American Chemical Society

# Fall 2008 National Meeting & Exposition

**236th ACS National Meeting & Exposition**
**August 17-21, 2008**
**Philadelphia, PA, USA**

American Chemical Society

**NOTE: Abstracts public availability on June 30, 2008; rooms and times subject to change.**

**ENVR** **Wednesday, August 20, 2008**

8:30 AM-11:50 AM Doubletree -- Maestro B, Oral

## *New Energy Technology*

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| Sponsored by: | ENVR | |
| Organizer: | Jan Marwan | |
| 8:30 AM | 89 | Cold fusion in light of green chemistry<br>**Jan Marwan** |
| 8:55 AM | 90 | Low energy nuclear reactions research: 2008 update<br>**Steven B. Krivit** |
| 9:20 AM | 91 | Overview of LENR research: Critical steps on the pathway to technology<br>**Michael Charles Harold McKubre** |
| 9:45 AM | | Intermission |
| 10:10 AM | 92 | Macroscopic quantum dynamics and the problems of loading in Pd-H(D) systems<br>**Antonella De Ninno**, Emilio Del Giudice, Antonio Frattolillo |
| 10:35 AM | 93 | CR-39 studies of Pd/D codeposition<br>**P. A. Mosier-Boss**, Stanislaw Szpak, Frank E. Gordon, Lawrence Forsley |
| 11:00 AM | 94 | Study of the nanostructured palladium deuterium system<br>**Jan Marwan** |
| 11:25 AM | 95 | Sonofusion from deuterons to helium<br>**Roger Stringham** |

1:30 PM-4:25 PM Doubletree -- Maestro B, Oral

## *New Energy Technology*

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Organizer: Jan Marwan

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|---|---|---|
| 1:30 PM | 105 | Elaboration of deuteron cluster fusion model<br>**Akito Takahashi** |
| 1:55 PM | 106 | Quark-Gluon model for nuclear magic numbers related to low energy nuclear reactions<br>**George H. Miley**, Heinz Hora, N. Ghahramani, M. Ghanaatian, M. Hooshmand, F. Osman |
| 2:20 PM | 107 | Radiochemical comparisons on low energy nuclear reactions (LENR) and uranium fission<br>**George H. Miley**, Heinz Hora, Andrei Lipson, Prajakti Joshi Shresthra |
| 2:45 PM | | Intermission |
| 3:10 PM | 108 | Theoretical models relevant to excess heat production<br>**Peter L. Hagelstein**, Irfan U. Chaudhary |
| 3:35 PM | 109 | Using chemical potential to build a CMNS reactor<br>**XingZhong Li**, Bin Liu, QingMing Wei |
| 4:00 PM | 110 | Concepts and experiments for utilizing van der Waals forces and Casimir effect for new energy technologies<br>**Thorsten Ludwig** |

# Cold fusion in light of green chemistry ENVR 89

**Jan Marwan**, info@marwan-chemie.fta-berlin.de, Research and Development, Dr Marwan Chemie, Rudower Chaussee 29, Berlin, 12489, Germany

The goal of the field is directed toward the fabrication of so called "cold fusion" devices with unique commercial potential, demonstrating an alternative energy source that does not produce greenhouse gases, long-lived radiation or strong gamma radiation. The idea of cold fusion has led to endless discussions about the kinetic impossibility of intense nuclear reactions with high coulomb barrier potential. However, recent theoretical work may soon shed light on this mystery. Understanding this process is one of the most challenging and perhaps important issues in the scientific world. This review includes previously unpublished studies, new and controversial theories to approach cold fusion with access to new sources and experimental results. The presentation offers insight into this controversial subject and will help the audience re-evaluate their perspective on cold fusion for a possible alternative energy source.

# Low energy nuclear reactions research: 2008 update ENVR 90

**Steven B. Krivit**, steven1@newenergytimes.com, New Energy Times, 369-B 3rd. St. #556, San Rafael, CA 94901

A science journalist's view of the field of low energy nuclear reactions, historically known as "cold fusion," is presented. The author has investigated innumerable aspects of this controversial subject including its strengths and weaknesses. He has engaged proponents and opponents alike and provides a balanced understanding and view of the field.
LENR topics to be discussed in this talk:
* Reaction products and anomalous results
* Examples of repeatability and reproducibility

* Examples of energy production
* Examples of low energy nuclear transmutation
* Comparison of thermonuclear fusion and low energy nuclear reactions

## Overview of LENR research: Critical steps on the pathway to technology ENVR 91

**Michael Charles Harold McKubre**, michael.mckubre@sri.com, Energy Research Center, SRI International, PS385, 333 Ravenswood Ave., Menlo Park, CA 94025

Attention has been directed to low energy nuclear reactions or LENR as the third nuclear option, in addition to conventional fission and hot fusion, with the potential to sustain a virtually unlimited primary energy source for mankind, without the attendant chemical and environmental hazards of fossil fuel combustion. This paper will review presently active research programs worldwide, and their approaches, staffing, funding and objectives. As a tool to assess their likelihood of success, a brief analysis will be performed of the importance in technological (rather than scientific) achievement of critical engineering operational parameters such as: source power density; energy density; operating temperature; reaction rate control; chemical and radiation hazard; and cost.

## Macroscopic quantum dynamics and the problems of loading in Pd-H(D) systems ENVR 92

**Antonella De Ninno**, deninno@frascati.enea.it, Emilio Del Giudice, and Antonio Frattolillo. Agency for New Technologies Energy and Environment, Enrico Fermi, Rome, 27 00044, Italy

It was discovered a long time ago that gases (in particular all the hydrogen isotopes) enter easily into metal matrices at up to very high stoichiometric ratios x= [H]/[M]. Palladium hydrides exhibit the most interesting features. Several findings point to the existence of a collective oscillation of hydrogen within the lattice. However, the existence of a strong cooperation among hydrogens is hardly understandable in the frame of the usual lattice dynamics. One should consider the possibility that a macroscopic ensemble of oscillating hydrogen could be described by an unique quantum state created by the collective dynamics. This point of view has been suggested in the last two decades in the frame of coherent quantum electrodynamics. We have achieved a clear indication that the Pd-H system in the β-phase is a macroscopic quantum system. As a consequence, the analysis of the Pd-H system in terms of coherent plasmas of H nuclei and Pd electrons is corroborated and new, interesting methods to reach high loading and inexpensive de-loading can emerge.

## CR-39 studies of Pd/D codeposition ENVR 93

**P. A. Mosier-Boss**, pam.boss@navy.mil[1], Stanislaw Szpak[1], Frank E. Gordon[2], and Lawrence Forsley[3]. (1) Code 71730, SPAWAR System Center San Diego, 53560 Hull St., San Diego, CA 92152, (2) Code 71000, SPAWAR System Center San Diego, 53560 Hull St., San Diego, CA 92152, (3) JWK

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CR-39 is an example of a solid state nuclear track detector commonly used in the inertial confinement fusion field. These detectors can detect energetic particles such as alphas, protons, deuterons, and tritons as well as neutrons. Recent experiments using CR-39 detectors in Pd/D co-deposition experiments have shown that energetic particles and neutrons are formed and that the source of particles and neutrons is the cathode. The kinetic energy of these particles can be directly converted into electricity. In order to optimize this process, the energy of the particles needs to be determined. In this communication, the results of experiments utilizing spacers between the CR-39 detector and cathode as well as track modeling will be discussed.

## Study of the nanostructured palladium deuterium system ENVR 94

**Jan Marwan**, info@marwan-chemie.fta-berlin.de, Research and Development, Dr Marwan Chemie, Rudower Chaussee 29, Berlin, 12489, Germany

Electrochemical deposition of metals from hexagonal lyotropic liquid crystalline phases produces metal films with a unique ordered nanostructure in which the cylindrical pores of 1.7 to 3.5 nm running through the film are arranged in hexagonal arrays. Nanostructured Pd films were deposited electrochemically from the template mixture of either $C_{16}EO_8$ or Brij 56. Electrochemical studies showed that the metal films have a high electroactive surface area. These values together with the TEM and X-ray data are consistent with the expected nanostructure. Adsorption characteristics of deuterium on the Pd metal surface are slightly different than those obtained for hydrogen in previous studies. Diffusion of deuterium into the Pd metal lattice works with fast kinetics under appropriate surface modification. This paper highlights the research on the nanostructured palladium deuterium system outlining the kinetic behaviour of deuterium diffusing into the pores of the nanostructure. To our understanding, this kinetic aspect is believed to be the key issue to achieve nuclear reactions within metals of any choice.

## Sonofusion from deuterons to helium ENVR 95

**Roger Stringham**, firstgate@earthlink.net, First Gate Energies, 4922 Akai Pl, Princeville, HI 96722

A developing sonofusion technology uses the collapsing cavitation bubble to develop very high transient fusion densities. The data collected from many experiments suggests a possible connection between high-energy events and measured $^4He$: [$D_2O \rightarrow D^+$; jet compression; $D^+$ implantation; $D^+$ cluster; DD fusion; heat and ejecta]. The path to these ends is found in close packed $D^+$ clusters that have been implanted into various targets where DD fusion occurs before coulombic repulsion. The timeline for this sequence of events is a few picoseconds. The heat pulse generated from DD fusion removes some of the target lattice and fusion products, $^4He$, as vaporous ejecta from the target foil. The heat from these events is removed by the circulating $D_2O$.

## Elaboration of deuteron cluster fusion model ENVR 105

**Akito Takahashi**, akito@sutv.zaq.ne.jp, Osaka University, Yamadaoka 2-1, Suita, Osaka, Japan

Deuteron cluster fusion model has been proposed and elaborated to explain clean (radiation-less) nuclear energy generation with helium-4 ash in cold-fusion/condensed matter nuclear science experiments.

The theoretical models have been elaborated in three steps.

1) Multi-body deuteron fusion model
2) Electronic-quasi-particle/tetrahedral-symmetric-condensate (EQPET/TSC) model
3)Molecular dynamics calculation by Langevin equation

This paper presents briefly the step-1 and step-2, first, as an introduction: The main focus is directed on step-3. Time-dependent condensation motion for 2D-molecules, $3D^+$ ion, 4D/TSC cluster and $6D^{--}$ cluster were modeled by one-dimensional Langevin equations and solved by the Verlet method. Numerical tables for time-dependent d-d distance were obtained, which were further used for calculating Coulomb barrier peneration factors by HMEQPET method. Fusion rates (4D fusion to produce two helium-4 particles) were calculated by Fermi's golden rule. Only 4D/TSC makes ultimate condensation to induce remarkable 4D fusion. TSC realizes super Coulomb-barrier screening and clean (radiation-less) fusion under dynamic ordering/constraint of the PdD system. 2D fusion rate was found to be negligibly small.

## Quark-Gluon model for nuclear magic numbers related to low energy nuclear reactions ENVR 106

**George H. Miley**, ghmiley@uiuc.edu[1], Heinz Hora, hora@phys.unsw.edu.au[2], N. Ghahramani[3], M. Ghanaatian[4], M. Hooshmand[4], and F. Osman[3]. (1) Department of Nuclear, Plasma and Radiological Engineering, University of Illinois, Champaign-Urbana, 100 NEL, 103 S. Goodwin Ave, Urbana, IL 61801, (2) Department of Theoretical Physics, University of New South Wales, 2052 Sydney, Australia, (3) School of Computing and Mathematics, University of Western Sydney, Penrith, NSW, Australia, (4) Department of Physics, Shiraz University, Shiraz, Iran

A new Quark-Gluon model is presented for derivation of the magic numbers of nuclei and compared with the model based on the Boltzmann distribution from the standard abundance distribution (SAD) of nuclei in the Universe in the endothermic branch. This new model results in a $3^n$ relation leading to the motivation to explore the quark state in nuclei. But this is in contrast (duality) to the fact that the confinement of nuclei by a generalized Debye layer can be based only on a nucleon and not on a quark structure. These Debye model results force a change of the Fermi energy of the nucleons into the relativistic range at higher than nuclear density. This then results in a mass independent state at higher than nuclear densities for the quark state in neutron stars. This result and the $3^n$-relation motivated us to consider the quark state in nuclei. The success is reported here uses quark statistics for nuclei reproducing the magic numbers up to 126 identical with the Boltzmann model. But for the highest number, the conventional Boltzmann model arrives at 180 while the new quark model definitively leads to the number 184. This paradox may be solved by the very accurate measurements of a local Maruhn-Greiner maximum from low energy nuclear reactions (LENR) reported earlier by Miley, *et al.* In those experiments the reaction yield curve shows a distinctive intermediate (tertiary fission) peak at A=155 originating from a compound nucleus was found, consistent with the new magic number of 184 predicted by the new quark model. This result is not only very important to understanding quark-gluon physics, but also to the understanding of the branch of cold fusion involving nuclear transmutations called LENR.

# Radiochemical comparisons on low energy nuclear reactions (LENR) and uranium fission ENVR 107

**George H. Miley**, ghmiley@uiuc.edu[1], Heinz Hora, hora@phys.unsw.edu.au[2], Andrei Lipson[1], and Prajakti Joshi Shresthra[1]. (1) Department of Nuclear, Plasma and Radiological Engineering, University of Illinois, Champaign-Urbana, 100 NEL, 103 S. Goodwin Ave, Urbana, IL 61801, (2) Department of Theoretical Physics, University of New South Wales, 2052 Sydney, Australia

Measurements of production of heavy elements by low energy nuclear reactions (LENR) of very high concentrations of deuterium within palladium permitted a comparison with the standard abundance distribution (SAD) of the endothermic element generation measured in the Universe. Consequences for the magic numbers of elements could be concluded and the jump between the two Bagge sequences could be based on a Boltzmann distribution without needing the Jensen-Goeppert-Mayer spin-orbit explanation. Relating the LENR measurement of the element distribution with that of uranium fission, the Maruhn-Greiner maximum did not exactly fit a magic number 180 for a compound reaction via a hypothetical element $^{306}X_{126}$, based on the Boltzmann derived magic numbers. A better fit was directly indicated from the LENR measurements for $^{310}Y_{126}$. This could be based on a quark-gluon model by Ghahramany *et al.* in contrast to the Boltzmann model, whereas both models agreed with the magic numbers up to 126.

# Theoretical models relevant to excess heat production ENVR 108

**Peter L. Hagelstein**, PLH@aol.com and Irfan U. Chaudhary, irfanc@mit.edu. Research Laboratory of Electronics, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Room 36-570, Cambridge, MA 02139

We have considered models in which two-level systems are coupled to a simple harmonic oscillator; under conditions where the oscillator is highly excited, and where the characteristic energy of the oscillator is much less than the transition energy of the two-level systems. Energy exchange between the two-level systems and oscillator can occur at a relatively slow rate if a great many quanta are exchanged. It is possible to enhance this rate by many orders of magnitude in a system in which loss spoils the destructive interference in the model. Excitation can be transferred from one two-level system to another, also at a slow rate. This process can also be enhanced in models augmented with loss. These models may be relevant to excess heat generation in PdD electrochemical experiments.

# Using chemical potential to build a CMNS reactor ENVR 109

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Condensed matter nuclear science(CMNS) has been developed through 18 years. It developed both in experiments and in theory. The experiments confirmed the calorimetry (excess heat) and nuclear transmutations. The theoretical model (selective resonant tunneling) explained its main features: excess heat without strong neutron or gamma radiation; correlation between deuterium flux and nuclear

transmutation; 3-deuteron fusion reaction etc. The next steps are: detection of neutrino emission from the metal hydrides(deuterides), and building a CMNS reactor using chemical potential. This presentation will address the calculation of the chemical potential of hydrogen (deuteron) in metal hydrides (deuterides), and how to make a CMNS reactor in steady state operation. The gas-loading method will be introduced instead of the electrolytic method. The related experimental results will be discussed as well.

## Concepts and experiments for utilizing van der Waals forces and Casimir effect for new energy technologies ENVR 110

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In 1912 Max Plank upgraded his quantum theory realizing that the ground state is half a Plank's constant and not equal to zero. The famous chemist Walter Nernst expanded this concept to space itself, stating that the vacuum must be filed with energy in the form of quantum fluctuations. Feynman, Tomonaga and Schwinger formed the modern quantum field theory, in which empty space is full of energy. The sum of these quantum fluctuations is the energy density of space. These fluctuations give rise to a number of effects including van der Waals force and the Casimir effect. The author will present his measurements of the Casimir force and concepts how this vast energy resource can be tapped to power new energy technologies. The knowledge of this sea of energy that we live in is very useful for technologies such as catalytic hydrogen production, plasma-, magnetic technologies and advanced nuclear chemistry.