Physics is the experimental science

Richard Feynman

E.N. Tsyganov

COLD NUCLEAR FUSION TODAY

V.I. Veksler and A.M. Baldin LPHE, JINR

Dubna, 24 June 2016

Flammarion, 1888, on the motives of the 16th century

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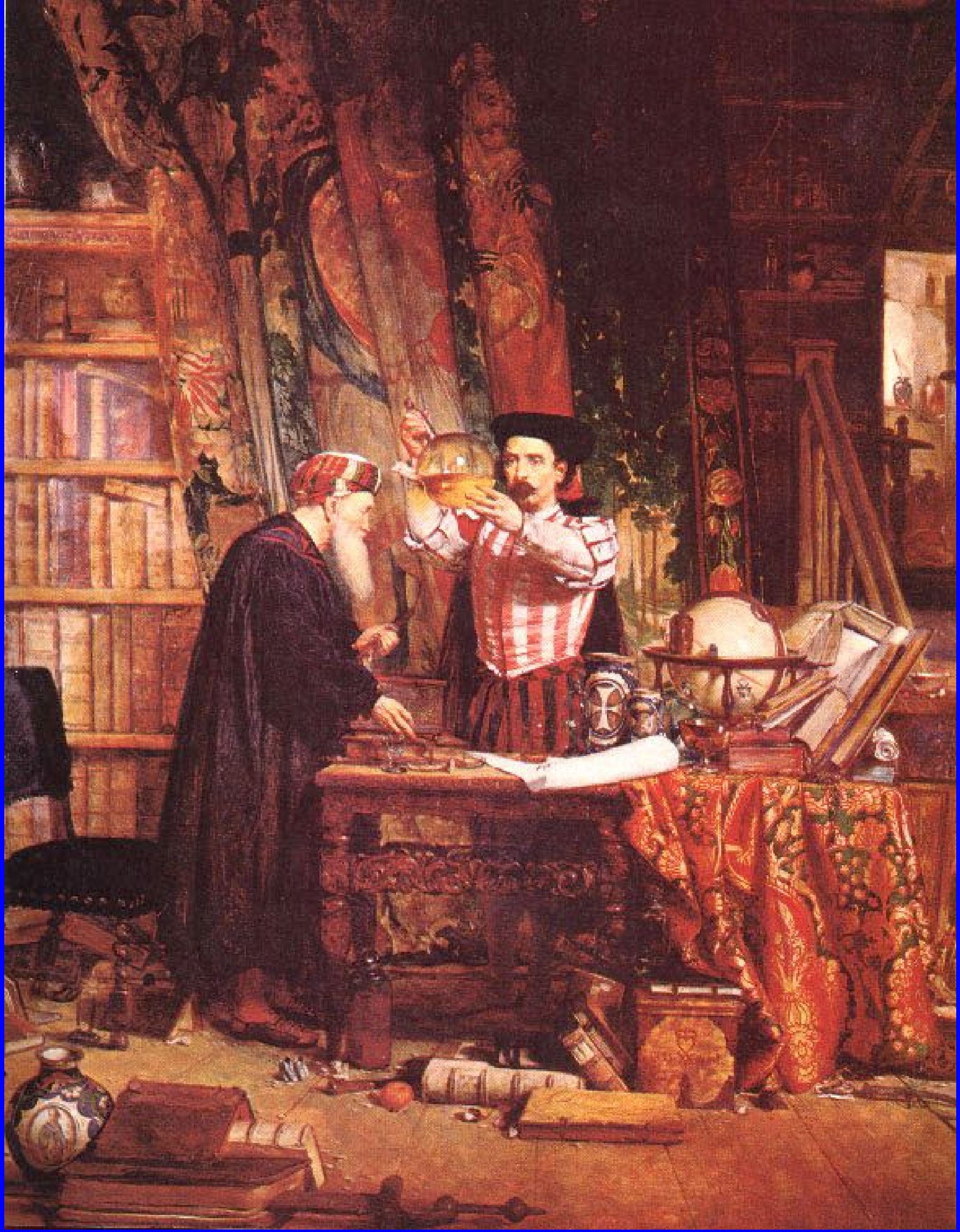
Dubna, 24 June 2016

Alchemy



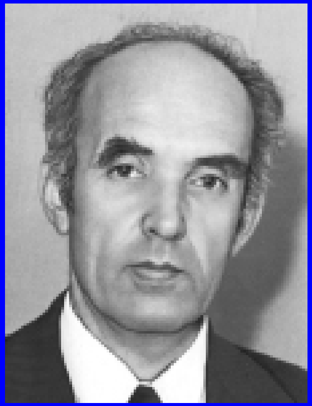
“The alchemist” of Sir William Fettes Douglas (1822–1891)

Currently, humanity is facing a severe energy shortage, as well as the effects of pollution. Nuclear power plants based on *fission reactions* are not safe — remember Chernobyl and Fukushima. Reliable preservation of nuclear power plants and disposal of their waste for a period of thousands of years is simply unrealistic. In addition, the proven reserves of fissionable materials are drying up quickly.

V.L. Ginsburg in his 2003 Nobel lecture put the possibility of *controlled nuclear fusion* at the top of the list comprising many scientific priorities. However, thermonuclear fusion is still only a dream, due to plasma instabilities and the high cost of building huge corresponding installations.

"Tokamaks from A.D. Sakharov to these days"
E.A. Azizov
Uspehi, Volume 182, Number 2, February 2012, p. 203

"By October 1950, A.D. Sakharov and I.E. Tamm prepared a preliminary theoretical ground for a magnetic thermonuclear reactor (MTR) and made the first evaluation of its options."



Vitaly Dmitrievich Shafranov:

Senior Assistant, Junior Researcher, ... Academician of the Russian Academy of Sciences

Listen, guys, your own history,
Everything was started by a soldier on duty.

V.I. Veksler and A.M. Baldin LPHE, JINR
Dubna, 24 June 2016

Everything was started by soldier

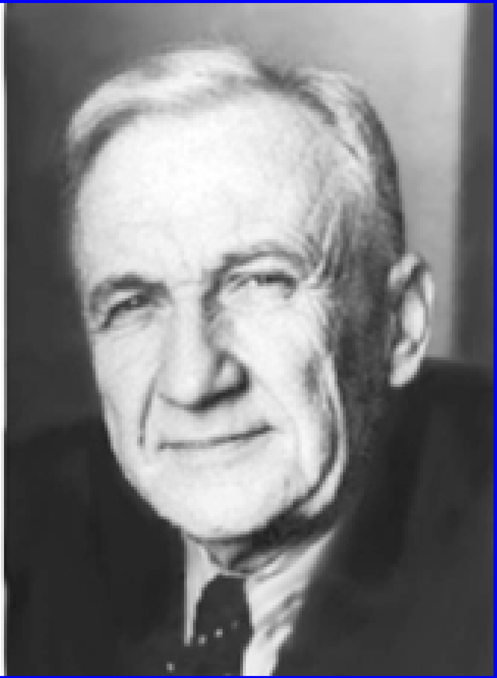
Sergeant Oleg Aleksandrovich Lavrentiev who served on Sakhalin wrote a letter to the Central Committee of the CPSU(b) on July 22, 1 950, in which he proposed:

1. Use the lithium-6 deuteride in H-bomb, instead of liquid deuterium and tritium;
2. Create a system with electrostatic confinement for hot plasma control in thermonuclear fusion.

The founders of the tokamak

O.A. Lavrentyev

A.D. Sakharov



I.E. Tamm

Lev Andreevich Artsymovich

Igor Kurchatov and John Cockcroft at the Center for Nuclear Energy in Harwell on 26 April 1956

So, the history of controlled thermonuclear fusion (tokamaks and other devices) in this year marks 66 anniversary, even at the maximal support of governments of developed countries.

In 1989, Martin Fleischmann and Stanley Pons proposed a different method of implementation of nuclear fusion, the so-called cold fusion.

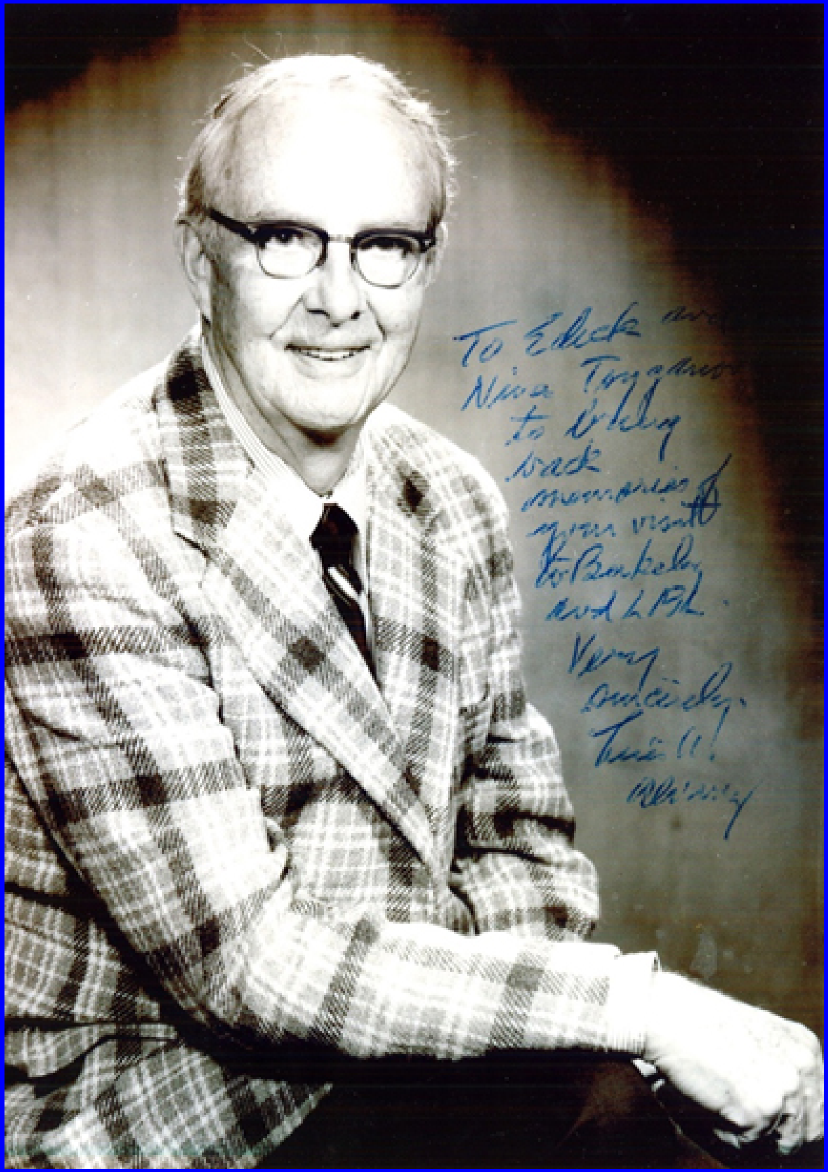
The phenomenon of cold fusion in conducting crystals today is confirmed by numerous experiments and, in our opinion, is understood in its main features.

Discovery of the process of cold fusion in conducting crystals can be seen as a sign that NATURE gives us a hand. Humanity got a confident hope for the future.

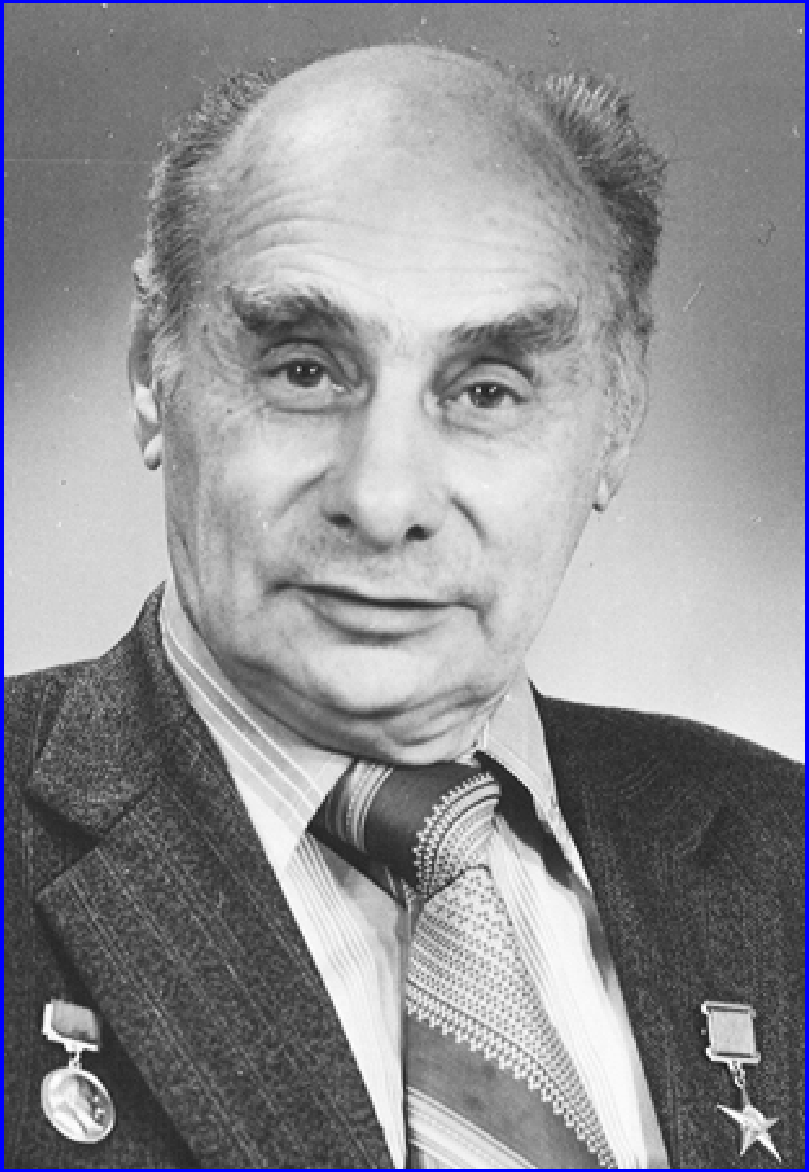
Apollo-Soyuz, Fermilab, 1975

Washington, 1975

Luis Alvarez



Georgy Flerov



1978, Argonne Laboratory, USA-USSR

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1978, Argonne Laboratory, USA-USSR

1978, Argonne Laboratory, USA-USSR

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November 19, 1984

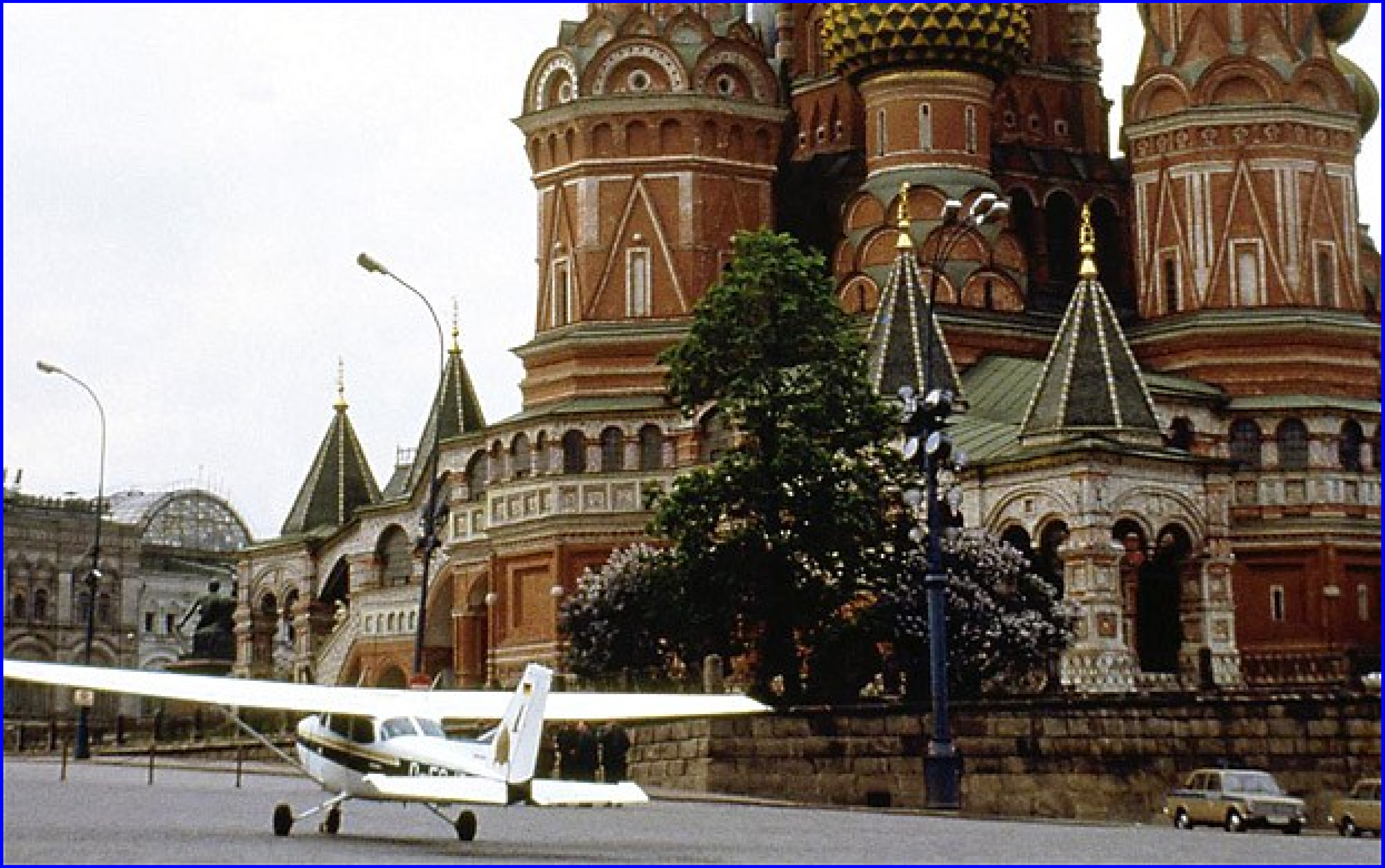
1985

Chernobyl, April 26, 1986

Efim Pavlovich Slavsky (1898 – 1991)

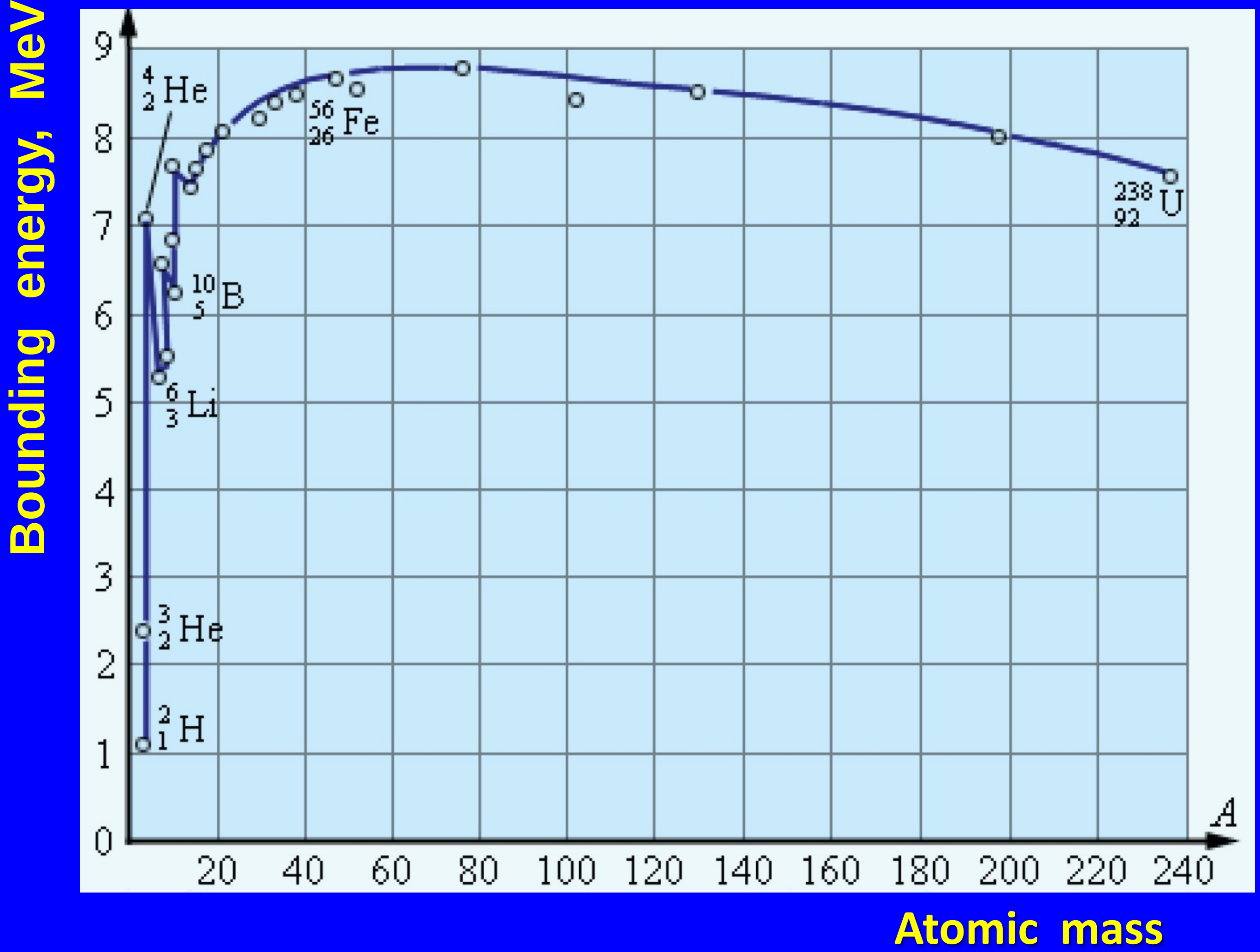
From November 21, 1986 - Personal pensioner of Soviet Union

Matheus Rust, May 28, 1987



Fukushima, 2011

Bounding energy per nucleon for different elements



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Dubna, 24 June 2016

Ya. B. Zeldovich
μ – catalysis, *DD* piezo-synthesis

$$B = \exp\left\{-\frac{2}{\hbar}\int_{x_1}^{x_2}\sqrt{2M\,(U(x) - E)}\,dx\right\} = \exp\left\{-\frac{2}{\hbar}\sqrt{2M\overline{\overline{U}}}\,(x_2 - x_1)\right\}$$

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Dubna, 24 June 2016

μ – catalysis

Ya.B. Zeldovich, Doklady , v. 95, p. 493 (1954)

Luis W. Alvarez et al., Physical Review Series II v. 105, 1957, p. 1127-1128

"Rough estimates of the barrier penetration factor (approximately 10^{-6}) and the vibration frequency (approximately 10^{17} per second) indicate that the time required for a nuclear reaction between H and D should be small compared with the life of the μ-meson ".

Frequency of quantum vibrations $\nu \simeq E_{eff} / \hbar$ ($\hbar = 6.5 \times 10^{-34}$ Js, 1 eV = 1.6×10^{-19} J)

A.A. Vorobiev, S.S. Gershtein, L.I. Ponomarev, Presidium of Russian Academy of Sciences, March 23, 2004

$m_\pi = 139{,}6$ *MeV*

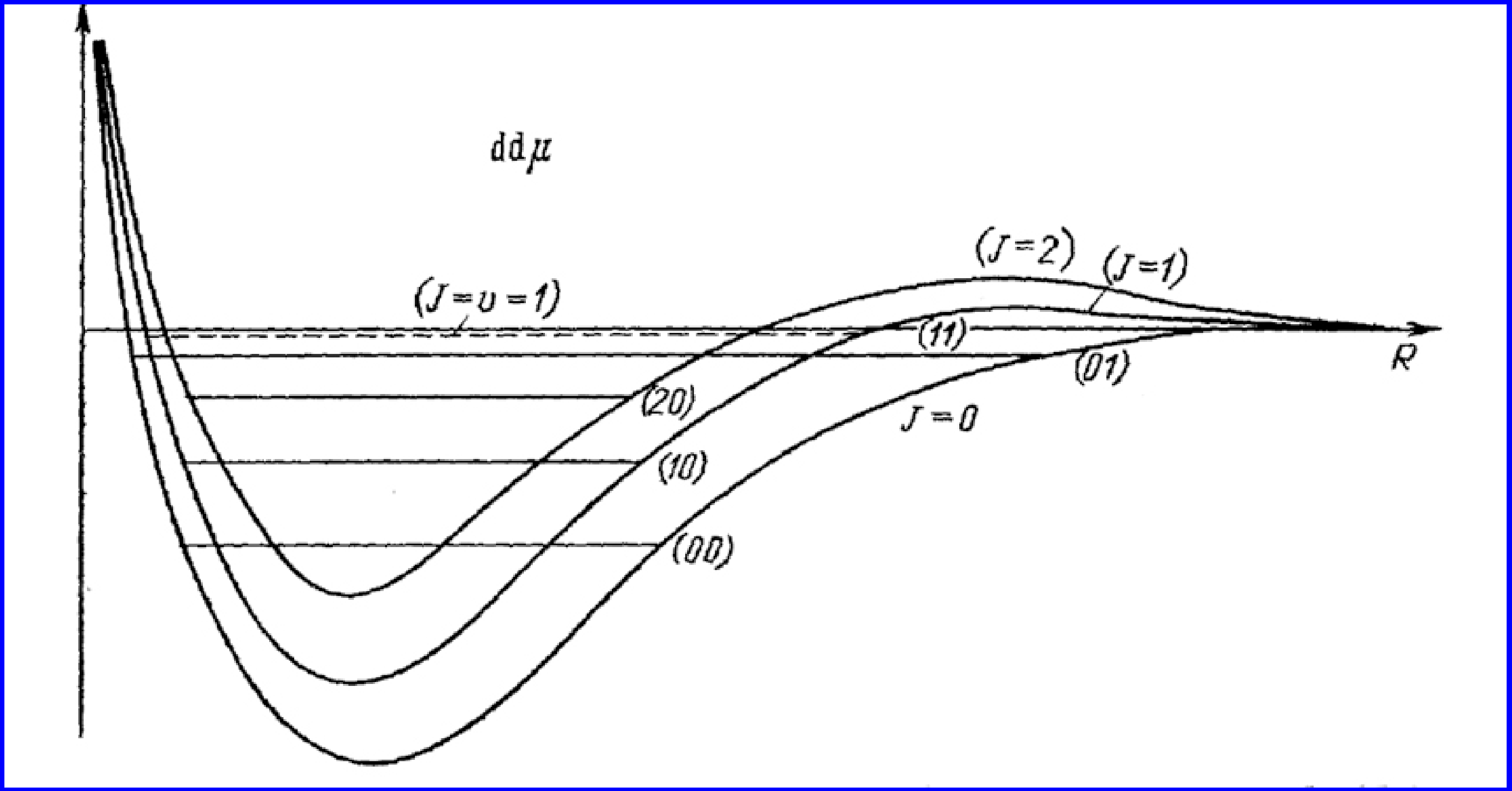
$\pi \longrightarrow \mu + \nu_\mu$

$\tau_\mu = 2{,}2 \times 10^{-6}$ s

$m_\mu = 105{,}7$ *MeV*

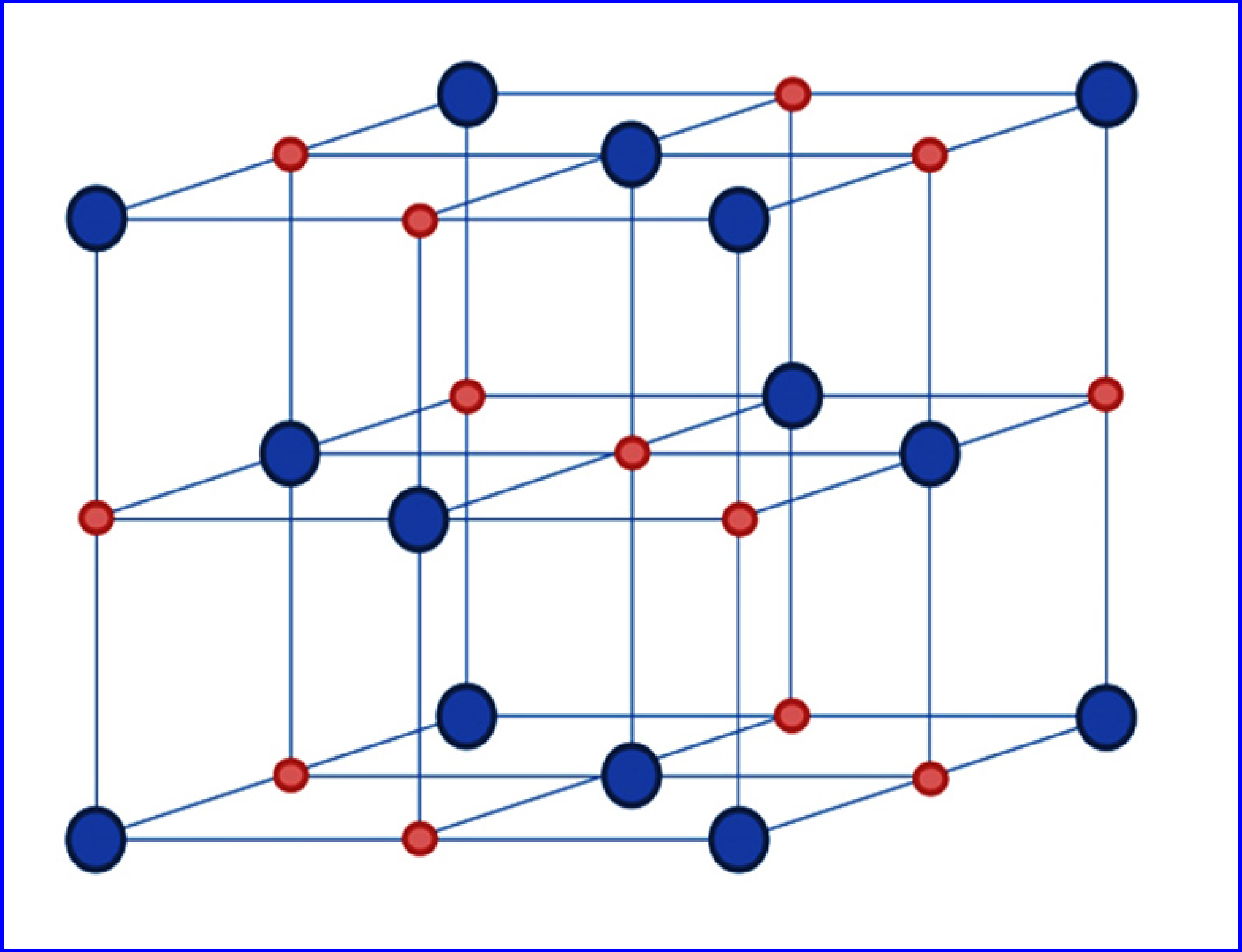
$m_e = 0{,}511$ *MeV*

$m_\mu / m_e \approx 207$



The energy level scheme of rotational-vibrational states (J, υ) in meso-molecule $dd\mu$

fcc crystal structure - palladium, platinum. Red circles denote the deepest potential niche



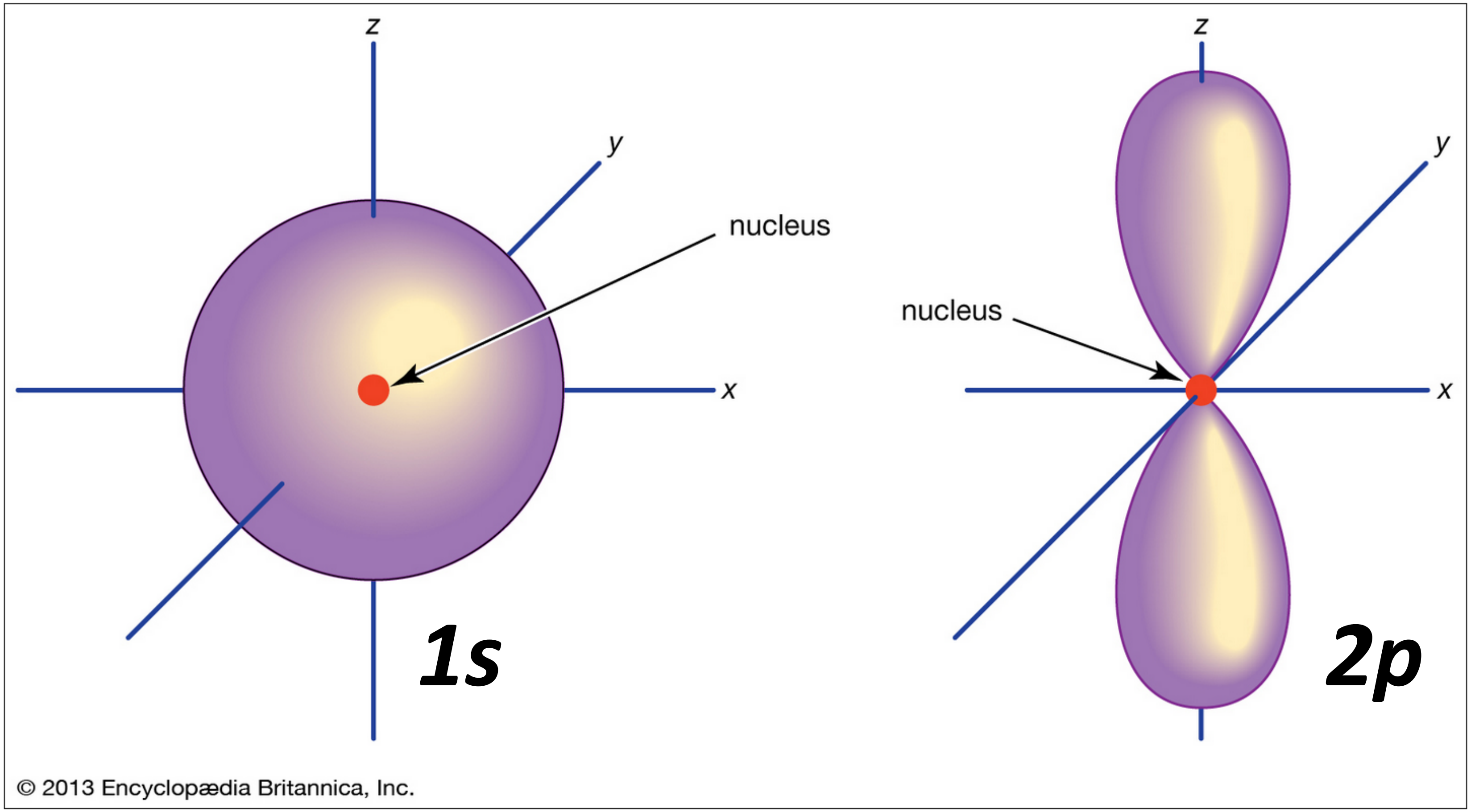
In explaining the cold fusion of deuterium in crystals, one must have in mind that the Bohr atom (*1s*) cannot be placed in the "deepest" location in the center of the cell of conductive metallic crystal due to the concentration there *free conduction electrons.*

The energy threshold for this ban is about 10 eV. In the process of implantation of the hydrogen atom in a conducting crystal, these atoms are excited from *1s* state to *2p*, *3p* states and above by the value of 10-14 eV.

Under normal circumstances, the excited states of atoms quickly return to the ground state. For a free atom of hydrogen, the transition time of *2p* → *1s* is ≈ 1.6 ns. However, the *1s* in the metal state is forbidden due to the presence of the conduction electrons in the zone of the lowest electric potential. At the same time, the state *2p* and higher can easily survive with this inconvenience.

Hydrogen atom orbitals ©2013 Encyclopædia Britannica, Inc.

orbital: s- and p-orbitals



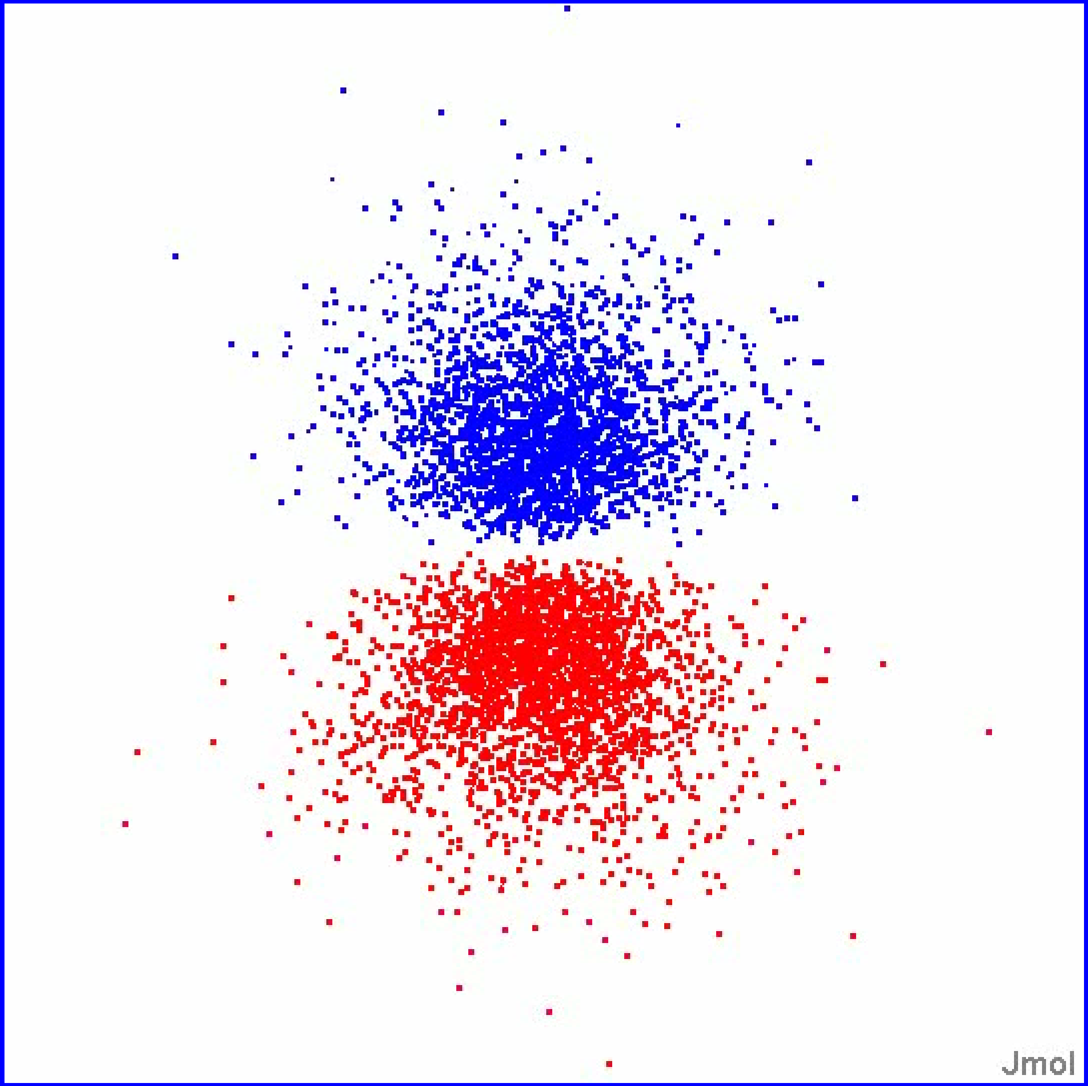
Electron orbitals in atoms **(Left) *s* orbital; (right) *p* orbital**

Encyclopædia Britannica, Inc.

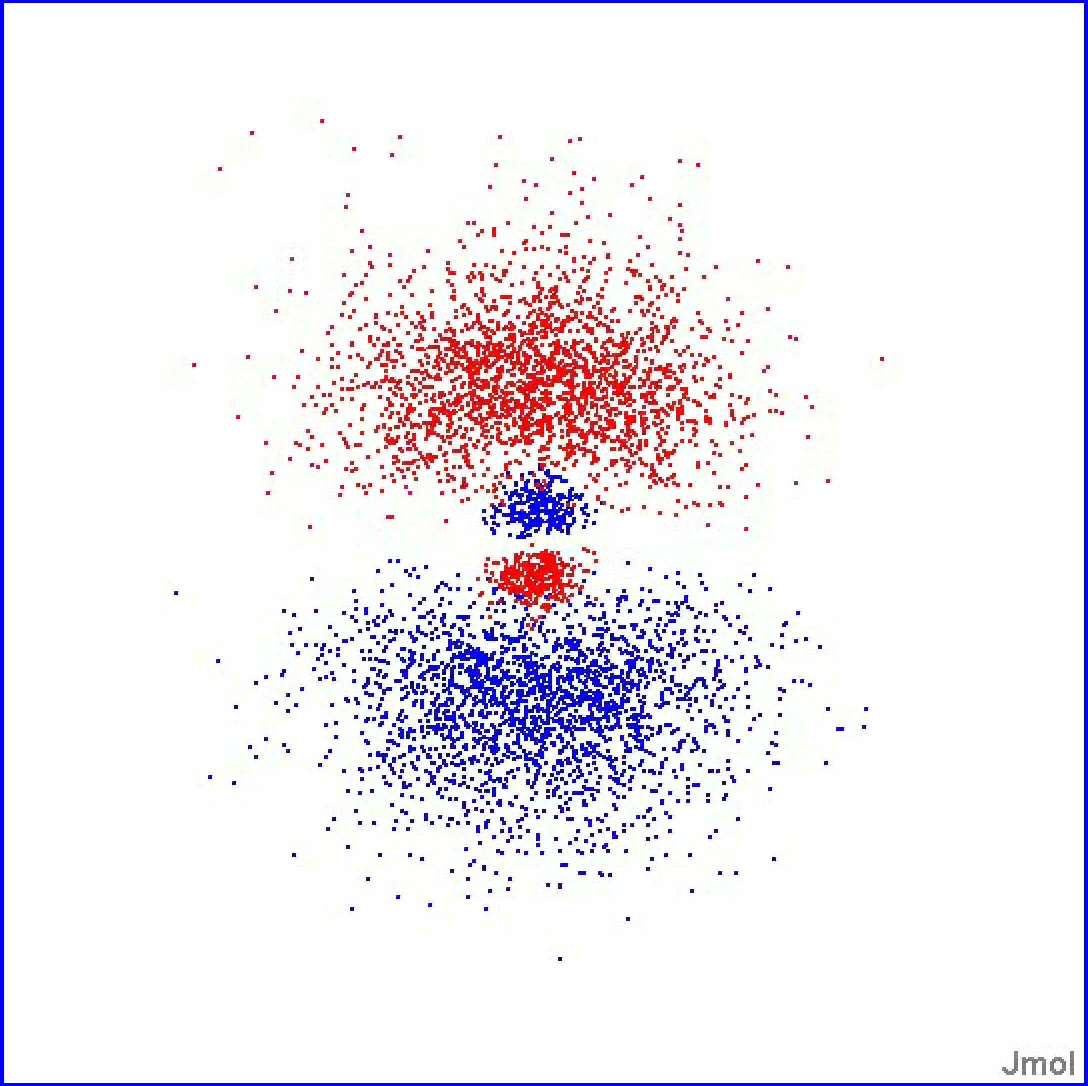
Numerical solutions of the Schrödinger equation for the hydrogen by calculations of M. Winter's (University of Sheffield, England) *2p* and *3p* states are shown in the following two figures. The nucleus of the deuterium atom is located in the center of the atom between two electronic clusters

2p orbital of hydrogen atom

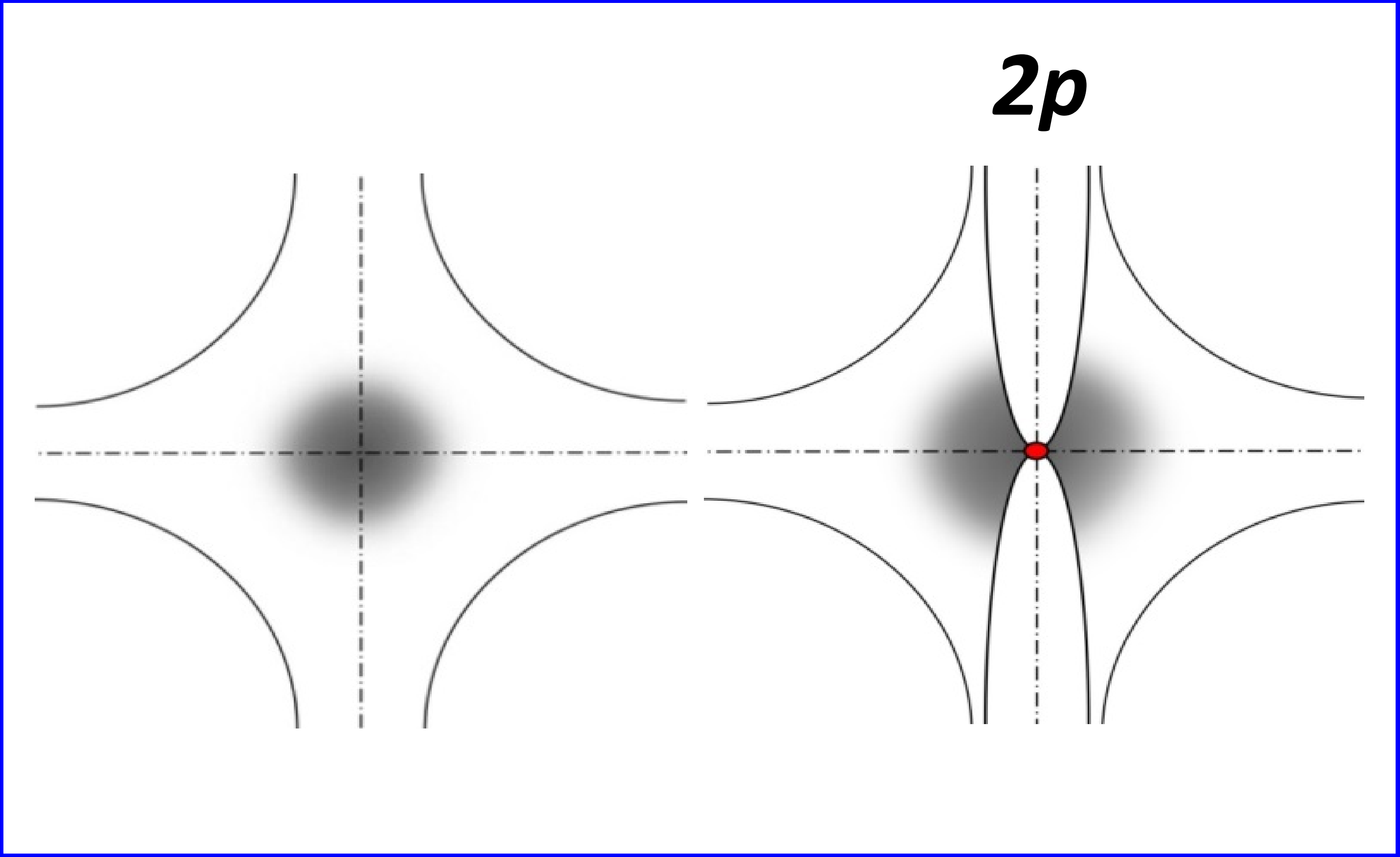
Dot-density plot of the *2p* electron density function ψ_{2p}^2. Blue represents negative values for the wave functions and red represents positive values. http://winter.group.shef.ac.uk/orbitron/AOs/2p/wave-fn.html



3p orbital of Hydrogen atom

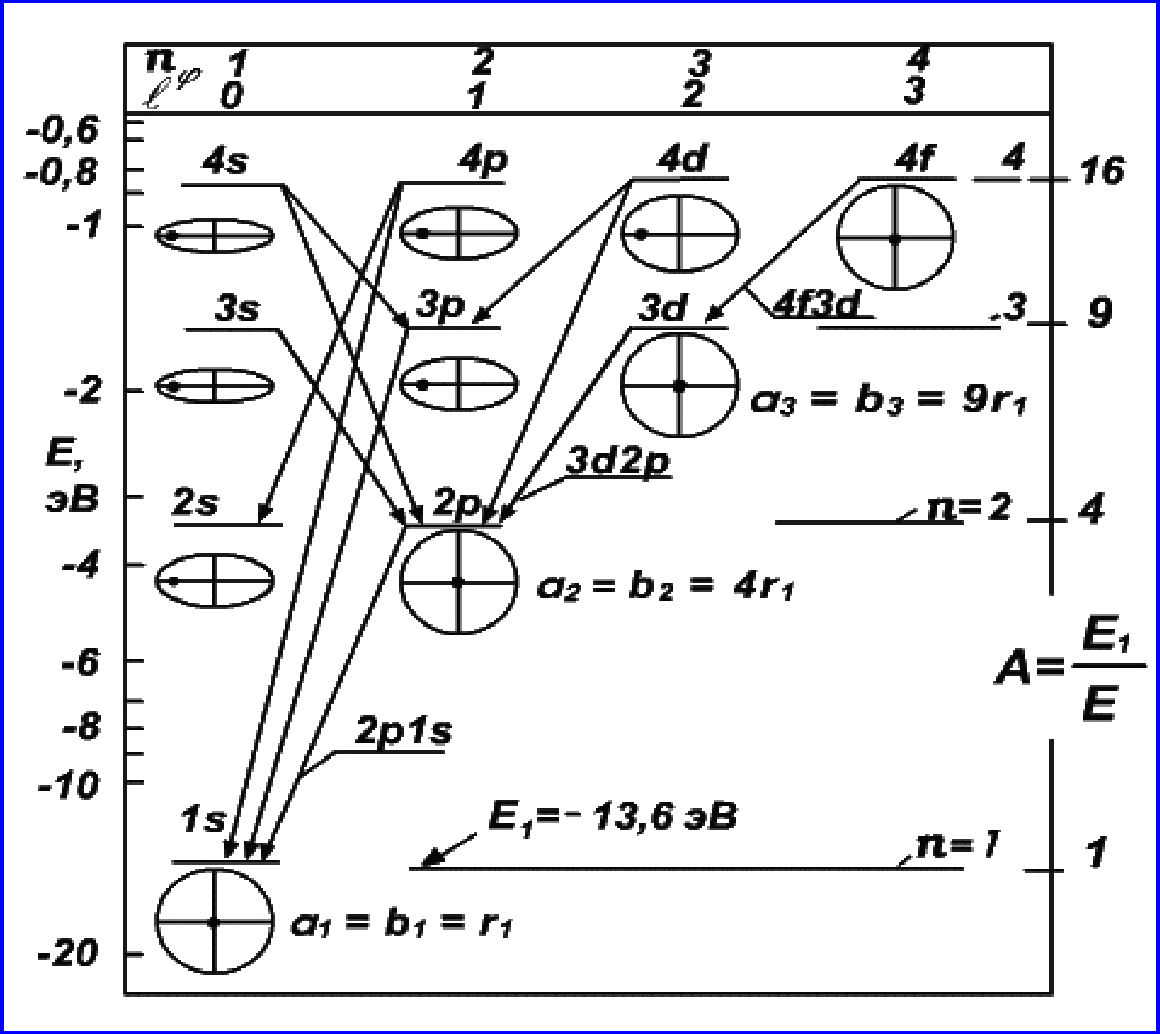


Schematic illustration of influence of the conductive crystal free-electron cloud on the implantation of a foreign atom.



Energy levels of hydrogen atom.
Rydberg states, 1885

Johannes Robert Rydberg
Sweden
1854 – 1919



Quantum numbers:
n – energy
ℓ – angular moment

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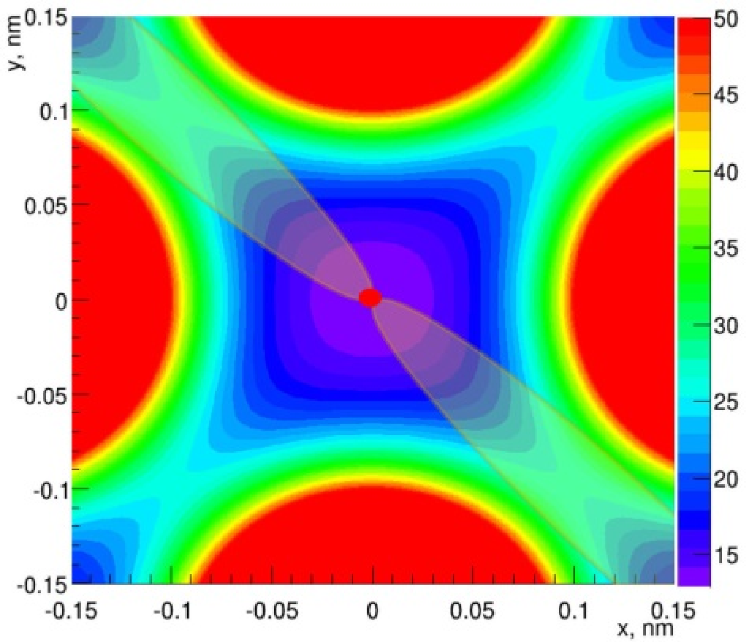
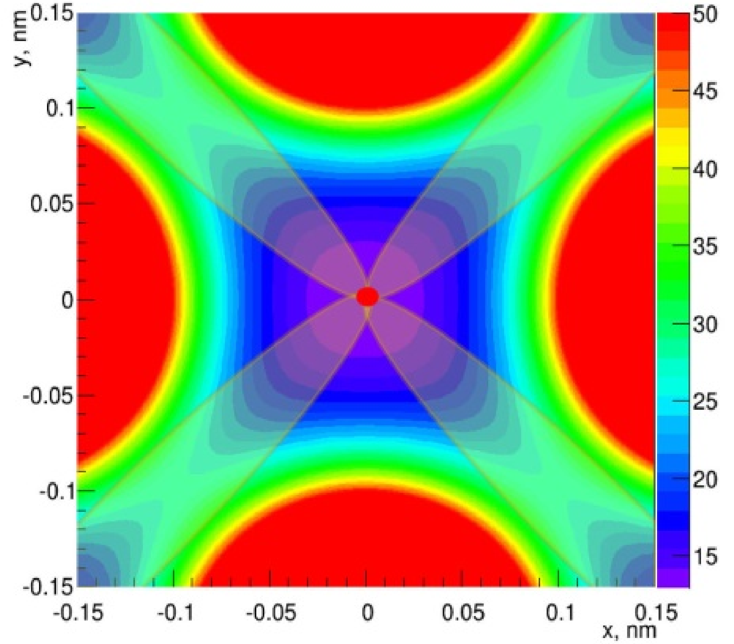
Dubna, 24 June 2016

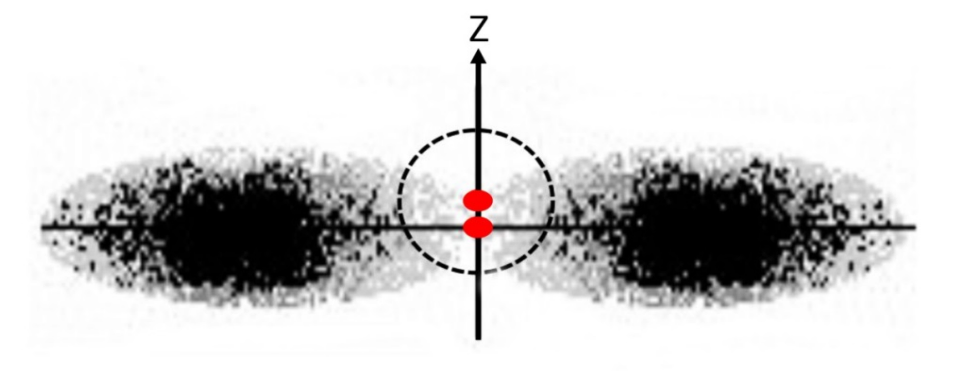
When all the deepest potential niches in the crystal are already filled by hydrogen atoms in position *2p* or higher, filling them further create *doubles of such clusters*. *2p* atoms or higher p-excitations due to their non-sphericity do not take an arbitrary positions, but instead take a well-defined spatial orientation in a crystal niche in order to minimize their potential energy.

The following figure shows two hydrogen atoms in a *2p* state on the octahedral niche of platinum crystal, in a horizontal *XY* plane that is in a *crisscross* orientation at *Z* = 0, and on the vertical axis by *Z*. Color scale – the crystal electric potential in Volts.

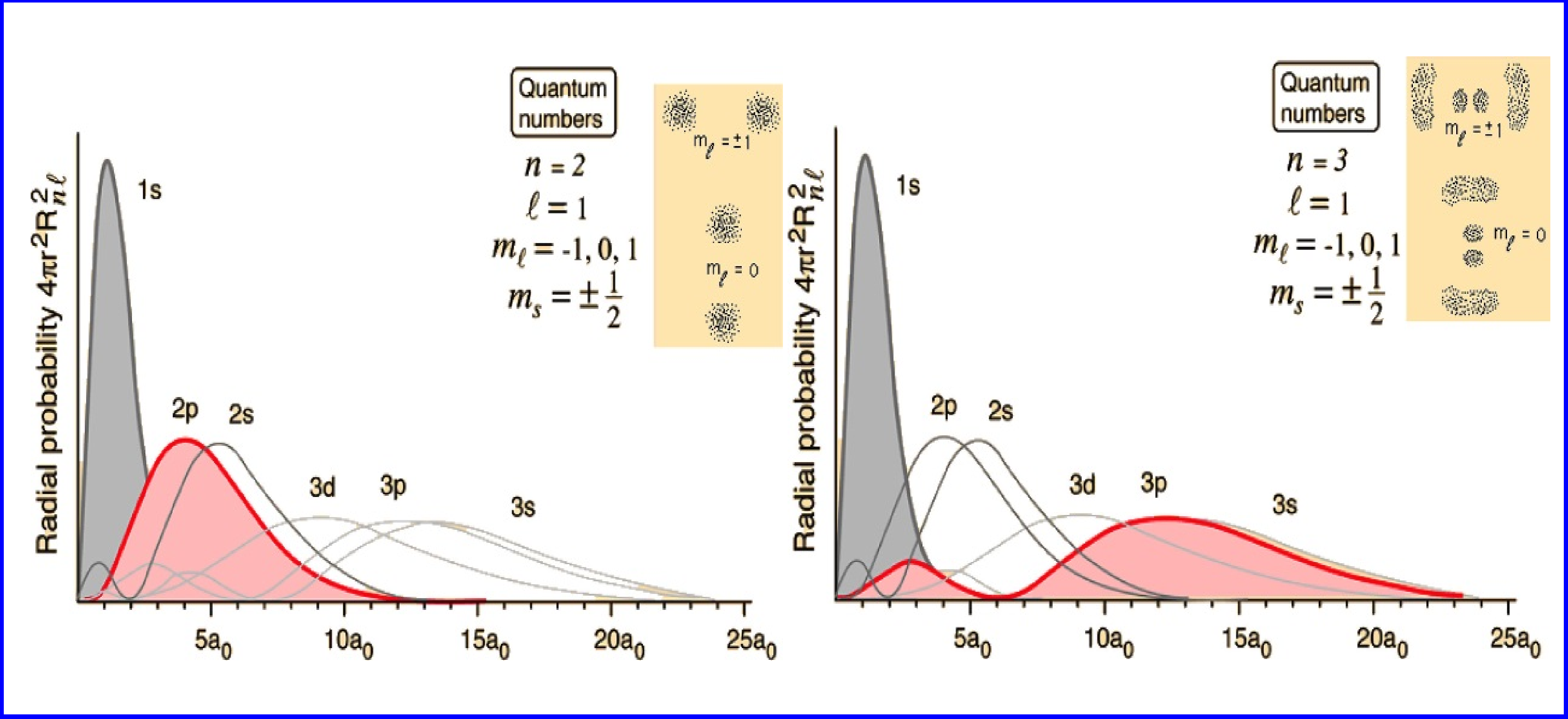
Hydrogen atoms in 2p states in octahedral niche of platinum







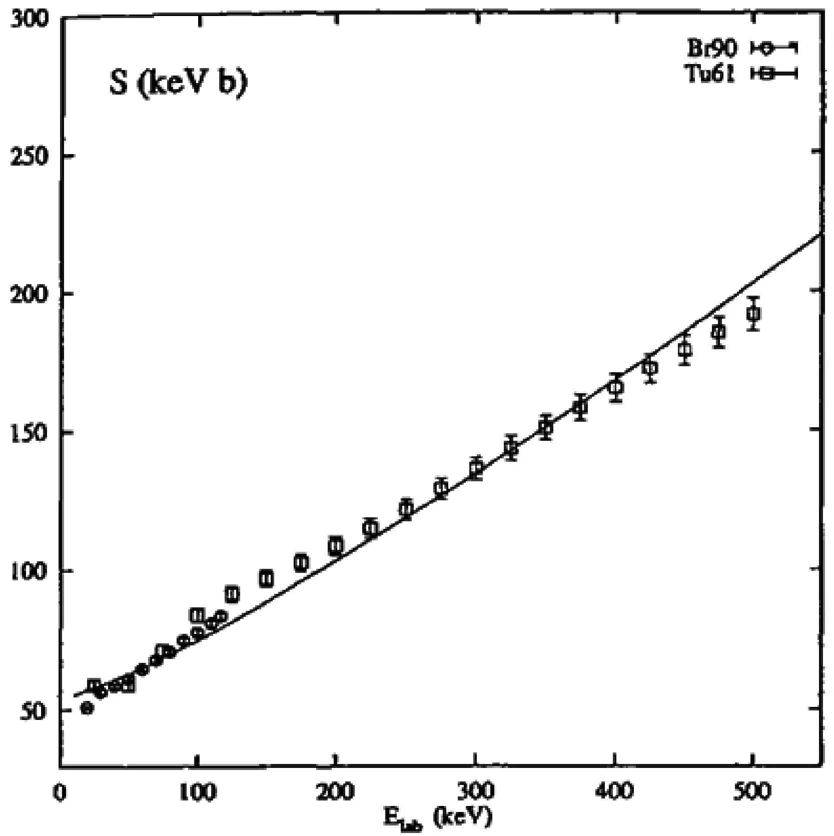
Dependence of probability of electron position in Hydrogen atom on distance. a_0 – Bohr radius = 52.9 *pm*.



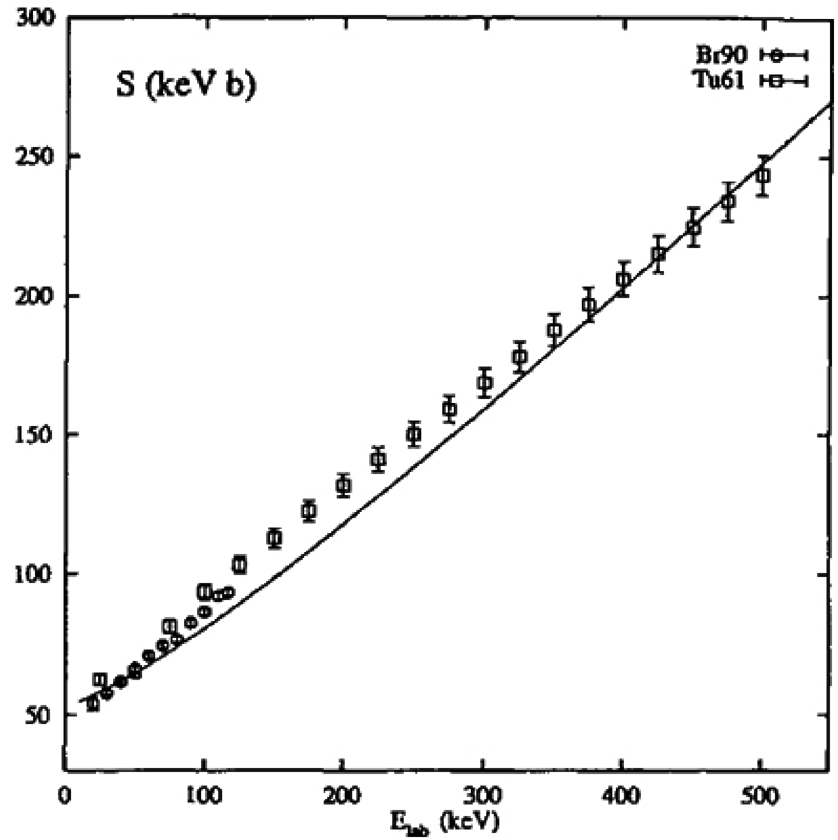
S(E) – astrophysical factor for reactions *D(d,p)^{3}H* and *D(d,n)^{3}He*, Lemaitre, S. at al., *Ann. Physik 2* (1993), 503.

$$S(E) = E\sigma \bullet \exp\left(\pi \frac{e^2}{\text{h}c}\sqrt{\frac{M_{\text{d}}c^2}{E}}\right) = E\sigma \bullet \exp(31.41/\sqrt{E})$$

$D(d,p)^3H$

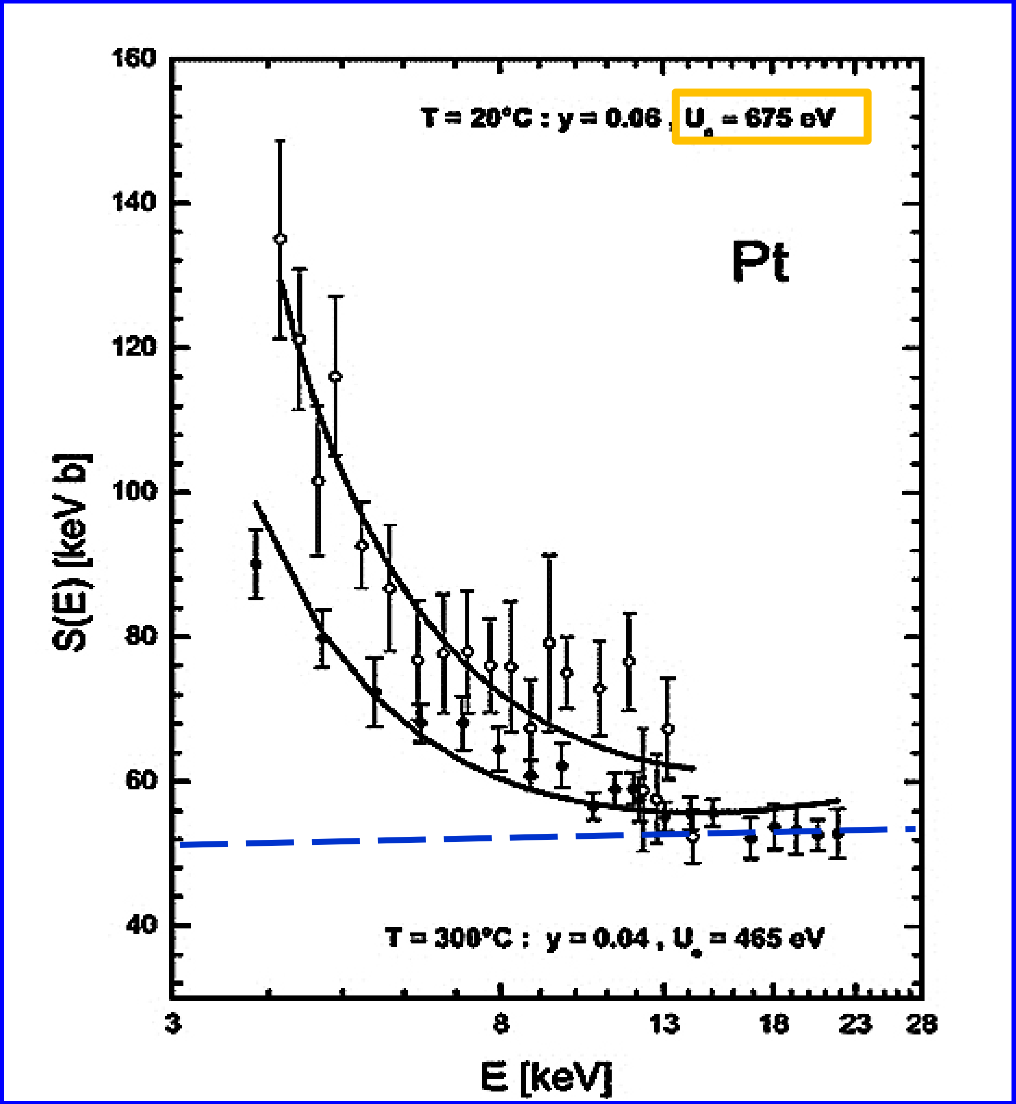


$D(d,n)^3He$



Astrophysical factor *S(E)*
For *DD* reaction in Platinum

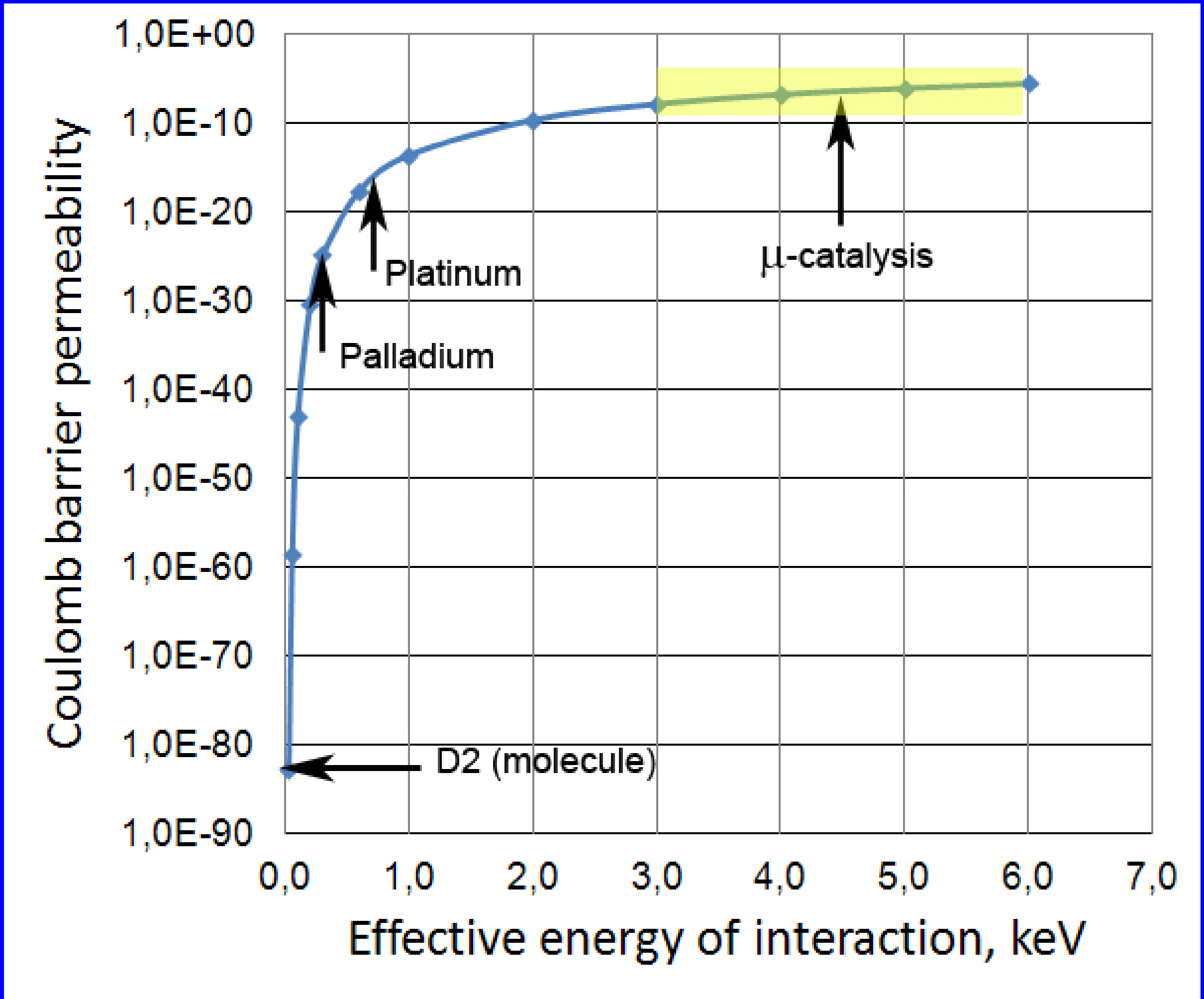
F. Raiola, B. Burchard et al., *Eur. Phys. J. A27 (2006) 79.*



Transparency of Coulomb barrier is *increased by about 65 orders of magnitude* with an increase in the so-called screening potential for deuterium molecules (27 eV) to 300 - 700 eV for a cluster of two deuterium atoms in *2p* state or higher for the platinum crystal *in a crisscross position.*

Transparency of Coulomb barrier for *DD* fusion

$P = e^{-2\pi\eta}$ $(2\pi\eta = 31{,}41/E_{eff}^{1/2},\ E_{eff},\ \text{кeV})$



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Rate of *DD*-fusion in a crystalline cell

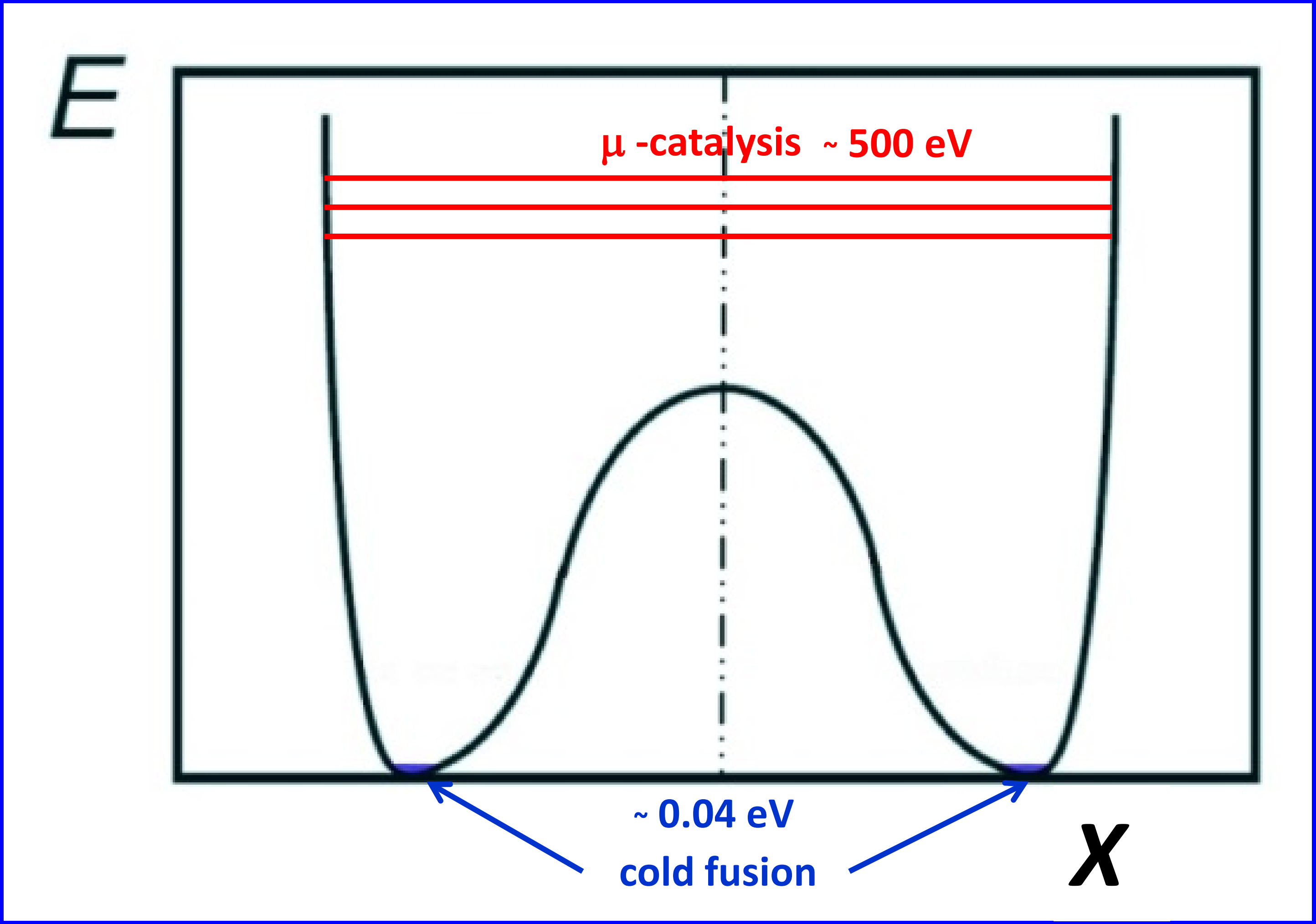
Crystal type	Screening potential, eV	Quantum vibration frequency ν, s^{-1}	Barrier permeability $e^{-2\pi\eta}$	Rate of *DD* fusion λ, s^{-1}
Palladium	300	$0{,}74\times10^{17}$	$1{,}29\times10^{-25}$	$0{,}95\times10^{-8}$
Platinum	675	$1{,}67\times10^{17}$	$2{,}52\times10^{-17}$	4,2

E.N. Tsyganov, "Cold Nuclear Fusion", *Physics of Atomic Nuclei*, 2012, Vol. 75, No. 2, pp. 153–159

The observed slowing down of the decay of the intermediate nucleus through the direct channels of nuclear decays of $^4He^*$ system in cold fusion experiments can be explained by the existence of residual *Coulomb barrier* (about 100-200 eV) already in the potential well of the strong interaction after the reaction DD $\rightarrow$ 4He* at the thermal excitation energies.

Thermal deuterons that penetrated the potential well of strong interactions at the low excitation energies are separated by a relic of the *Coulomb repulsion* and are at opposite ends of the well. In this case, the energy discharge of the $^4He^*$ system having a projection of the orbital angular momentum $\ell = 0$ occurs primarily through the emission of *virtual photons* with the spin directed on the time axis.

Schematics of a potential well after cold fusion reaction *DD* → $^4He^*$



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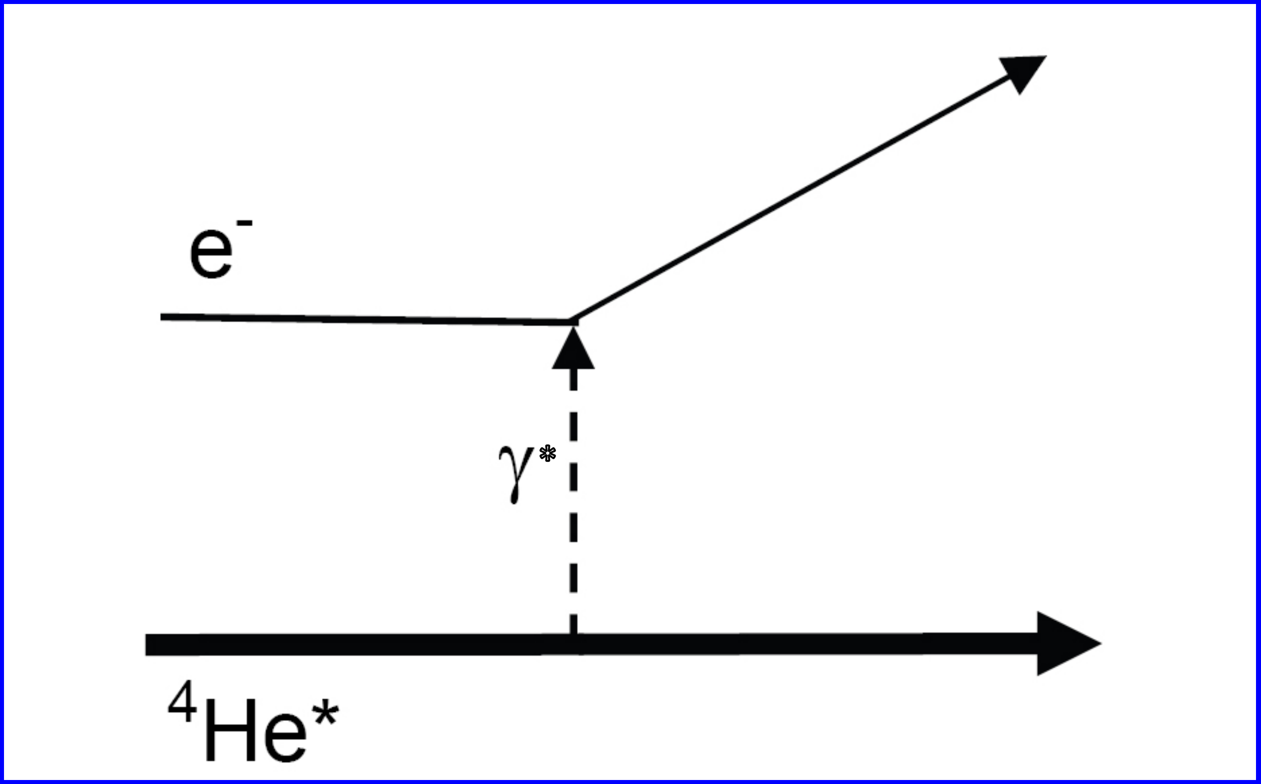
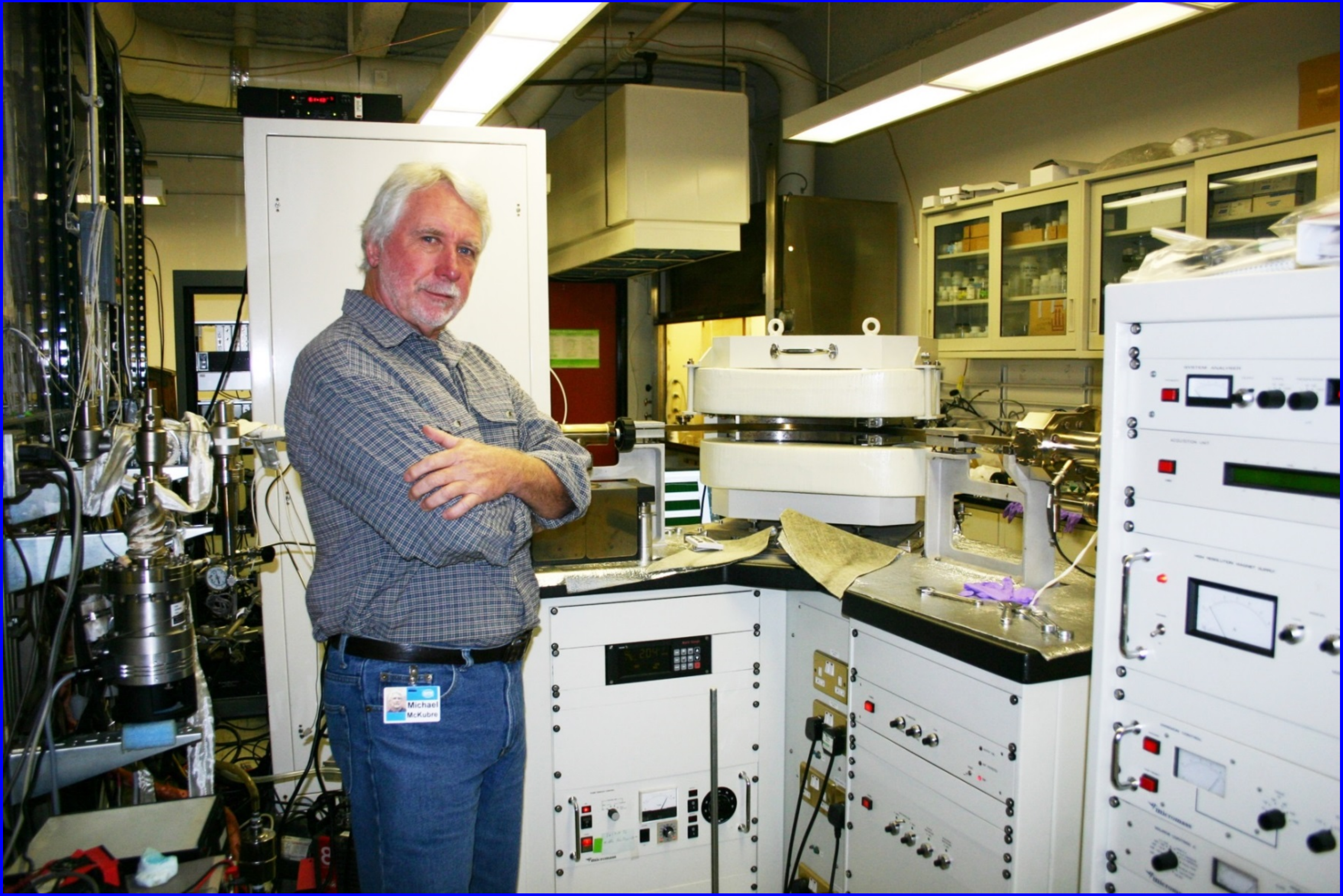
Departure of *virtual photon* from excited nucleus and its subsequent absorption with nearest electron



Dr. McKubre, 2011



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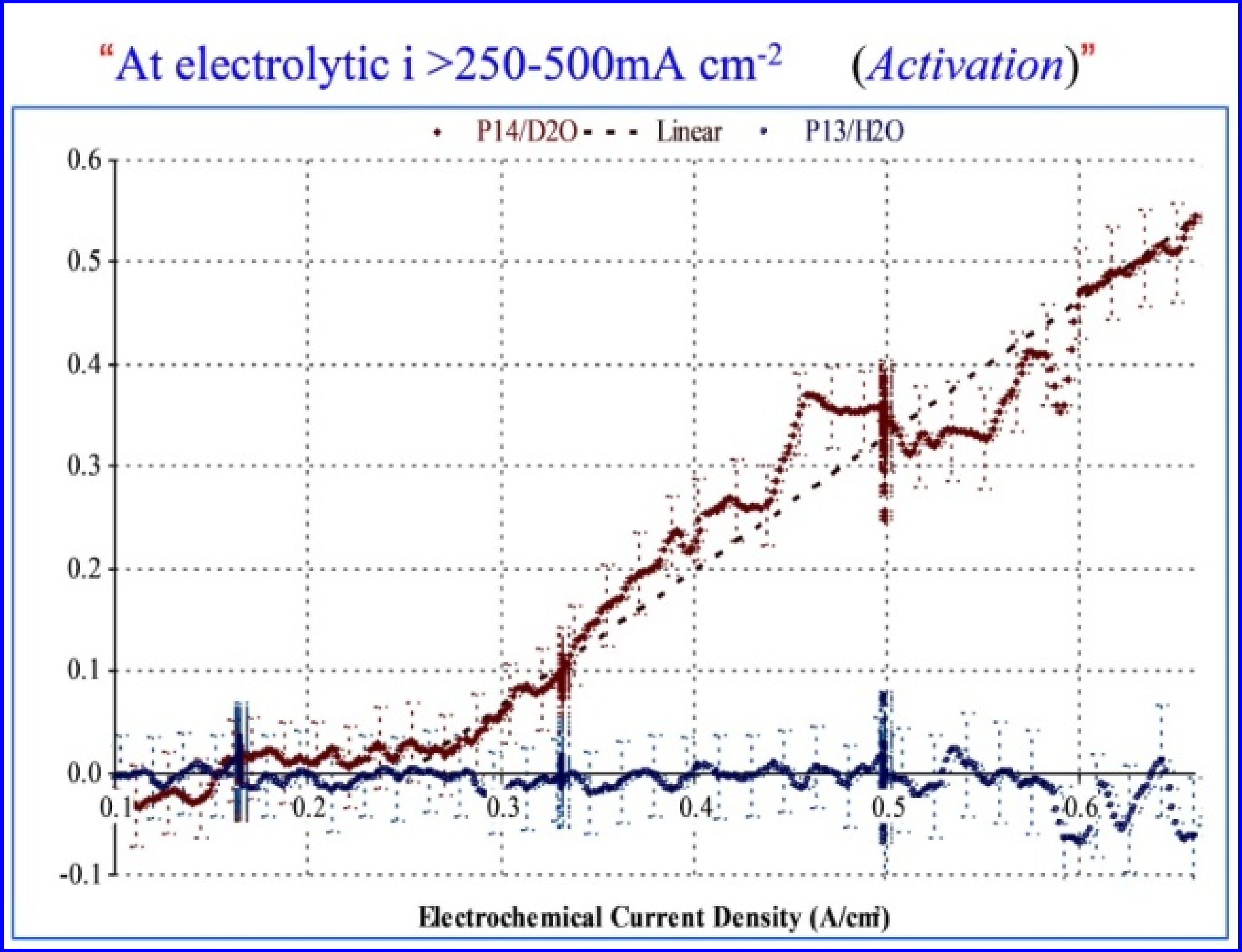
P13/14 Simultaneous Series Operation of Light & Heavy Water Cells; *Excess Power vs. Current Density*



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Cold fusion theme in CERN plans

Consideration of cold fusion took place at the seminar of *ISOLDE* Department on October 14, 2015 in the reports of G. Hubler, V. Violante and J. Shell.

Graham Hubler:

We call this phenomenon, discovered in 1989, the *anomalous heat effect* (AHE) since its origin is unknown.

Vittorio Violante:

ENEA's research of the *material science* of cathode preparation.

Juliana Schell:

The third part of the presentation reviews our *recent preliminary in-situ PAC measurements.*

In conclusion, *ISOLDE* department management decided to continue further studies of *anomalous thermal effect (ATE).* We hope that these efforts will be successful.

ISOLDE administration and the guests of the seminar

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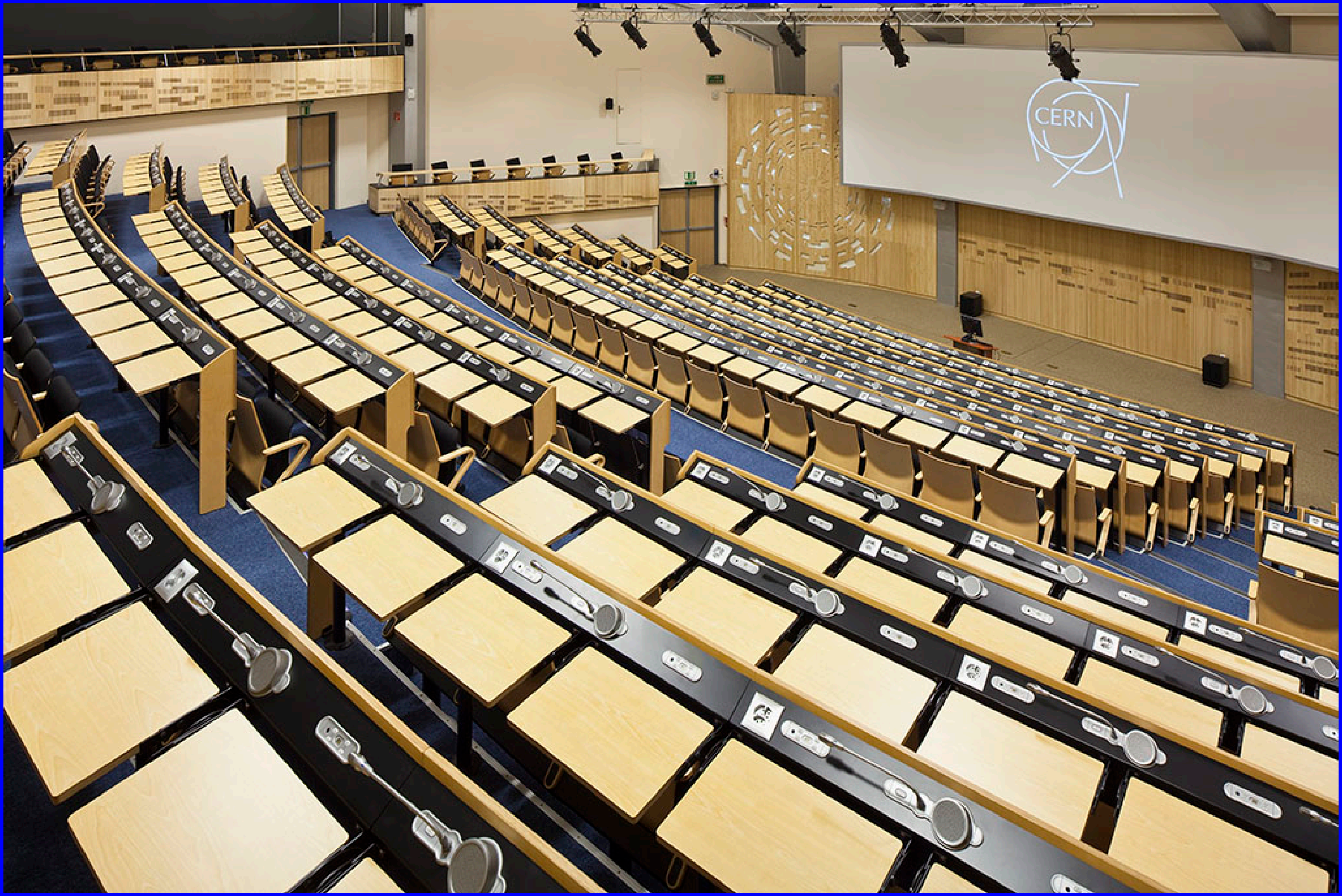
Martyn Fleischmann, CERN, March 31, 1989

M. Fleischmann

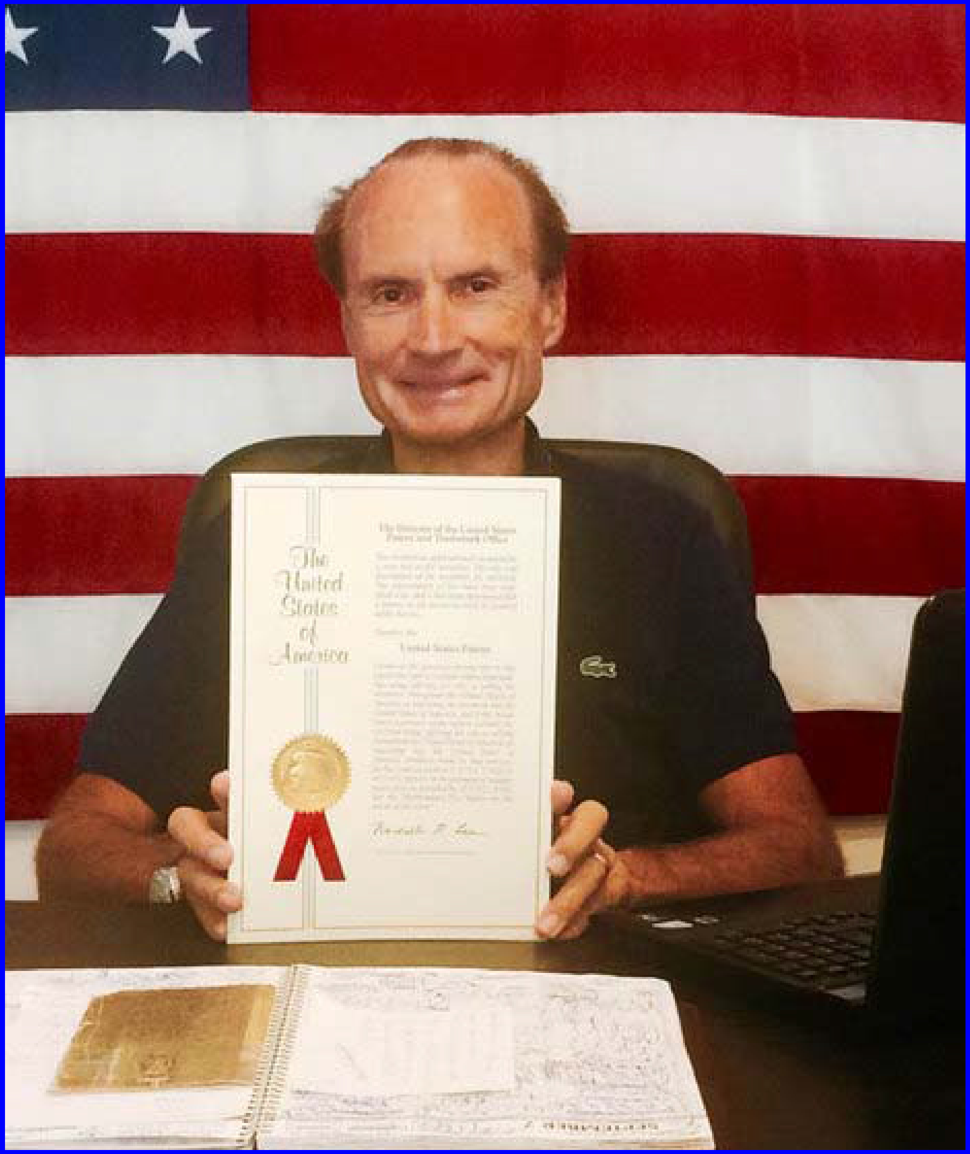
C. Rubbia



New results

1. Andrea Rossi and Giuseppe Levi
2. A.G. Parkhomov
3. China Institute of Atomic Energy
4. I.N. Stepanov et al.
5. LENZ
6. Brillouin Energy Corporation

Andrea Rossi – Patent



Tom Darden
Industrial Heat

$Li_7 + H_1 \rightarrow Be_8 \rightarrow 2\ He_4 + 17.3$ MeV

(12) **United States Patent**
Rossi

(10) **Patent No.:** **US 9,115,913 B1**
(45) **Date of Patent:** **Aug. 25, 2015**

(54) **FLUID HEATER**

(75) Inventor: **Andrea Rossi**, Miami Beach, FL (US)

(73) Assignee: **Leonardo Corporation**, Miami Beach, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under U.S.C. 154(b) by 609 days.

(21) Appl. No.: **13/420,109**

(22) Filed: **Mar. 14, 2012**

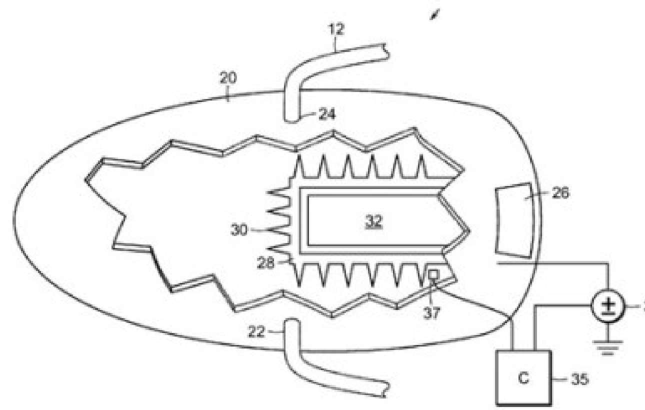
(51) **Int. Cl.**
F24J 1/00 (2006.01)

(52) **U.S. Cl.**
CPC ***F24J 1/00*** (2013

(58) **Field of Classification Search**
USPC 122/16.1
See application file for complete search history.

2004/0013585 A1*	1/2004	Whyatt et al.	....	422/189
2004/0065314 A1*	4/2004	Layer et al.	....	126/263.03
2010/0251694 A1*	10/2010	Hugus et al.	....	60/253
2010/0252023 A1*	10/2010	Coffey et al.	....	126/263.01
2011/0005506 A1	1/2011	Rossi		

FOREIGN PATENT DOCUMENTS



The Rossi Effect

Until the inventor Andrea Rossi discovered the *Rossi Effect* there were basically only two categories of LENR studied:

1. Palladium – Deuterium (the original *Cold Fusion* process)
2. Nickel – Hydrogen

The *Rossi Effect* is a completely new discovery in the field of LENR technology and raises the available power density of LENR processes several orders of magnitude to at least *10 kW/kg*. *(Density 10 kW/kg means that we have a power of 10 kW for every kg of plant; means , for example, that we can make a 1 MW power generator with an apparatus that weighs 100 kg.)*

With Power Densities this high most conventional Energy Applications have the potential of being replaced with an ECAT energy source.

The *Rossi Effect* is based on a LENR process including Hydrogen and Lithium where Nickel is merely used as a catalyst and is not consumed in the process (some Nickel – Hydrogen reactions occur but the major part of the Nickel is not consumed and can be recycled). The Hydrogen – Lithium reaction is highly exothermic;

1. $Li_7 + H_1 \rightarrow Be_8 \rightarrow 2\,He_4 + 17.3\ MeV$,

where the *17.3 MeV* $(=2.8 * 10^{-12}\ J)$ is released as heat. This is equivalent to an Energy Density (Specific Energy) of *209 million MJ/kg or 58 million kWh/kg* or 5 million times the Energy Density of Oil.

ECAT uses *Lithium Aluminium Hydride* ($LiAlH_4$) as fuel for utilizing the *Rossi Effect*. The benefit of *Lithium Aluminium Hydride* as a Fuel Source is that it is a solid and therefore much easier to handle than ordinary Hydrogen Gas.

Leonardo Corporation received a US patent for this ECAT process on the 25 Aug 2015, see ECAT patents.

When heated *Lithium Aluminium Hydride* decomposes in a three-steps:

1. $3\ LiAlH_4 \rightarrow Li_3AlH_6 + 2\ Al + 3\ H2$ (R1)
2. $2\ Li_3AlH_6 \rightarrow 6\ LiH + 2\ Al + 3\ H_2$ (R2)
3. $2\ LiH + 2\ Al \rightarrow 2\ LiAl + H_2$ (R3)

Especially beneficial is that gamma radiation is naturally absent in the *Rossi Effect* because the energy is only released as kinetic energy through thermal *Helium* nuclei which later thermalize the *Nickel* Lattice and the inner walls of the ECAT reactor core, under impact, turning kinetic energy into thermal energy. This makes the *Rossi Effect* ideal for utilizing nuclear sized energy in the complete absence of both radioactive materials and radiation.

Announcement of "dissolution of marriage"

Leonardo Corporation announced today, June 2, 2016, that it has terminated the license granted to Industrial Heat, LLC for the Energy Catalyzer ("E-Cat") technology. Effective immediately, Leonardo Corporation has the sole and exclusive right to the E-Cat intellectual property in all territories previously licensed to Industrial Heat, LLC. According to Leonardo Corporation, the decision to terminate Industrial Heat, LLC's license follows Industrial Heat, LLC's failure to pay the agreed upon licensing fee.

“Muon catalysis and nuclear breeding”

S.S. Gerstein, Yu.V. Petrov, L.I. Ponomarev
Uspekhi, Vol. 160, Issue 8, August 1990

“All professionals tacitly admit that in the future the only dt cross-section reaction of fusion could be foreseeable because it is approximately 100 times greater than the dd reaction. In this case, a limiting factor is the lithium, which has been obtained from the tritium (n + 6Li $\longrightarrow$ 4He + t). The amount of Lithium on the Earth is small, and it is difficult to extract because it is a trace element. In other words, the potential for fusion energy reserves does not exceed the energy reserves of the fission.”

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BROWSING TOOLS

Observation of abundant heat production from a reactor device and of isotopic changes in the fuel

Levi, Giuseppe ; **Evelyn, Foschi** ; **Bo, Hoistad** ; **Roland, Pettesson** ; **Lars, Tegnér** ; **Hanno, Essén** (2014) *Observation of abundant heat production from a reactor device and of isotopic changes in the fuel.* [Preprint]

V.I. Veksler and A.M. Baldin LPHE, JINR
Dubna, 24 June 2016

"Observation of abundant heat production from a reactor device and of isotopic changes in the fuel"

Giuseppe Levi
Bologna University, Bologna, Italy

Evelyn Foschi
Bologna, Italy

Bo Höistad, Roland Pettersson and Lars Tegnér
Uppsala University, Uppsala, Sweden

Hanno Essén
Royal Institute of Technology, Stockholm, Sweden

October 6, 2014

ABSTRACT

Data were collected during 32 days of running in March 2014. The reactor operating point was set to about 1260° C in the first half of the run, and at about 1400° C in the second half. The measured energy balance between input and output heat yielded a COP factor of about 3.2 and 3.6 for the 1260° C and 1400° C runs, respectively. The total net energy obtained during the 32 days run was about 1.5 MWh. This amount of energy is far more than can be obtained from any known chemical sources in the small reactor volume.

Giuseppe Levi et al.

$H + {}^{7}Li \rightarrow {}^{8}B^* \rightarrow {}^{4}He + {}^{4}He$

Ion	Fuel		Ash		
	Counts in peak	Measured abundance [%]	Counts in peak	Measured abundance [%]	Natural abundance [%]
${}^{6}Li^{+}$	15804	8.6	569302	92.1	7.5
${}^{7}Li^{+}$	168919	91.4	48687	7.9	92.5
${}^{58}Ni^{+}$	93392	67	1128	0.8	68.1
${}^{60}Ni^{+}$	36690	26.3	635	0.5	26.2
${}^{61}Ni^{+}$	2606	1.9	~0	0	1.8
${}^{62}Ni^{+}$	5379	3.9	133272	98.7	3.6
${}^{64}Ni^{+}$	1331	1	~0	0	0.9

Conclusion

In summary, the performance of the E-Cat reactor is remarkable. We have a device giving heat energy compatible with nuclear transformations, but it operates at low energy and gives neither nuclear radioactive waste *nor emits radiation*. From basic general knowledge in nuclear physics this should not be possible. Nevertheless we have to relate to the fact that the experimentally from our test show heat production beyond chemical burning, and that the E-Cat fuel undergoes transformations.

X-cat Андреа Росси

V.I. Veksler and A.M. Baldin LPHE, JINR
Dubna, 24 June 2016

E.N. Tsyganov, S.B. Dabagov, M.D. Bavizhev

"XI International Scientific Conference: Solid State Chemistry" Nanomaterials, Stavropol, Russia on 22-27 April 2012, p. 51-57.

68,27%	$^{58}Ni + ^{1}H$	$\rightarrow$	$^{59}Cu^{*}$	$\rightarrow$	$^{59}Ni + \beta^{+} + \gamma^{*} + \nu_{e}$	1,3	мин.
	$^{59}Ni + ^{1}H$	$\rightarrow$	$^{60}Cu^{*}$	$\rightarrow$	$^{60}Ni + \beta^{+} + \gamma^{*} + \nu_{e}$	23,7	мин.
26,10%	$^{60}Ni + ^{1}H$	$\rightarrow$	$^{61}Cu^{*}$	$\rightarrow$	$^{61}Ni + \beta^{+} + \gamma^{*} + \nu_{e}$	3,3	мин.
1,13%	$^{61}Ni + ^{1}H$	$\rightarrow$	$^{62}Cu^{*}$	$\rightarrow$	$^{62}Ni + \beta^{+} + \gamma^{*} + \nu_{e}$	9,7	мин.
3,59%	$^{62}Ni + ^{1}H$	$\rightarrow$	$^{63}Cu^{*}$	$\rightarrow$	$^{63}Cu + \gamma^{*}$	^{63}Cu	стаб.
0,91%	$^{64}Ni + ^{1}H$	$\rightarrow$	$^{65}Cu^{*}$	$\rightarrow$	$^{65}Cu + \gamma^{*}$	^{65}Cu	стаб.

Here γ^{*} - multiple *virtual photons*

Lifetime of ^{59}Ni - 76,000 years

Norman Cook and Andrea Rossi

"On the Nuclear Mechanisms Underlying the Heat Production by the E-Cat"

http://arxiv.org/ftp/arxiv/papers/1504/1504.01261.pdf

CookRossi9April2015.docx

$^{58}_{28}Ni_{30}\ (0^+)+p \rightarrow {}^{59}_{29}Cu_{30}\ (3/2^-)(EC+\beta^+) \rightarrow {}^{59}_{28}Ni_{31}\ (3/2^-)(EC+\beta^+) \rightarrow {}^{59}_{27}Co_{32}\ (7/2^-)(stable)$

$^{60}_{28}Ni_{32}\ (0^+)+p \rightarrow {}^{61}_{29}Cu_{32}\ (3/2^-)\ (EC+\beta^+) \rightarrow {}^{61}_{28}Ni_{33}\ (3/2^-)(stable)$

$^{61}_{28}Ni_{33}\ (3/2^-)+p \rightarrow {}^{62}_{29}Cu_{33}\ (1^+)\ (EC+\beta^+) \rightarrow {}^{62}_{28}Ni_{34}\ (0^+)(stable)$

$^{62}_{28}Ni_{34}\ (0^+)+p \rightarrow {}^{63}_{29}Cu_{34}\ (3/2^-)(stable)$

$^{64}_{28}Ni_{36}\ (0^+)+p \rightarrow {}^{65}_{29}Cu_{36}\ (3/2^-)(stable)$

Norman Cook and Andrea Rossi in their descriptions of Ni + H reaction are repeating our conclusions from 2012. Authors do not pay attention to the fact that the annihilation of positrons produces hard gamma rays with energy of 511 keV.

ICCF-19

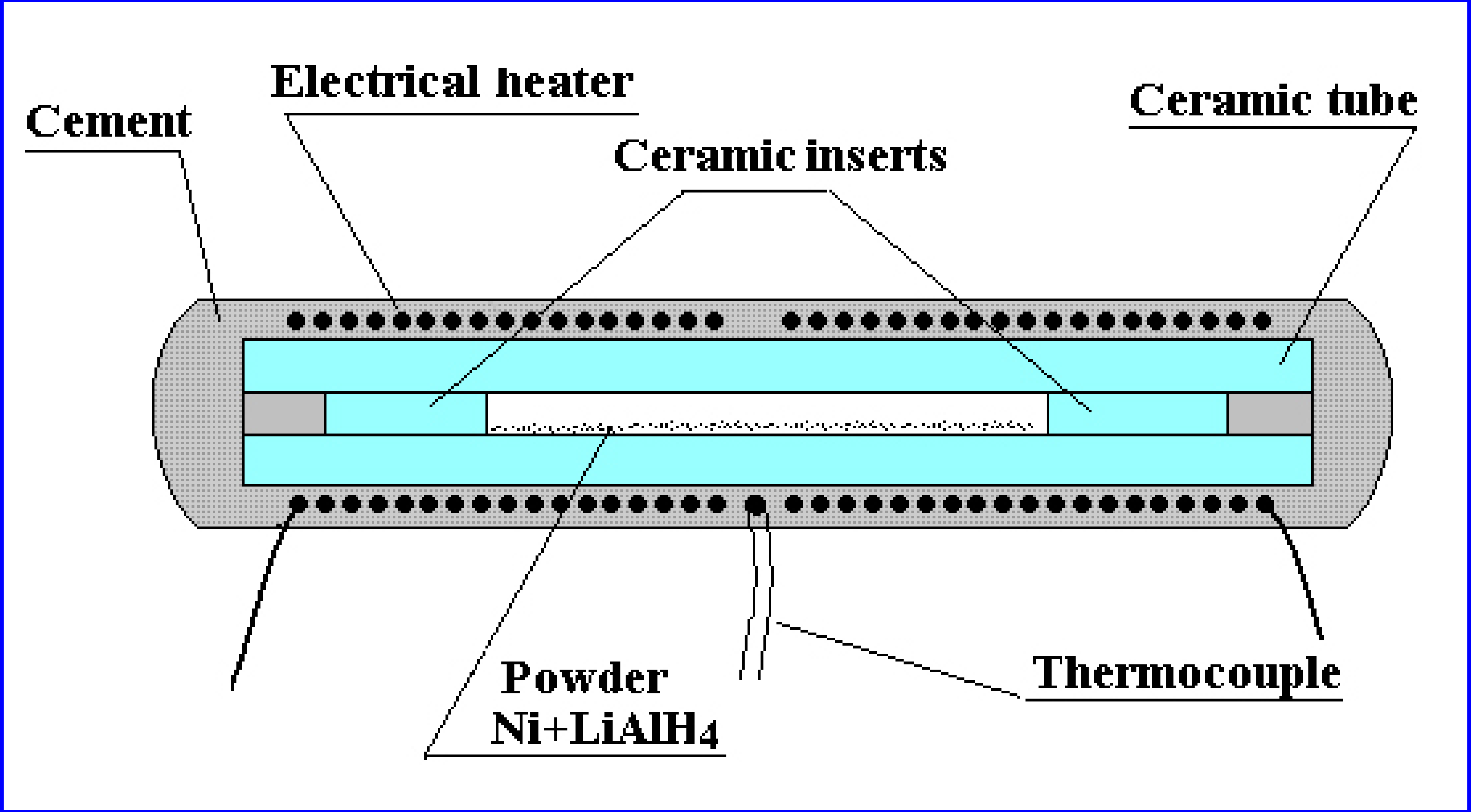
Researches of the Heat Generators Similar to High-Temperature Rossi Reactor

A.G. Parkhomov, E.O. Belousova
Lomonosov Moscow State University, Moscow, Russia

The devices similar to high-temperature Rossi reactor were made. Excess heat by the temperature about 1100 °C and more was demonstrated. *There was no ionized radiation observed during the reactor's work above the background level.*

V.I. Veksler and A.M. Baldin LPHE, JINR
Dubna, 24 June 2016

Схема реактора



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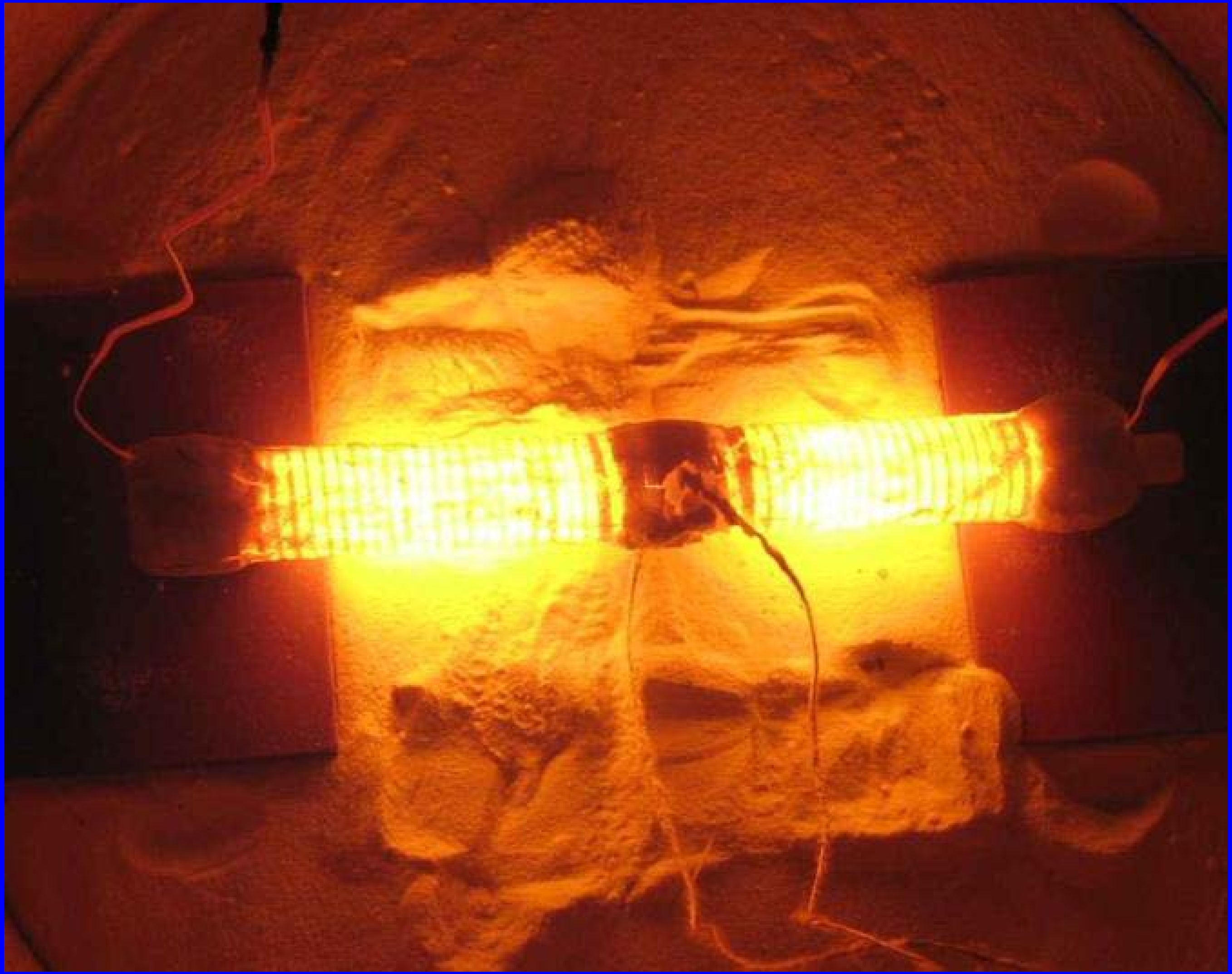
Реактор в процессе работы



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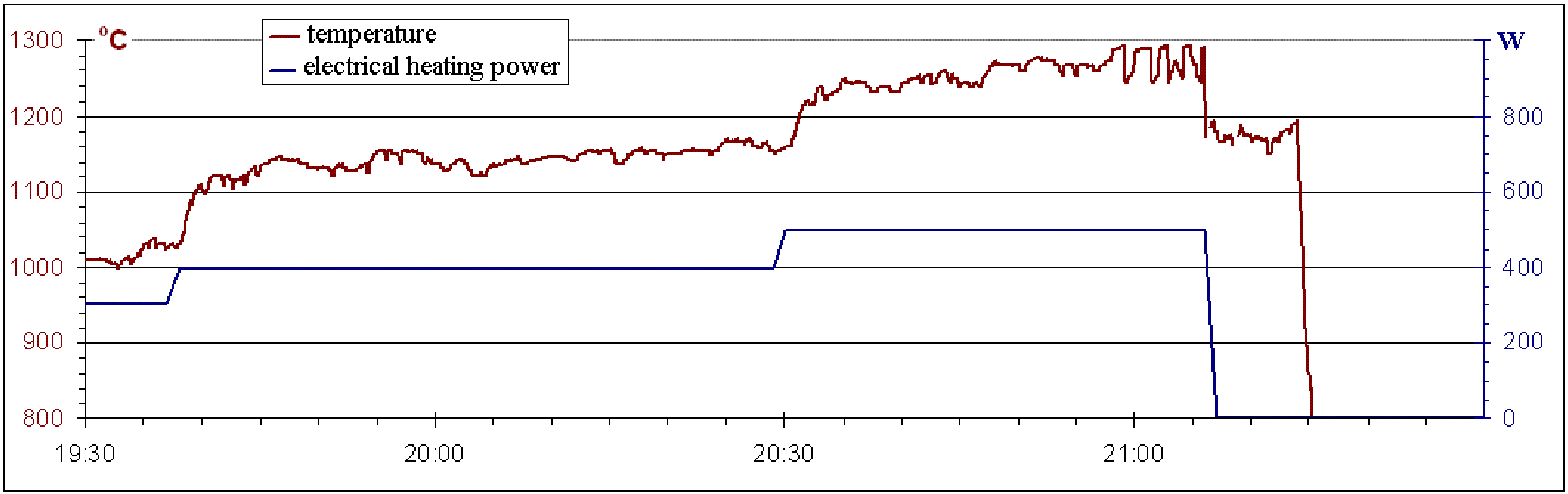
Dubna, 24 June 2016

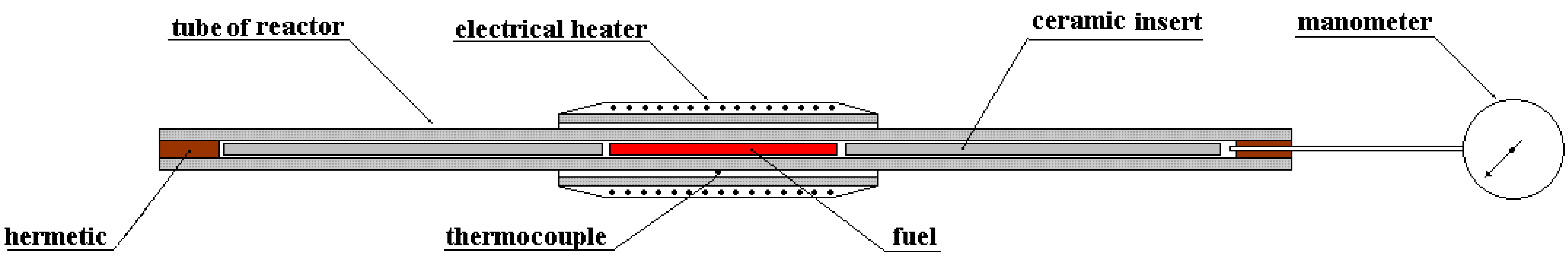
Temperature dynamics and electrical heating power at high temperature.



Reactor loaded with fuel

Date	Temper.	Durat.	Cons.	Prod.	COP
	°C	min	W	W	
20.12.2014	970	38	301	297	0,99
20.12.2014	1150	50	395	758	**1,92**
20.12.2014	1290	40	499	1365	**2,74**
04.01.2015	940	131	304	305	1,00
04.01.2015	1020	75	377	407	1,08
10.01.2015	1080	73	161	284	**1,77**
18.01.2015	800	90	308	293	0,95
18.01.2015	1080	38	78	135	**1,73**

Construction of the reactor for long time work



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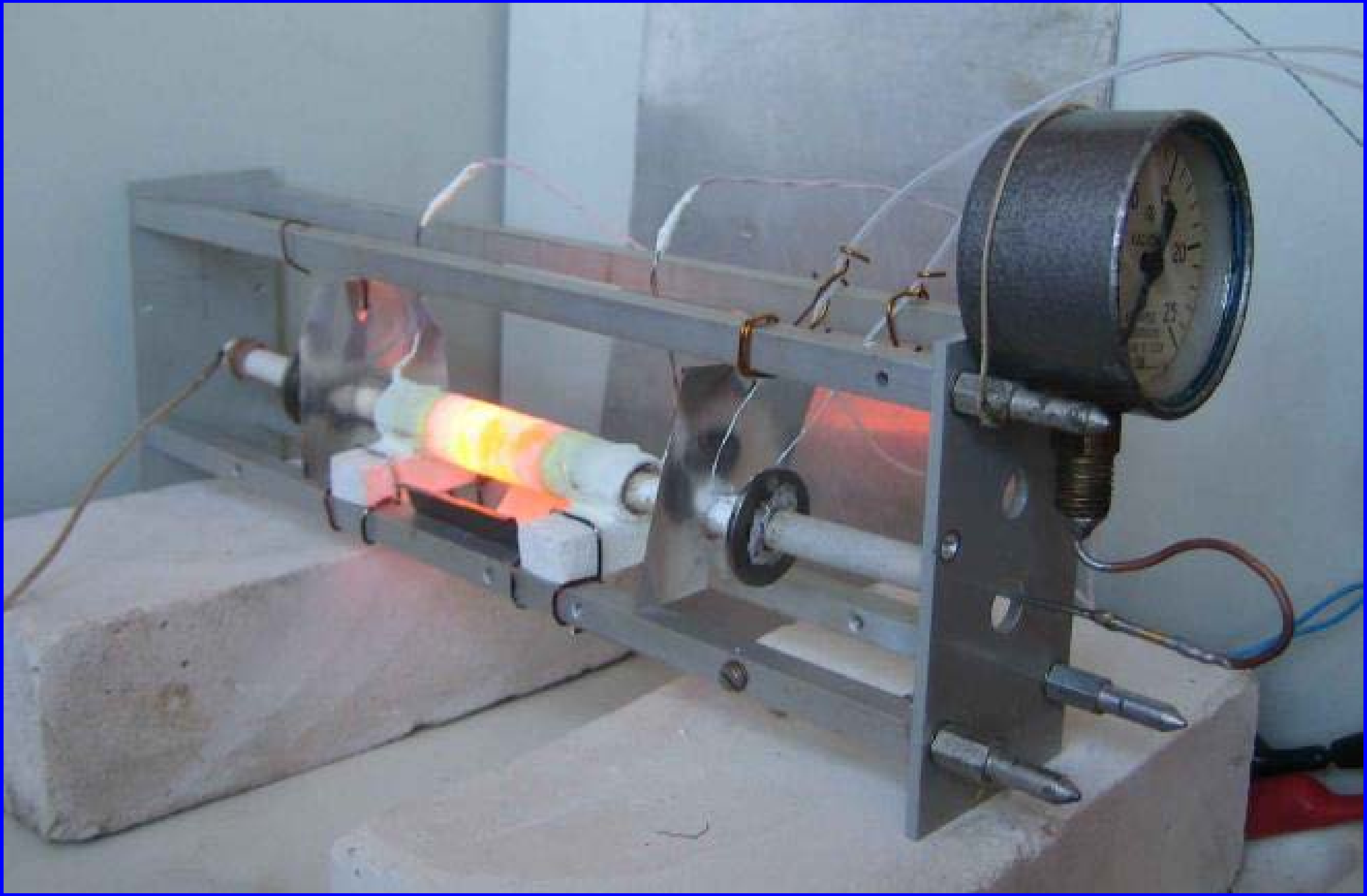
Dubna, 24 June 2016

Reactor during the tests



Anomalous heat production in hydrogen-loaded metals: possible nuclear reactions occurring at normal temperature

Bu-Jia Q Ming He, Shao-Yong Wu, Qing-Zhang Zhao, Xiao-Ming Wang, Yi-Jun Pang, Xian-Lin Yang and Song-Sheng Jiang *

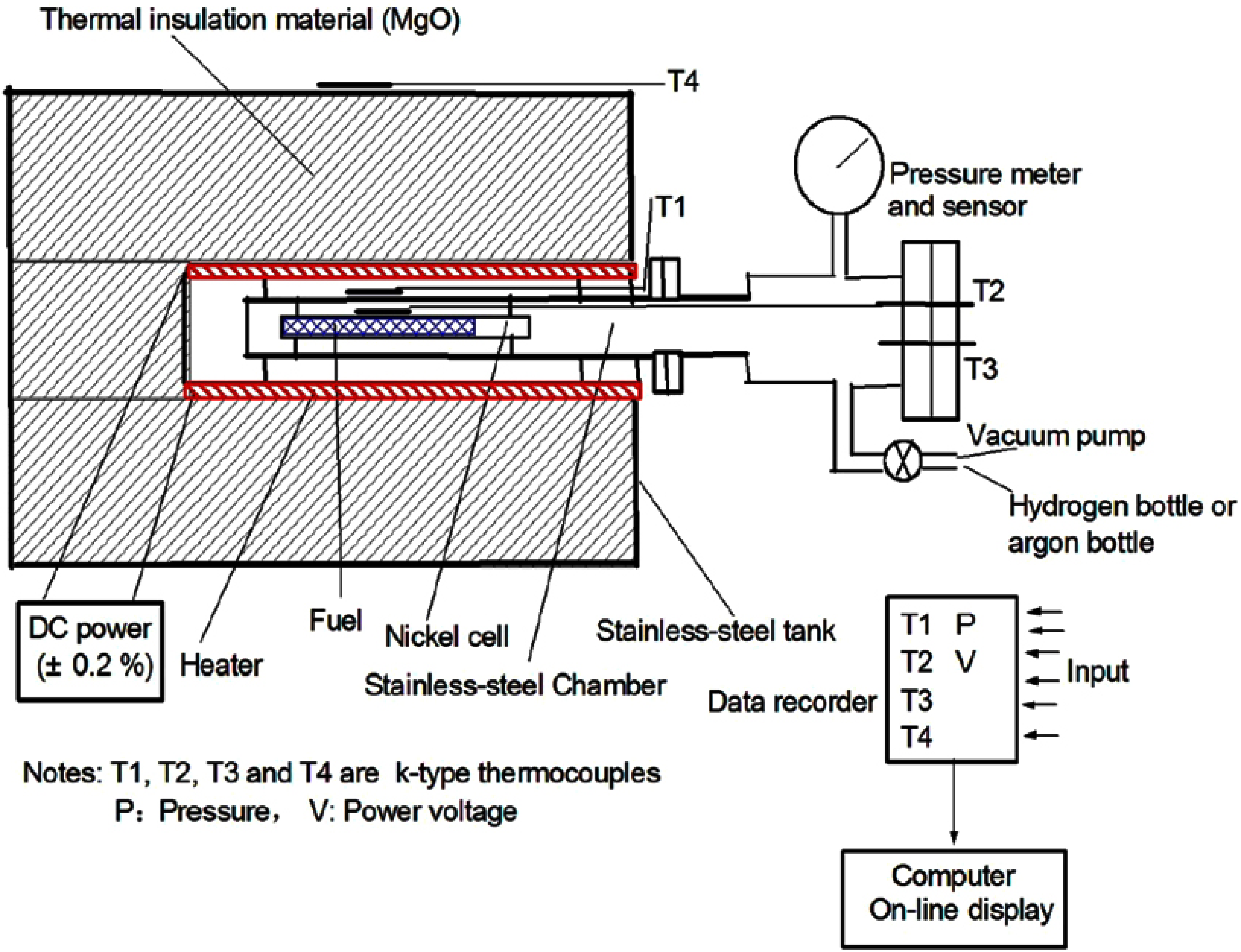
***China Institute of Atomic Energy*, PO 275 (49), Beijing 102413**

***Corresponding author, E-mail: ssjiang@ciae.ac.cn, jiang@ihep.ac.cn**

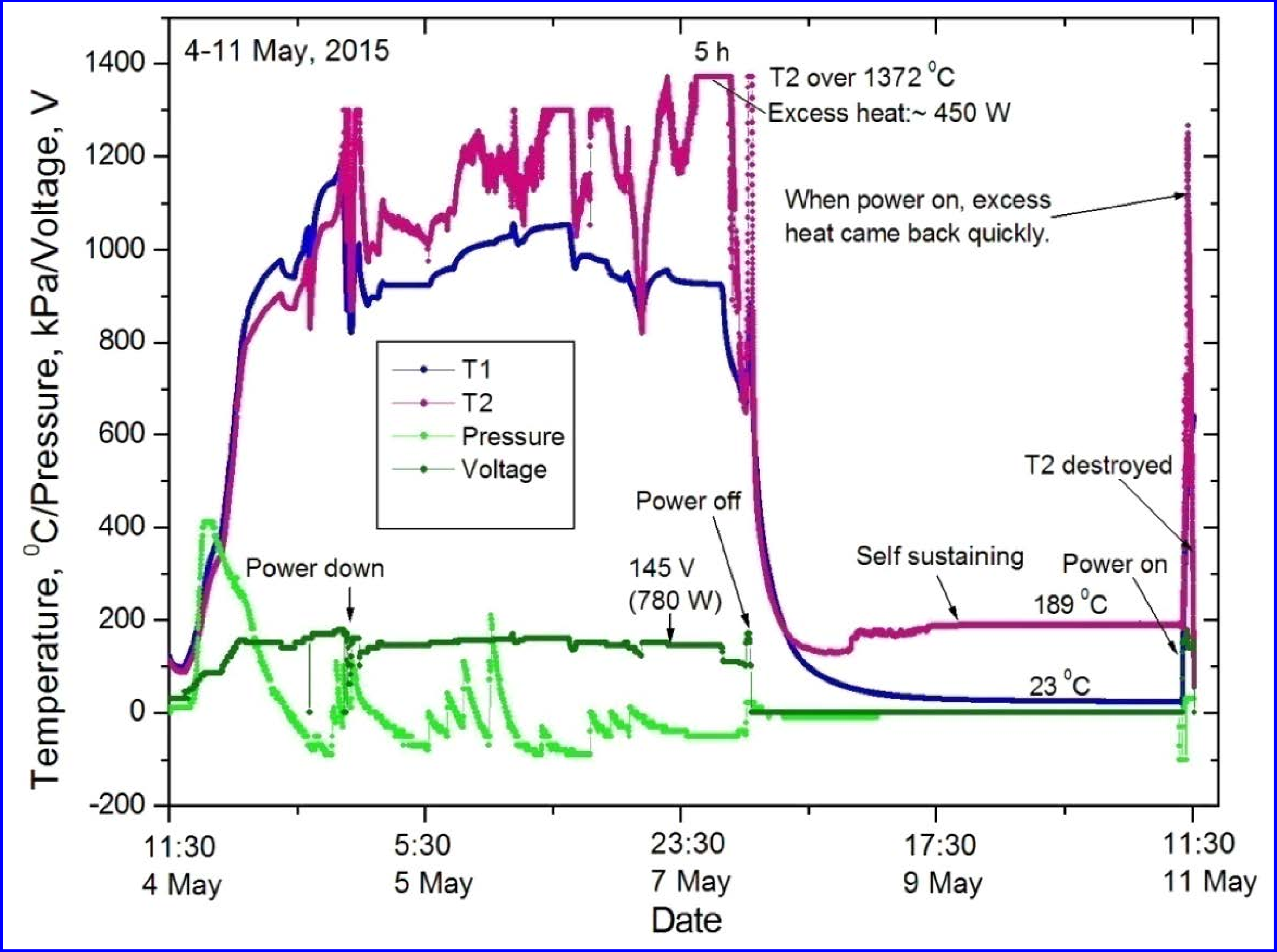
This paper reports results of anomalous heat generation in hydrogen-loaded metals at a temperature below 1300 °C. The heat was produced in the fuel sample (mixture of nickel powder and $LiAlH_4$), which was added to a nickel cell, and then the cell was placed in a sealed stainless-steel chamber. Results of two runs are demonstrated. Excess heat lasted for seven days in the first run.

The first run maximum excess heat power was greater than 450 W and the excess heat energy was evaluated to be 78 MJ for the first 72 hours.

In the second run, excess heat lasted for 120 minutes after external heating was turned off, and the maximum excess heat power was 450 W. The self-sustaining effect can be observed clearly when power was off in the second run. The maximum heat energy from possible chemical reaction was estimated to be 26 kJ, a value much smaller than the excess heat energy. Therefore, excess heat could not originate from any chemical reactions and it might originate from a nuclear reactions.



Notes: T1, T2, T3 and T4 are k-type thermocouples
P: Pressure, V: Power voltage



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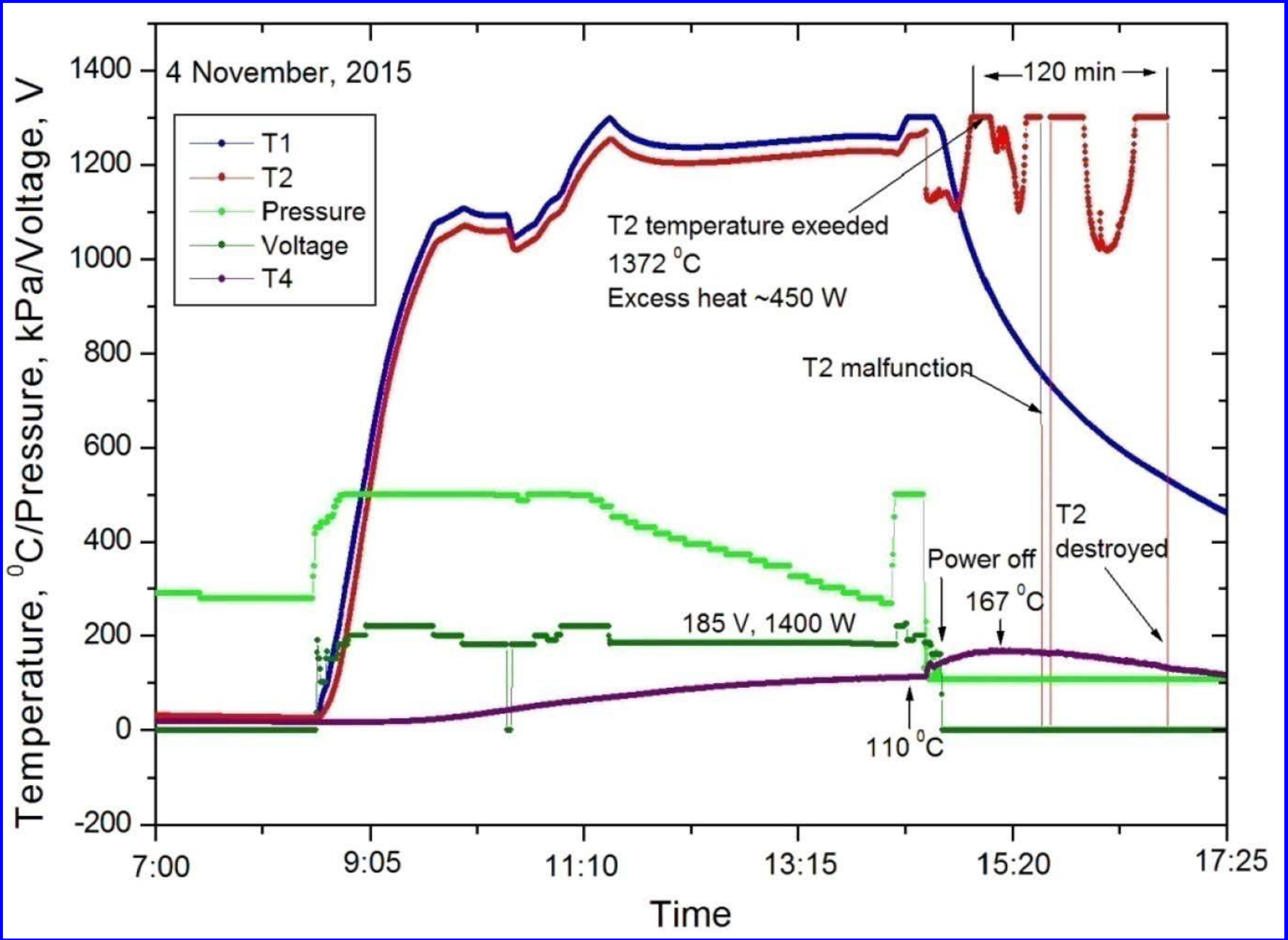


V.I. Veksler and A.M. Baldin LPHE, JINR
Dubna, 24 June 2016

In this paper, the experimental apparatus and method for measuring the high temperature heat anomalies were described in detail. The results show: nickel powder and lithium aluminum hydride, when used as a fuel sample and heated to a temperature of 1100° C - 1300° C, generate abnormal heat. In the first round experiment, a maximum power of 450 W of abnormal heat was generated over a period of 72 hours, generating 78 MJ of heat energy.

In the second round of experiments, when the external power was disconnected, T1 temperature decreased while the temperature at *T2 remained in the range of 1300° C for about 120 minutes*, demonstrating tolerance of the fuel samples for self-sustaining heat generation of about 450 W. In the second round experiment, when the external power supply was disconnected, temperature T4 on the outer shell of the assembly abnormally rose from 110° C to 167° C. This result indicates that, in addition to the heater power, there is another inner heat source to promote the T4 temperature.

The possible energy generated by chemical reaction was calculated to be 26 kJ. The abnormal heat output from the experiments was *higher than that of chemical energy by a factor of 3*. Therefore, such a huge excess heat may be caused by low-energy nuclear reactions (LENR).

Theoretical research of low-energy nuclear reactions has made significant progress in recent years, and there are many proposed mechanisms. However, there is no single accepted theory.

Our results clearly show thermal abnormalities in heating of metal containing hydrogen, capable of generating heat at constant temperature. This opens scientific research into a new and important source of energy.

I.N. Stepanov, Yu.N. Malakhov, Shi Nguen-Kuok

stepanovigorn@gmail.com, Moscow State Lomonosov University yumalakhov@yandex.ru, nguyenquocshi@yahoo.com, National Research University MEI, **"Journal of Forming Scientific Directions", No 9(3), pp. 90-93, 2015**

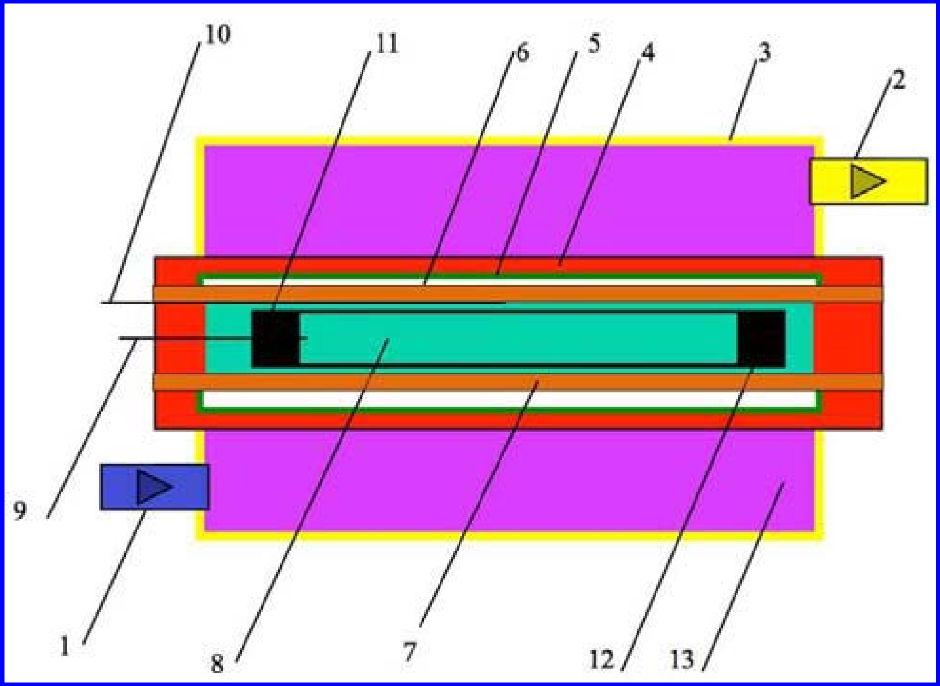
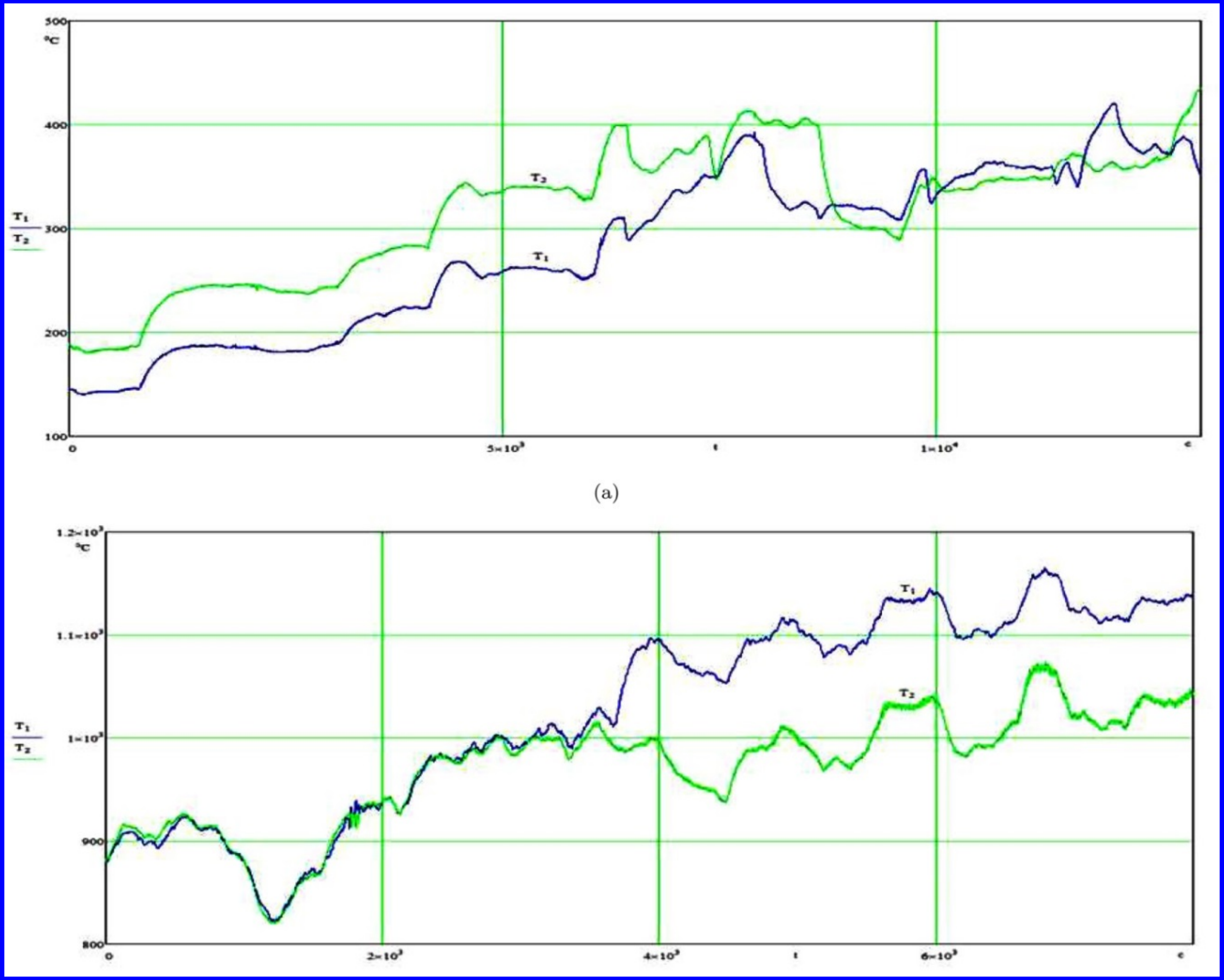


Figure 1. Schematics of a heat generator. 1 The inlet connection being inserted into the calorimeter thermocouple for connection to a cooling water pipe. 2 - Connecting the output from a thermocouple for open water discharge. 3 - The outer casing of the calorimeter. 4 - The inner shell of the calorimeter of the copper pipe. 5 -An electrically insulating layer. 6 - Heater. 7 - Ceramic body heater. 8 - Heating with fuel cell. 9, 10 - Thermocouple. 11, 12 - Container plugs. 13 - Running water.

The time dependence of the temperature inside the heat cell T1 and on its surface: a) the initial stage, b) energy generation stage.



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1. Setup of a heat generator for experiments to study the process of turning excess energy into heat is established with sealed boxes filled with a mixture of nickel powder and lithium aluminum hydride.

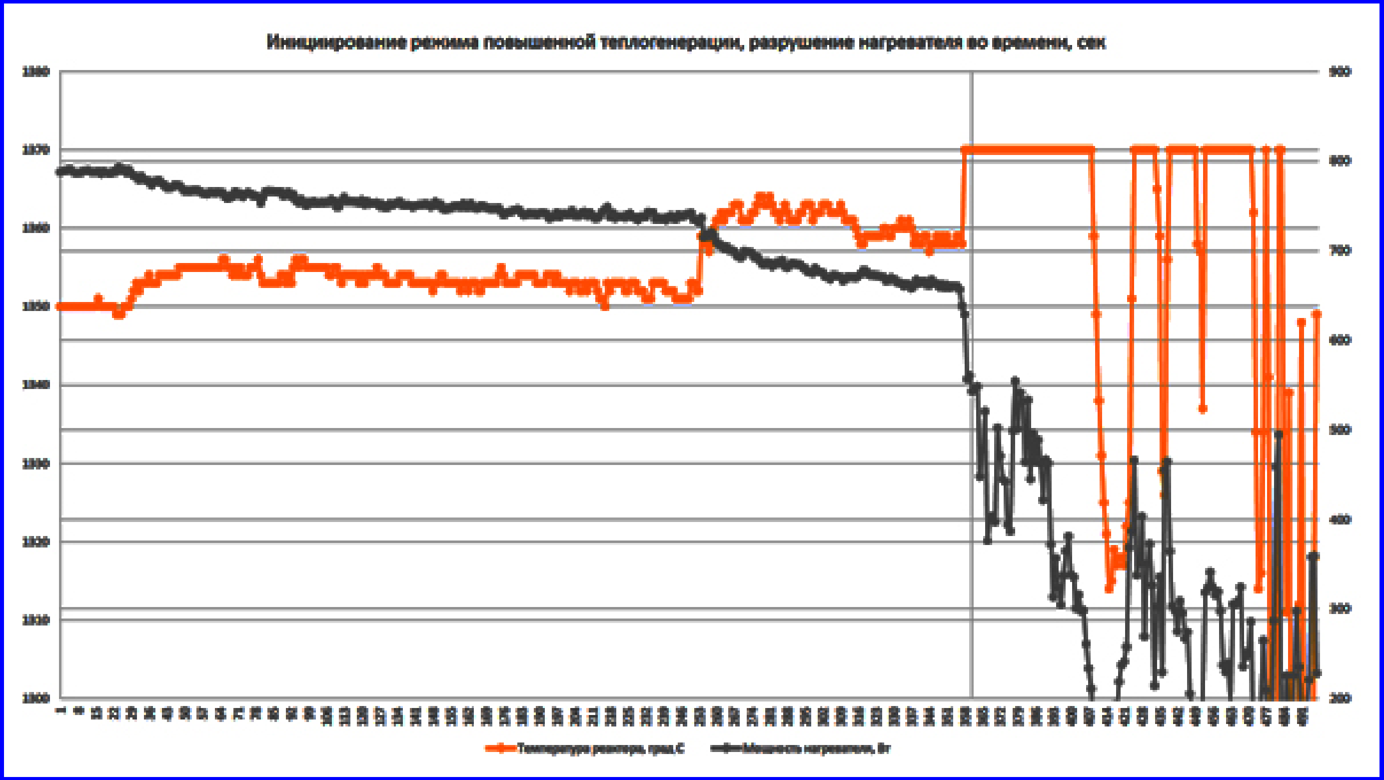
2. The results indicate excessive heat after heating a mixture of nickel powder and lithium aluminum hydride in a temperature range of 1030 - 1140° C, which is consistent with the results of the work of Levi (Lugano experiment) and Parkhomov.

3. During the work of the generator, no radiation by exposure of X-ray photographic emulsion (RF film 3) was recorded.

4. The results obtained by measuring the excess heat of reaction and the chemical analysis indicate the *large additional source of power inside the generator; these values are not achieved in known chemical reactions*. Determining the nature of this reaction, including confirmation that it is a kind of nuclear transmutation reaction in vapors of lithium aluminum hydride catalyst, would be necessary to analyze the source and the spent fuel isotopes after prolonged operation of the generator.

Study of modes of operation of heat Ni-H generator

LenzandColab@gmail.com



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Dubna, 24 June 2016

Conclusions

Initiation of energy generation mode for thin (0.2 mm) reactor can occur even with 800-900 ^{o} C.

The rising rate of temperature of the heater (air) for initiation of heat generation can be greater or equal to 0.5^{o} C/s.

Thermo-generation mode for thick-wall reactor can be initiated at a temperature of 1350 degrees.

Evaluation of COP (1347 ^{O} C) > 3.

Low Energy Nuclear Reactions (LENR) Phenomena and Potential Applications

Louis F. DeChiaro, Ph.D.
Physicist
September 23, 2015

ELECTROMAGNETIC & SENSOR SYSTEMS DEPARTMENT

V.I. Veksler and A.M. Baldin LPHE, JINR
Dubna, 24 June 2016

Summary

- Low Energy Nuclear Reactions appear to be real; are probably attributable to something like nuclear fusion. BUT ...
- Presence of lattice profoundly affects results; little prompt radiation...
- Multiple labs observed excess heat, elemental transmutations, soft X-ray emission, ^{4}He generation commensurate with heat, tritium production, occasional MeV neutron emission, and RF emission in the HF and mm wave bands.
- SPAWAR, & JWK Internat. and others all observed 100% repeatability.
- Rossi Hotcat tested by 3rd party academic group; $1.5x10^6$ Watt-hours excess thermal energy over 32 day continuous run + isotope shifts.
- Hotcat has been duplicated by Profs. A. Parkhomov (Moscow) & Jiang* (PRC).
- Commercial products (1 MW plant) now being tested, customer location.
- E-cats in 1 MW plant were still running on initial fuel charge at 4 months, COP varies between 20 and 80 in self-sustain mode.
- Multiple entrepreneurs now developing products for market.
- Ten LENR patents actually granted worldwide during past 5 years, 5 by USPTO.
- Plans exist to build LENR propulsion systems into vehicles for sale to public.
- NASA plans to use LENR thrusters in deep-space probes.

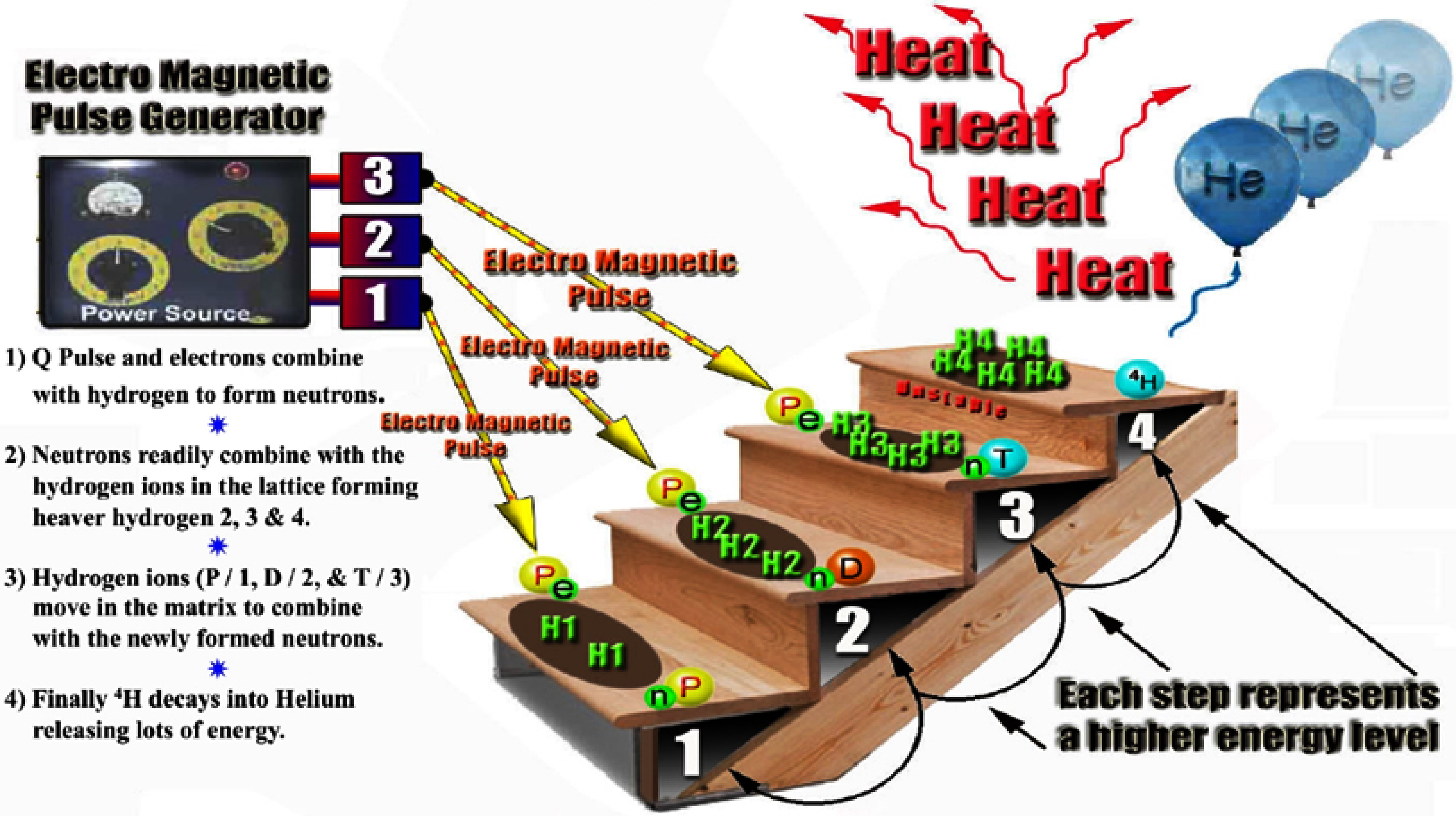
*Professor Jiang is also affiliated with China Institute of Atomic Energy, Beijing.

Press Release Brillouin Energy

CONGRESS VIEWS BRILLOUIN ENERGY'S LENR WET™ AND HHT™ BOILER REACTOR SYSTEMS FOR GENERATING THERMAL ENERGY

BERKELEY, CA, 18 November 2015 **- Brillouin Energy Corporation, developer of renewable energy technologies capable of producing commercially useful *amounts of thermal energy (heat) based on controlled low energy nuclear reactions (LENR),* announced today that its WET™ and HHT™ Boiler System reactor core modules were presented to Congress on Capitol Hill.**

As Dr. Michael McKubre said, “it is very clear that something on the order of *four times (4x) and potentially more gain power* (and therefore ultimately energy) was achieved at an impressive and industrially significant operating temperature of around 640 °C. This had not been achieved before in the LENR field. That the Brillouin Energy Q-Puls™ control system is capable of triggering the excess power on and off ‘s also highly significant.”



Step 1) Q Pulse and electrons combine with hydrogen to form neutrons.

Step 2) Neutrons readily combine with the hydrogen ions in the lattice forming heaver hydrogen 2, 3 & 4.

Step 3) Hydrogen ions (P / 1, D / 2, & T / 3) move in the matrix to combine with the newly formed neutrons.

Step 4) Finally ^{4}H decays into Helium releasing lots of energy.

Brillouin Controlled Electron Capture Reaction

A possible interpretation of the results of Brillouin

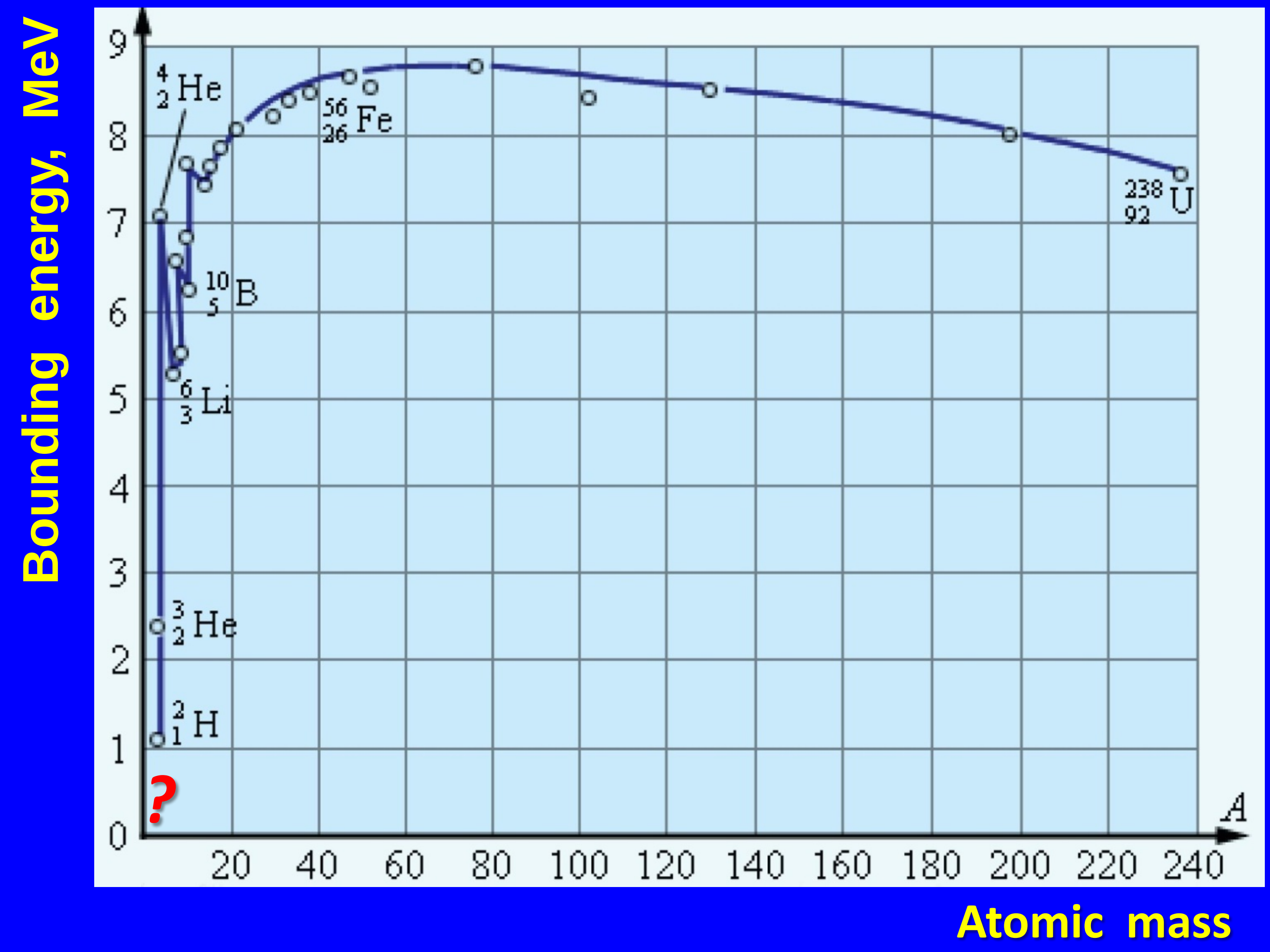
Earlier, it was observed that the electron capture (the weak interaction) for light element $^{4}Be_7 + e^- \rightarrow {}^{3}Li_7 + \nu_e$ runs with a lifetime of about 53 days. Experiments have shown that the electron capture rate depends on the electron proximity to the core. The reaction rate of the weak interaction $^{4}Be_7 + e^- \rightarrow {}^{3}Li_7 + \nu_e$, in the case when this process occurs in a metal, is expected to be higher than in the case where this process takes place in the insulator.

It can be *assumed* that a similar reaction $^{1}H_{1}+^{1}H_{1} \rightarrow {}^{2}He_{2}^{*} \rightarrow {}^{2}He_{2}^{*}+e^{-} \rightarrow {}^{1}H_{2}+\nu_{e}$ of hydrogen implantation in metals is very rapid. Please note that in *crisscross* configuration this reaction without any visible energy release can take place extremely fast.

=========

B. Wang, et al. (2006). "Change of the ^{7}Be electron capture half-life in metallic environments". *The European Physical Journal A 28: 375-377.

Bounding energy per nucleon for different elements



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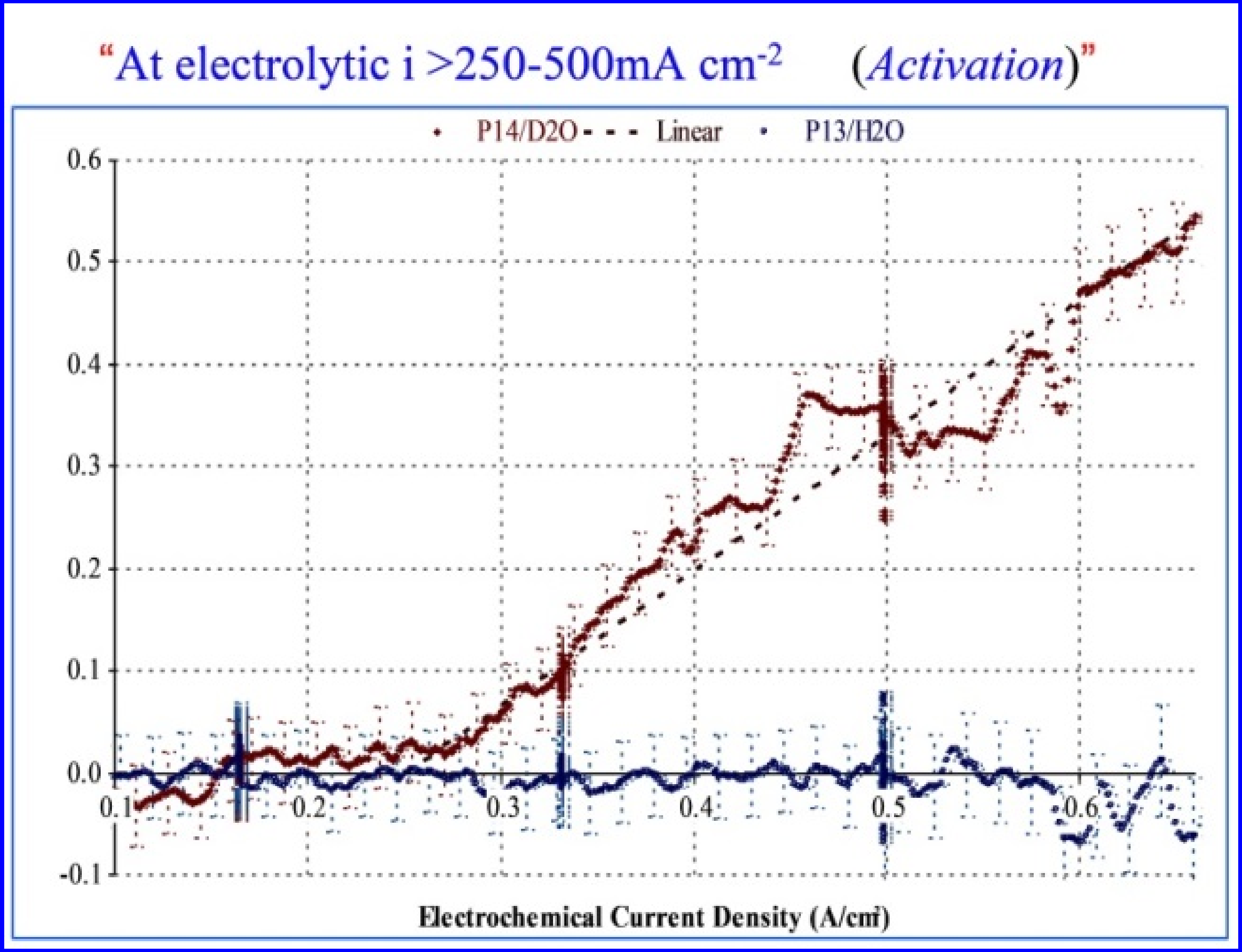
Dubna, 24 June 2016

<u>P13/14</u> Simultaneous Series Operation of Light & Heavy Water Cells; *Excess Power vs. Current Density*



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Dubna, 24 June 2016

The energy released in this reaction equals 0.93 MeV. Since the deuteron is quite a heavy particle, almost all of this energy is taken by the neutrino. Upon further saturation of the conductive crystal cell with $^{1}H_{1}$ hydrogen, $^{2}He_{3}$ is formed as a result of cold fusion, then $^{2}He_{4}$, etc.

As we can see, the first step in the fusion reaction of two ordinary hydrogen atoms $^{1}H_{1}$ in the conductive crystals with the electron-capture reaction causes no recorded energy release.

Apparently, this fact was the basis for the initial statement of the McKubre and others than the fusion reaction $^{1}H_{1}+^{1}H_{1}$ in their first experiments was not applicable.

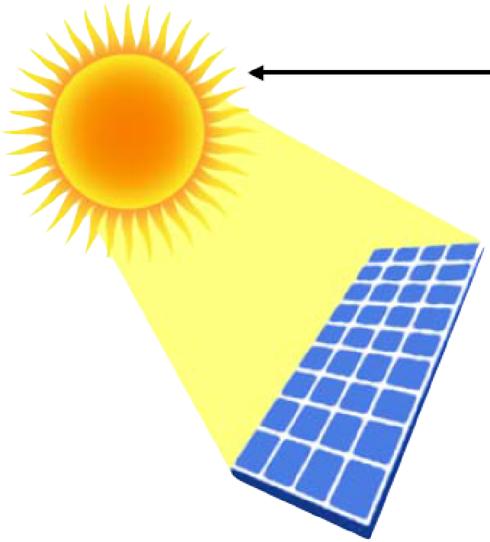
Further cold fusion reactions HD and DD occur without the neutrino emission.

Ultra-dense Hydrogen and Low Energy Nuclear Reactions

Presenter Sveinn Ólafsson Research professor Science Institute University of Iceland

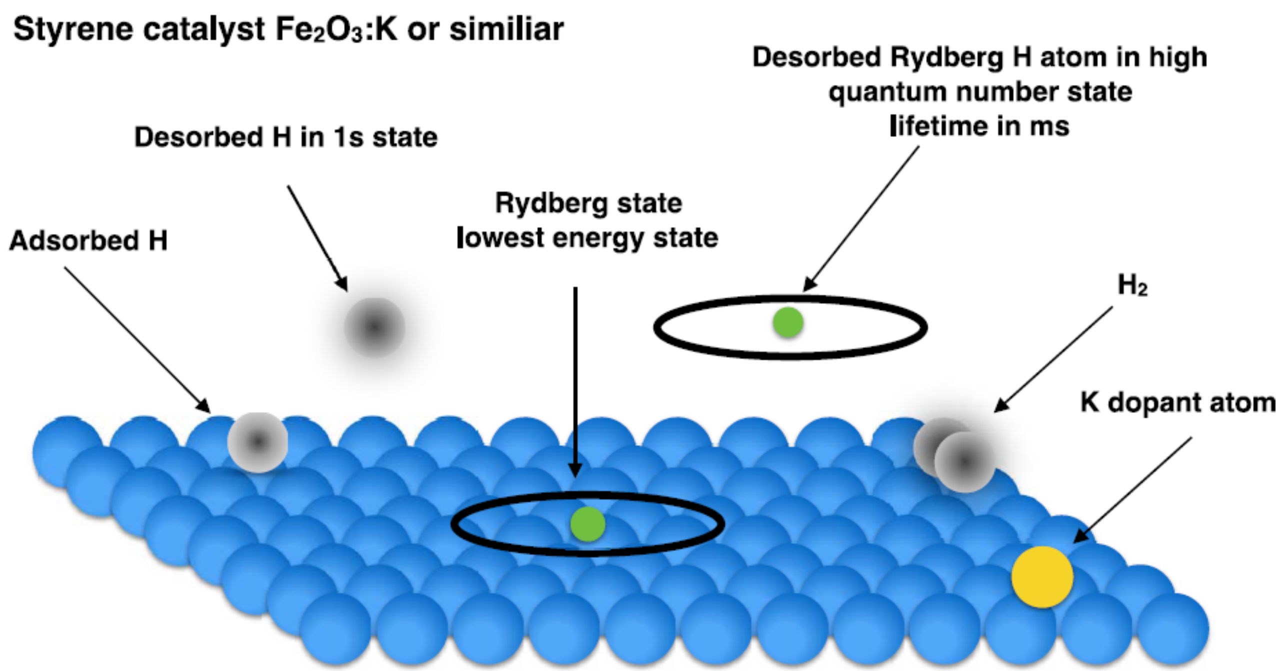
AVS62 Photocatalysis session

Overview of talk



1. Fusion reactions short overview
2. Palladium Deuterium
3. Nickel - Hydrogen
4. The Ultra-dense hydrogen
5. Theoretical discussion
6. Summary

Rydberg atom generation



Rydberg Matter Clusters: Theory of Interaction and Sorption Properties
Michael I. Ojovan J Clust Sci (2012) 23:35–46 DOI 10.1007/s10876-011-0410-6

114TH CONGRESS 2d Session | HOUSE OF REPRESENTATIVES | REPORT 114–537

NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2017

REPORT

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ON

H.R. 4909

together with

ADDITIONAL VIEWS

[Including cost estimate of the Congressional Budget Office]

MAY 4, 2016.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

V.I. Veksler and A.M. Baldin LPHE, JINR
Dubna, 24 June 2016

Low Energy Nuclear Reactions (LENR) Briefing

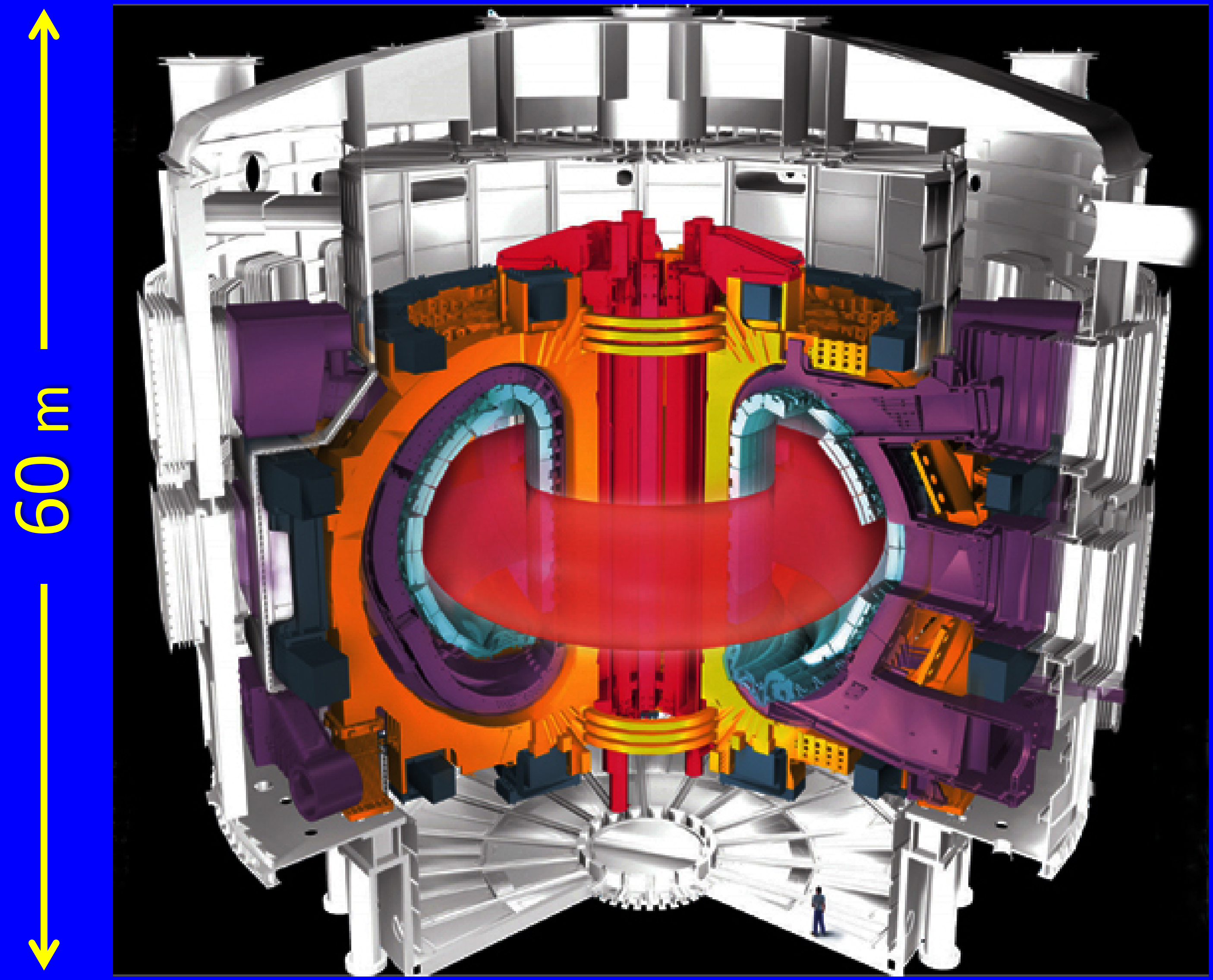
The committee is aware of recent positive developments in developing low-energy nuclear reactions (LENR), which produce ultra clean, low-cost renewable energy that have strong national security implications. ***For example, according to the Defense Intelligence Agency (DIA), if LENR works it will be a "disruptive technology that could revolutionize energy production and storage."*** **The committee is also aware of the Defense Advanced Research Project Agency's (DARPA) findings that other countries including China and India are moving forward with LENR programs of their own and that Japan has actually created its own investment fund to promote such technology.**

DIA has also assessed that Japan and Italy are leaders in the field and that Russia, China, Israel, and India are now devoting significant resources to LENR development. To better understand the national security implications of these developments, the *committee directs the Secretary of Defense to provide a briefing on the military utility of recent U.S. industrial base LENR advancements to the House Committee on Armed Services by September 22,* 2016. This briefing should examine the current state of research in the United States, how that compares to work being done internationally, and an assessment of the type of military applications where this technology could potentially be useful.

References

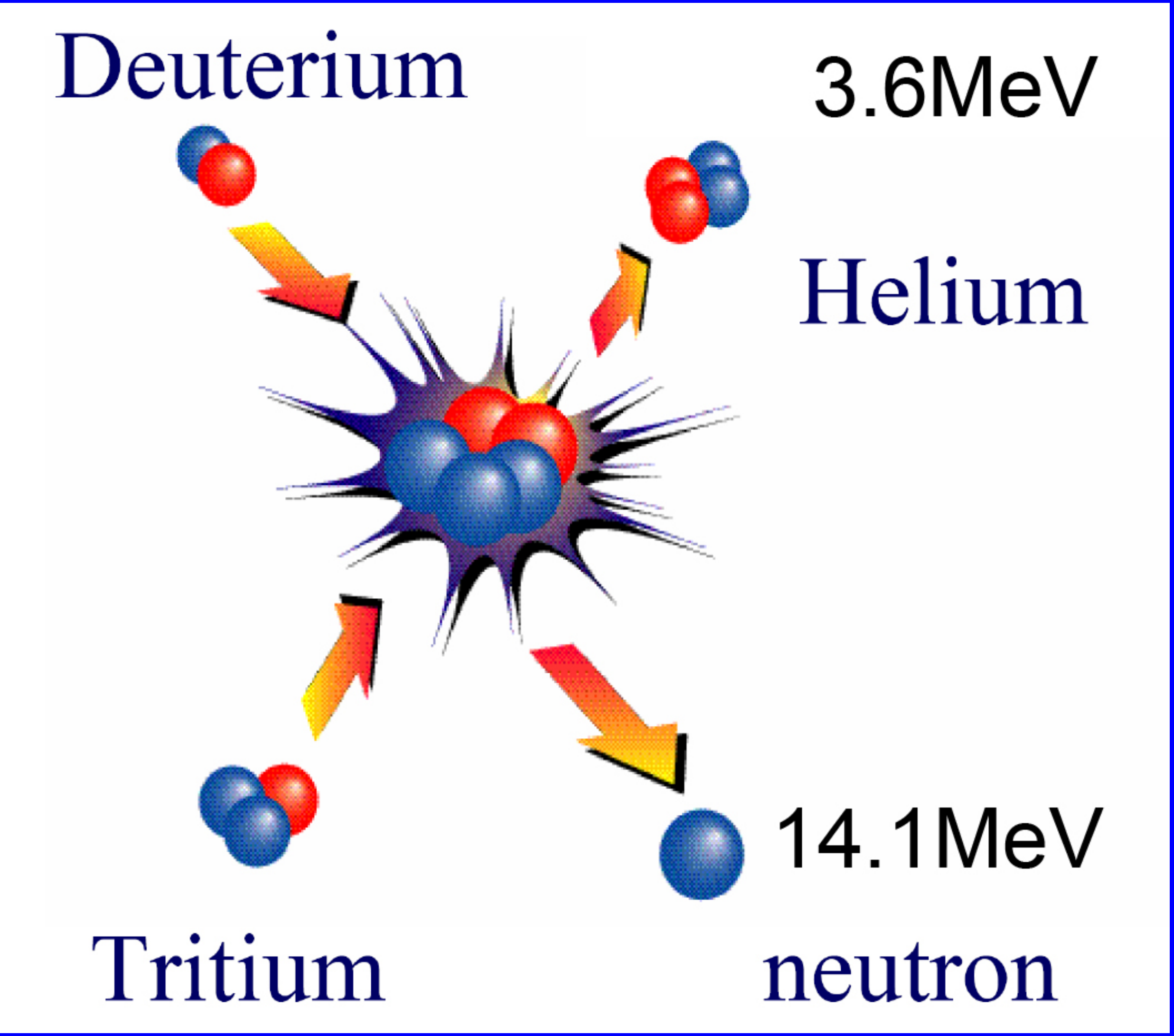
1. Я.Б. Зельдович, Доклады Академии Наук СССР, том 95, стр. 493 (1954)
2. Luis W. Alvarez et al., Physical Review Series II v. 105, 1957, p. 1127-1128
3. Johannes Rydberg, 1854-1919.
4. F. Raiola, (for the LUNA Collaboration), B. Burchard, Z. Fulop, et al., Eur. Phys. J. A27 (2006) 79.
5. Э.Н. Цыганов, *ЯДЕРНАЯ ФИЗИКА, 2012, том 75, №2, с. 174–180.*
6. E.N. Tsyganov et al., J. Condensed Matter Nucl. Sci. 17 (2015) p. 96-110
7. M. Winter, http://winter.group.shef.ac.uk/orbitron/AOs/2p/wave-fn.html
8. M.C.H. McKubre, F.L. Tanzella, I. Dardik, A. El-Boher, T. Zilov, E. Greenspan, C. Sibilia and V. Violante, in Low-Energy Nuclear Reactions Sourcebook, J. Marwan (Ed.), ACS Symposium Series 998, Oxford University Press, Oxford, 2008, p. 219
9. Andrea Rossi, http://ecat.com/ecat-science/the-rossi-effect
10. Giuseppe Levi et al., “Observation of abundant heat production…” University of Bologna Digital Library, in press.
11. National Defense Authorization Act for Fiscal Year 2017, May 4 2016.

ITER Project – developments of 1950 approach



V.I. Veksler and A.M. Baldin LPHE, JINR
Dubna, 24 June 2016

ITER Project



ICCF 19 International Conference on Condensed Matter Nuclear Science Padua (Italy) April 13-17, 2015

cea

How much does ITER cost?

More than 80% contributions are in kind

V.I. Veksler and A.M. Baldin LPHE, JINR
Dubna, 24 June 2016

ITER

ITER - an abbreviation for the International Thermonuclear Experimental Reactor. ITER began in 1985 as a Reagan-Gorbachev initiative (E.P. Velikhov). It is assumed that ITER will produce about 500 MW power and can operate continuously for up to 8 minutes. ITER, as it is expected, will provide energy (as heat) 10 times more than consumed for heating the plasma to fusion temperatures. ITER is a pure research project; the heat produced is not intended to be used to generate electricity. The project cost is about $15-20 billion.

Schedule of ITER construction

Timeline

Date	Event
2006-11-21	Seven participants formally agreed to fund the creation of a nuclear fusion reactor.
2008	Site preparation start, ITER itinerary start.
2009	Site preparation completion.
2010	Tokamak complex excavation starts.
2013	Tokamak complex construction starts.
2015	Tokamak assembly starts.
2019	Predicted: Tokamak assembly completion, torus pumpdown starts.
2020	Predicted: Achievement of first plasma.
2027	Predicted: Start of deuterium–tritium operation.

From the criticism of ITER project:

The total cost of ITER experiment could greatly exceed € 15 billion.

There are technical concerns that the 14 MeV neutrons which carry about 80% of the energy released, will *quickly destroy the reactor materials, as well as will cause a large secondary radioactivity*. Particular concern is the possible destruction of superconducting coils by the radiation.

ITER Project today

Another confirmation of the high level of French industry

V.I. Veksler and A.M. Baldin LPHE, JINR
Dubna, 24 June 2016

Stop ITER. Sortir du nucléaire!

“En 1950, nous espérions réaliser le réacteur thermonucléaire en 10 ans, 15 ansau grand maximum”. (A. Sakharov, "père" de la bombe H russe et des premiers tokamaks).

"Today, in 1950, we hope to create a fusion reactor in 10, maximum 15 years." (Sakharov, the "father" of the Russian hydrogen bomb on the first tokamak).

V.I. Veksler and A.M. Baldin LPHE, JINR
Dubna, 24 June 2016

Cold nuclear fusion

Power plants based on the principles of cold fusion, potentially have *quite unique advantage* over the still hypothetical thermonuclear fusion.

Compact cold fusion power setups will permit to use this technology on ships, planes, near and outer space, that in principle is *inaccessible for the giant thermonuclear installations*.

Thank you for attention!