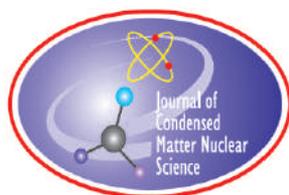


# **JOURNAL OF CONDENSED MATTER NUCLEAR SCIENCE**

**Experiments and Methods in Cold Fusion**

**Proceedings of the 20th International Conference  
on Condensed Matter Nuclear Science, Sendai,  
Japan, October 02–07, 2016**

**VOLUME 24, October 2017**



# **JOURNAL OF CONDENSED MATTER NUCLEAR SCIENCE**

Experiments and Methods in Cold Fusion

## **Editor-in-Chief**

Jean-Paul Biberian

*Marseille, France*

## Editorial Board

Peter Hagelstein  
*MIT, USA*

Xing Zhong Li  
*Tsinghua University, China*

Edmund Storms  
*KivaLabs, LLC, USA*

George Miley  
*Fusion Studies Laboratory,  
University of Illinois, USA*

Michael McKubre  
*SRI International, USA*

# **JOURNAL OF CONDENSED MATTER NUCLEAR SCIENCE**

**Volume 24, October 2017**

© 2017 ISCMNS. All rights reserved. ISSN 2227-3123

This journal and the individual contributions contained in it are protected under copyright by ISCMNS and the following terms and conditions apply.

## **Electronic usage or storage of data**

JCMNS is an open-access scientific journal and no special permissions or fees are required to download for personal non-commercial use or for teaching purposes in an educational institution.

All other uses including printing, copying, distribution require the written consent of ISCMNS.

Permission of the ISCMNS and payment of a fee are required for photocopying, including multiple or systematic copying, copying for advertising or promotional purposes, resale, and all forms of document delivery.

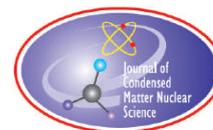
Permissions may be sought directly from ISCMNS, E-mail: [CMNSEditor@iscmns.org](mailto:CMNSEditor@iscmns.org). For further details you may also visit our web site: <http://www.iscmns.org/CMNS/>

Members of ISCMNS may reproduce the table of contents or prepare lists of articles for internal circulation within their institutions.

## **Orders, claims, author inquiries and journal inquiries**

Please contact the Editor in Chief, [CMNSEditor@iscmns.org](mailto:CMNSEditor@iscmns.org) or [webmaster@iscmns.org](mailto:webmaster@iscmns.org)





# JOURNAL OF CONDENSED MATTER NUCLEAR SCIENCE

Volume 24

2017

## CONTENTS

Opening Address – *Dr. Jirohta Kasagi*

Mayor's Speech – *Sendai City Mayor Emiko Okuyama*

Welcome Address – *Dr. Kimio Hanawa*

Welcome Address – *Dr. Hiroyuki Hama*

### RESEARCH ARTICLES

- The Fleischmann–Pons Calorimetric Methods, Equations and New Applications 1  
*Melvin H. Miles*
- CMNS Research – Past, Present and Future 15  
*Michael C.H. McKubre*
- Fluorescence-based Temperature Sensor for Anomalous Heat from Loaded Palladium Electrodes with Deuterium or Hydrogen 25  
*Sangho Bok, Cherian Mathai, Keshab Gangopadhyay, Shubhra Gangopadhyay, Orchideh Azizi, Jinghao He, Arik El-Boher, Graham Hubler and Dennis Pease*
- The *Zitterbewegung* Interpretation of Quantum Mechanics as Theoretical Framework for Ultra-dense Deuterium and Low Energy Nuclear Reactions 32  
*Francesco Celani, Antonino Oscar Di Tommaso and Giorgio Vassallo*
- Effects of D/Pd Ratio and Cathode Pretreatments on Excess Heat in Closed Pd/D<sub>2</sub>O+D<sub>2</sub>SO<sub>4</sub> Electrolytic Cells 42  
*Jie Gao, Wu-Shou Zhang and Jian-Jun Zhang*
- LENR Theory Requires a Proper Understanding of Nuclear Structure 60  
*Norman D. Cook*

Catalytic Mechanism of LENR in Quasicrystals based on Localized Anharmonic Vibrations and Phonons <i>V. Dubinko, D. Laptev and K. Irwin</i>	75
Statistical Mechanics Models for PdH <sub>x</sub> and PdD <sub>x</sub> <i>Peter L. Hagelstein</i>	87
Developing Phonon–Nuclear Coupling Experiments with Vibrating Plates and Radiation Detectors <i>Florian Metzler, Peter L. Hagelstein and Siyuan Lu</i>	98
Coupling between the Center of Mass and Relative Degrees of Freedom in a Relativistic Quantum Composite and Applications <i>Peter L. Hagelstein and Irfan U. Chaudhary</i>	114
Stabilization of Nano-sized Pd Particles under Hydrogen Atmosphere <i>T. Hioki, A. Ichiki and T. Motohiro</i>	123
Increased PdD anti-Stokes Peaks are Correlated with Excess Heat Mode <i>Mitchell R. Swartz and Peter L. Hagelstein</i>	130
Fusion of Light Atomic Nuclei in Vacuum and in Solids and Two Ways of Mastering Nuclear Fusion Energy <i>V.F. Zelensky</i>	146
Experimental Device of Cold HD-Fusion Energy Development and Testing (Verification Experiment) <i>V.F. Zelensky, V.O. Gamov, A.L. Ulybkin and V.D. Virich</i>	168
Anomalous Excess Heat Generated by the Interaction between Nano-structured Pd/Ni Surface and D <sub>2</sub> Gas <i>Takehiko Itoh, Yasuhiro Iwamura, Jirohta Kasagi and Hiroki Shishido</i>	179
Replication Experiments at Tohoku University on Anomalous Heat Generation Using Nickel-based Binary Nanocomposites and Hydrogen Isotope Gas <i>Y. Iwamura, T. Itoh, J. Kasagi, A. Kitamura, A. Takahashi and K. Takahashi</i>	191
Collaborative Examination on Anomalous Heat Effect Using Nickel-based Binary Nanocomposites Supported by Zirconia <i>Akira Kitamura, Akito Takahashi, Koh Takahashi, Reiko Seto, Yuki Matsuda, Yasuhiro Iwamura, Takehiko Itoh, Jirohta Kasagi, Masanori Nakamura, Masanobu Uchimura, Hidekazu Takahashi, Tatsumi Hioki, Tomoyoshi Motohiro, Yuichi Furuyama and Masahiro Kishida</i>	202
Implications of the Electron Deep Orbits for Cold Fusion and Physics – Deep-orbit-electron Models in LENR: Present and Future <i>Andrew Meulenberg and Jean-Luc Paillet</i>	214
Physical Reasons for Accepting the Deep-Dirac Levels– Physical Reality vs Mathematical Models in LENR <i>Andrew Meulenberg and Jean-Luc Paillet</i>	230

Fundamental Experimental Tests toward Future Cold Fusion Engine Based on Point-compression due to Supermulti-jets Colliding with Pulse (Fusine) <i>Ken Naitoh, Jumpei Tsuchiya, Ken Ayukawa, Susumu Oyanagi, Takuto Kanase, Kohta Tsuru and Remi Konagaya</i>	236
Observation of Anomalous Production of Si and Fe in an Arc Furnace Driven Ferro Silicon Smelting Plant at levels of Tons per day <i>C.R. Narayanaswamy</i>	244
Physical Model of Energy Fluctuation Divergence <i>K. Okubo and K. Umeno</i>	252
Advance on Electron Deep Orbits of the Hydrogen Atom <i>Jean-Luc Paillet and Andrew Meulenberg</i>	258
Evidence for Nuclear Transmutations in Ni-H Electrolysis <i>K.P. Rajeev and D. Gaur</i>	278
Helium Measurements From Target Foils, LANL and PNNL, 1994 <i>Roger Sherman Stringham</i>	284
Plasmonic Concepts for Condensed Matter Nuclear Fusion <i>Katsuaki Tanabe</i>	296
Controlled Electron Capture: Enhanced Stimulation and Calorimetry Methods <i>Francis Tanzella, Robert Godes, Rogelio Herrera and Cedric Eveleigh</i>	301

## Opening Address

ICCF 20 Conference 02–07 October 2016, Sendai, Japan

Ladies and Gentlemen, On behalf of the Organizing Committee, I would like to welcome all of you to the International Conference on Condensed Matter Nuclear Science, ICCF20. This is the 20th conference of the ICCF series, which started in 1990 in Salt Lake City in the U.S., and hence, continues 26 years. The ICCF conferences were held in Japan three times already so far: ICCF3 in Nagoya, ICCF6 in Lake Toya, Hokkaido and ICCF12 in Yokohama. We are very happy to have ICCF20 here in Sendai, Eleven years after the last one in Japan.

In these 11 years, the study of the anomalous heat effect has been greatly enhanced. Based on my personal opinion, I can give two examples as follows. First: the introduction of a device in which deuterium gas with particular nm-scale palladium particles by Prof. Arata in Osaka University: There was no electrical form of input, and the associated measurements of excess heat were performed by monitoring the change in temperature and gas pressure. Second: the revival of the nickel–hydrogen system by using nano-sized Ni particles with hydrogen gas and performing at higher temperature regions: I would say this is triggered by Rossi, although the evaluation of his device is quite uncertain now.

The study of anomalous heat generation, such as represented by these, has been making steady progress. Now, it has become very important to specify the material as well as to investigate its physical properties under a variety of experimental conditions. This may be a necessary step toward practical use, although it will take much more time, man-power, and money.

On the other hand, evidence linking the anomalous heat generation and the nuclear reaction is still sparse. First of all, detection of nuclear radiation is impossible if it is a special reaction process in which the reaction product is always in its ground state, as it would be with two deuterons only going to the  $4\text{He}$  ground state. However, one can expect nuclear radiation, i.e., gamma-rays, beta-rays associated with a decay of a radioactive nucleus when it is created as a result of the nuclear reaction. Other radiation including X-rays, light, electric waves, etc. are also expected since the system should deliver the whole energy. Much more effort toward detecting these types of radiation simultaneously with the heat generation are highly desirable, now, in order to overcome the present condition where we have mostly circumstantial evidence. In the present ICCF, these subjects are to be discussed more specifically based on the newest experimental results. In addition, many experimental ideas, trials and data related to the study of CMNS are also to be discussed as well as a large variety of theoretical studies including interesting unconventional ideas.

I do believe that extensive discussions in this conference may serve to deepen the basic understanding of CMNS phenomena as well as to develop wide-ranging applications.

We have about 130 participants already registered in this conference. About two thirds of them are from overseas: the participants are distributed over 17 countries. On this occasion of the international exchange, I would like you to know more about Masamune Date. As you see, his statue on horseback is an emblem of ICCF20. He was born in 1567 as a military commander of the period of wars before the Tokugawa era, and he created the foundation of Sendai City as a feudal lord of the Tokugawa government. He was not a local person but his one eye had been open to the world. Once Masamune obtained the approval of the Tokugawa, he sent a diplomatic mission to Spain and Rome in 1613: his retainer Tsunenaga Hasekura was the delegate. It was known as the Keicho era mission to Europe. Furthermore, Masamune had been well known as a person who excelled in both literary and military arts. Actually, Masamune was very good at Japanese poetry. His last poem is 「曇りなき心の月を先立てて、浮世の間を照らしてぞ行く」

I interpret this as follows: “I was just going the way I believed the best as if going with the clear moon light in my heart that illuminated this unpredictable warring world”. I am very pleased that the 20th ICCF is being held in this place, Sendai, where Masamune led a way of life which resembles an investigator’s thought.

Now, let us enjoy new findings and developments in this extremely interesting field of science and technology during these four and a half days, including a half-day sightseeing to Matsushima Bay which is famous for its scenic views.

Thank you very much.

Sincerely,

*Dr. Jirohta Kasagi*  
(Co-Chair of ICCF20 )

## Mayor's Speech



Sendai City Mayor Emiko Okuyama

ICCF 20 Conference 02–07 October 2016, Sendai, Japan

On behalf of Sendai City, it is with great pleasure that I welcome you and all of our other guests here in Sendai for the 20th International Conference on Condensed Matter Nuclear Science.

I have heard that Condensed Matter Nuclear Science has a great possibility of changing the entire industrial structure if its clean nuclear energy can be realized. I am also glad to know a number of researchers have been involved in this filled with active discussion and intensive study all over the world. Tohoku University located in Sendai is the first university in Japan to have a special division for CMNS, collaborating with a private company. Its aim is to obtain basic data on nuclear reactions in anomalous heat generation phenomena, as well as in nuclear transmutation phenomena. We have high expectations that the division at Tohoku University will achieve revolutionary progress in nuclear science and practical prospects for commercializing new clean energy.

As a representative of Sendai citizens, I would like to deeply thank all of the people who have supported us in our recovery from the Great East Japan Earthquake of 11 March 2011. We had promoted our reconstruction plans since the tragedy and completed the first step for restoration in 2016. It is our pleasure to let you know our current situation on this occasion. Thanks to support from all over the world, we have managed to overcome the disaster and proceed to a better life. For these reasons, it might not be difficult for you to imagine just how pleased we are to welcome you for ICCF20 as you open this conference here in Sendai after 11-year-absence from ICCF12 held in Yokohama, Japan. Sendai city, known as the 'city of trees', has abundant nature, beautiful scenery through four seasons and a variety of great food and hot springs. You can enjoy unique Japanese culture and hospitality as well. I am sure your stay in Sendai will be helpful to activate your discussion and interactions with each other.

It is delightful to have all of you here today. As Sendai City Mayor, I hope for further progress in Condensed Matter Nuclear Science and your success and prosperity.

Thank you very much.

## Welcome Address

ICCF 20 Conference 02–07 October 2016, Sendai, Japan

Good morning Ladies and Gentlemen. It is my great pleasure to have the opportunity to deliver a welcome address at the International Conference on Condensed Matter Nuclear Science. On behalf of Tohoku University, I warmly welcome all of you participating in this conference which is hosted by the Research Center of Electron Photon Science of our university.

As an Executive Vice President of the University, I first wish to take this opportunity to introduce Tohoku University. The University was established under the name of Tohoku Imperial University in 1907 as the third oldest university in Japan, following Tokyo Imperial University in 1877 and Kyoto Imperial University in 1897. Today, the university has 10 Faculties, 18 Graduate Schools, three Professional Graduate Schools, six Research Institutes, and 12 Inter-department Institutes for Education and Research. The total number of students is about 18,000 including about 7000 graduate students, while the total staff is about 6500 including 3200 academic teachers and professors.

The traditional mottoes of our university are 'Open Doors', 'Research First' and 'Practice Oriented Research and Education'. 'Open Doors' originates from having accepted the first female students at a university in Japan, in 1913. The 'Research First' reflects the situation of the time the university was founded. Then, bright young professors produced original research results one after another, which were used directly for student's education. Furthermore, the university has cherished a tradition of "Practice Oriented Research and Education," in which the results of cutting-edge research are put to use for the good of society and the improvement of living standards. Based on these traditions, Tohoku University has been a university which promotes high education and original research of the world's highest standard. Moreover, it contributes to the realization of human society in peace and fairness by using the results of research to solve problems which society faces, as well as to raise talented people to be leaders.

Last year, Tohoku University established a new joint research division with Clean Planet Inc. to study condensed matter nuclear reactions. I think that this unique research division reflects these mottoes of our university. I am very much pleased that the division is hosting the pre-eminent conference of Condensed Matter Nuclear Science only one and a half years after its establishment.

I heard from my friend Prof. Kasagi that this ICCF conference series started as a conference on Cold Fusion. The important and fundamental problem which is not yet solved exists in the subject of the conference. I remember so-called Cold Fusion. Although many researchers did challenging research after the famous press release of Fleischman and Pons, it seems that very many research efforts are still required in order to explain the mystery. On the other hand, if the mystery is solved and if completely different clean energy source becomes clear, then our life would change drastically.

I am very concerned about environmental problems as a researcher in the field of Physical Oceanography. It seems to me that we stand at the crossroads with the current use of nuclear power after the Great East Japan Earthquake on 11 March 2011, followed by one of the worst nuclear accidents on record at the Fukushima nuclear power plant. Thus, it is very meaningful that discussions on the possibility of future clean nuclear energy will be conducted here over the next several days by many scientists, engineers and specialists from the world.

I welcome all of you and sincerely hope that this conference will contribute to further progress in research on Condensed Matter Nuclear Science. Thank you very much.

Sincerely,

*Dr. Kimio Hanawa*  
(Executive Vice President, Tohoku University)

## Welcome Address

ICCF 20 Conference 02–07 October 2016, Sendai, Japan

Good morning to everybody. Welcome to the City of Sendai, one of the most beautiful cities in Japan.

I am really proud you are here. I am Hiroyuki Hama, the Director of the Research Center for Electron Photon Science, Tohoku University. Research in our lab., which was established 50 years ago, is centered on high-energy electron accelerators. Also major scientific fields are nuclear physics, nuclear chemistry and photon science. In the long history of the lab., I think the group of Profs. Iwamura and Kasagi, who chair the conference, is addressing pretty unique activity.

We had suffered from a big earthquake and Tsunami in 11 March 2011. Yes, it was really a tragedy for us. We have still not recovered completely, for example, some cities near seaside are now under re-construction. For us, the accelerators were heavily damaged and it took for more than 2 years to recover the research activity in the lab.

In addition, all of the people living in Japan were scared by the incredible accident of the nuclear power reactor. Now I do not want to discuss the issue of whether nuclear power is safe or not. However, the issue of energy for sustainable human life is getting to be a big subject.

It is a common problem in all of the countries of the world. Very recently, the Japanese government has been discussing about the future of a fast breeder reactor called MONJU. The fast breeder reactor was introduced as the ultimate energy source. However, the MONJU may possibly shut down. The conclusion at the moment, I have thought is that the technology of recycling nuclear power seems to be not organized perfectly by human science and technology.

I do not know that is a final conclusion, but I definitely understand that the problem of energy has to be solved by the science, not emotion. In this sense, this international conference, ICCF20 will open the door for new solution of the energy problem. I really hope it. So please have many fruitful discussions to grasp the prospect for the human future. Also enjoy the Sendai city in this beautiful autumn season.

Thanks a lot for coming. In closing, I have a small question. The name of ICCF means International Conference on Condensed Matter Nuclear Science. But there is no F. Personally I can suppose what it is. Thanks, enjoy your stay, and have a nice conference.

Sincerely,

*Dr. Hiroyuki Hama*  
(Director )

*Research Center for Electron Photon Science (ELPH) Tohoku University*