ICCF Cold Fusion Conference Held for the First Time in Poland

Christy L. Frazier
Photos courtesy of David Nagel.

The 25th International Conference on Condensed Matter Nuclear Science (ICCF25)[1] was held for the first time in Poland, during the last week of August 2023. The event began in the city of Szczecin on Sunday, August 27, with a Welcome Reception in the Copernicus Bar at the Radisson Blu Hotel, where the conference was held.

ICCF25 was chaired by Konrad Czerski and organized with his amazing team from the University of Szczecin. Czerski is Project Coordinator of CleanHME (Clean Energy from Hydrogen-Metal Systems),[2] which received over $6 million USD in funding from the EU European Commission Horizon 2020 Framework Programme[3] to develop hydrogen-metal and plasma systems. This four-year program (slated for completion in July 2024) involves many researchers and institutions in European countries, as well as collaborators in North America, many of whom presented at ICCF25 on work related to the CleanHME project.

Anthropocene Institute[4] was the main conference sponsor. Anthropocene recently unveiled the Solid State Fusion website,[5] which includes a wealth of information (including announcement of a new grant program for researchers). The Solid State Fusion YouTube page contains video of many of the ICCF25 presentations.[6]

Attendance at ICCF25 was reported to be 154, with 113 on-site and 41 virtual. *Infinite Energy* staff watched the conference via live stream on Zoom along with the other off-site participants (including some who were presenters). The four days were filled with 53 oral presentations and 29 posters.

Day 1 — August 28, 2023

Conference Chair Konrad Czerski (Poland: University of Szczecin; Institute for Solid-State Nuclear Physics) opened the first session of the conference by saying how satisfying it was to organize the ICCF conference "for the first time in Poland" and welcomed attendees from around the world. This conference series, dating back to 1990, always draws participants from many countries, a testament to the amount of work being done worldwide in the field of LENR.

Czerski noted, "We are sure that we can in the close future find new energy sources—very cheap, very friendly to the environment, very efficient. The goal is the same over the last 30 years, but we are very close to the final stage. There are some new projects worldwide. We have so many new results and a fundamental understanding of this process..." In presenting the Book of Abstracts to attendees, he said, "We are living in the time of computers, but books are still very important."

A photo tribute memorializing William Collis, founder of the International Society for Condensed Matter Nuclear Science (ISCMNS) who recently passed away, was followed by Jean-Paul Biberian's overview of Collis' dedication to and work in the LENR field. Biberian has worked under the guise of the ISCMNS, and with Collis, to publish the free online *Journal of Condensed Matter Nuclear Science*.[7] (See the *IE* tribute to Collis on p. 6.)

Jean-Paul Biberian (France: Retired, Aix-Marseille University; VEGATEC; editor, *Journal of Condensed Matter Nuclear Science*) was the first speaker in the Heat Production morning session. His talk, "Excess Heat in Nanoparticles Based on Hydrotalcites," was based on work being done by Biberian's team at VEGATEC as part of the CleanHME program. A hydrotalcite is a layered double hydroxide, used by Biberian's team to produce nanomaterials by replacing the magnesium atoms with transition metal atoms (nickel, copper, etc.). VEGATEC collaborates with researchers from CNRS France, the University of Szczecin, LIFCO and Lakoco. The abstract explains: "This unique method of manufacturing nanoparticles in a matrix made of alumina is very promising for industrial applications since it is very cheap..." Biberian reported on positive and negative results of tests over the past year with a reactor that is a 30 x 3.5 cm stainless steel tube. The hydrotalcite powder is placed in this tube, hydrogen is introduced on one side of the cylinder and then pumped out from the other side. He said that this continuous flow of hydrogen decarbonates the sample, reducing the metal oxides; this will allow for absorption of hydrogen inside the metal nanoparticles. Biberian noted that more excess heat is produced with this process, suggesting that some active sites in the nanoparticles hold onto some hydrogen and trigger a reaction.

Jirohta Kasagi (Japan: Research Center for Electron Photon Science at Tohoku University) presented on "Photon Radiation Calorimetry for Anomalous Heat Generation in NiCu Multilayer Thin Film During Hydrogen Gas Desorption." His team includes scientists from Clean Planet Inc. (Japan). They continue to use photon radiation calorimetry, which seems most reliable for obtaining heat from a sample placed in a vacuum. Kasagi said that they have added two new detectors to their system and changed the "case" that holds it, which has removed the requirement of rotating the sample to get measurements and improves time response for continuous measurement of radiation emission. H_2 or D_2 gas is occluded in a nickel-copper (NiCu) multi-layer thin film sample that has been deposited on a nickel substrate. After the sample absorbs the gas, the vacu-

um chamber is evacuated and the sample heated to about 1000K. They have found that the samples with a NiCu complex produce more excess heat than ones with a monolayer of Cu. Kasagi stated that, "Excess heat stays constant with 80 hours of continuous measurement, but there are some very short-term fluctuations, as if the system is oscillating."

Peter Hagelstein (U.S.: Massachusetts Institute of Technology) gave the talk for Melvin Miles (U.S.: Retired, University of LaVerne), who did attend virtually. "Helium-4 as a Measurement of Excess Power in the Palladium-Deuterium System" re-examines data from some of Miles' early 1990s experiments. Hagelstein noted that Miles' conclusions may only apply to his data set and not those of others; some of these conclusions include: the importance of grain boundaries as reaction locations and an escape path for gases; most of the helium-4 escapes from the palladium; the fusion reaction rate is controlled by diffusion of deuterons, not the Coulomb barrier; oxygen in the palladium (in his experiments) is detrimental to LENR effects. Hagelstein stated that the CERN website says that "5 sigma is considered the 'gold standard' in particle physics because it guarantees an extremely low likelihood of a claim being false," and the experiments Miles' re-visited for this presentation had measurements far greater than that.

Kang Zhou (China: Zhejiang University) presented remotely on "The Role and Mechanism of Anomalous Heat Generation During Earthquakes and Its implications for Regional Geothermal Resources," positing some similarities between what happens at the epicenters of earthquakes along the fault lines and what happens in LENR with anomalous heat generation. Zhou's ideas seem to align with *IE* editor George Egely's theory that "cold fusion" happens in Nature more often and in greater ways than most imagine. (As pointed out during the Q&A, these ideas are similar to what has been proposed by Alberto Carpinteri on fission reactions from earthquakes and earlier work by Francesco Piantelli.) Zhou gave some examples of how Edmund Storms' nuclear active environment has common features with the Earth's soil, and gave examples of metal hydrides that are formed at the core-mantle boundary. He suggested that understanding how earthquakes are similar to LENR could help lessen the impacts of major earthquakes in the future.

Francis Tanzella (U.S.: Energy Research Center LLC) talked about his work on examining and verifying Brillouin Energy's calorimetry in "Total Calorimetry ('from the wall') in a Brillouin Reactor." His co-authors, from Brillouin Energy, are Robert Godes, Robert George and Jin Liu. In the abstract, Tanzella noted that some criticism was received on his 2020 calorimetry work on the Brillouin reactor (calorimetry only examined a small portion of the total energy deposited into the reactor). The reactor and calorimeter system have been modified so that "all electrical power used to stimulate the system and all thermal power exiting the system are now measured." After over two thousand experiments on over 300 different Ni-coated cores in six different types of reactors, Brillouin has consistently shown overunity results. Continued and future work at Brillouin include *in-situ* nickel temperature measurement and building a next generation mass flow calorimeter, among other goals.

Takehito Itoh (Japan: Research Center for Electron Photon Science at Tohoku University) presented virtually on "Photon Radiation Analysis for Spontaneous Heat Burst During Hydrogen Desorption from Nano-sized Metal Composite." He works with Kasagi and others at Tohoku University, as well as a team from Clean Planet Inc. Their experiments using hydrogen and nano-sized metal composites (Cu/Ni/CaO) show "observation of heat burst phenomena, in which the temperature of the heater suddenly rises." They did photon radiation analysis to determine if they could detect photon radiations when the heat bursts occurred. Itoh found that "the visible, near-infrared and mid-infrared radiant intensities increase synchronously with the occurrence of heat bursts." The following experimental objectives were realized: Ni-H heat generation; improvement of the measurement accuracy of excess heat; elucidation of the reaction mechanism (size, location); measurement of low energy photons.

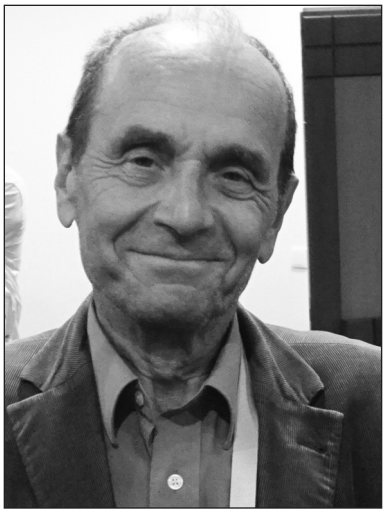
Dimiter Alexandrov (Canada: Lakehead University) closed the morning session with "Critical Temperature Required and Experimental Proofs About Nuclear Fission Reactions in Constantan." His experiments utilize constantan wires coiled on alumina rods. Alexandrov said he has "had replicable experiments with constantan wire at 300C and 400C with both nitrogen and deuterium." In the abstract, he wrote that the "cold nuclear fusion (CNF) reaction in the constantan occurred in its interaction with D_2, giving initial T increase followed by T decrease due to both gas saturation in the constantan lowering the CNF reaction and cooling caused by the injected D_2 gas."

The afternoon session continued with another talk on Heat Production, presented remotely by Shinya Narita (Japan: Iwate University): "Heat Measurement in Hydrogen Desorption Experiment Using Pd Foil Coated with Ni Membrane." In the abstract for the talk, Narita's team wrote: "We have estimated the excess power from comparison with the results for unloaded sample, and obtained preliminarily up to a few hundred mW [excess heat] so far. We are continuing the experiments to confirm the heat evolution and to improve the accuracy of the excess heat evaluation."

The day's Transmutation talks began with "Surprising Correlation Between Peaks in LENR Transmutation Data and Deuteron Fusion Screening Data" by David Nagel (U.S.: George Washington University). He warned attendees that this might be his "strangest presentation" on LENR, with "many questions but no answers." Over the years of analyzing so much experimental data on LENR, Nagel noticed an "unexpected correlation" between some 1996 transmutation data (Miley/Patterson[8] and Mizuno/Ohmori/Enyo[9]) and the 2006 screening data of Widom-Larsen.[9] The transmutation experiments have five peaks of similar atomic mass, and these peaks also occur in the theoretical potential model of neutron absorption by Widom-Larsen. Nagel noted that the appearance of the peaks in all three data sets is not fully understood, but that "theories of deuteron stripping reactions might prove to be useful" as an explanation. He said that these apparently correlated peaks "require further study to determine their reality and utility." Nagel cautioned that "the effort to validate and understand the peaking might be a wild goose chase." But, "it might end well, with additional understanding of the mechanisms that cause LENR."

Vladimir Vysotskii (Ukraine: Taras Shevchenko National University of Kyiv) continues cavitation experiments with his colleagues A.A. Kornilova and S.N. Gaydamaka, who are now affiliated with the U.S. company AVSystems, Inc. His

talk, "Stimulation of Efficient Low Energy Tritium Fusion Under the Action of a Weak Undamped Thermal Wave on Remote TiD Target," reported on his most recent experiments using TiD targets placed 20 cm from an undamped thermal wave and irradiated for 20 and 40 minutes. The position and activity of the helium-3 nuclei created was analyzed. Vysotskii said the "fast structural changes in the volume of the TiD target, which form coherent correlated states of helium nuclei, lead to the generation of giant energy fluctuations."



Ukrainian LENR scientist Vladimir Vysotskii

Harishyam Kumar (India: Indian Institute of Technology) talked about "Low Energy Nuclear Fusion at Second Order in Perturbation Theory" (the slides were titled "A Toy Model for LENR"). He and his colleagues at the Indian Institute of Technology suggest that LENR may be a second order perturbation with two interactions at the atomic and nuclear distance scales, and they assume that a photon is emitted "at the first vertex." The abstract indicates: "The high energy states have large amplitude for tunneling through the potential barrier and hence it is possible that the total amplitude for this process may be large." The model showed that if the "process takes place in free space, then the rate is very small" but "in a medium, the rate can be quite large and observable."

Florian Metzler (U.S.: Massachusetts Institute of Technology) gave the first Hot Gas Experiment talk, "Probing Neutrons and Purported Fission Daughter Products from Gas-Loaded, Laser-Irradiated Metal-Hydrogen Targets,"[11] a project that has received ARPA-E[12] funding. Metzler's group (Camden Hunt, Jonah Messinger, Nicola Galvanetto) has an average age of 32 (all are under 40); their interest in the field was inspired by MIT's Peter Hagelstein. Metzler noted that the ARPA-E program called for a reference experiment that: unambiguously points at a nuclear origin of observed effects; can be reproduced with some degree of reliability; ideally matches a theoretical hypothesis. In the abstract, Metzler's team wrote: "Our evaluation of the LENR literatures led us to conclude that a specific group of experiments may represent a suitable candidate for such a reference experiment: gas-loaded and laser-irradiated palladium-deuterium and titanium-deuterium samples which have been reported to produce energetic neutrons and/or low-Z elements such as Fe, Ni and Cr." They have sought (where possible) collaboration with the original scientists of the experiments they replicate. Metzler noted that the field needs irrefutable evidence "to overcome the stalemate" because there is "too much ambiguity about the results to date." Metzler said, "If there is potential for technology, then the might of the scientific enterprise must be brought to bear." He noted the need for convergence of bottom-up and top-down efforts.

Tomotaka Kobayashi (Japan: Waseda University) presented virtually on "Anomalous Temperature Increases in Single-Component Metal Powder Exposed to Pulsed High-Pressure Hydrogen Gas: Fundamental Experiments for High Power Focusing Engine." He and colleagues at Waseda University have conducted experiments to evaluate the anomalous heat in the hydrogen gas absorption of metal powder, similar to previous work by Miley, Arata and Kitamura. Kobayashi said, "Absorption of hydrogen gas injected with pulse flow generated by the solenoid valve into Pd-Ni-Zr composite powder shows temperature increases over 50K." They observed the temperature increase of Cu particles and hypothesize a "focusing engine having high power beyond chemical reactions such as combustion."

Francesco Celani (Italy: Instituto Nazionale di Fisica Nucleare) reported on "The Role of Electric Pulse Shape on the Generation of AHE in Surface-Modified Constantan at High Temperatures and Under Hydrogen or Deuterium Gases," work he and his colleagues have recently conducted as part of the CleanHME program. (AHE is the anomalous heat effect, or excess heat.) Celani noted a recent focus on simplifying the past Constantan experiments to enable easier replication by others. This included preparing the Constantan wire with different "milder" or low-cost coatings/powder (and even using "virgin wires") and creating a new power dimmer circuitry. Celani said, "Even if the mild-treated wire shows some excess heat larger under pulsed than in DC, we will have proof of the efficiency of the procedure." He said they will "start a new geometrical set-up of the core and chemical-physical treatments to reduce the energy given to the system, improvising the total COP toward a practical application of LENR-AHE."

Day 2 — August 29, 2023

The second morning of the conference kicked off with a Heat Production paper by Yasuhiru Iwamura (Japan: Research Center for Electron Photon Science, Tohoku University) and his team at CleanPlanet. In "Elemental Analysis and Quadrupole Mass Spectrometry Towards the Clarification of Anomalous Heat Generation Observed in Ni-based Nano-multilayer Metal Composite and Hydrogen Gas," Iwamura reported on their "innovative heat generation method induced by rapid heating of nano-structured Ni based multilayer thin film" loaded with hydrogen. They had peaks of anomalous excess heat above 20 keV/H, "too high to be explained by known chemical reactions." Samples that generated excess heat or heat bursts are showing very high concentrations of oxygen; they ruled out surface oxidation as a source but have not yet determined what is causing the appearance of oxygen.

Lawrence Forsley (U.S.: NASA John Glenn Research Center; Global Energy Corporation) presented the first of three Beam Experiment talks. Presenting virtually on "Plasma-induced Electron Screening at the Bragg Peak," Forsley reported on work conducted by he and colleagues at the NASA Glenn Research Center in conjunction with his company Global Energy Corporation, and researchers at PineSci Consulting and HX5. They propose that an enhanced electron screening effect "occurs due to plasma screening as charged particles traverse condensed matter and sweep electrons with them." Forsley said that plasma screen-

ing effects have not been previously considered in laboratory astrophysics experiments. He noted, "If these effects are considered, a better understanding of when and where d-d fusion reactions occur could be accomplished."

Sveinn Olafsson (Iceland: Science Institute University of Iceland) reported on "Time of Flight Characterization of Laser Accelerated Hydrogen Rydberg Matter Absorbed in Tantalum Foil," work done with colleagues at the University of Iceland to verify the observations of Leif Holmlid (2012) on generation of fast particles when metallic foils exposed to hydrogen Rydberg matter are hit with 5ns laser pulses. Olafsson is using improved instrumentation, which he described. He gave some preliminary results of the detection and observation of fast particles which "indicate that the fast particles have positive charge." The work is ongoing.


ICCF25 Chairman Konrad Czerski

Rakesh Dubey (Poland: Institute of Physics, University of Szczecin) and his colleagues, including Conference Chair Czerski, are working on "Electron Observation Benchmarking for Solid-state DD Fusion Experiments at Thermal Energies" as part of the CleanHME project. He discussed normal reaction channels, noting that "cold fusion studies lead to the conclusion that ^{4}He productions are the strongest reaction channel, and no simultaneous gamma emission takes place." Dubey presented details about their experimental observation of a new reaction channel, performed at the eLBRUS Ultra High Vacuum Accelerator Facility at Szczecin University; on the final day of the conference, attendees visited eLBRUS to see experiments in progress. The team will begin work with room temperature (not beam) experiments soon.

Five talks on Theoretical and Computational Studies finished the morning session and started the afternoon session.

Konrad Czerski (Poland: University of Szczecin) reported on "Proton Induced Nuclear Reactions at Thermal Energies," work done with colleagues from his university and also Maritime University of Szczecin as part of the CleanHME project. He discussed various possible reactions in their beam experiments, noting that excess energy "appears to be similar whether light or heavy hydrogen is used and significantly exceeds that expected for chemical reactions." The work focuses on calculating cross sections of proton-induced reactions at thermal energies and comparing them to d-d reactions in known electrolysis and gas loading experiments. He said that they will try to "predict to what extent the results of accelerator experiments carried out at higher projective energies can help us understand the data obtained at thermal energies." They think there may be more resonance and screening effects to be found at lower energy, and indicated that oxygen at very low concentrations seems to improve screening.

Ali Ihsan Kilic (Turkey: University of Eskosehir) discussed "Resonance Structure in ^{4}He Showing Material Dependence of Cross Section at Very Low Energies," a furtherance of the Polish group's work in the CleanHME program. He covered the energy dependence of the branching ratio and angular distributions of different target materials. The work looks at a 2006 Czerski paper (who is a co-author of this paper), in which Sr and Li targets showed a "significant suppression" of the neutron channel and an increase in angular anisotropy at deuteron energies below 20 keV. They applied newer models to the effect. Kilic said, "The theoretical results were found to be in good agreement with experimental data for most materials and with multi-channel R-matrix theory." The findings "highlight the importance of considering resonance contribution and the role of target materials in understanding the energy dependence of branching ratio and angular distributions in nuclear reactions involving deuterons."

Narayan Behera (India: Centre for Energy Research at Swami Vivekananda Yoga Anusandhana Samsthana University, SVYASA) spoke virtually on how "The Quantum Effects of Vacuum Polarization Can Significantly Enhance the Tunneling Probability of Deuterium Nuclei to Form Helium Nucleus in Cold Fusion." His team is exploring how vacuum polarizations due to strong electromagnetic fields around deep electrons could explain the tunneling effect and, ultimately, LENR. He said, "The electrons can move towards the deuterium nuclei and thus can create an effective screening of the Coulomb potential, reducing the strength of the Coulomb barrier." The virtual particles may interact with the deuterium nuclei, leading to modification of their effective mass and charge. Behera used the Feynman diagrams to illustrate the effect of vacuum polarization, including "significantly enhancing the tunneling probability of deuterium nuclei to fuse to helium nuclei and release energy."

Independent researcher Philippe Hatt (Belgium) discussed the "Relationship Between Higgs Boson Mass and Neutron, Proton and Electron Masses Strong Nuclear Interaction Explanation." He explained his views on: the mechanism yielding the neutron mass from the Higgs boson; electromagnetic effects based on this mechanism; the weak nuclear force; strong nuclear interaction. He said there is a "fundamental interest" in the strong nuclear force because it lends to "the understanding of LENR versus classical nuclear fusion." He presented examples of binding energy values for various nuclei determined by neutron and proton mass.

Lynn Bowen (U.S.: Colorado Mountain College) posited that LENR may no longer need a new theory, in "An Examination of LENR Design Improvements, Based on the Recently Gained Understanding of the LENR Mechanism," suggesting that cold fusion is fusion producing neutrons that are thermalyzed and absorbed, as observed in Fleischmann-Pons type experiments. She stated that four child products (n, p, ^{3}He, ^{3}T) have a high kinetic energy that transfers to the deuterons when scattered. The Coulomb barrier is overcome by this transferred kinetic energy. The abstract noted, "If enough of the ^{2}D are energized, a subsequent ^{2}D to ^{2}D reaction can take place" and a chain reaction will occur if more energetic deuterons are created from this reaction. The abstract lays out twelve "suggestions to improve the safety, reliability and energy output" of the reactor design.

The afternoon session finished with three talks on Instrumentation. Andrew Gillespie (U.S.: Texas Tech University) represented Robert Duncan's team's work on "New Mass Spectrometry, Calorimetry and Tritium Extraction Instrumentation with Applications to Lattice-Confined Fusion Experiments." They have been fine-tuning new high resolution mass spectrometers, pulsed evaporative calorimeters and tritium extraction and detection instrumentation. Gillespie said that "three different open-system calorimeters…are able to accurately and quantitatively isolate experiments from environmental heat fluctuations." The liquid nitrogen evaporative calorimeter works with the mass spectrometer in real time. He discussed detection limits (for nuclear by-products) of their equipment, and how their instrumentation may be useful in other labs.

Independent researcher Alexey Ivanchuk (Ukraine) spoke virtually on "Detection of LENR in Spark Plugs." Using a large array of used car spark plugs, he claims to have observed strange tracks made on blank CD/DVD discs. The used plugs are positioned plug-side down through a wooden board, and the disc is placed about 1 cm away (below and not touching). He said no tracks appear if he does the same set-up with new spark plugs. Read the abstract for details about all of the experimental approaches taken.

Gokul Das Haridas (Poland: Institute of Physics, University of Szczecin) presented more of the CleanHME work by the group working at the University of Szczecin in "Monte Carlo Geant-4 Simulation for Studying the DD Reactions at Thermal Energies." Referring to the experiments aforementioned at eLBRUS, this talk discussed "the nuclear measurement technique to distinguish between direct fusion events and indirect events arising from elastically scattered particles within the target and protection foils placed in front of the detector."

The Poster Session took place during the late afternoon of Day 2. *IE* staff was not been able to watch the presentations, though many of them were available to virtual attendants. The Posters were a hybrid of live and pre-recorded presentations, with each allotted about five minutes. There were 29 total posters/presenters. Those presenters who pre-recorded discussions of their poster because they were attending virtually had printed versions posted on-site for people to look at. The Book of Abstracts[13] lists all of the posters, with full abstracts for each of them.

Day 3 — August 30, 2023

The third day of the conference began with four Theoretical and Computational Studies talks.

Peter Hagelstein (U.S.: Massachusetts Institute of Technology) reported on progress to his theoretical model of the nuclear molecule in the talk, "Coherent Nuclear Dynamics for the Nuclear Part of LENR Models." This included simulation results. In the abstract, Hagelstein notes: "Excess heat in PdD_x starts with excitation transfer from D_2/He transitions to resonant ^{4}He/D(compact) transitions. For the nuclear system to down-convert the large 24 MeV nuclear quantum into lower energy quanta at the eV level and below, a large number of closely spaced reasonably stable nuclear states are needed, where the average energy difference between levels is on the order of the energy quantum that can be exchanged through the coherent energy exchange process. The largest density of relevant nuclear molecule states occurs near the band head expected near 35-40 MeV in the stable Pd isotopes." Hagelstein said, "When the coupling is insufficiently strong for the excess heat path to proceed efficiently, then the nuclear molecules can tunnel decay, leading to transmutation, or decay through tunnelling of low mass nuclear fragments, leading to low-level nuclear emissions. In essence, transmutation is connected fundamentally to the process that makes energy in this kind of model."

Representatives of the ISCMNS: Alan Smith (CEO), Lynn Bowen (President), Jean-Paul Biberian (Editor, *JCMNS*)

Zhing-Zhong Li (China: Tsinghua University) presented virtually on "$A^{1/3}$ Law in Nuclear Transmutation of Metal Hydrides (II)," a follow-up analysis of a transmutation model presented at ICCF24. He said that the "$A^{1/3}$ law justifies the existence of Low Energy Nuclear Resonance in condensed matter nuclear science" and that it highlights the "existence of the lattice in resonance." Li explained that nuclear transmutation depends on atomic mass (A). He discussed work by Nagel on A-dependence of nuclear transmutation in NiH experiments, and by Miley in TiH experiments, noting that both "imply the importance of multiple-scattering in resonance."

Independent theorist Daniel Szumski (U.S.) noted in "Calibration of an Electrode-Energy Partition Model Using George Miley's Published Data" that "the single greatest need in cold fusion research is a scientific theory of its nuclear process." He discussed how his Least Action Nuclear Process modeling program might be a solution, indicating that "the model's excess heat calculation accurately predicts" results by Miley. In addition to giving a step-by-step overview of how data is input into and interpreted by his model, Szumski discussed "how a continually increasing, internal electrode energy causes nuclear transmutations in the order of their increasing fusion-ignition requirement, and how unstable fusion products decay along known decay pathways to their final stable isotope products without gamma emissions."

Diadon Acs (U.S.: LENR Forum) discussed how artificial intelligence (AI) might be used in LENR research, in his talk "Utilizing Machine Learning Techniques for In-Depth

Investigation of Low Energy Nuclear Reaction (LENR) and Lattice-Assisted Nuclear Reactions (LANR)." Acs presented the various types of machine learning methods, proposing ways in which AI can help "decipher the underlying mechanisms driving" the LENR phenomena. He believes that AI extends human intelligence and could be helpful in the pursuit of open source science.

The end of the morning session and the start of the afternoon session consisted of five papers on Beam Experiments.

Tieshan Wang (China: Lanzhou University) and colleagues are doing work on "Sub-Coulomb Barrier Light-Nuclei Fusion in Various Environments." They studied the environmental screening effect in ion beam experiments, measuring resonance in various types of collisions. They found screening potentials "generally higher than existing theoretical predictions" (with values up to 600 eV), which are temperature dependent and also dependent on the host material and impurities. They have developed a hydrogen cluster ion fusion model.

Natalia Targosz-Sleczka (Poland: University of Szczecin) has a large team working on "Nuclear Reaction Enhancements Determined by Means of Direct and Inverse Kinematics in Metallic Environments" as part of the CleanHME program (this includes researchers from the Maritime University of Szczecin and the Jozef Stefan Institute in Slovenia). They investigated electron screening effects of beams on deuterated metallic targets using direct (deuterium) and inverse (heavy ions) kinematics. With direct kinematics, they "determined values between 100-500 eV," and with inverse kinematics they "arrived at the value of 7 keV." Their theoretical computations are compatible with experimental findings, but "did not take into account any effects in the crystal lattice," which they think is very important.

Benjamin Barrowes (U.S.: Army Cold Regions Research and Engineering Laboratory) presented "Morphological and Elemental Changes of Palladium Immersed in Deuterium under Laser Irradiation," which highlighted replications of past experiments done by Biberian and Nassisi that explored the properties and behavior of palladium under local optical excitation in hydrogen and deuterium atmospheres. Barrowes said, "While morphological and phase changes of palladium bathed in hydrogen have been studied extensively due to the remarkable ability of palladium to absorb hydrogen into the metal matrix, the effect on palladium from local excitation by laser irradiation under these conditions is less well understood." His team irradiated palladium with different lasers to study "before and after potential elemental changes to and on the palladium lattice." They found that "little to no" elemental changes were found in locations that were not irradiated, but found "noticeable difference under the locations of laser irradiation," including the "unexpected emergence of secondary electron SEM bright spots."

Peter Hagelstein presented "Low-level Energetic Ions from TiD_x in Ion Beam Experiments" for his student Sadie Forbes (U.S.: Massachusetts Institute of Technology). In the abstract, Forbes writes: "Our interest has focused on energetic ion emission not associated with dd-fusion reaction which may shed light on the nuclear processes responsible for excess heat production and other anomalies." The ion beam experiments utilized a vacuum chamber and pumps, and a proton gun "capable of delivering ions to a foil at energies up to about 1 keV, at a current up to a few mA." Hagelstein, who analyzed the data found in experiments conducted by Forbes, explained, "A lot of people believe that the problem is to detect LENR charged particles...The real problem is how to make them." They propose the creation of D_2 in the lattice. Hagelstein said they "got some positive results for low-level energetic ion emission from a D ion beam on Ti." This result was considered in the context of Hagelstein's nuclear molecule model. In the abstract, Forbes writes: "The protocol used for these experiments involves first loading a titanium foil with deuterium implantation, then switching to argon bombardment to create vacancies, stimulate vibrations and heat the sample. We think that deuterium outgassing is a trigger for low-level energetic charged particle emission."

Aleksandra Cvetinovic (Slovenia: Jozef Stefan Institute, JSI) collaborated on experiments related to "Electron Screening in Palladium" with researchers across Europe, with the primary work conducted using the 2 MV Tandetron ion accelerator at JSI. They measured reaction rates of three reactions on palladium foils, one prepared with hydrogen and the other deuterium. From the abstract: "In one of our targets, we measured no screening and in the second one we measured a high screening potential for all three reactions, that is an order of magnitude above the theoretical model. Contrary to the theoretical predictions, our research suggested that the reason behind this difference is linked to a dependence of electron screening potential on the host's crystal lattice structure and the location of the target nuclei in the metallic lattice."

The afternoon finished with three talks on Heat Production and three talks on Plasma Experiments.

Bin-Juine Huang (Taiwan: Advanced Thermal Devices, Inc.) discussed "Anomalous Gas Emission from Low-energy Nuclear Reaction of Water" during cavitation experiments. From the abstract: "Cavitation may induce low-energy nuclear reaction through implosion of vapor bubbles. We conducted experiments using two reactors made from multiple-pipe heat exchanger and found that the heat exchange process produces peculiar excess heat and nuclear transmutation." They moved on with eight other reactors; all reactors had similar results.

Yuta Toba (Japan: Waseda University) presented virtually about his team's "Optimization of Gas-jet Nozzle Length for Increasing Anomalous Heat Generation Due to Metal Composite Nanopowder and Hydrogen Gas." The small reaction chamber has a gas-jet nozzle, and hydrogen is absorbed into metal powders (PdNiZr). They varied the length of the nozzle and tested injection rates. The abstract notes that "the maximum temperature rise of 62.9 K was observed when gas-jet nozzle length was 825 mm."

Prahlada Ramarao (India: Centre for Energy Research at Swami Vivekananda Yoga Anusandhana Samsthana University, S-VYASA) spoke virtually about "Exploring the Potential of Low Energy Nuclear Reactions (LENR)" in "several hundred experiments with different combinations of raw materials and experimental processes." One set of experiments has "consistently produced excess heat by 30-40%." To support the observation, they conducted "twin experiments" where similar instrumentation was used but one had active materials and the other did not (reference experiment). Colleagues in a second lab also ran the experiments.

They found that "all the active reactors showed higher heat output when compared to the reference reactor" and all active reactors had helium observations.

Anissa Bey (Romania: Extreme Light Infrastructure, Nuclear Physics, ELI-NP; Horia Hulubei National R&D Institute for Physics and Nuclear Engineering) spoke virtually about work "Towards the Commissioning of a Laser-Electron-Driven Bremsstrahlung Gamma Source for Nuclear Isomer Studies at ELI-NP." Bey said: "Despite advances in experimental and astrophysics theoretical calculations, uncertainties concerning the population of isomers in nucleosynthesis environments subsist." The intense, short-pulse nature of the high peak power laser systems at their lab is "advantageous for studying isomeric states with life-times impractical for stable accelerator or reactor experiments." They aimed to "photoexcite isomers relevant for nuclear structure...and to potentially measure their photoreactions."

George Egely (Hungary: Egely Ltd.) presented some recent "Test Results of Catalytic Fusion" with his intermittent spark discharge reactor. Condensed plasmoids are formed ("a bubble made of thousands or millions of electrons entangled into a highly charged lump"). Some transmutation has been observed, and the COP has ranged from 2 to 5. Egely has identified several "crucial parameters" over the last few years of work with the reactor: distance of spark gaps; shape of the electrode; quality of the electrode surface; pressure in the reactor tube; chemical composition of the plasma; layout of the electric circuit. Four reactors were sent around the world for other scientists to test. The reactor has gone through numerous modifications, some based on the input of those scientists.

Sebastian Domoszlai (Hungary: Egely Kraft) presented on Egely's "Method for Measuring Input Power in Pulsed Electric Circuits," which aims to improve power measurement techniques. From the abstract: "A small but steadily growing branch of the LENR field deals with electric discharges in plasma. Often times, pulsed DC discharges are generated in a gas at sub-atmospheric pressure. Such systems are usually driven by a relaxation oscillator [with] a significantly varying frequency over time. Measuring input power in such devices poses a difficult challenge to experimenters in the field." Domoszlai noted that it is difficult to use conventional electric measurement methods in gas discharge systems. Egely proposes a method that utilizes calorimetry that "takes into account power coming directly from the power supply and power coming from the relaxation capacitor."

Day 4 — August 31, 2023

The final day of ICCF25 began with three talks related to Transmutation.

Theresa Benyo (U.S.: NASA Glenn Research Center) spoke virtually about her team's question: "LENR Products: Lattice Confinement Fusion (LCF), Fission or Both?" She noted that there are many different fusion reactions possible, and said: "I like to call it a nuclear soup...Some of us may concentrate on a couple of these reactions, but they are all happening at the same time in different probabilities." Her team has conducted three sets of experiments (gas cycling, Bremsstrahlung irradiation, electrolytic wet cells), all of which detected products/transmutation. Multiple analyses were performed on the gas cycling experiments because they detected elevated levels of some elements (especially chrome, manganese and zinc). They are trying to determine if the isotopes occurred in natural abundance and "if not, we have stumbled upon something very unique." In the Bremsstrahlung irradiation experiments they were surprised to see that exposure of TiD_2 and ErD_3 to a 2.9 MeV beam resulted in dd fusion and higher energy neutrons. Benyo said, "We think subsequent fusion reactions took place due to boosted or Oppenheimer-Phillips neutrons." The electrolytic wet cell experiments showed that exposure to low electric currents resulted in dd fusion and higher energy neutrons. She said that neutron detection is "not highly significant yet" but they have seen indications of 2.45 MeV and possibly higher neutrons. They found "some very interesting products in some instances that weren't with the starting materials," such as calcium peroxide spots on the surface of the co-deposition layer. Benyo talked a bit about transmutation theories. She stated, "We determined that inside the lattice is where the higher kinetic energy is happening, and yet the whole lattice stays room temperature." They suggest that fission and fusion may be taking place at the same time, and have recently begun looking at a hybrid fusion/fission reactor (with a NASA Innovative Advanced Concepts Fellowship grant) that powers an autonomous robotic probe.

Independent researcher Edo Kaal (Netherlands) spoke about "Fusion and Fission in LENR Experiments as the Underlying Mechanism Through the Lens of the Structured Atom Model." His team postulates that nuclear transmutation is the principal cause for the excess heat in many LENR experiments, and lament that "the scientific community has ignored these findings of new isotopes" as they continue to seek a theoretical explanation for LENR. Kaal spoke about the Structured Atom Model (SAM), like that proposed by Norman Cook, providing insights that existing models of the nucleus do not, including an explanation of the mechanics involved in transmutation observations. This model is "based on the fundamental belief that every atomic nucleus has a unique structure" and analysis of the structure of an element "reveals which pathways are available for a transmutation reaction." Kaal noted that LENR appears to be based on fusion and fission, with a multitude of mechanisms that can lead to LENR. His team plans to collaborate with other researchers on new and existing experiments that

Jonah Messinger (Breakthrough Institute), David Nagel (George Washington University) and Frank Ling (Anthropocene Institute)

can exploit transmutation for energy generation and especially ones that seem to fit the SAM theoretical model.

Shyam Sunder Lakesar (India: Indian Institute of Technology) presented virtually on "Reliability of EDS While Looking for Transmutation." His team has analyzed more than 100 samples from a two-electrode system with surface and bulk characterization techniques, finding a 1-7% compositional change in the reacted sample versus the unreacted sample. Lakesar said their results over the last year are less remarkable than the results reported at ICCF24 (which included a "significant amount of gold on the edge of a reacted nickel sample"). They have been conducting studies to rule out or prevent contamination of samples, and have analyzed some potential errors in their energy-dispersive X-ray spectroscopy (EDS) data from last year. The abstract recommends "more reliable techniques such as wavelength-dispersive X-ray spectroscopy (WDS) and inductively coupled plasma mass spectrometry (ICP-MS) for obtaining more accurate and reliable results" for detecting transmutations.

Vladislav Zhigalov (Kazakhstan: Sarbayev University) discussed "strange radiation" in his talk, "The Movement of Solid Particles on the Surface Forms Tracks of Strange Radiation" (work conducted with Alexander Parkhomov). Many think that these occurrences are traces of ionizing particles, appearing only on the surface of materials as "tracks" on photographic emulsions. In addition to studying tracks from previous work conducted by others, Zhigalov's team has done their own experiments with an incandescent lamp and DVD-R discs to measure the tracks. Over nine experiments and 46 discs, only one disc showed large tracks, but all discs showed some. They found that the tracks were periodical, each had a unique pattern/shape, identical tracks were grouped together and appeared closer to the device. The team concluded that tracks are formed by "translational motion of particles" that leads to heating of the surface along the track and the particle itself. Zhigalov said, "Smaller particles are heated to high temperatures and lead to melting of the surface materials. Movement of large particles does not lead to melting of surface materials." He noted that "very often, strange radiation has biological effects" and this is an open area of consideration, as well as the questions: what is the nature of solid particles; what is the nature of forces that make these tracks; what does it mean that the tracks are identical; what is the relationship of these findings to LENR?

Steven Krivit (U.S.: *New Energy Times*) provided "A Basic Introduction to the Widom-Larsen Theory." He is the self-proclaimed "biggest fan" of the W-L approach and noted that he is not sure if the theory is "right, wrong or somewhere in between." He cautioned that he is "not an expert on physics" but has spent a lot of time learning; as usual, he did a good job of outlining a complex idea for the layperson and feels that the W-L theory "is explainable and understandable in plain English." As the abstract notes, this is the first time at an ICCF conference that someone has provided a "basic introduction to the main concepts of the theory as well as ideas on how the theory could be exploited for LENR experiments." Beginning in 2006, W-L put forth a theory that might explain observed LENR results. Krivit highlighted the four basic steps of the theory: creation of heavy electrons; creation of ultra-low-momentum (ULM) neutrons; capture of ELM neutrons; creation of new elements. Details of the W-L theory are in abundance on the *New Energy Times* W-L portal.[14] Krivit announced that he is organizing the LENR session at the June 9-12, 2024 American Nuclear Society national meeting[15] in Las Vegas and is looking for contributors on the topic of "Sample Preparation and Examination of Materials for Low Energy Nuclear Reaction Experiments."

Frank Gordon (U.S.: Inovl) dedicated "Progress in Understanding and Scaling Up the Lattice Energy Converter (LEC)" to the late Stanislaw Szpak, his colleague of many years, noting, "I can't come to Poland and not recognize one of your native sons." At ICCF24 in 2022, Gordon reported that the LEC was producing a few nanowatts of power. At this conference, he said, "We think we've made 2 nanowatts of improvement since then and I'm convinced that with the help of the people here we can do much better." He noted that they now have a "better understanding of the gas-ion dynamics" and have switched to a flat electrode cell configuration (which are easier to make and scale up). Gordon said that the "importance of ion diffusion is an inadequately studied area of research" and they "don't know how or at what locations the gas is being ionized." (He said "active materials that produce more ionizing radiation will help.") Inovl, whose goal is to "combine innovation and novelty to deliver green energy to the world," will explore numerical or modern plasma modeling techniques in order to "solve the nonlinear differential equations using experimentally observed boundary conditions," which will hopefully lead to improved LEC cell designs. Gordon said that speaking on the last day of a conference has its benefits; he has been able to listen to all of the talks and figure out who is doing work that will supplement his on the LEC; he said, "If you presented here on nanomaterials, I will be contacting you!"

Software engineer Robert Christian (U.S.) has been following the cold fusion field for well over a decade. His first ICCF presentation, "Making CMNS Mainstream: A Possible New Approach," focused on his own self-funded media communications project that has a goal of helping the field to "reinstate CMNS as legitimate, mainstream science" and figuring out how to change the perception of the field by the mainstream (laymen, investors, scientists). He discussed some sociological issues at hand in the treatment of cold fusion, and the unscientific behavior exhibited by some scientists in relation to controversial science approaches. Christian stated, "Evidence must always travel a road to reach acceptance and that road is a social process which is sometimes rocky. Let's pave the road. Let's add guard rails." He said there are an "impressive number of researchers" engaged in LENR work—a review he conducted in 2021 showed 3,460 researchers from 375 distinct groups (with the majority having successful/good experimental results). He has been thinking about how transformative it could be if large numbers of people were advocating for LENR, and offered assistance in helping the field to be "effective communicators." Christian stated that the field must know their audience and "structure information given to each audience," noting that "it is not enough to just educate; you need a call to action." He is conducting a survey on Perspectives on the Controversies of Cold Fusion,[16] which everyone is encouraged to participate in. He is also gathering data on acceptance/rejection rates (papers, grants, patents, etc.) and positive/negative internet exchanges.

Robert Greenyer (UK: Martin Fleischmann Memorial Project, MFMP) discussed the "Practical Applications of the Fractal Toroidal Moment." This fast-paced talk highlighted occurrences of "fractal toroidal moment"-based phenomenon, including: a Pons-Fleischmann deuterated palladium experiment that "resulted in the destruction of the apparatus and a large hole in the lab floor"; various natural ball lightning incidents that "self-organize, 'boil' water, consume or disrupt glass and concrete, explode or disappear metals"; Matsumoto transmutation experiments that were likened to ball lightning or the exotic vacuum objects of Shoulders. The MFMP has conducted many experiments, including some that observe "specific magneto hydrodynamic structures forming in the free volume of a liquid, on surfaces or grain boundaries and in plasmas" that provide "strong evidence of disruption of matter, from weakening or breaking of electron bonds, to transmutation." Greenyer said, "Nature doesn't lie. It does what it does given certain inputs." He noted that the ability of fractal toroidal moment-type phenomenon to reorganize matter and energy forms has various uses, including increasing fuel efficiency, radioactive remediation and element synthesis/transmutation.

Thomas Grimshaw (U.S.: LENRGY) discussed "The Role of LENR in Securing the Earth's Habitability." While he noted that the market penetration of energy from LENR will likely be slow in relation to the rate at which global climate change is progressing, Grimshaw said that LENR is the best hope we have for mitigating the damage done by fossil fuel energy use. He highlighted the potential advantages of an LENR energy infrastructure, including: less expensive to produce; cost-effective for consumers; abundant; clean; safe; high energy return with flexibility in centralized or distributed systems. In addition to being a carbon-free energy source for consumers, LENR can potentially offer the energy needed to begin addressing climate change. LENR energy could be instrumental in removal/recovery of greenhouse gas and clean-up of its impacts. This includes processes to address pollution of our air, soil and water. Grimshaw discussed the myriad ways in which LENR energy might be put to use from start (for use in building new infrastructure) to finish (power plants). One near-term opportunity for LENR, discussed in the early days of the field and still a potentially viable option, could be the sequestration/remediation of spent nuclear fuel rods. He noted that "the transmutation of long half-life to short half-life radioactive elements" could "shorten storage requirements from thousands of years to decades."

Economist and economic historian Stephen Bannister (U.S.: University of Utah) spoke about the possible role of LENR in the future of the energy sector in his talk, "On the Edge of a Revolution." He said, "I believe that the experiments and technologies that are represented in this room should cause what I call the next great energy revolution." The next energy revolution will happen because we need to solve our "current existential crisis of global warming." Using an economic science model (elasticity of substitution), he discussed the scale and duration of this transformation. His model (partially based on ideas proposed by Jed Rothwell) shows that the transformation may take about eight years after LENR technology comes to market, which was a "huge surprise" for him. Bannister noted, "We need to ask how to dramatically lower the costs" and said that Rothwell's model estimated that LENR energy would be 10 to 20 times cheaper than carbon-based energy. Bannister stated that the goal of the forthcoming second energy revolution should be to "completely eliminate carbon-source CO_2 emissions" and "dramatically lower the cost of energy."

Robert Greenyer of the Martin Fleischmann Memorial Project and George Egely, *Infinite Energy* Technical Editor

Jacques Ruer (France: Société Française de la Science Nucléaire dans la Matière Condensée - French Society of Condensed Matter Nuclear Science) talked about "Energy for Mankind for the Next Centuries: A Role for LENR." He discussed the past and current energy structure, noting the current trend toward "massive electrification." Ruer said he is "optimistic that future energy demand should stabilize" even though "fossil fuels will be exhausted this century." He noted that carbon-free energy sources will begin to dominate, but said, "For sure, a new source of energy is required and we know which one in this room. It has many names." Ruer prefers the term "hydrogen metal energy" (HME, the name used by CleanHME, which Ruer is involved in). He said, "HME is a new source of energy urgently needed to contribute to the energy transition" and for addressing climate change. He discussed the benefits of HME, and noted that the reactors must utilize hydrogen or deuterium rather than rare metals (which are more difficult to obtain and "cannot be recycled"). Ruer acknowledged that there is still groundwork to be done to move towards social acceptance of HME as a future energy source: "It is human nature that the public will be reluctant, so we must develop communication, demonstration and education."

An add-on talk by David Nagel occurred at the end of the main session of this final day of the conference. "Progress Report on Modern AI Tools for LENR Research" highlighted a new program called LENRDashboard[17] that uses AI tools to mine the existing LENR literature. Nagel said there are some 5,000 papers on LENR and they already have 4,000 full text articles uploaded. The project is led by Anasse Bari, a computer science professor and director of the AI and Predictive Analysis Lab at New York University (eight students have assisted). More on this interesting development will follow.

A closing lecture was given by Maurizio Maggiore, who works for the EU's European Commission in Belgium, though he was not attending ICCF25 on their behalf. His slides were titled, "LENR Research: Unicorns in Sight? Or how I stopped worrying about the results we have and love

the future of energy." Maggiore referred to those present as "the most underappreciated group of scientists in the world." Interestingly, he became an "external observer" of cold fusion because his uncle was attempting to replicate the initial Pons-Fleischmann experiment. He recognized that most in the field had to work on shoestring budgets, what he called a "self-fulfilling prophecy" where "if there is not enough money there might not be enough results." Maggiore recommended a course of action that includes more focused efforts by ten or more designated labs to replicate a few simple experiments.

Florian Metzler prior to his invited lecture at the ICCF25 banquet.

An impromptu closing statement was given by Jirohta Kasagi, Professor Emeritus at Tohoku University, who also gave a talk on Day 1. He gave an overview of his own history in the field, dating back to the beginning in 1989. He said, "Heat measurements reported in this conference show very steady progress" and that overall he felt the presentations helped extend the explanation and understanding of the LENR field.

Social Program and Other Events

At the end of Day 1 (August 28), Alan Smith, then acting but now officially CEO of the ISCMNS, invited non-members of the ISCMNS to attend the General Meeting being held that evening. (The meeting is held at every ICCF, normally attended by members only.) The ISCMNS is undergoing a reorganization and many action items were voted on at the meeting. A story about the ISCMNS will appear in Issue 166.

At the end of the second day participants enjoyed a walking tour around the city of Szczecin for two hours during the evening.

The International Advisory Committee (IAC), which oversees the ICCF conferences under the guise of ISCMNS, held its annual committee dinner during the evening of Day 2. The committee voted to hold ICCF26 in Morioka, Japan in the Spring of 2025. Shinya Narita of Iwate University will chair the event.

The ICCF banquet was held on the evening of August 30 at the beautiful Opera at the Castle, an auditorium located in an old castle. The event opened with two invited lectures. Theoretical physicist Krzysztof Meissner, Professor of Physics at the University of Warsaw (Poland), discussed the "History of the Universe." Florian Metzler, a research scientist at MIT's Industrial Performance Center (U.S.), gave an overview of the LENR field in "Cold Fusion: Past and Present." The ISCMNS Preparata Medal was formally awarded to the late William Collis, founder and chief executive of the ISCMNS who passed away in July and was notified of the honor just before his death (see p. 6).

The team at LENR Forum (see p. 20) recently launched a news site for the field, LENR News.[18] Read Ruby Carat's report, "CleanHME shows strong at ICCF25,"[19] which highlights the scientists working in the EU program who were actively involved at ICCF25.

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