15th International Workshop on Anomalies in Hydrogen Loaded Metals

Abstracts

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Workshop Patrons

Organizing Committee

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An updated version of this document may be found at
www.iscmns.org/work15/abstracts.pdf

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The electron screening effect was studied in the $^{1}H(^{7}Li,\alpha)^{4}He$, $^{1}H(^{19}F,\alpha\gamma)^{16}O$ and $^{2}H(^{19}F,p)^{20}F$ nuclear reactions on two different hydrogen-containing palladium foils. One of the foils was soft and the other one hard. In the soft Pd target we did not detect any enhancement of the cross section due to electron screening, and in the hard one we measured a high electron screening potential for all three reactions. The magnitude of electron screening was an order of magnitude above the theoretical models. Contrary to the predictions given by the available theories, data suggest that the reason behind this difference is linked to a dependence of the electron screening potential on the host's crystal lattice structure and the location of the target nuclei in the metallic lattice.

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The existence of LENR processes is now well established, by numerous experiments carried out for decades, after the shock wave caused in 1989 by experiment of the famous pioneers S. Pons and M. Fleischmann. However, it is still difficult to develop an adequate theoretical model to explain these processes and contribute to significantly improving them. As LENR theory involves most of the known interactions, it becomes necessary to place oneself within the framework of modern fundamental physics research going beyond the Standard Model (SM).

For this purpose, we propose here a survey of string theory. But *why string theory* (ST) ?

- You can retort ST is not a very recent theory, since it was first studied in the late 1960s as a theory of the strong nuclear force and was then abandoned in favor of quantum chromodynamics (QCD). But the links of ST with nuclear interaction are not broken, quite the contrary, particularly thanks to the so-called *Anti-de Sitter/Conformal Field Theories* (AdS/CFT) duality, a surprising mathematical correspondence between ST and Field theories: it can be *applied*, *by using ST*, *to solve various problems in QFTs*, including some ones intractable by QCD.

- Likewise, AdS/CFT can be applied to *condensed matter*, to study exotic states and quasi-particles. This possibility would be of great interest for LENR research.

- ST was developed to reconcile general relativity with quantum mechanics. But it is more than a quantum gravity theory: non only it can represent all particles / interactions of SM, but it also leads to a variety of *hypothetical particles beyond the SM*. So, it could *solve the puzzles arising in SM* because of the increasing precision of modern experiments, as well as *help to understand LENR*.

Very briefly, strings are 1-dimensional objects, with (in principle) length scale of order the Planck lenght, which lie in multi-dimensional space-time worlds. Strings can vibrate, propagate and interact with each other, and the physical parameters of particles represented in ST are determined by the vibrational states of strings.

Here we will present, while avoiding too technical aspects, a path followed to build ST. We specify, that ST is not a complete and closed theory, but rather a *theoretical framework*, in constant evolution and of great richness on a fundamental level.

The progressive stages are as follows:

- Basic descriptive elements: strings, D-branes, boundary conditions, open /closed strings, compact extra-dimensions.
- Classical String dynamics, based on Lagrangian mechanics. Relativistic strings.
- Quantized relativistic open strings: bosonic strings, need of spacetime of dimension 26
- Quantized relativistic closed strings ---> theory of Quantum Gravity. One-particle states.
- Relativistic superstrings: introducing supersymmetry (SUSY) to obtain fermionic strings. Need of Spacetime of dimension 10.
- Standard Model representation in ST
- Some elements about AdS/CFT correspondence.
- "Hairy" black holes and Hawking's paradox.

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George Egely

As an unprecedented fiasco, mainstream science flatly rejects even to consider the possibility of LENR.

The root of this fiasco is the false notion that all laws of physics are known and firmly backed by experimental results - according to mainstream opinion. This is not true!

All LENR phenomena appear on opaque, murky areas of physics. The lecture argues that all type of LENR effects challenge the established views on different areas.

LENR is a great opportunity for mankind for two reasons:

1) It offers multiple economic methods for clean energy production. The denial of LENR makes the incoming environmental degradation faster.
2) The acknowledgment of LENR test results, plenty of them published, definitely widens the horizons of physics.

For both above reasons, LENR should become the focus of study instead of, for example, „black holes", or Higg's particles that do not offer any help in the incoming climate collapse.

The presentation covers the physics of the following four areas:

1. Heat producing diffusion methods, including the Pd-D_2 electrolytic effect studied at first by Pons & Fleischmann. This is perhaps the most complex chain of effects triggered by diffusion of deuterium nuclei into the Pd lattice at modest temperatures.

Another variant is the diffusion of hydrogen into Ni lattice, or Ni alloy lattice at higher temperatures, above 400°C pioneered by Celani et al., most of them Italians.

The fundamental effects seems to be the cracking of the metal lattice, and subsequent high-frequency lattice oscillations observed by Carpentieri et al.

2. The next effect is the underwater bubble generation/collapse.

These bubbles can be generated by cavitation, like rotating drums, or pulsed electrolysis. There were hundreds of experiment in this area, especially with oscillating, high-current, underwater arcing. It is a fascinating area, although hardly controllable. Julian Schwinger studied the bubble collapse, pointing to Casimir-type effects, tapping the energy of vacuum fluctuations in detail (but not the transmutation).

3. The next effect is the dusty plasma catalyzed fusion studied experimentally by the author, leading to transmutation. The rotating charged dust particles seem to cause novel physical effects.

4. The last area is the fusion catalyzed by condensed plasmoid, studied experimentally by the author. This effect may generate electric energy, thus it offers economic advantages. The catalyst, the condensed plasmoid is a quasi-particle discovered by several researchers, but always forgotten and neglected.

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The LEC or 'Lattice Energy Converter' is, in its simplest form, a 2 electrode dry cell with very modest electrical output. It is unique in that the only conductive medium between the anode and cathode is an ionized gas or vapour. Successful replications of the cell as described by Gordon and Whitehouse have been carried out by this author and others, all encouraged by its simplicity and replicability. Efforts to increase its energy output by many orders of magnitude are underway in laboratories in the USA, UK, and EU.

The current LEC requires the wet co-deposition of Pd or Fe with a hydrogen isotope onto the surface of a working electrode. When dried and placed in close proximity to, but not touching, a counter-electrode made of almost any metal, a very persistent voltage, typically up to 700-800mV is immediately measurable. This phenomenon is visible in air, hydrogen and other gases and vapours, and is presumed to be caused by the counter-electrode ionizing the gas-space between the electrodes. The LEC does not work in a vacuum environment.

Since no particle emissions have been characterized, the only evidence for them being the fogging of X-ray plates in close contact, the LEC is not only a battery but also an extremely sensitive low-energy ionisation detector and, potentially, a screening system for LENR fuel systems. In order to test this hypotheses and to determine if plating/co-deposition is essential to create a working LEC we present results involving the creation of working electrodes by pasting molten tin, indium, or zinc onto brass plates. Potential LENR supporting powders were added to the molten metal either by mixing into the liquid before spreading and abrading the cooled surface to expose them, or by pressing powders directly onto the surface of the still molten carrier metal immediately after spreading. The coated plates were then electrolytically loaded with hydrogen or deuterium and assembled into LEC-type cells and the spontaneous voltage created (if any) measured, the gas between plates being filled with air, hydrogen, argon or polar/protic solvent vapors.

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This paper will compare the predictions made by theory against experimental observations. The comparison will include expected interactions of naturally occurring stable isotopes. The concepts considered will include:-

1. Feasibility of nuclear fusion
2. Electron capture with fusion
3. Is there a Nuclear Active Site?
4. Fusion of multiple deuterons / protons (multibody fusion)
5. Deep Dirac Levels (electron screening)
6. Heavy electrons & Brillouin theory (also Widom Larsen theory)
7. Neutron Production
8. Polyneutron theory
9. Erzion theory

In addition we discuss common constraints that apply to all CMNS models. It is shown that there is no "Cold Fusion" because the expected products of Coulomb barrier penetration are not observed.

Mastromatteo - Excess heat from Nickel and Copper based powder samples with the addition of suitable low work function materials and dispersants, heated up to 700 degrees centigrade in a hydrogen atmosphere.

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A series of tests were carried out on a sample of Nickel and Copper-based powder samples with addition of compounds containing low work function metals, in order to activate anomalous exothermic processes, i.e. in degrees to generate specific energies greater than 1000 eV per single reaction. After a series of preparatory steps for activation, and a calibration of the thermal behavior of the reactor up to 700 degrees in Helium, the tests were carried out in hydrogen by repeating the same progressive thermal buildups of the calibration and at the same initial pressure of 260 mbar absolute. Already the first of these highlighted a significant deviation of the temperature both of the sample and in the external central point of the reactor, compared to the values obtained during the calibration, which began when the sample exceeded the temperature of 450 degrees. Figures 1 and 2 below show the temperature trend of the reactor and of the powder for the third test with H_2.

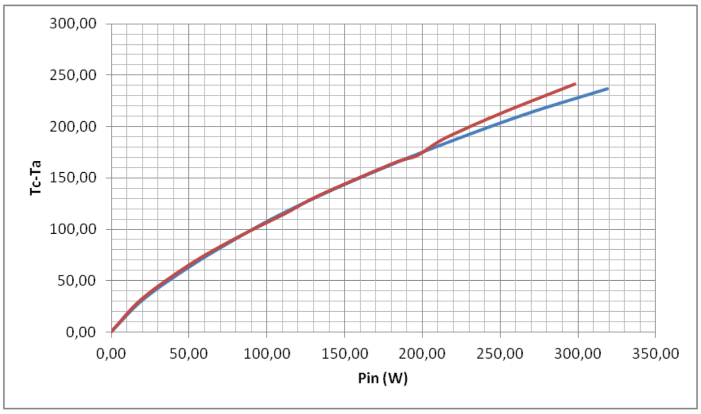

Figure 1. Reactor temperature trend as a function of the input power for one of the tests where the thermal anomaly is more evident. It is observed that around 200 W of input power, a significant deviation of the reactor temperature for the cycle in Hydrogen compared to the reference test in Helium. (the temperature trend for the test with H_2 is in red color)

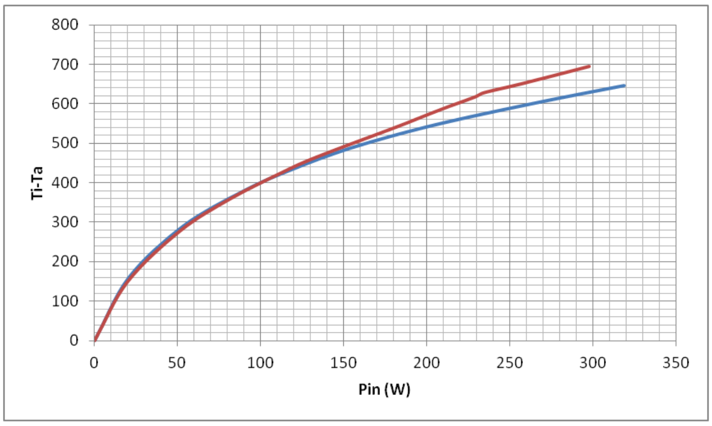

Figure 2. trend of the powder temperature as a function of the input power for one of the tests where the thermal anomaly is more evident. It is observed for the temperature of the powder that around 450 the power to reach the same temperature in the case of the hydrogen test is lower than that of the calibration up to about 60 W at 620 degrees. (the temperature trend for the test with H_2 is in red color)

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The opinions/results reported in the present document are made ONLY by the Authors quoted and don't necessarily represent the opinion of the whole CleanHME's Membership.

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Over the last 15 years, a relevant amount of experimental activities has been accomplished at the Politecnico di Torino in order to investigate the phenomenon of the “Low Energy Nuclear Reactions (LENR)” as a promising heat generation opportunity. The first attempts to exploit the electrolysis for the production of anomalous nuclear reactions started in 2012. In this first series of experimental tests, the electrolytic reactor was equipped by Co-Cr and Ni-Fe electrodes immersed in a water solution of Potassium Carbonate (K_2CO_3). During these tests, neutron-emission peaks were revealed up to ten times higher than the natural background, as well as time intervals of anomalous alpha-particle radiation activity. On the other hand, the compositional X-ray spectroscopy analyses of the surfaces of the electrodes, which resulted to be extensively microcracked at the end of he tests due to the hydrogen embrittlement, allowed to reveal significant compositional changes with respect to the conditions before the tests. The decrement in heavier elements was found to be almost perfectly balanced in mass by the increment in lighter ones. All this constituted an important evidence of the nuclear nature of the observed phenomena.

Subsequently, in the context of the activities performed within the European project CleanHME, a second experimental campaign on the effects of LENR was carried out. The electrolytic reactor was equipped with a 100% Palladium cathode and a 91% Ni anode. The electrolytic reactor was tested at three different trial times of 2.5, 5 and 10 hours. As in the previous case, a water solution of Potassium Carbonate was adopted. In addition to the alpha particle and neutron proportional counters, the electrolytic reactor was equipped with a FLIR A300 thermographic camera, a specific virtual multimetre, and a potentiometer in order to monitor the temperature within the cell and to assess the energy balance during the electrolytic reactor activity. The new tests on the electrolytic reactor equipped with the Pd and Ni electrodes allowed to detect relevant neutron peaks, also several times higher than the natural background, and significant compositional changes on the microcracked surfaces of the electrodes, which always almost fulfilled the stoichiometric mass balance and showed the decrease in heavier elements (-30% for Pd) and the increase in lighter ones. Furthermore, the thermal monitoring highlighted sensible variations in the temperature of the electrolytic cell during the tests. As a consequence, the energy balance assessment, which was performed during the intervals of intense neutron emission activity, allowed to detect energy excesses. The energy balance equation considers an input term, i.e. the energy provided to the cell by the electric network, and two output contributions given by the vaporisation energy of the water volume in the collector and the energy externally

transmitted by heat convection. The energy balances, carried out on the different intervals of intense neutron emission, show values of output energy between 2 and 3 times higher than the electrical input energy. Therefore, these anomalous heat generations may be explained as a direct consequence of the low energy nuclear reactions revealed during the electrolytic activity.

Montagnoli Neutron fracto-emissions for seismic forecasting and early-diagnosis of cyclic loading fatigue in metallic materials

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In the last fifteen years, a large amount of experimental data has been collected at the Politecnico di Torino about acoustic, electromagnetic, and subatomic particle emissions from solid media subjected to brittle fracture. This experimental evidence can be explained by considering the relationship between the frequency of pressure waves generated during the fracture process and the size of the forming cracks. It can be observed that cracks at the nanoscale emit neutrons, micro-cracks emit electromagnetic waves, as well as cracks at the millimetre scale emit ultrasonic acoustic waves.
Furthermore, the observation of anomalous and long-lasting neutron peaks seven days before the L’Aquila earthquake (2009) at the “Testa Grigia” Laboratory of Plateau Rosa (Cervinia, Italy) led to use the Acoustic (AE), Electromagnetic (EME) and Neutron Emissions (NE) as seismic precursors. Between July 2013 and June 2019, the continuous monitoring of the fracto-emissions at 100 metres underground in the “San Pietro Prato Nuovo” gypsum mine (Murisengo, Italy) allowed to demonstrate the suitability and reliability of this technique for seismic forerunning. In particular, it was found that neutron emissions several times higher than the natural background precede low-magnitude seismic events (from the second degree of the Richter scale) by approximately one week.
Based on the preceding observations, the neutron emission measurement was also applied in the fatigue early-diagnosis of metallic materials, focusing our attention on the fatigue behaviour of EN-AW6082 aluminium alloy hourglass samples in the Very High Cycle Fatigue (VHCF) range. In order to investigate on the scale effect on the fatigue resistance and on the neutron emission, two different diameters of the middle cross-section were selected, i.e. 3 and 6 mm. The VHCF tests were performed by means of an ultrasonic fatigue testing machine able to reach 10^{10} loading cycles. The experimental results show a decrement in the fatigue resistance by increasing the specimen size. In addition, considerable neutron emissions were revealed during the fatigue tests, which indicated a micro-cracking activity in the specimen. The neutron emissions were observed to slightly increase both with the specimen size and with the stress range. The samples of 3 mm in diameter, subjected to a stress amplitude of 170 MPa, show an average increment in the neutron emission with respect to the natural background equal to 7.4%, whereas a percentage of 11.3% was found for the larger specimen of 6 mm in diameter, subjected to the same stress amplitude. Furthermore, an increment in the neutron emission was also found by increasing the fatigue stress range in the middle cross-section, especially for the larger specimen size investigated. At present, although these results have to be interpreted as preliminary, they can be considered as a good starting point in order to better understand and analyse the application of neutron emission measurement as a new and promising structural health monitoring technique for components subjected to fatigue damage accumulation.

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Several models aiming at a reliable description of the atomic nucleus have been developed since the 1930s and throughout the twentieth century. All these models tried to address the fundamental questions underlying the main features of the nuclear structure, such as how nucleons interact with each other within the nuclear environment and how these interactions give rise to the variety of experimental evidence that we have accumulated during the past decades. Some of these models, such as the independent particle model (IPM) –also known as the *shell model*– rely on the assumption that the nuclear interaction is weak, with nucleons orbiting rather freely around a central potential well, in a similar way as electrons do within the atom. Other models, such as the *liquid drop model* (LDM), perceive the nucleus as an aggregate of strongly interacting nucleons, behaving similarly to the particles in liquids. The IPM provides strong evidence regarding the shell and sub-shell closures in nuclei with particularly stable combinations of protons and neutrons, whereas it fails to explain the experimental evidence indicating a strong nuclear force. On the other hand, the LDM is able to reproduce well some of the experimental nuclear features, such as nuclear size and binding energy, but it fails to predict the asymmetry of fission fragments and the internal shell texture of the nuclei. In order to overcome these inconsistencies, in the 1990s Norman D. Cook developed his face-centered-cubic (fcc) lattice model as a 3D representation and potentially unifying model of the atomic nucleus: the nucleus is represented as a solid lattice of strongly interacting protons and neutrons, whose position in the lattice is associated to the quantum numbers of the IPM. The Cook's lattice model is able to explain a variety of known nuclear features, ranging from nuclear size, shape, and binding energy, up to the phenomenon of asymmetric nuclear fission. In the framework of this model, nuclear fission is simply simulated as the fracture of the lattice along the main crystallographic planes. In this work, we develop a modified version of the lattice model to study nuclear fission. Each nucleus is not considered as a fixed lattice, but rather the structure is granted a certain flexibility by randomizing the position of the external nucleons. This leads to the generation of hundreds of thousands of slightly different lattices fof the same nucleus, that are subsequently fractured along their principal crystallographic planes, thus generating millions of fission fragments. After this large population of fission fragments is generated, the nuclear stability of these fragments is assessed in terms of its potential nuclear decay. The stable fragments are directly collected for further statistical analysis, whereas unstable fragments are allowed to undergo their preferred decay mode, such as β_+ or β_- decay and alpha-particle emission. The probability associated to each fission event is also included into the calculations, which is related to the energy required to induce fission along the specific crystallographic plane. Here, we report the results of the fission of medium-weight elements, such as Ca, Fe, and Pd, obtained with this updated version of the Cook's lattice model. The distribution of the fission energies is discussed, showing that all the fission events in Ca and Fe are endo-energetic, whereas sometimes the fissions of Pd nuclei are accompanied by a small release of energy. The analysis of the collected fragments is found to provide useful information about the nature of the fission products.

These outcomes are compared to previous experimental evidence concerning the evolution of the Earth's crust and the formation of the oceans, where the depletion of Ca and Fe play a key role, as well as the consistent Pd decrement in electrolysis experiments.

Hatt - Relationship between Higgs Boson and Neutron/Proton masses. Application to the Binding Energy

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1. The scalar Boson called Higgs Boson is the fundamental particle associated with the Higgs Field, a field that gives mass to other fundamental particles of the Standard Model such as electrons and quarks.

2. As the nucleon, i.e. the neutron that decays into proton, electron, and neutrino is the only stable particle of the Standard Model it is interesting to seek for a mass relationship between the Higgs Boson and the neutron, proton, and electron.

3. To determine the process of mass appropriation of the neutron, proton, and electron from the Higgs Boson a structuration of the Higgs Boson, on one side, and the neutron, proton, and electron, on the other side, is presented.

4. It will be shown how the neutron / proton mass derives from the Higgs Boson mass.
   Moreover, the mass structure of the neutron/proton will be explained, as well as their dipolar magnetic moments.

5. The weak nuclear interaction will be briefly addressed, explaining the variation of energy values of the electrons expelled.

6. The strong nuclear interaction will be longer discussed as there is a fundamental interest in that force for the understanding of the fusion in the frame of LENR versus classical nuclear fusion. These two processes are based on different approaches, the one on the Higgs Boson endowing mass process, the other on the known classical solution.

Keywords: Higgs Boson, neutron, proton, electron, dipolar magnetic moment, weak nuclear interaction, strong nuclear interaction.

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The LENR Research Documentation Initiative (LRDI) objectives are to document and archive LENR records while they are still available. A lot of progress has been made in meeting these objectives. Almost 30 participants are engaged, and about 25 project reports have been prepared [1]. The scope has now been extended to document and preserve important materials, such as newsletters and websites, that are of great importance to LENR but not necessarily involving someone still active in the field.

Much has been learned about both the LRDI methods [2] and the availability and characteristics of LENR research records. The procedure developed in the pilot project with Ed Storms [3] has been refined and reconfigured as necessary for each participant and project. As may be expected, given the marginalized status of the field, the records vary widely in the type of research being done, the completeness of recording experimental results, the state of preservation, and the methods used originally for reporting. The Marriott Library of the University of Utah has a strong interest in LENR records and has been established for long-term archiving of LRDI participants. The files of one LRDI participant have been provided to the Special Collections at the Library.

LRDI Procedure

While a lot of progress has been made, a great deal remains to be done in capturing, documenting, and preserving the invaluable records of LENR investigations. Plans call for continuing the LRDI both for historical preservation and to keep the records available for potential re-analysis to help understand LENR and realize its potential benefits.

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Iwamura - Anomalous Heat Burst Triggered by Input Power Perturbations observed in Ni-based Nanostructured Thin Films filled with Hydrogen

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An innovative heat generation method induced by rapid heating of nano-structured Ni based multilayer thin film filled with hydrogen in advance has been developed by our team. Anomalously large heat generation up to about 20keV/H, which was too high to be explained by known chemical reactions. The amount of released energy varies depending on the structure and composition of the multilayer film [1]-[3].

Two nano-sized metal multilayer composite samples, which were composed of Ni and Cu thin films on Ni bulk, were placed in the vacuum chamber. Temperatures were monitored by a thermocouple (TC) and two radiation thermometers looking at the surface of the multilayer thin film. H_2 gas was introduced into the chamber at 250°C after baking of the samples. Then, the sample started to absorb H_2 gas. Typically, after about 14 hour, H_2 gas was evacuated and simultaneously the samples were rapidly heated up by the ceramic heater up to 500~900°C. The evacuation and heating process triggers the anomalous heat generation.

As we repeated the experiments, we noticed that occasionally spontaneous heat burst phenomena occurred [2]. By investigating observed spontaneous heat burst phenomena in detail, we succeeded in intentionally inducing a heat burst phenomenon by perturbating the heater input power [3]. The heater centre temperature (TC) and the surface temperature of the sample were measured in experiments. Figure 1(a) shows an example of a heat burst induced by an intentional input perturbation, and (b) shows an example of a heat burst that did not occur even after a similar input perturbation. After perturbation in input power, the red TC and green and blue surface temperatures increased significantly in (a) but remained the same in (b) as in the beginning. A sample of $CuNi_7$ multilayer with CaO and a sample of Ni bulk were used in (a) and (b), respectively. The energy released by the single heat burst phenomenon was larger than known chemical reactions such as the reaction between the sample and residual gas in the chamber. By modelling the heat burst phenomena, we are trying to elucidate the mechanism by which the anomalous heat generation phenomenon occurs.

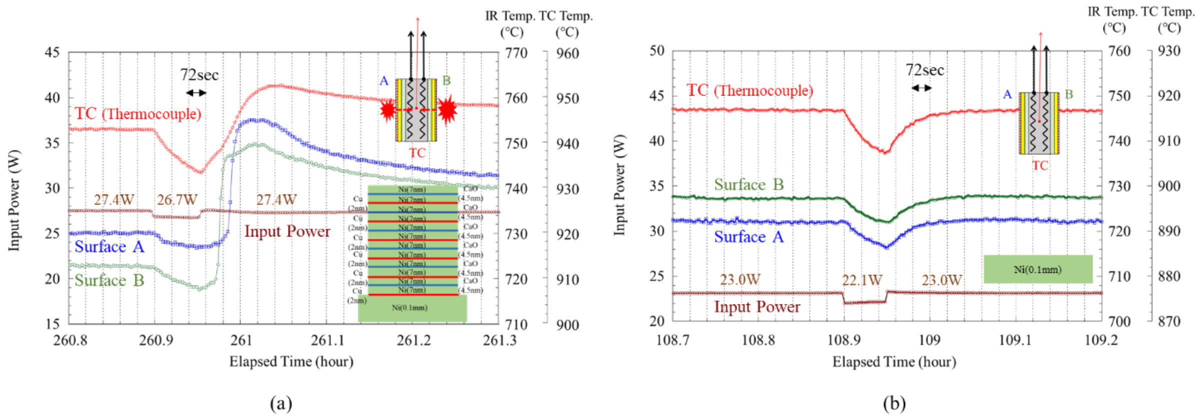

Figure 1. Different responses of sample surface and heater center temperature to input power perturbations: (a) An example of heat burst by an intentional input perturbation, (b) An example of no heat burst by a similar input perturbation.

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Valat -Results of XPS and PAS measurements on Zirconium samples implanted at eLBRUS

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Observation of the LENR phenomena have shown that the local crystal structure and defects of the metallic target play a large role. While this is well established that these features have a strong influence on hydrogen diffusion. The effective electron mass determines the strength of the local electron screening effect [1] and can modify the deuteron-deuteron reaction rates at very low energies energies by many orders of magnitude [2].

In this presentation we propose to analyze Zirconium samples that were implanted under a wide range of low energies conditions with our accelerator installation under ultra-high vacuum [3]. Comparison between sample at different initial metallurgical states with their virgin ones were investigated using positron annihilation spectroscopy (PAS) and X-ray diffraction (XRD).
While PAS offers information about crystal defects and vacancies density distribution, clustering and ordering in the depth of the sample; the second helps us to understand a range of phenomena of hydride formation, their crystal structures, their orientation on the surface [4,5].

Our XRD observations show us a range of modifications on the crystal structure. We observe formation of specific hydride phases, with their crystal orientation in the spot beam zone and in close proximity.
Defects density provided by PAS are showing that different beam composition (d+C, d+O, d+d) have a large effect on defect formation, but vacancy distribution with different beam composition show difference in depth of vacancy formation, conforming the importance of ultra-high vacuum conditions.
The presented diagnostic methods will be applied in the future studies to correlate the number of crystal defects and changes of crystallographic parameters with the increase of the deuteron-deuteron nuclear reaction rates.

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Dubey - Internal e- e+ pair creations in the DD reaction for cold fusion experiments *

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For A strong correlation of the ^{4}He production to the heat excess measured in the cold fusion experiments can be understood by excitation of the DD threshold resonance that changes correspondingly the reaction branching ratios [1 ,2]. Recently, the partial resonance width of the internal electron-positron (e- e+) pair creation has been theoretically calculated and demonstrated [3] that its value can exceed that of the proton one and contribute to the cold fusion heat excess.

In this talk, we will discuss experimental tools and techniques as well as related challenges to measure the electron-positron emission from the DD threshold resonance in the cold fusion experiments. A series of experiments with different metallic target (e.g. ZrD_2, NiBe) are being carried out at the eLBRUS Ultra High Vacuum Accelerator Facility of the Szczecin University, Poland [4]. A high current atomic and molecular deuteron beam is being accelerated to energies ranging from 5 to 20 keV and magnetically analyzed with a long-term energy uncertainty of about 10 eV. Thick Al absorption foils was placed for two distinct reasons in the front of the detector. First, the detector should be protected against elastically scattered beam deuterons. Secondly, the foil thickness was set to 12 µm to also absorb ^{3}He particles completely and reduce the energy of the emitted 1.2 MeV tritons to detect electrons free of background up to 2 MeV, which is the highest electron energy detectable by our Si detector. The electrons and protons resulting from the DD reactions are being detected to determine the reaction branching ratio and compare with theoretical predictions.

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The electron screening effect enhances the $^2H(d,p)^3H$ reaction rates at thermal energies by many orders of magnitude depending on the metallic environment and its local crystal structures [1,2]. The resulting reduction of the Coulomb barrier height, however, cannot change the branching ratio of the DD reactions at room temperature compared to that determined in accelerator experiments at the deuteron energies of few keV in which the proton and neutron channels are the strongest. The dominance of the ^4He channel observed in the cold fusion experiments and lack of observation of any gamma rays [3] can be explained by the excitation of the DD threshold resonance in the compound nucleus ^4He [4]. This resonance should have spin and parity $J^\pi=0^+$ and be very narrow with a total width below 1 eV, which may explain why it could not be observed before.

For the first time, the DD threshold resonance was found in the experimental study of the $^2H(d,p)^3H$ reaction in the Zr target performed under ultra-high vacuum conditions [2]. A similar resonance contribution was also recognized [5] in the older data of the gas target experiment [6], which enabled to estimate the partial proton resonance width at several tens meV. On the other hand, it has been recently predicted that this resonance should decay predominantly by the internal electron-positron pair creation [5]. Here, both theoretical calculations of the DD threshold resonance width and the first experimental results confirming electron-positron pair emission from this resonance will be presented. Based on these data, the DD reaction rates at thermal energies and the corresponding branching ratios will be determined. Particular attention will be paid to study the interplay between the electron screening effect and threshold resonance excitation, which can explain difficulties in the reproducibility of cold fusion experiments.

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For over 25 years the low energy nuclear reactions have been studied in accelerator-driven experiments in various environments, starting from gasses, insulators and metals and ending with their alloys [1-14]. The results show that the metallic structures loaded with hydrogen can play a crucial role for the energy production in nuclear fusion reactions performed at room temperature. In that case, the electron screening effect causes an exponential-like enhancement of the nuclear reaction cross section measured in atomic environments compared to the bare nuclei case. It mainly results from the shielding of the Coulomb barrier between the reacting nuclei by quasi-free electrons of the metallic environment that leads to an increase in the probability of a quantum tunnel transition and thus enhances the reaction cross section [7]. The enhanced electron screening effect has been confirmed in many laboratory investigations for different host metals and various nuclear reactions studied.

Here, we would like to present an overview of the experimental efforts and the most interesting results delivered so far. A reliable comparison between experimental data collected by different groups of researchers is quite difficult because of the systematic errors in experiments and diverse techniques that have been used [9]. The data acquisition and data analysis are heavily affected by the formation of surface contamination layers under beam irradiation, hydrogen density in the studied environment and understanding of the nuclear and solid-state processes taking place. We will address these aspects of the laboratory trials as well.

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At National Institute of Nuclear Physics, Frascati National Laboratories (INFN-LNF)-Italy, studies about Cold Fusion started on March 26, 1989. We found, since the beginning, that non-equilibrium situations are key factors to get any “anomalous effect” (thermal/nuclear): mostly, they are forced reactions, not spontaneous. The present abstract is: A) “updating” of what will be presented by us at ICCF24 (July, 24-28, 2022); B) upgrading about explanation of AHE origin; C) addition of the most recent results (if any). The document is on the line of efforts to find simple procedures to activate the specific material we developed (since 2011; based on surface-modified Constantan, shape of long-thin wires, Joule heating) that are able to produce measurable values of AHE after proper conditioning. The main origin of AHE seems reconfirmed, in agreement with the initial (some since 1989) results of Researchers in USA, Japan, Italy: the FLUX of Hydrogen (or Deuterium) through specific lattice structures seems to be the main origin of AHE. The geometry of the reactor’s core is almost the same we developed since 2019: “inverse coaxial coil”. Energy balance (at several fixed input powers, step like) were made by thermometry (possibility of much faster measurements in respect to usual flow-calorimetry) using, as references, experiments made under He gas at the beginning of the tests, with similar pressures (>0.5 bar) of the active gases (H2, D2). We considered useful for the energy balance the temperatures (by K-type thermocouple, SS shielded) measured at the external wall of the glass reactor: surface covered by several layers of thermal-conducting thick Al foil with side toward ambient painted by high emissivity (>90%)-high temperatures (800 °C) black compound. Maximum temperatures, internal/external: 900/380 °C. Maximum power applied: 150 W. Wire’s weight: 0.45 g. *We reconfirm that the simple procedure, just DC Joule heating at high power (100-150 W) and long times (50-150 h), was enough effective to activate a virgin Constantan coil with thin wire’s surfaces properly treated (mainly by Low Work Function materials). Again, we found that the AHE measured, during the cooling cycles from the highest power, depends on the time previously spent by the reactor’s core at the highest powers. We found that there is a sort of “positive memory effect” (in respect to AHE), lasting usually 10-20 h. Moreover, AHE increases increasing the number of cycling (high-->low-->high power).
We found, also, that increasing the wire resistance by proper “aging” treatments increased the amount of AHE. We speculated that it could be related to increased surface area, spongy like, of the wire that allows, among others, easier income<-->outcome of active gases, i.e. flux. We measured that D2 gas (latest experiment presented at ICCF24) gave larger values of AHE (9 W) in respect to H2 (5 W), at input power of 130 W. BTW, AHE are related to the voltage drop along the wire (as larger as better): possible candidates are electromigration, NEMCA, “Preparata” effects. We observed such behaviour even since 1995 by using longthin Pd wires. Obviously, our speciality of high-peak-power pulsing (HPPP) procedure (at proper duty cycles) is the most promising to increase both the AHE and overall COP of the system: toward practical applications. In the whole, the flux of gas (i.e. forced non-equilibrium) from the surface and/or along the bulk of the wire seems to be the origin of AHE. Such observation was pioneered by G. Fralick (NASA-USA); A. Takahashi, Osaka Univ.-Japan; Y. Iwamura, MHI-Japan; our Group-Italy. *Taking into consideration most of the conditions/procedures adopted to get AHE (large DC electromigration, several cycles of loading-->deloading-->loading, the powerful effects of HPPP), we think that SAV (Super Abundant Vacancies) condition is a note-worthy co-factor to get AHE in wires (M. R. Staker, Loyola-Univ. USA). SAV, as pointed-out also by Staker, can be obtained/increased by our HPPP procedures, although not so easy to be performed. In conclusions, low-cost Constantan seems to behave like expensive Pd, even regarding the SAV lattice conditions. We are trying simpler procedures to get SAV: latest results, if any. The Project CleanHME has received funding from the European Union’s Horizon 2020 research and innovation program under grant agreement No 951974.

Marano - Poor man's (but solid and affordable) DAQ and calorimeter for LENR experiments

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Can an undergraduated student with a limited amount of resources perform high precision electrical and thermal measurements on LENR experiments?

In the present work it is show how a data acquisition system (DAQ) based on Theremino open source hardware and software [1] was built and adapted on a multiple cell electrolysis system. A custom-made interface board was designed and printed using an online service available worldwide[2] in order to expand to 256 or more the number of available channels, each with a theoretical resolution of 24bit. They can be used to read voltage or temperature data from Pt1000 sensors.

Following recent developments by the Theremino team [1] a software able to control all the hardware, read and monitor live data, compute physical quantities and logging them to file was easily written, allowing customizable experiments to be performed.

Main features and performances of the DAQ system will be described, as well as the way to calibrate it and its application to LENR electrolysis experiments.

A Seebeck calorimeter was also designed with the following features: small reacting volume (~ 4 cm^3), good sensitivity (~130mV/W), relatively fast time constant (~10 min), cost effectiveness and being suitable for electrolysis experiments with electromigration on one electrode.

Furthermore, the calorimeter was also designed in order to be built from commercially and easily available materials on the online market. Its thermal behaviour was simulated by mean of 2D finite elements analysis and its design was optimized following such study.

Performances of the actual device were tested and results were found to be in agreement with simulation.

[1] https://www.theremino.com/
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The single greatest need in cold fusion research is a scientific theory of its nuclear process fundamentals. It is only at this level of understanding that nuanced insights can be brought to electrode design and developing a commercial device. This goal is the essence of my research into the Least Action Nuclear Process [LANP] theory of cold fusion.

This presentation begins with a summary discussion of the model. I will discuss the source of the raw process energy, and how it is accumulated to thermonuclear energy levels, and stored within a room temperature nickel electrode. I want you to understand how a continually increasing electrode energy state causes nuclear transmutations in the order of their increasing ignition energies, and also how unstable transmutation products decay down the known decay pathways to their final stable isotope products.

The entire transmutation process is simulated in the LANPDESIGN program. The user begins by inputting an initial electrode's isotope composition, and the rules that are to govern nuclear transmutation predictions. The model then produces all of the possible nuclear reactions involving the initial isotopes, … and proton or neutron additives. These reactions are then arranged in order of increasing ignition energy and summarized as: 1) a four component energy balance, 2) the one or two final stable isotope products, and 3) a comparison to final electrode measurements…in this case those in George Miley's published transmutation paper.

Comparison of simulated isotope products, to Miley's measurements shows better than 90% agreement. The model's excess heat calculation accurately predicts Miley's reported 2-4 watts.

The model is based entirely in classical physics. It is completely interactive, allowing the user to change model parameters at will. I will bring a computer with the program to the Assisi workshop so that I can help participants try their hand at designing an electrode for specific purposes. These might include maximizing COP, or perhaps using electrode design to produce specific isotopes or rare earth elements.

Finally, I will be presenting two experimental designs that might be used to test the LANP model.

	FUSION REACTION			FUSION PRODUCT	LANP PRODCT	RARE DECAY	RARE DECAY PRODUCT	SPONT.	FISSION	PRODUCT	ENERGY COMPONENTS (amu) FUSION	LANP	RARE DECAY	FISSION	TOTAL
1	50Cr	+ 70Zn	+ (4)n =>	124Xe	=> 124Xe	=> B+B+	=> 124Te	=> SF	=> 62Ni	61Ni	0.00013	0.00000	0.00417	0.03146	0.03576
2	51V	+ 54Fe	+ (3)n =>	108In	=> 106Cd	=> B+B+	=> 108Pd	=> SF	=> 54Cr	54Cr	-0.00013	0.00496	0.00139	0.02503	0.03126
3	61Ni	+ 50Cr	+ (4)n =>	115Te	=> 115Sn			=> SF	=> 57Fe	57Fe	-0.00014	0.00746	0.00000	0.02170	0.02902
4	51V	+ 57Fe	+ (3)n =>	111In	=> 111Cd			=> SF	=> 55Mn	55Mn	0.00024	0.00147	0.00000	0.01613	0.01785
5	57Fe	+ 57Fe	+ (4)n =>	118Te	=> 118Sn			=> SF	=> 59Co	58Fe	-0.00038	0.00422	0.00000	0.02372	0.02757
6	52Cr	+ 52Cr	+ (3)n =>	107Cd	=> 107Ag			=> SF	=> 53Cr	53Cr	0.00039	0.00097	0.00000	0.01349	0.01485
7	52Cr	+ 54Cr	+ (3)n =>	109Cd	=> 109Ag			=> SF	=> 54Fe	52Cr	0.00040	0.00078	0.00000	0.00000	0.00118
8	50Cr	+ 57Fe	+ (3)n =>	110Sn	=> 110Cd			=> SF	=> 55Mn	54Cr	-0.00041	0.00484	0.00000	0.01467	0.01910
9	58Ni	+ 54Cr	+ (4)n =>	116Te	=> 116Sn			=> SF	=> 58Ni	57Fe	0.00042	0.00562	0.00000	0.02015	0.02619
10	54Cr	+ 54Cr	+ (3)n =>	111Cd	=> 111Cd			=> SF	=> 55Mn	55Mn	-0.00042	0.00000	0.00000	0.01613	0.01571
11	61Ni	+ 53Cr	+ (4)n =>	118Te	=> 118Sn			=> SF	=> 59Co	58Fe	0.00054	0.00422	0.00000	0.02372	0.02849
12	62Ni	+ 50Cr	+ (4)n =>	116Te	=> 116Sn			=> SF	=> 58Ni	57Fe	0.00059	0.00562	0.00000	0.02015	0.02636
13	60Ni	+ 50Cr	+ (4)n =>	114Te	=> 114Sn			=> SF	=> 57Fe	55Mn	-0.00060	0.00822	0.00000	0.00927	0.01688
14	51V	+ 70Zn	+ (4)n =>	125I	=> 125Te			=> SF	=> 62Ni	62Ni	-0.00069	0.00075	0.00000	0.03579	0.03584
15	64Ni	+ 52Cr	+ (4)n =>	120Te	=> 120Te	=> B+B+	=> 120Sn	=> SF	=> 60Ni	59Co	-0.00089	0.00000	0.00292	0.02681	0.02884
16	54Fe	+ 58Fe	+ (4)n =>	116Te	=> 116Sn			=> SF	=> 58Ni	57Fe	-0.00092	0.00562	0.00000	0.02015	0.02485
17	50V	+ 68Zn	+ (4)n =>	122I	=> 122Te			=> SF	=> 61Ni	59Co	-0.00093	0.00400	0.00000	0.01762	0.02069
18	50V	+ 70Zn	+ (4)n =>	124I	=> 124Te			=> SF	=> 62Ni	61Ni	0.00093	0.00284	0.00000	0.03146	0.03523
19	50V	+ 56Fe	+ (3)n =>	109In	=> 109Ag			=> SF	=> 54Fe	52Cr	0.00094	0.00240	0.00000	0.00000	0.00334
20	58Ni	+ 50Cr	+ (4)n =>	112Te	=> 112Sn	=> B+B+	=> 112Cd	=> SF	=> 56Fe	55Mn	-0.00096	0.01110	0.00316	0.01727	0.03056

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Successfully performed replicable experiments about cold nuclear fusion reactions in constantan specimens are reported. These experiments were performed successfully thanks to the initial author's research in the field of cold nuclear fusion as the corresponding results were partially published in [1].

The experimental scheme consists of gas chamber where the constantan wire specimens were placed and where interaction of these specimens with injected deuterium gas having purity 99.9998% took place. The pressure of the deuterium gas was maintained by mass-flow controller and the temperatures of the specimens were measured by both pyrometer and optical spectrometer. The constantan wires were coiled on alumina rods and initial heating of the wires was performed by electrical power supply, whose heating current and voltage were controlled. Residual gas analyser was used for mass-spectroscopical determination of the nature and the pressures of the gasses in the chamber. Two types of experiments were performed:

i) Several replicable experiments ware performed at initial temperature 950^{0}C of the constantan wires. In all experiments, explosive evaporations of the wires occurred momentary after the beginning of the interactions of these wires with deuterium gas (D) injected in the chamber. Copper metal release was observed in the experiments. The released excess momentary power was at least greater than 3400W, the density of this power was at least 2280 W/g in terms of the constantan wire and the ratio (Released Excess Power)/(Initial heating electrical power) ≈ 15 and greater. No external radiation was registered.

ii) A lot of replicable experiments were performed at initial temperatures of the constantan wires in range 660^{0}C – 690^{0}C as the specimens were not destroyed during the experiments and they were used in other further experiments. The heated constantan wires interacted with injected deuterium gas (D) having room temperature and certain pressures for different experiments. The temperatures of the constantan wires began increase at ~8 seconds after the beginning of injection of the deuterium gas and additional increases with 300^{0}C – 316^{0}C for different experiments were reached at ~25 seconds. The released excess power was in range 158W – 179W, the density of the released excess power was in range ~105W/g – 119W/g in terms of the constantan wire and the ratio (Released Excess Power)/(Initial heating electrical power) ≈ 2.7 for different experiments. No external radiation was registered.

Although no external radiation (gamma rays and neutrons) was registered, the observed released excess power was of nuclear origin due to the following proofs: *a)* The observed released excess power was not of electrical origin, because the parameters of the heating circuit remained unchanged during the experiments; *b)* The observed release of excess power of chemical origin was ~0.18% of the total released excess power; *c)* Significant density of the released excess power in terms of the mass of the constantan wire; and *d)* Registered release of helium (^{3}He and ^{4}He).

The corresponding presentation on the workshop will be based mainly on short videoclips and on pictures proving the successfully performed cold nuclear fusion experiments reported in this abstract.

[1] Dimiter Alexandrov, "Low Energy Nuclear Fusion Reactions in Solids: Experiments", International Journal of Energy Research, **45(8)**, pp.12234-12246 (2021) / Impact factor: 5.16

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For decades, nuclear engineers have calculated the specific values of the parameters needed for a nuclear reactor to ignite and maintain a chain reaction. In this paper, these conventional and time-proven calculations are used to determine the probability that a Low Energy Nuclear Reactor (LENR) can ignite and maintain a chain reaction. These calculations specifically include both the presence of the Nuclear Active Environment (NAE) and the secondary reactions occurring within the reactor.

One common type of LENR is a palladium (Pd) core, surrounded by a heavy-water lithium electrolyte solution, with an electric current driving the ^{2}d ions into the palladium lattice. It is known experimentally that the nuclear reaction by-products for LENR are found within small regions of the palladium core, called the NAE. Even when the entire sample is exposed to the same general conditions, the nuclear reactions occur only in the small NAE regions. The NAE is not a flawless palladium lattice uniformly loaded with interstitial deuterons, as is frequently assumed. Rather, by examining the crystal structure of known-good palladium cores, the most obvious possibility for the NAE are the cracks, fissures, and other crystal defects within the Pd lattice. The concentration of ^{2}d in the NAE is estimated to be around 10 times higher than in the lattice.

When calculating whether or not an LENR reactor can create a chain reaction, both the primary and secondary reactions must be considered. By including these secondary reaction, the mysterious “Three Miracles” of LENR are easily explained. There are several possible secondary nuclear reactions that could occur in an LENR; however, only those with a high enough reaction rate are considered here. Specifically, the primary and secondary reactions with high reaction rates are:

^{2}d+^{2}d --> ^{3}t+p (primary 1 reaction)
^{2}d+^{2}d --> ^{3}He+n (primary 2 reaction)
^{2}d+^{3}t --> ^{4}He+n (secondary 1 reaction)
^{2}d+^{3}He --> ^{4}He+p (secondary 2 reaction)

A four-part calculation is done for an example LENR, using reasonable parameters and assumptions for the core and the NAE. The intent of this example calculation is to determine if the LENR can maintain a chain reaction within itself.

Part 1: For the energetic by-products of the two primary reactions, calculate their scattering rate with the cold ^{2}d. Determine the number and average energy of the successfully scattered ^{2}d.

a. Calculate the scattering rate of energetic protons with ^{2}d.
b. Calculate the scattering rate of energetic ^{3}t with ^{2}d.
c. Calculate the scattering rate of energetic ^{3}He with ^{2}d.
d. Calculate the scattering rate of energetic neutrons with ^{2}d, using neutron scattering equations.

Part 2: Calculate the reaction rate of the secondary reactions for ^{2}d with ^{3}t and ^{3}He.

a. Calculate the total distance traveled by the energetic ions in the NAE.
b. Calculate the reaction rate of the secondary 1 reaction, ^{3}t+^{2}d --> ^{4}He+n.
c. Calculate the reaction rate of the secondary 2 reaction, ^{3}He+^{2}d --> ^{4}He+p.

Part 3: For the energetic by-products of the two secondary reactions, calculate their scattering rate with the cold ^{2}d. Determine the number and average energy of successfully scattered ^{2}d.

a. Calculate scattering rate of energetic ^{4}He (from secondary 1 reaction) with cold ^{2}d, using the percentage of the secondary 1 reaction.
b. Calculate scattering rate of energetic neutrons (from secondary 1 reaction) with cold ^{2}d, using the percentage of the secondary 1 reaction.
c. Calculate scattering rate of energetic ^{4}He (from secondary 2 reaction) with cold ^{2}d, using the percentage of the secondary 2 reaction.
d. Calculate scattering rate of energetic protons (from secondary 2 reaction) with ^{2}d, using the percentage of the secondary 2 reaction.

Part 4: Determination of a chain reaction.

a. Calculate the total number of the energetic ^{2}d, and their average energy.
b. Calculate the average distance travelled by the energetic ^{2}d ions.
c. Calculate the reaction rate for the subsequent ^{2}d to ^{2}d reaction.
d. Calculate the ratio of the subsequent ^{2}d reactions occurring as a result of previous reactions, and determine if a chain reaction occurs.

Also, using conventional calculations, answers are given as to why neutrons and ^{3}He atoms are not commonly detected.

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The thermodynamic analysis of the different types of HME reactors allows the comparison with the conventional sources of heat and power. It makes it possible to find out the applications domains where the new technology would be in competition with conventional ones and others where LENR sources would offer new opportunities. Although the precise features of the reactors nor the future costs are still unknown it is already possible to describe some potential applications where the new form of energy will provide valuable benefits.

An overview of the direct and indirect usages of heat in the society and the industry is presented in terms of temperature requirements and energy consumptions [1]. An attempt is made to evaluate the number of consumers in the world for each market segment.

The double analysis is used to build scenarios to imagine the possible introduction of the different LENR types in the industry.

The deployment of HME should be progressive. The prime market for each type will be different and unfold at different paces. Reactors requiring a continuous supply of electricity to be able to operate will first be confined to small power ratings, the cost will decrease following the cumulated number of units produced. Self-sustained units will first be utilized in niche applications where the absence of frequent refuelling will prove an important asset. The learning curve will allow a progressive augmentation of the unitary power and the clustering of units in large stationary generators.

If the power density is low mobile equipment (automotive, trucks, airplanes, marine) will first be supplied via the use of HME to provide an increasing fraction of the existing energy vectors like electricity for EVs, or near-future vectors like hydrogen and synthetic fuels without a breakthrough in the infrastructure for energy distribution.

At some point, movable HME sources will become feasible provided the energy density is sufficient. Breakthrough technologies will be developed accordingly for moving equipment. Type 4 systems will likely make this revolution a reality.

The study is part of the Project CleanHME. This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 951974.

[1] J. Ruer, "Could LENR Change the World?" J. Condensed Matter Nucl. Sci., vol.33, pp.1–9 , 2020

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Future HME (Hydrogen-Metal-Energy) reactors will deliver heat utilized in the society and the industry. The reactors can be characterized by the temperature level of the heat source, the power density, the size and the mode of operation. In the present study the HME sources are considered as pieces of equipment generating energy in the form of heat. They must receive an excitation energy to operate.

Different types of LENR reactors are defined according to the operation parameters [1]:

- Type 1: Reactors requiring external electricity for activation and additional heating
- Type 2: Reactors exporting heat but requiring an external supply of electricity for activation
- Type 3: Self-sustained reactors with a heat engine generator exporting electricity
- Type 4: Solid state technology and direct generation of electricity

Type 2 differ from type 1 by the heat losses mainly influenced by the size of the reactor. While type 1 requires external heating, type 2 must be cooled to maintain a stable temperature. Type 3 require a sufficient heat conversion efficiency so that the production of electricity exceeds the energy consumed for activation and control. Type 4 are basically solid-state technology.

The control of the reaction is different following the type of activation. In particular the reactors activated by a simple reheating of the active core must be controlled by an appropriate cooling method to avoid runaway or extinction [2].

The study is part of the Project CleanHME. This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 951974.

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Gordon - A Lattice Energy Converter (LEC) Contact Potential Difference (CPD) battery

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Upon several occasion people commenting on a Lattice Energy Converter (LEC) have suggested that the observed performance can be explained by assuming that a LEC is a battery. However, although a LEC is not an electrochemical battery using liquid electrolyte, or a 'direct charging device' that uses naturally radioactive materials (RCA, 1955)[1], LEC electrical performance can be described as a unique type of 'direct charging device' that does not require the use of naturally radioactive materials. In particular, when the working electrode is not in direct electrical contact with the counter electrodes a LEC is a type of Contact Potential Difference (CPD) battery.

The use of radioactive material has limited conventional CPD batteries to low-power applications where the hazardous radiation from the radioactive material does not present a physical or health problem. This limitation is critical since the power of a conventional CPD battery only increases with increasing radiation flux and not with temperature. A LEC CPD battery overcomes these limitations by the use of a currently uncharacterized source of ionizing radiation from hydrogen occluded hydrogen-host-materials such as metal hydrides. Since the LEC ionization process does not emit normally detectably levels of harmful radiation the surface area of the hydrogen-host-material can be arbitrarily increased to provide increased electrical power. In addition, the temperature also can be increased for greater LEC power.

Thus, the suggestion that a LEC is a battery is correct, but it is a unique and new type of CPD battery. This presentation discusses the history of nuclear CPD batteries in comparison to the LEC CPD battery and will include multiple approaches to overcome the limitations of nuclear CPD batteries.

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Bartalucci - The predictive power of the Correlated- Coherent States model in LENR research: experimental results from p-Li reactions at low energy

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The Correlated-Coherent quantum States (CCS) model [1-2] is described in this paper, showing its potentialities in the explanation of anomalous effects in Nuclear Physics and Astrophysics, such as excess energy production in LENR and the cosmological enigma of primordial lithium abundance[3].

The occurrence of nuclear reactions at very low energy is a clear indication of a strong enhancement of Coulomb barrier transmissivity, which has been observed in some crystal lattices at several accelerator facilities and is mainly ascribed to the classical electron screening mechanism. However, these experiments are downwards limited in energy ($E_{min} \geq 5$ keV) due to the strong electrostatic repulsion and a connection with room temperature experiments is impossible, due to the lack of effective theoretical ideas. The CCS model may allow this connection, according to an extensive literature [4-6]. A description of recent (pre-COVID) experimental test [7] of the CCS model predictions for the $^{7}Li(p,\alpha)^{4}He$ reaction is given in this paper at a c.m. energy around 450 eV, where the expected "standard" cross section is of the order of 10^{-50} barn! The detected α are unambiguously identified as coming from the above reaction and cannot be ascribed to background.

These results are compared to previous experimental findings [8], made by an independent team, which showed very high α-counting rates, but were erroneously interpreted by the authors thereby making further development impossible.

Some technical issues, which are related to this experiment, are discussed and suggestions for improvement and planning of the next activity on this topic are also presented.

Potentialities of the CCS method for practical realization of a powerful energy source are also highlighted.

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Agenda
William Collis, ISCMNS Chief Executive

1. The Report of the Chief Executive
   1. Membership
   2. Services – Web site, JCMNS, Library of Papers, Conferences.
   3. New medals
   4. Executive Committee recruitment
2. Proposal that the ISCMNS Executive Committee should reorganize the publication of the Journal of Condensed Matter Nuclear Proposal to suspend member fees for all members Science as it thinks fit to improve its readership.
3. Which payment system is preferred – PayPal or bank transfer?
   1. Charges 2-3%
   2. Delays
   3. Unfamiliarity
   4. Bureaucracy
4. Any other business. – Discussion

ULTR - A simple quick and repeatable demonstration of the LENR process

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A patent application by Dr. Ryushin Ohmasa in 2007 claimed synthesis of an array of elements from the 100Hz vibration of light water for 100+ hours. This was reported in Cold Fusion Now in 2013. [1]

Testing by the Martin Fleischmann Memorial Project in 2019 in Japan of the water vibration systems of Dr. Ryushin Ohmasa in Japan, revealed that the system produced ultrasound and vortex pair structures with vortical transmutation patterns and tracks emitted from the centre of these vortex structures. An indium foil exposed to this agitated water appeared to show transmutation also. A serendipitous event followed in Alan Goldwater's Magic Sound Lab during the ultrasonic cleaning of an indium foil control sample. Again, it appeared that transmutation had occurred due to resonant sound interaction.

Realising the long history of ultrasonic driven transmutation in the LENR field (Stringham, Ohmasa, LeClaire, Dardik, Ralkar, Claytor) could be replicated in a trivial way, in September 2019, the principal author proposed simple experiments whereby an affordable (typically $35) domestic ultrasonic cleaner would be used with fixed metal foils in light water with the interaction studied.

The first 3rd party to attempt replication, Allan Kusk, chose Al kitchen foil and noticed interesting marks repeatedly forming. This was rapidly replicated by many researchers all over the world. On further examination it was shown that these structures are extremely intense vortex pairs that appear to resonantly focus energy and matter, leading to a very predictable yin-yang cone/pit structure which appears to conduct the synthesis of elements as well as the balancing of them. The synthesis occurs within seconds, in all cases, in and around the core of these vortical structures, making it easy to verify.

David Boutilier found that some of the Al cones torn away from the bulk foil could be harvested by a magnet. Since other systems the MFMP had examined (microwave plasma, natural ball lighting, water electrolysis) appeared to produce Fe-rich crenelated micro-spheres, it was predicted that these would be present. Alan Goldwater subsequently ran an experiment and on first attempt found equivalent Fe-rich crenelated micro-spheres. They were subsequently found synthesised in another MFMP low pressure air, gas discharge system. It is believed this repeatable experiment shows the basis for all LENR. [2]

Vortex pair transmutation - Ohmasa vibrator

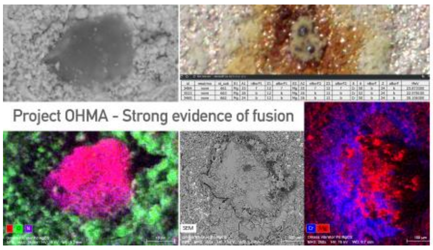

Fig 1: Ohmasa vib Vortex pair showing vo arrangement elements

Vortex pair transmutation – $35 ULTR experiment

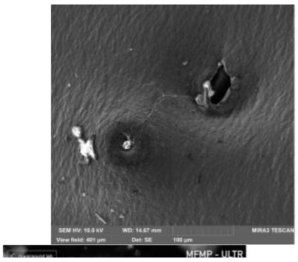

Fig 2: Vortex pair structure with fused-in light/heavy elements at cores

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[2] R.W. Greenyer, "ULTR - Experiment how to 4K," https://youtu.be/By1xWRLE4pY, April 2021.

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In their ICCF23 paper Frank Gordon and Harper Whitehouse reported a gas-mode metal cell that produced a DC current and voltage when the metal cathode was prepared in a certain way.They named the device a Lattice Energy Converter, or LEC. It has been replicated and discussed by several other researchers, and an update to the paper was given at ICCF24. Following that conference a working LEC device was provided by Gordon and Whitehouse for study. It consists of a ~ 3 cm square of stainless steel mesh plated with Pd. The mesh is sealed between two insulators made of PTFE plastic, with the center of the mesh exposed. Measurements of the cell electrical characteristics, and its morphology using SEM/EDX were done.

Tarasenko - Electrical discharges in the earth's crust

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In the earth's crust there are volumes filled with natural gas, consisting of molecules of hydrocarbon compounds, water vapor and other materials, as well as underground volumes filled with water or oil. In each of these phases-vapor-gas, liquid and solid, under certain conditions, the appearance of an electromotive force of free electric charges, the accumulation of a volumetric charge in the formation of strong electric fields is possible. Electromotive force and currents caused by physical and geological processes may also occur. The formation of a tornado is associated with electrical discharges accumulated in a thundercloud, by induction causes the appearance on the earth's surface of a charge equal to it in magnitude and opposite in sign. The charge of the opposite sign released in the Ground spreads due to conduction. Electric field lines appear between the cloud charge and a section of the Earth's surface. During the discharge, a strong current flows between the cloud and a piece of Earth and an alternating electromagnetic field is formed, the change of which causes the appearance of an electromotive force in the Earth.

When the electric field strength of the bulk charge reaches the value of the electrical strength of the medium, a discharge will occur in which an electron-ion gas-discharge plasma is formed. When a large pulse current flows through the plasma, in case of poor heat exchange, it can be heated to a very high temperature. In a low-temperature plasma formed in a discharge or track of a high-energy particle, various chemical reactions of both synthesis and decomposition are possible. Numerous chemical reactions of organic synthesis occurring in low-temperature plasma have been studied in laboratory conditions. Industrial production of various substances in discharge plasma, for example, acetylene from methane, has been mastered.

During discharge in gaseous, liquid and solid phases and the formation of low-temperature plasma in the bowels of the Earth, chemical reactions of inorganic synthesis and the formation of compounds from simple substances, for example, carbon and hydrogen, are also possible. In high-temperature plasma, if it is formed in the bowels of the earth, various yaler reactions are possible, predicted theoretically and carried out practically in laboratory conditions. The release of a large amount of energy in the discharge plasma leads to the occurrence of shock waves and earthquakes. A strong electro-magnetic field of the discharge current causes a disturbance of stationary fields can be recorded as well as fields from lightning discharges in the atmosphere. At an earlier stage of the formation of our planet, violent tectonic activity took place, which was accompanied by electrical discharges with the release of a large amount of energy in the discharge plasma. The hypothesis under consideration suggests one of the possible mechanisms for the formation of chemical compounds and radioactive isotopes in the Earth's crust. According to the proposed hypothesis, the synthesis of chemical compounds from simple bodies in low-temperature plasma and the formation of radioactive isotopes in hot plasma in the Earth's crust occurred in the distant geological epochs of the formation of the planet. Such processes are also possible in the present stage of its existence. The proposed hypothesis, in particular, allows for the formation of natural gases, oil, radioactive ores in our time, as well as the restoration of their reserves as a result of natural processes occurring in the plasma of the planet igniting in matter. The formation of electric charges in rocks and voids filled with gas and liquid can occur under the influence of processes occurring in the Earth's crust, atmosphere or near-Earth space.

It is impossible to observe directly electric charges in the Earth, but it is possible to observe phenomena caused by discharges in the Earth, for example, a change in the components of the Earth's electromagnetic field. The correlation between earthquakes and changes in the components of the Earth's magnetic and electric fields does not contradict the proposed hypothesis of thunderstorm activity in the Earth's interior. An electric discharge in a dielectric is accompanied by the detection of a large amount of energy that can cause an increase in temperature along the discharge channel to a value at which a thermonuclear reaction will be possible. Calculations show that due to the low electrical conductivity and high electrical strength of some rocks, a large volume charge can accumulate in them, the wave energy of which is hundreds or more times higher than the charge in the atmosphere of free gas. The charge concentration in rocks will also exceed the charge concentration in the atmosphere by several orders of magnitude. As a result of the spark discharge indicated in the bowels of the Earth, energy can be released in the order of magnitude equal to the energy released during earthquakes. Therefore, it becomes possible for stress waves and earthquakes to occur during underground lightning discharges