

**INTERNATIONAL SOCIETY OF  
CONDENSED MATTER NUCLEAR SCIENCE  
RUSSIAN PHYSICAL SOCIETY  
NUCLEAR SOCIETY OF RUSSIA  
RUSSIAN COMMITTEE ON BALL LIGHTNING  
PROBLEMS**

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**13<sup>th</sup> INTERNATIONAL  
CONFERENCE ON CONDENSED  
MATTER NUCLEAR SCIENCE**

**PROGRAM & ABSTRACTS**

**DAGOMYS, city of SOCHI  
June 25 – July 1, 2007**

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**Scope and Goals of the Conference**

**New Energy Times Archives**

The International Conferences on “CONDENSED MATTER NUCLEAR SCIENCE» originate from the notorious press-conference in March 1989 at the University of Utah where Martin Fleischmann and Stanley Pons announced about their experiments with electrolyzing heavy water resulted in registration of excess heat yield. Since their interpretation of the phenomenon observed related it to a possibility of running nuclear reactions at normal temperature which contradicted to the system of academic nuclear physics knowledge this discovery agitated the whole worldwide scientific community and actually initiated a new direction in modern physics – Condensed Matter Nuclear Science.

The new direction got supported by a great number of research groups and qualified researchers in more than 30 countries and in some of the countries those research activities immediately got state support as well as participation of small and medium business and sometimes also funding from the part of big business groups.

It can not be said that the optimistic expectations of fast solving energy problems based on the newly discovered physical principles have already been justified. But at the same time it should not be ignored the fact that the process of developing those research efforts with implementation of a wide variety of different methods now has resulted in appearing strong belief in that a new field of scientific activities has opened before modern science with quite reasonable expectation of finding not only new solutions of a number of fundamental problems about origination and interaction of matter and energy in the Universe but also development of a number of breakthrough technologies that would make capable to provide noticeable influence on the global technical civilization. Even nowadays a number of research groups pass from laboratory investigations of the phenomena of low energy nuclear reactions in condensed matter towards developing practically valuable technologies and technical projects. Evident recognition by the business community takes place regarding the commercial perspectives of implementing the results of scientific achievements in this field.

The present Conference is the 13<sup>th</sup> international forum in this new field of science. According to the opinion of the Organizing Committee the main subjects and goals of the Conference should incorporate consolidation of the results obtained by the scientists of many countries in investigating the physical phenomenon with the achievements in some other fields of science and technology such as nuclear engineering, mechanical engineering, electrical engineering, laser science and engineering, material science, nano-technology, bio-technology, etc. for the sake of fast solving valuable application problems.

The special aspect of the ICCF13 is that according to the tradition of the Russian National annual conferences the scope of the problems to be considered

incorporates also the theoretical and experimental research related to the phenomena of nuclear transmutations not only in condensed matter but also in gaseous and plasma media which relates to another important problem of modern science – the nature and likely implementation of Ball Lightning phenomenon.

We believe that the physics of low energy nuclear reactions in condensed matter will take one of the leading roles among the brand new directions of developing science and technology in XXI century. The future shall definitely come! It is just crucial not to fall behind with realization of it reality and importance!

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**Bychkov V.L.,** Department of Physics, Lomonosov Moscow State University,  
**Famina N.V.** Moscow Technical University (MADI);

**Kornilova A.A.** Department of Physics, Lomonosov Moscow State University,  
**Nikitin A.I.,** Institute of Energetic Problems of Chemical Physics, RAS;  
**Sarkisov V.I.** Firm "Svitaks".

## Schedule of the Conference

| Hours       | Dates and Events             |   |                                      |                                      |                                      |                          |
|-------------|------------------------------|---|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------|
|             | June 25                      | June 26                                       | June 27                              | June 28                              | June 29                              | June 30                  |
| 9:30-11:00  | Registration                 | 1 <sup>st</sup> Session<br><small>www</small> | 4 <sup>th</sup> Session              | 7 <sup>th</sup> Session              | 10 <sup>th</sup> Session             | 13 <sup>th</sup> Session |
| 11:00-11:30 |                              | Coffee - b r e a k                            |                                      |                                      |                                      |                          |
| 11:30-13:00 |                              | 2 <sup>nd</sup> Session                       | 5 <sup>th</sup> Session              | 8 <sup>th</sup> Session              | 11 <sup>th</sup> Session             | 14 <sup>th</sup> Session |
| 13:00-14:00 |                              | L u n c h                                     |                                      |                                      |                                      |                          |
| 14:00-15:30 |                              | 3 <sup>rd</sup> Session                       | 6 <sup>th</sup> Session              | 9 <sup>th</sup> Session              | 12 <sup>th</sup> Session             | 15 <sup>th</sup> session |
| 15:30-16:00 | Opening, Greetings<br>School | Coffee - b r e a k                            |                                      |                                      |                                      |                          |
| 16:00-17:30 |                              | 1 <sup>st</sup> Posters presentation          | 2 <sup>nd</sup> Posters presentation | 3 <sup>rd</sup> Posters presentation | 4 <sup>th</sup> Posters presentation | Conference closing       |
|             |                              |   |                                      |                                      |                                      | Farewell Departures      |

## List of Abstracts

### **(AD) Analysis and Diagnoses Techniques**

1. Bazhutov.AD-abs.
2. Clauzon.AD-abs.
3. Kirkinsrii.AD-abs.
4. S.S.Jiang.AD-abs.
5. Velikodnyi.AD-abs.
6. Samsonenko.AD-abs.
7. Chernov-1.AD-abs.
8. Chernov-2.AD-abs.

### **(GP) Processes in Gaseous and Plasma Media**

1. Karabut.GP-abs.
2. Krivshich.GP-abs.
3. Shabanov.GP-abs.
4. Bychkov-1.GP-abs.
5. Bychkov-2.GP-abs.
6. Bychkov-3.GP-abs.
7. Nikitin.GP-abs.
8. Velikodnyi.GP-abs.
9. Krivitskii.GP-abs.
10. Vlasov.GP-abs.
11. Sinyapkin.GP-abs.
12. Schelkunov.GP-abs.

### **(HP) Excess Heat and Related Nuclear Products**

1. Bazhutov.HP-abs.
2. Biberian.HP-abs.
3. Celani.HP-abs.
4. Dash-1.HP-abs.
5. Dash-2.HP-abs.
6. Karabut.HP-abs.
7. Koldamasov.HP-abs.
8. Lipson.HP-abs.
9. McKubre.HP-abs.
10. Parkhomov.HP-abs.
11. Pinaev.HP-abs.
12. Savvatimova.HP-abs.
13. Tianjian.HP-abs.
14. Tsvetkov.HP-abs.
15. Castagna.HP-abs.
16. Yamada.HP-abs.
17. Zilov.HP-abs.

### **(IP) Innovative Engineering and Projects**

1. Cantwell.IP-abs.
2. Krivitskii.IP-abs.
3. Rodionov.IP-abs.
4. T.Chubb.IP-abs.
5. Tarasenko.IP-abs.
6. Velikodnyi-2.IP-abs.
7. Velikodnyi-1.IP-abs.
8. Goryachev.IP-abs.

**(MC) Materials and Conditions**

1. Castagna.MC-abs.
2. Kasagi.MC-abs.
3. Lipson.MC-abs.
4. Kuz'min.MC-abs.

**(NT) Nuclear Transmutation**

1. Dash.NT-abs.
2. Iwamura.NT-abs.
3. Vysotskii.NT-abs.
4. David Chung.NT-abs.
5. Savvatimova.NT-abs.
6. Hioki.NT-abs.

**(SP) Social, Political, and Philosophical Issues**

1. Krivit.SP-abs.
2. Goryachev.SP-abs.
3. Collis.SP-abs.
4. Miley.SP-abs.

**(TM) Theoretical Models and Results Interpretation**

1. Afonichev.TM-abs.
2. AkitoTakahashi-1.TM-abs.
3. AkitoTakahashi-2.TM-abs.
4. Alexandrov.TM-abs.
5. Bazhutov.TM-abs.
6. Hagelstein.TM-abs.
7. Chubb.S.TM-abs.
8. Collis.TM-abs.
9. David Chung.TM-abs.
10. Samsonenko-3.TM-abs.
11. Fukuhara.TM-abs.
12. Gareev.TM-abs.
13. Goncharov.TM-abs.
14. Hagelstein.TM-abs.
15. X.Jiang. TM-abs.
16. John Fisher.TM-abs.
17. Goryachev.TM-abs.
18. Kirkinsrii.TM-abs.
19. Kozima.TM-abs.
20. Kuhner.TM-abs.
21. X.Z.Li.TM-abs.
22. Meulenberg.TM-abs.
23. Miley-1.TM-abs.
24. Miley-2.TM-abs.
25. Myshinsky.TM-abs.
26. Nagel.TM-abs.
27. Repchenko.TM-abs.
28. Rodionov.TM-abs.
29. Samsonenko-1.TM-abs.
30. Samsonenko-2.TM-abs.
31. Shestopalov.TM-abs.
32. Tsuchiya.TM-abs.
33. Vlasov.TM-abs.
34. Yabuuchi.TM-abs.



# ICCF13 Program

*JUNE 25 (Monday)*

12.00 - 18.00      Registration

15.30 – 16.30      Opening ICCF13

Session Co-chairs: Yuri Bazhutov & Igor Goryachev

1. Yuri Bazhutov, Chair ICCF13    “ICCF13 Opening”
2. Igor Goryachev, Scientific secretary    “Organizing introduction”
3. William Collis – “New Preparata Medal Winners”

## Greeting ICCF13

1. Vitaliy Mikhailin, President of Russian Physical Society
2. Andrew Mozzhegorov, ICCF13 Sponsor
3. Konstantin Sviridov, General Director “Dagomys” Hotel
4. Akito Takahashi, President of International Society Condense Matter Nuclear Science (ISCMNS)
5. Mahadeva Srinivasan, International Advisory Committee (IAC) member

16.40 - 18.00      School Session

Session Co-chairs: Victor Sharkov & Peter Mobberley

## Social, Political, and Philosophical Issues (SP)

1. STEVEN B. KRIVIT. “FROM COLD FUSION TO LOW ENERGY NUCLEAR REACTIONS: 2007 REVIEW” (SP-1)
2. YURI N. BAZHUTOV, IGOR V. GORYACHEV. “FROM COLD FUSION TOWARDS NUCLEAR TRANSMUTATION – PROBABLE ALTERNATIVE FOR NUCLEAR ENERGY” (SP-2)
3. WILLIAM COLLIS. “Presentation of the 8th International Workshop on Anomalies in Hydrogen / Deuterium Loaded Metals” (SP-3)

19.00      Welcome party (“Panorama” cafeteria)

**JUNE 26 (Tuesday)**

**9.30 - 11.00**

**1-st Session**

**Session Co-chairs: Irina Savvatimova & John Dash**

**Analysis and Diagnostic Techniques (AD - Oral)**

1. **P. CLAUZON, J.F. FAUVARQUE, G. LALLEVÉ, G. LE BUZIT.** “A STEAM CALORIMETER FOR THE STUDY OF THE ABNORMAL EXCESS HEAT OBSERVED DURING MIZUNO-TYPE EXPERIMENTS” (AD-2)
2. **V.A. KIRKINSKI, A.I. KHMELNIKOV.** “SETUP FOR MEASURING OF ENERGY BALANCE AT INTERACTION OF METALS AND HYDROGEN ISOTOPES GAS AT HIGH TEMPERATURES AND PRESSURES” (AD-3)
3. **CHERNOV I.P., CHERDANTSEV Y.P., LIDER A.M., NIKITENKOV N.N., GARANIN G.V.** “THERMAL AND ISOTOPE EFFECTS DURING TITANIUM ELECTROLYTIC CHARGING BY HYDROGEN IN CELLS WITH THE DIVIDED VOLUME AND USE OF TRACK-ETCHED POLYMERIC MEMBRANES (AD-7)

**11.00 - 11.30**

**Coffee-break**

**11.30 - 13.00**

**2-nd Session**

**Session Co-chairs: Vladimir Bychkov & Francesco Celani**

**Processes in Gaseous and Plasma Media (1-GP - Oral)**

1. **A.B.KARABUT.** “CHARACTERISTICS OF X-RAY EMISSION FROM SOLID-STATE CATHODE MEDIUM IN ELECTRIC DISCHARGE SYSTEMS” (GP-1)
2. **G.D.SHABANOV, A.G.KRIVSHICH, B.YU.SOKOLOVSKY, O.M.ZHEREBTSOV.** “THE NATURE OF BALL LIGHTNING” (GP-3)
3. **A.G.KRIVSHICH, G.D.SHABANOV, B.YU.SOKOLOVSKY, O.M.ZHEREBTSOV.** “CLASSICAL COLD SYNTHESIS. WHETHER IT EXISTS?” (GP-2)

**13.00 - 14.00**

**Lunch**

**14.00 - 15.30**

**3-rd Session**

**Session Co-chairs: Vasilii Velikodnyi & Steve Krivit**

**Processes in Gaseous and Plasma Media (2-GP - Oral)**

1. **D.V.BYCHKOV, V.L.BYCHKOV.** “BALL LIGHTNING OBSERVATION PROPERTIES (MODERN ANALYSIS) (GP-4)
2. **A.I.NIKITIN, A.M.VELICHKO, T.F.NIKITINA.** “THE POSSIBILITIES FOR THE FORMATION OF THE ORDERED PLASMA STRUCTURES IN NATURE” (GP-7)
3. **A.N.VLASOV, B.I.KOLOTILIN, S.A.KOLESNIKOV, A.B.MANOSHKIN AND V.PANIN.** “EXPERIMENTAL RESEARCHES OF ELECTRICAL EXPLOSION OF THE WIRE SPIRAL TURNED IN THE TORUS AND DIPPED IN WATER” (GP-10)

**15.30 - 16.00**                    **C o f f e e - b r e a k**

**16.00 - 17.30**                    **1-st Posters presentation**

**Session Co-chairs: Anatoly Nikitin & William Collis**

**Analysis and Diagnostic Techniques (AD)**

1. YU.N.BAZHUTOV, YU.V.KOZLOV, V.P.MARTEMIYANOV, E.V.PLETNIKOV, A.A.SABELNIKOV, V.A.STAROSTIN, V.G.TARASENKOV, E.V.TURBIN, V.N.VYRODOV. “NEW RESULTS ON COSMIC RAY ERZIONS SEARCH RECEIVED ON THE SCINTILLATION SPECTROMETRIC TELESCOPE “DOCH-4M” DURING (2001-2006)” (AD-1)
2. SONGSHENG JIANG. “TRITIUM RELEASED FROM INTERIOR’S EARTH: EVIDENCE FOR NATURAL NUCLEAR FUSION” (AD-4)
3. V.J.VELIKODNYJ, S.V. GAVRILOV, V.G.GRISHIN, J.A.POPOV. “RESEARCH OF WORK OF THE PLASMA-ELECTROCHEMICAL STEAM AND GAS GENERATOR” (AD-5)
4. I.V.GORJACHEV, V.I.KARYAKA, M.M. MARTYNYUK, N.V.SAMSONENKO. “THE IMPULSE ELECTRICAL BREAKDOWN OF THE DISTILLED WATER WITH THE MICRON DISTANCES BETWEEN DEUTERIZED TITANIUM ELECTRODES” (AD-6)
5. I.P.CHERNOV, YU.M.KOROTEEV, V.M.SILKIN, YU.I.TYURIN. “EXCITATION OF HYDROGEN SUBSYSTEM IN METALS BY EXTERNAL INFLUENCE” (AD-8)

**Processes in Gaseous and Plasma Media (1,2-GP)**

1. V.L.BYCHKOV, V.A.KRIVITSKY, V.V.NIZOVTSSEV. “CLASSICAL APPROACHES TO ANOMALOUS AND GEOPHYSICAL PHENOMENA” (GP-9)
2. V.L.BYCHKOV. “UNIPOLAR BALL LIGHTNING THEORY” (GP-5)
3. D.V.BYCHKOV, V.L.BYCHKOV. “MODERN REALIZATION OF LABORATORY BALL LIGHTNINGS (MODERN ANALYSIS)” (GP-6)
4. V.A.BITYURIN, V.Y.VELIKODNY, I.A.SAMUOLIS, E.B.KOLESNIKOV, V.V.POPOV. “RESEARCHES OF INTERACTION OF LONG-LIVING PLASMA FORMATIONS WITH SUPERSONIC STREAM AND BARRIER” (GP-8)
5. YU.T.SINYAPKIN, D.YU.SINYAPKIN. “ON ISSUE OF SPATIAL DISTRIBUTION OF ELECTRICAL EXPLOSION PRODUCTS OF SINGLE WIRE” (GP-11)
6. G.P.SCHELKUNOV, I.M.OLIKHOV. “GLOBE LIGHTNING: MODELING AND APPLICATION” (GP-12)

**Social, Political, and Philosophical Issues (SP)**

1. GEORGE H.MILEY. “PREPARATA MEDAL LECTURE - A TRIBUTE TO GIULIANO PREPARATA, A TRUE PIONEER IN COLD FUSION THEORY” (SP-4)

**17.30 - 18.00**                    **1-st Posters exhibition**

**18.00**                                **Time for free discussion**

**JUNE 27 (Wednesday)**

**9.30 - 11.00**

**4-th Session**

**Session Co-chairs: Alexander Vlasov & Mahadeva Srinivasan**

**Excess Heat and Related Nuclear Products (1-HP - Oral)**

1. YU.N.BAZHUTOV, V.G.GRISHIN, A.V.EREMEEV, N.I.KHOKHLOV, A.P.KOSHELEV, V.V.POPOV, A.D.RUMYANTSEV, YU.A.SAPOZHNIKOV, V.A.STAROSTIN, V.YU.VELIKODNY. “NEUTRONS,  $\gamma$ -RAYS & TRITIUM DIAGNOSTIC AT ELECTROLYSIS WITH ANODE GAS DISCHARGE IN WATER SOLUTIONS” (HP-1)
2. J.-P.BIBERIAN, N.ARMANET. “EXCESS HEAT PRODUCTION DURING D2 DIFFUSION THROUGH PALLADIUM” (HP-2)
3. FRANCESCO CELANI, A. SPALLONE, E. RIGHI ET AL.. “STUDIES ABOUT PALLADIUM NANO-PARTICLES SYNTHESIS FOR DEUTERIUM ABSORPTION AT HIGH TEMPERATURES” (HP-3)

**11.00 - 11.30**

**C o f f e e - b r e a k**

**11.30 - 13.00**

**5-th Session**

**Session Co-chairs: Andrew Lipson & Michael Melich**

**Excess Heat and Related Nuclear Products (2-HP - Oral)**

1. W.-S. ZHANG AND J. DASH. “EXCESS HEAT REPRODUCIBILITY AND EVIDENCE OF ANOMALOUS ELEMENTS AFTER ELECTROLYSIS IN PD|D<sub>2</sub>O+H<sub>2</sub>SO<sub>4</sub> ELECTROLYTIC CELLS” (HP-4)
2. M. MCKUBRE, F. TANZELLA, V. VIOLANTE ET AL.. “REPLICATION OF ENERGETICS HEAT AND TRITIUM PRODUCTION” (HP-9)
3. A.V.PINAEV. “THE ANALYSES OF TEST DATAS OF CAVITATIONAL HEAT GENERATOR OF TMK-25 TYPE” (HP-11)

**13.00 - 14.00**

**L u n c h**

14.00 - 15.30

6-th Session

Session Co-chairs: Dmitry Baranov & Michael McKubre

Excess Heat and Related Nuclear Products (3-HP - Oral)

1. I.B. SAVVATIMOVA, A.A. KORNILOVA, G.V. SAVVATIMOV. "THE GAMMA EMISSION DURING AND AFTER EXPERIMENTS WITH TUNGSTEN IN DEUTERIUM GLOW DISCHARGE" (HP-12)
2. V. VIOLANTE, F. SARTO, E.CASTAGNA ET AL. "CALORIMETRIC RESULTS OF ENEA COOPERATIVE EXPERIMENTS" (HP-15)
3. T.ZILOV, IDARDIK\*, H.BRANOVER ET AL. "REPORT ON ELECTROLYSIS EXPERIMENTS AT ENERGETICS TECHNOLOGIES" (HP-17)

15.30 - 16.00

C o f f e e - b r e a k

16.00 - 17.30

2-nd Posters presentation (HP, IP)

Session Co-chairs: Boris Rodionov & Jiroto Kasagi

Excess Heat and Related Nuclear Products (1,2,3-HP)

1. A.B. KARABUT. "EXCESS HEAT POWER REGISTRATION IN HIGH VOLTAGE ELECTROLYSIS AND DISCHARGE SYSTEMS" (HP-6)
2. A.I.KOLDAMASOV, N.J.BAKUMTSEV. "DEVELOPMENT OF MULTI-PURPOSE INSTALLATIONS FOR ENERGY GENERATION BY WAY OF COLD NUCLEAR SYNTHESIS" (HP-7)
3. ANDREI LIPSON, ALEXEY ROUSSETSKI, GEORGE H. MILEY. "PROOFS OF NUCLEAR ORIGIN OF CMNS EFFECTS IN METALS WITH A HIGH DEUTERIUM SOLUBILITY" (HP-8)
4. A.G.PARKHOMOV. "BURSTS OF COUNT RATE OF BETA-RADIOACTIVE SOURCES DURING LONG-TERM MEASUREMENTS" (HP-10)
5. J.TIANJIAN, L.H.JIN, B.J.SHEN, C.Y.WANG, J.W.GUO. "CALORIMETRY IN PT/K<sub>2</sub>CO<sub>3</sub>/PD LIGHT WATER ELECTROLYSIS SYSTEM" (HP-13)
6. S.A. TSVETKOV. "EXCESS HEAT WHILE SATURATION OF TITANIUM BY DEUTERIUM AND AIR MIXTURE" (HP-14)
7. H. YAMADA AND S. NAGAO. "LARGE CHANGE IN ISOTOPIC RATIO OF LI WITH ANOMALOUS <sup>6</sup>LIH FORMATION BY LIGHT WATER ELECTROLYSIS" (HP-16)
8. H.KOZIMA, W.S.ZHANG AND J.DASH. "PRECISION MEASUREMENT OF EXCESS ENERGY IN ELECTROLYTIC SYSTEM Pd/D/H<sub>2</sub>SO<sub>4</sub> AND INVERSE-POWER DISTRIBUTION OF ENERGY PULSES VS. EXCESS ENERGY" (HP-5)

Innovative Engineering and Projects (IP)

1. R. F. CANTWELL, S.S. BOOTH, M.L. MCCONNELL. "A FLOW CALORIMETER FOR GLOW DISCHARGE EXPERIMENTS" (IP-1)
2. V.A.KRIVITSKY AND F.A.GAREEV. "PURPOSEFUL SYNTHESIS OF CHEMICAL ELEMENTS" (IP-2)
3. G.V.TARASENKO. "THE CAPACITOR BATTERY" (IP-5)
4. M.D.BERKOVA, A.A.BIKOV, V.J.VELIKODNYI, ET AL. "PLASMA TECHNOLOGIES AND ECOLOGY PROBLEMS" (IP-6)
5. I.V.GORYACHEV, I.N.GORYACHEVA. ADVANCED PROJECTS OF ENERGY GENERATING UNITS (IP-8)

17.30 - 18.00

2-nd Posters exhibition

18.0

Time for free discussion

## **JUNE 28 (Thursday)**

### **9.30 - 11.00            7-th Session**

**Session Co-chairs: Alla Kornilova & Tanya Zilov**

#### **Innovative Engineering and Projects (IP-Oral)**

1. ***M.S.GODIN, B.U.RODIONOV, I.B. SAVVATIMOVA.*** “INSPECTION METHOD TO CHECK QUALITY OF NUCLEAR TRANSMUTATION MEDIA” (IP-3)
2. ***T. A. CHUBB.*** “COLD FUSION HEATERS” (IP-4)
3. ***Y.N.BAZHUTOV, A.A.BIKOV, V.J.VELIKODNYJ, V.G.GRISHIN, V.V.POPOV.*** “CYCLONIC - CAVITATIONAL GENERATOR” (IP-7)

### **11.00 - 11.30            C o f f e e - b r e a k**

### **11.30 – 13.00            8-th Session**

**Session Co-chairs: Alexander Karabut & Akito Takahashi**

#### **Materials and Conditions (MC-Oral)**

1. ***E.CASTAGNA, V.VIOLANTE, C.SIBILIA, F.SARTO.*** “SURFACE PLASMONS EXCITATION ON METAL AND METAL HYDRIDE SURFACES” (MC-1)
2. ***J. KASAGI.*** “INTERPLAY BETWEEN DEUTERON AND HOST ATOMS IN METAL DEDUCED FROM LOW-ENERGY BEAM EXPERIMENTS” (MC-2)
3. ***ANDREI LIPSON, ALEXEY ROUSSETSKI, BORIS LYAKHOV, EUGENI SAUNIN, ASLAN TSIVADZE.*** “NOVEL HIGHLY D-LOADED/HIGH D-DIFFUSIVITY PD- BASED CATHODE MATERIALS AS A POTENTIAL MEDIA TO ENHANCE LOW ENERGY NUCLEAR REACTIONS” (MC-3)

### **13.00 - 14.00            L u n c h**

### **14.00 - 15.30            9-th Session**

**Session Co-chairs: Aleksey Rusetskiy & Mikio Fukuhara**

#### **Nuclear Transmutation (NT-Oral)**

1. ***J. DASH.*** “EVIDENCE OF NUCLEAR TRANSMUTATION AFTER LOADING METALS WITH HYDROGEN AND/OR DEUTERIUM” (NT-1)
2. ***DAVID Y. CHUNG AND JAMES LINDESAY.*** “RESONANT TUNNELING IN GLOW DISCHARGE EXPERIMENTS” (NT-4)
3. ***T.HIOKI, N.TAKAHASHI, AND T.MOTOHIRO.*** “XPS STUDY ON SURFACE LAYER ELEMENTS OF Pd/CaO MULTILAYER COMPLEX WITH AND WITHOUT DEUTERIUM PERMEATION” (NT-6)

15.30 - 16.00

Coffee-break

16.00 - 17.30

3-rd Posters presentation (MC, NT, 1,2-TM)

Session Co-chairs: Ivan Chernov & Jean Paul Biberian

Materials and Conditions (MC)

1. R.KUZMIN, P.SEROV. “LUMINESCENCE OF MICRO-BUBBLES FROM LIQUIDS” (MC-4)

Nuclear Transmutation (NT)

- 1.. Y.IWAMURA , T.ITOH, N.YAMAZAK. “TRANSMUTATION REACTIONS INDUCED BY D<sub>2</sub> GAS PERMEATION THROUGH PD COMPLEXES (Pd/CaO/Pd)” (NT-2)
2. I.B. SAVVATIMOVA. “ISOTOPES TRANSMUTATIONS AFTER IRRADIATION OF TUNGSTEN BY LOW-ENERGY DEUTERONS” (NT-5)

Theoretical Models and Results Interpretation (1,2-TM )

1. D.ALEXANDROV. “EFFECTIVE ELECTRICAL CHARGE IN DISORDERED SEMICONDUCTORS” (TM-4)
2. U.CHAUDHARY, P.L.HAGELSTEIN. “NUCLEAR WAVEFUNCTIONS, MATRIX ELEMENTS, AND COUPLED CHANNEL EQUATIONS BASED ON SYMMETRIC GROUP CONSTRUCTION” (TM-6)
3. HIDEO KOZIMA. “PHYSICS OF THE COLD FUSION PHENOMENON” (TM-19)
4. XINGLIU JIANG AND LIJUN HAN. “ANOMALOUS NUCLEAR REACTIONS CREATED BY TORSION FIELD WITHIN ELECTROCHEMICAL SYSTEMS” (TM-15)
5. L.I. KHOLODOV, I.V.GORYACHEV. “ABOUT THE FEATURES OF LEPTON TERLETSKI QUADRIGA IN ELECTROMAGNETIC VACUUM” (TM-17)
6. V.A. KIRKINSKII. “ESTIMATION OF GEOFUSION PROBABILITY” (TM-18)
7. RAINER W. KÜHNE. “ THE EXTENDED MICRO HOT FUSION SCENARIO” (TM-20)
8. V.D.KUZNETSOV, G.V.MISHINSKY. “PHENOMENOLOGICAL MODEL OF TRANSMUTATION AND ELEMENT DISTRIBUTION IN TRANSMUTATION PRODUCTS” (TM-25)

17.30 - 18.00

3-rd Posters exhibition

18.00

Time for free discussion

**JUNE 29 (Friday)**

**9.30 - 11.00            10-th Session**

**Session Co-chairs: Vladimir Vysotskii & Peter Hagelstein**

**Theoretical Models and Results Interpretation (1-TM -- Oral)**

1. D.D.AFONICHEV. "MECHANISM OF LOW ENERGY NUCLEUS REACTIONS IN METALS" (TM-1)
2. AKITO TAKAHASHI AND NORIO YABUUCHI. "CONDENSED MATTER NUCLEAR EFFECTS UNDER PLATONIC SYMMETRY" (TM-2)
3. AKITO TAKAHASHI, NORIO YABUUCHI. "DEUTERONS-TO-<sup>4</sup>HE CHANNELS" (TM-3)

**11.00 - 11.30            C o f f e e - b r e a k**

**11.30 - 13.00            11-th Session**

**Session Co-chairs: Nikolay Samsonenko & John Fisher**

**Theoretical Models and Results Interpretation (2-TM - Oral)**

1. YU.N. BAZHUTOV. "POSSIBLE GENERATION OF NEUTRONS BIRTS IN FRAMEWORK OF ERZION MODEL & THEIR POSSIBLE REGISTRATION" (TM-5)
2. WILLIAM COLLIS. "THE INTERACTIONS OF ERZIONS WITH NATURAL ISOTOPES" (TM-8)
3. SCOTT R. CHUBB. "RESONANT ELECTROMAGNETIC INTERACTION (EMI) IN LOW ENERGY NUCLEAR REACTIONS (LENR)" (TM-7)

**13.00 - 14.00            L u n c h**

**14.00 - 15.30            12-th Session**

**Session Co-chairs: Vitally Kirkinskiy & Pierre Clauzon**

**Theoretical Models and Results Interpretation (3-TM - Oral)**

1. DAVID Y.CHUNG, THOMAS K.T.HSIEH AND FRANK SENFTLE. "USE OF A QUANTUM MECHENICAL TUNNELING MODEL TO EXPLAIN THE GLOW DISCHARGE (GD) CHARACTERISTIC OF AN (I -V) CURVE" (TM-9)
2. I.U.CHAUDHARY, P.L.HAGELSTEIN. "NUCLEAR WAVEFUNCTIONS, MATRIX ELEMENTS, AND COUPLED CHANNEL EQUATIONS BASED ON SYMMETRIC GROUP CONSTRUCTION" (TM-6)
3. F.A.GAREEV, G.F.GAREEVA AND I.E.ZHIDKOVA. "NEW DISCOVERY: QUANTIZATION OF ATOMIC AND NUCLEAR REST MASS DIFFERENCES " (TM-12)



**15.30 - 16.00                      Coffee-break**

**16.00 - 17.30                      4-th Posters presentation**

**Session Co-chairs: Fangil Gareev & Tatsumi Hioki**

**Theoretical Models and Results Interpretation (3,4,5,6-TM)**

1. S.L.DOUBKOV, N.V.SAMSONENKO. “ON THE BOUNDED STATES OF THE TWO-BODY PROBLEM FOR PURELY "MAGNETIC" INTERACTION” (TM-10)
2. XING Z. LI, QING M. WEI, BIN LIU . “SELECTIVE RESONANT TUNNELING MODEL FOR LATTICE CONFINED DEUTERONS” (TM-21)
3. A.MEULENBERG AND K.P.SINHA . “PHOTON/PHONON-AIDED LOW-ENERGY NUCLEAR REACTIONS IN CONDENSED MATTER” (TM-22)
4. GEORGE H. MILEY, ANDREI LIPSON, NIE LUO, HEINZ HORA AND PRAJAKTI JOSHI SHRESTHA. “CLUSTER REACTIONS IN LENRS” (TM-23)
5. GEORGE H.MILEY, LAWRENCE P.G. FORSLEY, PAMELA A. MOSIER-BOSS. “ISSUES FOR CHARGED-PARTICLE AND X-RAY EMISSION IN LENR EXPERIMENTS” (TM-24)
6. O.N.REPCHENKO . “THE CONCEPTION OF NUCLEAR FORCES IN FIELD PHYSICS” (TM-27)
7. N.V.SAMSONENKO, S.L.DOUBKOV. “ON THE POSSIBILITY OF THE DINEUTRON EXISTENCE AND THE DIFFICULTIES OF IT'S EXPERIMENTAL DETECTION” (TM-29)
8. KEN-ICHI TSUCHIYA, SHIGERU SASASBE AND MASAO OZAKI. “MANY-BODY EFFECTS OF BOSE PARTICLE SYSTEM IN SOLID” (TM-32)
9. A.N.VLASOV. “POSSIBLE CATALYSIS OF NUCLEAR TRANSMUTATIONS AT ELECTRONIC SCREENING OF NUCLEUS CHARGES IN THE DENSE LOW-TEMPERATURE PLASMA OF THE POWERFUL PULSING INDUCTION DISCHARGE” (TM-33)
10. NORIO YABUUCHI AND AKITO TAKAHASHI. “FORM OF NUCLEAR FUSION IN SOLID CRYSTALS” (TM-34)

**17.30 - 18.00                      4-th Posters exhibition**

**from 18.00                      Time for free discussion**

**19.00                      International Advisory Committee (IAC) Meeting (Blue reception room)**

**JUNE 30 (Saturday)**

**9.30 - 11.00            13-th Session**

**Session Co-chairs: Dmitry Afonichev & Scott Chubb**

**Theoretical Models and Results Interpretation (4-TM - Oral)**

1. A.I.GONCHAROV, V.A.KIRKINSKII. “THEORETICAL ESTIMATION OF D-D FUSION REACTIONS RATES IN DEUTERATED PALLADIUM” (TM-13)
2. L.HAGELSTEIN, I.U.CHAUDHARY. “PROGRESS ON PHONON EXCHANGE MODELS FOR EXCESS HEAT IN METAL DEUTERIDES” (TM-14)
3. JOHN C.FISHER. “POLYNEUTRON THEORY” (TM-16)

**11.00 - 11.30            C o f f e e - b r e a k**

**11.30 - 13.00            14-th Session**

**Session Co-chairs: Anatoly Shestopalov & David Chung**

**Theoretical Models and Results Interpretation (NT, 5-TM - Oral)**

1. V.I.VYSOTSKII, A.A.KORNILOVA, A.B.TASHYREV. “DETAILED INVESTIGATION OF MEMORY PHENOMENA IN WATER AND STUDY OF ISOTOPES TRANSMUTATION IN GROWING BIOLOGICAL SYSTEMS CONTAINING ACTIVATED WATER” (NT-3)
2. M.FUKUHARA. “THEORY OF COLD NUCLEAR TRANSMUTATION” (TM-11)
3. DAVID J.NAGEL. “RATES FOR LOW ENERGY NUCLEAR REACTIONS AT SURFACES” (TM-26)

**13.00 - 14.00            L u n c h**

**14.00 - 15.30            15-th Session**

**Session Co-chairs: Vladimir Krivitskiy & David J. Nagel**

**Theoretical Models and Results Interpretation (6-TM - Oral)**

1. B.U. RODIONOV, O.G.KUDRJAFTZEV, V.V.BOTVINOVSKY. “NUCLEAR TRANSMUTATIONS AT METEOROLOGY” (TM-28)
2. N.V.SAMSONENKO. “FUNDAMENTAL INTERACTIONS AND THEIR RELATIVE CONTRIBUTION TO THE NUCLEAR REACTIONS AT LOW ENERGIES” (TM-30)
3. A.V.SHESTOPALOV. “COLD NUCLEAR FUSION MECHANISM AT CRACK TIP SPEARHEADS LOCATED DEEP UNDER THE GROUND” (TM-31)

**15.30 - 16.00            C o f f e e - b r e a k**

**16.00 - 17.30            Closing Conference**

**Session Co-chairs: Yuri Bazhutov & Igor Goryachev**

**Shot Personal Summaries**

- 1. Michael McKubre**
  - 2. Scott Chubb**
  - 3. Fangil Gareev**
  - 4. Andrew Lipson**
  - 5. Nikolay Samsonenko**
  - 6. Peter Hagelstein**
  - 7. Akito Takahashi**
  - 8. Jiroto Kasagi**
  - 9. Vladimir Vysotskii**
  - 10. Jean Paul Biberian**
  - 11. Francesco Celani**
  - 12. William Collis**
  - 13. Boris Rodionov**
- And some others...**

**Yuri Bazhutov, ICCF13 Chair - Shot ICCF13 Resolution**

**19.00                      Gala dinner (“Saturn” restaurant)**

**JULY 1 (Sunday)**

**9.30 - 12.00            Excursion**

**after 12.00            Free time    Farewell Departure**

# **ABSTRACTS**

## **Analysis and Diagnostic Techniques (AD)**

# **1. NEW RESULTS ON COSMIC RAY ERZIONS SEARCH RECEIVED ON THE SCINTILLATION SPECTROMETRIC TELESCOPE “DOCH-4M” during (2001-2007)**

***Yu.N. Bazhutov\**, *Yu.V. Kozlov\*\**, *V.P. Martemiyarov\*\**,  
*E.V. Pletnikov\*\*\**, *A.A. Sabelnikov\*\**, *V.A. Starostin\*\**,  
*V.G. Tarasenkov\*\**, *E.V. Turbin\*\**, *V.N. Vyrodov\*\****

**\*Terrestrial Magnetism and Radio Propagation Institute (IZMIRAN),  
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**\*\*Russian Science Center «Kurchatov Institute», Moscow**

**\*\*\*State Technical University (MAI), Moscow**

It is presented the new results of day and season variations of running the scintillation spectrometric telescopes “Doch-4M” in the high ionization region received in the framework of cosmic ray Erzions search program during (2001-2007). For the first time it was observed in cosmic rays the large variations ( $A \sim 30\%$ ), depending of zenith orientation of the telescope “Doch-4M” axis. These events nature is discussed using their classification by character types of events depended on the number of charged particles passed through the outer plastic scintillation environment. It was received the abnormal absorption curves of the studied high ionization cosmic ray component in the passive absorber (aluminium, lead & polyethylene) placed above the telescope. These new unusual results, contradicted orthodox cosmic ray physics as by variations so by absorption curves, are analyzed in framework of Erzion model.

## **2. A STEAM CALORIMETER FOR THE STUDY OF THE ABNORMAL EXCESS HEAT OBSERVED DURING MIZUNO-TYPE EXPERIMENTS**

P. Clauzon- J.F. Fauvarque, G. Lallevé- G. Le Buzit

### *CNAM Electrochimie Industrielle*

We have given in YOKOHAMA at the ICCF12 conference the results of a study on abnormal excess heat observed during MIZUNO-type experiments (1). These electrolyses were carried out in a beaker under quite strong voltages (300-350 volts). The measurements of vaporised water weights gave us thermal energies and the indications of a UNIGOR wattmeter gave us the amounts of the electric consumption.

However, the possible loss of electrolyte in tiny droplets, the eventual storage and de-storage of thermal energy and maybe false indications of the wattmeter in severe conditions for the current and the voltage have been raised as possible artefacts being able to give suspicions on our experimental conclusions. In the new device described here after, a steam calorimeter, the possible loss of electrolyte droplets and the storage and de-storage of thermal energy are measured and taken into account. Their influence is negligible. Moreover, the measurement of the thermal heat given by a resistance in series with the electrolysis experiment showed us that the UNIGOR wattmeter gave consistent results within 2% accuracy.

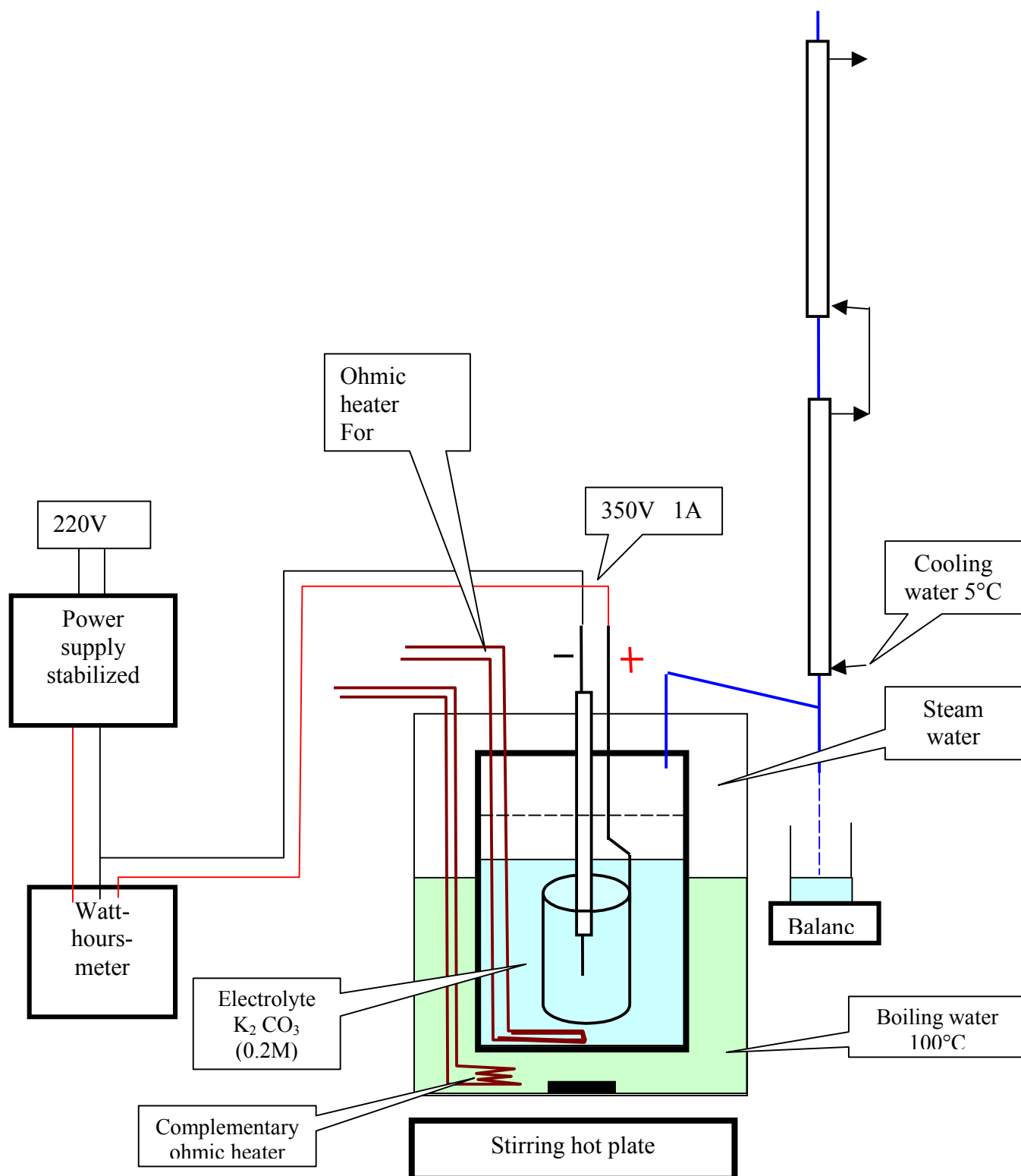
Our experiments have confirmed the coming out of abnormal excess heat. Energy out over energy in ratio (COP) gives us reproducible results around 1.3. This device thus seems to be suitable for more detailed studies to elucidate the MIZUNO mystery. We present finally some ideas for the future experimental program.

(1) “Abnormal excess heat observed during MIZUNO-type experiments” by J.F.

FAUVARQUE- P.P. CLAUZON- G.J-M. LALLEVE ( CNAM – Paris ).

Paper presented at YOKOHAMA ICCF12 Conference in November 2005.

## Experimental Scheme





### **3. SETUP FOR MEASURING OF ENERGY BALANCE AT INTERACTION OF METALS AND HYDROGEN ISOTOPES GAS AT HIGH TEMPERATURES AND PRESSURES**

**V.A. Kirkinskii , A.I. Khmelnikov**

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The setup was designed for investigation of fusion reactions in gas - solid systems at temperatures up to 1000 K and pressures up to 50 bar. It is based on our RF Patents No 2056656 and No 2195717.

The reactor is designed as two coaxially positioned steel tubes. The inner tube has a closed bottom. The external tube has thread and autoclave valve. The tubes were welded at one end through a steel washer. The working reactor capacity is nearly 300 cm<sup>3</sup>. On the outer tube of the reactor a heat exchanger is mounted, thermally insulated from outside. The cooling distilled water is fed from the thermostat through thick-walled rubber hoses with incorporated thermocouple elements connected for measuring the temperature difference of the water entering and exiting the heat exchanger. The total mass of the water having passed through the heat exchanger is measured by weighting. A fine grained palladium powder was placed into the reactor. After charging the reactor with working substance the tightening copper ring was plastically deformed with packing nut through an obturator. The reactor is connected to a vacuum pump through a drainage-type vacuum valve and a receiver. The reactor vacuum treatment is performed until the pressure was less than 1Pa. Then the necessary quantity of hydrogen or deuterium gas produced from heavy water (99.9 % D<sub>2</sub>O) was fed into the reactor, and the latter was hermetically sealed with a high-pressure needle valve. Resistance furnaces are placed in the inner tube of the reactor. The electric energy input is measured by watt - hour meter of active energy with the accuracy  $\pm 0.5\%$ . The difference in the temperatures of the water flowing into the heat exchanger and out of it was measured every 30 seconds and was averaged over the experience time. The energy output is calculated on the heat capacity and mass of water, which has passed through the heat exchanger. Two operating modes were used: stationary and circling. The error in the measurement of the released energy, according to our estimation, is  $\pm 2\%$ .

This work is supported by RFBR (grant No05-05-64930).

#### **4. TRITIUM RELEASED FROM INTERIOR'S EARTH: EVIDENCE FOR NATURAL NUCLEAR FUSION**

Songsheng Jiang

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Detection of tritium in the Earth's interior is a key to explore natural nuclear fusion in deep Earth. Mantle helium isotopes and other volatiles will be released to the some of volcanic crater lakes. The ability of volcanic lakes to store magmatic gases can be used to detect mantle degassing. In this paper we demonstrate the observation of mantle tritium in the volcanic lakes. The excess  $^3\text{H}$  and  $^3\text{He}$  have been observed at the bottom of two volcanic lakes, Lakes Nemrut and Laacher. The excess helium isotopes are confirmed to be from the mantle. The excess  $^3\text{H}$  in the both lakes might also originate from mantle source. To our knowledge, this is the first time to report a positive result on searching for tritium released from deep Earth. The "mantle tritium" concentrations are estimated to be  $3.7 \pm 1.1$  TU in Lake Nemrut and  $>1.0$  TU in Lake Laacher.

## **5. RESEARCH OF WORK OF THE PLASMA-ELECTROCHEMICAL STEAM AND GAS GENERATOR**

**V.J.Velikodnyj, S.V, Gavrilov \*, V.G.Grishin, J.A.Popov\***

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On the basis of plasma-electrochemical processes the economic generator water vapor is developed. For the fundamental scientific researches directed on perfection and introduction in the industry of a technical product the laboratory stand is created. Operating modes of a steam and gas generator with a positive output of thermal energy are received.

## **6. THE IMPULSE ELECTRICAL BREAKDOWN OF THE DISTILLED WATER WITH THE MICRON DISTANCES BETWEEN DEUTERIZED TITANIUM ELECTRODES**

**I.V.GORJACHEV\*, V.I.KARYAKA\*\*, M.M. MARTYNYUK\*\*, N.V.SAMSONENKO\*\***

\* Russian Research Center "Kurchatov Institute ", Moscow

\*\* Peoples' Friendship University of Russia, Moscow

The stimulation of nuclear reactions in the electrical explosion of the deuterized metallic points in the heavy water is possible as a result of the spark and homogeneous cavitation or the spinodal disintegration of the unstable liquid-metal phase. Such conditions can arise with the impulse breakdown of interelectrode space under tens of megavolts per centimeter of electrical tensions. An experimental study of the impulse electrical breakdown of the distilled water in the system of titanic electrodes (deuterized point-plane) with the micron interelectrode distances was carried out. Conditions of the discharge: the pulse duration – 1 mks, electrode voltage – to 10 kV, a radius of point -  $\geq 10$  mkm.

## 7. EXCITATION OF HYDROGEN SUBSYSTEM IN METALS BY EXTERNAL INFLUENCE

*I. P. Chernov<sup>1</sup>, Yu. M. Koroteev<sup>2</sup>, V. M. Silkin<sup>2,3</sup>, Yu. I. Tyurin<sup>1</sup>*

<sup>1</sup>Tomsk Polytechnic University, Tomsk, Russia

<sup>2</sup>Institute of Strength Physics and Materials Science, Tomsk, Russia

<sup>3</sup>Donostia International Physics Center, San Sebastian, Spain

Numerous investigations show, that saturation of metals by hydrogen at electrolysis or in a glow discharge can be accompanied by excess heat evolution, X-rays emission, change of isotopic and mass composition of metals. However these processes, as a rule, are uncontrolled, realized spontaneously and their mechanism is unknown. The reason of it is absence of sufficient knowledge about influence of the electrolytic medium and the glow discharge on behavior of the hydrogen dissolved in a solid

In the present report the new phenomenon found out by authors which promotes understanding listed above processes is discussed. Experimental results reveal that hydrogen atoms occupying regular positions in metal create a proper hydrogen subsystem [1,2]. Energy of an external ionizing irradiation (x-rays, accelerate electrons and ions) is accumulated by the hydrogen subsystem resulting in its excitation. In such a way hydrogen atoms obtain significantly larger energy in comparison with the host metal atoms and begin intensively migrate and leave the metal. To understand the mechanism of hydrogen system excitation necessary detailed information on electronic and atomic structure of the metal-hydrogen systems.

For this, we have performed *ab initio* density-functional calculations of electronic structure Pd and Pd-H and imaginary part of dielectric function. The analysis of the received results has shown, that dissolution of hydrogen a topology of the metal-solvent Fermi surface considerably changes. This circumstance strongly influences processes of excitation and a relaxation of an electronic subsystem metal-hydride. Dissolution of hydrogen considerably changes imaginary part of the dielectric function of metal, increasing ability of its electronic subsystem to absorb energy of external influence (for example, irradiations).

Besides we have performed *ab initio* calculations of moment-frequency dependence of dielectric function  $\varepsilon(q, \omega)$  and loss function  $\text{Im}[-\varepsilon^{-1}(q, \omega)]$  for a pure palladium and Pd-H system by the pseudopotential method. For pure Pd it was found out a plazmon mode, which dispersed in region from 2,5 up to 7,5 eV. In palladium enriched by hydrogen this plazmon mode was split on two almost undispersed branches with energies 2.7 and 3.5 eV. Received results allow to speak

us about occurrence under action of an irradiation oscillation to the electronic density, creating strong ( $E \sim 10^{10}$  V/m) local ( $L \sim 10^{-10}$  m ) electric fields in all sample. It is natural to assume, that more effectively these fields will influence on an easy component of the system, i.e. on hydrogen, increasing its energy.

Thus, the energy, insertion during external influence, is accumulated by a hydrogen subsystem therefore atoms of hydrogen get energy on orders greater in comparison with atoms of a metal and as consequence, stimulates course of some exothermal chemical and nuclear processes in a solid.

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1. I. P. Chernov, Yu. I. Tyurin // Reports of Russian academy of the sciences, 1999, V.367, №3, P.3282.
2. I. P. Chernov, Yu. I. Tyurin // Int. Journal Hydrogen Energy, 2002, V.27, P.829-837.

# **PROCESSES in GASEOUS and PLASMA MEDIA (GP)**

# 1. CHARACTERISTICS OF X-RAY EMISSION FROM SOLID-STATE CATHODE MEDIUM IN ELECTRIC DISCHARGE SYSTEMS

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Experimental results on X-ray emission characteristics from the cathode material in the high-current Glow Discharge are presented. The X-ray emission ranging 0.6 – 10.0 keV and more with the dose rate up to 0.01 J/s has been registered. The X-ray spectra were registered on a film with the curved mica crystal X-ray spectrometer. The spectrum is registered both as bands of the continuum with energies ranging 0.6 - 4.0 keV and as spots resulting from the emission of series of high-density monoenergetic X-ray beams (with energies of 0.6 - 10.0 keV) characterized by small angular divergence. The energetic position within the above spectrum range is dependent upon the cathode material used (specific for a given cathode material) and looks similar to characteristic X-ray spectra.

The obtained results were the direct experimental evidence of existing the excited metastable energy levels with the energy of 0.6-10.0 keV in the solid of the cathode sample. Hypothetically, the mechanism of forming the metastable energy levels with the energy of 0.6-10.0 keV in the solid was caused by exciting the electron inner levels of the solid atom shells when bombarding the cathode surface by plasma ions. Hypothetically, the inverse medium population with the energy of 0.6-10.0 keV was created in the volume of separate crystals having the sizes of 0.1-0.01 mm.



## 2. CLASSICAL COLD SYNTHESIS. WHETHER IT EXISTS?

*A.G. Krivshich, G.D. Shabanov, B.Yu. Sokolovsky, O.M. Zherebtsov*

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Ectons and explosive emission of electrons play a fundamental role in various types of electric discharges. Based on these concepts we have verified the results of the recent works that assumed existence of so-called "cold nuclear transmutation of chemical elements" and "cold synthesis" in particular. The results of those works are disputable and not evident. This relates to the empirical approach they used while "cold synthesis" requires high precision of parameters that is difficult to achieve in practice.

We show the problems related to the empirical approach and consider that "cold synthesis" ("cold nuclear transmutation of chemical elements") is actually Coulomb synthesis. By analogy with the recently introduced Coulomb explosion we suggest to change the notion of "cold synthesis" to "Coulomb synthesis".

### 3. THE NATURE OF BALL LIGHTNING

***G.D. Shabanov, A.G. Krivshich, B.Yu. Sokolovsky,  
O.M. Zherebtsov***

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We want to perform the laboratory ball of lightning (LBL). LBL is a hollow body; it has free like charges (negative charge) inside itself. LBL doesn't have free positive charges. LBL and natural ball of lightning have the identical mechanism of formation and of its lifetime. BL forms when the leader of a streak lightning stops (lightning stroke doesn't exist). The statistical data on ball of lightning in our hypothesis corresponds to the same data on streak lightning. The performed data confirmed by experimental way:

1. G.D. Shabanov // Technical Physics Letters. 2002. V28. №2. P164.
2. N.G. Shabanova, G.D. Shabanov // New Energy Technologies. 2004. №4 (19). P71.
3. G.D. Shabanov, B.Yu. Sokolovsky // Plasma Physics Reports. 2005. V31. №6. P512.
4. a) G.D. Shabanov, O.M. Zherebtsov //Proceedings of the 10-th Russian Conference on Cold Nuclear Transmutation of Chemical Elements and Ball Lightning. Dagomys, City of Sochi. 29.09-06.10.2002 (M: 2003). (RCCNT & BL-10). P285. b) N.G. Shabanova, G.D. Shabanov // RCCNT & BL-11. 2003 (M: 2004). P269. c) G.D. Shabanov, O.M. Zherebtsov // RCCNT & BL-11. 2003 (M: 2004). P279.
5. G.D. Shabanov, A.G. Krivshich, B.Yu. Sokolovsky, O.M. Zherebtsov //Proceedings 9<sup>th</sup> International Symposium on Ball Lightning (ISBL-06), 16-19 August 2006, Eindhoven, The Netherlands. P202.

#### ***4. BALL LIGHTNING OBSERVATION PROPERTIES***

*(Modern analysis)*

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A review of ball lightning (BL) observation data collecting state and their discussion is presented. These data was collected during last two decades. Anew consideration of BL properties such as surface temperature and energy is given. New observations are represented, which show that BL could be warm and even hot material object, it can leave small holes in glasses at contact with them. From the point of view of the author fireballs appearing in trolleybus pantograph also represent one form of BL. Undertaken analysis shows that part of BL represents high-energy objects with hot surface. Traces left by BL speak about a possibility of thermal and electric impact of BL. Rare properties of BL requiring additional collection of information are singled out.

## 5. UNIPOLAR BALL LIGHTNING THEORY

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Analysis of a number of ball lightning observations and several experiments on realization of organic and inorganic origination long lived luminous objects is made. It allows to formulate ball lightning theory where the Ball lightning is considered as unipolarly charged spherical object in an atmospheric electrical field. According to this model creation of melted bubble type substance and its unipolar charging take place during thunderstorms by strike of linear lightning into earth and other different objects of inorganic and organic origination that can be melted. At high electric field in the ground atmospheric layer and high electrical charge of this object there appears a capability of this object to levitate. This object explosion is connected with its combustion in air after its heating by plasma on its surface to temperatures of ignition. Electrohydrodynamic instabilities on its surface can lead to appearance of droplets and filaments on it and to facilitation of ignition. Specific energy of this object proves to be as high as  $10^3 - 10^5 \text{ J/cm}^3$  and it is in agreement with observations. In frames of this model one can explain observed lifetime of BL, appearance it from plugs and separation it into shells, its capability to penetrate through glasses, to coil from a thread to a ball,. Thunderstorm, geological and electric circuit origination of this object is discussed.

## **6. MODERN REALIZATION OF LABORATORY BALL LIGHTNINGS (Modern analysis)**

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A review of laboratory ball lightning (LBL) realization has been made. It includes analysis of experiments with jets and gas discharges, discharge vortices, polymeric structures, combustible fires and other spherical configurations. Mutual properties of LBL and real ball lightning are discussed.

## 7. THE POSSIBILITIES FOR THE FORMATION OF THE ORDERED PLASMA STRUCTURES IN NATURE

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In the second half of the 20th century due to the works by I.R. Prigozhin and his school one could come to perceive that self-organization of the matter is possible in open thermodynamic systems (far from their equilibrium) along with the formation of microscopic structures. In nature ball lightning appears to be regarded as an example of such an orderly plasma structure. It was reported to carry electric charges, to be particularly energetic and to exist for a rather long time. This raises the questions of special interest of what can prevent the fast recombination of charges, in which form the energy is stored in ball lightning, what forces confine the electric charges to the bounded region of a space, what is the mechanism of its radiation.

In recent years the model of ball lightning has been developed by the authors, in which it is considered as a heterogeneous structure composed of energy core and dielectric shell. The core is a system of electrons and protons moving in vacuum. Electrons move in a circle drifting in the crossed electric and magnetic fields, and protons, generating the magnetic field, revolve around electron ring: they are maintained in orbit with the electric field, produced by the charge of the ring. The total number of protons in the system exceeds the number of electrons therefore the energy core has a non-compensated positive charge. Like any plasmoid the core couldn't be confined by its own magnetic field and expands radially. This expansion of the core is retarded by the bubble-shaped shell, which tends to shrink under the action of non-uniform electric field of the core. The stability of the system is kept by the equality in value of two forces, expanding and shrinking the shell. The energy in the system is stored in the form of kinetic energy of protons and the energy of the core's electric field. The radiation of ball lightning may be associated with a synchrotron emission of relativistic electrons. In nature the discussed ordered plasma system may be formed in the vicinity of the linear lightning channel as a result of vacuum cavity rise, separation and acceleration of the charges, the loss of the part of negative charge and production of the shell by water drops.

## **8. RESEARCHES OF INTERACTION OF LONG-LIVING PLASMA FORMATIONS WITH SUPERSONIC STREAM AND BARRIER**

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As early as N.Tesla in his experimental works say, plasma, which contains products of electrode erosion or condensate from special wax surface evaporation substrate has some unique properties. In particular, it mentions that this plasma formations has long period of life (0.1..1sec) Based on “cold test bench” technique created earlier for investigations of liquid atomization into supersonic flow, plasmatron unit has been created. It is used for investigation of interaction of lon-lived plasmas with the supersonic flow. Working medium is a supersonic flow of air mixed with microdrops of electrolyte. Electrodes were covered with a layer of artificial, vegetative or animal polymers to create long-lived plasma formations. Interaction with supersonic flow caused rosary-like and spheric formations to split away from the discharge. Interaction of these formations with a conductive screen was studied. The signal from the screen was transmitted to oscillograph. Oscillogrammes viewed can be characterised as short impulses of current and voltage appearing when a plasma formation hits the screen.

## **9. CLASSICAL APPROACHES TO ANOMALOUS AND GEOPHYSICAL PHENOMENA**

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In the report we represent results of classical typical for continuous media analysis of several geophysical phenomena including Ball lightning, motion of planets in Solar system and corresponding approach to the increase of planets size and mass. Conducted analysis shows a necessity of geophysical processes existence leading to transformation of initial matter (physical vacuum) and to synthesis of physical and chemical elements.



## 10. EXPERIMENTAL RESEARCHES OF ELECTRICAL EXPLOSION OF THE WIRE SPIRAL TURNED IN THE TORUS AND DIPPED IN WATER

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The previous experiments with electrical explosions of the wire spirals turned in a torus have shown that the lifetime of gained plasmoids is much higher in comparison with the plasmoids gained at electrical explosions of wires with other configurations. The probable reason of this phenomenon is presence of a powerful toroidal magnetic field inside a spiral before its explosion, but that stability of plasmoids provided with a shaped ring vortex is not excluded. Revealing of the mechanism is of interest from the point of view of a potential opportunity transmutation nucleus of chemical elements at electrical explosion of the wire spirals turned in the torus, as if the toroidal magnetic field promotes pinch of a lifetime of gained plasmoids thus the toroidal current layer with extremely high density of an electric current should be shaped. In this case the opportunity of electronic screening of charges of nucleus down to nuclear gauges is not excluded. Dipping of the wire spirals turned in the torus in water essentially changes parameters of electrical explosion that allows revealing new properties of this process and establishing the possible mechanism of occurring processes.

The experimental installation contained the capacitive store of electrical energy connected through the current circuit changer with replaceable cartridge. In cartridge the wire spiral turned in the torus was established. This spiral was disposed inside a vacuity filled with water. Parameters of electrical explosion processes of wires were varied.

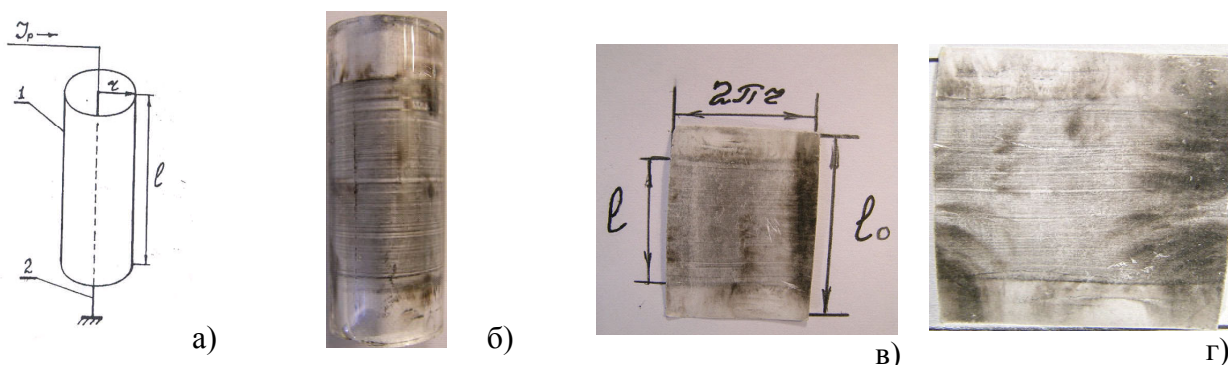
The experimental results as video recordings processes, current and voltage impulses oscillograms, oscillograms of electromagnetic electrical explosions of electromagnetic and ultrasonic processes, and also measuring of a radioactive phone are represented in report. Alongside with the data on explored processes the results of check experiments with wire of various configurations, including the spirals, which had not been dipped in water, are represented too.

## 11. ON ISSUE OF SPATIAL DISTRIBUTION OF ELECTRICAL EXPLOSION PRODUCTS OF SINGLE WIRE

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Investigations of multi-wire liner systems, being carried out both in Russia and in foreign laboratories, the main goal of which creation of high-power pulsed x-ray source of megajoule range, are stalled due to recently discovered phenomena, impeding adiabatic self-constriction process. First of all this is heterogeneous absorption of electric energy on Z and X by a single wire and appearance of “kern” regime. Finally this leads to appearance of azimuth and axial heterogeneities at the end of a shell convergence, disturbing adiabatic regime. That is why it is impossible to get continuous (solid) plasma shell. Taking into account general gas-dynamic regularities we considered that large heterogeneities on the liner finish are consequences of small heterogeneities, i.e. their reasons are associated with the processes taking place on the start in the single wire. This work is devoted to investigation of this issue. It was preferable for us to study spatial mass distribution of exploding wire. Complexity and high cost of the equipment for spatial and time measurements lead us to creation of a method, called AUTOGRAPHY. Its main idea lies in absorption of scattered plasma-cluster-drop fragments with the target, located around the wire (a). Patterns obtained with this were densitometered (b) and, based on the results, we made a conclusion on a structure of mass spatial distribution of exploded wire, homogeneity of its scattering.



Experimental facility for multi-variant studies consisted of pulsed power source, based on lines with distributed parameters, hermetically sealed chamber for samples fastening, evacuation and gas filling unit of a discharger and the chamber, complex of measurement equipment to record electric parameters of the wire explosion process, and also instruments to control charging voltage and pressure in the discharger and working chamber. Results of experimental research have good reproducibility and make it possible to affirm that scattering products of electrical

explosion of the single wire have a structure of successively located, relatively to the wire axis, self-organized toroidal-vortex formations from plasma-cluster fragments. Multiple investigation results showed that the structure is sensitive to experimental conditions and depends on wire material, its length, diameter and surface clarity, type and pressure of surrounding air, current and voltage of the power source.

## 12. GLOBE LIGHTNING: MODELING AND APPLICATION

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We assume different periods of solving globe lightning problem, which are revelation of its nature and creation of generating plasmoid-models mechanism.

We suppose here a new device project, which enable some more valid experiments.

**EXCESS HEAT and RELATED NUCLEAR  
PRODUCTS (HP)**

## 1. NEUTRONS, $\gamma$ -RAYS & TRITIUM DIAGNOSTIC AT ELECTROLYSIS WITH ANODE GAS DISCHARGE IN WATER SOLUTIONS

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It was fulfilled series of experiments of electrolysis with anode gas discharge. Voltage was (100-1000)V. Current amplitude was (1-10)A. Heavy water concentration in electrolyte was (0,017-30)%. Possible addition of Lithium & Potassium in electrolyte was (0-20)%. Titanium or Nickel plates was used for cathode, Gold or Tungsten were used for anode. For received results there were used following diagnostic methods: 1)  $\gamma$ -spectrometer based on lowbackground pure Ge-detector (120 ml) & NaI ( $\varnothing 63 \times 63 \text{ mm}^2$ ) scintillator detector; 2) Tritium scintillation diagnostic in electrolyte (sensitivity  $\sim 0,1 \text{ Bq/ml}$ ); 3) Neutrons flux diagnostic (sensitivity  $\sim 2 \text{ n/cm}^2\text{s}$ ). Received results of regular reproducibility of neutrons & tritium generation were corresponded to the Erzion model predictions. Large neutron yield reached value of  $10^6$  neutrons per second with correlated tritium yield value  $\sim 10^{11}$  in heavy water & much less in light water. Control experiment predicted in framework of Erzion model suppressed neutron yield down to zero.

## **2. EXCESS HEAT PRODUCTION DURING D2 DIFFUSION THROUGH PALLADIUM**

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### **Introduction**

We have developed a mass flow calorimeter enabling us to measure accurately excess heat production during deuterium diffusion through the walls of palladium tubes. The experiment consists of a palladium 10 cm long, 2mm in diameter tube with 100  $\mu\text{m}$  walls, closed at one end. Deuterium gas is introduced in the tube at various pressures, and diffuses out through the walls of the tube. The tube is positioned inside a cell which is a small vacuum chamber, and is heated with a resistor. The cell itself is positioned inside a second vacuum chamber. The outer walls of which are water cooled. Thermal energy is determined by measuring input and output temperatures and water mass flow. Input power of the system is the Joule heating of the resistor. The energy yield of this calorimeter is 96%.

We study the influence of deuterium pressure, tube temperature and various metal powders placed inside the tube, and metal deposited on the external surface of the tube.. Excess heat has been observed for long periods of time.

We will discuss excess heat produced using the various treatments.

### 3. STUDIES ABOUT PALLADIUM NANO-PARTICLES SYNTHESIS FOR DEUTERIUM ABSORPTION AT HIGH TEMPERATURES

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\* Following our paper presented at ICCF12 (Yokohama-Japan, November 2005, World Scientific, ISBN 981-256-901-4, pp. 377-391), we stated that most of anomalous effects (both of thermal and/or of nuclear origin), sometimes found mainly in the Palladium-Deuterium (Pd-D) system, come out because nano-structured surfaces of Pd.

\* Usually, the nano-structures (fractals included) grow just by a lucky chance and are due to a couple of well known phenomena in Pd-D (or H) system:

- a) embrittlement of Pd due to several loading→deloading→loading cycles (by gas or electrolysis procedures);
- b) enhanced growth of nano-structure and/or fractal at Pd surfaces due to several cycles of cathodic/anodic current, as usually performed in Cold Fusion studies using electrolysis.

\* According to our paper, we quoted the three experiments that *intentionally* growth nano-structures to get anomalous effects:

- c) Yoshiaki Arata's (Osaka University-Japan) nano-particles, made by embedding nano-sized (about 10nm) Pd into a matrix of Zirconia: Pd-ZrO<sub>2</sub> nanoparticles pressurised (30-80 bar) at high temperature (140-210°C) with D<sub>2</sub> gas into a pure Pd tube (double walls structure, called by Arata *Double Structure Reactor*). Detected: very large (recently up to 50°C) and stable temperature gain, <sup>4</sup>He;
- d) Yasuhiro Iwamura's (Mitsubishi Heavy Industries, Yokohama-Japan) nanometric multi-layers of Pd-CaO with the element to be studied (Sr, Cs, Ba) deposited at the top of the



first multi-layer: pressurised by D<sub>2</sub> (only 1-1.2 bar at a temperature of 70-80°C), flowing from the front “active” side (covered with Sr/Cs/Ba) to the back (in the vacuum) of the multi-layer. Detected transmutations, reliably, although at low intensity (about 10<sup>14</sup> Atoms/day), of natural: Sr→Mo Cs→Pr, Ba→Sm;

- e) Francesco Celani’s (Nat. Inst. Nucl. Phys., Frascati-Italy) procedure of cyclic loading and pulse deloading (by millisecond-high current anodic electrolysis) of long (60-100 cm) and thin (50 μm) Pd wires. Detected some excess heat (not stable over long times) and transmutations (from the whole Pd-Sr-Th-Hg wire-electrolyte to, mainly, Cu, Zn, Pb).

\* Taking into considerations:

- f) The impressive results, about excess heat, obtained by Arata with his specific nano-particles;
- g) The complexity (melt spinning of Zr-Pd alloy from over 1200°C to room temperature in about 1 millisecond, under argon atmosphere; selective oxidation of Zr with contemporary growth of amorphous Pd up to the optimal size) to get them;

we decided to synthesize Pd nano-particles using a (possibly more simple) chemical route, not a metallurgical one.

\* In order to characterise the material from the point of view of H,D/Pd ratio, even at high temperatures and pressures, we built a modular (Swagelock standard) fully Stainless Steel (AISI 304 and 316) twin chambers (volume 35cc), able to withstand temperatures from –196 to 350°C, with pressures from vacuum up to 100bar. The accuracy of pressure gauges was 0.25% of full scales adopted (25 or 100bar). The temperature accuracy was +-1°C (home-selected, type K thermocouples). The accuracy of D/Pd ratio measured was of the order of 0.02-0.08, depending on the amount of material used (crucible volume 5cc). The heater can give up to 30W of power; the insulation system (apart a home-made first wall multilayer thermal radiation screening, is based on a silvered glass-stainless steel Dewar, WKG-Germany) is such that with an external power of only 4 Watt we get an inner reaction chamber temperature of about 190°C (290°C with 8 Watt).

\* We tested 4 types of materials (commercial or home-made): a) commercial Pd-black (Aldrich, both at normal and high surface area), b) Pd on activated carbon, c) mixing of Pd salts with nano-sized colloidal silica, d) absorption of soluble salts of Pd-Sr mixtures by nano-porous basic □Alumina (holes of 5.8nm; incipient wetting impregnation procedure and proper high temperature calcination)

\* Analyses were made by: XRPD, TGA, TDA, ICP-MS, ICP-OES, SEM.

\* Up to now, the best result was obtained by □Alumina-Pd-Sr material.

We get a D/Pd ratio (referred to Pd content) of about 1.7 at 22°C (as comparison, Arata get values as high as 3-4). Moreover, we think that also the *Spillover effect* can make some role about the measured D/Pd ratio because very close contact (nanometric size) between Pd and host material. With a Pd amount of 0.6g (over a total weight of 5g) we get a temperature gain (in respect to a not-active material used as reference) of over 10°C at a temperature of about 300°C and a D<sub>2</sub> pressure of 30bar.

\* Work is in progress in order to improve: reproducibility, stability over time, measuring system set-up facilities, temperature gain.

#### 4. EXCESS HEAT REPRODUCIBILITY AND EVIDENCE OF ANOMALOUS ELEMENTS AFTER ELECTROLYSIS IN Pd|D<sub>2</sub>O+H<sub>2</sub>SO<sub>4</sub> ELECTROLYTIC CELLS

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Electrolyte temperature is a key factor in excess heat production using Pd|D<sub>2</sub>O+H<sub>2</sub>SO<sub>4</sub> electrolytic cells. Best results are obtained when the electrolyte temperature is close to the boiling point. Stable excess heat is generated by events on or near the Pd cathode surface. In addition to the stable excess heat, heat bursts are sometimes observed. Excess heat measured by isoperibolic calorimetry is directly verified by Seebeck envelope calorimetry. Experiments with D<sub>2</sub>SO<sub>4</sub> replacing H<sub>2</sub>SO<sub>4</sub> in heavy water electrolyte showed that there was no affect on excess heat production. After electrolysis, localized concentrations of silver were found on Pd cathode surfaces. Three characteristic morphologies, (1) craters with rims containing electroplated Pt; (2) cracks in the sample; and (3) palladium regions around the cathode edges are preferred locations for the occurrence of silver.

## 5. PRECISION MEASUREMENT OF EXCESS ENERGY IN ELECTROLYTIC SYSTEM Pd/D/H<sub>2</sub>SO<sub>4</sub> AND INVERSE-POWER DISTRIBUTION OF ENERGY PULSES VS. EXCESS ENERGY

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Excess energy was measured with a Seebeck envelope calorimeter in an electrolytic system containing a two mm diameter Pd tube cathode<sup>1</sup>. After about 50 hours of electrolysis, many power bursts of excess energy were observed.

The distribution of the number of power bursts  $N(P)$  with definite excess power  $P$  plotted on a logarithmic scale is expressed as a line with a gradient  $\approx -1$  to  $-2$  by our preliminary estimation, showing the typical behavior of the  $1/f$  noise. This characteristic behavior is discussed in relation to complexity in the mechanism of the excess energy generation in the experimental system.

### Reference

1. W.-S. Zhang and J. Dash, "Excess Heat Reproducibility and Evidence of Anomalous Elements after Electrolysis in Pd/D<sub>2</sub>O+H<sub>2</sub>SO<sub>4</sub> Electrolytic Cells", submitted to ICCF13.

## 6. EXCESS HEAT POWER REGISTRATION IN HIGH VOLTAGE ELECTROLYSIS AND DISCHARGE SYSTEMS

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The experimental researches of heat, high-energy and nuclear processes occurring in the cathode solid medium in the electric discharge systems presented. The Excess Heat power was registered in experiments with High-Voltage Electrolysis (up to 1000 V ) and high-current Glow Discharge. The experiments showed that the maximum Excess Heat power for Glow Discharge and for High-Voltage Electrolysis, were registered at the anode - cathode voltage ranging 1000-1300 V. Production of the impurity nuclides (nuclear ash) with atomic masses less than and more than that of the cathode material was registered.

The X-ray emission were recorded during the Glow Discharge operation and after the Glow Discharge current switch off. Presumably the observed X-ray emission proceeds as a result of relaxation of excited energetic levels in the cathode solid medium. These excited levels are formed during the exposure of the cathode sample solid surface to the effect of the ions flux produced by plasma or electrolyte medium. These excited energetic states (0.5 – 10.0 keV) formed in the cathode solid medium trigger LENR (Low Energy Nuclear Reactions) which leads to production of Excess Heat power and nuclear ash.

## 7. DEVELOPMENT OF MULTI-PURPOSE INSTALLATIONS FOR ENERGY GENERATION BY WAY OF COLD NUCLEAR SYNTHESIS

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In this work is given the brief review of processes of cold nuclear synthesis on the basis of water with mixture of heavy deuterium water. The data are obtained on the real authors research installation.

The nuclear synthesis is activated in “Koldamasov cell” by cavitations and outer electromagnetic field. Cavitations cause the generation of water drops (“water dust”) with radius  $R_k$  and perimeter of drops  $\sim 6 \lambda_{el}$ . The radius is proportional to the wave length of electromagnetic radiation  $R_k \sim \lambda_{el}$ . The local self-interference results increase the local electromagnetic radiation energy density on many orders of magnitude and that is higher than energy necessary for nuclear synthesis ( $W \approx 6,8 \cdot 10^8$  kilojoule/cm<sup>3</sup>).

The high energy density causes intense optical pressure and appearance of blast waves and (or) of commulative effects, autosynchronization of waves and resonance and processes of self-sustaining reaction. In zone of synthesis appears ultrahigh optical pressure bringing together the nucleus in the field of nuclear reaction.

The power insensity of nuclear synthesis reaches  $W \approx 6,8 \cdot 10^8$  kilojoule/cm<sup>3</sup> and optical pressure  $P_{opt.pressure} = W \cdot 10^4$  kgs/cm<sup>2</sup>. The nucleus fusion follow the atoms micro explosions of nana drops with energy generation. The invention is protected by patents of the Russian Federation which refer to the reactors of cold nuclear synthesis of multi – purpose modifications including for generating Hydrogen.

It is found the design –manufacturing parameters and ways of their improvements for energy generation. Are obtained the data for calculations and other design basis data for development of pioneer multi – purpose energy generation equipment.

## 8. PROOFS OF NUCLEAR ORIGIN OF CMNS EFFECTS IN METALS WITH A HIGH DEUTERIUM SOLUBILITY

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After more than 18 years of peer studies of CMNS many questions concerning its nuclear nature are still at the table. Typical effects of “Condensed Matter Nuclear Science”, including Excess heat (EH) and so-called transmutations do not show nuclear signatures characterizing occurrence of conventional nuclear reactions. So, often cited a magnitude of the *specific energy of Excess heat* (keVs/Pd-atom) may not be a critical factor to convince in nuclear origin of EH. The same is related to the detected products. The <sup>4</sup>He and <sup>3</sup>T species are detected in atomic form (not as nuclear particles) and may be extracted from surrounded media, thus presenting only indirect evidence for DD-fusion. Even if <sup>4</sup>He detected in electrolysis experiments is really from a giant enhancement of  $d(d,\gamma)^4\text{He}$  channel of DD-reaction suppressed in plasma by factor  $10^7$  (the rate is  $\sim 10^{11} \text{ s}^{-1}$  to produce 1 W of EH is required), there is no sign of intense (at least of  $10^4 \text{ s}^{-1}$ ) of  $d(d,p)t$  and  $d(d,n)^3\text{He}$  channels (even suggesting their suppression by factor  $10^7$  compared to “main” He-4 channel). There is also no intense X-ray emission accompanying EH generation. The similar criteria could be applied to occurrence of “nuclear” transmutations where only change in stable isotope abundance is observed without any traces of X-ray and nuclear radiation. Thus, the results allowing to extract unambiguous proofs for CMNS nuclear origin, that are enable to convince majority of physicists in reality of CMNS are highly desirable.

In this paper we are going to present and discuss “conventional” nuclear signatures of non-equilibrium processes in deuterated metals that in our opinion could only serve as an evidence of nuclear energy release in atomic lattice, particularly CMNS. These effects include, but may not be limited by:

- a. DD-reaction enhancement during low energy deuteron bombardment of metallic targets (accelerator and glow discharge experiments).
- b. Low intensity emissions of DD-reaction nuclear species: 3 MeV protons, 1 MeV tritons, 2.45 MeV neutrons (in Pd-D cannot be explained by fractoemission).
- c. Energetic alpha emission ( $E_\alpha \geq 8 \text{ MeV}$ ). These alphas cannot be emitted by natural radionuclides or from cosmic background.

d. Soft X-ray emission ( $E_x \leq 1.5$  keV) in experiments with pulsed Glow discharge with Ti, Pd and other metal cathodes as well as during D-desorption from Pd/PdO:D<sub>x</sub>.

The nuclear/X-ray emission results presented here indicate the ways to convince physical society in nuclear origin of excess heat/transmutation production in CMNS experiments. To this goal the following approach is proposed:

- To perform complete experiment with simultaneous on-line detection of excess heat, atomic  $^4\text{He}$ ,  $^3\text{T}$ , charged particles (DD-products+energetic alphas) and neutron emissions, as well as soft X-rays (not exactly the characteristic  $K_\alpha$  of Pd).
- To search for correlations between excess heat events and emissions of atomic, nuclear species and X-rays.
- To use only appropriate electrolytic cells equipped with the state-of-the-art calorimetric and nuclear detection facilities.



## 9. REPLICATION OF ENERGETICS HEAT AND TRITIUM PRODUCTION

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Difficulty in replicating the experiments of others has led to a criticism of an apparent irreproducibility that has severely handicapped the development and emergence of the field of Condensed Matter Nuclear Science (CMNS). Probably the most important experimental program in the CMNS and potentially any other emerging energy field is that undertaken by Energetics Technologies and presented at each of the past ICCF conferences with reports of factors of 10 or more power and energy gain in both D<sub>2</sub> gas phase and D<sub>2</sub>O electrolytic experiments [1, 2, 3].

In the past year SRI has succeeded in reproducing the major results of excess power and tritium production in D<sub>2</sub>O electrolytic experiments. Similar replication has also been accomplished at ENEA (Frascati) with support from the University of Rome. These results will be reported separately. There can be very little doubt that there is a heat production in the D/Pd system on the scale of 100's or 1000's of eV per palladium or absorbed deuterium atom, that there is an associated but not quantitatively correlated nuclear product (in this case tritium), and that the effect is reproducible under defined conditions. Detailed results will be reported.

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## 10. BURSTS OF COUNT RATE OF BETA-RADIOACTIVE SOURCES DURING LONG-TERM MEASUREMENTS

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When scanning the celestial sphere by a reflecting telescope with a radioactive source of  $^{60}\text{Co}$  at the focus, bursts in the count rate were registered. The probability of their registration depended on the orientation of the telescope. The number of bursts in a day as well as its connection with the orientation of the telescope was not reproduced in a unique manner. There were registered as single bursts with duration of about 1 second and an increase in the count rate up to three orders of magnitude so more prolonged (up to several hours) events that consisted of short bursts of various amplitude distributed in time in some complicated manner. The possible reasons of the found out effects are discussed.

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## 11. THE ANALYSES OF TEST DATAS OF CAVITATIONAL

## HEAT-GENERATOR OF TMK-25 TYPE

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### Introduction

The dynamic and integrated factors of transformation of an energy in cavitation hydrodynamic heat-generator TMK-25 [1] with plane counter rotors are defined experimentally. On measurements of a cooling rate of a tank with water after a heat termination the heat loss are designed. Their comparison is carried out with the energy, accumulated in a tank before the beginning of cooling. The analysis of results and accuracy of measurements confirms high effectiveness of heat-generator with factor of transformation of an energy (the attitude of received thermal energy or power in the open system respectively to the spent electric energy or power) 1,23. It testifies that heat-generator is a «open» system with a release of an additional energy during a cavitation. An abnormal conducting of the magnetic field near to heat-generator, the output pipeline and a tank with water was detected during the work of heat-generator. The probable mechanisms [2-8] of an additional energy release in a system are considered at collapse of cavitation bubbles. In particular, the mechanisms of cold nuclear fusion, structural reorganization of water with formation of associate clusters, release of energy of hydrogen bonds, burning of water are considered. The executed researches are of interest in connection with acute need of use of ecologically pure, renewed energy sources.

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## 12. THE GAMMA EMISSION DURING AND AFTER EXPERIMENTS WITH TUNGSTEN IN DEUTERIUM GLOW DISCHARGE.

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The gamma emission issue during experiments in Deuterium Glow Discharge (DGD) with a tungsten cathode and after experiments in DGD was fulfilled by CdTe detector. Measuring in the DGD carried out through a double quartz wall of tube with cooling by water flow of the Glow Discharge chamber.

Energy of gamma peaks from the tungsten foils, placed in contact with CdTe detector after irradiation by ions in DGD, did not exceed 200 keV. The energy of gamma peaks filed during experiments in DGD through a double quartz wall of tube with water cooling, was even lower.

Quantity of the impulses count per second (CPS) during experiment was higher than background by factor 15-20. Quantity of CPS after DGD experiments from a tungsten foil was higher of the background only in separate periods of time. Peaks of gamma spectra were compared with thermo ionization mass-spectrometry (TIMS) results.

Isotopes identification with using peaks of gamma energy data correlates with TIMS data.

### 13. CALORIMETRY IN Pt/K<sub>2</sub>CO<sub>3</sub>/Pd LIGHT WATER ELECTROLYSIS SYSTEM

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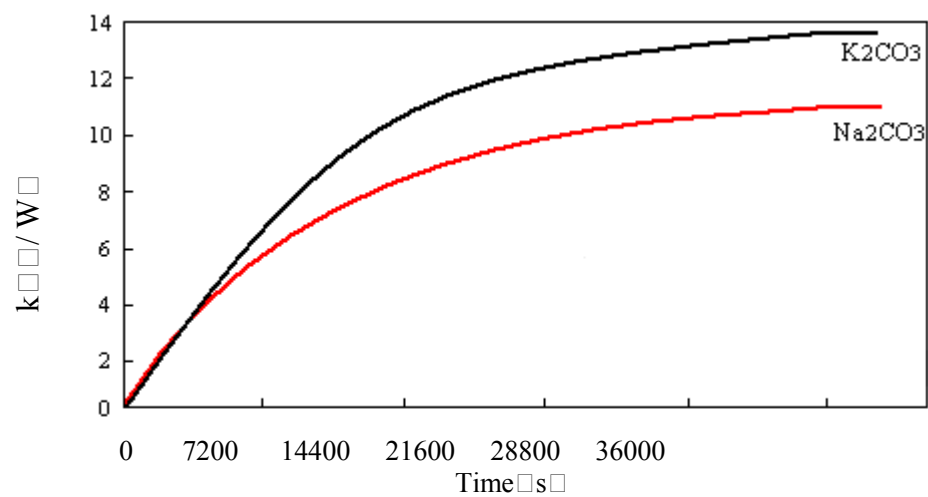
Followed the experiments of Pt/K<sub>2</sub>CO<sub>3</sub>(Na<sub>2</sub>CO<sub>3</sub>)/Ni light water electrolysis by Noninski<sup>[1]</sup> and Tian<sup>[2]</sup>, some calorimetry of Pt/K<sub>2</sub>CO<sub>3</sub>/Pd in light water electrolysis was carried out. A similar Pt/Na<sub>2</sub>CO<sub>3</sub>/Pt light water cell in series was used as a control. When some certain electric currents were passed through the circuit the temperatures in both experimental (E) and reference (C) cells changed. It can be seen that there was an obvious difference in temperature property by comparing the change of heating coefficient ( $k = \Delta T / P$ ) respectively.

When the input current was 0.071A the power in the E and C cells were 0.21W and 0.27W respectively, i.e. more energy was used in the C cell. But the temperature in both cells were reversed. The temperature in the E cell was about 5° higher than that in the C cell. When the system reached steady state after 10 hours' electrolysis, the average heating coefficient in the E cell ( $k_{\text{Na}_2\text{CO}_3}$ ) was 13.88°/W and the coefficient in the C-cell ( $k_{\text{K}_2\text{CO}_3}$ ) was 10.89°/W. The difference of heating coefficient between two cells was nearly 3°/W. During 11 hours' electrolysis the input energy to the E cell was  $7.56 \times 10^3 \text{ J}$ . But the output energy that was measured was up to  $1.0 \times 10^4 \text{ J}$ . The total “excess heat” was roughly about  $3 \times 10^3 \text{ J}$ . There was no “excess heat” in the C cell.

Another interesting phenomenon was found in the experiment. When the electrolysis was carried out for about 100 seconds, the temperature in the E cell was obviously increased by 0.6°. And this higher temperature in the E cell was kept for about 10 minutes. When the time of electrolysis reached 747 seconds, the temperature dropped back approximately 0.3°. In this duration the “anomalous excess heat” was about 26.7J. But the temperature in the C cell did not have any obvious change in the meantime. There was also no temperature increase when the electrolyte of K<sub>2</sub>CO<sub>3</sub> was changed to Na<sub>2</sub>CO<sub>3</sub> in the E cell.

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#### **14. EXCESS HEAT WHILE SATURATION OF TITANIUM BY DEUTERIUM AND AIR MIXTURE.**

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According to previously received data, while saturation of titanium with deuterium and air mixture, temperature rising of 45°C was registered for the titanium deuteride sample in comparison with a similar sample saturated with pure deuterium. The calculation of excess heat based on the data is given. The results are compared with the data on heat for uranium division and heat nuclear fusion.

## 15. CALORIMETRIC RESULTS OF ENEA COOPERATIVE EXPERIMENTS

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The main research work in ENEA (Italian Agency for Energy New Technologies and Environment) in the field of Condensed Matter Nuclear Science, was oriented towards material science in order to increase both the magnitude and reproducibility of excess of power production.

The work was performed within a cooperative framework involving University of Rome La Sapienza, SRI, Energetics and also NRL that has been established specifically for fundamental research in the field of material science. Such a research strategy was conceived to gain a significant control of the phenomenon in order to create appropriate conditions to operate diagnostics both for seeking nuclear products and related signals and to define the physics of the process.

The excess of heat reproducibility increased up to more than 70% and the gain, in some occasions, was larger than 500%.

Material processes developed at ENEA have been successfully used also in the other Institutions involved in the cooperation both in loading and in calorimetric experiments.

The amplitude of the signals giving a very high signal/noise ratio, the gains in energy, the level of transferred reproducibility and their correlation with the status of the material, are well above noise and error bar criteria. Detailed experimental results will be reported.



## 16. LARGE CHANGE IN ISOTOPIC RATIO OF LI WITH ANOMALOUS ${}^6\text{LiH}$ FORMATION BY LIGHT WATER ELECTROLYSIS

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We performed DC electrolysis of Li contained  $\text{H}_2\text{O}$  solution for 2 weeks using Pt foil anode and Ni film cathode. The electrolyte cell is made of polytetrafluoroethylene with volume of 500ml. In order to investigate the change in the composition of elements on Ni surface electrode, we prepared the control Ni film sample. The control Ni film was immersed into a part of the solution for the same period of 2 weeks without electrolysis.

After the electrolysis, the surfaces of Ni cathode and the control sample were analyzed by time-of-flight secondary ion mass spectroscopy (TOF-SIMS) (ULVAC-PHI: TFS-2100). The primary ion in TOF-SIMS was  $\text{Ga}^+$  and measured area was  $40 \times 40$  micron square. Three randomly selected areas on the Ni film surface were analyzed.

The isotopic ratio of Li for the control sample fairly agrees with that of natural one. Almost no count of  ${}^6\text{LiH}$  also  ${}^7\text{LiH}$  was detected for the control sample. To the contrary, an enormous count of  ${}^6\text{Li}$  was detected for the Ni electrode after electrolysis, which increased the natural isotopic ratio  ${}^6\text{Li}/{}^7\text{Li}$  from  $\sim 0.08$  to the anomalous values of 0.51-1.61. The count peak of  ${}^7\text{Li}$  was clearly separated from that of  ${}^6\text{LiH}$  in the figure of spectrum. In other words, no overlapping between these counts was observed. Of particular interest is that almost no count for  ${}^7\text{LiH}$  was detected, even though an enormous count of  ${}^6\text{LiH}$  was detected. This would imply that the molecule  ${}^6\text{LiH}$  was formed during the electrolysis.

If these phenomena were caused by a cold nuclear transmutation, the following is one of plausible processes. Element  ${}^7\text{Li}$  was transmuted into  ${}^6\text{Li}$ , accompanied by simultaneous emissions of proton and electron. The proton would collide with another proton in surrounding molecules  $\text{H}_2\text{O}$  and might immediately take the low energy state. Next, a part of such low energy protons could be captured by their MOTHERs  ${}^6\text{Li}$  to form molecules  ${}^6\text{LiH}$ .

## 17. REPORT ON ELECTROLYSIS EXPERIMENTS AT ENERGETICS TECHNOLOGIES

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The primary objectives of the Energetics Technologies experimental program are: (1) Improvement of reproducibility of excess heat generation, and (2) Amplification of power and energy gain (factors exceeding 10).

The program focuses on electrolytic cells driven by I. Dardik's SuperWaves [1, 2, 3]. Four experimental approaches are being pursued:

- Modify cathode surfaces by special annealing-etching procedures jointly developed with ENEA (Frascati) and the University of Rome.
- ☐ Modify cathode surfaces by SuperWaves glow discharge etching.
- Electrolysis with ultrasonic wave excitation.
- ☐ Develop new cathodes

Experimental results in each of these research areas will be reported along with results from metallurgical and the X-ray analysis of the cathodes.

Successful replications of Energetics heat production was accomplished at SRI and at ENEA (Frascati), the results will be presented separately.

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## **INNOVATIVE ENGINEERING AND PROJECTS (IP)**

## 1. A FLOW CALORIMETER FOR GLOW DISCHARGE EXPERIMENTS

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Coolescence, LLC has developed a flow calorimeter, for the purpose of detecting excess heat in glow discharge cold fusion experiments. Accurate calorimetry is an essential tool for the detection, quantification, and verification of excess heat. The calorimeter functions by pumping temperature controlled fluid at a set rate through a jacket on an experimental chamber, measuring the temperature of the incoming and exiting fluid, and utilizing the temperature change to calculate power. The entire apparatus is housed in a small temperature controlled enclosure. The calorimeter design incorporates refinements such as, fluid temperature polishing, dual temperature probe redundancy, a LabView<sup>TM</sup> control system, and a custom built form fitting calorimeter block. This calorimeter is an advancement over previous Coolescence designs, with a 95% power capture efficiency, a sensitivity of +/- 10 mw or 1% of input power, and has been tested for power inputs up to 10 W.

Details of calorimeter construction and performance are discussed.

## 2. PURPOSEFUL SYNTHESIS OF CHEMICAL ELEMENTS

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It is well known [1] that the natural geo-transmutation of chemical elements occurs in the atmosphere and earth in the regions of a strong change in geo-, bio-, acoustic-, and electromagnetic fields.

The mineral row materials contain the same accompanying chemical combinations which independent of mineral deposit [2]. This means that the formation of chemical elements occur in the same physical and chemical conditions. These conditions were simulated on the fundamental cooperative resonance synchronization principle [1]. The experimental installation on the ground our model was constructed which provided with the calculated final chemical elements. These experimental results indicate the new possibilities for, simulating, inducing and controlling nuclear reactions by low energy external fields. The borrow from the geo-transmutation mechanisms of chemical elements creates the fundamental directions in low energy nuclear reaction researches for construction new ecologically pure mobile sources of energy independent from oil, gas and coal, new substances, and technologies.

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### **3. INSPECTION METHOD TO CHECK QUALITY OF NUCLEAR TRANSMUTATION MEDIA**

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The instability of work of "alchemical reactors", which have been researched in various laboratories all over the world, can be connected with absence of quality surveillance of the working media, in which occur (or which causes) nuclear transmutations.

For such control it is offered to use registration of currents on strings of a hypothetical dark matter. It is supposed, that the strings of this matter – “fluxes”, with a diameter of 60 femtometers, could penetrate any substance. Low energy nuclear reactions are possible at presence of these fluxes. A current is being measured by its magnetic influence on the specially developed flux ammeter - fammeter.

## 4. COLD FUSION HEATERS

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Cold fusion heaters crossed a development threshold in 2005 when Arata and Zhang (A-Z) loaded deuterium into ZrO<sub>2</sub>, nano-Pd powder at ~141 °C, which raised the temperature of the powder to ~183 °C and produced continuous cold fusion heat.[1] The A-Z powder apparently produces heat by a chemical-equilibrium process using thermodynamically unstable material [2]. The instability problem was overcome by embedding nano-Pd in ZrO<sub>2</sub> crystal.[3] Also, international research has led to an increased understanding of the instabilities [4] encountered in overvoltage electrolysis of D ions onto bulk metal electrodes.[5]

The A-Z success comes partly from their use of gas loading studies to evaluate nano-metal powders before applying them to cold fusion studies.[6] These studies show that the ZrO<sub>2</sub>, nano-Pd powder stores much more hydrogen per Pd atom than bulk Pd. The equilibrium H/Pd for the ZrO<sub>2</sub>, nano-Pd powder at 100 bar is ~3.0,[3] which compares with ~0.8 for bulk Pd. Where does the extra H go and why does D absorption support cold fusion? A-Z showed that the hydrogen does not go into the ZrO<sub>2</sub>. Low density options include: 1) Increased occupation of interstitial octahedral and tetrahedral sites, forming a communicating network in the metal's fcc lattice and opening the possibility of superfluid behavior.[8] 2) Occupation of the interface volume between ZrO<sub>2</sub> crystal and nano-metal.[9] Both "Superfluid Network" (SFN) fusion and "Crystal-Metal Interface" (CMI) fusion could create heat without energetic particles.

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## 5. THE CAPACITOR BATTERY

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The principle device capacitor battery is founded on characteristic of the oils, which is a good dielectric. There was is created container-reactor with two electrodes, between which clearance formed from 1 before 10 mms, flooded layers oil. Constant voltage was given on electrodes before 15 kV with the help of capacitor battery by capacity 16 mkf on minimum voltage 6 kV through ball air discharges with clearance from 1 before 5 mm. At stabilizations of the phosphorescence of the category on ball discharges, voltage was unplugged, but category lasted for 1,5 hours. Occurred the gradual discharge to capacitor battery. And herewith recharge occurs by leaps and bounds whole in a matter of seconds, unlike hours of the charging, which are required for modern battery.



## 6. PLASMA TECHNOLOGIES and ECOLOGY PROBLEMS

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Here we investigate some applications of electrical volume-diffusion discharge in modern technologies like water clearing factories and ballast water treatment. We research the influence of electrical volume-diffusion discharge on microflora and microfauna concentrations. Earlier we used the electrical volume-diffusion discharge for cold nuclear transmutation of chemical elements and find that the physical properties of the electrical volume-diffusion discharge in microbubble salt water allows destroy any biology admixture with reasonable energy balance . Now we developed working scale model for plasma-destroy biology objects plant.

## 7. CYCLONIC - CAVITATIONAL GENERATOR

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In previous paper we used cluster model to describe process of accumulation energy on internal binds of the water molecules. Our last experiments shown  $k=13,4$ , where  $k$  = thermal energy / power of moving water electrical engine. In this pape we investigate dependence  $k$  from time and date from the beginning of the experiment. Also we measure variation of  $k$  from heavy water admixture, neutrons and gamma-ray background.

## **MATERIALS and CONDITIONS (MC)**

# 1. SURFACE PLASMONS EXCITATION ON METAL AND METAL HYDRIDE SURFACES

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Surface plasmons (polaritons) are quantum of plasma oscillations created by the collective oscillation of electrons on a solid surface.

As a surface phenomenon, SP excitations is strictly dependent from the physical and morphological properties of interface between metal and non-metal media: while bulk plasmons frequency  $\omega_p$  is a constant typical of the considered material, the SP one,  $\omega_{sp}$ , is also a function of boundary conditions, i.e. non-metal dielectric constant and metal surface roughness. The latter condition is quite interesting if using a laser beam incident on metal surface to excite SP. To obtain SP excitation in this way one has to fulfill the matching condition between laser wave vector and SP ones real component; such an excitation is theoretically not allowed on a smooth interface, because both energy and momentum conservation could not be respected. Moreover, electric field has to belong to the incidence plane, i.e. the wave has to be polarized in the p mode: if the electric field is perpendicular to incidence plane, and thus parallel to the interface (s-type polarization), it would assume the same value in the two mediums, without giving rise to the charge displacement needed to excite surface plasmons. Using a prism coupler placed on the surface, a minimum of the reflectance in the laser beam intensity, for an incidence angle larger than the total reflection one, indicates a resonant condition for plasmons creation. An interfacial corrugation could act as a diffraction lattice, increasing incident radiation wave vector, thus satisfying the requested matching condition.

## 2. INTERPLAY BETWEEN DEUTERON AND HOST ATOMS IN METAL DEDUCED FROM LOW-ENERGY BEAM EXPERIMENTS

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It was found from deuteron beam experiments that screening potential for the DD reaction in metal shows very large values up to 300 eV: this causes enhanced reaction rates at energies far below the Coulomb barrier. However, the origin of the large screening is not understood well, yet. In addition, the reaction products observed in cold fusion experiments suggested the change of reaction mechanism from the normal DD reaction to the unknown collective or cooperative DD reaction.

In order to see any change of reaction mechanism in beam experiments, we have continued measurements of nuclear reactions induced by deuterons with various conditions of host metals. Recently, the following measurements have been carried out:

- (1) Yield ratio of protons to tritons in the  $D(d,p)t$  reaction in various metals.
- (2)  $Li+D$  reactions with Li target in solid, liquid and liquid/gas mixture phases.

These measurements have provided important information on the behavior of deuterons with velocity similar to the electrons on Fermi surface in metal.

In the present work, we show the results of these measurements and discuss on the interplay between deuterons and the surrounding environments, especially on effective deuteron-atom interactions in various metals as well as on the effect of liquefaction.

### 3. NOVEL HIGHLY D-LOADED/HIGH D-DIFFUSIVITY PD- BASED CATHODE MATERIALS AS A POTENTIAL MEDIA TO ENHANCE LOW ENERGY NUCLEAR REACTIONS

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In order to enhance LENR effects in Pd-D system, two novel highly D- loaded/ high D-diffusivity materials containing multilayer structures deposited on top of Pd substrate have been explored.

The first composite material synthesized in our Laboratory is representing a high capacity hydrogen storage media consisting of Single Wall carbon nanotube (SWCNT) layer encapsulated by thin Pd films electrodeposited on top of Pd foil (Pd-SWCNT composite). The SWCNT, etched in concentrated nitric acid can be easy loaded with hydrogen by electrolysis of the Pd-SWCNT cathode and reproducibly show high capacity value (9-14 wt. % of H<sub>2</sub>) or loading ratio  $H/C \geq 1.5$ . The adsorption of hydrogen occurs mainly inside inner space of SWCNT and almost independent on initial sort (purity) of SWCNT. The activation energy of hydrogen desorption from SWCNT in electrochemically loaded Pd-SWCNT composite was found to be of 0.14 eV/H<sub>2</sub>-molecule, indicating hydrogen physisorption inside nanotubes [1].

The second cathode material is a multilayer Pd-Re-Pd-Re structure electrodeposited on top of 50 micron Pd foil (Pd-Re multilayer). This structure provides high H/D diffusivity during deuterium permeation through it (Now under charged particle emission study by Prof. J. Kasagi in Tohoku University).

The nuclear emissions from both Pd-SWCNT composite and Pd-Re multilayer structure have been studied after deuterium loading (the deuterium desorption mode) using CR-39 track detector technique [2]. The electrochemical loading of the Pd-SWCNT cathode up to  $x = D/Pd \sim 0.88$  and Pd-Re cathodes by  $x = D/Pd = 0.7$  has been carried out with low current density ( $j \sim 20$  mA/cm<sup>2</sup>) electrolysis in 1M-LiOD/D<sub>2</sub>O solution using a special cell with divided cathode and anodic spaces. Immediately after achieving a maximal loading, the electrolysis was interrupted. The cathode samples with attached CR-39 detectors were exposed under mechanical strain ( $m=150$  g) for several hours at  $t=20$  °C. Both open and filtered (with thin Al and Cu foils) CR-39 track detectors have been applied in our experiments in order to estimate type and energy distributions of emitted particles.

Reproducible emissions of DD-reaction products (3.0 MeV protons) and energetic alpha particles (in the range of 8-15 MeV) have been detected during both new cathode samples exposure with CR-39 detectors. These results will be discussed in details during presentation.

Results on nuclear emissions from Pd-SWCNT and Pd-Re multilayer cathodes during D-desorption showed that these novel materials are enable to enhance the LENR effects in deuterated solids and could be used as new type of cathodes allowing to trigger and enhance fusion reactions (compared to pristine Pd) during electrolysis.

[1] A.G. Lipson et al, PRL (submitted April, 2007).

[2] A.G. Lipson et al, in Proc. of ICCF-12, Yokohama, 27 Nov.-2 Dec., 2005.

#### **4. LUMINESCENCE OF MICRO-BUBBLES FROM LIQUIDS**

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The report presents the results of experimental studies and theoretical analysis of luminous bubbles from boiling liquid (water), diluted with luminous additives. Exit of micro-bubbles across the border section (between gas phase and liquid phase) exceeds liquid vapor layer several times. Normal micro-bubbles emitting through the border section between gas and liquid phase shows on the collective impact of micro-bubbles (the analogue to Mossbauer's effect). A comparison of luminous bubbles and their explosion afterwards with the ball passing formations (laboratory lightning ball) was given.

The time of super-accumulative processes in the gas phase influence on the spatial change of micro-bubbles. As illustrations of macro-quantization (under the limits of Ghaizenberg's ratio of uncertainties), the results of experiments with evaporating liquid, liquid flowing from wettable holes, the formation of gas bubbles in the liquid are given. In the latter case, the liquid can be described as similar to quark-gluon vacuum, when bubbles' "non-emitting" from the "hadronic" liquids requires more energy. All results presented in the phenomenological theory framework of graduated energy transfer.



# **NUCLEAR TRANSMUTATION (NT)**

## 1. EVIDENCE OF NUCLEAR TRANSMUTATION AFTER LOADING METALS WITH HYDROGEN AND/OR DEUTERIUM

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Most of our research was on Pd, but Ti and U were also studied. For most electrolysis experiments the electrolyte contained  $\text{H}_2\text{SO}_4$  and  $\text{D}_2\text{O}$ . This has the advantages of increased conductivity of the electrolyte and reduced attack on glass cells, compared with basic electrolytes.

We first reported Our discovery of localized concentrations of unexpected elements (Au and Ag) on the surfaces of Pd cathode foils after electrolysis in an electrolyte containing  $\text{H}_2\text{SO}_4$  and  $\text{D}_2\text{O}$  at ICCF4<sup>1</sup>. A scanning electron microscope with an energy dispersive spectrometer was used to detect the unexpected elements. The ability to analyze micron-sized features on the Pd surfaces was essential to this research. Localized concentrations of unexpected elements (V, Cr, and Fe) have also been observed on Ti cathode foils after electrolysis in a similar electrolyte<sup>2</sup>. Gamma ray spectroscopy suggests that transmutation of U is enhanced by exposure to H isotopes in glow discharge and also in aqueous electrolysis. Results of recent experiments with tubular Pd cathodes will be presented.

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2. Warner J, J. Dash. Proceedings of ICCF8. 2000. V.70. P. 161-167.

## 2. TRANSMUTATION REACTIONS INDUCED BY D<sub>2</sub> GAS PERMEATION THROUGH PD COMPLEXES (Pd/CaO/Pd)

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We have been studying on low energy nuclear transmutation reactions induced by D<sub>2</sub> gas permeation through Pd multilayer complexes. Transmutation reactions of Cs into Pr, Ba into Sm and Sr into Mo were observed. Especially, transmutation of Cs into Pr has been confirmed by “in-situ” measurement using x-ray fluorescence spectrometry (XRF) at SPring-8. Up to now, we reported that transmutation reactions seem to occur at localized spot near surface within 100nm under our experimental conditions.

In this conference, we present recent progress of our research; measurement of depth profile of hydrogen for a Pd complex during permeation using a resonance nuclear reaction  $^1\text{H}(^{15}\text{N}, \alpha\gamma)^{12}\text{C}$ . The resonance width is so narrow that we expect depth resolution under 10nm. Identification for an unidentified peak that appears during transmutation experiments of Cs into Pr at SPring-8 by changing x-ray excitation energy will be also presented.

### 3. DETAILED INVESTIGATION OF MEMORY PHENOMENA IN WATER AND STUDY OF ISOTOPES TRANSMUTATION IN GROWING BIOLOGICAL SYSTEMS CONTAINING ACTIVATED WATER

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Among different types of condensed matter water-containing systems are most adapted to alive objects. Water is that natural background, in the scope of which all biochemical and biophysical processes (including controlled isotope transmutation) are running.

The work presents the results of complex experimental and theoretical studies of the characteristics of activated water obtained under a controlled action of nonionizing low-frequency (about 7 Hz) electromagnetic irradiation with composite space structure and very weak amplitude (less 1 Oersted) on ordinary distilled water.

The number of mechanical, electrodynamic, optical, and other characteristics of activated water are discussed. It was discovered in our detailed physical experiments that under the action of this irradiation there are very essential modifications of the basic physical-molecular properties of distilled water:

- decrease of viscosity of activated water by 100 or more times in relation to the same but nonactivated distilled water;
- change of electrical conductivity and permittivity of activated water by 5-10 or more times in the spectral range of low and very low frequencies;
- sharp increasing and time-dependent oscillations of pH exponent etc.

It was discovered also that duration of internal storage of these abnormal characteristics of activated water equals several hours, days or weeks at low temperature which allows us to say about the presence of a distinctive long-term memory of water. The effectiveness of action on water depends on time of irradiation. The most optimal time of irradiation is 30 min.

The results of the theoretical analysis of a possible mechanism of the water memory and methods of its stimulation are given, and the comparison of the duration of existence of this memory with experimental results is made. A particular attention is paid to the "clathrate" model of the water memory [1,2], for which the specific calculations were carried out for different temperatures. It is shown that the results of the theoretical analysis and the data of physical experiments are in good agreement.

We have discovered that activated water changes some very important biochemical and biophysical processes which proceed in alive systems. It renders the essential influence on the processes of cell division, on ionic transport and on metabolic activity.

We have observed and investigated strong influence (increasing) of nonionizing activation of water-containing nutrient medium (both  $\text{H}_2\text{O}$  and  $\text{D}_2\text{O}$ ) on effectiveness of nuclear transmutation in reaction  $\text{Mn}^{55} + \text{d} = \text{Fe}^{57}$  in growing microbiological cultures and microbiological associations. We have observed a very strong increase of the metabolic (reductase) activity of microbiological associations at growth under anaerobic conditions. The difference in effectiveness of the same reaction in nonactivated [3] and activated water is discussed .

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#### 4. RESONANT TUNNELING IN GLOW DISCHARGE EXPERIMENTS

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Some earlier work using resonant tunneling (RT) in the description of the nuclear transmutation (NT) phenomenon in electrolysis has been documented in the past.[1]. Here we will concentrate on glow discharge experiments where excess heat and NT have been observed by many authors [2]. Chiceo [3] pointed out the screening effect in electron clusters and found that the apparent fusion rate can be greatly increased in discharge experiments. Here we make use of the screening potential due to the plasma layer in glow discharge experiments to investigate the possible RT effects at low energies.

We have numerically solved the Schrodinger equation in a simple model with a charged particle in a screened Coulomb potential with a double layer. We assume that nuclear forces dominate on nuclear size scales, thereby cutting off the Coulomb repulsion. The results for the probability of tunneling through the barrier was very interesting. At certain energies of the incoming particles, there are very sharp resonances which enhances the probability several order of magnitude higher than with non-resonant tunneling. The possibility of resonant enhancement occurs because of the screening of the Coulomb potential due to the plasma layer. This may provide a possible explanation for the fusion reactions which may occur near the surface of the electrodes. And as a result, NT and excess heat can be produced as observed by many experimenters. Detail calculations and results will be presented in the meeting.

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## 5. ISOTOPES TRANSMUTATIONS AFTER IRRADIATION OF TUNGSTEN BY LOW-ENERGY DEUTERONS

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To study isotopes transmutation in the tungsten foil irradiated by  $D^+$  ion was used thermo ionization mass-spectrometry (TIMS). Effective current of Glow Discharge (GD) was 5-20 mA, voltage was 500-800 V. After the experiment completing, 14 spectrums of isotopes in the range of 166-206 mass numbers were analyzed every 10 - 15 minutes. The same area was analyzed ~1000 minutes after experiment completing (9 spectrums). Counts per second (cps) of the unirradiated tungsten foil in the same range of mass numbers were 10-20.

In the first set of spectrums after experiment, isotopes with mass 188-200 numbers heavier than tungsten isotopes were found. Isotopes with mass less than W in the range of 180 to 168 after 100-120 minutes were detected. Their counting peak values have increased by factor of 2 - 4 (40-80 cps). After 18 h counting, intensity of 171-172 and 180 isotopes achieved 100 cps. Intensity of 188 - 206 isotopes (with masses higher then tungsten isotopes by 2 - 10 masses) was detected in tungsten foil irradiated by deuterium ions. The intensity in this mass range compared with initial W foil was higher by factor ~ three - eight. The intensity for isotopes with mass 181 after exposure ~1.5 h and with masses 176-168 after 2 h was increased as well. Maximum values had isotopes with masses 168 (2000 cps) and 170 (1600 cps) after 1133 minutes. The higher intensity for isotope with mass 172 isotopes (sufficiently higher of tungsten isotopes intensity) five month later after these experiments with using other TIMS device was got. The isotopes with masses 155 and 156 were observed repeatedly in TIMS spectra also. Isotope groups of Hafnium, Gadolinium and Thallium usually presented in TIMS spectra of tungsten samples after deuterium GD.

The formation of stable isotopes with masses less than tungsten isotope mass after irradiation by low-energy deuterium ions after some time can be explained by transmutation due to lattice excitation under low-energy ions irradiation. The processes of fusion and following  $\alpha$ - and  $\beta$ -decay could explain these phenomena. In our earlier experiments with Ti and Pd foils, maximum of the film blackening after irradiation for 2 h was observed [ICCF5].

Comparison of TIMS data with peaks of X-ray energy of W foil after irradiation showed presence of the same isotopes (next abstract).

## 6. XPS STUDY ON SURFACE LAYER ELEMENTS OF Pd/CaO MULTILAYER COMPLEX WITH AND WITHOUT DEUTERIUM PERMEATION

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We will report a X-ray photoelectron spectroscopy (XPS) study on the surface layer elements of Pd/CaO multilayer complex with and without D<sub>2</sub> permeation treatment. The structure of the multi-layer was the same as that reported by Iwamura et al.[1];

Pd(40nm)/CaO(2nm)/Pd(18nm)/CaO(2nm)/Pd(18nm)/CaO(2nm)/Pd(18nm)/CaO(2nm)/Pd(18nm)/CaO(2nm)/Pd(25μm). Sr or Cs were electrochemically deposited on the multi-layer complexes in the same manner as that reported by Iwamura et al.[1]. D<sub>2</sub> permeation treatments were conducted at 70°C for 13-16 days.

For the samples deposited with Sr, a comparison of XPS spectra with and without D<sub>2</sub> permeation treatment indicated that with the D<sub>2</sub> treatment, Sr3p decreased slightly and Mo3d and/or S2s increased. Mo3d peaks are overlapped by S2s peaks, and existence of S was confirmed from S2p peaks for all the samples studied. Therefore, with the qualitative nature of XPS for estimation of elemental amount, it was difficult to conclude an emergence of Mo instead of Sr with D<sub>2</sub> permeation. It is necessary to completely exclude the contamination of S.

For samples deposited with Cs, Pr3d XPS peaks were clearly observed for a sample treated with D<sub>2</sub> permeation, while there was no peak of Pr3d for a sample without D<sub>2</sub> permeation. The intensity of Pr3d peaks was fairly small compared to Cs MNN Auger peak. It was also noted that the intensity of Cs MNN Auger peak for a sample without D<sub>2</sub> permeation was much smaller than that for a sample with D<sub>2</sub> permeation. Further experiments are being conducted to examine whether the observed Pr is a contamination or not.

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**SOCIAL, POLITICAL,  
and  
PHILOSOPHICAL ISSUES  
(SP)**

## 1. FROM COLD FUSION TO LOW ENERGY NUCLEAR REACTIONS: 2007 REVIEW

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*This paper presents an overview of the field of low energy nuclear reactions (LENR), a branch of condensed matter nuclear science. It explains some of the various terminology that has been used to describe this field since it debuted as “cold fusion” in 1989.*

*The paper also reviews some of the most interesting news and developments regarding low energy nuclear reaction experiments and theory, and some of the trends that have affected the field over the last 18 years. It concludes with a list of resources and information for scientists, journalists and decision makers.*

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## **2. FROM COLD FUSION TOWARDS NUCLEAR TRANSMUTATION – PROBABLE ALTERNATIVE FOR NUCLEAR ENERGY**

***Bazhutov Yu.N., Goryachev I.V.***

The presentation contains a review of scientific events and results of multiple experimental and theoretical investigations carried out after the notorious discovery of cold fusion phenomenon announced by Fleischmann and Pons in 1989. It gives general characteristics to the achievements of scientists in different countries. Special attention is paid to the status of these research in Russia. The paper discloses the main directions of works and projects being developed in this new field of physics. The authors present arguments supporting their opinion about the importance of Nuclear Science in Condensed Matter as being new physics of XXI century. The authors stress out that the newly discovered physical phenomenon – Cold Transmutation of Nuclei of Chemical Elements (Condensed Matter Nuclear Science) is actually a powerfull reserve for developing breakthrough technologies which deserves to pay close attention at and be actually supported.

#### **4. PREPARATA MEDAL LECTURE - A TRIBUTE TO GIULIANO PREPARATA, A TRUE PIONEER IN COLD FUSION THEORY**

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Anyone who attended an ICCF meeting before 2000 remembers the brilliant and fiery theoretical physicist, Giuliano Preparata. He provided new insight into the deep mysteries of cold fusion, and greatly enlivened the meetings with his lively debates. My own discussions with him usually concerned thin film electrolysis. I recall encountering him after one of his ICCF talks and questioning one of his conclusions. Giuliano snapped back – “George, you haven’t read chapter 8 of my book!! Read it before you talk to me again!” I responded that I had read it but still didn’t understand!! Giuliano took pity on me and just laughed (As others knowing him will recognize, this was a “mild” interaction compared to usual). His book, *QED Coherence in Matter*, is a gem; it provides a view into Giuliano’s unique approach to coherence of matter and cold fusion (the “famous” chapter 8). It is not easy reading, so, I subsequently put his book in my briefcase and pulled it out whenever I found time on a trip. Indeed, I still had it with me when I sadly learned of his untimely passing. I pulled the book out and stared at the cover, then moved to the dedication page where Giuliano credits his father for teaching him the meaning of “honour and honesty”. His father must have been proud since Giuliano learned the lesson well. The community lost a leading light that day.

Giuliano was born in Padova, Italy in 1942. After receiving his Ph.D. in 1964, he became immersed in strong interaction physics theory. In 1967, he joined Princeton University and after several positions, ended up in 1970 as Assoc. Professor at NYU. From 1980 until his death, he was the Chair Person of High Energy Nuclear Physics at Milan University. In the early days of cold fusion, Giuliano joined the activities of the National Cold Fusion Institute in Salt Lake City. This experience peaked his interest in the physics of this exciting new field. His later cold fusion research was done at Milan University and in collaboration with the ENEA Fascati Laboratory where he played a key role in both theory and interpretation of cold fusion experiments.

This lecture includes recollections of Giuliano’s participation in ICCF meetings. In addition, the relation of his coherence theory to other more recent theories will be discussed.

**THEORETICAL MODELS  
and  
RESULT INTERPRETATION (TM)**

## 1. MECHANISM OF LOW ENERGY NUCLEUS REACTIONS IN METALS

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The almost twenty year study of the process of cold nuclear fusion resulted in development of several mechanisms of solid state cold fusion occurrence. However, unfortunately they fail to explain all the experimental facts known. Moreover, they do not take into account the unique properties of deuterium and the structure of metals used for deuterium absorption.

The mechanism of resonance transfer of neutron from  $^2\text{D}$  to  $^2\text{D}$ ,  $^3\text{T}$  or  $^n\text{A}$  ( $^n\text{A}$  – nucleus of heavy elements) is proposed. Firstly, pairs of correspondent ions of DD, DT or DA generate in metallic matrix. As these ions move in the alternating crystal field they start to vibrate that results in occurrence of resonance and neutron transfers from deuteron to the other nucleus in the pair. As a result is generated correspondingly  $^3\text{T}$ ,  $^4\text{H}$ ,  $^{n+1}\text{A}$ .  $^4\text{H}$  is the short-living isotope which then transforms to  $^4\text{He}$  due to  $\beta$ -decay.

Formation and especially movement of all these ions is impossible in the idle lattice such processes can occur only in defects of crystal structure. The amount and types of structure defects in metals and alloys depend on their prior thermo-mechanical processing that explains the nonreproductivity of the majority of experiments studying low energy nucleus reactions in metals.

## 2. CONDENSED MATTER NUCLEAR EFFECTS UNDER PLATONIC SYMMETRY

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Transient Bose-type condensations of deuteron cluster in near surface lattice or on surface trapping points are modeled<sup>1-9)</sup> as TSC (Tetrahedral Symmetric Condensate) or OSC (Octahedral Symmetric Condensate) with bosonized pseudo-particle states of symmetrically arranged electrons alternatively to symmetrically arranged deuterons, which cause very enhanced 4d or 6d multi-body fusion reactions to produce  $^4\text{He}$  main products.

Multi-particle arrangements by Platonic Symmetry can play intrinsic roles there in four steps: 1) molecular state arrangement, 2) Coulomb barrier penetration and 3) strong interaction at initial state, and 4) final state break-up.

Philosophical background of Platonic Symmetry (PS) is first mentioned<sup>10, 11)</sup>. Substantiated models for the 4 steps are shown with some numerical results.

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### 3. DEUTERONS-TO- $^4\text{He}$ CHANNELS

Comments and discussions are summarized on possible  $^4\text{He}$  production channels<sup>1-11)</sup> for two-body and multi-body deuteron-related fusion reactions.

- 1) The reason why  $^4\text{He}$  production channel by two-body d+d fusion can not be major branch is discussed in the view that the idea of reversed kinetic process (namely negative kinetic energy) is hardly realized to go to lower  $^4\text{He}$  excited state than excited states for n and p emission channels.
- 2) Then, the participation of third interaction into d-d strong interaction is generally discussed for going out to  $^4\text{He}$  production channels. As forces of the third interaction, gravity, weak-interaction, electro-magnetic interaction<sup>4-6, 11)</sup> and strong interaction are briefly compared.
- 3) Cluster deuteron fusion processes under Platonic symmetrical constraint in condensed matter<sup>1,2, 8-10)</sup> are lastly discussed. 4D fusion reactions by TSC (Tetrahedral Symmetric Condensate) and its outgoing channels, mainly going out to 2  $^4\text{He}$ -particles emission, are discussed.

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### *Introduction*

The author's research progress in the field of disordered semiconductors related to InN is connected with discovering of energy pockets for the electrons in the structures of these alloys [1, 2]. In this paper it is found that if electrons are located in the structures of these semiconductors their electrical charge changes, which can be less or greater than the electron charge in the vacuum, i.e. the electron obtains effective electrical charge. Possibilities, that the deuterium cationic atoms to have similar behavior in solids, are discussed.

### **Results**

The LCAO energy sub-bands CB1 (it is the minimum of the conduction band) and VB1 (it is the maximum of the valence band), which are parts of a corresponding LCAO electron band structure, are calculated for the following semiconductors:  $\text{In}_x\text{Ga}_{1-x}\text{N}$ ,  $\text{In}_x\text{Al}_{1-x}\text{N}$ ,  $\text{InN:O}$  and non-stoichiometric  $\text{InN:In}$ . They are provided in Fig.1 for  $\text{InN:O}$ . Energy pockets for electrons in CB1 (sectors 5 and 2 in Fig.1 with states  $\Gamma_{c1}^5$  and  $\Gamma_{c1}^2$  respectively) are identified.

It is found that if electron is in solid having variable energy band gap across the crystal its electrical charge changes – it can be greater or less than  $1.6 \cdot 10^{-19}\text{C}$ . Even the effective electron charge can approach zero value. These results come on the basis of model, which has been developed by the author, considering a break of electron charge symmetry in solids of this type.

It is discussed this model can be used for determination of the effective charge of a deuterium cationic atom if its charge symmetry is broken due to interaction with ions of solids.

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## **5. POSSIBLE GENERATION OF NEUTRONS BIRSTS IN FRAMEWORK OF ERZION MODEL & THEIR POSSIBLE REGISTRATION**

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In framework of Erzion model charged cosmic ray Erzion, stopping in special substance, begins to create Erzion nuclear catalysis chains with generation of neutrons bursts during  $\sim 1$ -1000 mks. It is proposed to use 2 methods for such neutrons bursts registration: as with registration of thermal neutrons in gas counters, so with fast neutrons registration in large ( $>m^3$ ) plastic scintillator. It is expected that such thermal neutron bursts in real Neutron Monitors must be appeared every day. Such events from fast neutrons can be observed every day also on the Spectrometric Scintillation Super-Telescope (SSTIS) creating in IZMIRAN for cosmic rays monitoring.

## 6. NUCLEAR WAVEFUNCTIONS, MATRIX ELEMENTS, AND COUPLED CHANNEL EQUATIONS BASED ON SYMMETRIC GROUP CONSTRUCTION

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The inclusion of phonon exchange in nuclear problems in general is not straightforward. We have developed methods which treat the spin and isospin algebra analytically, allowing the focus to be on the spatial part of the problem in the case of 3-body and 4-body problems. The approach is based on a construction of the microscopic nuclear wavefunction that takes advantage of the symmetric group. Once the wavefunctions have been constructed in this way, then the reduction of matrix elements is straightforward into spatial integrals. The systematic development of coupled channel equations also follows directly.

Once the microscopic nuclear problem has been put into this form, then the inclusion of other degrees of freedom, such as phonon modes, becomes possible [1]. The results allow us to compute matrix elements for  $d+d \rightarrow {}^4\text{He}$  and  $p+d \rightarrow {}^3\text{He}$  transitions including phonon exchange.

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## 7. RESONANT ELECTROMAGNETIC INTERACTION (EMI) IN LOW ENERGY NUCLEAR REACTIONS (LENR)

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Only recently has it become possible to trigger high energy particle emission and Excess Heat, on demand, in LENR involving PdD[1]. Also, most nuclear physicists are bothered by the fact that Excess Heat appears to be related to the least common deuteron (d) fusion reaction,  $d+d \rightarrow \alpha + \gamma$ . A clear consensus about the underlying effect has also been illusive. One reason for this involves confusion about the role of the strong force and the approximate (SU2) symmetry that applies in most strong force-dominated nuclear reactions: The fact that all d-d fusion reactions conserve isospin has been widely assumed to mean the dynamics is driven by the strong force interaction (SFI), NOT EMI. Thus, most nuclear physicists assume: 1. EMI is static and involves the conventional Coulomb Barrier; 2. Dominant reactions have smallest changes in incident kinetic energy (T); and (because of 2)  $d+d \rightarrow \alpha + \gamma$  is suppressed. But this assumes a stronger form of SU2 symmetry than is present;  $d+d \rightarrow \alpha + \gamma$  reactions are suppressed not because of large changes in T but because the interaction potential involves EMI, is dynamic (not static), the SFI is static, and because the two incident deuterons must have approximate Bose Exchange symmetry and vanishing spin. A generalization of this idea involves a resonant form of reaction, similar to the de-excitation of an excited neutral atom. But as opposed to the situation in a neutral atom, where net atomic charge is conserved (so that locally current and charge densities,  $\vec{J}$  and  $\rho$ , satisfy the conservation rule  $-\nabla \cdot \vec{J} = \frac{\partial \rho}{\partial t}$ ), in PdD, long-range coupling can take place, and it can become possible over finite periods of time, for charge not to be conserved across the boundaries of the solid. In the somewhat counter-intuitive limit in which d-d collisions and collisions between d's and electrons are actually suppressed, these forms of coupling can result in coherent (Bloch) oscillations, in which many deuterons can occupy a single or many wave-like (ion energy band) states that superficially resemble the lowest energy acoustical phonon modes, associated with vibrations of the Pd atoms. But because these modes do not conserve charge inside the solid, they are not phonon modes. Instead, they can include coupling between many possible modes in which the periodic regions of charge have poorly defined boundaries but are allowed to couple effectively with other modes that are slightly different. At the lowest energies (and longest timescales), the associated coupling can be viewed semi-classically as involving extremely "stiff" phonons, in which the solid effectively appears to move in a rigid manner, similar to the forms of coupling that occur in Umklapp processes. The associated

dynamics is similar to the situation that occurs in a Bose Condensed collection of particles in a periodic lattice (similar to Bose Condensed neutral, alkali atoms in an optical lattice). An important distinction is that in the PdD situation, only a very small fraction of the d's occupy this state, and because of the peculiar forms of coupling to the lattice, size dependent effects can become important. A key point is that because the d's can almost share a common energy, many forms of coupling to EMI can take place. And this can explain how to "overcome the Coulomb Barrier" (through a form of coherent, Zener-Ionic breakdown, similar to Zener-electronic breakdown in dielectrics) and why coupling through externally applied electric and/or magnetic fields can potentially explain how high energy particles ( $\alpha$ 's, neutrons and  $\gamma$ 's) can be created.

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## **8. THE INTERACTIONS OF ERZIONS WITH NATURAL ISOTOPES**

In the early 1990s, Hagelstein proposed that neutrons could be transferred between natural isotopes producing energy and explaining transmutation of heavy nuclei. The beauty of this idea was that there is no Coulomb barrier for neutral particles. Alas, the nuclear energy barrier, typically 8 MeV, is sufficient to suppress the rate of neutron hopping to immeasurably small values, and the idea was duly abandoned.

However it may be that other Exotic Neutral Particles (ENP) could catalyse neutron transfer without insuperable energy barriers. Independently John Fisher proposed a model involving poly-neutrons and Yuri Bazhutov proposed another based on Erzions. Both classes of particles are, of course hypothetical, but share numerous common features. In particular, the rates of reaction are expected to be very high permitting a tiny number of ENPs to create substantial heat and transmutation products.

The purpose of this paper is to examine whether the Erzion model is able to explain CMNS phenomena. To do so, we use ENSAP, a PC based software tool to enumerate all possible interactions of the hypothetical Erzions with natural isotopes. In some cases, beta radioactive products may be expected, and experiments should be designed to look for them.

In addition, beta radio-activity may be predicted but not observed. To preserve the Erzion model, it may be necessary to change masses of the particles.

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## 9. USE OF A QUANTUM MECHANICAL TUNNELING MODEL TO EXPLAIN THE GLOW DISCHARGE (GD) CHARACTERISTIC

## OF AN I-V CURVE

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The GD found during electrolysis of ordinary water has been observed for many years in our laboratory. The essential results can be described in detail by dividing the area under the I-V curve into specific regions. The excess heat and abnormal hydrogen production and associated NT have been reported in the past [1,2].

In this In this paper, a quantum mechanical tunneling model will be described to study GD characteristics in detail. Using a model similar to that used to describe a semiconductor tunnel diode [3], one can construct a phenomenological theory to explain many aspects of the GD experiments. A model calculation using a transfer matrix method to solve the relevant Schrödinger equation for a single barrier tunneling problem has been ddeveloped. (Double barrier problems have also been tried). The calculated results can be used to compare with our experimental results. The general agreement between the calculated and experimental I-V curve, confirms the theoretical tunneling model. The detailed comparison between experimental and theoretical results will be discussed in the meeting.

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10. On the bounded states of the two-body problem  
for purely "magnetic" interaction



In the frames of traditional quantum mechanics the different ways of insertion of "magnetic" interaction, using the simplest problems for two-body systems as an example, are discussed. It is shown that there is a large number of the variants of their examination, quite correct both from mathematical and physical points of view. However only some them permit the existence of mathematically and physically reasonable solutions. Nevertheless in some particular cases even the exact solutions can be obtained. The physical interpretation of those solutions and the possibility of their identification with neutrino 'atoms' ("ve" – states), excited states of deuteron ("np" – system), exotic states of "en" system etc. and the effects of their existence on the behavior of the probabilities of reactions at super low energies is discussed.

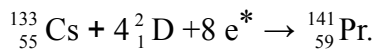
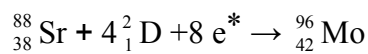
The increase of those probabilities can be interpreted as a basis of observable phenomena of nuclear transmutation of elements.

## **11. THEORY OF COLD NUCLEAR TRANSMUTATION<sup>1</sup>**

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The cold transmutation observed on the surfaces of Sr- or Cs-doped Pd/(CaO+Pd)Pd complexes<sup>2</sup> is interpreted to be a result of virtual  ${}^8_4\text{X}$  particle addition by the confinement of four interstitial solute deuterons jumping from four tetragonal sites to octahedral ones sites along [111] directions in a Pd/CaO lattice and electrostatic attraction due to the charge transfer in the chains of atoms; i.e., an alternating tetrahedral-octahedral site arrays with the aid of the electron-phonon charge-density wave coupling and electropionic attraction effects due to the capture of excited electrons from Pd and Ca by vacuum pumping:



The deuterons are a source of supply for reparation for mass balance in the transmutation. The roles of CaO are dissolution of Sr and Cs and the creation of a good route for deuteron rushing. We have reported the electron and the neutrino in a nucleus enhance the fusion reaction<sup>3</sup> as well as the catalytic effect of neutral pions for formation of nitrogen in Earth<sup>4</sup>.

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## 12. NEW DISCOVERY: QUANTIZATION OF ATOMIC AND NUCLEAR REST MASS DIFFERENCES

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We come to the conclusion that all atomic models based on either the Newton equation and the Kepler laws, or the Maxwell equations, or the Schrodinger and Dirac equations are in reasonable agreement with experimental data. We can only suspect that these equations are grounded on the same fundamental principle(s) which is (are) not known or these equations can be transformed into each other. We proposed a new mechanism of LENR: cooperative processes in the whole system – nuclei + atoms + condensed matter - nuclear reactions in plasma - can occur at smaller threshold energies than the corresponding ones on free constituents. We were able to quantize [1] phenomenologically the first time the differences between atomic and nuclear rest masses by the

formula:  $\Delta\Delta M = \frac{n_1}{n_2} \cdot 0.0076294$  (in MeV/c<sup>2</sup>),  $n_i = 1, 2, 3, \dots$ . Note that this quantization rule is

justified for atoms and nuclei with different A, N and Z and the nuclei and atoms represent a coherent synchronized open systems - a complex of coupled oscillators (resonators). The cooperative resonance synchronization mechanisms are responsible for explanation of how the electron volt world can influence on the nuclear mega electron volt world. It means that we created new possibilities for inducing and controlling nuclear reactions by atomic processes grounded on the fundamental law of physics – conservation law of energy.

The results of this research field can provide new ecologically pure mobile sources of energy independent from oil, gas and coal, new substances, and technologies. For example, this discovery gives us a simple and cheap method for utilization of nuclear waste.

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### 13. THEORETICAL ESTIMATION OF D-D FUSION REACTIONS RATES IN DEUTERATED PALLADIUM

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We calculated reaction rates of D-D fusion for atomic deuterium residing in crystal structures of deuterated metals, particularly for the case when a flow of free electrons (conduction electrons) takes place. Computer modeling was performed to evaluate the screening action of electrons which causes conditions for deuterons approaching one another. Roles of orbital and of free electrons in the screening mechanism were investigated. A combination of the quantum-mechanical and of the classical methods was applied for calculation of behavior of many-particle systems using the method developed by us earlier [1].

Some quantum-mechanical tasks related to the problem of low-energy nuclear reactions for simple systems are also considered.

This work is supported by RFBR (grant No 05-05-64930).

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## 14. PROGRESS ON PHONON EXCHANGE MODELS FOR EXCESS HEAT IN METAL DEUTERIDES

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The basic idea in the models under consideration is that nuclear reactions at different sites in condensed matter can be coupled indirectly through phonon exchange with a common highly excited phonon mode. In schemes currently of interest, the reaction energy from  $D_2$ - $^4\text{He}$  transitions is transferred elsewhere, so that the reaction energy is not expressed through energetic products as in the vacuum case. Recent progress that we will describe includes: (1) a formulation of nuclear reaction matrix elements including phonon exchange using general correlated nuclear wavefunctions based on a symmetric group construction [1]; (2) model results for excitation transfer between two-level systems indirectly coupled to an oscillator, and energy exchange between two-level systems and a low energy oscillator, in strong coupling limits [2]; (3) estimates for reaction rates based on these models [2].

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## **15. ANOMALOUS NUCLEAR REACTIONS CREATED BY TORSION FIELD WITHIN ELECTROCHEMICAL SYSTEMS**

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Physicists know that we are immersed in an energy field—zero point electromagnetic energy field. The vacuum is now considered as filled with randomly fluctuating fields having the zero point energy spectrum. Anomalous heat and nuclear phenomena in electrical discharge systems including electrochemical cells with ultrafast processes within double layers could be explained by tapping the zero point energy associated with dynamic Casimir effect. Nuclear products with high concentration, unidentified tracks with highly collimated lines of low energy nuclear reactions in the electrochemical systems and glow discharge devices were recorded by CR-39 solid detectors and photo-films, and localized spots with chemical alterations were observed at our laboratory and others in world. The yields of nuclear transmutation products are related to the current distribution on the cathode surface. Transient processes in an open dynamic system

always create vortex effect. A theoretical model of vortex dynamics creating torsion field proposed by Xingliu Jiang has been used for explanation of so called “cold fusion”. Anomalous nuclear reactions generated by axial accelerated particles due to the torsion field are essential.

## 16. POLYNEUTRON THEORY

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It is suggested that neutron clusters of sufficient size are bound and stable against strong decay and that these massive neutron isotopes can react with ordinary nuclei by transferring neutrons to them, accepting neutrons from them, and binding with them to form composite nuclei. Implications of this enlarged scope of nuclear physics are explored, including chain reactions with nuclear fuels such as  $^{18}\text{O}$  and  $^2\text{H}$  that produce energy,  $^4\text{He}$ ,  $^3\text{H}$ , and a wide range of nuclear transmutations. Natural explanations emerge for these and other nuclear phenomena for which evidence has been accumulating over the past two decades. A theoretical framework is provided for guiding future research and for exploring potential applications.

## 17. ABOUT THE FEATURES OF LEPTON TERLETSKI QUADRIGA IN ELECTROMAGNETIC VACUUM

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### Abstract

The features of Lepton Terletski Quadriga (LTQ=KTJI) in vacuum with electro-magnetic constants  $\varepsilon_0$  and  $\mu_0$  have been considered. The consideration is based on the assumption that  $\varepsilon_0$  and  $\mu_0$  are correspondingly specific linear capacity and inductance of electro-magnetic structure of vacuum in the form of LTQ (KTJI):

$$\varepsilon_0 = \varepsilon_{\hat{E}\hat{O}\hat{E}} = C/l \text{ и } \mu_0 = \mu_{\hat{E}\hat{O}\hat{E}} = L/l,$$

where C and L – capacity and inductance of positron electric dipole  $\hat{e}^+ - \hat{e}^- \bar{p}_Y = e\bar{l}$  and of magnetic negaton dipole  $\check{e}_+ - \check{e}_- \bar{p}_M = g\bar{l}$  KTJI.

It is shown that if the positron energy of LTQ to defined through  $\varepsilon_0$  as  $\hat{W} = \frac{e^2}{2C} = \frac{e^2}{2\varepsilon_0} \frac{1}{l}$

and to compare it with the energy of a quantum  $E = \hbar\omega = h\frac{c}{\lambda}$ ;  $h\frac{c}{\lambda} = \frac{e^2}{2\varepsilon_0} \frac{1}{l}$ , then  $l$  will come

$$\text{up to } l = \frac{e^2}{2\varepsilon_0 hc} \lambda = 7,3 * 10^{-3} \lambda = \alpha \lambda.$$

Then it follows that the CONSTANT OF FINE STRUCTURE is equal to the relation of the length of the positron dipole  $\hat{e}^+ - \hat{e}^-$  to the quantum wave length  $\alpha = l/\lambda$ . Based on that it

was proposed to determine that LTQ is the electromagnetic cell of vacuum with  $\varepsilon_0 = \varepsilon_{\hat{E}\hat{O}\hat{E}}$  and  $\mu_0 = \mu_{\hat{E}\hat{O}\hat{E}}$ , that provides the equal phase speed of quanta of different frequencies:

$$v_\varphi = \frac{1}{\sqrt{\varepsilon_0 \mu_0}} = \frac{1}{\sqrt{\varepsilon_{\hat{E}\hat{O}\hat{E}} \mu_{\hat{E}\hat{O}\hat{E}}}} = C = C_{\hat{E}\hat{O}\hat{E}}, \text{ which looks like in an electric line of}$$

transferring energy without losses  $v_\varphi = \frac{1}{\sqrt{C_0 L_0}}$ , where  $C_0, L_0$  - capacity and inductance per

unit of the line length.



## 18. ESTIMATION OF GEOFUSION PROBABILITY

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Conditions for the fusion in the Earth are much less suitable than in artificial systems first of all by low deuterium concentration in natural hydrogen (0,015%), nevertheless some processes similar to that initiated experimentally can exist in the nature. Diffusion of hydrogen atoms in native iron, cavitation in water solutions, red-ox reactions etc. are among them. We based on theoretical analysis, computer modeling and experimentally revealed conditions favorable for the fusion reactions to seek for geological situations where fusion products can probably occur. The Earth core forming nearly 1/3 of the planet's mass is the most probable region for the geofusion. Physical-chemical and cosmo-chemical data strongly suggest the presence of hydrogen admixture in the iron core. Using the model of dynamic deformation of electron orbitals [1] we have calculated fusion reactions rates during hydrogen ions diffusion along octahedral positions of the close atom packing in gamma-iron, stable at high pressures. The evaluated rate of  $D+H \rightarrow {}^3\text{He}+5.5\text{MeV}$  reaction is  $10^{-18} \text{ s}^{-1}$  per DH pair for 0.1 at % hydrogen in iron. The calculation of the energy efficiency of this reaction for the Earth core mass  $1.88 \cdot 10^{25} \text{ g}$  reveals  $11 \cdot 10^{12} \text{ W}$  released from the core in average. Hence several fractions of atomic percents of hydrogen in the core can afford the heat flow from the core  $13 \cdot 10^{12} \text{ W}$  found by geophysicists. Zones of lithosphere plates subduction are another probable regions for fusion reactions. Downsinking of sedimentary and metamorphic rocks with minerals containing water into asthenosphere causes their dehydration at high temperatures at a depth, explosive vapor-gas release in volcanoes and geysers, cavitation processes in which, according to the experimental data, evolve fusion reactions. In the oceanic rifts contacts of aluminosilicate melts with sea water cause its boiling and hydrothermal processes, accompanied by cavitation phenomena and red-ox reactions, which are the factors favorable to the fusion reactions. The correlation of heat and helium flows in these zones bears witness to nuclear fusion. Geochemical data on hydrogen and helium isotopes, which point to the fusion reactions, are discussed.

This work is supported by RFBR (grant No 05-05-64930).

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## 19. PHYSICS OF THE COLD FUSION PHENOMENON

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The cold fusion phenomenon (CFP), or the condensed matter nuclear science (CMNS), was discovered in 1989 by Fleischmann, Pons and Hawkins and extensively investigated thence by many researchers giving experimental data sets with tremendous amounts and variety of qualities unexpected by the pioneers themselves. We have given tiny scientific steps to explore the physics and chemistry of CFP in many papers in these 17 years which were compiled as a recent book<sup>1□</sup>. In the works, the riddles including the discrepancy between the Fleischmann's hypothesis and experimental data sets were resolved, which had been noticed already by the pioneers that was mentioned as "The most surprising feature of our results however, is that reactions (v) and (vi) are only a small part of the overall reaction scheme and that the bulk of the energy release is due to an hitherto unknown nuclear process or processes (presumably again due to deuterons)."

In this paper, following themes are investigated further to explore CFP on the results obtained and developed in nuclear and solid state physics; the neutron halos of medium mass-number nuclides, the nonlocal behavior of proton/deuteron wavefunctions in transition-metal hydrides/deuterides, the super-nuclear interaction between neutrons in adjacent lattice nuclei catalyzed by interstitial protons/deuterons, formation of CF-matter composed of neutron clusters floating in a thin neutron liquid, the interaction of lattice nuclei with the neutron clusters resulting in CFP.

The excited energy levels of a neutron in a nuclide near the evaporation level have a high level density and may be influenced little by the change of mass number. This is the reason that samples with transition metals with natural isotope ratios work as positive agents for CFP. Furthermore, the diffusivity of protons/deuterons in transition metals is surely correlated with extension of wave functions in them while the relation is pointed out by us but is not well resolved yet. It should be pointed out the interesting problem of the chemical riddles concerning the favorable affinity of transition metal- electrolyte combinations, e.g. Pd-Li, Ni-K, etc. are experimentally known but not explored until now.

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## 20. THE EXTENDED MICRO HOT FUSION SCENARIO

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When hydrogen is absorbed by metals, then it forms bubbles around impurities and lattice defects of the metal. During their growth until a diameter of several micrometers, the bubbles deform the metal lattice and create mechanical stresses. After several hours, the mechanical stresses have become strong enough to create cracks which propagate through the metal lattice. The cracks are formed preferentially between the hydride bubbles and the weaker hydrided metal. Palladium dihydride is a semi-metal. Therefore the different electronegativities of metal and hydrogen generate positively electrically charged hydride bubble surfaces. Hence, the crack sides become electrically charged. Within the cracks of typically one micrometer width and ten to hundred micrometers length there arises an electric field strength of one hundred million volts per centimeter. Within strongly hydrided metals, electrons are bound stronger than hydrogen nuclei. Therefore the electric field within the cracks allows the hydrogen nuclei of the bubbles to accelerate until they reach energies of typically ten kilo-electron-volts.

Within the weaker hydrided metal, the hydrogen nuclei transfer their kinetic energy of several kilo-electron-volts to the metal lattice during a path of one tenth of a micrometer. This energy transfer creates hot spots within the hydrided metal with a mean temperature of typically ten thousand degrees Celsius and a pressure of ten billion Pascal. Within the hot spots, the hydrided metal is gaseous. Because of the high internal pressure, the hot spots transfer their heat energy explosively to the surrounding solid hydrided metal, where the explosions generate further cracks. When such a crack collides with the surface of a hydrided bubble, then the electrically charged bubble surface generates a strong electric field within the crack. Again, the electric field accelerates hydrogen nuclei from the bubble until they get several kilo-electron-volts of energy. Hence, a cycle reaction of the creation of cracks, electric fields, kilo-electron-volt hydrogen nuclei, hot spots, and micro-explosions is generated. This cycle reaction might result in the pulverization and even explosion of the entire metal hydride.

If the hydrogen isotope deuterium is used, then this cycle reaction is accompanied by fusion reactions. These fusion reactions occur when the kilo-electron-volt deuterons reach the other crack side and fuse with the non-accelerated deuterons of the weaker hydrided metal. This cycle reaction which includes deuteron fusion reactions is called the “extended micro hot fusion scenario”. This scenario was suggested by Roman Sioda and me [1, 2]. It is able to explain the neutron emissions reported by Jones et al. [3], the neutron bursts reported by De Ninno et al. [4,

5] and Menlove et al. [6], the simultaneous heat and neutron bursts reported by Gozzi et al. [7], and the explosions of cold fusion cells reported by Fleischmann et al. [8].

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## 21. SELECTIVE RESONANT TUNNELING MODEL FOR LATTICE CONFINED DEUTERONS

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Selective resonant tunneling has been successfully applied to both hot fusion and “cold fusion”. It gives not only the best formula to calculate the hot fusion cross-section of  $d+t$ ,  $d+d$ , and  $d+^3\text{He}$  in the low energy region, but also explains the puzzle of “excess heat” without strong neutron and gamma radiation for low energy nuclear reaction. In the present paper, it is shown that when deuterons are confined by crystal lattice, the Block Theorem requires:

- (1) A deuterium flux is necessary to keep the quantum steady state in the lattice;
- (2) The fusion reaction rate is enhanced by a factor of  $\theta$ . Here  $\theta$  is a big number in the order of  $10^{27}$  (Gamow factor in the beam-target case is in the order of  $(1/\theta)^2$ ).
- (3) The Chubb-Bloch state of electrons which provide the stronger screening effect.

The density of states in energy band would be discussed along with the Chubb-Bloch state of deuterons in lattice. It may provide a mechanism of negative feedback to stabilize the steady state which is necessary for this macroscopic quantum mechanic phenomenon.

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## 22. PHOTON/PHONON-AIDED LOW-ENERGY NUCLEAR REACTIONS IN CONDENSED MATTER

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Models to account for the observed experimental results for low-energy nuclear reactions in palladium-deuteride systems have been extended from earlier work [1]. The crucial idea is a mechanism of improved probability for the needed penetration of the Coulomb barrier for a D-D reaction. This facilitation occurs, in condensed matter, with the formation of D<sup>-</sup> ions at special frequency modes (e.g. via phonons) and, specifically for the laser-stimulated case, with utilization of an enhanced optical potential at a selected interface or structure. Spatial-confinement and alignment modes in various media are explored. Resonant modes, in particular, are studied as a means of raising the interaction rate and/or peak energies in a low average-energy medium. Such mechanisms, which may be coupled to work in concert to increase the probability of barrier penetration, are of greatest interest.

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## 23. CLUSTER REACTIONS IN LENRS

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A distinctive array of nuclear reaction products was observed previously in the “Patterson” flowing packed-bed type electrolytic cell experiments using multi-layer thin films of metals on mm-size plastic beads [1]. The swimming electron layer and a new magic number theory were proposed to explain this. More recently these theories have been expanded into a “cluster” model to explain a wider range of transmutation experiments [2]. The cluster model is consistent with certain measurements of energetic charged-particle emission during thin film electrolysis, with observations suggesting localized reactions and also with x-ray production during plasma bombardment experiments [3-6]. The cluster reaction concept and supporting experimental data will be discussed in this presentation. In addition to explaining transmutations, if understood and optimized, cluster reactions could lead to an important new power source based on LENR.

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## 24. Issues for Charged-Particle and X-Ray Emission in LENR Experiments

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Various researchers have reported charged particle emission from cold fusion experiments based on CR-39 tracking methods [1-3]. Low energy x-rays have also been observed by some using solid-state detectors and also TLD methods. In several cases, attempts have been made to correlate emissions with cold fusion reactions, but this remains open to interpretation. The design for these experiments differs in detail but generally involved electrolysis. The characteristics of these radiations as reported by various researchers differ greatly. Lipson et al. [1] found distinct energy groups of charged particles, identified as  $\sim 1$ -MeV protons and  $\sim 10$ -MeV alpha particles. P. Mosier Boss, et al., [2] as well as R. Oriani and J. Fisher [3] report dense track clusters due to unidentified particles, sometimes coming from regions outside of the electrode. Soft x-ray emission has also been reported in other types of experiments. A. Karabut S.A. Kolomeychenko [4] report 1-keV coherent x-ray radiation emission during plasma bombardment experiments while Miley et al., [5] find softer diffuse emission under somewhat different discharge characteristics.

In principle, the origin of all of these emissions should be from a common reaction, but the differences seem too large to justify. Some explanations are discussed in the presentation.

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## **25. PHENOMENOLOGICAL MODEL OF TRANSMUTATION AND ELEMENT DISTRIBUTION IN TRANSMUTATION PRODUCTS**

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A phenomenological model of transmutation process is proposed. Possible end products obtained in this process taking into account energy balances of nuclear transformations are calculated. Analysis of experimental data and phenomenological model yield that multiple transmutation processes (processes with participation of both primary and secondary chemical elements – products of previous transmutations) cause an appearance of stable atomic nuclei of all chemical elements in its products. It is assumed that element distribution in hyper-multiple transmutation tends to become “universal”, i.e. independent of element composition of a matter, in which transmutation processes started. The “universal” distribution has maximums related to nuclear “magic” numbers. Element abundance in the earth’s crust correlates with element abundance in zirconium transmutation case at its electron beam melting. Based on above circumstances, a hypothesis is offered that nucleosynthesis and power generation in the Universe occur, among other things, due to low energy transmutation processes.

## **26. RATES FOR LOW ENERGY NUCLEAR REACTIONS AT SURFACES**

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Several requirements and features for LENR are known from experiments. Prime among them is the need for high loading, that is, ratios of protons or deuterons to lattice atoms that are near unity. One open basic question of both scientific and technological importance is the locations at which such reactions occur in heavily loaded materials. It matters greatly whether the reactions take place in the bulk of materials or at their surfaces. This paper examines the evidence for and implications of LENR occurring on or very near the surfaces of materials.

Experimentally, there are a few types of evidence for LENR taking place at the surfaces of materials. Such experimental results will be reviewed. Theoretically, Widom and Larsen published a concept that postulates the production of very slow neutrons on the surfaces of heavily loaded lattices and their subsequent reactions with nearby nuclei.

The rates for generation of heat and nuclear products are computed in this paper as a function of (1) the total area of the surfaces on which reactions can occur, (2) the fraction of the area that is active at any time, (3) the fundamental reaction rates, that is, the number of reactions per unit of active area per second and (4) the energy or number of products produced per reaction. Each of these factors and their limits are reviewed. A graphical means of relating the four factors over wide variations has been devised. It permits facile estimates of excess power and of the production rates of new elements for various combinations of the factors.

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The field physics is a new scientific trend, which develops the idea of dynamical nature of mass. Thus in field physics the masses of all particles and objects, including the elementary particle masses of rest do not represent their internal properties (the quantity of matter), but are caused by external interactions (fields).

The conception of dynamical mass leads to traditional results in classic conditions, however at small distances it considerably changes the mechanical properties of the system. For instance, according to field physics, at the distances of the order of  $10^{-15}$  m. the strong attraction of two identically charged particles (protons) converts into the adequately strong repulsion, and this behavior becomes possible because of the gravitational fields. This fact permits the construction of the new model of the nuclear interactions, and leads to better understanding of new approaches to the description of nuclear fusion and element transmutation.

The main ideas of this conception can be found in the book "**The field physics or how the World is arranged**" or at [www.fieldphysics.ru](http://www.fieldphysics.ru)

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The results of measurement of vertical current of non-ion nature on the coast and ice of Novosibirsk reservoir in January 2007 have shown that this unusual current is directed upwards over the water and downwards over the land (direction of the current is defined by the positive charge motion). We suppose the non-ion current (far from coast over the water it's about 10 mA/m<sup>2</sup> and at coastal line is close to zero) flows by dark matter. The dark matter consists of hypothetical long strings ("fluxes") with diameter about 60 femtometers on which being is cold nuclear transmutation in the water. It explains known effect of change of direction of horizontal component of the geomagnetic field along the coastal line and is possible reason of coastal squalls when the storm clouds are absence. Measurements of the non-ion current inside and near the large magnetic screens confirm a possible electromagnetic nature of squalls, tornados and hurricanes. These phenomena are believed to be produced by the non-ion currents induced by nuclear transmutations in the thread-like dark matter.

## 29. ON THE POSSIBILITY OF THE DINEUTRON EXISTENCE AND THE DIFFICULTIES OF IT'S EXPERIMENTAL DETECTION

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In the frames of nonrelativistic quantum mechanics with due regard for spin-spin and spin-orbital interactions the possibility of the bounded states (real and virtual) with negative (common nuclei), positive (resonances) and zero energies is investigated. The case with zero energy due to the limited lifetime (instability) despite of good localization should most likely be considered as resonances.

It is shown that proceeding from the general principles of quantum theory (ordinary Schrödinger equation with traditional insertion of electromagnetic interaction by extension of derivatives and inclusion of Pauli term is used) the Hamiltonian without free parameters which under certain condition permits the existence of exact solutions for bounded states of two neutrons (dineutron) can be obtained. The dineutron properties, the difficulties of it's detection and the effects of its existence on traditional nuclear physics including nuclear transmutation of elements at low energies are analyzed.

### 30. FUNDAMENTAL INTERACTIONS AND THEIR RELATIVE CONTRIBUTION TO THE NUCLEAR REACTIONS AT LOW ENERGIES.

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The influence of the fundamental interactions (strong, weak, electromagnetic and gravitational) on the low energy processes in condensed media is analyzed. It is shown that the gravitational interaction on the distances of atomic or nuclear order is negligibly small and can be ignored, but the electromagnetic interaction, under certain definite conditions can lead to the considerable increase of the probabilities of different reactions (including nuclear) and generate exotic bounded states, yet experimentally unobserved at present ("neutrino atoms", dineutrons, dineutrinos, "magnetic" hydrogen etc.). The existence of such states (including virtual) can explain the observable exotic phenomena of nuclear transmutation of elements in condensed media.

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### **31. COLD NUCLEAR FUSION MECHANISM AT CRACK TIP SPEARHEAD LOCATED DEEP UNDER THE GROUND**

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Ore mines become deeper as mineral resources are extracted. At a depth of approximately 500 meters and more specific gas dynamics phenomena are observed, which are not typical at shallow depths. Power effects, e.g. on a bench coal, remain the same, while the response of the mining mass becomes inadequate to the effects. For example, once 14.5 thousand t of coal and 250 thousand cubic m of methane were thrown out from a 1-m bench coal. According to geologists' findings, amount of methane discharged at a coal outburst can be 10-times greater than that contained in the bench coal. The gas is discharged in a mode of filtration in the absence of permeability. The gas secrete volume is so great that one may speak about discontinuous diffusive superpermeability.

The author proposes that the described phenomenon can occur under the effect of a mechanical energy flow through aligning of defects (conductive channels for this flow) along field force lines. A mechanism of discontinuous self-decomposition of geomaterial under the effect of rock pressure, i.e. external power source, was developed basing on these effects. It is not thermodynamic decomposition of solid solution, i.e. a process due to internal power sources, like at heating. It is a mechanism of gas generation from a solid atomic solution (not molecular), when new elements and materials are synthesized as a result of nuclear reactions. The heaviest flow of rock pressure ("wind") appears at a crack tip spearhead. This "wind" "blows out" nuclei of different elements and free electrons, i.e. basic material for building atoms and molecules, into micro defect cavities. One may know that this type of synthesis is cold by touching the rock by a hand. For some time hydrogen and oxygen are in the form of atoms. As a result of interaction between them water and hydrogen dioxide are generated. If hydrogen is not enough, only water is generated.

Thermodynamics describes closed systems, which do not exist in nature. Another thermodynamics is needed to explain the CNF (cold nuclear fusion) phenomenon which would be based on balance of in- and out-flows of energies (balance of sinks and sources) rather than on conservation laws.

## 32. MANY-BODY EFFECTS OF BOSE PARTICLE SYSTEM IN SOLID

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Many-body effects strongly depended on the symmetry of the wave functions. And the screening effect by conduction electrons affects the interactions between charged particles in solids. In this study, the behaviors of charged Bose particles in solids are estimated by considering those two factors. Firstly, we introduce the pseudopotential, which acts on the Bose particles in the same way that symmetrization of the many-body wave functions will do. This is done by calculating the matrix elements of the density operator in the quantum statistical mechanics [1]. Secondly, screened interactions between charged Bose particles are introduced by using Hartree-Fock equation.

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### **33. POSSIBLE CATALYSIS OF NUCLEAR TRANSMUTATIONS AT ELECTRONIC SCREENING OF NUCLEUS CHARGES IN THE DENSE LOW-TEMPERATURE PLASMA OF THE POWERFUL PULSING INDUCTION DISCHARGE**

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The theoretical analysis of possible circuit solutions for input of energy in plasma of powerful induction discharges is carried out. It is shown that the circuit solution based on fly-back pulsing schema is the most effective in plasma carrier gas with pressure, close to atmospheric pressure. In this case at quantity of inlet energy is higher than a threshold level at which magnetic pressure is comparable to pressure of plasma carrier gas the formation of a current of the accelerated electrons is possible in plasma with toroidal geometry at simultaneous replacement of plasma from area of the space engaged in a toroidal magnetic field. As the result the toroidal current layer [1] may be generated that stabilization may be carried out with the help of rotary circulation of plasma carrier gas. The high density of an electric current and high energy of electrons of the toroidal current layer allow expecting for high parameters of electronic screening of nucleus in a scope of a current layer. It is shown that for the one-charging nucleus the maintenance of effective screening (flesh up to the sizes of nuclear gauge) is possible and the nuclear fusion is feasible. Velocity of nuclear fusion for case deuterium plasmas is estimated. Calculation of an energy efficiency of nuclear transmutation for various parameters of the induction discharge process is carried out.

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### 34. FORM OF NUCLEAR FUSION IN SOLID CRYSTALS

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In analogy of self-organization in molecular level, the authors first discuss configurations (forms) of condensed matter, and propose a theory that needs the following two requirements.

- 1) The configuration of every object, including atomic nuclei, is either a combination or a modification of regular polyhedra.
- 2) Mutual bonds between atomic nuclei are analogous to mutual bonds between atoms and molecules.

Requirement 1 is from the theory of “form” in Plato's *Timaeus* (*Timaeus*, chapter 20), and Requirement 2 is from the theory of existence in Aristotle's *Metaphysics*: namely, analogy makes various phenomena to be a singular existence (*Metaphysics*, book 12, chapter 4).

Requirement 1 is satisfied with the Plato's theory as in the solar system according to Kepler, the molecular structure according to modern chemistry, the atomic structure according to Professor Matthias Brack of Germany, and the nuclear structure model according to Yabuuchi.

Requirement 2 is analogous to the mutual bonds between condensed matters in each respective stage of matter, while simultaneously satisfying Requirement 1. In the case of nuclear fusion, the mutual charged-pion-bonds in atomic nuclei can be considered analogous to the mutual electron bonds in chemical molecules.

As an example, theories of nuclear fusion can be constructed naturally in analogy to chemical reactions. Examples of this analogy include the ground state energy of the electron orbit in a condensed molecule in sub-nanometer level confining atomic nuclei. Crystallized sodium chloride and fully deuterium-loaded palladium crystal lattice are analogous. Hydrogen acceptors in chemical reactions and proton/deuteron acceptors by “form” in nuclear reactions are also analogous.

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## NOTES











