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Book of Abstracts

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Oral Presentations

Overview of LENR Science and Business in the United States

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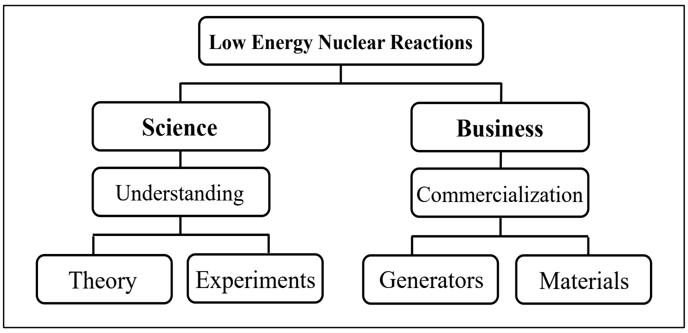
Some work on Low Energy Nuclear Reactions (LENR) in the U.S. is being done by individuals who believe in the potential value of the field, but are not funded. However, there are a few reasonably funded programs on LENR. They include long-term support from Thomas Darden of Industrial Heat and Carl Page of the Anthropocene Institute. In 2023, the Advanced Research Project Agency for Energy (ARPA-E), part of the U.S. Department of Energy, began a program funded at a level of $10M. LENR support in the U.S. is roughly 1/1000th of the amount of money for hot fusion research.

Scientific research and commercialization of LENR can be organized as shown in this figure. This paper reviews the four topics in the bottom of the figure.



- Currently, there is limited theoretical work on LENR in the U.S. Hagelstein is consistently active in developing a quantitative understanding of both the occurrence and rates of LENR [1].
- LENR experiments are being done at eight organizations funded by the ARPA-E program. The following table is a summary of the organizations and activities in that program.

Amphionic LLC	Development of Nano-Materials for LENR
Energetics Technology Center	Pd-D Co-Deposition onto Coated Radiation Detectors
Lawrence Berkeley Nat'l. Lab.	Nucl. Radiation Measurements from Energetic Beams onto Deuterides
MIT	Radiation Measurements from Gas-Loaded Metal-Hydrogen Systems.
Stanford University	Radiation Measurements from LENR-Active Nanoparticles & D_2 Gas
University of Michigan	D_2 Cycled through a Chamber Filled with Palladium Nanocrystals
Texas Tech University	Advanced Materials Fabrication, Characterization, and Analysis
University of Michigan	Neutron, Gamma, and Ion Emissions from LENR Experiments

Two types of LENR experiments are being performed at the George Washington University by Marano and this author: (a) calorimetric electrochemical measurements and (b) LENR-related measurements, including co-deposition and electromigration [2]. The research includes electrical noise, acoustic, optical, infrared, and radio-frequency measurements of various LENR materials.

- Two U.S. companies are seeking to develop commercial LENR generators, Leonardo and Brillouin Energy Corporations, with websites at https://e-catworld.com/tag/leonardo-corporation/ and https://brillouinenergy.com/ It is not known when they might be able to produce marketable products.
- Materials for commercial LENR generators must have high performance, controllability, and durability. Output powers of at least one kilowatt will be needed for high-volume sales to power homes. The output powers must be controllable, and the active materials must remain effective for at least several months. If LENR generators operate at temperatures of a few hundred degrees C, which are needed for efficient electricity production, inevitable diffusion will change the materials during operation. Operational durability is a main challenge to the successful commercialization of LENR. A research and development program on LENR materials has been formulated [3]. Funding for that four-year program is being sought currently. It should result in valuable LENR Intellectual Property.

[1] P. L. Hagelstein *et al.*, "Progress on a Model for Anomalies in Condensed Matter Nuclear Science", This Conference
[2] E. F. Marano and D. J. Nagel, "Experimental Study of Electromigration of Hydrogen Nuclei in Palladium", This Conference
[3] D. J. Nagel, M. A. Imam, and E. F. Marano, "Development of Effective, Controllable and Durable Materials for LENR Generators", Unpublished

A world in turmoil: a perspective on LEAP developments in Europe and R&D funding opportunities in an unstable environment

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Maurizio Maggiore

The presentation will highlight developments in LEAP (Low Energy Anomalous Phenomena) in the EU since ICCF-25, highlighting in particular some recent theoretical and experimental results and the emergence of publicly announced private investment by a reputable listed company.

It will also speculate on the perspectives of R&D funding in this and other “unorthodox” domains, which has been very limited up to now.
In fact, the global EU funding profile is evolving in all areas due to different external causes and changing political priorities: the presentation will look at these and try to predict what the consequences could be, since the changes are still incubating and a clear picture is not yet available.

In the second part of the presentation we will discuss the current attitude of the UK government to cold fusion, look at some independent research initiatives in the UK and its near neighbours, and discuss the growing interest of VC’s and other private funders in alternative energy.

Current Status of Research and Development of Condensed Matter Nuclear Science in Japan

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This paper will review the progress of CMNS (Condensed Matter Nuclear Science) research in Japan and outline the main findings. In addition, an overview of past state-sponsored and private foundation-sponsored research projects in Japan will be presented. We also report on current university-based research trends and private companies entering this field. And we will discuss the challenges and directions of future research and development of CMNS in Japan. Specific details will be presented according to the following.

1 Past Research (1989-2015) in Japan
  - 1.1 Electrolysis experiments in the early days
  - 1.2 NHE (New Hydrogen Energy) project (1993-1998)
  - 1.3 Hybrid experiments of electrolysis and gas loading
  - 1.4 Gas loading Experiments
  - 1.5 Japan CF-Research Society (1999-)

2 Current research (2015-) in Japan
  - 2.1 NEDO project (2015-2017)
  - 2.2 Current Research Participating Organizations (universities and companies) in Japan
  - 2.3 Overview of main university research
  - 2.4 TEET project (2023-2026)

3 Challenges and directions of future research

Characteristics, trends, and future prospects of CMNS research in Japan would be discussed at the conference.

Results of the European CleanHME Project

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The European project CleanHME (Clean Energy from Hydrogen-Metal Systems) was completed in January 2025, but the results achieved will stimulate further fundamental research in the field of low-energy nuclear reactions (LENR) and the development of a new energy source based on thermal nuclear fusion in metallic environments for many years to come. The CleanHME consortium originally included 16 scientific institutions and commercial companies from Europe, the USA and Canada. The main research goal was not only to find new materials that would allow for generating a stable and reproducible amount of excess heat for the future technology demonstrator, but also to understand the physical phenomenology of investigated effects. Therefore, the hydrogen-loading experiments conducted as part of calorimetric studies were combined with accelerator experiments analyzing the enhancement of nuclear reaction yields at extremely low energies, and with extensive material diagnostics such as positron annihilation spectroscopy (PAS) or X-ray diffraction (XRD).

In the present contribution, the main achievements of the CleanHME project will be presented. They include both the mastery of the production of hydrotylcite powders containing different active metallic components and demonstration of the deuteron-deuteron fusion at thermal energies by detection of its nuclear products. We also understand the mechanism of LENR, which couples the diffusion of hydrogen atoms in the crystal lattice with crystal defects responsible for the local increase of the effective electron mass, resulting in an enhanced electron screening effect and easier tunneling through the Coulomb barrier. The discovery of the threshold resonance in ^{4}He related to the emission of electron-positron pairs at thermal energies on the one hand, and the observation of the electric voltage generated over active metallic powders on the other hand, will enable much more effective studies of LENR effects in the future. Finally, the excess heat observed in hydrogen loading experiments is very impressive, ranging from about 80 mW to 2500 mW for 100 g of powder or bulk materials, respectively.

Despite many successful results, one of the conclusions of our project is that there are still many open issues that should become the subject of further leading research programs supporting both the applied and fundamental part of the development.

High Temperature LEC experiments

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The Lattice Energy Converter (LEC) has been discovered by Gordon and Whitehouse (1). Most experiments done so far have been performed near room temperature showing that a voltage is generated between an activated electrode (palladium or iron) and a reference electrode in hydrogen or deuterium. They have also shown that the voltage varies with temperature up to 200°C (2).

We have shown (3) that excess heat is observed with nano powders of nickel alloys (Ni/Cu) embedded in an amorphous alumina matrix and simply obtained after activation/reduction of a starting hydrotalcite. However, the excess heat occurs only above about 700°C. We have designed a device to do LEC experiments up to 900°C. Our experiments show that the voltage between the active electrode made of the nano powder and a reference electrode made of stainless steel starts above 600°C. This behavior is very similar to the thermal behavior of the excess heat. This work shows that the voltage varies with the various loading and de-loading of hydrogen as shown in Figure.

An application of this technique will be the use of LEC to find out quickly which material is good or not for excess heat measurements.

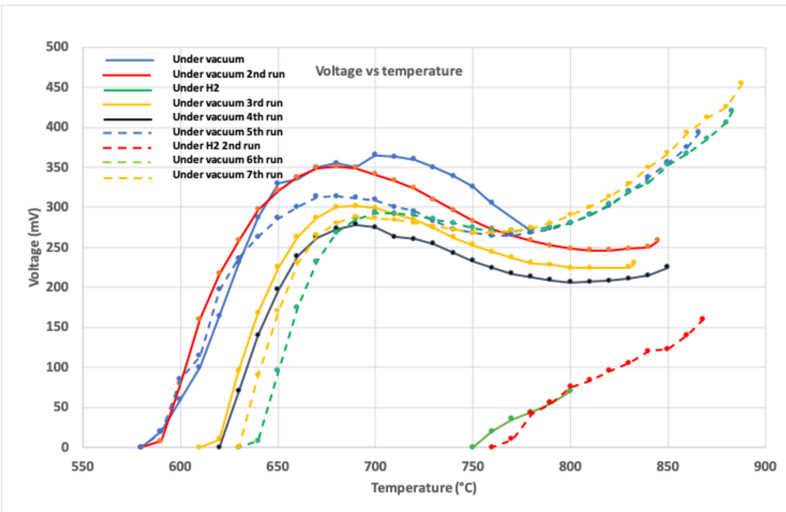

Figure 1: Voltage between an electrode composed of Ni/Cu nano-powder and a stainless-steel counter electrode. The voltage varies with the various cycles of loading and de-loading. The voltage is higher under vacuum.

References:

(1) Gordon F. E., Whitehouse H. J., *"Lattice Energy Converter",* J. Condensed Matter Nucl. Sci. 35 (2022) 30-48.
(2) Gordon F. E., Whitehouse H. J., *"Lattice Energy Converter II: Iron Hydrogen Host Metal",* J. Condensed Matter Nucl. Sci. 36 (2022) 1-24.
(3) Biberian J.-P., Michel R., Le Roux C., Valat M., Bucher S., Kodeck A., Sjöberg P.J.R., Ruer J., Chaudanson D., "*Excess Heat in Nanoparticles of Nickel Alloys in Hydrogen*" J. Condensed Matter Nucl. Sci. 38 (2024) 186-195.

26p-2

Measurement of radiant spectrum for excess heat generation in NiCu thin film during hydrogen gas desorption

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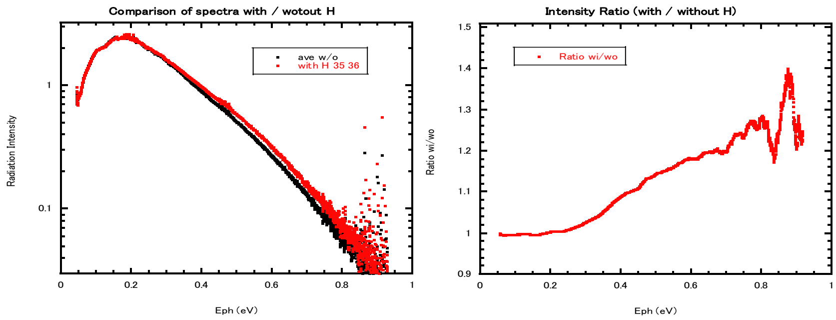
We have been developing a radiation calorimetry method, which aims to reliably evaluate the value of large excess heat produced by the metal thin film with hydrogen. A wide range spectrum of electromagnetic radiation was obtained by measuring the heat flow from the radiation emitted in a vacuum by a metal thin film sample heated to a high temperature [1,2]. In these measurements, three spectroscopic instruments with different wavelength ranges were used. However, in the range below 0.5 eV, only the average intensity between 0.2 and 0.4 eV was measured and, hence, more complete measurements were awaited. Recently, we have added an FTIR device, INVENIO R manufactured by Bruker, for the range of 0.043 eV to 0.93 eV (MIR mode; 28.5 - 1.33 mm) and 0.004 eV to 0.084 eV (FIR mode; 325 - 14.8 mm).

Samples are a complex film of six layers of NiCu deposited on a Ni substrate (0.1 mm thick) and a Ni substrate itself. The sample NiCu/Ni was fabricated by sputtering as described in [3]. It consisted of thin layers of Ni (20 nm) and Cu (4 nm) alternatively deposited to form 6 bilayers on Ni substrate (0.1-mm thick, 25×25 mm^2 in area).

In the experiment, before hydrogen absorption into the sample, the radiation spectrum is measured for each heater input power. This measurement is a background measurement that serves as a standard for evaluating the excess power caused by hydrogen introduction. Hydrogen gas was then introduced into the sample in the vacuum chamber. The heater input was turned on at the same time as the start of evacuation.

The radiation spectrum during hydrogen desorption was compared with the one before hydrogen absorption. The observation of the spectrum in the 0.05-0.5 eV region eliminated the model dependency in the quantitative evaluation of excess heat, leading to more reliable results. Figure shows an example, in which the spectra are compared when the heater input voltage is 40 V. The black dots are background intensity, i.e., those measured before hydrogen desorption of the NiCu sample, and the red dots are foreground, measured during hydrogen desorption several hours after the start of evacuation. The intensity ratios are seen on the right figure. The increase in intensity with increasing photon energy seen in the region above 0.3 eV in the foreground spectrum corresponds to the generation of excess thermal energy inside the sample. In the region lower than 0.3 eV, it is almost the same intensity as the background spectrum. It is clear that the emissivity of the sample depends on the radiative energy.
The presentation will also examine the radiant intensity spectrum, its changes over time, and the deduced excess thermal energy.



Left: Radiation intensity spectrum measured without H_2 (black dot) and with H_2 (red dot). Right: Intensity ratio (with H_2 / without H_2). The abscissa is photon energy (eV).

[1] T. Itoh et al., J. Cond. Matt. Nucl. Sci. 36, 274 – 284, 2022.

[2] J. Kasagi et al., arXive: 2311.18347, to appear in ICCF25 Proceedings.

[3] Y. Iwamura et al., J. Cond. Matt. Nucl. Sci. 33, 1 – 13, 2020.

26p-3

Detections of He-3 in Cu-Ni/ZrO_2 samples after anomalous heat generation experiments

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The recent progress in research has confirmed the reproducibility of anomalous heat generation by Cu-Ni/ZrO_2 exposed to hydrogen gas. One theoretical model, 4 hydrogen/tetrahedral symmetric condensate (4H/TSC) WS fusion (weak and strong nuclear cascade fusion), has been proposed to explain the anomalous heat generation, and it suggest that He-3 is produced as a result of nuclear reaction [1,2]. Atmospheric helium exhibits a He-3 abundance of approximately one part per million. The extreme scarcity of He-3 implies that its detection in mere hundreds of milligrams of material would constitute compelling evidence for the occurrence of nuclear reactions, potentially including light hydrogen "cluster"-fusion processes such as 4H/TSC-WS fusion. In the present study, a novel approach in specifically targeting He-3. The research's innovative premise stems from the hypothesis that He-3 is entrapped within the Cu–Ni/ZrO_2 samples which after exothermic experiments. This is because Ni and Cu retain helium stably inside even when the temperature is raised to about 500 °C, which higher than the heat treatment temperature of the Cu–Ni/ZrO_2 samples [3-5]. To explore the hypothesis, two distinct analytical techniques were employed: nuclear reaction analysis (NRA) utilizing deuteron beams from an accelerator, and thermal desorption spectrometry (TDS) using a quadrupole mass spectrometer (QMS) coupled to a vacuum chamber with a controllable heating element.

The NRA experiments were conducted using the tandem electrostatic accelerator at The Tandem Accelerator Laboratory of Kobe University (TAcLKU), Graduate School of Maritime Sciences, Japan. Deuteron beams with an energy of 1.4 MeV and a current of 5 nA were employed, with each sample subjected to 5 h of irradiation. Above 14 MeV proton from nuclear reaction between He-3 and deuteron detection was achieved using CR-39 track detectors. As a result, etch pits, which are signals from protons above 10 MeV, are detected, and the proton etch-pit density increases almost in proportion to the integrated calorific value [6].

The TDS experiments, samples were subjected to a controlled temperature increase from ambient to 1200°C at a constant rate of 10°C min^{-1}. The mass-3 signals above 900°C region from the samples after the exothermic experiments have higher values than before the exothermic experiments. He-3 signals manifest at mass-3; however, H^{3+} ions, inevitably produced in the ion source of QMS due to residual hydrogen-containing gases, also contribute to this signal. Correlation between the signals of mass-2 and 3 has been investigate, and the emissions in the temperature range above 900°C showed poor correlation with H_2. In addition, mass-3 signal from the sample after the exothermic experiments increased independently of the increase in the mass-18 (water) signal as the temperature increased, and even showed an inverse correlation when the temperature was increased further above 1100°C. This suggests the release of molecular species unrelated to hydrogen. Following a process of elimination, the mass-3 signals above 900°C remains only the possibility of He-3 [6].

[1] A. Takahashi, "Physics of cold fusion by TSC theory," J. Condens. Matter Nucl. Sci. 12, 1 (2013).
[2] A. Takahashi, "Nuclear products of cold fusion by TSC theory," J. Condens. Matter Nucl. Sci. 15, 1 (2014).
[3] T. Yamauchi et al., "Thermal release behavior of helium implanted into nickel," J. Nucl. Mater. 178–181, 308 (1991).
[4] T. Yamauchi et al., "Thermal release behavior of helium from copper irradiated by He+ ions," J. Nucl. Mater. 155–157, 438 (1988).
[5] T. Yamauchi et al., "Thermal release behavior of helium implanted into copper at high fluences," J. Nucl. Mater. 178–181, 308 (1990).
[6] T. Yamauchi et al., "Detections of He-3 in Ni-based binary metal nanocomposites with Cu in zirconia exposed to hydrogen gas at elevated temperatures"Jpn. J. Appl. Phys. 64, 017004 (2025).

26p-4

Tracks on CR-39 from the SPAWAR co-dep experiment

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We recently conducted the electrochemical co-deposition experiments explored by SPAWAR Systems Center San Diego [1], in which Pd is co-deposited on an Au substrate in heavy water. This process produces a highly fractal Pd deposit with vacancies, enabling instant deuterium loading. Both high D/Pd loading and vacancy formation are believed to be necessary conditions to initiate low-energy nuclear reactions (LENR) effects. A significant observation in our experiment is the emission of MeV charged particles, which is a LENR effect not expected by the conventional theory. Since the charged particles are produced at a low rate, the CR-39 for track detection is well suited for a long-duration (1-2 days) experiment with a low count rate. Our results show track patterns on CR-39 similar to those reported in SPAWAR studies.

Additionally, we observed triple tracks on the CR-39 detector, suggesting the presence of energetic neutron emission [2]. These tracks indicate C-12 disintegration by neutrons exceeding about 9 MeV of energy. Notably, we detected triple tracks even with a 50 µm Mylar® film placed between the CR-39 detector and the Au substrate, further supporting that energetic neutrons shatter C-12 in Mylar®.

Reproducibility has been a longstanding challenge in LENR research, with a need for reliable and accessible "lab rat" experiments [3]. Our findings reinforce that SPAWAR experiment meets these criteria, providing a reproducible platform for further investigation of LENR anomalies.

References:

[1] P. A. Mosier-Boss, S. Szpak, F. E. Gordon, and L. P. G. Forsley, "Use of CR-39 in Pd/D co-deposition experiments," The European Physical Journal-Applied Physics, vol. 40, no. 3, pp. 293-303, 2007.
[2] P. A. Mosier-Boss, S. Szpak, F. E. Gordon, and L. P. Forsley, "Triple tracks in CR-39 as the result of Pd–D Co-deposition: evidence of energetic neutrons," Naturwissenschaften, 96, pp.135-142, 2009.
[3] P. A. Mosier-Boss and L. P. Forsley, "Energetic particle emission in Pd/D co-deposition: an undergraduate research project to replicate a new scientific phenomenon," Journal of Laboratory Chemical Education, vol. 6, no. 4, pp. 69-76, 2018.

The Explanation for Mysteries in E-Cat Presentations and Applications

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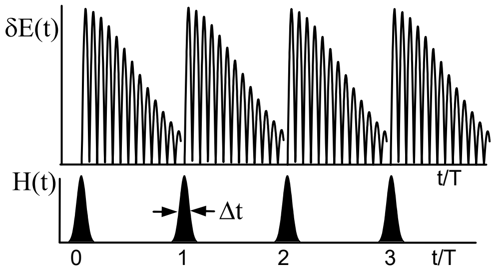
The E-Cat heating coil system is widely recognized as one of the most efficient designs for large-scale implementation of LENR technologies. However, numerous demonstrations of this system have revealed several anomalies and mysteries typical of LENR, which are challenging to reconcile with one another or to explain using a single mechanism. These anomalies include: *a*) anomalously high efficiency at low temperatures; *b*) absence of radioactive daughter isotopes; *c*) extremely low levels of accompanying gamma radiation; *d*) selective support or inhibition of certain nuclear reactions that appear similar under standard fusion theory; *e*) a remarkably high coefficient of performance (COP =100-500) in different modifications of the original E-Cat system, contrasting sharply with the significantly lower COP (≤ 2-10) observed in numerous independent replications of E-Cat since 2011.
An additional mystery that complements these features is the necessity of external RF ($\Omega \approx 100$ kHz [1,2]) pulse stimulation in the original E-Cat system. It is very important and surprising that the time-averaged power ($\langle P_{RF} \rangle \approx 115$ W) of this RF stimulation is significantly lower than the thermal power required for initial heating by AC current ($P_{AC} \approx 3$ kW) and approximately 100 times less than the thermal power released during nuclear fusion, which occurs synchronously with the external RF action [2]. This RF pulse action enables the E-Cat system to transition into a sustained operational mode.
All numerical estimates used are based on detailed descriptions of the initial E-Cat activity [2].
This report proposes that the primary mechanism underlying these anomalies is the generation of short ($\Delta t \approx 0.25$ μs), periodic ($T \approx 10$ μs) pulses of magnetic field H(t) (see Fig.) induced by RF action within the heating coil, which also is an efficient solenoid. This magnetic field control the pulsed formation of harmonic oscillators with frequency $\omega(t)=eH(t)/m_p c$ for free protons, forming coherent correlated states (CCS) of protons within the active E-Cat chamber [3–6]. The CCS are characterized by giant ($\delta E \geq 20$-50 keV) and prolonged ($\delta t \gg \hbar/2\delta E$) fluctuations in proton kinetic energy [3–6], consistent with the Schrödinger–Robertson uncertainty relation for CCS.



The interaction of these virtually accelerated protons with foreign nuclei (e.g. Ni, Li, Al) located in the volume or on the walls of the chamber leads to selective fusion processes [5,6]. For example, the $Li^7+p=2He^4$ reaction occurs with high probability, while the alternative $Li^6+p=He^3+He^4$ reaction is suppressed. This behavior contradicts standard fusion theory (the probability of (Li^6,p) reaction is greater than (Li^7,p)), but aligns closely with experimental data and analysis [6]. Studies [5,6] demonstrate that the of particles exhibiting large energy fluctuations in CCS regime can only activate nuclear fusion channels that produce stable daughter isotopes or, with low probability, channels accompanied by gamma decay. All these mysteries, their explanations and reasons are discussed in the report.

[1] Alan Smith. Use of Frequencies in the E-Cat, E-Cat World, May 4, 2016, https://e-catworld.com/2016/05/04/use-of-frequencies-in-the-e-cat/.
[2] Test of Energy Catalyzer (Bologna, October 6, 2011).
[3] V.I.Vysotskii, M.V.Vysotskyy, "Formation of correlated states and tunneling for a low energy and controlled pulsed action on particles", J. Exp. Theor. Phys., Vol.125(2), pp.195-209, 2017.
[4] V.I.Vysotskii, M.V.Vysotskyy, "Self-controlled flashing nuclear fusion in stationary magnetized low-temperature plasma", Fusion Science and Technology, Vol.79:5, pp.537-552, 2023.
[5] V.I.Vysotskii, M.V.Vysotskyy, "Universal mechanism of LENR in physical and biological systems on the base of coherent correlated states of interacting particles". Cold Fusion. Advances in Condensed Matter Nuclear Science, Edited by J.-P. Biberian, Elsevier, Chapter 17, pp.333-369, 2020.
[6] V.I.Vysotskii, M.V.Vysotskyy, "Features of correlated states and a mechanism of self-similar selection of nuclear reaction channels involving low-energy charged particles", J. Exp. Theor. Phys., Vol. 128(6), pp.856–864, 2019.

26p-6

Replication of Low-Energy Nuclear Reaction in Water

\# Bin-Juine Huang[1,2,6], Mou-Yung Liao[1,6], Yu-Hsiang Pan[2], Po-Hsien Wu[2], Jong-Fu Yeh[2], Ming-Li Tso[2], Ying-Hung Liu[2], IF Chen[2], Che-Hao Lin[2], TR Tseng[3], Fang-Wei Kang[3], Tan-Feng Tsai[3], Kuan-Che Lan[4], Yi-Tung Chen[5], Li Xu[6], Sih-Li Chen[6], Robert William Greenyer[7]

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Since we published a paper [1] claiming that water can trigger low-energy nuclear reaction (LENR) and produce isotopic gases, we have continued to explore this topic to present more evidence to support the conclusion, including the fact that ^{12}C and isotope ^{17}O are the intermediates of LENR. They finally form CO_2 and isotope gases containing ^{17}O, including $H_2{}^{17}O$ (heavy-oxygen water), $^{16}O^{17}O$, and $^{12}C^{16}O^{17}O$ etc. Since all the output gases were analysed by mass spectrometry in [1], we further utilized NMR (Nuclear Magnetic Resonance) technique as an alternate method to analyse the ^{17}O isotope contained in the output water produced by a reactor (DEX-1Aa). The ^{17}O NMR peak signal intensity was found to be 35% higher than the background value of the reactor input pure water. It was confirmed that the LENR of water can produce the isotope ^{17}O and further form isotopic compounds including $H_2{}^{17}O$, $^{12}C^{16}O^{17}O$, $^{12}C^{17}O^{17}O$, $^{16}O^{17}O$ and $^{17}O^{17}O$, which is the source of the NMR peak signals.

Furthermore, we continued to test another 10 reactors and analysed the contents of the output water. We found from mass spectrometry that ^{22}Ne always appears with excess heat ($COP_x > 1.05$). And the isotope gases ($H_2{}^{17}O$, $^{12}C^{16}O^{17}O$, $^{12}C^{17}O^{17}O$) and regular gases (CO_2 and O_2) are also produced. But the formation of $^{16}O^{17}O$ and $^{17}O^{17}O$ is not quite stable, implying lower probability of ^{17}O fusion into isotope oxygen gas. Among the isotope gases, the ^{17}O heavy water ($H_2{}^{17}O$) is in the form of mixture, and rest of the other isotope gases are in the form of dissolved gas in water. All the evidence suggests that ^{12}C and ^{17}O act as intermediates in LENR [1] leading to the compounds observed in mass spectrometry analysis. We also found that simultaneous formation of H_2 and O_2 gases takes place in strong LENR ($COP_x > 1.2$), implying that a sort of electrolysis phenomenon of water might also be part of the process.

Table 1. Mass spectrometry analysis of output water from 10 LENR reactors.

Reactor ID	Sample ID	COPx	LENR	Isotope gases						Regular gases		
				^{22}Ne	$H_2{}^{17}O$	$^{16}O^{17}O$	$^{17}O^{17}O$	$^{12}C^{16}O^{17}O$	$^{12}C^{17}O^{17}O$	H_2	O_2	CO_2
				KK22	LL19	KK33	KK34	KK45	KK46	KK2	KK32	KK44
			COPx >1.05	LENR index	Isotope gas byproducts					Regular gas byproducts		
RNJ-A1	Tube64	1.27	strong	2.58	5.11	1.12	0.99	2.73	2.43	1.68	1.03	2.71
nDJT-B	Tube67	1.21	strong	3.56	6.58	1.18	1.02	3.33	2.82	1.87	1.05	3.30
DEX-1	Tube69	1.12	weak	1.23	1.41	1.16	1.18	1.16	1.74	-	1.24	1.09
JT2	Tube70	1.04	No	0.58	0.32	1.01	1.11	0.47	0.94	-	1.16	0.50
VCS(5RT)	Tube76-1	1.65	strong	4.43	6.97	2.47	2.04	4.19	4.49	-	2.11	3.36
DEX-1	Tube81	1.25-1.37	strong	1.19	1.57	3.37	1.24	1.07	1.18	-	1.24	1.06
DEX-1D	Tube94	1.12	weak	1.84	2.05	1.15	0.98	1.80	1.22	1.45	0.99	1.63
DEX-1Aa	Tube98	1.30	strong	1.73	1.20	0.94	0.97	1.67	1.19	1.00	0.98	1.60
JT5-A3V1.2*2	Tube108	1.20	strong	1.39	2.42	1.19	1.02	1.98	1.18	1.43	1.01	1.37
SRJ-5	Tube111	1.16	weak	1.17	2.62	1.22	0.99	1.33	1.43	1.35	1.00	1.12

I## (gas) = m/z ##(gas) ÷ m/z 40 (gas); LL##(gas) = I##(gas) ÷ I##(BG)
K##(gas) = I##(gas)) ÷ I##(air); KK##(gas) = K##(gas) ÷ K##(BG) BG: background samples

[1] BJ Huang, YH Pan, PH Wu, *et al.* Water can trigger nuclear reaction to produce energy and isotope gases. *Sci Rep* **14**, 214 (2024). https://doi.org/10.1038/s41598-023-50824-8

Neutron flux measurements in D_2O electrolysis experiments

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The Department of Physics at the Indian Institute of Technology Kanpur has undertaken a detailed investigation into low-energy nuclear reactions (LENR) that occur during the electrolysis process [1,2]. This study, conducted at room temperature and pressure, focuses on neutron and charged particle flux measurements emitted from platinum, palladium and nickel cathodes during heavy water electrolysis driven at energies below 5 eV. The electrolyte used consists of palladium and lithium chlorides, with platinum anode in all cases. The main contribution of this work is providing clear evidence of radiation emissions like neutrons, protons or alpha particles, during the electrolysis process. Additionally, providing flux measurements are important for selecting appropriate nuclear detectors and setting radiation safety standards for such experiments.

The key innovation in this study is the use of a boron fission reaction to detect neutrons generated during the electrolysis process. Building on the foundational Fleischmann-Pons experiments, we integrate a solid-state nuclear track detector, specifically Columbia Resin 39 (CR-39), into the electrolytic cell, customized to detect the types of particles being emitted. The study emphasizes the effectiveness of detectors that operate in integral mode, which helps differentiate LENR signals from background radiation. The alpha and lithium particle tracks formed through the boron reaction via:

$$\mathbf{{}^{10}B + \mathit{n} \rightarrow {}^{7}Li\ (0.8\ MeV) + {}^{4}He\ (2\ MeV)} \qquad \mathbf{(1)}$$

create damage trails in the CR-39 medium. The neutrons can also scatter protons from the heavy water onto the CR-39. By analysing the geometry of these tracks, such as track depth and diameter, the energy and charge of the incident particles can be estimated using 3D profilometers and microscopes. Calibration experiments with a Plutonium-Beryllium thermal neutron source revealed a detection efficiency of 1.15×10^{-3}, providing a quantitative lower bound for the neutron flux generated during the electrolysis experiments. The estimated average thermal neutron flux, according to the boron reaction (1), was 4 neutrons/$cm^2\cdot$sec inside the electrolytic cell and 2.2 neutrons/$cm^2\cdot$sec just outside it for Pt cathode. Further details of variations in radiation emissions with the use of different cathodes will be presented at the conference. We look forward to explore how altering the surface properties of the cathodes influence the neutron flux and energy. We also plan to detect any accompanying gamma emissions with the neutrons.

References:

[1] Ankit Kumar, Pankaj Jain, K. P. Rajeev, and R. G. Pala, "Upper bound in the fusion products and transmutation enhancement in alloys," Journal of Condensed Matter Nuclear Science, vol. 36, pp. 327–335, 2022.
[2] K. Ramkumar, H. Kumar, Pankaj Jain, "Low energy nuclear reactions through weak interactions." Physical Review C, vol.110.044605, 2024.

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Geant4 Monte-Carlo Simulations of Neutron Behavior in a Typical Electrolytic LENR Apparatus

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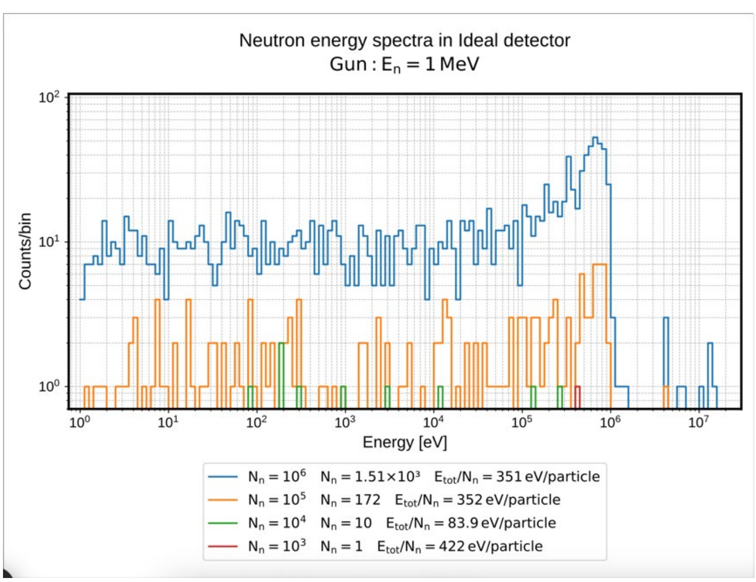
For over 35 years, it has been believed that Low Energy Nuclear Reactions (LENR) do not emit large quantities of neutrons. However, it is difficult to conceive of a conventional LENR process that occurs without emitting either large quantities of neutrons or high intensities of gamma radiation. As a result, many unusual and non-conventional models for LENR have been created. Regrettably, this situation has led to conventional nuclear scientists claiming that these non-conventional models for LENR are in violation of known physics and that LENR is a pseudo-science, precisely due to the lack of a conventional model.

When neutrons are emitted in a reaction within an LENR apparatus, they are scattered, slowed, and captured by reactions within the apparatus. Depending on the initial energy of the neutrons, only a small fraction of the neutrons will escape the experimental apparatus. During this process, neutron activation may also occur, giving increased gamma ray radiation. A practical solution to study this process is a Monte Carlo simulation of the neutrons as they pass through the apparatus and escape a typical LENR reactor. In this paper, detailed Geant4 Monte-Carlo simulations have been performed to analyze the neutron behavior of an LENR reactor. This understanding of neutron behavior is essential for the understanding of an LENR. A typical LENR apparatus has been simulated, with a burst of neutrons released within a simulated palladium core acting as a neutron generator. This simulated neutron generator must then be placed inside of a set-up that is similar in geometry and dimensions to the actual set-up of the experimental apparatus. The expected energies of the emitted neutrons are 2.45 MeV and 14.07 MeV.

The Monte Carlos simulation will give the number of neutrons that escape the typical apparatus. In the end, we then estimate how many of these escaped neutrons are subsequently detected by a small He-3 detector, placed in a typical moderator tube of 5 cm diameter and 5 cm length. We will also place a 2x2 inch NaI detector outside the apparatus and simulate the gamma radiation due to neutron activation.



These results will help to make calibration and sensitivity estimates for an actual physical experiment for a small He-3 detectors, of similar geometry. In an actual physical LENR experiment, the accurate calibration of the sensitivity of the neutron detector is not straightforward. In a proper experimental calibration process, a physical neutron generator, emitting a known quantity of neutrons at the expected fusion energies, is placed inside of the physical apparatus. This difficult calibration procedure has not been done for an LENR, because such an actual neutron generator does not exist, and this problem is therefore solved by our Geant4 simulation results.

Progress on a model for anomalies in Condensed Matter Nuclear Science

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During the past year significant progress was made on our model for anomalies in Condensed Matter Nuclear Science. To develop cooperative Dicke enhancement factors, we work with nuclear transitions coupled to spatially uniform phonon and plasmon modes. Interactions are mediated by the new relativistic phonon-nuclear interaction, which is a result of the non-separability of internal and center of mass degrees of freedom for nuclei in the lattice [1]. The coupling is significantly stronger for this relativistic interaction than for electric and magnetic dipole coupling for the parameter regime of interest.

We have focused on a model for excitation transfer from the $D_2/^4He$ transition primarily to bound state Pd^*/Pd transitions [2,3]. The excitation of nuclear molecule states in the Pd isotopes in the model contributes to a loss mechanism connected to fission-based transmutation. Under normal conditions, destructive interference very much hinders excitation transfer rates. We have found that fast path-dependent loss mechanisms can increase the associated indirect coupling by many orders of magnitude.

In previous years our focus was on models based on coherent dynamics. There are technical issues associated with such an approach, and in the end, the associated rates are not sufficiently fast to connect with experiment. We have found that a model based on the Golden Rule for quantum mechanical incoherent processes can lead to dynamics sufficiently fast to be able to connect with experiment. A model that describes the system starting up has been developed and documented [3]. In this model, energy from acoustic phonons contributes to the excitation of Pd^*/Pd transitions, increasing the associated density of states, and greatly increasing the associated rate. A new model for the free exchange of phonons during the process has been proposed for this energy transfer. An analytic version of the model is found to agree with the numerical version, allowing the system to be better understood.

A model for excess heat production beyond start-up has also been proposed, but as yet not quantified. Prior to the meeting an effort will be made to evaluate this new model, and results if available will be presented. A model for the rate for low-level dd-fusion has been outlined, and results from this model will be presented if available.

[1] P. L. Hagelstein, "Lowest-order relativistic interaction between lattice vibrations and internal degrees of freedom of a nucleus," Journal of Physics B: Atomic, Molecular and Optical Physics, vol. 56, no. 19, p.195002, 2023.
[2] F. Metzler, C. Hunt, P. L. Hagelstein, and N. Galvanetto, "Known mechanisms that increase nuclear fusion rates in the solid state," New Journal of Physics, vol. 26, no. 10, p. 101202. Documentation of the new model is in the associated Supplementary Information section which was written by F. Metzler, M. Lilley, P. L. Hagelstein, J. Messenger and N. Galvanetto.
[3] Hagelstein, P.L., Metzler, F., Lilley, M.K., Messinger, J.F. and Galvanetto, N., 2024. Models for nuclear fusion in the solid state. *arXiv preprint arXiv:2501.08338*.

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Status of the Project on Using Modern AI Tools for LENR Research

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The field of Low Energy Nuclear Reactions (LENR) is a mixture of good and bad news. The good news is that 40 years of global laboratory research have (a) shown that LENR do occur and they produce significant energy, (b) provided a wealth of empirical information on LENR, and (c) indicated that LENR might be a very important new source of cheap and clean energy from widely distributed small generators. The bad news includes (a) LENR are not yet understood theoretically, (b) problems with LENR-active materials challenge the development of commercial power generators based on LENR, and (c) information on LENR is widely scattered in diverse publications, reports and postings. The last problem is being addressed in a program at New York University, which is supported by the Anthropocene Institute.

Recent advances in Artificial Intelligence (AI) have shown that modern computer tools based on sophisticated "Deep Learning" neural networks are widely useful for many tasks. Billions of dollars are being spent on the development, training, and deployment of AI programs for diverse uses in many countries. Modern AI tools are being applied and further developed in our program to enable mining and new uses of the literature on LENR for both scientific research and commercial developments. This paper will present the status of the project, and indicate our future directions.

The literature on LENR has been fully collected and systematically archived in a structured database. Currently, about 3,200 documents are fully formatted for use by Machine Learning algorithms. Additionally, approximately 1,200 documents have been downloaded and are in the process of being structured, with full completion expected by May 2025.

We are applying AI tools to the LENR literature, particularly focusing on ensemble learning algorithms. Our initiative involves (1) leveraging multiple Large Language Models (LLMs), including ChatGPT, LLaMA2, and others, to analyse and extract insights from LENR research, and (2) developing an ensemble learning framework that integrates outputs from these LLMs to enhance accuracy and robustness. This approach allows us to generate new algorithms that synthesize knowledge from different LLMs. We believe this work is novel, and will be presented for the first time at this conference.

The LENR Dashboard is fully deployed and offers a range of analytics and machine learning tools, including: (1) easy access to LENR research papers, (2) an advanced search engine, (3) an initial version of a ChatBot dedicated solely to LENR literature to minimize hallucinations, and (4) a document similarity tool, for which we plan to release an improved second version by the time of the conference.

The ChatBot was tested by asking experts on LENR to pose two types of questions to the ChatBot, and then evaluate the answers numerically. Some questions were provided to the experts and others were made up by them. The evaluations, although subjective, give an indication of the utility of the ChatBot.

Our future work will focus on enhancing the LENR research ecosystem through several key developments. We aim to establish a process for continuously updating the database and tools, covering the entire pipeline from LENR publications to processing and then applying machine learning algorithms to an updated corpus. Additionally, we plan to deploy a new version of the ChatBot incorporating an ensemble of ChatBots, which we expect to provide more accurate responses to LENR-related queries. The document similarity tool will be upgraded to support full-text similarity search. Lastly, we will explore using the ChatBot to assist in validating LENR experiment designs before they are conducted.

Acknowledgements: Contributors to this project include Naman Lalit, Suryavardan Suresh, Rasmika Billa, Dev Pant, Sneha Singh, Yvonne Wu, Atmaj Koppikar, Tanya Pushkin Garg, Yifei Xu, Emos Ker, Charles Wang, Benjamin Kang, Adelina Simpson, and Dongjoo Lee.

Dicke-Enhanced ^{57}Fe Nuclear Supertransfer and Implications for Solid-State Nuclear Reactions

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In 1964, Terhune and Baldwin proposed that nuclei embedded in a solid-state lattice are not independent two-level systems but instead interact through shared electromagnetic and phonon fields. [1] They anticipated that such interactions could lead to nuclear superradiance (i.e., collective spontaneous emission), which was realized in Chumakov et al.'s 2018 demonstration of superradiant decay in an ensemble of ^{57}Fe Mössbauer nuclei. [2] Nuclear decay lifetimes were observed to accelerate by up to a factor of fifteen for a ten-fold increase in the ^{57}Fe ensemble.

Here, we propose a modification to the Chumakov experiment designed not to enhance nuclear decay, but instead to stimulate nuclear supertransfer—a Dicke-enhanced process characterized by nuclear resonance excitation transfer and diffusion rather than enhanced radiative emission. Our approach places a ^{57}Fe crystal within a uniform, oscillating magnetic field, providing an indirect coupling mechanism that allows excitation to transfer between excited and ground-state nuclei. Unlike nearest-neighbor coupling, which is too weak to drive excitation transfer at the nuclear scale, this second-order interaction provides a pathway for long-range energy transfer. However, in its conventional form, nuclear supertransfer is suppressed by destructive interference between symmetric virtual-state transfer pathways and has thus never been demonstrated. We, therefore, introduce lead (Pb) into the shared boson field as a symmetry-breaking element. Ionization of Pb 2p electrons acts as a loss channel that selectively removes one set of interfering pathways, partially breaking destructive interference and enabling measurable transfer rates.

The ability to redistribute nuclear excitation in a solid-state environment has direct implications for condensed matter nuclear science. While the present experiment relies on indirect magnetic coupling, recent work on fusion in the solid state has suggested that an analogous process could be driven by phonon-nuclear interactions, where energy transfer is mediated by collective lattice vibrations. [3-5] If nuclear supertransfer can be realized in an engineered ^{57}Fe system, it would provide a controlled test case for mechanisms that may explain low-energy nuclear reaction anomalies in metal-hydrogen systems.

We discuss experimental considerations for detecting supertransfer as well as theoretical implications for engineered nuclear interactions in solid-state systems. By extending the framework of nuclear excitation supertransfer, this work provides a step toward controlled nuclear state and reaction parameter manipulation in structured materials.

[1] Terhune and Baldwin., Phys. Rev. Lett., 14:589–591, 1965.
[2] Chumakov et al., Nat. Phys., 14(3), 261–264, 2018.
[3] Metzler et al., New J. Phys., 26 101202, 2024.
[4] Hagelstein, J. Phys. B: At. Mol. Opt. Phys., 56 195002, 2023.
[5] Hagelstein et al., arXiv, 2024.

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Development of Quantum Hydrogen Energy and its practical applications

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Founded in September 2012, Clean Planet was established with a clear and unwavering mission: *"to create safe, stable, and affordable clean energy and make it available to all humankind to protect our beautiful Planet Earth."* In pursuit of this goal, we have worked in close collaboration with Tohoku University, advancing the research and development of **Quantum Hydrogen Energy (QHe)** — a groundbreaking energy source that promises a new path to clean and sustainable heat generation.
Since 2020, we have transitioned from basic research to applied development, accelerating efforts toward practical implementation and commercialization. Our work spans experimental validation, engineering design, and system integration — all with the aim of bringing QHe-powered devices into real-world use.

This presentation will highlight the latest developments at Clean Planet, illustrating how our technology has evolved and how we are striving to realize our founding mission. We will also share our current milestones and future outlook, as we take tangible steps toward delivering a next-generation energy solution.

Today, the world is facing an unprecedented energy challenge. Demand is growing rapidly, driven by the rise of artificial intelligence and data infrastructure. Energy prices continue to soar, and the climate crisis is deepening, with record-breaking temperatures becoming a new normal. Against this backdrop, the need for clean, reliable, and accessible energy is more urgent than ever.
The Clean Planet team remains firmly committed to this cause. We will continue to push the boundaries of science and technology until we succeed — to power a better future and protect the planet we all call home.



Waste heat power generation using Z Mechanism air expander

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As shown in Figure 1, The XY-separation crank mechanism (hereafter referred to as the Z Mechanism), which was devised by the authors, transmits force components independently along the X and Y axes. This mechanism replaces the connecting rod of a conventional piston-crank system with the Sliding Big-End Block and a combinator. As a result, the rocking motion of the connecting rod is eliminated, and the piston displacement follows a sinusoidal pattern with respect to the crankshaft angle.

Consequently, the modification of the mechanism's characteristics contributes to improved overall motion of the mechanism.

By configuring this mechanism in a mirror image layout, as shown in Figure 2, the reciprocating mechanism can operate with reduced vibration. An engine using the Z Mechanism in a mirror image arrangement is capable of achieving low-vibration operation, similar to a multi-cylinder engine utilizing a piston-crank mechanism.

We fabricated a prototype internal combustion engine and conducted operational tests. The results confirmed that the engine operated at 10,000 rpm, with suppression of both primary and secondary vibrations [1]. A conventional single-cylinder 4-stroke engine was used as the baseline for comparison, and the prototype demonstrated better torque performance at 2,000 rpm.

Currently, we are attempting to adapt this prototype engine for use in the ORC (Organic Rankine Cycle) under a NEDO-funded research project. As part of the preparatory phase, we modified the engine to operate using compressed air. This engine, operating on an air refrigeration cycle, achieved an output of over 0.9 kW when driven at 0.8 MPa.

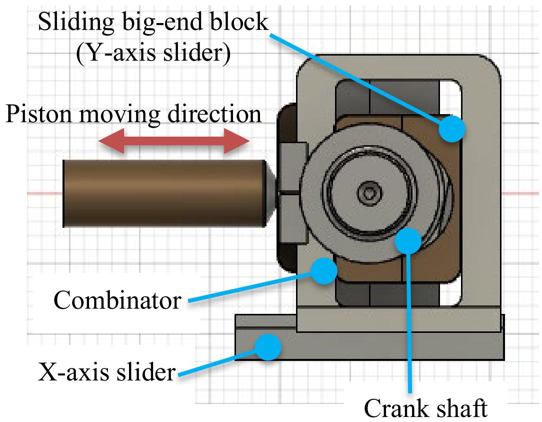

Fig.1 Side view of the Z Mechanism

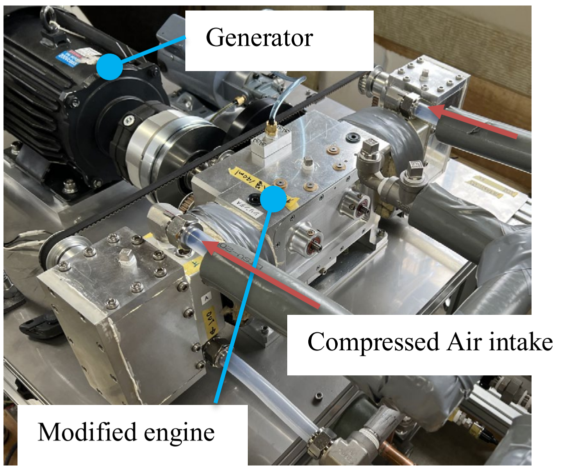

Fig.2 Experimental device of modified engine

We hope that this Z Mechanism can be used to convert anomalous heat into practical energy.

[Reference]

[1] Y. Yoshizawa et al., “Development of a low-vibration new structure engine by using the XY-separate crank mechanism (Second Report)”, Society of Automotive Engineers of Japan Autum Congress 2017. 20175200, pp. 1111–1115, (2017).

The ENG8 EnergiCells

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ENG8 is developing a range of **LENR reactors (EnergiCell®s)** that are being tailored for diverse market applications.

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3. Delivering electricity, both directly and indirectly.
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Each type of EnergiCell, test data and explanations of the reactions seen inside the EnergiCells will be presented. The progress we have made over the years is placing ENGS's technologies between **TRL4 and TRL7** on the technology readiness scale. With commercial deployment anticipated within the next two years.
ENGS's energy generators will be installed directly with end users factories, buildings, and homes-minimizing distribution inefficiencies. The cost of thermal and electrical energy generation using current components and a robust supply chain ranges between **€10-€15/MWh,** depending on operational factors like usage patterns and energy mix.
This energy price makes LENR energy costs **between five and ten times lower than alternative competitors (both renewable and hydrocarbon),** providing both a substantial market opportunity and high profit margins. Which is a primary driver for investors. This example should attract investors into investing in LENR research and companies working on commercialisation.

ENG8 aims to provide abundant, clean energy with love and compassion to our customers, bringing harmony to society and the environment we share.

We believe that universal access to abundant, affordable, pollution-free energy is a fundamental human right. ENG8 intends to be a catalyst for change ushering in a future where such energy isn't just a luxury but a necessity, we can all afford.

With practically unlimited energy available via its EnergiCell®s, ENG8 plans to be an energy supplier that aims to educate its customers about their environmental and social responsibilities as well as how to maximise the benefit they will receive from using EnergiCell®s.

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Advancements in Low Energy Nuclear Reactions (LENR) for Sustainable and Efficient Energy Production

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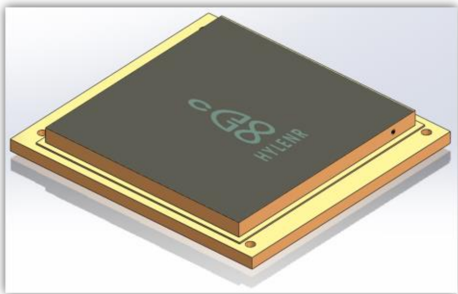
HYLENR Technologies Pvt Ltd is at the forefront of developing innovative solutions for clean and efficient energy generation through Low Energy Nuclear Reactions (LENR). Our system employs minimal hydrogen and a small electrical input to produce significant excess heat/electricity. Recently the company has achieved improved coefficient of performance (COP), which has increased from 1.5 to values as high as 1.78, repeatedly and consistently with occasional peaks reaching 2. This advancement stems from extensive research in various process parameters. These findings demonstrate the potential of LENR technology as a groundbreaking approach to sustainable and efficient energy production.

The devices are being configured and customised to different form factors such as cuboidal, single and double flange and tiles to suit customers' requirements.

The current focus is on developing heating systems that benefit various industries in multiple ways. A key achievement is the creation of heat treatment furnaces using proprietary HYLENR heaters. These furnaces are designed for a range of applications such as casting, molding, and manufacturing processes. Efforts are now directed toward scaling up the systems for real-world testing, with plans to collaborate with research institutions to set safety standards and improve manufacturing processes. The LENR technology has been actively demonstrated to the public, media, and industry.

At HYLENR Technologie's goal is to make energy generation cleaner, safer, and more efficient for everyone.



References
[1] Prahlada Ramarao, Shree Varaprasad N S, Shashank G Dath, Mohankumara P B and Suprith G C, “Validation of Excess Energy in the H2 Loaded Palladium System,” Journal of condensed matter nuclear science, vol. 38 (1), pp. 357-362, 2024
[2] Prahlada Ramarao, Shree Varaprasad N S, Shashank G Dath, Mohankumara P B and Suprith G C, "Exploring the Potential of Low Energy Nuclear Reactions (LENR)," 25th International Conference on Condensed Matter Nuclear Science, SZCZECIN, POLAND, pp. 49, 2023

Hot spots and melted regions observed during anomalous heat generation using nanostructured Ni composites and hydrogen

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We have been working to clarify the anomalous heat generation phenomenon caused by NiCu nanostructured composites and hydrogen with the aim of applying this phenomenon to energy sources. The experimental method is to generate anomalous heat by hydrogen absorbed nanostructured NiCu composite and rapid heating in a vacuum. Anomalous heat generation exceeding 20 keV/H per hydrogen is observed reproducibly, and spontaneous and intentional heat burst phenomena are often observed, which cannot be explained at all by known chemical reactions. Amount of energy released and whether heat bursts occur have also been found to depend on the surface structure and composition.[1]-[3].

Two-color surface temperature measurement system was introduced to measure the surface temperature (two-dimensional) distribution during anomalous heat generation and heat bursts about a year ago. Main results obtained so far from 2D surface temperature distribution measurements are as follows.

1) The surface temperature distribution during the intentional heat burst phenomenon was observed and summarized as a movie, which allowed a good understanding of the heat burst phenomenon situation.
2) The surface temperature of Ni nanocomposite structure sample with heat generation had an extremely high temperature gradient. This is because anomalously large energy was generated in the higher temperature region and transferred to the lower temperature region.
3) Such regions of high temperature, or to put it another way, several hot spots were often observed in some cases.
4) In some cases, hot spot temperatures exceeded 1000°C, the upper limit for measurement. Furthermore, SEM observation of the area near the hot spots after the experiment showed that the surfaces had melted and recrystallized. This suggests that the temperature near the hot spots exceeded 1455°C, the melting point of Ni.

Since the number of observations is still small after the start of surface temperature distribution measurements, further experiments under various conditions and verification of measurement accuracy are needed. Nevertheless, recently obtained experimental results further support the existence of anomalous heat generation phenomenon that cannot be explained by known chemical reactions.

Acknowledgements
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Reference

[1] Y. Iwamura, T. Itoh, S. Yamauchi and T. Takahashi, *Jpn. J. Appl. Phys.* **63** (2024) 037001.https://doi.org/10.35848/1347-4065/ad2622
[2] Hioki T, Iwamura Y, Itoh T, Saito M, Yamauchi S, Takahashi T and Kasagi J, *Frontiers in Materials* **11** (2024): 1407810. https://doi.org/10.3389/fmats.2024.1407810
[3] Y. Iwamura, T. Itoh, J. Kasagi, T. Takahashi, S. Yamauchi, M. Saito, S. Murakami, and T. Hioki, “, *J. Condensed Matter Nucl. Sci.* **38** (2024) 269-286.

27p-2

Anomalous Heat Effects via Longitudinal and Transversal Excitations in Constantan Wires: Advances in Electromigration and Plasma Generation

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** Experiments at LNF concluded on 01 August 2024 due to bureaucratic challenges; however, they were seamlessly resumed at an alternative location using the identical setup.*

Since ICCF25 in August 2023, our experimental focus has been on enhancing the Coefficient of Performance (CoP) of Anomalous Heat Effects (AHE) by increasing the heat effect itself from an academic perspective and by reducing the external energy required to create forced non-equilibrium states through primarily electrical excitations. Historically, since 1994, we employed long, thin wires of palladium, an "active material" with a high capacity for hydrogen or deuterium absorption, especially into dislocations, vacancies, and impurities. The AHE was primarily induced by electromigration along the wire, using both DC and more effectively, high-peak-power, high-frequency pulsed (unipolar negative) currents. In 2011, we transitioned to using Constantan (Cu-Ni-Mn alloy) due to its cost-effectiveness and suitability for practical AHE applications.
We identified two primary methods for inducing AHE in wires: longitudinal excitation of the main electrode (ME) to affect the bulk (incorporating the effects researched by Y. Fukai, M. Staker, and G. Preparata) and transversal excitation near the surface of a counter-electrode (CE) doped with low work function materials (Ca-Sr-Ba). This latter method operates under Paschen or dielectric barrier discharge (DBD) conditions, utilizing short distances and low gas pressures to apply high voltages (effective 300-1200 V) and several microsecond pulses. The typical operating temperatures within the core reactor ranged from 500-900°C. Significant improvements over the past two years include:

1. The adoption of a commercial dimmer (TECNEL-Italy, costing less than 400 Euro) enhanced with simple ancillary circuitry to generate the primary pulse for both longitudinal and transversal excitations. This high-power, high-efficiency (95%), 2 kVA dimmer, equipped with two independent SCR stages for outputting both positive and negative voltage pulses, has replaced our previous high peak power, fast rise and fall time pulser which was home-made and less durable under heavy and unpredictable test conditions. The main limitation of the TECNEL unit is its fixed frequency (recently increased from 50 to 100 Hz) and a maximum peak voltage of about ±300 V, necessitating an uninterruptible power supply for stable voltage output.
2. We developed a custom circuitry with a broad bandwidth connected to the CE capable of inverting the polarity of the main pulse, boosting the voltage up to about 1000 V (necessary for Paschen/DBD regimes), controlling current injection to protect the long, thin ME wire (2 m long, 200 µm diameter), and providing a delay time of only 50 ns.
3. Introduction of a weak gamma source (~30 kBq) using WTh TIG electrodes inside a hermetically sealed stainless steel tube external to the reactor, aimed at increasing the rate of Paschen/DBD discharges through gas pre-ionization.
4. Development of unique connections and novel circuit designs (patent pending) linking the dimmer to the reactor, enhancing both the overall efficiency of the dimmer and its repetition rate (from 50 to 100 Hz).

Utilizing these facilities, we achieved a best AHE of about 18 W with an input power of 60 W, corresponding to an efficiency of approximately 27% for several weeks under a H2-Ar gas mixture at about 140 mbar pressure. We will present and extensively discuss these latest results and, if the fourth improvement proves effective, we will also briefly cover its impact.

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Heat Measurement in Hydrogen Absorption into Metal Composite Powder and Thin Films

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In a study of low-energy nuclear reactions in condensed matter, it was reported that hydrogen absorption in copper-nickel powder with zirconia as a support (CNZ) generated excess heat 100–1000 times higher than that expected from the chemical reaction [1]. This suggests the induction of new physical phenomena that cannot be explained by the reaction processes in conventionally considered metal–hydrogen systems.

In this study, experiments were conducted to confirm the reproducibility of this heat generation phenomenon in a CNZ sample. The experimental setup is shown in Fig. 1. After setting the CNZ sample in the inner chamber, the outer and inner reactor chambers, which can be thermally insulated from the environment, were evacuated to a pressure of a few pascals using a scroll pump, and hydrogen was supplied to the reactor chamber at a pressure of 1.6 atm. Then, 50–80 W of constant power was applied to the heater, and the sample was heated for 6 h. Four thermocouples were installed in the inner chamber to measure the sample and gas temperatures at various locations throughout the experiment. For reference, we performed an experiment using zirconia beads, which do not absorb hydrogen. Subsequently, the heat generation due to hydrogen absorption for the CNZ sample was evaluated by comparing its thermal behavior with that of the zirconia beads. Consequently, at an input power of 80 W, an excess heat of 4–9 W was calculated for the hydrogen gas temperature inside the reactor chamber. This result is consistent with that reported in [1], and we confirmed the reproducibility of the phenomenon.

Nuclear transmutation has also been reported to occur under laser irradiation [2]. Thus, we performed a hydrogen loading experiment on the sample. We used a laser with a wavelength of 793 nm and varied its output power as 1–6325 mW. We did not observe a significant effect of laser irradiation. It may be necessary to optimize the laser specifications and irradiation conditions based on the properties of the CNZ and zirconia beads.

In addition to powder samples, exothermic phenomena in hydrogen absorption and desorption with composite metal thin film samples have also been reported. Therefore, we are currently performing experiments using composite thin film samples. In this paper, we report the heat generation results for a palladium-nickel multi-layer sample deposited onto a zirconia plate.

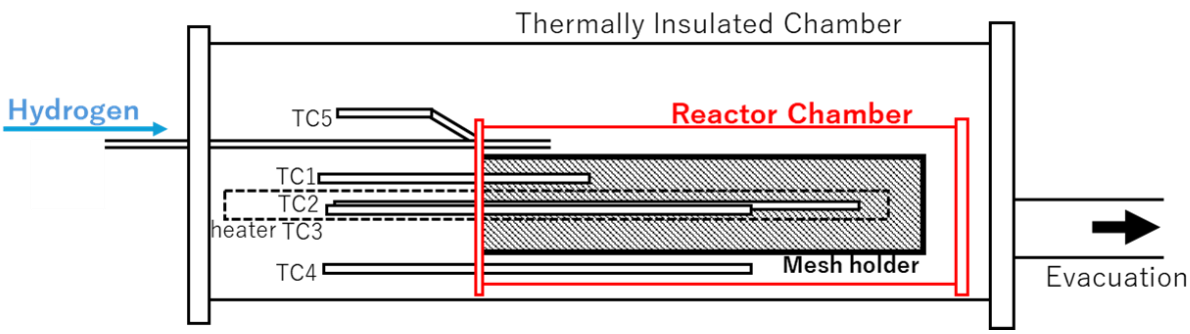

Fig.1: Schematic of the experimental setup.

[1] M. Hasegawa et al., Proc. of JCF22 (2022) 13.
[2] U. Mastromatteo, J. Condensed Matter Nucl. Sci. 19 (2016) 173.

An XAFS study on the surface structure after anomalous heat generation experiments using a material system of Ni-Cu multilayer on Ni substrate

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Anomalously large heat generation has been reported using nano-structured multilayer metal composites and hydrogen gas by Iwamura et al [1, 2]. They prepared a material system consisting of ~100 nm-Ni/Cu multilayer on 0.1 mm-Ni substrate. When the system was preloaded with hydrogen followed by evacuation and simultaneous heating to several hundred ℃, a heat power larger than the input power was triggered to generate. The anomalous heat generation for the system was also confirmed using radiation calorimetry established by Kasagi et al. [3, 4]. Once triggered, the excess heat generation persisted for a long time (e.g., 6~80h), sometimes accompanied by sudden heat burst phenomena. The total excess heat was far too large to be explained by any known chemical reactions and the excess heat was suggested to originate from nuclear related reactions [2, 4]. However, neither neutrons nor gamma rays were observed, and no significant increase in mass number 4 (^{4}He) was observed in mass spectroscopy measurements during anomalous heat generation experiments [2]. The characteristic feature for the surface of samples that showed greater excess heat was the presence of regions of high oxygen concentration (ROHC) [2].The ROHC was randomly distributed on the surface and its size was ~ 5 μm. The oxygen concentration in the RHOC was 10 ~ 40 at% on the surface, which was much larger than that of less than ~1 at% for normal area surrounding the ROHC.

In this study, to clarify the surface structure and the chemical state of oxygen, X-ray absorption fine structure (XAFS) measurements were performed for samples which showed higher excess heat in long time (~10 h) heat generation experiments. Ni K-edge XAFS spectra were taken by conversion electron yield method and Cu K-edge XAFS spectra were taken by fluorescence yield method, using the beam line BL5S1 at the Aichi Synchrotron Radiation Center. The incident angle of the X–ray was fixed at 2° to the sample surface. The footprint of the irradiated X-ray at the center of the sample was 0.5mm wide and 2.3mm long. The near edge (XANES) spectra were compared with those for reference materials of pure metals, oxides, and hydroxides. As a result, about 5 % of Ni and Cu atoms were suggested to be in the chemical state of $NiO_{1-⊿}$ and $CuO_{1-⊿}$, respectively. The Cu K-edge extended X-ray absorption fine structure (EXAFS) spectra suggested that Cu atoms occupy Ni sites of FCC structure. Thus, the structure of the surface layer after anomalous heat generation experiments was suggested on average to be approximately $(Ni_{1-x}Cu_x)_{1-y}O_y$ with FCC structure close to pure Ni, where x ≦ ~ 0.01, y ~ 0.05. The Ni K-edge XANES spectra suggested that RHOC extended much deeper than the thickness of natural oxide film of metallic Ni. To clarify the formation mechanism of RHOC, further studies using in-situ measurements with micro beam are expected.

[1] Yasuhiro Iwamura, Takehiko Itoh, Jirohta Kasagi, Shoichi Murakami, Mari Saito, ”Excess energy generation using a nano-sized multilayer metal composite and hydrogen gas” J. Condens. Matter Nucl. Sci. vol.33, pp.1-13, 2020.
[2] Yasuhiro Iwamura, Takehiko Itoh, Shinobu Yamauchi, Tomonori Takahashi, “Anomalous heat generation that cannot be explained by known chemical reactions produced by nano-structured multilayer metal composites and hydrogen gas”, Jpn. J. Appl. Phys., Vol. 63, 037001, 2024.
[3] Takehiko Itoh, Yoshinobu Shibasaki, Tomonori Takahashi, Mari Saito, Jirohta Kasagi, Yasuhiro Iwamura, “Optical observation of spontaneous heat burst phenomena during hydrogen desorption from nano-sized metal composite”, J. Condens. Matter Nucl. Sci., Vol.36, pp.274-284, 2022.
[4] J. Kasagi, T. Itoh, Y. Shibasaki, T. Takahashi, S. Yamauchi, Y. Iwamura, “Photon radiation calorimetry for anomalous heat generation in Ni-Cu multilayer thin film during hydrogen gas desorption”, arXiv:2311.18347 [physics.ins-det], 2024.s

A New Understanding of Cold Fusion Based on the Observed Behavior

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Cold fusion requires two essential conditions for it to occur. First, the creation of a location in which the Coulomb barrier can be reduced, which is called the nuclear active environment (NAE). This process cannot happen in the crystal structure because the required conditions violate the rules governing such structures. Second, the nuclear fuel must diffuse from its usual location in the crystal structure to the NAE. The number of active sites and the rate at which the fuel can be replaced in the NAE as it is converted to the nuclear product determines the total amount of power. Upon arrival in the NAE, the fuel is converted to a nuclear product by a very unusual nuclear process, which involves the electrons within the NAE reducing the Coulomb barrier and carrying away part of the nuclear energy, with helium being the final nuclear product when deuterium is used. This paper describes how these requirements can be applied without violating the rules governing a chemical environment or the nuclear mechanism. The nature of the nuclear process is discussed using only the observed behaviors and their implications.

The following questions are answered:

1. How can the NAE be created with reliability?
2. How can the rate of the fusion reaction be controlled and increased?
3. What behaviors justify the proposed emission of H^4 as an initial nuclear product?
4. What behaviors justify the proposed emission of electrons as the result of fusion?
5. How can the cold fusion process be made a practical source of energy?

Reactor Model Leveraging Arrhenius Equation Quantifies LENR Ignition Conditions

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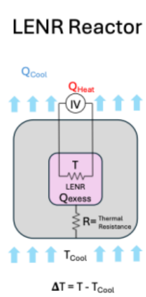
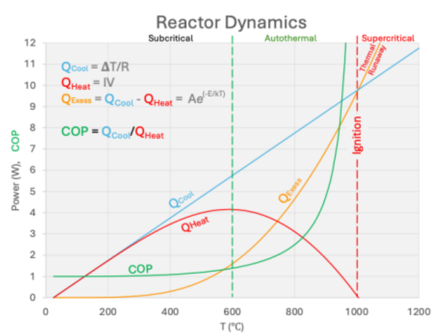
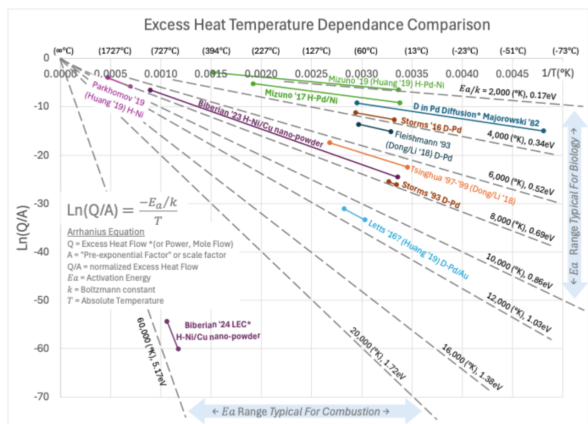
LENR experiments which have reported excess heat that follow an Arrhenius temperature dependance [1] are analyzed and compared. Building on Ruer's reactor model [2] along with textbook reactor principles [3], the model is extended, enabling the calculation of critical temperature thresholds for autothermal and runaway action.

COP is calculated as a function of temperature, thermal resistance and Arrhenius parameters. It stays close to 1.0 at temperatures below the autothermal threshold, getting to only ~1.2 as it crosses it. However, it rises fast as fuel temperature increases above this threshold.

The data from several published experiments including Mizuno[4] and Biberian[5] were loaded into the model. These experiments operated at or below their autothermal thresholds. Mizuno's reactor, with very low thermal resistance, would seem to benefit from adding insulation. Biberian's has good vacuum insulation that is however offset by lower fuel reactivity (high activation energy). A reactor with Mizuno's fuel and Biberian's insulation could possibly achieve full autothermal operation below 500℃.







References
[1] Nagel, D.J., 2022 "*Input Stimuli and Output Signals for LENR Experiments",* J. Condensed Matter Nucl. Sci.,. **36**: p. 62. https://doi.org/10.70923/001c.72589
[2] Ruer, J., 2017 "*Basic Design Considerations for Industrial LENR Reactors",* J. Condensed Matter Nucl. Sci.,. **22**: p. 11. https://doi.org/10.70923/001c.72416
[3] Hill, C. G. 1977 "Introduction to Chemical Engineering Kinetics and Reactor Design", Wiley. p.365. ISBN: 0-471-39609-5
[4] Mizuno, T., 2017 "*Observation of excess heat by activated metal and deuterium gas",* J. Condensed Matter Nucl. Sci.,. **25**: p. 1-25. https://doi.org/10.70923/001c.72456
[5] Biberian, J.P., et al., 2024 "Excess Heat in Nanoparticles of Nickel Alloys in Hydrogen", J. Condensed Matter Nucl. Sci., 2024. 38: p. 186-195. https://doi.org/10.70923/001c.124956

Multiple Scattering, Quantum Flux and Quantum Hydrogen Energy

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30 year pursuing "Heat after Death" reveals: the anomalous heat is correlated with an anomalous D_2 flux (Fig.1). Multiple scattering is able to explain this correlation using 2-step resonance model. In addition, it may answer the Huizenga's 3 puzzles, Karabut's directional X-ray, Helium-4 and Tritium-4 production, Mizuno's electron beam effect in Aluminium hydrides, etc. The isotope effect in electron screening potential is proposed to test this multiple scattering model.

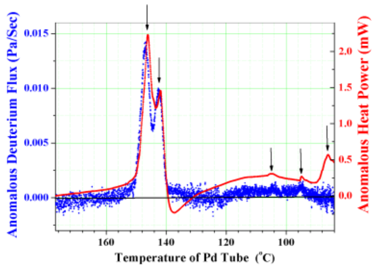

Figure 1. Correlation between anomalous D_2 flux peaks and anomalous heat power peaks while Pd tube is cooling down

Correlation between Anomalies. Anomalous flux passing through the thin wall of a Pd tube is different from the classical 2-body collisional diffusion which is monotonically decreasing with temperature. In Fig.1 peak wise anomalous D_2 flux (blue) appears near certain temperatures (145°C and 80°C). It implies a quantum diffusion mechanism (Wave mechanics). Peak wise anomalous heat power (red) appears near the same temperatures and its temperature dependence is different from 2-boday nuclear resonant reaction also. It implies a mechanism other than 2-body resonance reaction also.

Resonance connects forward scattering and nuclear transition in lattice.

Multiple scattering assumes the solid as a group of scatterers with electron screening potential. In Fig.2, the red primary incoming wave and scattered wave would be interfered by the blue secondary incoming waves and scattered waves. It may enhance the phase shift and result in resonance when the scatterers satisfy the coherence condition. Based on ***optical theorem***, this resonance would maximize the forward scattering–a penetrating D_2 flux. At the same time the resonance would put the peak of the wave function at the surface of target nucleus–***"pull-in effect"***, which would greatly enhance the probability of nuclear transition. Thus, nuclear reaction is correlated to a D_2 flux through the coherent resonance in multiple scattering. Quantum diffusion induces quantum hydrogen energy due to cohenrent resonance in multiple scattering.

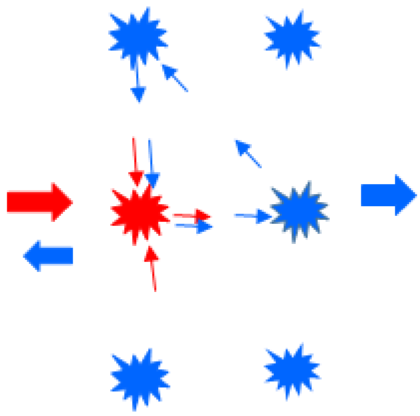

Figure 2. Multiple scattering in crystal lattice

Isotope effect of electron screening potential. Prof. Kasagi pointed out that it might need some new mechanism to explain the peaks of the "electron screening potential". The isotope abundance of first 3 peaks (Be-9, Al-27, Co-59) is 100%, and their atomic mass numbers, A, follow the cubic root law ($\sqrt[3]{A}$) very well (Fig.3). It predicted the Pd-110 as the 4-th peak in Kasagi's plot. However, these experiments were done using natural Pd only, and Pd-110's isotope abundance is 11.72%. If enriched Pd-110 is applied for screening material, the stripping reaction ${}^{110}_{46}Pd(d,p){}^{111}_{46}Pd$ might produce more additional protons to enhance the 4-th peak of the electron screening potential. Using enriched Pd-110 would be a good test to this coherent multiple scattering resonance model.

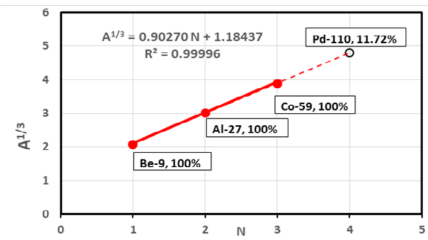

Figure 3. $A^{1/3}$ **of first 4 peaks in Kasagi's plot align on a straight line.**

Review of LENR Experiments with Titanium

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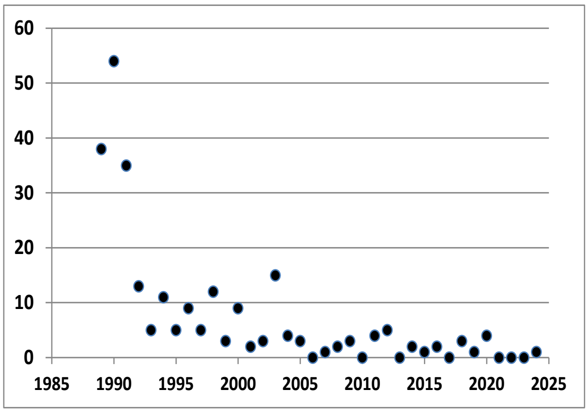
Most LENR experiments have involved palladium or nickel. However, there are many other metals, compounds, and alloys that can absorb large amounts of hydrogen isotopes. Such "hydrogen storage" materials are candidates for additional LENR experimentation [1]. There are two motivations for such research, (1) scientific understanding of LENR and (2) development of high-performance, long-lasting materials for commercial LENR generators.



Titanium was recognized as a potentially valuable LENR materials soon after the announcement by Fleischmann and Pons. A compilation of the titanium LENR papers was made for the years 1989 through 2024. This figure is a plot of the number of papers for each year as a function of the year. It is seen that there was a high level of interest and activity in the early three years of 1989, 1990 and 1991. Overall, 127 papers on Ti LENR experiments appeared in those three years. The reason for the large drop from 1991 to 1992 is unclear. After that, the publication rate declined erratically until about 2005. Since then, there have been only a few papers on the use of titanium in LENR experiments within a year, often times only two, one or even no papers. What caused the variation in the interest in Ti for LENR experiments?

LENR experiments with Titanium were dominantly electrochemical, with very few hot gas or plasma approaches to loading. Output measurements included (a) neutron, charged particle, and photon measurements, (b) calorimetry for heat production, and (c) chemical analyses for transmutation products. A few studies in the LENR literature focused on titanium processing and properties, including electrical resistance.

The current low rate of production for LENR papers involving titanium does not mean that such experiments are not worthwhile. There are many input variables, such as short pulses, that have yet to be explored in titanium LENR experiments. Also, there are very many variables in the composition and structure of titanium materials for LENR studies. One is the use of TiD_2, an FCC metallic compound, as cathodes in electrochemical LENR experiments. Another is to use flash-sintered porous Ti materials as cathodes, which contain numerous small structural gaps.

The relative importance of composition and structure in LENR-active materials, such as titanium, remains to be determined. It is possible that the composition mainly determines the ability of a material to retain hydrogen isotopes, and to supply them to active sites. Then, it might be the structure that determines the active sites for LENR. Support for such a scenario is in a new paper by Storms [2]

[1] G. Walker (Editor), Solid-State Hydrogen Storage: Materials and Chemistry, Woodhead Publishing, 1st Edition (2008)
[2] E. Storms, "A New Understanding of Cold Fusion Based on the Observed Behaviour", This Conference

28a-5

Investigation the impact of temperature and atmosphere on the microstructure and excess heat of Pd-Ni-Zr alloys

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Pd-Ni-Zr (PNZ) alloy powder has been identified as one of the most promising materials for low-energy nuclear reactions (LENRs) [1]. Various compositions of PNZ alloy powders were synthesized via high-energy ball milling and subsequently treatments under high-temperature vacuum, high-temperature oxidation, and deuterium gas reduction atmospheres [2]. The resulting powders were then evaluated for their LENR excess heat. Microstructural characterization was performed using scanning electron microscopy (SEM), transmission electron microscopy (TEM) and X-ray diffraction (XRD). The results indicate that both temperature and atmosphere conditions significantly influence the microstructure of the powders, particularly in terms of particle size and phase composition as shown in Figs. 1 and 2. Seebeck calorimetry revealed that atmospheric treatments enhance the excess heat, which increases with repeated deuterium charging cycles. It ultimately produced a stable excess heat of about 0.5 W using a 5-g PNZ sample (see Fig. 2(b)) and maximum excess heat of 8 W using a 2.5-g Pd-Ni (weight ratio 1:10) sample. Additionally, the excess heat exhibits a dependency on temperature changes but is not sensitive to specific stable temperature values.

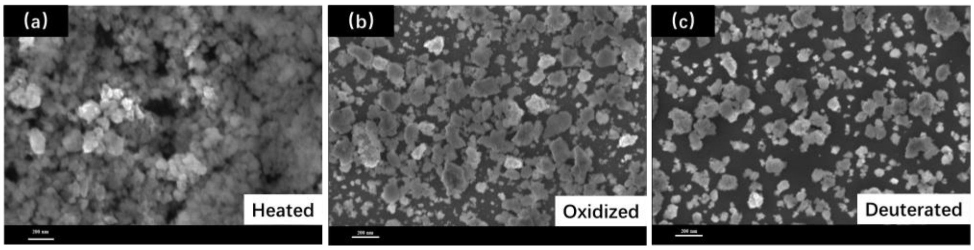

Fig. 1. SEM of PNZ7 after (a) High-temperature vacuum, (b) Air calcination and (c) High-temperature deuterated.

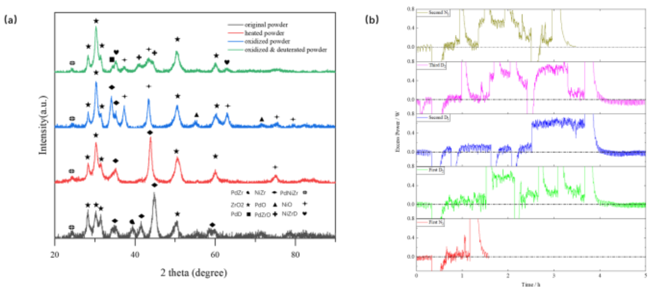

Fig. 2. (a) XRD patterns of the original and pre-treated PNZ7; (b) Excess heat under different atmospheres.

Keywords: LENR, SEM, TEM, XRD

References

[1] A. Kitamura, A. Takahashi, et al., "Excess heat evolution from nanocomposite samples under exposure to hydrogen isotope gases", Int. J. Hydrogen Energy, 2018, **43**: 16187-16200.

[2] H. Zhao, Y.-X. Liang, W.-Y. Xiao, W.-S. Zhang, D.-H. Liu, X.-H. Ma, "Refinement process and mechanism of nano Cu-Ni-Zr alloy by high-energy ball milling", J. Condensed. Matt. Nucl. Sci., 2025, **39**.

Anomalous temperature increases in Cu nano particles exposed to colliding pulsed super-multi-jets of hydrogen gas

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Anomalously large heat generation due to the interaction between nano-structured metals and hydrogen was observed in several reports. Kitamura and Takahashi demonstrated that binary metal nanocomposites produce significant excess heat energy, up to 100 MJ/mol-M, at 200-300 °C, beyond what can be explained by chemical reactions, with observations extending across D-Pd·Ni, H-Pd·Ni, and H-Cu·Ni systems [1]. Iwamura and Itoh developed an experimental method to observe anomalously large heat generation exceeding 10 keV H^{-1} using Ni-based nano-structured multilayer metal composites preloaded with hydrogen and rapidly heated to induce the reaction [2].

Thus, we have developed a reaction system with a small constant volume chamber and conducted some fundamental experiments to evaluate the anomalous heat from the absorption of hydrogen gas into nano-metal powder and several kinds of nano-structured metal composites, especially under the rapid pressure increase. In the experiments on the absorption of hydrogen gas (0.12–0.5 MPaG) injected with single pulsed flow generated by the solenoid valve into 3.0 g of Pd-Ni-Zr composite powder initially heated(367K-517 K) by the heater. [3], the results indicated that higher-pressure conditions, higher initial temperature of metal powder, and the single pulse flow led to more temperature increase in hydrogen gas absorption by metal powder [4]. In other experiments on the absorption of 0.5 MPaG hydrogen gas injected with pulsed flow into 1.0 g Cu nano particle about 280 K of temperature rise is observed within 1 second from injection of hydrogen gas [5].

In this study, we developed another new reaction system (Fig.1) which could generate high-temperature and high-pressure regions by applying the super-multi-jets colliding with pulse [6] and conducted some experiments. We measured temperature increase of 1.0 g Cu nano particles initially heated over 523 K in hydrogen gas injected with 8.0MPaG pulsed flow. As a result, we observed rapid temperature rise over 600 K, reaching up over 1000 K, by 0.1 second after hydrogen gas injection (Fig.2). This refers to the possibility that hydrogen injection with the colliding super-multi-jets leads to much more temperature increase of Cu nano particles.

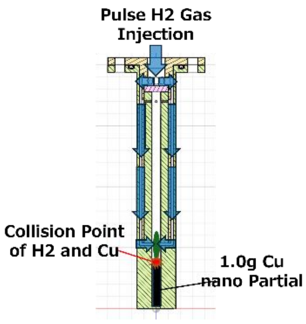

Fig.1 Chamber of new reaction system

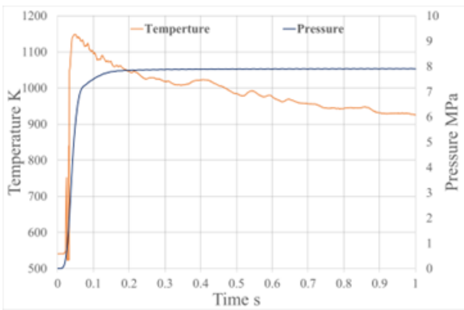

Fig.2 Result of experiment with Cu particles and hydrogen

[1] A.Kitamura, A.Takahashi, et al, Int. J. Hydrogen Energy, vol. 43, pp.16187-16200, 2018.
[2] Y.Iwamura, T.Itoh, S.Yamauchi, T.Takahashi et al, Jpn. J. Appl. Phys. 63, 037001, 2024.
[3] T.Kobayashi, et al, "Heat generation of metal composite powder caused by the pulse flow of hydrogen gas," The 22nd Meeting of Japan CF-Research Society JCF22 Abstracts, pp.6, 2022.
[4] T.Kobayashi, K.Naitoh, et al, J. Condensed Matter Nucl. Sci. 36, 318-325, 2022.
[5] T.Kobayashi, K.Naitoh, et al, ICCF-25, Radisson Blu Hotel, Szczecin, Poland, Aug. 2023.
[6] K.Naitoh. et al, J. Condensed Matter Nucl. Sci. 24, 236-243, 2017.

29a-2

Boosting the interaction between Pd and H_2/D_2 via atom-stepped interfaces

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The highly active interface is crucial for the H/D loading performance of nanomaterials, which profoundly affecting the occurrence of low energy nuclear reaction (LENR). However, it is still challenging to conveniently and efficiently regulate the atomic packing of metals used for LENR. Herein, a simple and effective strategy is reported to obtain abundant high-energy stepped atoms at the interface via controlling the migration behavior of sputtered atoms during thin film deposition. By adjusting the sputtering power and temperature of substrate, a wide-scale stepped interface structure with micro-nano and sub-nanometer size is formed, resulting in the formation of irregular conical columnar nanocrystals as shown in Fig. 1. Benefiting from the activity and stability of a large number of atomic steps at the serrated interface, Pd nanofilm materials exhibit superior threshold pressure and saturation pressure at 200°C. The resultant Pd film demonstrates a hydrogen loading capacity of 110.06 cm^3/g at 6 MPa, which is 2.2 times that of conventional Pd films. This method is based on the control of nucleation and crystal growth during the film deposition of magnetron sputtering. This approach of obtaining high-density stepped interface structure by providing appropriate energy during atomic migration on the surface of columnar crystals can be easily extended to other substrates or precious metal systems, providing a new strategy and guidance for designing efficient and economical H/D carrying materials to enhance LENR performance.

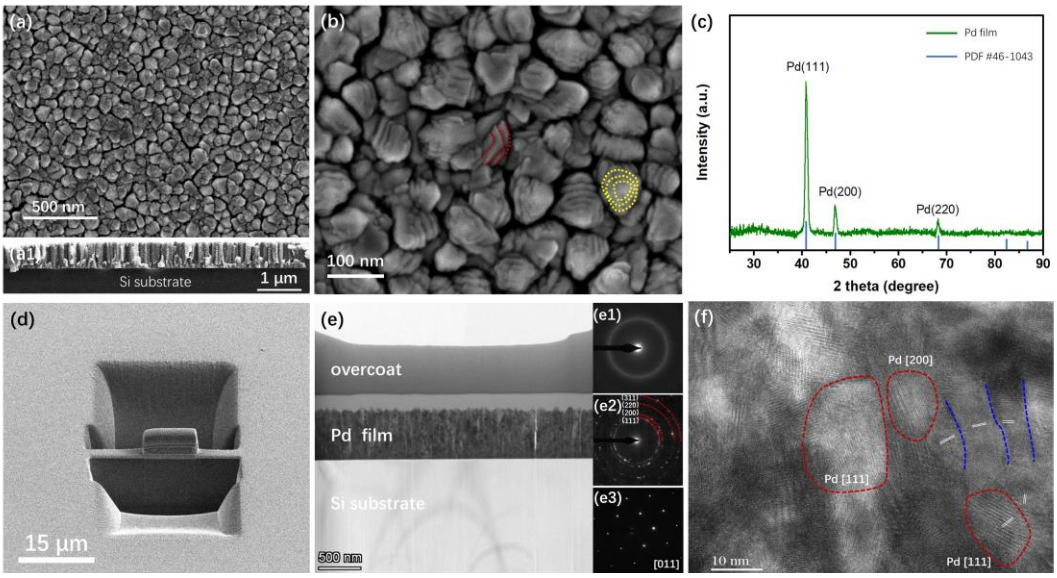

Fig. 1. (a) Planar SEM and (a1) cross-sectional SEM of Pd film with a typical stepped interface structure; (b) High magnification SEM; (c) XRD pattern; (d) FIB diagram; (e) TEM, where (e1) is the diffraction pattern of the protective layer region, (e2) is the diffraction pattern of the thin film layer region, and (e3) is the diffraction pattern of the substrate layer region; (f) HRTEM, where the red- and the blue-dashed curves represent typical grains and adjacent crystal interfaces, respectively. The white-solid lines represent atomic arrangement orientations.

29a-3

Changes in the excess heat from Cu-Ni/ZrO2 samples with their initial calcination conditions

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The evaluation of excess heat of Cu-Ni/ZrO_2 sample at Kobe university has been executed with the powder sample and hydrogen (H2) by gas loading method. The results show that the clear generation of excess heat (250W/kg) and reproducibility due to the repetition of test and the samples by different fabrication lot. The reaction sites of MHE seem to be in some nanostructure of Cu and Ni, but the exact site and nanostructure have not been determined. The fabrication process of sample is important matter for the nanostructure and for the excess heat generation. [1,2,3]

The steps of fabrication of sample and the evaluation test are as follows; the amorphous ribbon made by melt-spinning method is calcinated in the air (so called “initial calcination”), and glinted to powder sample. The powder sample is settled with hydrogen gas in the reactor chamber and heated to high temperature above 350 °C by electric heater. The sample was calcinated again in the air (so called “re-calcination) after the evaluation test. The past result shows the increase of excess heat by the re-calcination. The nanostructure and reaction site are seemed to be made in these steps, namely the initial calcination, high temperature with hydrogen and re-calcination.

In this presentation, the relation will be shown between the initial calcination conditions and the generated excess heats. In the initial calcination, zirconium in the amorphous ribbon was formed to be zirconium oxide (ZrO2) and to be powder sample. Cu and Ni were formed to be some nanostructure in the way dispersion and fixed in and on the Zirconia base structure. The used three conditions of initial calcination were as follows;

1) Increase to 450 °C in 10 min and keep 450 °C for 60h (usual way till now)
2) Preheated up to 450 °C and keep 450 °C for 60h
3) Increase to 450°C by 30h and keep 450°C for more 30h

Each sample generated the excess heat at the first evaluation test. Each sample shows the deference of excess heat and hydrogen absorption behavior. The effects of re-calcination are confirmed at first one, but it’s not clear for the increase at second one and after. The detail results will be reported in the presentation.

[1] A. Takahashi et.al., “Rising characteristics of MHR power with CNZ material”, IN Proc. JCF23, pp. 119-125.

[2] Y. Mori et.al., “New MHE experiments by D-system”, IN Proc. JCF22, pp. 1-12. (2022).

[3] M. Hasegawa et.al., “Characteristics of excess power generation in MHE experiments by D-system”, IN Proc. JCF22, pp. 13-26.

Collective Oscillations of Protons in Hydrogen-loaded Metals

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We summarize our recent calculations and numerical simulations [1,2,3] showing the formation of coherent states of protons in hydrogen-loaded metals with a cubic crystal lattice.

In these states protons oscillate in phase at frequencies of the order of 10^{13} Hz and with a fixed phase relation with a strong high-frequency electric field which is trapped in the material (especially if the material is made of micro-powders). The energy gap of the coherent ground state is of the order of 1 eV per particle, thus making it robust against thermal fluctuations.

The analytical calculations address the realistic case of a large number of protons, in the RWA approximation. The numerical calculations are presently limited to a small number of protons but go beyond the RWA approximation and allow to take into account a dissipation term associated with the strong oscillating electric field.

The next task of this theoretical model is to compute the excited states of the coherent system. There are strong indications that in those states protons can be excited by an external pump to energies much larger than those achievable by single incoherent protons in condensed matter. Such energies are actually large enough to make possible some electron capture processes, with generation of slow neutrons.

This dynamical mechanism offers an alternative to the Widom-Larsen hypothesis of “heavy electrons” [4], and is definitely closer to current models in mainstream physics. The consequences, in terms of nuclear transmutations, of neutron generation via electron capture would be similar to those predicted by Widom and Larsen, plus several other processes like those recently re-examined by Metzler et al. [5].

In particular, we also have recently published an experimental study on the possible production of Deuterium from Titanium hydride powders subjected to thermal cycles [6] (experiment performed by L.G.), whose results can be understood in terms of our model plus a calculation in the standard model of electroweak interactions of the coherent transition rate for the reaction $p+e^- \rightarrow n+\nu_e$ [7].

References

[1] L. Gamberale, G. Modanese, "Coherent Plasma in a Lattice", Symmetry 2023, Vol. 15, p. 454, 2023
[2] L. Gamberale, G. Modanese, "Numerical simulations unveil superradiant coherence in a lattice of charged quantum oscillators", Physica B: Condensed Matter, Vol. 671, p. 415406, 2023
[3] L. Gamberale, G. Modanese, "Spectral Analysis of Proton Eigenfunctions in Crystalline Environments", Quantum Reports, vol. 6, no. 2, pp. 172-183, 2024
[4] A. Widom, L. Larsen, "Ultra low momentum neutron catalyzed nuclear reactions on metallic hydride surfaces", Eur. Phys. J. C, vol. 46, no. 1, pp. 107-111, 2006
[5] F. Metzler, C. Hunt, J. Messinger, N. Galvanetto, P. Hagelstein, “Probing Neutrons and Purported Fission Daughter Products from Gas-Loaded, Laser-Irradiated Metal-Hydrogen Targets” (April 5, 2023). Available at https://ssrn.com/abstract=4411160 or http://dx.doi.org/10.2139/ssrn.4411160
[6] L. Gamberale, G. Modanese, "An Experimental Study on Deuterium Production from Titanium Hydride Powders Subjected to Thermal Cycles", Symmetry, vol. 16, no. 11, p. 1542, 2024
[7] L. Gamberale, "Neutron Production via Electron Capture by Coherent Protons", arXiv:2209.06139, 2022, https://arxiv.org/abs/2209.06139

Evolution of the Lattice Energy Converter (LEC) From 600 BCE to 2025 AD

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A Lattice Energy Converter (LEC) is a device for the direct conversion of energy in a metal lattice into electricity based on electrophysical properties of electrode materials with different work functions and Fermi levels, wherein at least one electrode includes materials that are occluded with hydrogen such as Palladium hydride, Iron hydride, and Titanium hydride. A LEC will spontaneously self-initiate and self-sustain the production of an electrical current through and voltage across a resistive load impedance. Experimental results are published in peer reviewed journals [1-3] as have independent replications by multiple scientists throughout the world. [4-7] Radioactive materials are not required and hazardous radiation and CO_2 have not been detected. Additional information including copies of patents and videos of presentations are available at www.inovl.com

The scientific evolution leading to the LEC began more than 2500 years ago when the basic principle of static electricity was discovered by a Greek mathematician and philosopher named Thales (c.624–546BCE). [8] He discovered that if he rubbed a rod made of amber, (a fossilized tree resin) he could pick up light objects, such as bits of feathers. At that time, electricity was still just a 'magical' curiosity—of very little practical use. This discovery plus discoveries and advances since then by many scientists including A Volta, Lord Kelvin (William Thomson), I. Langmuir, and E. Fermi, as well as Martin Fleischmann and Stanley Pons, have been instrumental in the development of the LEC.

Based on experimental evidence, published papers in peer-reviewed journals, and multiple independent replications, the ability for direct energy conversion by a LEC is no longer in question. In this presentation, we will describe the electrophysical mechanisms that produce these surprising results as well as recent experimental data and progress toward transitioning the technology to produce a variety of commercial energy sources.

References:

[1] F.E. Gordon, H.J. Whitehouse, Lattice Energy Converter, *JCMNS*, **35** (2022) 30-48.
[2] F.E. Gordon, H.J. Whitehouse, Lattice Energy Converter II: Iron Hydrogen Host Material, *JCMNS*, **36** (2022) 1-24
[3] F.E. Gordon, H J. Whitehouse, Scaling up the Lattice Energy Converter, *JCMNS* **38** (2023) 1-10.
[4] G.A. Erickson, Private Communication with Frank Gordon, Jan 2021.
[5] A. Smith, Anomalous Electrical Output from Room-Temperature Reactors IWAHLM 14, Assisi, Italy 29 Aug – 1 Sep 2021. https://www.lenr-forum.com/attachment/18631-assisi-iwahlm-2021-presentation-final-pdf/
[6] A. Di Stefano, Experimental Observations on the Lattice Energy Converter. ICCF 24, *JCMNS* **38 (1)** (2023) 42–50.
[7] F. David, Direct Conversion Replications, IWAHLM 14 Assisi, Italy 29 Aug – 1 Sep 2021.
[8] C. Woodford Last updated: December 3, 2021. History of Electricity https://www.explainthatstuff.com/history-of-electricity.html

A No-Loss Air-Flow Calorimeter

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Airflow calorimetry is a technique to assess the heat produced by a device. Unfortunately, conventional airflow calorimeters suffer from inaccuracies mainly due to various heat losses.

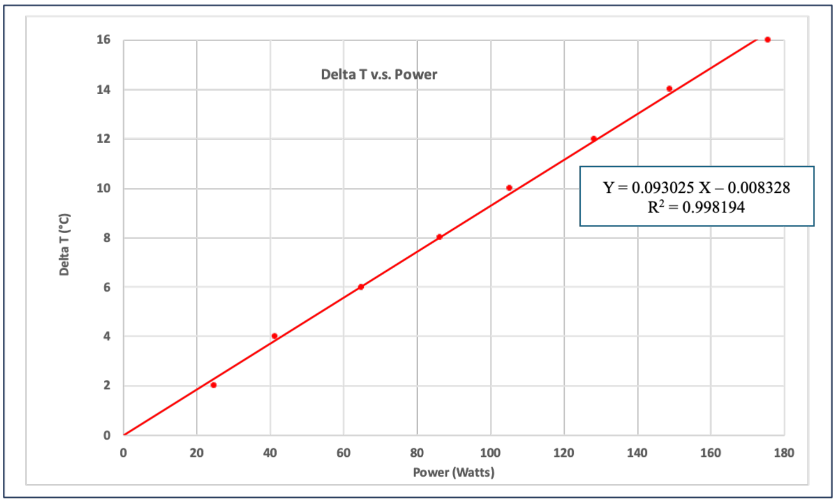
A new type of air-flow calorimeter has been designed with the objective to eliminate the heat losses. It incorporates an internal transpiration screen that surrounds the hot object being tested. The air permeates through the screen and absorbs all the heat coming out of the hot object by convection or radiation. The external wall of the calorimeter enclosure remains at the ambient temperature independently of the temperature inside the transpiration screen, ensuring that the maximum amount of heat is transferred to the airflow and that environmental heat loss is negligible. This makes the device essentially a 'No-Loss Air Flow Calorimeter'.

The design features of the new calorimeter are described, and its accuracy is discussed. Key to its performance are the precise measurements of:

The cooling air mass flow rate.
The accurate determination of both the average inlet and average outlet temperatures
The air heat capacity, which varies with temperature, local air pressure, and humidity.

A specialized software was developed to handle these calculations.

A first model was built and tested successfully. It was used during the frame of the CleanHME project. Some results are presented.



Calibration of the No-Loss Airflow Calorimeter for a constant air mass flowrate of 0.0105 kgs^{-1}– The linear relationship between the power and the air temperature shows that all the heat is captured by the airflow and no heat is lost to the environment.

The CleanHME project has received funding from the European Union's Horizon2020 research and innovation program under grant agreement no 951974

29p-1

Nuclear Transmutations to Nuclei with Magic Numbers Induced by Deuterium Permeation through Pd/CaO Multilayer Films

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The nuclear transmutation from Cs to Pr induced by deuterium permeation through a Pd/CaO multilayer film has been reported [1]. We conducted its replication experiments employing RF sputtering to form Pd/CaO multilayer films and Cs was deposited on the surface by electro-chemical method. D_2 gas bellow 130 kPa down to around 80 kPa was permeated for several days keeping the film temperature around 120°C to 140°C.

Elemental analysis was made utilizing TOF-SIMS (Time of Flight Secondary Ion Mass Spectroscopy) with mass resolution of 11,000@29u (FWHM) and EDX (Energy Dispersive X-ray Spectroscopy). Thereby we found the following points,

a) The number of CaO layers or its width are not important parameters, so that the presence of a CaO layer near the surface is a key to induce nuclear transmutation.

b) The nuclear transmutation to ^{141}Pr was observed even the deposited ^{133}Cs and the Pd/CaO multilayer were placed at the down-stream, i.e., pumping side.

c) Two nuclear transmutations of ^{136}Ba to ^{140}Ce and ^{104}Pd to ^{112}Sn by D_2 permeation through a Pd/CaO multilayer film at temperatures below about 140°C were newly found by TOF-SIMS and EDX analysis.

d) Including the nuclear transmutation of ^{133}Cs to ^{141}Pr, gamma rays above background levels were never detected during D_2 permeation.

e) The number of CaO layers and its width were demonstrated to be not important parameters for the nuclear transmutations. The magic numbers of nucleon were found to be related to the products of nuclear transmutation by D_2 permeation.

f) In addition to the misidentification of $^{40}Ca_2O$ as ^{96}Mo revealed by TOF-SIMS analysis [2], we could not confirm ^{137}Ba to ^{149}Sm nor ^{138}Ba to ^{150}Sm, ^{137}Ba had not been enriched beforehand in contrast to the reported case [3] though. D_2 gas permeation through a W-deposited Pd/CaO multilayer film did not produce elements just below 190 such as ^{190}Pt or ^{190}Os claimed by Iwamura *et al.*[4], neither.

h) Although ^{44}Ca atoms were always present in a multilayer film, the count of ^{48}Ti of TOF-SIMS had never been above ground levels. A peak of $^{32}S^{16}O$ might to be misidentified as ^{48}Ti peak.

[1] Y. Iwamura, M. Sakano and T. Itoh, "Elemental Analysis of Pd Complexes: Effects of D_2 Gas permeation", Jpn. J. Appl. Phys. Vol. 41, pp. 4642-4650, 2002.
[2] A. Murase, N. Takahashi, S. Hibi *et al.*, "TOF-SIMS Investigation on Nuclear Transmutation from Sr to Mo with Deuterium Permeation through Multi-layered Pd/Ca0", J. Condensed Matter Nucl. Sci., vol. 6, pp. 34-43, 2012.
[3] Y. Iwamura, T. Itoh, M. Sakano *et al.*, "Observation of Nuclear Transmutation Reactions Induced by D_2 Gas Permeation through the Pd Complexes", Proc. ICCF11, 2004.
[4] Y. Iwamura, T. Itoh and S. Tsuruga, "Transmutation Reactions Induced by Deuterium Permeation through Nano-structured Palladium Multilayer Thin Film", Sci., Vol. 108, No. 4, pp. 628-632, 2015.

High Incremental Power Gain Is The Future of CF/LANR

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This new generation of dry, preloaded CF/LANR quantum electronic devices create considerable instantaneous power and energy gain [1,2,3], and then heating faster and easier. This useful reproducible behavior has also enabled a way to better heat, image, measuring emissions, apply magnetic fields, and provide open demonstrations. The self-contained two electrical terminals NANOR®-type components are fully preloaded with deuterons. They are ~2 cm in length, with 30 to ~400 milligrams of an LANR active nanocomposite ZrO_2-PdD core. The power density ~19.50 watts/gram of nanostructured material helps their already superior handling properties, and portability. Fig. 1 shows the applied input voltage and resultant incremental power gain for NANOR®-type Component N14-7, calibrated by an ohmic control resistor in Run E549-240323A. The LANR core here of some of these components were initially, partially made from Dr. Yoshiaki Arata's base nanomaterial, then greatly augmented and improved, as shown, after JET Energy's Wickian deuteron-loading [3]. Note how many orders of magnitude the incremental power gain [excess heat ["XSH"]] were obtained from the active NANOR®-type component compared to the ohmic control. Achieving these high incremental power gains has required improved alloys and their loading by deuterons; and then meticulous avoiding electric avalanches and extending the duration of the heat production cycles.

The secret of very successful LANR/CF for applications is now revealed: large incremental power gain with 1 microwatt in, then circa 10 watts or so out. Thus, dry preloaded LANR NANOR®-type components, bundled in groups, appear to enable a future of clean energy production poised to enable and enhance future demonstrations, technical improvements, and then entry to real commerce.

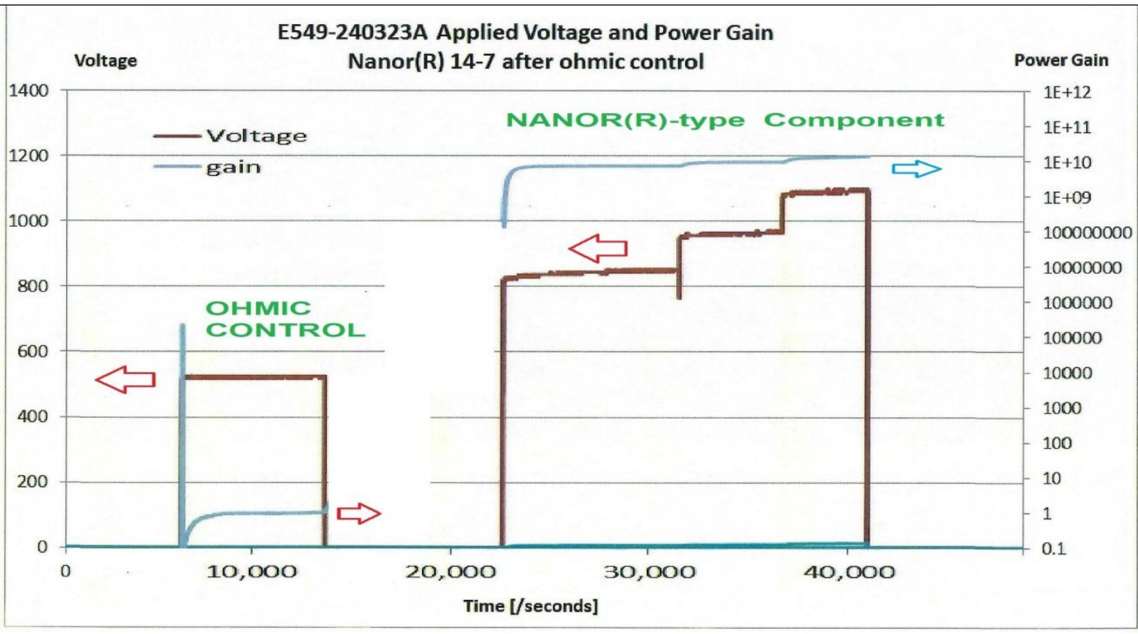

Fig. 1 – Applied Input Voltage and the Resultant Incremental Power Gain For an Ohmic Control and NANOR®-type Component N14-7 [fully D-loaded, in Run E549-240323A]. The horizontal axis is time in seconds. The ohmic control was driven prior to the LANR preloaded component. The applied input voltage and the calculated effective incremental power gain of both are read off the left hand voltage axis and the right hand logarithmic incremental power gain axis, respectively.

[1] Swartz M. R., Hagelstein P.I., Demonstration of Energy Gain from a Preloaded ZrO_2–PdD Nanostructured CF/LANR Quantum Electronic Device at MIT, *J. Condensed Matter Nucl. Sci.* 13, 516 (2014).
[2] Swartz M. R., Verner G., *et al*., Energy Gain From Preloaded ZrO_2–PdNi–D Nanostructured CF/LANR Quantum Electronic Components, *J. Condensed Matter Nucl. Sci.* 13, 528, (2014).
[3] Swartz M. R., Achieving Very High Increment Power Gain, *J. Condensed Matter Nucl. Sci* , (ICCF-25).

Transmutations in Light Water Electrolysis and Hydrogen Gas Loading Experiments

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Light water electrolysis with various cathodes and hydrogen gas loading in metals have revealed intriguing evidence of heavy elemental transmutations, suggesting possible nuclear processes occurring under low-energy conditions [1-4]. The presence of an upper bound (in terms of atomic number) is also observed in the transmutation products [3].

In the present work, we report two experiments investigating possible heavy element transmutations. The first involves light water electrolysis using a high-purity nickel (99.5%) cathode and platinum (99.99%) anode in a two-electrode setup with ~30V Half-wave rectified DC and 3-5A/cm^2 current density, conducted for 10 days. The second experiment is hydrogen gas loading, where nickel (99.95%) and constantan wire ($Ni_{44}Cu_{55}Mn_1$) are placed inside a quartz tube at 250°C and ten bar pressure for 50 days. Energy-dispersive X-ray spectroscopy (EDX) is used to analyse the reacted and unreacted samples in both light water electrolysis and gas loading experiments to examine elemental changes. Additionally, inductively coupled plasma mass spectrometry (ICP-MS) is employed to examine isotope ratios in both reacted and unreacted samples, providing insights into possible transmutation effects.

The EDS analysis of electrolysed Ni cathode shows significant elemental production, including Fe (31.6%), Pb (4.7%), Au (1.08%), and Zn (2.8%), with Pb as an upper bound. Additionally, ICP-MS results indicate notable isotopic shifts in electrolysed Ni, where the ^{58}Ni/^{60}Ni ratio changes from 2.46 in unreacted samples to 2.62 in reacted samples. We also suggest that the observed decrease in ^{60}Ni compared to ^{58}Ni in the reacted nickel may be attributed to nuclear reactions where ^{60}Ni undergo transmutations more readily than ^{58}Ni.

In gas loading experiments, transmutations are observed at some locations, with notable amounts of Na (2.02%), K (1.93%), and Fe (7.66%) in the Ni sample, while the constantan sample shows Al (3.98%) and Fe (15.18%). Both experiments show different elemental transmutation results except Fe.

The above experimental results may contribute significantly to a better understanding of Low-Energy Nuclear Reactions (LENR).

REFERENCES:

[1] K. P Rajeev, & D Gaur, “Evidence for nuclear transmutations in Ni–H electrolysis” J. Condensed Matter Nucl Sci. Vol. 24, pp. 278-283, 2017.

[2] Biberian, J.P., L. Forsley, and P.A. Mosier-Boss, “Transmutation of Palladium Induced by Laser Irradiation” J. Condensed Matter Nucl. Sci., **37,** pp 9-22, 2023.

[3] A. Kumar, R. Pala, P. Jain, K. P. Rajeev, “Upper Bound in the Fusion Products and Transmutation Enhancement in Alloys” J. Condensed Matter Nucl. Sci., Vol. 36, pp. 327-335, 2022.

[4] U. Mastromatteo, A. Bertele, F. Celani, “Hydrogen Absorption and Excess Heat in a Constantan Wire with Nanostructured Surface” J. Condensed Matter Nucl. Sci., Vol. 15, pp. 240–245, 2015.

Research Funding via ISCMNS Project Pathway and LENR-DAO

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Dr. N.L.Bowen, Charles Moore

ISCMNS President Lynn Bowen and Secretary/CEO Alan Smith have been successful in securing pledges from interested investors to fund research into LENR systems. Details will be made available at ICCF-26. These funds will be used to finance projects submitted by members of the ISCMNS or our affiliated bodies the SFSNMC and JCFS.

Following a circulated Request for Proposals (RFP) we will be asking interested parties to submit a plan for an experimental research project related to LENR. The RFP will be in the form of a document, asking members involved in experimental LENR research to submit a proposal describing an experimental research project with a timeline and budget to us for consideration. This proposal would be for research that they would like to do, if they were given funds. A panel of members, (representing all three societies) will decide on which of these proposals is to be granted funds, up to a maximum of four projects. All funded projects will be the subject of one or more video documentaries shot in part 'on site'. Research progress will be monitored, and part of the funding will be made in advance. The ISCMNS will not retain any commercial interest in the research IP, but benefactors may well ask sensitive questions, since the hope is that they will use preliminary findings from this project as a springboard for more investment.

In addition to this programme, there is a second funding source for LENR projects based on cryptocurrency-derived assets organized by Charles Moore of EVO-Labs in the form of a DAO - a decentralized autonomous organization with its own constitution and requirements which will be explained in greater detail at the conference.

D+D fusion at thermal energy

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Deuteron-deuteron nuclear fusion occurring in metallic environments at very low energies is strongly enhanced due to the electron screening effect of the Coulomb barrier between the reacting nuclei. The reduction in the barrier height, called the screening energy, has been observed for different metals in numerous experiments [1-7] over the past 20 years and has been found to be more than an order of magnitude greater than the value obtained for gaseous targets [8]. This is mainly caused by quasi-free conduction electrons, which can be modeled using plasma physics methods and applied to astrophysical plasmas where the nuclear cross section can be increased by many orders of magnitude.

The recent accelerator experiments performed at inverse reaction kinematics at very low ^{6}Li, ^{7}Li and ^{19}F beam energies at the JSI on different targets containing hydrogen and deuterium [6,7], demonstrate that electron screening is additionally enhanced by crystal lattice defects in metallic targets. Independently, the same conclusion has been reached by the group from the University of Szczecin, Poland, who studied d+d nuclear fusion in Zr targets [2]. The measurements in Szczecin [10] have also given the first indication of a contribution of a 0^{+} resonance situated close to the d+d reaction threshold (23.85 MeV excitation energy) in the compound nucleus ^{4}He with a large partial width for the internal electron-positron ($e^{-}e^{+}$) pair creation. The contribution of this channel to the d+d reaction cross section increases for decreasing deuteron energies far below the Coulomb barrier and becomes dominant below 5 keV.

From accelerator experiments it is known that the d+d nuclear reaction proceeds through the formation of the compound nucleus ^{4}He, which decays through two main mirror reaction channels ^{2}H(d,p)^{3}H and ^{2}H(d,n)^{3}He, being almost of the same strength. The electromagnetic transition resulting from the E2 deuteron radiative capture ^{2}H(d,γ)^{4}He is seven orders of magnitude weaker than the nucleon channels. However, the existence of the threshold 0^{+} resonance may change the branching ratios of the d+d reaction at very low deuteron energies thus contributing in solving the long-standing cold fusion puzzle. Furthermore, electron screening enhanced by impurities and crystal defects can change nuclear reaction rates at thermal energies dramatically, even up to 40 orders of magnitude. Additionally, the presence of the threshold resonance can increase reaction rates at thermal energies up to 7 orders of magnitude.

The preliminary results from the d+d experiment performed at JSI unequivocally showed $e^{+}e^{-}$ pair emission from the zirconium target after the deuterium beam had been switched off. This could be the first glimpse into what is happening during thermal fusion: the phenomenon occurs due to the diffusion of deuterium in zirconium crystal lattice at room temperature. This effect was observed for first time and there are no obvious alternative theories for the d+d thermal fusion that might explain the observed results. Moreover, we measured the excess counts in the 511 keV positron annihilation γ-ray line on the Zr target comparing the background.

[1] E. Salpeter, Aust. J. Phys. 7, 373 (1954).
[2] K. Czerski et al., Europhys. Lett. 68, 363 (2004).
[3] J. Kasagi, Prog. Theor. Phys. Suppl. 154, 365 (2004).
[4] F. Raiola et al., Eur. Phys. J. A 19, 283 (2004).
[5] J. Cruz et al., Phys. Lett., B 624, 181 (2005).
[6] A. Cvetinović et al., Phys. Rev. C 92, 065801 (2015).
[7] A. Cvetinović et al. Physics Letters B 838, 137684 (2023).
[8] H. J. Assenbaum et al., Z. Phys. A 327, 461 (1987).
[10] K. Czerski et al., Phys. Rev. C 109, L021601 (2024).

Hydrino Mediated Nuclear Reactions: Search for Experimental Evidence and Implications

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In the context of light/heavy water electrolysis and gas-loading-based heavy element transmutation experiments [1, 2], we have been exploring Hydrino mediated nuclear reactions (HMNR) [3] as being one of the possible mechanisms underlying the observed nuclear reactions activated at very low energies. Hydrinos are putative states of Hydrogen wherein the electron adopts a fractional quantum number ($n < 1$) and commensurately reduced nucleus-electron distances following a resonant energy transfer to a catalyst [4]. As Hydrino syntheses and characterizations are still being debated, as a confidence-building measure, our preliminary studies involved computational studies comparing results obtained from the Millsian software [5], which encodes the Grand Unified Theory of Classical Physics (GUTCP) [4], state-of-the-art quantum chemical density functional analysis via VASP [6], and experimental results. We found the Millsian software extraordinarily computationally efficient and accurate, which buttresses our search for experimental evidence for Hydrino in our experiments. While the Hydrino electronic states are not consistent with quantum mechanics, they are consistent with non-radiation conditions of classical electromagnetic theory [7]. Extensive experimental evidence has been provided in support of Hydrinos [8,9] and such pointers provide a guide to our acquisitions of experimental indicators for possible Hydrino states within our system that display nuclear transmutation. Specifically, we have explored XPS and XRD for Hydrino signatures and are currently exploring Raman and ESR studies. Further, the Hydrino based model provide signatures for Hydrino decay and predict 511 keV gamma signals, which we are exploring. In addition, the HMNR model provides mechanisms for neutron production, neutron capture followed by beta decay and offers a rationalization for the effects of magnetic field on nuclear reactions observed in our experiments.

[1] A. Kumar, P. Jain, K. P. Rajeev and R. G. S. Pala, , "Upper bound in fusion products and transmutation enhancement in alloys" J. Condensed Matter Nuclear Science, 36, 327–335 (2022)
[2] S. S. Lakesar, R. G. S. Pala and K. P. Rajeev, "Voltage-Dependent Nuclear Transmutation in Nickel Electrolysis," M. Kumawat, R. G. S. Pala and K. P. Rajeev, "Transmutations in Light Water Electrolysisand Hydrogen Gas Loading Experiments," A. Kumar, T. Verma, R. G. S. Pala and K. P. Rajeev, "Neutron flux measurements in D_2O electrolysis experiments," A. Kumar, T. Verma, N. K. Jain, R. G. S. Pala and K. P. Rajeev, "Detection of Fast Neutron Emissions in Low-Energy Electrochemical Cells: Evidence of Nuclear Reactions," Abstracts submitted to ICCF-26 (2025)
[3] R. L. Mills, "Ch. 5: Hydrino Theory-BlackLight Process," The Grand Unified Theory of Classical Physics (2025 edition)
[4] R. L. Mills, "The Grand Unified Theory of Classical Physics, Volumes 1 to 3" (2025 edition)
[5] W. Xie, R. L. Mills, W. Good, A. Makwana, B. Holverstott, N. Hogle, "Millsian 2.0: A Molecular Modeling Software for Structures, Charge Distributions and Energetics of Biomolecules," Physics Essays, Vol. 24, 200–212 (2011)
[6] G Kresse and J Furthmüller, "Efficient iterative schemes for *ab initio* total-energy calculations using a plane-wave basis set," Physical review B 54 (16), 11169 (1996)
[7] G. H. Goedecke, "Classically Radiationless Motions and Possible Implications for Quantum Theory," Physical Review, Vol.135, B281-B288 (1964)
[8] W. R. Hagen, R. L. Mills, "Electron Paramagnetic Resonance Proof for the Existence of Molecular Hydrino", Int. J. Hydrogen Energy, Vol. 47, No. 56, (2022)
[9] R. Mills, Y. Lu, R. Frazer, "Power Determination and Hydrino Product Characterization of Ultra-low Field Ignition of Hydrated Silver Shots", Chinese Journal of Physics, Vol. 56, 1667-1717 (2018)

Temperature Effects and Transmutations with High Frequency Induction

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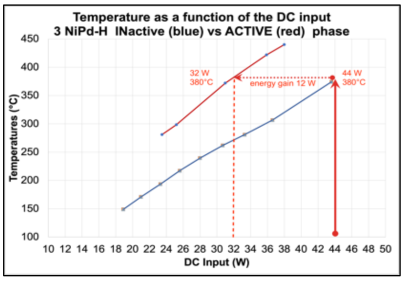
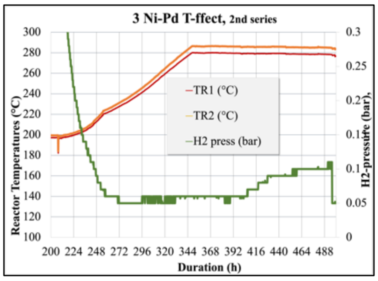
The inductively excited reactor was developed by an interdisciplinary team of engineers. The laboratory unit allows the exchange of reactants, which is ideal for R&D. It forms the basis for a scale-up to industrial scale energy production. The system is described in [1], [2].

Various materials were tested under different conditions. Nickel foil and hydrogen generated excess heat of more than 100% for several days. In contrast, palladium-coated pure nickel foil only achieved 20-28%. However, due to the small amount of palladium used – 200 mg (2.6 µm) Pd per 3 g Ni – the effect is relevant. (Fig. 1). The rather arbitrarily chosen materials and operating conditions leave plenty of room for improvement.

A special effect of the experiments with palladium-coated nickel foil, however, was a repeatable temperature rise of +100 K (Fig. 2). This effect can be started and stopped at will with a constant power input in the range of 20 - 40 WDC: When the hydrogen pressure is reduced to below 100 mbar, the temperature develops over a period of 4-5 days and always changes with a sharp kink to a constant value that remains stable for weeks. With a short pressure pulse of up to 0.3 bar, the temperature spontaneously returns to its initial value. This phenomenon remains puzzling





Element (surface)	starting w%	reacted w%
C	0	3.2 - 12.6
O	2.4	9.8 - 25.9
Al	0	0 - 14.6
Si	0	0.8 - 6.1
Ni	20	33.9 - 62.4
Pd	77.6	11.7 - 28.4

SEM/EDX analyses (1) showed morphological changes at the surface, which are associated with the appearance of new elements not present in the starting material (Tab. 1). Experiments with a nickel-hydrogen system also showed carbon in relevant concentrations [1]. Another notable observation is the pressure increase that occurs during the active state at constant temperature. A leak could be excluded. The transparent quartz glass reactor could enable a spectroscopic gas analysis.
The process could be an atomic decay, as explained by the new, insightful structured atomic model SAM by Edo Kaal et al. [3]. A NASA study by N. Benyo et al. comes to a similar conclusion [4]
The dissociation of palladium into multiple elements opens up the possibility of using hydrogen metal technology for applications other than energy generation. It could conceivably be used to treat radioactive waste, offering new possibilities for the safe disposal of such materials.

(1) Nano Imaging Lab, Swiss Nano Science Institute, University of Basel

[1] H.B. Winzeler et. al., "Inductively activated LENR reactor", 25th Internat. Conference on Condensed Matter Nuclear Science, Book of Abstracts, p.57, 2023
[2] H.B. Winzeler: "Device and Process for generating Heat Energy using Low-Energy Nuclear Reaction», US2025022619A1, 2021
[3] E. Kaal et.al., "The Nature of the Atom. An Introduction to the Structured Atom Model". Curtis Press, 2021.
[4] Th. Benyo, "Lattice confinement fusion, fission or both?" 25th Internat. Conference on Condensed Matter Nuclear Science, BoA, p. 102, 2023

30a-4

Design Tool of LENR Reactor Using Linear Flow Network Analysis

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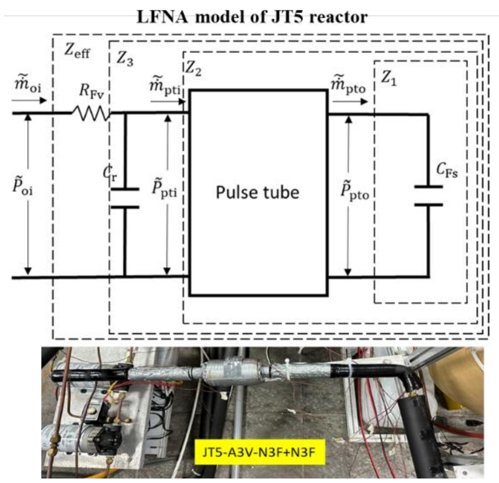
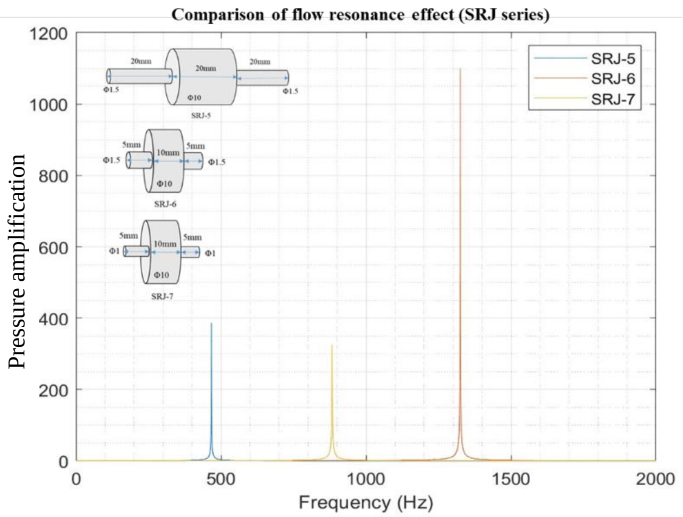
We have reported the development of resonator-type reactors which can trigger low-energy nuclear reaction (LENR) in water to produce excess energy via cavitation [1]. The development of LENR reactor is based on trials-and-errors approach using test results of small prototypes. For scale-up in practical applications, a design tool is needed. The excess heat or COP of the reactor was found to increase with increasing thermal impact. Resonance in the reactor also can improve the performance. In some experiments, we found that abnormal temperature rises took place in some parts of the reactor [1]. This can create a higher thermal impact to benefit the reactor performance. All these involved dynamic phenomena of water flow, which can be treated using the theory of system dynamics.

Linear flow network analysis (LFNA) is a powerful tool to investigate the behaviour of a dynamic flow system of LENR reactor. By applying small perturbation at the equilibrium point of the continuity and momentum equations in different parts of the reactor, a linear dynamic model can be derived [2]. LFNA utilizes electric circuit analogy, i.e., voltage analogous to pressure, current analogous to mass flow rate. Each fluid-flow part can be treated as an assembly of capacitance, inductance, or resistance. LFNA can be used for the design of LENR reactor. We found that a large temperature rise higher than 100°C inside the reactor can be achieved and enhances the reactor performance. LFNA is also used for the analyse of the resonance effect which can result in pressure amplification and strengthening cavitation flow [3]. For Reactor SRJ, it is shown that a 1000 times pressure amplification can be achieved (Figure). The present LFNA provides a powerful tool for the design of LENR reactor.





[1] BJ Huang, YH Pan, PH Wu, *et al.* Water can trigger nuclear reaction to produce energy and isotope gases. *Sci Rep* **14**, 214 (2024). https://doi.org/10.1038/s41598-023-50824-8
[2] BJ Huang, MD Chuang, "System Design of Orifice Pulse-Tube Refrigerator Using Linear Flow Network Analysis." Cryogenics, 36, 11, 889 (1996).
[3] Yuan, Miao, et al. "Characteristics of oscillation in cavity of Helmholtz nozzle generating self-excited pulsed waterjet." Chinese Journal of Mechanical Engineering 35.1 (2022): 73.

Difference in the physical mechanisms of both cold nuclear fusion and thermonuclear fusion

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Difference in the physical mechanisms of both cold nuclear fusion and thermonuclear fusion is subject of discussion in this paper. The Authors' experimental results [1, 2] show energy release (it is significant in [2]), which correlates with helium release, in interactions of deuterium gas with solid specimens. The Author developed a quantum mechanical theory based on muonic hydrogen molecule. This theory relates to existence of heavy electrons having non-zone effective mass greater than 153 m_0 (m_0 - electron mass in rest) as this effective mass can be achieved by certain temperature of the solid. It is proved that two heavy electrons $\boldsymbol{e_h}$ of opposite spins occupy low energy level $\boldsymbol{E_h}$ in a quantum well existing in a solid due to fluctuation of the potential energy (Fig.1), and that the wave function ψ_h associated with this electron couple goes rapidly to zero in the vicinity of the walls of the well as it makes possible that deuterons to approach the electron couple. The couple does a screening of the electrical repulsion between the two deuterons and as result both deuterons can approach each other on a sub-angstrom distance and nuclear fusion reaction can occur. The same process in thermonuclear reactions requires significant kinetic energies of the interacting nucleus in order for the Gamow potential to be overcome. There are both energy and helium releases in both types of fusion reactions. The interacting nucleus in case of cold fusion have negligible kinetic energies, and this is the reason for absence of gamma rays release [3] as it contrasts with thermonuclear reactions having significant kinetic energies of the interacting nucleus giving gamma release. It is shown that if there is third non-coupled electron $\boldsymbol{e_l}$ occupying higher energy level $\boldsymbol{E_l}$ in the quantum well (Fig.1) then its wave function ψ_l is broad. In this way, this electron can interact with a quark of a single deuteron (Fig.2), which has been attracted by the coupled heavy electrons (Fig.1), and as result either protons or neutrons release can occur (depending on the spin of $\boldsymbol{e_l}$) and both particles can participate in further cold fusion reactions. It is shown that the released neutrons in this case have negligible kinetic energies, and this fact explains the lack of external neutron radiation ([1,2]). The mechanism of neutron release in the thermonuclear reactions is different and the released neutrons have significant kinetic energies. As conclusion – the physical mechanisms of both cold nuclear fusion and thermonuclear fusion are different and that's why no external radiation can be expected in cold nuclear fusion reactions. The results in [1, 2] confirm the Authors' theory.

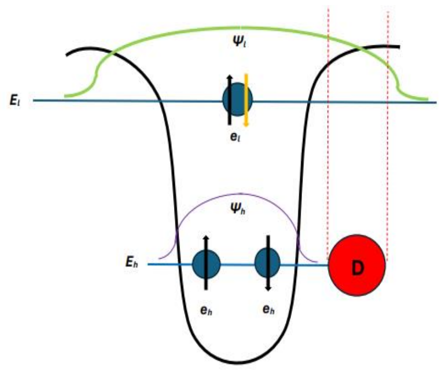

Figure 1

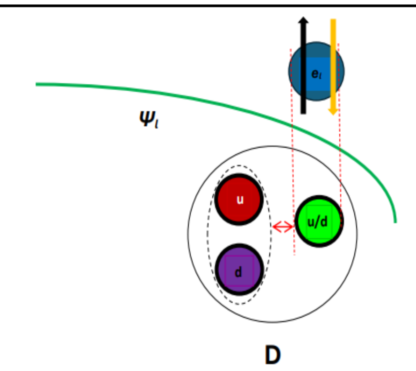

Figure 2

[1] D. Alexandrov, Low Energy Nuclear Fusion Reactions in Solids: Experiments, International Journal of Energy Research, 1 – 13, 2020 https://doi.org/10.1002/er.6356
[2] D. Alexandrov, Artificial Intelligence in the Controlled Nuclear Fusion Reactions, IEEE Xplore, 2025 DOI: 10.1109/COMSCI63166.2024.10778530
[3] M. Nocente et al., "Gamma-ray emission spectrum from thermonuclear fusion reactions without intrinsic broadening", Nucl. Fusion, vol 55, 123009 (2015)

30a-6

A Modular Platform for Pd and Ti Gas-Loading Experiments with Real-Time Radiation Detection and Comprehensive Surface Mapping

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Colin Clark [1], Yet-Ming Chiang [1], Peter Hagelstein [1]

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We present a new experimental platform developed at MIT under the US ARPA-E LENR program to rigorously investigate a wide range of reported anomalies in deuterium- or hydrogen-loaded Pd and Ti samples. Samples to be tested include Pd foils, Pd thin films, Pd wires, Ti pressed powder pellets, and Ti foils (per Uchikoshi 2020, Mastromatteo 2020 & Biberian 2023, Nassisi 1998, Beltyukov et al. 1991 as cited in [1], and Zhang 2024 [2]).

At the heart of this effort is a highly customizable experimental platform consisting of several modular tabletop chambers, which may be connected to a centralized gas manifold for pressurization and evacuation, supporting high flexibility and experimental parallelization. Each chamber is equipped with positive pressure and vacuum gauges as well as temperature sensors (RTDs and thermocouples), isothermal external heating up to 200 °C, and optionally internal heaters up to 1000 °C. All heaters are computer controlled, enabling programmable temperature ramps, cycling, and dwell steps. Data from all instruments are continuously recorded. The sample holders, heaters, and sensor configurations can be readily reconfigured to accommodate a wide variety of samples and test conditions.

For diagnostics, we focus on real-time nuclear particle detection and on comprehensive sample surface maps before and after experiments. We employ both liquid scintillation and He-3 based neutron detectors, read out by CAEN and Picoscope electronics that store full waveforms for each pulse. We characterized the neutron background over several weeks with each detector, which has shown high stability and provides a clear baseline for identifying signals. Additionally, we employ NaI, high-purity Germanium, and Si-PIN gamma spectrometers as well as CR-39 track detectors for charged particle detection. For CR-39 analysis, we collaborate with leading experts to implement in-house scanning and analysis. For surface characterization, we use a fully automated digital microscope that produces high-resolution composite images of each sample immediately before and after each experiment, supplemented by SEM-EDS scans, and, for selected regions of interest, isotopic ratio determination via spatially resolved LA-ICP-MS.

In this presentation, we introduce the new facility and provide an update on ongoing experiments. We outline limitations in previous studies and show how our diagnostics and protocols are designed to overcome them. This includes detailed detector calibration, long-term background measurements, and pulse waveform analysis. Finally, we will share lessons learned that may support the community's broader efforts toward more reproducible and well-characterized LENR experiments.

[1] F. Metzler et al. (2023). Probing Neutrons and Purported Fission Daughter Products from Gas-Loaded, Laser-Irradiated Metal-Hydrogen Targets (SSRN Scholarly Paper No. 4411160).
[2] H. Zhang (2024). Laser irradiation of hydrogen-containing metal anomalies. IWAHLM-16 Seminar, Strasbourg, France.

Poster Presentations

P1-1

Electrical Noise on Voltages for LENR Electrochemical Cells

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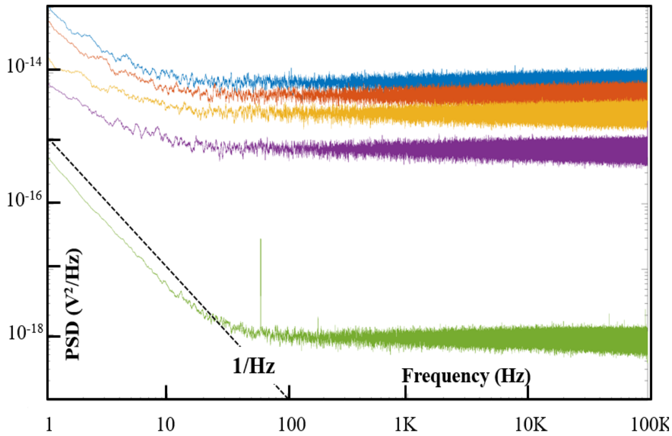
Low Energy Nuclear Reactions (LENR) produce two types of products, energy and new nuclei. The transmuted nuclei can be measured using a variety of sensitive analytical methods. The types and numbers of transmutation products are useful indicators of the reactions and rates that occurred. However, it is the energy from LENR that is of greatest interest. It might result in a new nuclear power industry that produces low-cost and clean energy from widely-distributed small generators.

Various types of calorimeters are used to measure the power and energy from LENR. They have provided much useful data from many experiments since the 1989 announcement by Fleischmann and Pons. However, calorimeters are not highly sensitive instruments. A very good calorimeter might have a minimum detectable power of 1 mW, which corresponds to about 260 million deuterium-to-helium fusion reactions per second. We are using the electrical noise in electrochemical LENR experiments with the potential of measuring LENR rates that are much lower than those accessible by calorimeters.

Electrical noise reflects the effects of circuit elements through which currents pass. It has long been known that electrical noise provides a useful way to probe diverse circuit elements, including various devices [1] and MEMS [2]. Measurement of noise gives a tool to measure effects in electrochemical cells, which are wet circuit elements [3].

Our test cells are small Lucite containers that are about 2.5 cm square and 5 cm high. They are powered by six D cell batteries and a resistor network, since batteries provide a low-noise power source. A MyDAQ ADC captures voltage readings using LabVIEW at 200 KSamples/sec for 100 seconds. The ADC is inside of a grounded box with walls of copper plates to ensure that the digitizer noise does not interfere with our measurements. The 20 million data points are stored in EXCEL and, recently, subjected to a FFT written in Python to produce the Power Spectral Distribution from 1 Hz to 100 kHz.

Initial measurements were made using a Stanford Research Low Noise Amplifier (gain of 1000) with two Pt electrodes separated by about 2 cm. The results in the figure are for applied voltages of 0, 2, 3, 4 and 5V (bottom to top).



The noise floor of 10^{-18} V^2/Hz is a very low power. If a small fraction of the energy released by LENR in short times adds noise to the cell current and voltage, we might be able to detect the occurrence of LENR at levels far below calorimeter thresholds. Estimates of improvements of orders of magnitude in the detection of LENR have been published [4]. We are exploring this technique using electrolytes with light and heavy water, with cathodes of Pt and Pd.

[1] L.K.J. Vandamme, "Noise as a diagnostic tool for quality and reliability of electronic devices", IEEE Transactions on Electron Devices, vol. 41, no. 11, pp. 2176-2187, (Nov. 1994), doi: 10.1109/16.333839.
[2] Faisal Mohd-Yasin and David J. Nagel, "Noise as Diagnostic Tool for Quality and Reliability of MEMS", Sensors, vol. 21, p. 1510 (2021) https://doi:10.3390/s21041510
[3] Arjang Hassibi *et al.* "Comprehensive study of noise processes in electrode electrolyte interfaces", Journal of applied physics, 96(2), pp.1074-1082 (2004)
[4] D. J. Nagel, "Input Stimuli and Output Signals for LENR Experiments", J. Condensed Matter Nuclear Science, vol. 23, pp. 1-33 (1922)

P1-2

University and College Course on Nuclear Energy, including Low Energy Nuclear Reactions

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Interest in Low Energy Nuclear Reactions (LENR) is increasing due to both a push and a pull: (a) the many advances in the scientific research and commercial development of LENR, and (b) the need for a new, widely-distributed, and low-cost source of clean energy. A new energy industry might emerge if LENR are commercialized. LENRIA was established to serve as an industrial association for LENR. Even before commercial success, the growing interest in LENR makes it likely that universities and colleges will offer courses on LENR in the coming years. If so, individual professors would be faced with developing such courses. Not all of them would be experts on LENR. We have long been involved in the study of LENR, and are in the process of developing a one-semester, three-credit-hour course on nuclear energy, including LENR. The week-by-week outline of the dozen topics in the course follows:

1. Overview of Energy Production
2. Survey of Nuclear Physics

3. Fission Physics and Engineering
4. History of Fission Reactors
5. Current and Coming Fission Reactors

6. Fusion Physics and Engineering
7. Hot Fusion Research History
8. Current Hot Fusion Developments

9. Mid-Term Examination

10. Cold Fusion and LENR History
11. Materials and Methods for LENR
12. LENR Measurements and Evidence
13. LENR Commercialization

14. Final Examination

This syllabus shows that this course is divided into three sections after two introductory lectures on energy production and Nuclear Physics. The sections are (a) nuclear fission, (b) nuclear fusion, and (c) LENR. Later university and college courses will undoubtedly be focused solely on LENR.

The course is based on PowerPoint graphics. Assuming that there will be three 50-minute lectures for each of the weekly topics, we are producing about 50 graphics for each of the 12 topics. Each graphic will have a recorded vocal explanation and written notes containing the explanation. We leave it to teachers to prepare their examinations depending on topics they emphasize in the course.

We will post the materials for this course on the web, so they can be used at no cost to teachers and students. We plan to have links to the course from the websites of both the LENR intellectual society, the International Society for Condensed Matter Nuclear Science (https://iscmns.org), and the LENR industrial association LENRIA (https://www.lenria.org). Our course web site will also include links to websites that provide information on LENR. They will be useful to students who might want additional information on various LENR sub-topics, either due to their own interests or to write papers assigned by the teachers. The website for the New York University Artificial Intelligence program on LENR should be a particularly useful source (lenrdashboard.com).

If this course proves to be useful, we will have the option of producing YouTube videos of the various lectures to make the content of the course available to an even wider audience. Production of a normal paper textbook is another possibility, but it is less desirable than a set of web-based presentations.

We hope that the breadth and ready availability of the materials for this course will attract the attention of physicists in the Nuclear Physics and other communities in many countries. The course might also be of interest to many others, including engineers, and even investors, who wish to take advantages of the diverse intellectual, technical, and financial opportunities that might result from the eventual understanding and expected commercialization of LENR.

P1-3

An improved Seeback calorimeter for electrochemical LENR experiments with commercial thermoelectric cells

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Calorimetry was the first experimental technique used to study LENR phenomena back in 1989, after the first report by Fleischmann and Pons [1]. Many different types of calorimeters were developed during the years, including water flow, isoperibolic [2], direct measurement of the radiated power from the electromagnetic spectrum [3] and so on.

In this work, a Seeback calorimeter (Figure 1) is presented, in which thermal output is converted directly to an electrical voltage from the temperature difference between the inner part of the cell and a fixed temperature reference.

Improvements in respect to a first version of the same, presented ad ICCF24 in Mountain View, California [4], will be shown.

The improved version presents:

- Larger thermoelectric elements (50x50mm).
- Larger waterblocks, used to flow water at constant temperature.
- Copper inner cell.
- More precise temperature controller.

This resulted in a sensitivity increase from about 105 mV/W to 260 mV/W (Figure 2 shows the calibration curves obtained at different temperatures and different thermoelectric elements).

Figure 1 – Photo of a stack with the main cell (center), Seeback elements (white) and waterblocks.

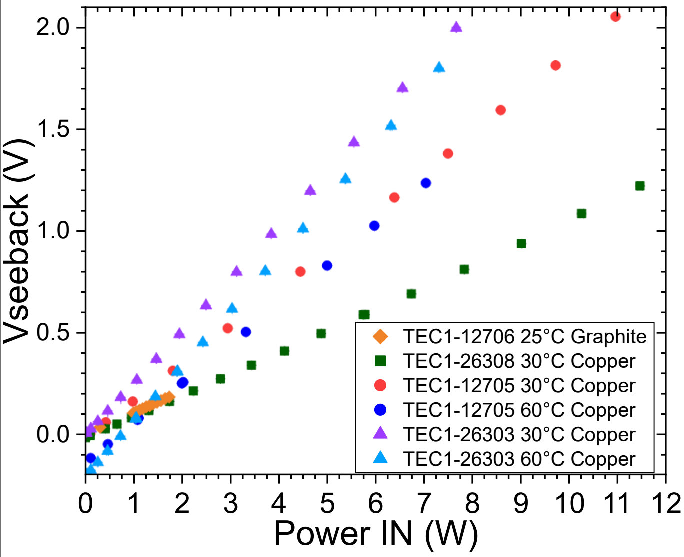

Figure 2 – Sensitivity of tested calorimeters

The response of the calorimeter is very linear, highlighting very small heat losses.

Two calorimeters were run during 2024 in a first attempt to reproduce the Staker experiment at GWU.

Limitations and proposal for further improvements will be also discussed in the work.

[1] M. Fleischmann, S. Pons, “Electrochemically induced nuclear fusion of deuterium”, Journal of Electroanalytical Chemistry, vol. 261, 2 part 1, pp. 301-308, 1989.

[2] M. H. Miles, “Electrochemical isoperibolic calorimetry for D_2O electrolysis”, Journal of Condensed Matter Nuclear Science, vol. 34, pp.140-147, 2021.

[3] T. Itoh, Y. Shibasaki, J, Kasagi, T. Takahashi, S. Yamaguchi, Y. Iwamura, “Photon radiation analysis for heat burst phenomena during hydrogen desorption from nano-sized metal composite”, Proc. JCF23, Tokyo, Japan, pp. 104-115, 2023.

[4] E. Marano, “A calorimeter for Electrolysis Electromigration Experiments”, ICCF24 (poster), Mountain View (CA), USA, 2022.

P1-4

Cold Nuclear Fusion in Supernova SN 1987A and on Planet Earth

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Cold nuclear fusion (LENR) can be understood exclusively in a philosophical-metaphysical way based on a new scientific paradigm beyond the Standard Model, postulating:

1) the primacy and absoluteness of the non-mechanical self-oscillatory motion of matter,

2) as a process of spherical material-neutrino-energy induction (sink-source, convergence-divergence) with the frequency of Planck time, (by formal analogy with electromagnetic induction),

3) considering elementary particles, material bodies and physical fields as the corresponding states of our eternal infinite single moving transcendental irrational World. [1]

On 23.02.1987, during the explosion of the supernova SN1987a with a mass of 17M⊙, when 99% of its baryonic matter was converted into neutrino radiation (neutrino field), during the first decade the energetic luminosity of SN1987a decreased, and then increased to a maximum for almost three months, in the remnants of the supernova at t~5500ºK an observational experiment of cold nuclear fusion took place according to the scheme [2]: ${}^{56}Ni_{28} \rightarrow {}^{56}Co_{27} \rightarrow {}^{56}Fe_{26}$.

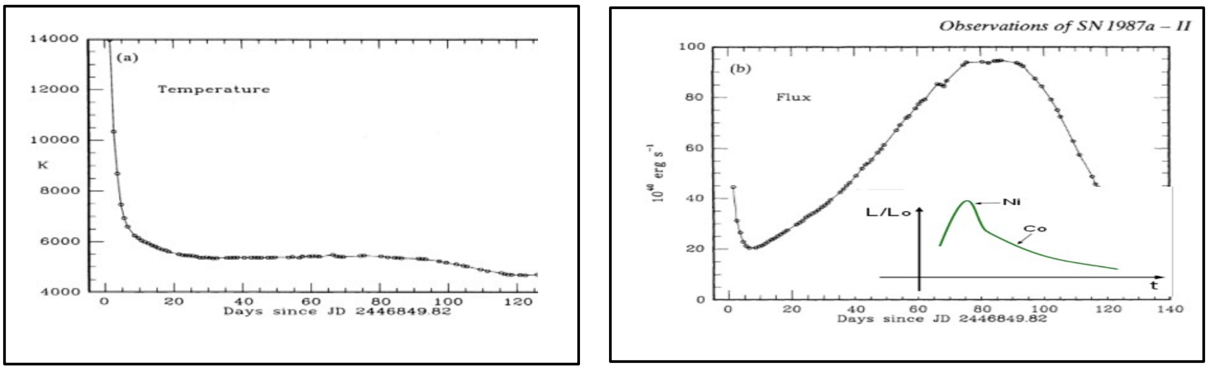

Fig.1,2. Derived quantites for SN1987a from blackbody fitting plotted as a function of time assuming A_v=0,6. The temperature is shown in (a). The flux, assuming a distance modulus of 18.5, is shown in (b). Note how the change in the rate of decline at about day 120 may indicate that SN1987a is now showing radioactive decline. [2]

It is likely that in the growing core of the Earth there is a chain reaction of cold nuclear fusion with the release of thermal energy and geoneutrinos with the participation of hydrogen ${}^{1}H$, oxygen isotopes O, silicon Si, nickel Ni, to stable iron ${}^{56}Fe$. In terrestrial conditions, by analogy with a natural experiment - the explosion of SN1987a, one of the real nuclear chain reactions of β-decay ($n \rightarrow p + e^- + \bar{\upsilon}_e$) is feasible in the laboratory: passing hydrogen ${}^{1}H_1$ through ${}^{63}Ni_{28}$ (artificial radioactive isotope of nickel, harmless to humans, serving as a source antineutrino and substance absorbing neutrons), at $t \sim 1200°C$ (by acting on the material field with a moving neutrino field) [1]:

$\rightarrow \bar{\upsilon} + {}^{63}Ni_{28} + {}^{1}H \rightarrow {}^{63}Cu_{29} + e^- + \bar{\upsilon} + {}^{1}H + Q \rightarrow \bar{\upsilon} + p^+ + e^- \rightarrow \bar{\upsilon} + p^+ \rightarrow e^+ + n \rightarrow n \rightarrow p^+ + e^- + \bar{\upsilon} \rightarrow + {}^{1}H \rightarrow$

where ${}^{63}Cu_{29}$ is a stable non-radioactive copper isotope.

With this chain reaction of LENR, along with the release of the kinetic energy of the particles in the form of heat Q, it is possible to generate a high power electric current from emitted electrons.

[1] A.P. Nikitin. Cold Fusion (CF) Chain Reaction and Non-mechanical Engine. 2022 https://vixra.org/abs/2204.0144 https://vixra.org/pdf/2204.0144v1.pdf

[2] R.M. Catchpole, J.W. Menzies, A.C. Monk, et al. Spectroscopic and photometric observations of SN1987a–II. Monthly Notices of the Royal Astronomical Society, v229, v1, pp.15–25, 1987. https://doi.org/10.1093/mnras/229.1.15P

P1-5

Cold nuclear fusion in fields Western Kazakhstan

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During the discoveries of oil and gas fields, we constantly receive their release during drilling, but how can we explain the origin of high pressures in the well if we include all the data on drilling projects? According to drilling data, the deposits have low reservoir pressures and the possible influx of oil (migration) can no longer create much pressure inside the deposit. So, the origin of high pressure in the well is associated with cold nuclear fusion, where electricity and plasma raise the pressure much higher than given in the projects. It is impossible to determine their pressure by calculation, and an emergency discharge in the well is obtained.

An example of such emissions are wells in the Tengiz and Kashagan fields, where the pressure reaches 1000 atm. Hydrogen sulfide is being released at the Kashagan field in the Caspian Sea, which for many years in a row has been associated with the death of various fish species and the Caspian seal, which has led to a multiple reduction in their population. In the pursuit of profit, humanity has gone very far, processes are taking place in nature that cannot be stopped, for example, the shallowing of the Caspian Sea, which is also associated with the extraction of hydrocarbons. Humanity needs a new source of energy, one of which may be cold nuclear fusion (CNF). Due to the CNF, it is possible to obtain new energy using a plasma engine. Maxwell's equations can be used to solve the speed of light. It is assumed that this is just a function of the dielectric constant and the permeability of free space. The measured speed of light exactly matches the predictions. Thus, when the special theory of relativity predicted gravity as a function of the speed of light, it was assumed that gravity would somehow be a derivative of the electromagnetic force. Many theories have tried to combine gravity and electromagnetic force with varying success. In addition, for more than 90 years, electrogravity has been studied for a non-reactive engine, also with varying success. However, perhaps when we understand how electromagnetic force and gravity can affect nuclear reactions, we can better understand how these forces are related. It is even possible to find ways to use gravity for engineering purposes: even a non-reactive propulsion system is possible. But the radiation from a cold fusion reaction can create an image as if the radiation were a light source. This development of images, rather than just footprints, is a unique cold fusion radiation. A related but different phenomenon is ball lightning and images of ball lightning when diodes fly apart during reactions.

Thus, the purpose of this topic is to discuss and analyze cold fusion data, especially with regard to experiments related to ball lightning, charge clusters, and gravitational effects. Another goal is to suggest that an explanation summarizing these observations could be called electrogravity.

P1-6

Quantifying Elements in Biological Materials

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The change of element concentration in living organisms – a so-called biological transmutation – was reported several times in the last 150 years. Since this research has been conducted a long time ago, most of the reports do not meet today's standards. We aim at conducting such experiments by using state-of-the-art methodology. Measuring element or isotope concentrations in organisms is a prerequisite to detect this phenomenon. When using methods such as inductively coupled plasma with optical emission spectroscopy (ICP-OES) or ICP-mass spectrometry (ICP-MS) for element / isotope concentration measurements, a critical step is the complete acidic digestion of the organisms. Minimizing potential contamination, the whole experimental process should be conducted within the same closable vessel: the organism should be grown in the same tube in which the digestion will be performed. Since we were using plants among others as model organisms and plants need light for their growth, we tested several tubes made of transparent and acid-resistant materials: (1) polypropylene (PP), (2) FEP (fluorinated ethylene propylene, a relative of polytetrafluorethylen (PTFE, Teflon®), (3) borosilicate glass, and (4) quartz glass (fused quartz) for their characteristics during acidic digestion. PP and borosilicate glass were disposable materials whereas Teflon and quartz glass had to be cleaned and reused because of their high price. PP became increasingly porous during the digestion process. Borosilicate glass leached especially K and Na ions. The Teflon derivative we were testing, showed a good performance in terms of repeated cleanliness even after several reuses. But we also found several deformations after the process. Quartz glass showed very low levels of K leaching. The performance of the vessel material during the digestion process of the different materials will be reported.

Preloaded NANOR®-Tech Trumps the "TDK Energy Solution"

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TDK, a large Japanese electronics company, purports their new lithium oxide-based solid electrolyte energy production component replaces coin-shaped cell batteries. They offer no technical details, but their recent announcement received good reviews on line, such as by Hackaday: "*While the energy density is high, keep in mind that the batteries of this type are usually tiny, so the total actual power available is probably not very high. Tiny batteries are definitely a thing. We are always hearing about breakthroughs, but we always wonder if and when we'll see actual products.*" One wonders also if there is high energy density, then why is a battery used instead of direct energy production, like cold fusion (lattice assisted nuclear reactions; LANR). The answer is: energy production is not detected, as it is with CF/LANR systems. The TDK battery is not even close to a competing method to CF/LANR-derived actual clean, energy production. As we report, in contrast to simple batteries, the continued development of these new CF/LANR quantum electronic devices, which have at their core nanostructured ZrO_2-PdNiD, has achieved considerable reproducible energy gain. Most importantly, the activation of the cold fusion/lattice assisted nuclear reaction, for the first time, is separated from loading. The core is ZrO_2-PdNiD [Zr (~66%), Ni (0-30%), and Pd (5-25%) by weight] with additional D. The PdNiD nanostructured core islands are electrically isolated by the zirconia (ZrO_2) dielectric. These preloaded, dry, CF/LANR NANOR®-type components feature two terminals and self-contained superior handling properties enabling portability and transportability [2] and energy production [3]. Surprisingly these ZrO_2-PdNiD nanostructured materials/components can generate significant LANR/CF energy gain [4, 5]; where CF/LANR energy and power density far exceeds simple batteries. Figure 1 shows the energy density for these batteries and also the NANOR®-type components. The incremental power gains and power outputs of these LANR components have greatly increased.

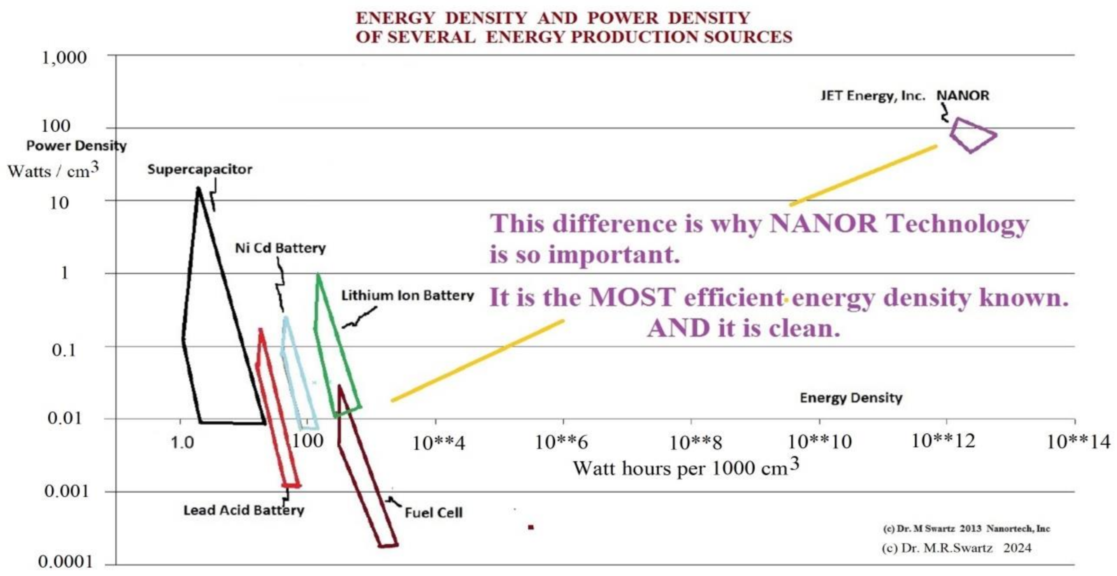

Figure 1 – Power Density and Energy Density for a Number of Energy Production and Energy Storage Systems including CF/LANR NANOR®-type components.

[1] Williams, A, TDK Claims Solid State Battery With 100X Energy Density", Hackaday, June 18, 2024. https://hackaday.com/2024/06/18/tdk-claims-solid-state-battery-with-100x-energy-density/
[2] Swartz M. R., Hagelstein P.I., Demonstration of Energy Gain from a Preloaded ZrO_2–PdD Nanostructured CF/LANR Quantum Electronic Device at MIT, *J. Condensed Matter Nucl. Sci.* 13, 516 (2014).
[3] Swartz M. R., Verner G., *et al*., Energy Gain From Preloaded ZrO_2–PdNi–D Nanostructured CF/LANR Quantum Electronic Components, *J. Condensed Matter Nucl. Sci.* 13, 528, (2014).
[4] Swartz, M. R, Comparison of NANOR-type LANR Components to 238Pu as a Heat Source for Space Flight**,** J. Condensed Matter Nucl. Sci, Vol 29, 238 (2019).
[5] Swartz M. R., Achieving Very High Incremental Power Gain, *J. Condensed Matter Nucl. Sci* (in press).

Coenergy Enables Force and Loading Measurements

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The coenergy equation is used in continuum electromechanics, electrophysics and electrical engineering [1] to consider and include magnetic fields for linear, conservative systems.

$$W'_m = 1/2\ m * H^2 \qquad \text{[Eq. 1]}$$

The derivation of force for such a magnetostatic system is simply the negative spatial gradient. This enables the fusion cathode to have its intravolumetric deuteron population measured *in situ* – and without interrupting the electrical current flow, as follows. Increasing mass by loading will decrease the frequency. The equation of motion, with terms including magnetostriction, is

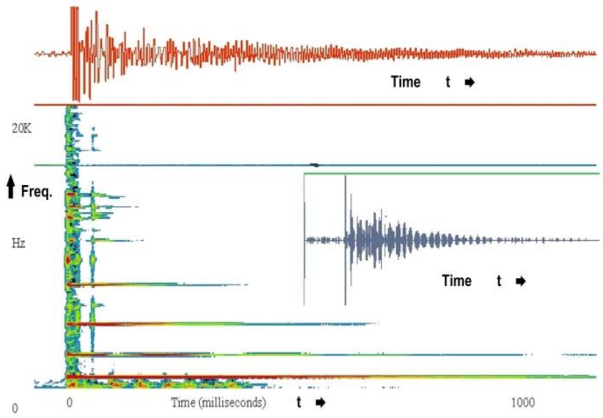
$$M\frac{d^2x}{dt^2} = -[K*x] - \frac{[Bo]^2}{2*\mu^2}\left[\Delta\mu + \left[(-\Delta\rho)*\left(\frac{\delta\mu}{\delta\rho}\right)\right]\right] \qquad \text{[Eq. 2]}$$

The solution of the equation has an amplitude, and natural frequency, of

$$\frac{[Bo]^2}{2*V*\rho*\mu^2*K*\sqrt{(\omega_0{}^2-\omega^2)}}*\left[\Delta\mu + \left[(-\Delta\rho)*\left(\frac{\delta\mu}{\delta\rho}\right)\right]\right] \qquad \text{[Eq. 3]}$$

$$\omega_0 = \sqrt{\frac{K}{\rho*V}} \qquad \text{[Eq. 4]}$$

The magnetoelectric term at the end of Eq. 2 is similar to that from dielectrophoresis. K is the first order spring-constant, representing the frictional force exerted back on the cathode. The total energy of the whole system is minimized by motion of the cathode, which creates its vibrations. This cathode vibration enables a hydrogen (or D) loading measurement. Furthermore, other benefits arise from an arrangement enabling an applied external magnetic field [1]. In addition to inducing a vibrational frequency of the cathode [Fig. 1], the magnetic field can be used increase the incremental power gain or collect a product within a portion of the electrode. In addition, by this process LANR domains can also become magnetic [2, 3], and interact [3], and can be followed [e.g. Fig. 1 on right].



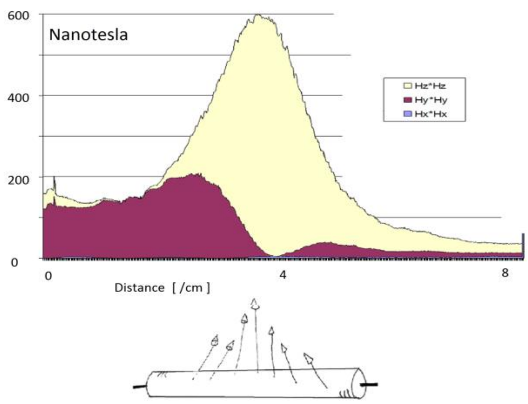


Figure 1 –Coenergy Enables Measurement of Loading and Induced Magnetic Microdomains
(left) Fourier Transform of A Vibrating Cathode - After beginning the vibration, the short-lived vibrational modes of the electrode are revealed here by FFT. The sampling rate was ~100 kilohertz, and the cathode was #92-505bjNi-B2 immersed in ordinary water. A calibration signal was also inserted at 17,390$^{+/-53\ \mathrm{Hz}}$. (blue horizontal line, approximately half-way up the image). (right) Magnetic Domains in this used NANOR®-type component NANOR® 7-8M. The magnetization (in nanotesla) is shown after it was previously operated.
(inset below) Estimated vectorial magnetization scan shown along its entire body.

[1] Woodson, Herbert H., James R. Melcher, Electromechanical Dynamics, Part II: Fields, Forces, and Motion, Massachusetts Institute of Technology: MIT OpenCourseWare, p. 464; http://ocw.mit.edu

[2] Swartz, M. R, G. Verner, J. Tolleson, P. Hagelstein, Dry, preloaded NANOR®-type CF/LANR components, *Current Science*, 108, 4, 595 (2015).

[3] Swartz, M. R, "Oscillating Excess Power Gain and Coerced Magnetic Domains in M-NANOR®-type CF/LANR Components", *J. Condensed Matter Nuclear Sci.*, 22, 35-46 (2017).

Detection of fast neutron emissions in low-energy electrochemical cells

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The potential for nuclear reactions below 6 eV has been studied since the late 20th century. In 1989, Fleischmann and Pons suggested that nuclear fusion was taking place in heavy water (D_2O) electrolysis with a palladium (Pd) cathode [1], though their claims faced initial scepticism and reproducibility challenges. We revisit the original experiments with improved methods to detect particle emissions in D_2O electrolysis experiments at low energies below 6 eV, using Columbia Resin #39 (CR-39) solid-state nuclear track detectors to detect and characterize fast neutrons. The detectors are tuned to measure fast neutron energy by first filtering out thermal neutrons using a boron-loaded absorber and then characterizing the energy of the remaining fast neutrons by studying their reaction products with various materials. With varying materials, this setup can help us characterize the energy of the neutrons emitted from the electrolytic cell. Preliminary results show an increase in track density on CR-39 detectors with aluminium coating, indicative of fast neutron emissions during electrochemical reactions.

Characterizing the energy of neutrons can shed light on the dominant mechanisms involved in our experiment. We observed triple tracks on CR-39 indicative of a 9.6 MeV fast neutron-induced ternary fission of carbon into three alpha particles. Our results show that nuclear processes are taking place below 6 eV applied energy, a range traditionally considered too low for such phenomena.

[1] Fleischmann, Martin, Stanley Pons, and Marvin Hawkins. "Electrochemically induced nuclear fusion of deuterium." (1989): 301-308

Phase Space Geometric Algebra

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A covariant conformal geometric algebra model of phase space is described. The model is motivated by experimental results observed in LENR [1] and ultra-dense hydrogen (UDH) experiments [2] through clues about hydrogen transport in metals and Rydberg matter formation as protons leave the metal.

The particle models of Consa [3], Celani et al [4], and Vasallo et al [5] propose that points or spheres are in an oscillating Zitterbewegung motion as an explanation for certain parameters of particles such as the magnetic moment. These models have also shown skill in describing UDH.

Geometric algebra is a natural language for physics that unifies objects and transformations, readily allows for covariant descriptions, and tends to make geometry more linear as the number of dimensions increases. At the lowest level, the 3D vector space model in geometric algebra is not expressive enough to algebraically distinguish vectors from points, and the number of transformations available is very limited. Spacetime Geometric Algebra (a 4D model projective model of 3D space) has revolutionized the Maxwell and Dirac equations. Conformal Geometric Algebra (CGA) is a 5D model of 3D space that introduces more invariants, geometric primitives, and transformations (such as inversions and dilations) that may be useful for describing physics.

In this work, fundamental particles are described with origin forms and then transformed to general states. Interactions between particles are informed by the tools of geometric algebra and quantum field theory. Connections to UDH observables are made.

[1] Hagelstein, P. L., D. Letts, and D. Cravens. "Terahertz difference frequency response of pdd in two-laser experiments." J. Condensed Matter Nucl. Sci. 3 (2010) 59-76.
[2] L. Holmlid, S. Zeiner-Gundersen. "Ultradense protium p(0) and deuterium D(0) and their relation to ordinary Rydberg matter: a review," Physica Scripta, Volume 94, Number 7, 94 075005, 2019.
[3] O. Consa. "Helical solenoid model of the electron," Progress in Physics vol. 14, 2, 80-89, 2018.
[4] F. Celani, A. Di Tommaso, G Vassallo, J. Condensed Matter Nucl. Sci. 25 (2017) 76–99.
[5] G. Vassallo, A. Kovacs 2023 J. Phys.: Conf. Ser. 2482 012020

P1-11

Ultrafast Tunnelling in Halogen Clusters

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We report on chemical transmutations observed in halogen-based reactions and room temperature systems. Ultrafast electro-nuclear tunnelling processes[1] in in diatomic molecules and larger clusters are considered as a theory. Based on the thresholds for hypercharge screening in topological defects we discuss decay widths for colour superconducting vorton states which lead to exotic electron statistics. We will provide the results of atomistic modelling,[2] as well as supporting experimental, preliminary XRF and Mass Spectrometry results.

[1] D. Popova-Gorelova and R. Santra, "Imaging instantaneous electron flow with ultrafast resonant x-ray scattering," *Phys. Rev. B*, vol. 91, no. 18, p. 184303, May 2015, doi: 10.1103/PhysRevB.91.184303.

[2] J. Zhang, J. Pagotto, T. Gould, and T. T. Duignan, "Scalable molecular simulation of electrolyte solutions with quantum chemical accuracy," Nov. 15, 2024, doi: 10.48550/arXiv.2310.12535.

P1-12

Experiment on detecting neutrons produced by low-energy nuclear reactions using CR39

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This experiment qualitatively proves the objective existence of low-energy nuclear reactions by detecting neutrons. This experiment was conducted according to MIT's experimental plan. I used a 445 nanometer laser with a laser power of 3.5-4.5 watts to irradiate titanium metal sheets in an atmosphere of air, hydrogen, deuterium, and argon gas. CR39 uses a solid-state track detector produced by BARYOTRAK in Japan for neutron detection outside the container. The detector is located 13mm away from the laser point and after 22 days of laser irradiation, a large number of fast neutron imprints are detected, which are one order of magnitude higher than the background, confirming that low-energy nuclear reactions can produce neutrons.

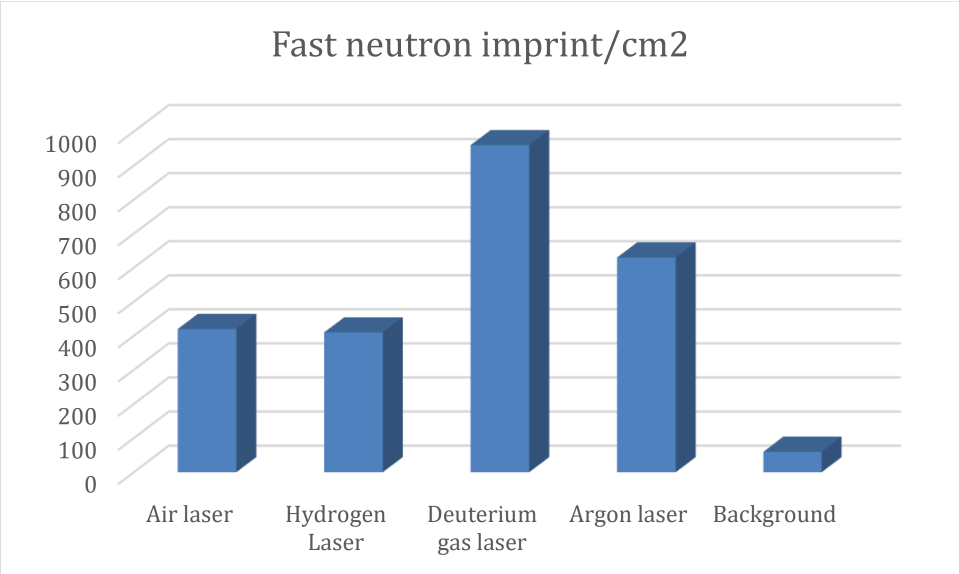

Figure 1: Number of neutron imprints produced by laser irradiation on titanium metal in different gas atmospheres

References

[1] Probing neutrons and purported fission daughter products from gas-loaded, laser-irradiated metal-hydrogen targets Principal Investigator: Yet-Ming Chiang, Professor, MIT Presentation by Florian Metzler, Research Scientist, MIT

[2] Laser induced transmutation in palladium thin films in hydrogen atmosphere
Jean-Paul Biberian , Pamela Mosier-Boss , Larry ForsleyAix-Marseille University, France Global Energy Corporation, U.S.A.

[3] LENR Anomalies in Pd–H2 Systems Submitted to Laser Stimulation
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SAM and the early LENR results from Japan

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The initial LENR findings from Japan represent a valuable repository of data on transmutations, including isotopic shifts, which are regarded as evidence of such processes. Prof. Mizuno later expanded this research, showing more detailed results with only the Cu 63 isotope and not Cu 65.

Using the Structured Atom Model (SAM) we examine the reported transmutations, including isotopic shifts. SAM enables us to do a detailed analysis of potential nuclear reactions and offers a logical explanation for how these reactions may be initiated.

The logic of the Structured Atom Model allows us to discover that stable elements are subject to transmutation via both fusion and fission / spallation. In case of fusion small nuclei can combine with an existing base to form the new element. During fission events smaller nuclei are removed from the base or whole branches are broken of the nucleus.

In conclusion, through collective research within the LENR community, we 'stumbled' upon a method for triggering fission-like transmutations for stable elements as well as creating heavier stable elements through primarily carbon and oxygen fusion on an existing base.

P1-14

Element Concentration Changes in Biological Material

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During the last and the beginning of the current century the change of element concentration in living plants, fungi and bacteria was reported. The proof of the phenomenon of the so-called biological transmutation remains vague and its potential mechanism is not yet understood. Additionally, the phenomenon itself is difficult to demonstrate, and the results are often found to be not fully reproducible. Therefore, we started a new attempt to measure biological transmutation, i.e. the differences in element concentration during the growth phase of organisms, using state-of-the-art methodology. In our experiments, we grew fungal cells (*Saccharomyces cerevisiae* – baker's yeast) and plant seedlings (*Lepidium sativum* – garden cress) in closed environments. The single-celled fungi were grown in liquid nutrient media. An acidic digestion was followed by measurement of the elements Ca, Fe, K, Mg, Mn, Na, P and Zn using inductively coupled plasma with optical emission spectroscopy (ICP-OES) of the initial start solution directly after inoculation (only a few cells in solution). These values were compared to the solution measured after 48h incubation including the multiplied cells. For the cress seedlings the seeds were grown on water for seven days. The element concentration of the seeds was compared to the one of the seedlings. The results of several experimental series of yeast indicated that a change of element concentration of less than one percent occurred in small but partially statistically significant amounts. The results of the experiments with cress indicated a trend towards changed element concentrations after the growth phase of 5-10%. We will report on the current state of the experiments.

P1-15

Theory of Neutron Production via Electron Capture by Coherent Protons

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The conduction electrons and protons within a metal hydride can spontaneously form coherent quantum plasmas in specific vibrational states. These states are capable of interacting coherently via weak interactions to produce neutrons at remarkably low energies.

The existence of these vibrational coherent states is supported by a recent theoretical analysis [1], which demonstrates that such configurations are characterized by an energy gap of approximately 1 eV per particle compared to incoherent states, making them dynamically stable. When coherently excited, these states can transfer energy through an up-conversion process, enabling highly energetic mechanisms.

In this presentation, I demonstrate how neutrons can be produced through such coherent interactions. The resulting neutrons are essentially at rest and remain confined within the metal matrix. The theoretical framework presented operates within the limits of the Standard Model of Particle Physics, providing a basis for calculating the neutron production rate.

[1] Gamberale, L.; Modanese, G. “Coherent Plasma in a Lattice” *Symmetry*, *15*, 454, **2023**

From Effects towards LENR-Products

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Replacing combustion by LENR will soon be possible and greatly impact our economy. A home heating system is likely the first major application. Dr. h. c. Hans-Peter Bierbaumer in Austria, whom I supported since 2006, reached an important milestone in 2012: He achieved 20 kW heating power with a COP of 20 to 50 by 2012. For two months, the prototype heated his house. Sadly, he passed away in August 2012. His investors tried to continue but failed. The documentation went lost.

In honor of Bierbaumer, I present a part of his work. He was convinced that he could solve the remaining challenges. That's why he mortgaged his house. My organization is experimenting with a focus on market-ready solutions. We are aware that many theoretical challenges are the subject of further research and are therefore open to collaborations.

The prototype image will be shown and explained. That was developed according to professional requirements: (i) regulation of the heat source; (ii) separation of the primary from the secondary fluid circle; (iii) sensors for all key parameters; (iv) materials to avoid neutrons, gamma-rays and ensure safety; (v) a control system for the first and secondary fluid circle and the heat source; (vi) a design for easy maintenance; (vii) and remote monitoring and control to ensure timely maintenance.

Bierbaumer patented the LENR heat source, although the theories were incomplete in 2010 and still are. The design suggests that convection, from the anode or cathode, is not the working principle. Recombination of hydrogen with oxygen, separated by LERN in the heating device, delivers the energy in the primary fluid circle. The lifetime of the cathode determines the maintenance interval. Separating the primary liquid cycle from that of the radiators allows a liquid that supports LENR.

The system operates at pressures and temperatures known from today's heating systems. Higher temperatures and pressures would be possible, e.g., for industrial processes or to run a gas turbine. Between the anode and cathode, the fluid moves in a pulsed electric field. EM waves up to visible light will be sent into the fluid. Helium was found in the gas separator.

Thanks to your tremendous progress for LENR! Failed experiments helped on the right path and explosive cells for safety. Now we see a crazy situation with the so-called "trap patents". If you want to build a LENR car, it is already patented. This also applies to many other applications. A patent war began. Any heat source, electrical source, apparatus, and industrialized process, could use LENR. Can we block those trap patents, so they don't block you?

[1] H.P. Bierbaumer Patents: (a) Energy Converting Device; EP1685276A1.pdf Prio 14.10.2003
(b) Device for Heating Fluid; WO2011/082441A2; Prio 11.01.2010

[2] R. Lechner-Schobel: (a) Die Geschichte (the history of) der Kalten Fusion; FUSION #1/2020
(b) Die richtige Energiewende; FUSION #2/2020

[3] L. Jaitner: (a) The Physics of Condensed Plasmoids (CPs) and Low-Energy Nuclear Reactions (LENR); https://condensed-plasmoids.com/
(b) New Evidence of an Ultra-Dense State of Matter in LENR Experiments; IWAHLM-16 Presentation; Sept. 2024

[4] Metzler *et al*: 2024 *New J. Phys.* 26 101202: Known mechanisms that increase nuclear fusion rates in the solid state; **DOI** 10.1088/1367-2630/ad091c

[5] G. Egely: Faces of LENR; Infinite Energy, Issue 151/152, May-August 2020

[6] A. Bari; D. Nagel: Utilizing Artificial Intelligence for advancing LENR: Mining and Mastering the LENR Literature; IWAHLM-19 Presentation, Sept. 2024

P1-17

Introducing Hyper-Cold Fusion

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Hyper-cold fusion is a novel approach that leverages the unique properties of 2D materials to enable fusion reactions under conditions distinct from traditional hot or cold fusion. Unlike conventional methods, hyper-cold fusion involves conducting experiments at elevated gas pressures while maintaining a low-energy state. We propose using graphene, a 2D material with exceptional electronic properties, to create an electron-rich environment conducive to fusion. When hydrogen is introduced as a high-pressure gas onto graphene, it is expected to move freely by expanding its displacement field—thereby increasing the likelihood of fusion interactions compared to hydrogen-occluded 3D metals.

Recent advancements in THz technology have demonstrated enhanced excess heat generation in cold fusion experiments [1]. We hypothesize that graphene sheets or powders will emit THz radiation [2], creating an excited electron-rich environment. Electrons in graphene form plasmons as quasi-particles, with a Fermi velocity of 6000 km/s. These plasmons may interact with hydrogen nuclei, facilitating fusion through mechanisms such as electron capture [3]. Specifically, we propose that ground-state hydrogen (with a 1s orbital electron) could undergo electron capture, resulting in fusion reactions on the graphene surface.

In this experiment, we also introduce borophane (a borohydride sheet), a 2D material composed of boron and protons with a composition ratio of H:B = 1:1 [4]. When heated above 200 °C, borophane undergoes temperature-programmed desorption, releasing hydrogen atoms from its surface. This process enables proton-boron fusion reactions through electron capture on graphene. By irradiating the graphene-borophane system with electromagnetic waves, we aim to generate excess heat or electrical power in future developments under rigorously controlled conditions.

Our experimental setup (Fig. 1) involves encapsulating a mixed powder of graphene and borophane in a 100 mL pressure-resistant chamber. The chamber is evacuated to a vacuum level ranging from 1×10^{-3} torr to a maximum of 150 MPa. The outer wall is heated to several hundred °C using an electric heating wire, causing borophane to release hydrogen gas. We anticipate that this hydrogen will interact with graphene and boron, initiating fusion reactions through electron capture. Detection of excess heat or fusion byproducts (e.g., alpha particles) will be used to validate the proposed mechanism.

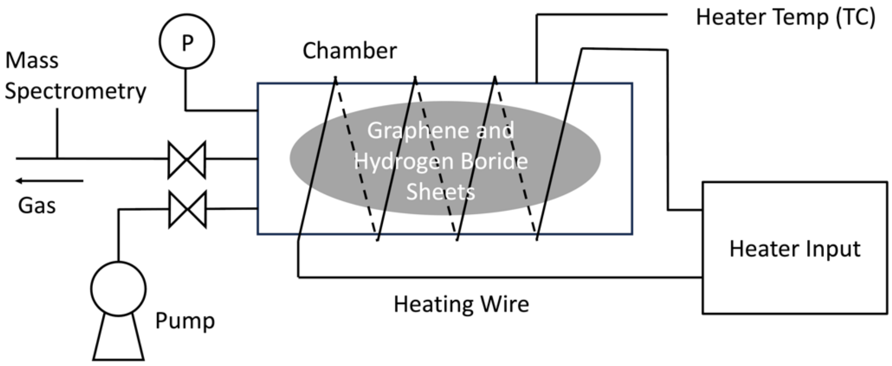

Fig. 1 Hyper-Cold Fusion Experimental Setup

[1] D. Letts, Highly Reproducible LENR Experiments Using Dual Laser Stimulation, Current Science 108, no.4 (2015) 559-561
[2] S. Boubanga-Tombet, W. Knap, D. Yadav, A. Satou, et al., Room temperature amplification of terahertz radiation by grating-gate graphene structures, Phys. Rev. X, vol. 10, July 6, 2020.
[3] A. Widom and L. Larsen, Ultra low momentum neutron catalyzed nuclear reactions on metallic hydride surfaces, Eur. Phys. J. C, 46, (2006) 107-111
[4] H. Nishino, T. Fujita, N.T. Cuong, et al., Formation and Characterization of Hydrogen Boride Sheets Derived from MgB2 by Cation Exchange, J. Am. Chem. Soc 2017 139 (39), 13761-13769

Voltage Dependent Nuclear Transmutations in Nickel Electrolysis

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We investigated nuclear transmutations in a Nickel (99.5% pure) cathode with a pure graphite anode in 1M K_2CO_3 light water solution electrolysis[1, 2]. The applied *rms* voltage ranged from 2 V to 45 V from a half-wave rectifier (50 Hz) driven by an autotransformer. Electrolysis conducted below 2 V showed no observable transmutations, while higher biases resulted in significant transmutations in the cathode. Elemental analyses (WDS & ICP-MS) revealed the emergence of the elements Mg, Cu, Fe, Au and Pt in descending order of wt%. Our findings show that the transmutations are voltage-dependent, with both the applied voltages 5 V and 20 V showing significantly large changes.

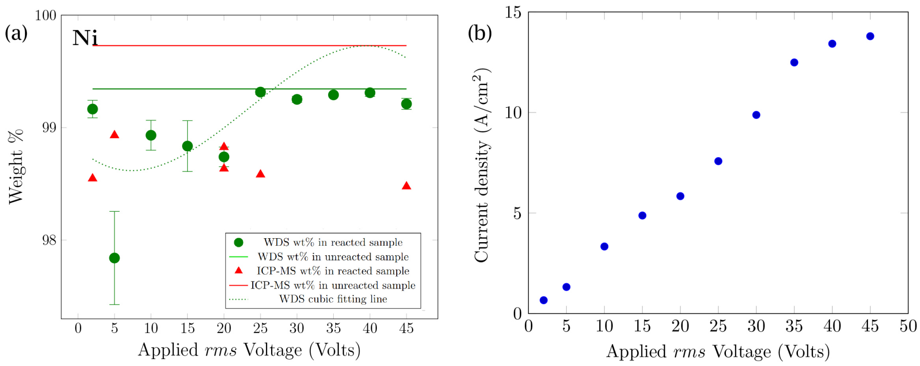

Figure 1: (a) Plots show Ni wt% data from WDS (green circles) and ICP-MS (red triangles). Horizontal lines indicate unreacted sample wt% for comparison, and the green dotted line is the cubic fit for WDS data. (b) V-I characteristics of electrolytic cell

References

[1] Rajeev, K. P., Gaur, D. Evidence for nuclear transmutations in Ni–H electrolysis. *Journal of Condensed Matter Nuclear Science, 24*(1), 278-283., 2017

[2] Kumar, A., Jain, P., Rajeev, K. P., Pala, R. G. Upper Bound in the Fusion Products and Transmutation Enhancement in Alloys. *Journal of Condensed Matter Nuclear Science, 36*(1), 327-335., 2022

Experimental exploration of multi-frequency laser induced LENR in metal-hydrogen system

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The Pd-H(D) system has been observed to undergo nuclear reactions under relatively mild conditions, with numerous experiments demonstrating that laser excitation can trigger low-energy nuclear reactions (LENRs) in it and produce new elements [1]. The frequency of the laser plays a crucial role in these reactions. Specifically, lasers at certain frequencies are capable of ionizing hydrogen (deuterium) gas [1], which subsequently increases the concentration of hydrogen within the palladium lattice and enhances reaction efficiency. Additionally, lasers can also locally heat the surface of palladium or ionize it via photoelectric effects, further boosting reaction effectiveness [2]. Despite these findings, the precise relationship between laser frequency and transmutation reaction efficiency remains elusive.

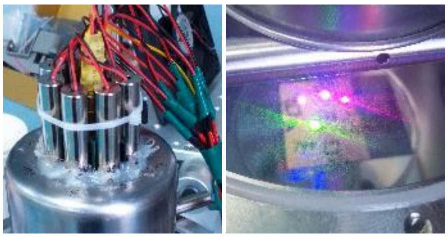

Fig. 1. Multi-frequency Laser.

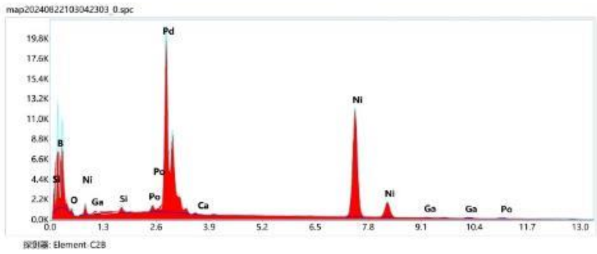

Fig. 2. New elements detected.

Biberian's study shows that red laser, possessing a longer wavelength compared to blue-violet light, is more favorable for the transmutation reactions [3]. In our experiments, we opted for lasers with a broader range of wavelengths to further investigate how the frequency of the excitation laser influences the occurrence of transmutation as shown in Fig. 1.

We conducted SEM/EDS analyses on the coated material at the intended irradiation site prior to initiating the experiment. Subsequent SEM/EDS inspections were performed post-irradiation, revealing alterations in surface morphology and elemental transmutation characterized by the emergence of new elements due to laser exposure (see Fig. 2). At the same time, CR39 detection resin was deployed both inside and outside the reactor. This setup enabled us to ascertain that neutron counts near the reactants significantly exceeded those in the external background.

Keywords: Laser, LENR, transmutation, Pd-D

References

[1] V. Nassisi, "Transmutation of elements in saturated palladium hydrides by an XeCl excimer laser", Fusion Technol., **33** (1998) 468-475.
[2] P.L. Hagelstein, D. Letts, D. Cravens, "Terahertz difference frequency response of PdD in two-laser experiments", J. Cond. Matter Nucl. Sci., **3** (2010) 59-76.
[3] J.P. Biberian, L. Forsley, and P.A. Mosier-Boss, Transmutation of Palladium Induced by Laser Irradiation. J. Condensed Matter Nucl. Sci., **37** (2023) 9-22.

P2-1

Experimental study of electromigration of hydrogen nuclei in palladium

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Thirty-five years of the experimental study of Cold Fusion and Low Energy Nuclear Reactions (LENR) have made it clear that two factors are important. One is the features of the material on or in which LENR occur. Another is the concentration of protons or deuterons in the active material [1]. A third factor is not as well established experimentally, but must be important. It is the motions of the hydrogen nuclei, which are necessarily prerequisite to their interactions and reactions.
Electromigration is the motion of ions and atoms within materials due to the flow of electrical currents. The potential benefits of electromigration were recognized as early as 1991 for the study of LENR [2]. Since then, there have been about 20 LENR papers in which electromigration played a role.
The apparent effectiveness of electromigration in causing LENR is potentially important, at least scientifically and maybe also practically. It might enable materials that would not otherwise support LENR to enable such reactions and produce thermal power. That favorable news is counter balanced by fundamental problems with quantitative understanding electromigration. There are two opposing mechanisms active in electromigration. One mechanism postulates that the positive protons P or deuterons D move in materials due to the field of the applied voltage. In that direct electrostatic attraction case, P or D accumulate at the negative end of the material. The other mechanism envisions the motion of P or D as being due to momentum transfer from electrons, so that the hydrogen isotopes go to the positive end of the material. This case is termed the momentum transfer or "electron wind" model. Both ideas have been and still are invoked in studies of the effect of electromigration in LENR experiments. However, their relative importance and effects are unknown.

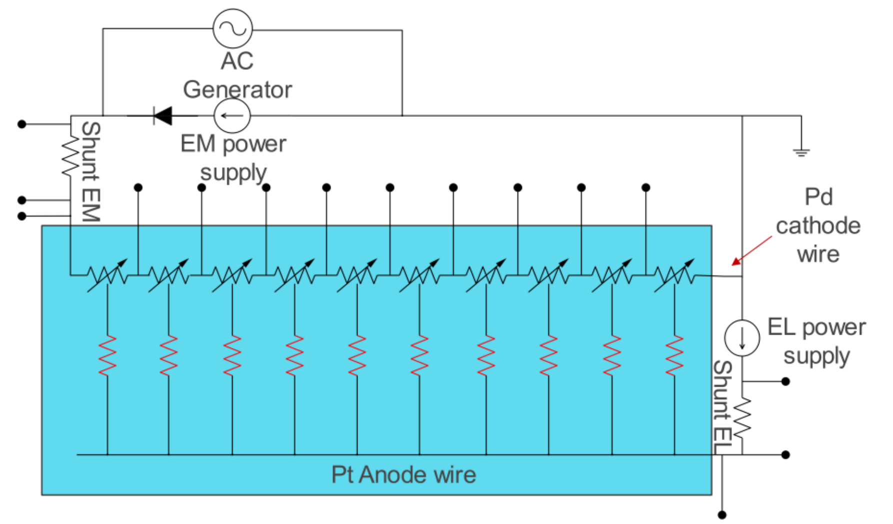

Figure 1 – Schematics of the electrical circuit for an experiment to study the electromigration on Pd wires.
Area in blue is the electrochemical cell. Resistors in red represent the electrolyte.

We designed a new experiment to measure the directions and magnitudes of electromigration in Pd wires that are 250 μm in diameter and 10 cm in length. Using knotted Pt wire leads, we have contacts to the wire with separations of 1 cm. The Pd wire is the cathode in an electrochemical cell in which the anodes are separate 1 cm-long Pt wires near each of the Pd segments. This arrangement enables us to load protons into segments of the Pd wire, and then use resistance ratio measurements to monitor the motion of the protons or deuterons within the Pd wire. With this setup, we can measure the concentrations of protons in each segment of the Pd wire, including their temporal variations due to diffusion and electromigration. Theremino software [3] is used to control and monitor the experiments, and to store the data.

[1] McKubre et al., "Excess power observations in electrochemical studies of the D/Pd system: the influence of loading", Proc. ICCF3, Nagoya, Japan, 1992.
[2] K G. Rajan *et al.*, "Electromigration approach to verify cold fusion effects", Fusion Technology, vol. 20, p. 100 (1991)
[3] https://www.theremino.com/en

P2-2

On the mechanism of nodule formation in electrical discharges

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One of the urgent problems is to establish the mechanism of formation of spherical nodules. There is no doubt that linear underground electrical discharges are the cause of nodule formation on the Earth's surface and under water. Despite considerable efforts, one of the least studied objects in Nature is linear lightning, which is formed by electrical discharges in the atmosphere during thunderstorms. There are also less studied underground lightning, which are formed due to earthquakes, as well as friction between tectonic plates. It should be noted that electrical discharges in the Earth's atmosphere, including the upper layers and underground discharges, have the same nature of origin in different environments.

The progress made in the field of obtaining ball lightning in the laboratory allows us to explain the mechanism of generation of nodules, which are also formed at the junction of two media in electrical discharges inside the Earth. A theoretical model of the mechanism of nodule formation, which is formed when underground linear lightning exits into a less dense environment, has also been created.

Based on the available data, it can be concluded that charged plasma formations similar to fireballs are formed as a result of physical, electrical and magnetic phenomena, and that these charged plasma balls are able to move at great speed under the influence of and as a result of the balance of electric charges in the earth's crust. This process can be called electrogravity. Electric charges of opposite signs accumulate in the Earth's core and geospheres. This creates an Earth-based electrical capacitor, which accumulates a huge amount of electrical energy. Periodically, this capacitor breaks through, and electric arcs arise in the bowels of the planet – underground lightning. Sometimes ball lightning – round plasmoids - form at the ends of these lightning bolts. The plasma in these plasmoids is held by a strong, closed magnetic field. These spherical magnetic fields in tectonic faults filled with fluid and pulverized (fragmented) rock, which is attracted by an electromagnetic field, create stone balls.

The release of spherical nodules is often observed in regions of oil and gas occurrence on the Earth's surface. It can be assumed that oil reservoirs can play the role of an insulator between statically differently charged layers of the planet's interior. Nodules are found in the sediments of various geological systems and in the sediments of modern lakes, seas and oceans. Regular relationships are observed, for example, in limestones, marls and chalk, flint nodules predominate, in sandstones – nodules of iron oxides, in clays, oil shales and coals – carbonate and pyrite. The age of the rocks does not affect the formation of nodules, but the predominance of fine-grained silty sediments in them at the time of deposition is a favorable factor. Therefore, concretions are often found in the Upper Cretaceous, which contains many fine-grained rocks. Significant accumulations of ferromanganese nodules (about 10% of the total area of the ocean bed) of practical interest have been identified on the surface of the bottom of the Pacific, Atlantic and Indian Oceans.

P2-3

Research and development of electrical technology for the model of planet Earth and the formation of hydrocarbons

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This work is devoted to the study of the effects of high-voltage electric discharges on reservoir fluids in the laboratory in order to study new methods of energy production. The electrical action of plasmoids and ball lightning in the earth's crust leads to the formation of spherical and linear nodules, which we see in the fields of the Mangistau region of the Republic of Kazakhstan and other regions of the world. The appearance of such nodules all over the world stimulates us to study them, which can lead to the realization of new ways of obtaining energy.

To test the proposed theory based on the studied geological and geophysical data on the structure of the planet Earth and spherical nodules, experiments were conducted to create electrical discharges in laboratory conditions. Figure 1 shows a diagram of a laboratory installation, which consists of a reactor, an electric capacitor and ball arresters. The reactor was filled with a mixture of various compositions and reservoir conditions were created. An electric capacitor with a capacity of 1000 mcF was supplied with a voltage of up to 7 kV, during which a discharge appeared on the ball arrester and entered the reactor through the cable, where discharge (clicks) also occurred. The gap between the electrodes ranged from 5 to 10 mm. The voltage was measured with a milliammeter set to 20 kV. According to the above scheme, the author has been conducting various studies for 20 years to produce ball lightning in a reactor. The main one is the production of blue plasma on ball arresters, presumably, the same plasma is formed on the arresters inside the reactor (the formation of plasmoids, or artificial ball lightning), which confirms the plasma chemical reactions taking place inside the reactor with the participation of various chemical elements. After the tests, aggregates, specific nodules, etc. were formed inside the reactor vessel. Modern physico-chemical analysis methods must be used to study the composition of fluids.

Due to electrical processes and cold nuclear fusion, all secondary minerals are formed, such as coal from oil, ores from aqueous solutions containing metals, diamonds from organic carbon, gold from lead, etc. The proposed theory of sliding plate tectonics fully explains all processes in the Earth's crust and confirms the theory of continental drift, which, however, is currently being criticized.

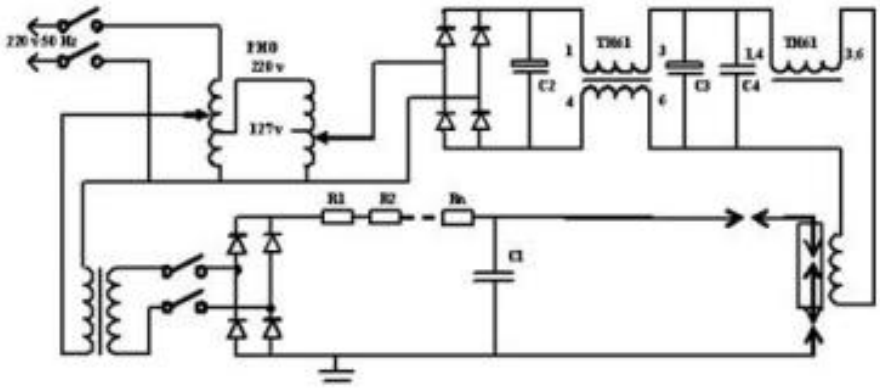

Figure 1. Schematic diagram of a laboratory installation

Excess Power Gain using LANR from Deuterated Niobium

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Niobium [Nb] may offer new lattice assisted nuclear reactions and other CF/LANR opportunities. This element is actually very complex. Although niobium was discovered in 1734 by John Winthrop in Massachusetts, that critical ore sample sat in the British Museum until 1801. Niobium from the Earth's crust is one stable isotope, ^{93}Nb. This metal element is ductile and soft, hardening with impurities. It is grey, and becomes blue greenish color when exposed to air at room temperature. The Nb lattice is body-centered cubic, and it may change because Nb can become anomalous on thermal heating and expansion. Also, importantly Nb is anti-corrosive after it forms oxide layers. Today, it is much more complicated. Now, more than a score of Nb radioisotopes have been synthesized with atomic masses 81 to 115. Paramagnetic niobium has the largest magnetic penetration depth of all elements. It is central to superconducting based technologies, including high-Q radio frequency cavities, and resonators used for quantum computing and gravitational wave detectors. Nb is one of three elements forming Type II superconductors [with vanadium and technetium]. Niobium becomes a superconductor at 9.2 K, but its hydride phases shows no sign of superconductivity down to 1.3 K.

Pertaining to LANR, entry of D in Nb has recently been examined [1,2]. The results of several well-controlled experiments prove that LANR-derived excess heat can be obtained from electrically driven deuteron-loaded niobium. For example in the run shown in Figure 1, a five electrode calorimetric cell containing heavy water had a platinum anode, and separate nickel and niobium cathodes, and an ohmic control. Each were in the same thermal and electrical driving system. Note that there was excess heat for the deuteron loaded niobium. The nickel Phusor®-type component was also included as an additional excess-heat producing control, and for that the incremental power gain was $3.76^{+/- 0.23}$. The incremental excess power gain was for the niobium Phusor®-type component was $2.88^{+/- 0.21}$ compared to the ohmic control. Nb may indeed have a future in LANR both because it is an option to palladium and nickel, and offers unique magnetic, high temperature [3], and now XSH opportunities.

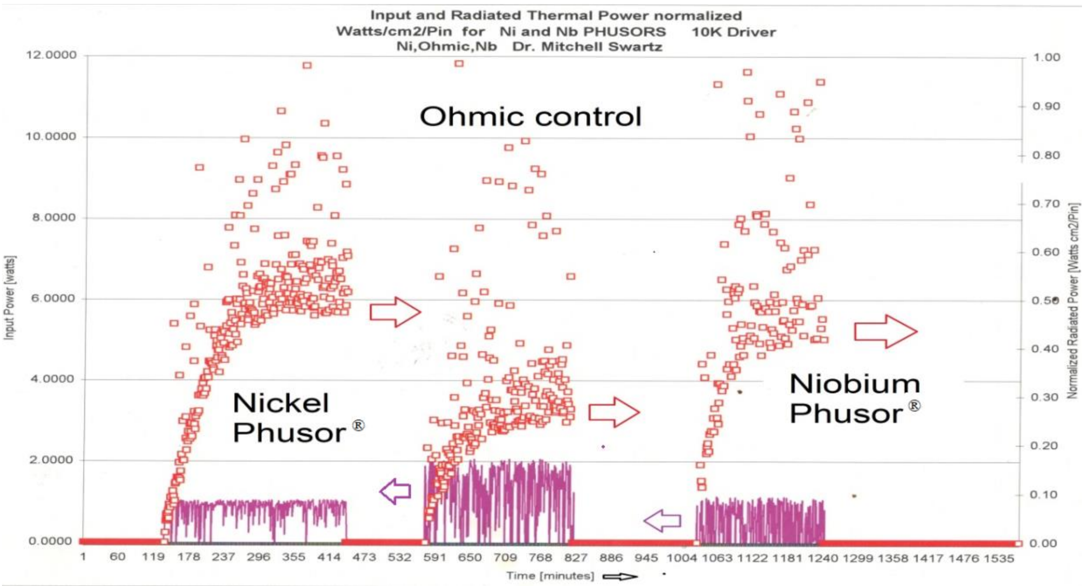

Figure 1 – Input Powers and Input Power-Normalized Output Thermal Power [Watts/cm^2/Pin] for a Nickel Phusor®-type system, an ohmic control and a Niobium Phusor®-type system.

1. Qi Dan, Ru Tang & Xiaohong Chen, Effect of Deuterium Loading on Permeation of Deuterium Through Niobium at Relative Low Pressure, Journal of Fusion Energy, Volume 43, article number 53, (2024). https://link.springer.com/article/10.1007/s10894-024-00448-1
2. Abdulaziz Abogoda, W. A. Shelton, I. Vekhter, and J. A. Sauls, Hydrogen and Deuterium Tunneling in Niobium, https://arxiv.org/pdf/2409.09014
3. https://www.firstpost.com/world/what-is-niobium-alloy-that-china-is-claiming-a-breakthrough-in-13850701.html

Ordinary H-Humidity Can Inactivate D-Loaded CF/LANR Components

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The desired result from lattice assisted nuclear reactions [CF/LANR] is activity. This includes the working production of excess heat ["XSH"] by either conventional CF/LANR systems or deuteron-preloaded ZrO_2-PdD and ZrO_2-PdNiD nanomaterial core NANOR® -type components. Unfortunately, XSH can be quenched by excessive ordinary H-humidity, although in a very complicated way. We report this unexpected type of CF/LANR inactivation which can be irreversible. We report it impacting both the incremental excess power gain and the electrical resistivity of active, working NANOR®-type components. This is important because these dry, very highly preloaded NANOR®-type LANR components are the future of clean efficient energy production. Therefore, any side reactions which potentially quench or inactivate the desired reactions must be understood and controlled. This new inactivation of the desired XSH is beyond H merely preventing D entry into metal during loading, as previously known. It is also beyond the complete but usually temporary inactivation loss of power gain made by NANOR®-type components [1] driven above the breakdown ["avalanche"] voltage, and the partial inactivation observed as the electrical avalanche threshold is approached [2]. This new, often irreversible, inactivation was only uncovered by the use of larger core volume components at MIT, where the ordinary H-humidity changes in the laboratory building were significant. Fig. 1 shows irregular losses of electrical resistivity, and the associated existential loss of the desired XSH-activity. The first graph shows the electrical impedance of NANOR® 8-2 as function of ordinary H-humidity, and the second graph reveals that ordinary H-humidity drastically changed the desired LANR activity results. Observe how the initial steady electrical resistance decreased irregularly. Each time the activity and resistivity returned to their baselines, and is partially marked as 'stable operation' and indicated by black lines. The second graph in Fig. 1 shows the horrible final loss of the desired excess heat ["XSH"; dT(*)/Pin in Run EF9-160410A, with the temperature measured at the heat sink location], even though the component is initially active (orange region) At higher humidity, there is fall off of both electrical resistance and desired XSH-activity. Thus, it is clearly seen that there are two modes, between which there is a inactivation fall off produced by high humidity ordinary water. The final unwanted H-induced loss is seen as the undesired XSH-missing blue region. Ordinary H-humidity can partially or completely quench the desired XSH from D-loaded components, and altered component electrical resistance, too. This negative transformation by inactivation of an LANR component is quite serious. Preventing or resolving this will better engineer and help commercialize these systems.

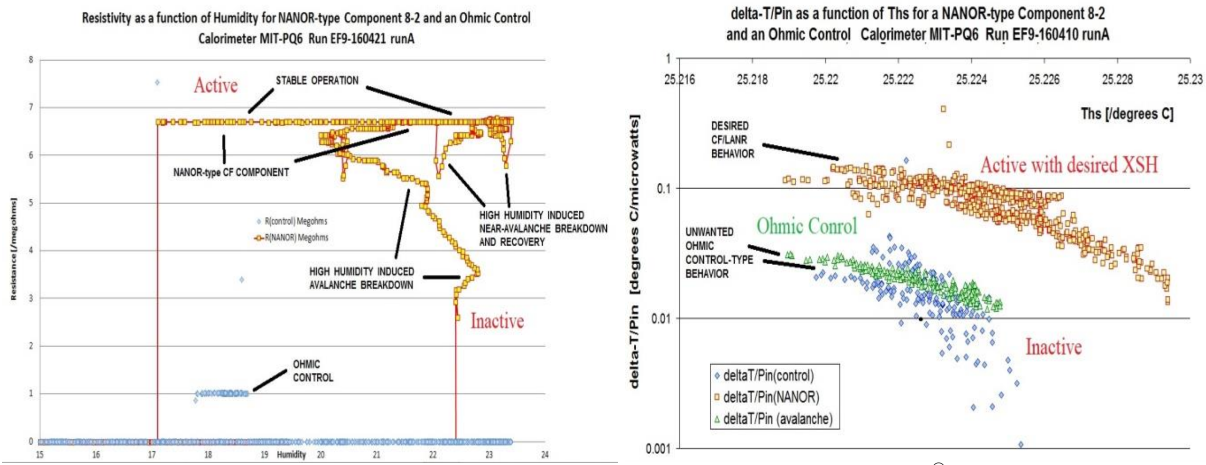

Fig. 1 – Losses of Electrical Resistivity and the Desired XSH-activity for NANOR®-type component 8-2 as a function of Ordinary H-Humidity during two Experimental Runs. (left) - The electrical impedance as function of ordinary H-humidity at MIT was significant, and clearly changed the results. (right) The desired XSH generated by the LANR component (orange) and its absence in the control (green) are shown on a logarithmic axis. Also shown is the inactivation (blue) that represents and shows the loss of XSH after the ordinary H-humidity was too high for too long. The LANR component now matches the ohmic control.

[1] Swartz M. R., Verner G., Tolleson, J, Energy Gain From Preloaded ZrO_2–PdNi–D Nanostructured CF/LANR Quantum Electronic Components, J. Condensed Matter Nucl. Sci. 13, 528 (2014).

[2] Swartz, M., P. Hagelstein, G. Verner, Impact of Electrical Avalanche Through a ZrO_2-NiD Nanostructured Component on its Incremental Excess Power Gain", ICCF-19, JCMNS, 19, (2016).

Radio-Frequency Studies of LENR Electrochemical Cells

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A wide variety of electrical and other excitations has been put into, and measured from electrochemical cells that were used for research on Low Energy Nuclear Reactions (LENR) [1]. Among the various excitations, radio-frequency (RF) signals have proven to be both beneficial and instructive [2]. In some experiments, RF emissions from LENR cells provided information on frequencies generated within the cells. Given that history, we are using modern RF instrumentation for research on LENR electrochemical cells. Our ultimate goal is to detect signatures of the occurrence of LENR.

We are using a variety of RF instruments. One of our main tools is a Vector Network Analyzer (VNA), which operates in the frequency range from 2 MHz to 6 GHz. A Network Analyzer produces RF signals, sends them to the material, device or circuit being tested, and then detects what fraction of the power is returned from (S11) or transmitted by (S21) the test object. A Vector unit also keeps track of the phases of the generated and measured signals.

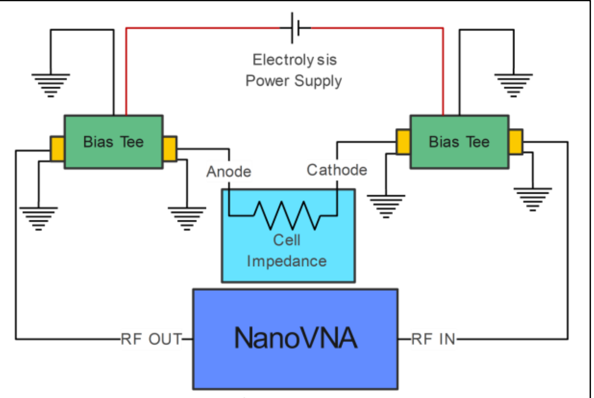

Figure 1. Circuit for the VNA measurements.

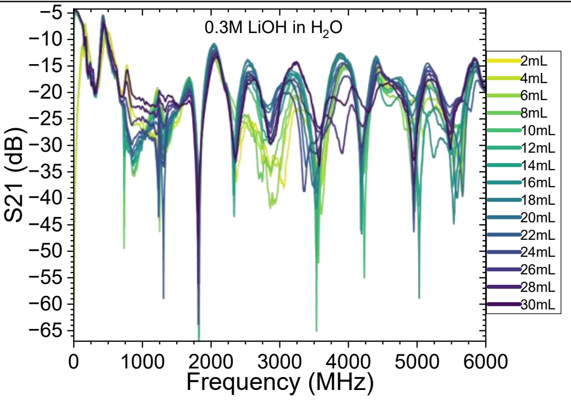

Figure 2. Example data from this experiment.

Coupling a VNA to the DC electrochemical circuit requires the use of Bias Tee devices, which enable interaction of the RF signals with the cell, but keeps the DC electrolysis voltage off of the VNA. The circuits for both electrolysis and the RF measurements are shown in Figure 1. The VNA provides information on Voltage Standing Wave Ratios, Phases and Delays, as well as Smith Charts. We are measuring cells with Pt anodes, and either Pt or Pd cathodes, as a function of the electrolysis current, and the LiOH(D) electrolyte concentration. Figure 2 contains an example of data that can be obtained: the S21 parameter, representing the voltage wave ratio of the transmitted wave coming out of the cell due to the application of an incident wave, while varying the frequency and the level of the electrolyte. We are seeking differences in the VNA measurements that might indicate the occurrence and rates of LENR, or the condition of the electrode surfaces.

Our work will also be applicable to LENR cells in which co-deposition occurs. We note that there have been relatively few VNA measurements of electrochemical devices. One example is reference [3].

[1] D. J. Nagel, "Input Stimuli and Output Signals for LENR Experiments", J. Condensed Matter Nuclear Science, vol. 36, pp. 56–88, 2022. https://doi.org/10.70923/001c.72589
[2] F. Scholkmann, D. J. Nagel, and L. F. DeChiaro, "Electromagnetic Emission in the kHz to GHz Range Associated with Heat Production During Electrochemical Loading of Deuterium into Palladium: A Summary and Analysis of Results Obtained by Different Research Groups", Journal of Condensed Matter Nuclear Science, vol.19, pp. 325–35, 2016. https://doi.org/10.70923/001c.72402.
[3] M. Saghafi *et al.*, "High-frequency phenomena and electrochemical impedance spectroscopy at nanoelectrodes", Current Opinion in Colloid & Interface Science, 63:101654, 2023.

P2-7

Discussion on the Causal Network of LENR Process

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The detailed mechanism of low energy nuclear reactions (LENR) has not been understood clearly. But after 35 years of efforts, a lot of experimental evidence and clues have already been mastered. Based on such progress, it is possible and necessary to discuss the outline of LENR process. As a problem of condensed matter science, the occurrence and development of LENR is a complicated process, involving many influence factors. The causal network[1] can be a useful tool to analyse the experimental phenomena and underlying mechanism. This paper attempts to describe the LENR process occurred in metal samples under H/D-gas charging with causal network methodology.

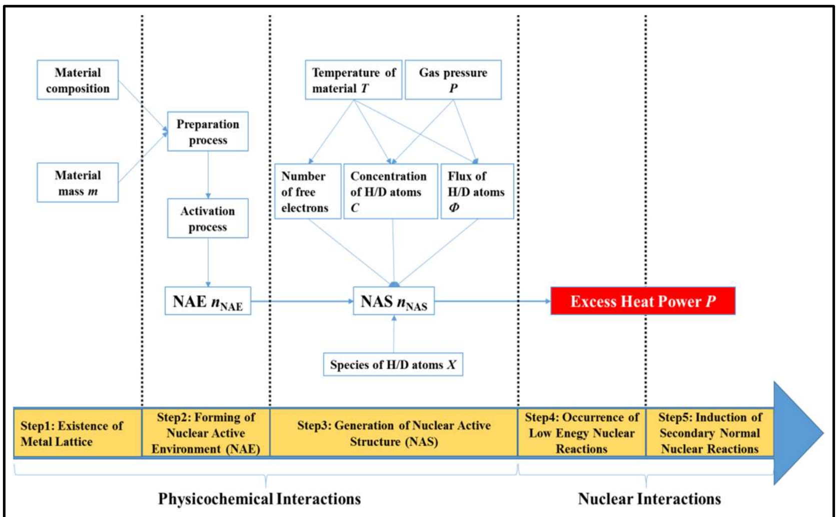

Fig.1 Schematic diagram of LENR causal network

Based on the opinions of Edmund Storms[2], Melvin H. Miles[3], Wu-Shou Zhang[4], and some of our own understanding, we draw a schematic diagram of the causal network to indicate the gas charging LENR process, as shown in Fig. 1. The time sequence is divided into five steps. The first is the existence of metal lattice, which is the material basis of LENR. The second is the formation of nuclear active environment (NAE) in the metal samples. The third is the generation of nuclear active structure (NAS). The fourth is the occurrence of LENR. The last is the induction of secondary normal nuclear reactions. Steps 1 to 3 belong to physicochemical interactions, while steps 4 and 5 are nuclear interactions. As a causal network, this figure shows the key influence factors to gas charging LENR. Any line with an arrow indicates a relevant cause to an effect. Although it is still simple and even contains errors, it can give us a comprehensive scheme about what maybe important to LENR.

At present, it is still unclear about the truth of above nuclear interactions. But from Fig. 1 we know that the physicochemical interactions are essential, and the theory of physical chemistry is important to analyse the influence parameters and establish the effect function of output excess heat. The further research should focus on the preparation and activation of metal samples, as well as the controlling of gas charging experiments. Meanwhile, more attention should be paid on the analysis of physicochemical process through first-principles calculation and material characterization. With the direction of an accurate causal network, the causal inference method can be used to discover the complicated mechanism of LENR, converting the dark box to a grey or even white one step by step.

[1] Judea Pearl, Dana Mackenzie, "The Book of Why", Basic Books, New York, USA, May 2018.
[2] Edmund Storms, "The Nature of Cold Fusion (Cold Fusion Made Simple) ", Journal of Condensed Matter Nuclear Science, vol. 38, pp. 130-146, 2024.
[3] Melvin Miles, Ruby Carat, Thomas W. Grimshaw, "Dr. Mel Miles' autobiography for his cold fusion research, A project of the LENR research documentation initiative", https://lenr-canr.org/acrobat/MilesMdrmelmiles.pdf, 2022.
[4] Wu-Shou Zhang, "Reproduction of Excess Heat of Pd-B Cathode Measured by Seebeck Calorimeter", Journal of Condensed Matter Nuclear Science, vol. 38, pp. 1-12, 2024.

Direct electric energy production with feedback

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The least known among the LENR devices is direct electricity production. This is the oldest method among the effects based on LENR. The essence is a nuclear catalysis process based on condensed plasmoids.

The condensed plasmoids are generated during sparking. That is, during a very fast, non self sustained gas discharge. Though this gas discharge has been known for centuries, the first transmutation results were published only in the 1910's.

We have built and tested such devices by the hundreds.

More electric energy is generated than the input at a very narrow range of pressure and spark gap distance during the sparking. The energy extraction is a real technical challenge during the very fast sparking process.

We used ohmic, capacitive, inductive loads, and even their combinations in our research. In principle, the excess transient electric energy can be harvested, transformed into DC, and fed back to the input side. There are inevitable losses during this process,

We succeeded in finding several electric circuits that tackle this problem. Thus a self sustaining process is observable for a priod of half an hour to sometimes one hour, but in an erratic, random manner.

All LENR methods have the same problem: quality control. The repeatability is challanging, because material properties are very hard, and expensive to control (as known in semiconductor production).

The output maximum is about 1W, because we use only a single sparking surface in our reactor tube. The power is scalable, though only the effect and the extraction circuit is investigated.

The reactor works on a plasma based hydrogen and water vapor.

The test runs will be shown on videos at three intervals: during the start,
half an hour later,
one hour later.

Several transmutation products have been found on the cathode surface as a side effect (shown first at ICF24). Carbon and sulfur are the most frequent byproducts, though even tungten has been found on an isolated surface spot on the aluminum cathode.

There was no excess energy effect when clean argon was used in a control experiment. However, even a small leak in the reactor sealing was enough to increase the efficiency of the process. Hydrogen in the water vapor is the apparent source of energy. There was no need for deuterium to produce transmutation side effects in our experiments.

The device shown below is small, portable, but extremely sensitive to technical parameters, just like any other LENR devices.

The Plasmoid Paradigm — Micro Ball Lightning As Evidence That Anomalous Reactions Are Happening

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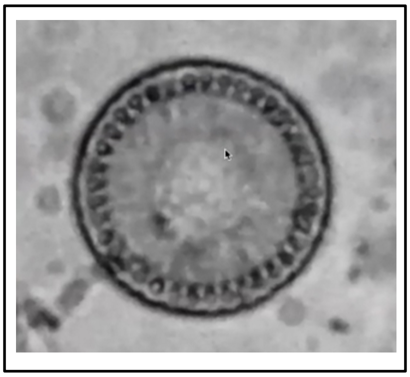

Anomalous reactions are reactions that contradict quantum mechanics. Ken Shoulders was very clear that the old paradigms of QM and relativity could not do for explaining what happens in the objects that he called EVs (*EVs: A Tale of Discovery*) and that I call "microscopic ball lightning" (MBL). MBL are a type of "microplasmoids" (as I call them) that fly or transverse through gases such as air or liquids such as water. They behave in the same way that much larger natural ball lightning (BL) does. But there are other types of microplasmoids too. The transmutation/energy creation/energy loss reactions that happen are all due to the temporary existence of the intermediate state of matter that I call the "5th state of matter." I had these ideas since 1992 after I read Takaaki Matsumoto's brief note about the observation of strange microscopic (about 50 micrometers wide) rings and other markings on his particle detection film. People can use particle detection film, X-ray film, and other kinds of detectors and targets to know that an anomalous reaction has happened in these experiments since they might be emitted and detectable from experiments that contain material in the fifth state.

In the 1970s, Bostick and Nardi researched plasmoids that in papers they called "EB filaments." Bostick realized that the plasmoids' energy effects were anomalously high. Shoulders started to research these plasmoids intensively in the late 1970s, and in the 1980s, he determined that the plasmoids of Bostick are composed of smaller objects about a micrometer wide that he called EVs. He wrote that the MBL form rings and strings. Except for a few physicists such as Richard Feynman, Shoulders was ignored. Perhaps this was partly because he tried to keep it secret during the 1980s by being very selective about who he sold his book to at high prices and by putting a notice at the beginning of his book that everything in it was to be kept confidential. Then, when Matsumoto started to publish in *Fusion Technology*, he was also ignored and misunderstood. People I knew who are thought to be the leaders in the field who selected the people to participate in the ICCFs and other meetings thought that his work was poor and not important. He said the ICCF organizers were "closed minded." I myself was never allowed to present about MBL and microplasmoids though I repeatedly sent in abstracts as I am doing now over the last 30 years! I think Matsumoto's articles helped Urutskoev to understand the nature of the MBL that the Russians have been calling "strange radiation." In Russia and the Ukraine, MBL are now a regular part of the research in most anomalous experiments such as those presented at ICCFs. The Russians present at the RCCNT&BL conference. They are making new discoveries about MBL. Greenyer obtained a huge quantity of Matsumoto's data before he died recently. He is planning to publish a book that Matsumoto wrote and include original clear pictures of MBL marks that Matsumoto never published. These pictures show that some MBL rings, at least in the white state, are constituted by a fine structure including a strand of MBL in close proximity to each other (different from how Shoulders explained) or a filament. See Figure 1. Jaitner and Mishinsky have proposed different models of filaments that constitute MBL.

MBL may be emitted from experiments where the 5th state of matter forms. The MBL and also the 5th state of matter that stays inside the experiment exist in at least two states called the white and black states. If white state MBL reach detectors, they can be detected. If they reach them in the black state, they are not detected. The detected MBL shows that anomalous reactions involving matter and energy are happening in the experiment. I helped originate the plasmoid paradigm by explaining to Matsumoto and others about the MBL and 5th state of matter and their characteristics and behaviors such as how they move through materials and transmute atoms in the early 1990s. More info: scientificrevolutions.com

Paradigm Shifts Happen Every 80 Years

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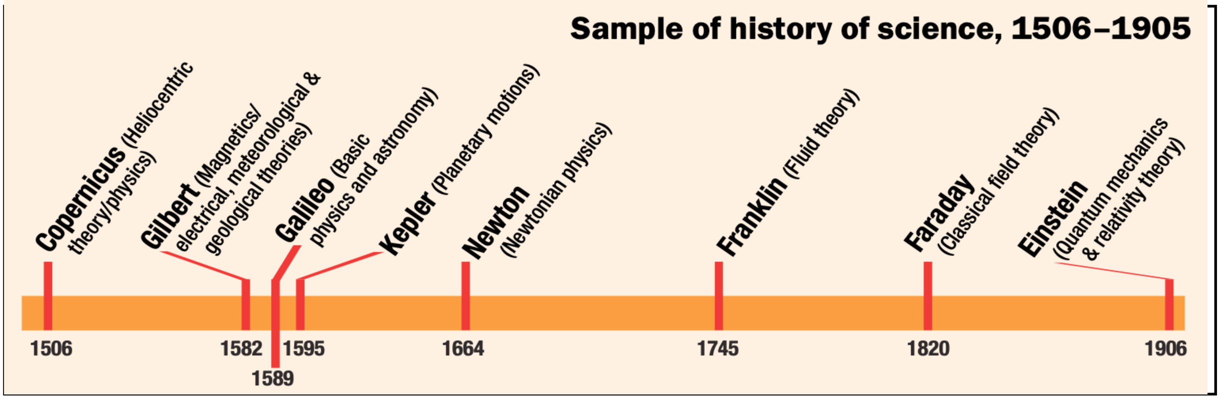
Paradigm shifts happen every 80 years as I realized in 1989. As you can see from the chart in Figure 1, there is a clear 80-year pattern for the paradigms of physics. The concept of physics paradigms stems in part from Thomas Kuhn. Einstein wrote similar ideas. Revolutionary scientists introduce the new paradigms. Then, the second generation helps develop the theories of the paradigm. Then the third generation find the important anomalies of the paradigm. This article will help people to understand the historical pattern and the past, present and possible future development of the plasmoid paradigm.



A plasmoid is a configuration of matter and energy that wasn't known to exist until 1992. When I studied Takaaki Matsumoto's research and ball lightning (BL) literature, it was clear to me that his electrolysis cell was producing micro BL that left the voids, pits, and transmuted atoms in the palladium electrode that he used to attempt to replicate the F&P experiments. I wrote Matsumoto and Shoulders about these ideas. Matsumoto quickly accepted this hypothesis. Shoulders did also, but maybe he understood Matsumoto's research independently of me. It was clear to me in 1992 that atoms can be in a state very different than gas, liquid, matter, and plasma. I call this the 5th state of matter or the "plasmoid state." It was clear to me by about 1996 by the work of Dash and Miguet that there is experimental evidence that the 5th state of matter can exist stationary for long periods of time. They showed evidence of isotopic and morphological change of filaments that kept changing for long periods of time after their experiment were over. I knew from studying BL, tornadoes, astrophysical plasmoid research, and BL-like objects that material in the 5th state can last for hours in the atmosphere as tornadoes do. Vonnegut and H. Jones were two meteorologists that wrote very good articles about BL-like huge very bright tornadoes and huge round lights inside of clouds. Many anomalies in space, physics, and nature are resolved by plasmoid theory.

See Ref. 1 for more information about this theory. Each of the 6 paradigms shown in the chart were developed in 3 stages. The 7th paradigm started in 1992 when I resolved that transmutation/excess energy and other anomalies in experiments are due to microscopic materials in the 5th state and started viewing everything as a plasmoids. Right now, maybe only a few hundred people believe this paradigm, and Mishinsky, Jaitner and some others are theorists from a QM point of view. Based on the past timing of paradigm development, we can predict that perhaps this paradigm's theory will be developed by 2034 or so and that a plasmoid industrial revolution might start about 2062. For more info: scientificrevolutions.com

[1] E. Lewis, B. "The Paradigm Shift Cycle as the Cause of the Kondratieff Wave," *Long Waves*, pp. 39-63, 2022.
www.sociostudies.org/almanac/articles/the_paradigm_shift_cycle_as_the_cause_of_the_kond-_ratieff_wave/

P2-11

LOADING -DEGASSING EXPERIMENTS OF TITANIUM WITH HYDROGEN, DEUTERIUM AND DEUTERIUM+HYDROGEN MIXTURE 1:1 AT "SETARAM"- THERMOGRAVIMETRIC INSTALLATION IN 1989.

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One of the main processes of initiation of cold fusion reactions, in our opinion, is the process by hydrogen loading and degassing of metals. Therefore, the study of these processes is of the greatest interest for understanding and explaining the course of cold fusion reactions. We offer you a study of the processes of hydrogen loading and degassing of titanium using "Seteram" - thermogravimetric installation at the very beginning of our work in the field of cold fusion. The result of these works is the registration of heat release and absorption as a relation of hydrogen, deuterium and hydrogen+deuterium mixture absorbed and evacuated from titanium separately in the ratio 1:1 ($50\%H_2+50\%D_2$). Neutron and gamma radiation were recorded during these processes. A comparative analysis and calculation of the absorption and emission energies are given. The conclusion is made about the difference of heat release and absorption in the interaction of hydrogen, deuterium and their mixture with titanium.

Fractal Magneto-Hydrodynamic Structures in Working LENR Systems

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Based on extensive literature review and experimentation, it was hypothesised in a Dec 2023 presentation [1] that fractal magneto-hydrodynamic structures having specific form, would be behind the observed excess in Bin-Juine Huang's et. al. heat and element isotope producing reactors presented at ICCF-25 [2] extended work on which was later published in Nature – Scientific Reports [3].

Samples were aquired on 29th Dec 2024 and first analysed by SEM/EDS on 15th March 2024, where clear fractal Magneto-Hydrodunamic structures were observed as whole and partial fragments, with their range of actions and sub-structures, frozen in time in the sample. A wide range of interaction with the substrate material, consumption of it and emission of new elements emerging from or connected between these structures was observed from which the order of action can be determined. These clear and repeatable phenomena will be discussed with reference to hard physical observations.

In 2024, Griffin Brock's 1A21 Tesla-inspired shadowgraph vacuum tube electrode [5] was predicted to have had similar structures on it, based on the emissions of highly penetrating colimated radiation that it produced and an understanding of the likely form of this radiation [6]. Indeed, testing revealed conclusive arrangement of features and substructures with apparent areas of element synthesis. This simple device has the potential to be a lab rat for the study of LENR and potentially the key form of radiation that the process produces which has confounded researchers since the early 20th century.

Taken together, this repeatable evidence shows that a common Fractal Magneto-Hydrodynamic process is behind a broard range of anamalous observations in both cavitation and plasma LENR systems.

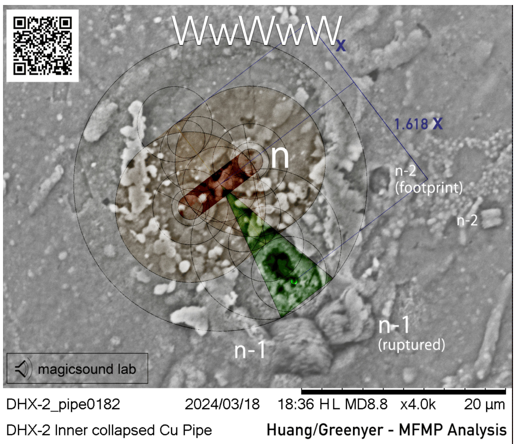

Fig.1. Evidence of wheels, within wheels, within a wheel from the breakup of a fractal MHD structure in a cavitation based heat producing LENR device

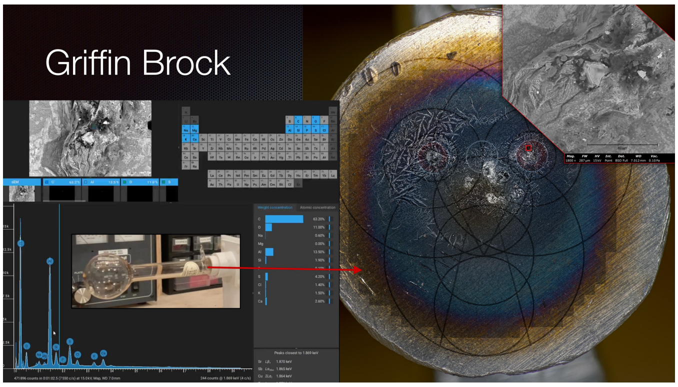

Fig.2. MHD structure and elemental arrangements on Griffin Brock's 1A21 vacuum tube shadowgraph electrode

References

[1] R.W. Greenyer, "Working with nature - Possible nuclear reaction mechanism in water", Taiwan Silicon Valley Presentation, Taipei, 13 Dec 2023
[2] B-J Huang et. al "Anomalous gas emission from low-energy nuclear reaction of water", ICCF-25 (2023).
[3] B-J Huang et. al. "Water can trigger nuclear reaction to produce energy and anomalous gases.", Nature – Scientific Reports, (Jan 2nd 2023). 10.13140/RG.2.2.20412.62081.
[4] R.W. Greenyer, "O-Day - Flux capacitor", MagicSound Lab and Alan Goldwater for MFMP, March 2024
[5] G.G. Brock, "Introducing the 1A21 Vacuum Tube", CA, USA
[6] A.L. Shishkin "New type of penetrating radiation" Cold Nuclear Transmutation & Ball Lightning confrerence, Sochi, Russia, October 2018

P2-13

Exothermic Phenomena in Hydrogen Desorption Experiments Using Pd-Ni Samples

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Excess heat has been observed in the hydrogen diffusion process with nanosized particles or thin multilayer composites of Pd-Ni and Cu-Ni [1,2]. The phenomena observed in these studies are supposed to be related to a low-energy nuclear reaction in condensed matter. It is suggested that the sample conditions, such as nanostructured metal and complex composition, might be crucial for inducing the reaction. Based on these results, we conducted a hydrogen desorption experiment using a sample of Pd foil coated with a Ni membrane and investigated its thermal and hydrogen diffusion behaviors.

In this experiment, the sample was fabricated by depositing a thin metal membrane by Ar-ion beam sputtering onto one of the surfaces of a Pd foil with dimensions of 10 mm × 10 mm × 0.1 mm. The membrane thickness was approximately 100 nm. A fine-structured interface was formed by etching the Pd foil surface with an Ar-ion beam before membrane deposition. The fabricated samples were exposed to hydrogen gas at 5 atm for 20 h for loading. The loading ratios (H/Pd) were 0.6–0.7. After loading, the sample was placed in a chamber and evacuated using a turbo-molecular pump (~10^{-4} Pa). In the chamber, the sample was heated by applying constant power to the heater to stimulate hydrogen diffusion. The sample temperature and chamber pressure were monitored continuously for approximately 24 h. A thermocouple was used for the temperature measurement. The pressure inside the chamber was measured using an ionization gauge. The voltage and current applied to the heater were recorded during the experiments. The experimental setup is shown in Fig. 1.

Consequently, exothermic phenomena were occasionally observed. In addition, the pressure changed simultaneously with the temperature. This phenomenon occurred within a few hours after the experiment was started. The unique conditions of the sample may induce specific hydrogen diffusion, causing an exothermic reaction. We estimated the excess power from a comparison with the temperature measured for the unloaded sample and preliminarily obtained up to several hundred mW. We are continuing experiments to confirm the heat evolution and improve the accuracy of excess heat evaluation.

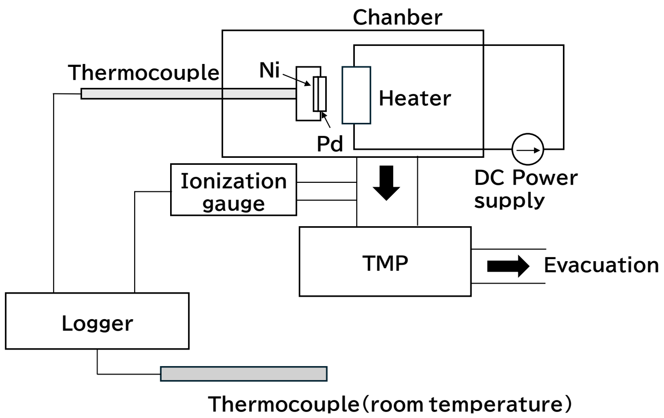

Fig. 1 Schematic of the experimental setup.

[1] A. Takahashi et al., J. Condensed Matter Nucl. Sci, 33(2020) pp. 14–32
[2] Y. Iwamura et al., J. Condensed Matter Nucl. Sci, 36(2022) pp. 285–301

P2-14

The Biophysical Reasons, Physical Mechanism and Experimental Implementation of Iodine to Xenon Transmutation in Biological Systems

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The traditional description of the process of low-energy isotope transmutation is limited to the substantiation of the physical mechanism for overcoming the Coulomb barrier. In such reactions, the influence of the environment on the conditions for LENR implementation can be quite significant, but not selective and not "motivated".

Previous studies have shown that extending the LENR field to biological systems leads to the conclusion that such systems can selectively respond to an objective "request" for the possibility of realizing a particular nuclear reaction. In particular, with a specially organized absence of iron in the nutrient medium in which growing microorganisms are located, the $Mn^{55} + d = Fe^{57}$ and $Na^{23} + P^{31} = Fe^{54}$ fusion reactions are implemented very effectively [1,2]. These features are due to the fact that iron is a vital microelement and in its absence, the growth of microcultures becomes impossible. Such conditions are associated with the general functional features of nuclear reactions in biological systems [1,2].

The report presents for the first time the results of a study of selective-functional methods for stimulating similar nuclear processes associated with the fusion of xenon. It is well known that xenon is not a vital micro- or macroelement and is not their biochemical analogue. On the other hand, it is well known that xenon has unique protective and healing properties on the body, which are widely used in modern medicine and in the treatment of animals. In applied veterinary science, there are known cases of recording a significant concentration of xenon gas near the thyroid gland in the respiratory tract of white mice that are subjected to physiological stress (in particular, the action of a short high-frequency acoustic signal). The formation of such xenon cannot be explained from the point of view of physiology, anatomy and biochemistry. The most probable mechanism of xenon formation in such cases is associated with a $I^{127} + p = Xe^{128}$ fusion reaction on the surface or in the volume of the thyroid gland, where iodine atoms are localized. The presence of physiological stress leads to the excitation of rapid acoustic shifts and local shock waves in this biological environment and the formation of coherent correlated states of protons, characterized by very large and relatively long-term energy fluctuations [3,4], which ensures effective nuclear fusion and Xe^{128} creation.

The implementation of this fusion and creation of xenon gas were confirmed in our new anaerobic experiments with the participation of microbiological syntrophic associations in a liquid nutrient medium containing iodine and all the necessary biogenic elements (K, P, N, Na, S, Cl, Mg, Fe, Ca). If we take into account the therapeutic and protective effects of xenon, then from a physiological point of view, such fusion is a kind of protective reaction of the biological system to physiological stress, which was developed in the process of biological evolution.

[1]. Vladimir Vysotskii, Alla Kornilova. “Effective LENR and transmutation of stable and radioactive isotopes in growing biological sysems”. Cold Fusion. Advances in Condensed Matter Nuclear Science, Ed. by J.-P. Biberian, Elsevier, Chapter 12, pp. 205-232, 2020.
[2]. V.I. Vysotskii, A.A. Kornilova. ”Transmutation of stable isotopes and deactivation of radioactive waste in growing biological systems”. Annals of Nucl. energy, v.62, pp. 626-633, 2013.
[3] V.I.Vysotskii, M.V.Vysotskyy, “Universal mechanism of LENR in physical and biological systems on the base of coherent correlated states of interacting particles”. Cold Fusion. Advances in Condensed Matter Nuclear Science, Ed. by J.-P. Biberian, Elsevier, Chapter 17, pp.333-369, 2020.
[4] V.I.Vysotskii, M.V.Vysotskyy, “Features of correlated states and a mechanism of self-similar selection of nuclear reaction channels involving low-energy charged particles”, J. Exp. Theor. Phys., v. 128(6), pp.856–864, 2019.

P2-15

Astrophysical part of LENR: concentration of nuclear active agent

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Among the non-traditional experimental results there is a class of experiments in the foci of parabolic mirrors. They relate mainly to astrophysics, the pioneer of this field was the Soviet astrophysicist N.A. Kozyrev [1]. In these experiments, sensitive detectors were placed in the focus of a reflecting telescope, and the telescope aperture was closed with a light-tight cover. When such a telescope scans the sky, the detectors react to certain positions in relation to astronomical objects (stars, galaxies). The development of such experiments showed that the agent affecting the detectors exhibits nuclear-active properties [2]. In the experiments of A.G. Parkhomov, bursts of radioactivity were observed at beta sources in the focus of a reflecting telescope. The theory proposed by Parkhomov suggests the presence of streams of ultra-cold neutrinos as part of dark matter, which may cause induced beta decay. The same agent, according to Parkhomov's theory, is responsible for the catalysis of low-energy nuclear reactions and causes LENR near incandescent lamps and other sources.

The author conducted experiments in which radiation of unknown nature from a local source (an incandescent lamp) caused beta-radioactivity bursts at ^{40}K, which were detected by a Geiger counter. The radiation of unknown nature was directed by an aluminum mirror at the beta source. Analysis of beta-activity bursts showed a strong dependence on the phases of the Moon ($p \sim 0.0001$), Fig.1, and on the operation of the incandescent lamp ($p \sim 0.002$). The bursts followed after turning on the lamp with an average delay of 8.9 hours, mainly in certain phases of the Moon. Without a working lamp, no bursts occurred.

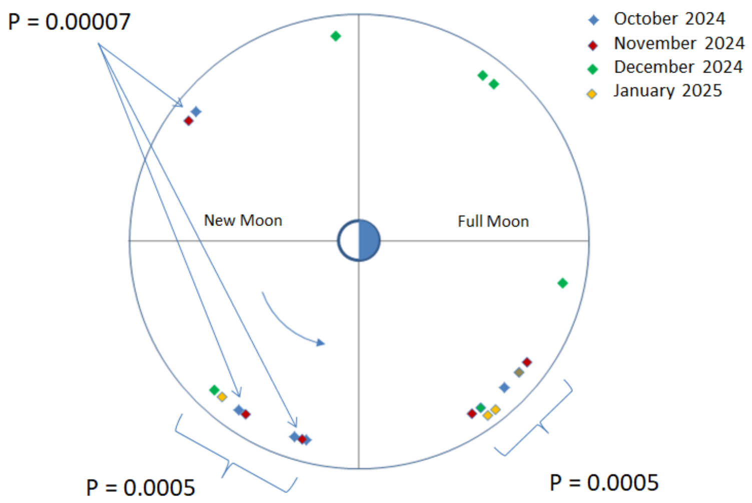

Fig. 1. Non-randomness of beta-activity bursts in ^{40}K with Moon phases.

The hypothesis explaining these and similar results suggests the existence of some astrophysical agent that, under certain conditions, can cause LENR, including induced beta decay. Modulation of LENR in biological systems by an external factor may explain the poor reproducibility of results in the field of biological transmutations [3].

[1] N.A. Kozyrev. Selected works (In Russian). Leningrad University Publishing House, Leningrad, 448 p., 1991.
[2] A.G. Parkhomov. Space. Earth. Human: New Views on Science. Amazon Digital Services LLC - KDP Print US, 251 p., 2019.
[3] J.P. Biberian. “Biological transmutations: historical perspective”. Journal of Condensed Matter Nuclear Science, V. 7, No 1, pp. 11-25, 2012.

P2-16

An Experimental Study on Deuterium Production from Titanium Hydride Powders Subjected to Thermal Cycles

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An extensive multi-year experimental study was conducted to investigate the potential production of deuterium from titanium hydride (TiHx) powders subjected to specific thermal cycles.

Mass spectrometry analysis focused on the variation in signal intensities at m/z = 2, 3, 4, 18, 19, 20, and 21, corresponding to fragments primarily involving deuterium, during the degassing process as the sample temperature was raised from room temperature to approximately 1100 °C. The results revealed a significant anomaly in the deuterium-to-hydrogen ratios, with an increase in deuterium concentration by a factor of approximately 280 compared to its natural concentration on Earth. Three independent methods confirmed the excess deuterium.

Simultaneously, flow calorimetry performed during the degassing process did not show any measurable excess heat in the configuration used.

These experimental findings are consistent with novel theoretical predictions based on the standard electroweak theory with gauge symmetry, which suggest the generation of slow neutrons within metal hydrides when exposed to coherent excitations [1].

The results also align with direct measurements of neutron emission by TiHx powders under cavitation in liquid water, as recently published by Fomitchev-Zamilov [2].

[1] Gamberale, L. “Neutron Production via Electron Capture by Coherent Protons” *arXiv*, arXiv:2209.06139, **2022**.
[2] Fomitchev-Zamilov, M. “Observation of neutron emission during acoustic cavitation of deuterated titanium powder” *Sci. Rep.* *14*, 2045–2322, **2024**.

P2-17

Detonation and LENR

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It is known that LENR is accompanied by transmutation of the initial chemical elements and excess thermal energy release. Thus, LENR is an exothermic reaction. A legitimate question arises: - under what conditions this exothermic reaction can transform into the detonation regime? This problem is investigated in this work. In our earlier works [1-3], LENR was revealed in a heterogeneous hydrocarbon plasma consisting of carbon nanoclusters and ionized hydrogen (protons). These works describe a pulsed plasma generator design (PG) with a erosive capillary discharge, in which a metastable high- energy heterogeneous plasma with a specific energy of about 100 eV/atom and its typical lifetime of about 0.1-1 second can be created. This heterogeneous plasma (HP) was obtained in a capillary discharge gap made of polyethylene due to the erosion of its walls by a powerful electric discharge (current amplitude of about 100 A and its duration of 1-10 ms). In this HP, transmutation of the initial chemical elements (C and H atoms), significant thermal energy release, neutron flux and soft X-ray radiation were measured. In this PG, sufficiently high values of the coefficient of perfomance COP = 2-4 (the ratio of the output thermal energy release in the HP to the input electrical energy spent on its creation) was measured [1, 2]. In this work, significant acceleration of LENR in heterogeneous hydrocarbon plasma using a pulsed temperature increase in the PG was obtained. For this purpose, a second powerful current pulse with an amplitude of up to 10 kA and a duration of less than 100 μs is additionally created in this plasma generator with some delay time relative to the first current pulse. It is shown that under certain conditions a directed detonation (explosion) can occur in heterogeneous hydrocarbon plasma. It is shown that the specific energy release in such a GP behind the shock wave front can reach a large value of the order of 1000 eV/atom and higher. Detonation in heterogeneous plasma is accompanied by accelerated transmutation of the initial chemical elements, a powerful flashes of soft X-ray radiation and a neutron flux.
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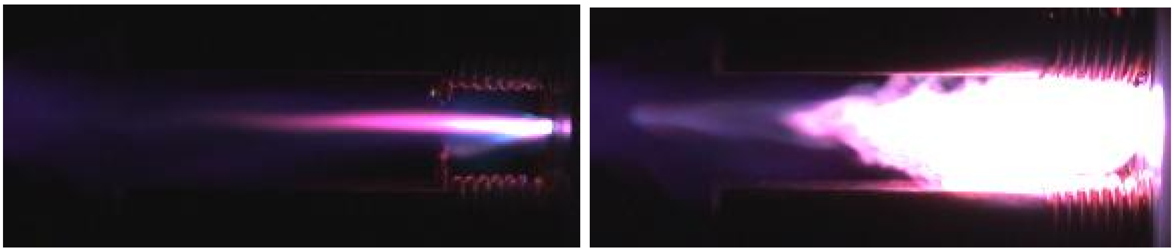

Figure 1. Detonation in hydrocarbon heterogeneous plasma. Right- metastable heterogeneous plasma (carbon nano-clusters+ hydrogen ions). Left- time moment of ignition of this plasma

[1] Ball Lightning in Laboratory, Chemistry, Moscow, pp.000-256, 1994, (in Russian)
[2] A. Klimov, A. Pashchina, “LENR- Experiment on Heterogeneous Hydrocarbon Plasma Jet Interaction with Ni-Foil-Target”, J. Condensed Matter Nucl. Sci., vol. 36, pp. 312–317, 2022.
[3] V. Brovkin, A. Klimov, A. Pashchina, “Stimulated Detonation of a High- Energy Heterogeneous Plasma Formation Created by a Capillary Erosive Plasma Generator and Magneto - Plasma Compressor” , Russian Journal of Physical Chemestry B, vol.18, no.5, pp. 1415-1421, 2024.

P2-18

The Lawson Criteria for LENR

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Conventional nuclear physicists claim that Low Energy Nuclear Reactions (LENR) violate the laws of physics. They claim that LENR reactors cannot exist because they do not meet the Lawson Criteria required for a self-sustained reaction. They claim that the temperature of LENR is not hot enough for the reactions to occur, preventing the ability of the reactor to self-maintain its own reactions.

This paper will address the Lawson Criteria, and the specific modifications that should be applied to it, for the science of LENR. Historically, the Lawson Criteria, which are energy-balance equations, have been modified for the specifically conditions of hot fusion. These modifications cannot be applied to LENR, since there are many differences between hot fusion and LENR. These include:

- LENR does not need a hot plasma; thus, the input energy to the reactor is drastically reduced. Also, LENR does not need a high-strength magnetic field. Again, the input energy is greatly reduced.
- For LENR, deuterium is the only fuel of the reaction. Deuterium and tritium are needed for hot fusion.
- In LENR, there are 2 primary and 2 secondary reactions, 4 in total. In hot fusion, there is only one reaction. The released energy from the 4 reactions in LENR is more than for the one hot fusion reaction.
- In hot fusion, 100% of the kinetic energy of the neutrons is lost energy; this is 80% of the total released reaction energy. In LENR, only 30% of the neutron energy is lost, which is approximately 15% of the total released energy; the remaining energy is fed back into the core, to sustain the reactions.
- Hot fusion suffers greatly from electron-braking radiation loss. However, LENR, especially lattice-assisted LENR, does not suffer nearly as much from this type of loss.
- In the LENR core metal, there are more electrons than just those that are ionized from the fuel. This is due to the conduction electrons of the host material.
- Electron shielding can take place in LENR, but not in hot fusion. This is because the hot fusion electrons are going too fast, and they traveling in the opposite direction from the positive ions.
- Experimentally, it is known that the electronic-heat coefficient in the LENR palladium-deuteron core is decreased by a factor of six when it is loaded. This means the electrons are moving at a much slower-than-normal speed. This, in turn, greatly reduces the electron-stopping effect.
- For hot fusion, as more input energy is delivered into the plasma, the electrons become faster and more massive. The energy loss from the electron-braking radiation increases accordingly. The result is only a slight-asymptotic improvement for the reaction rate.

For hot fusion, the heat generated in the plasma of the core can only be used for the self-maintenance of the reaction. It is not able to produce useable energy, since the temperature is so hot that it would melt the steam generators. In hot fusion reactors, useable energy is obtained only via the subsequent reactions of the neutrons interacting with a layer of lithium surrounding the plasma core. Basically, this means that the hot fusion plasma core is nothing more than a very expensive neutron generator.

For cold fusion, neutrons that escape the core can also be directed toward a layer of lithium, for subsequent reactions, to generate more heat and improve efficiency. However, unlike the hot plasma-core reactors, this subsequent neutron reaction is not the only useable source of heat coming out of the reactor. Rather for LENR, a significant and substantial amount of useable energy is generated in the LENR core itself.

In conclusion, the specific application of the energy-balance equations, which are the very heart of the Lawson Criteria, must be *correctly* modified for LENR. This is essential for the understanding of how Low Energy Nuclear Reactors work. And no, they do not violate the laws of physics.


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