering a turnkey experiment to a group of well-regarded laboratories and experimentalists. Institutionalizing the engineering, construction, programming, testing and materials phases of the experiments is expected to reduce the introduction of unknowns, while permitting participants to focus on operating and vetting the experimental regime, and reporting their results.

The multi-lab nature and simultaneity of the experiments and reporting for the LEAP program are designed to improve the environment for debate and analysis of the experimental data and to draw attention to the field.

The best outcome of the LEAP program would be to achieve demonstrable proof of the LENR phenomenon that is sufficient to begin to change the perception of the scientific establishment, of 'very important people,' and the public.

The flow diagram for the LEAP follows. The first phase consists of the preparation and qualification activities. Phase II requires the involvement of major international laboratories. Phase III will be comprised of review and publication activities for a scientific journal, along with a media campaign.



Currently, we are well into the three activities in the first phase of the LEAP. The status of work on the program will be detailed. Comments on both the strategy and the details of the LEAP are solicited.

LENR, Existential Risks and Rewards.

Alan Smith.
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Over the last 20 years, encouraged by thoughtful academics and nervous politicians, both 'old guard' and 'new unicorn' global corporations have begun to take a serious interest in existential risks, at the very least to those things that threaten the markets they serve and consequently their business model. These risks are often, though not always, the result of unintended consequences. Examples include pollution, climate change, antibiotic resistance, and war. A list that will get longer with the debut of AI systems, the 'Silicon Nukes', with their huge potential to increase under-employment in every social group.

LENR researchers, perpetually underfunded and mostly ignored are like the maverick steers that protect the flanks of the herd. This outsider status is viewed as a problem of course, but it also offers opportunities to repurpose 'useful' LENR as a key component of risk-aversion strategies for our planet. When our work is seen not just as oddball physicists doing odder experiments, but presented as a viable path to zero-emission energy in an unstable world, it will re-awaken interest and open up new sources of support from risk-aware governments, businesses, and individuals.

Can we avoid penetrating radiation?

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This paper assesses the ways various models attempt to explain the lack of observable penetrating radiation in CMNS. The models considered include:-

1. The Widom Larsen theory
2. The Deep Dirac Level (DDL) model of Paillet of Meulenberg
3. The Exotic Neutral Particle (ENP) models of Bazhutov and Fisher

We show that none of these models can suppress penetrating gamma and beta radiation completely. Nevertheless some approaches appear to be better than others.

References

Collis W. **Rubidium carbonate electrolysis with a fibrex nickel cathode.** This workshop.

Preventing Thermal Runaways of LENR Reactors

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According to the literature, the heat generation rate of some LENR processes increases rapidly with the temperature. The control of the LENR reactor requires a safe balance between the heat generation and the heat removal by the cooling system. If the balance is not properly maintained, the temperature may increase, leading to a further increase of the reaction rate. Under some conditions, the reactor undergoes a runaway that may be destructive. Several runaway events have already been reported in the LENR literature therefore the problem is real and must be adequately addressed in order to make the dissemination of future industrial LENR devices acceptable.

Runaways are well known in the chemical industry. Examples of the importance of temperature control in chemical reactors are discussed. Some criteria to avoid runaways have been elaborated. The lessons learned in the chemical industry may be utilized to design LENR reactors that are inherently safe. Potential convenient designs are presented.