Further results using SIMPLE procedures to activate surface-modified Constant wires for AHE production

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Further results using SIMPLE procedures to activate surface-modified Constant wires for AHE production.

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IWAHLM15, September 26-28, 2022; Assisi-Italy

At National Institute of Nuclear Physics, Frascati National Laboratories (INFN-LNF)-Italy, studies about Cold Fusion started on March 26, 1989. We found, since the beginning, that *non-equilibrium situations* are ***key-factors*** to get any "anomalous effect" (thermal/nuclear): mostly, they are forced reactions, not spontaneous.

The present abstract is: A) "updating" of what will be presented by us at ICCF24 (July, 24-28, 2022); B) upgrading about explanation of AHE origin; C) addition of the most recent results (if any).

The document is on the line of efforts to find ***simple procedures*** to activate the specific material we developed (since 2011; based on surface-modified Constantan, shape of long-thin wires, Joule heating) that are able to produce measurable values of AHE after proper conditioning. The ***main origin of AHE*** seems reconfirmed, in agreement with the initial (some since 1989) results of Researchers in USA, Japan, Italy: the **FLUX** of Hydrogen (or Deuterium) through *specific lattice structures* seems to be the main origin of AHE.

The geometry of the reactor's core is almost the same we developed since 2019: "inverse coaxial coil". Energy balance (at several fixed input powers, step like) were made by thermometry (possibility of much faster measurements in respect to usual flow-calorimetry) using, as references, experiments made under He gas at the beginning of the tests, with similar pressures (>0.5 bar) of the active gases (H_2, D_2). We considered useful for the energy balance the temperatures (by K-type thermocouple, SS shielded) measured at the external wall of the glass reactor: surface covered by several layers of thermal-conducting thick Al foil with side toward ambient painted by high emissivity (>90%)-high temperatures (800 °C) black compound. Maximum temperatures, internal/external: 900/380 °C. Maximum power applied: 150 W. Wire's weight: 0.45 g.

*We ***reconfirm*** that the simple procedure, just DC Joule heating at high power (100-150 W) and long times (50-150 h), was enough effective to activate a virgin Constantan coil with thin wire's surfaces properly treated (mainly by Low Work Function materials). Again, we found that the AHE measured, during the cooling cycles from the highest power, *depends on the time previously spent by the reactor's core at the highest powers.* We found that there is a sort of "positive memory effect" (in respect to AHE), lasting usually 10-20 h. Moreover, AHE increases increasing the number of cycling (high-->low-->high power).

We found, also, that increasing the wire resistance by proper "aging" treatments, increased the amount of AHE. We speculated that it could be related to increased surface area, spongy like, of the wire that allows, among others, easier income<-->outcome of active gases, i.e. ***flux***. We measured that D_2 gas (latest experiment presented at ICCF24) gave larger values of AHE (9 W) in respect to H_2 (5 W), at input power of 130 W.

BTW, AHE are related to the voltage drop along the wire (as larger as better): possible candidates are electromigration, NEMCA, "Preparata" effects. We observed such behaviour even since 1995 by using long-thin Pd wires. Obviously, our speciality of high-peak-power pulsing (**HPPP**) procedure (at proper duty cycles) is the most promising to increase both the AHE and overall COP of the system: **toward practical applications**. In the whole, the flux of gas (i.e. ***forced non-equilibrium***) from the surface and/or along the bulk of the wire seems to be the origin of AHE. Such observation was pioneered by G. Fralick (NASA-USA); A. Takahashi, Osaka Univ.-Japan; Y. Iwamura, MHI-Japan; our Group-Italy.

*Taking into considerations most of the conditions/procedures adopted to get AHE (large DC electromigration, several cycles of loading-->deloading-->loading, the powerful effects of HPPP), we think that **SAV** (Super Abundant Vacancies) condition is a note-worthy co-factor to get AHE in wires (**M. R. Staker**, Loyola-Univ. USA). SAV, as pointed-out also by Staker, can be obtained/increased by our HPPP procedures, although not so easy to be performed. In conclusions, low-cost Constantan seems to behave like expensive Pd, even regarding the SAV lattice conditions. We are trying simpler procedures to get SAV: latest results, if any.

The Project CleanHME has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 951974.

OUTLINE

(most of the results were shown at ICCF24-Moutain View-USA; July 25-28, 2022.
NEW: understanding of the role of material modification=>co-factor for "positive feedback?"*)*

1) **Motivation.**

2) **Experimental set-up.**

3) **Main unusual procedures to induce AHE: bulk and surface. Combined effects of bulk modification and surface activation of coated submicrometric materials: based on Low Work Function materials ("easy" emission of electrons from surfaces due to high temperatures, i.e. Richardson effect). The role of long-time high-power conditioning in DC conditions: simple approach. Further improved, in the whole, efficiency by pulsing: specific experiences since 1994 but complex procedures.**

4) **Some of the key results obtained. Correlation with behaviour of voltage drop along the wire.**

5) **Possible explanation of part of the phenomenology based on, hydrogen-induced, Super Abundant Vacancy (SAV) in specific materials (Pd) and even alloy (like Constantan): recent studies by Prof. Mike R. Staker (Loyola Univ.-USA); pioneer Prof. Yuh Fukai (Tokyo Univ.-Japan).**

6) **It seems reconfirmed that the main, key-factor, of AHE is the *flux* of Hydrogen/Deuterium entering or outgassing from specific materials. First demonstration by Dr. Gustave Carl Fralick at NASA, December 1989: used Pd H2/D2 purification tube at high temperatures (about 350 °C).**

7) ***New,* *in deep, data-analysis: possible role of treatments at HT and Vacuum, for long times, to change the surface and bulk composition of Constantan. Co-factor for positive feedback situation to increase AHE?***

8) **Next experiments and conclusions.**

9) **Addendum: invitation to attend a short presentation of new model about relationship between time and gravity, correlated with AHE problematics, by Pietro Cerreoni at the Multidisciplinary Section (ANV10, September 29-30, 2022), same location of the present Workshop.**

Motivations and reconfirmations

- **Following the efforts to find *simple procedures* to activate the (unconventional) material we developed (since 2011; based on surface-modified Constantan in the shape of long and thin wires, Joule heating), able to produce measurable values of AHE, *we reproduced them* at a qualitative level.**

- **Made new specific tests to investigate also *isotopic effects*. Moreover, according to our interpretation of the results, the "over-all" *main origin of AHE* seems reconfirmed: in agreement with the initial (some since 1989) results of Researchers in USA, Japan, Italy.**

- **The specific work was originated because we would like to reconfirm the procedures we discussed in deep, both during the talk and after waiting 1 month for questions (by web), during the ANV8 Workshop: held in Assisi-Italy on December 2021 (DOI: 10.13140/RG.2.2.27006.6683).**

- **Such presentation got a quite large interest among the LENR-AHE community and several questions were raised, specially about its *effective reproducibility*, i.e. restarting from the beginning: a) virgin wire and its multiple treatments; b) sequence of electric cycles to activate the AHE production, by proper gas at suitable pressures.**

- **New: role of bulk material composition, modified by specific thermal treatments.**

Experimental Set-Up

- **The geometry of the whole reactor and its core is almost the same we developed since 2019: “inverse coaxial coil” (cf. DOI document). Described in Figs. 1, 2, 3.**

- **Energy balance (at several fixed input powers, step like) were made by thermometry (because possibility of much faster measurements in respect to usual flow calorimetry) using, as references, experiments made under He gas at the beginning of the tests, with similar pressures (usually >0.5 bar) of the active gases (H_2, D_2).**

- **We considered useful for the energy balance the temperatures (by K type thermocouple, SS shielded) measured at the external wall of the glass reactor, Fig.1: surface covered by several layers of thermal conducting thick Al foil with side toward ambient painted by high emissivity (>90%)-high temperatures (800 °C) matt. Aim is to emulate black-body emission (i.e. Stefan-Boltzmann law), apart conduction and convection phenomena. The maximum temperatures were: internal 900 °C, external 380 °C. Maximum power applied was >150 W. Wire’s weight is 0.45 g.**

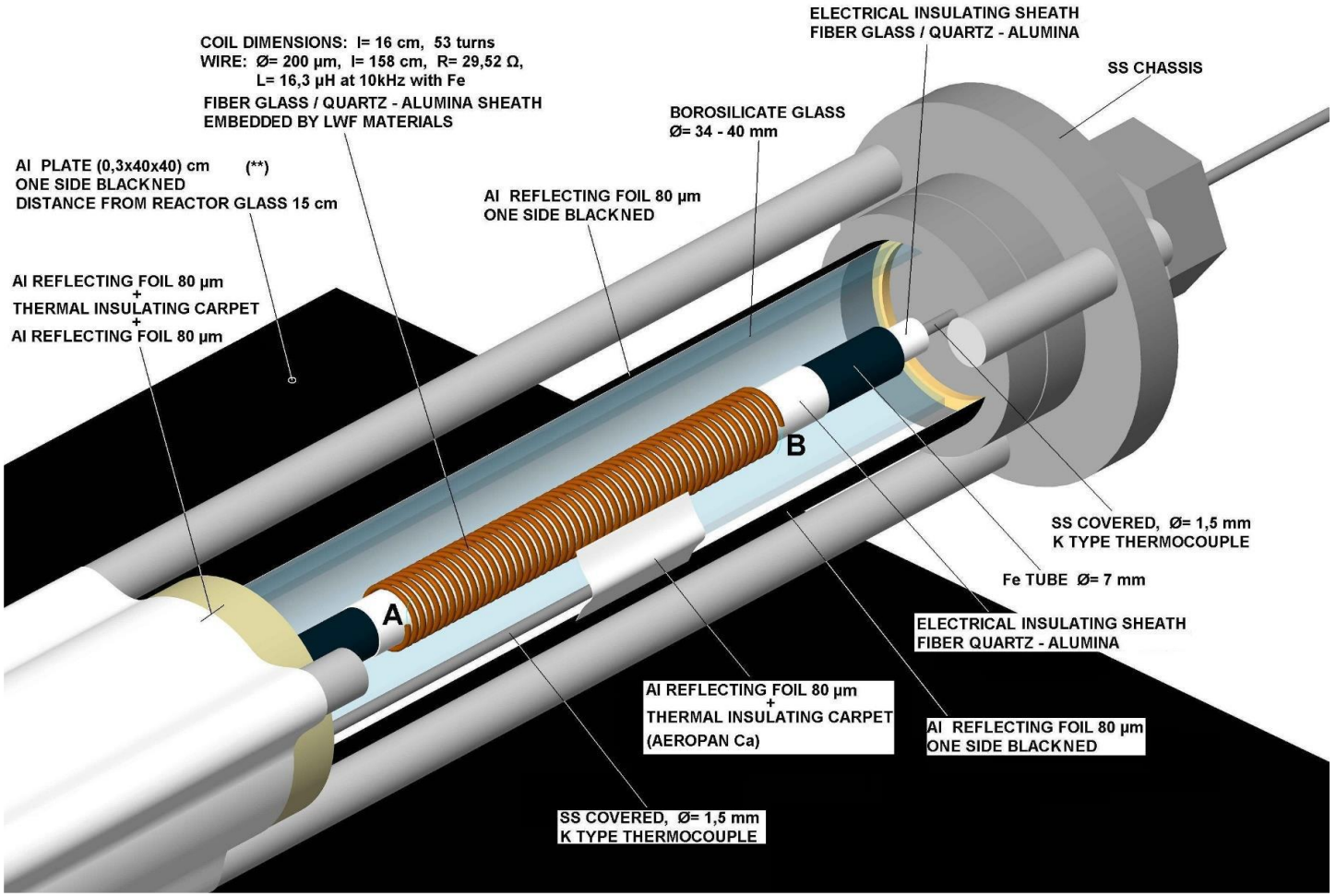

Fig. 1. Schematic of the reactor body. The container is tick-wall (3.2 mm) borosilicate glass, specifically developed/tested for high-temperature mild pressure operations *("Vetreria Scientifica Spaziani")*.

Real reactor

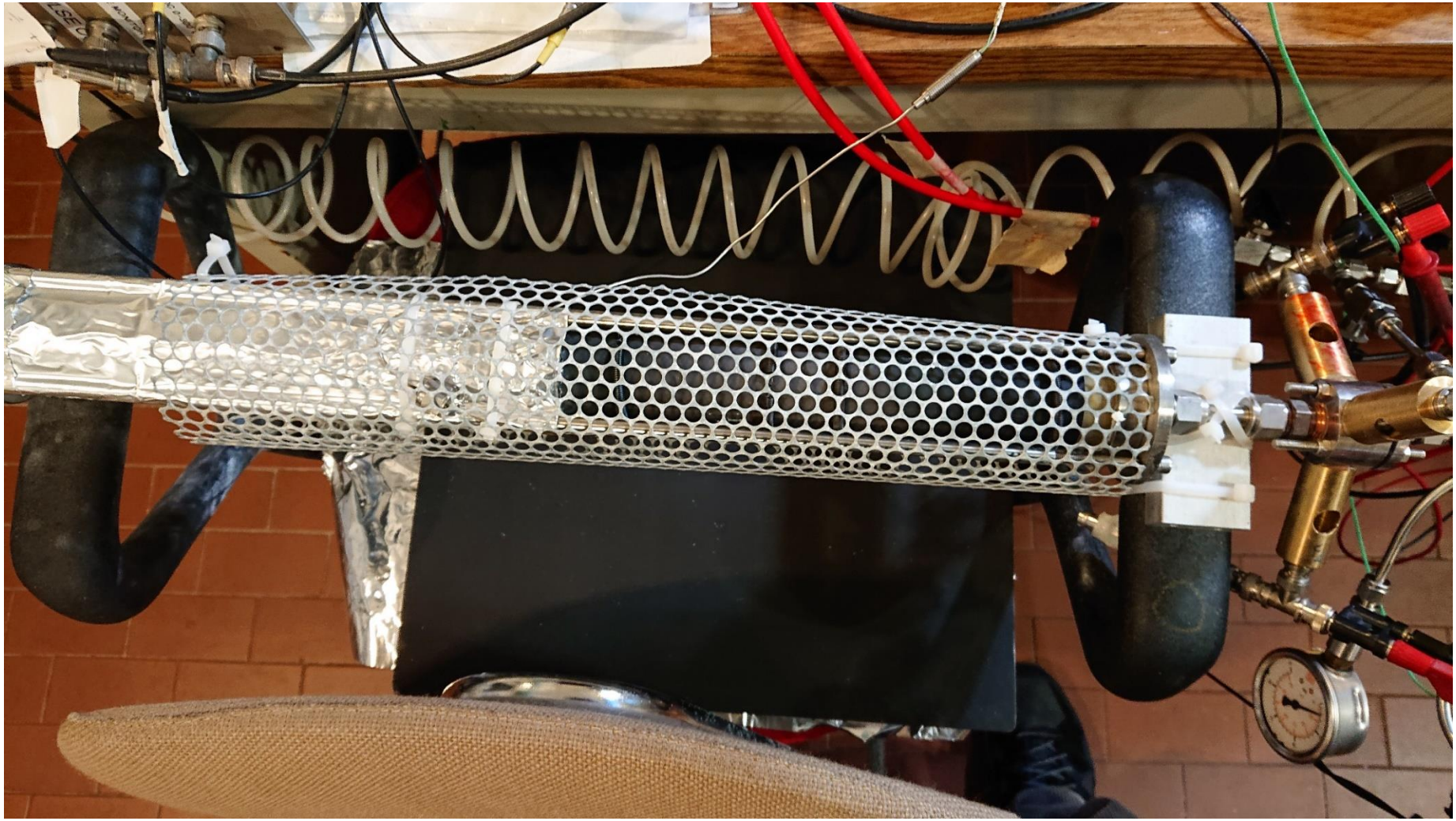

Fig. 2. Photo of the reactor. Because safety reasons, it is protected by a SS net.

Inner reactor core, standard structure

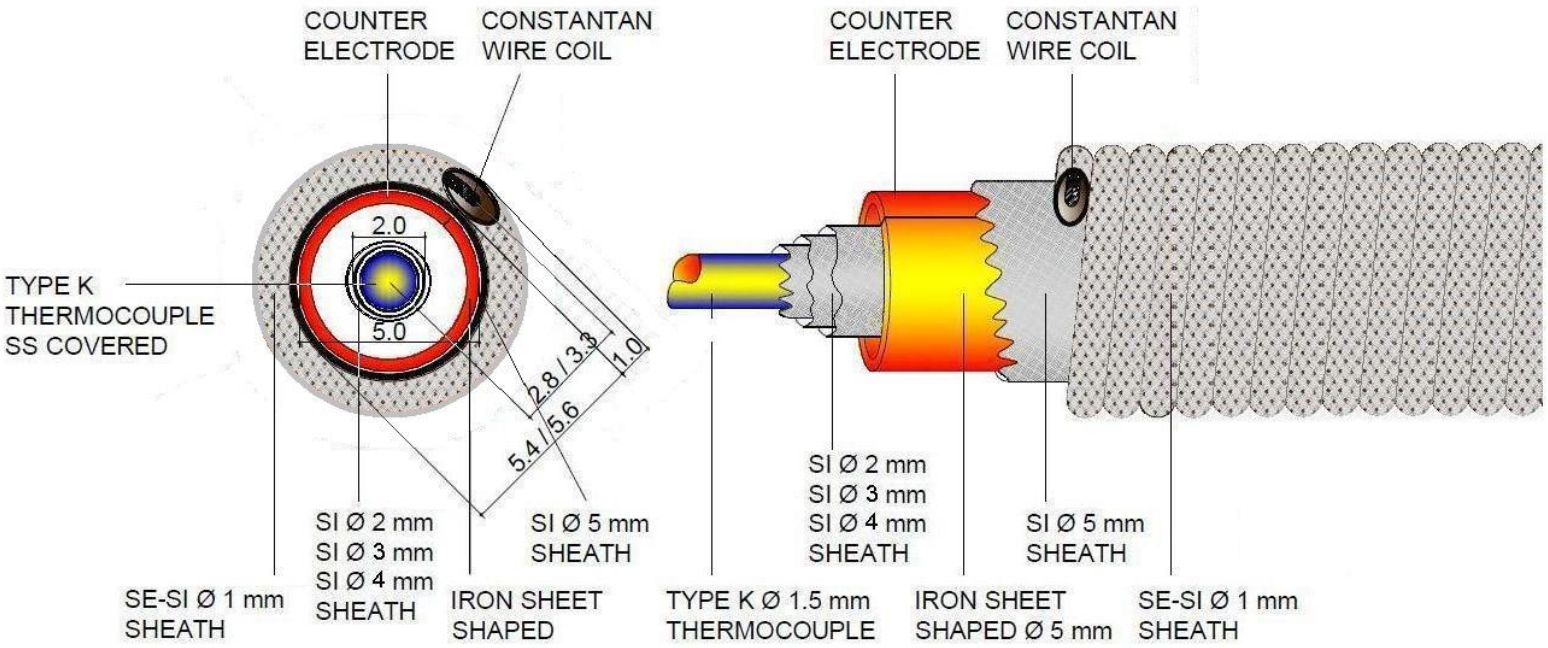

Fig. 3. Details of reactor's inner core. Standard/simplified set-up used for pulsing test to avoid unexpected interferences due to Cu tapes and SS tube. Scheme of the coaxial coil with its inner Fe counter-electrode. The coil, wire length of 158 cm, had usually 75 turns; recently reduced to about 50 because HV insulation problematics. The present core, in respect to ICCF23 version, is a simplified version without IR screening (by Al foil, Cu tapes) and thermal insulation.

Unusual procedures to induce AHE by bulk and surface treatments.

AHE may be obtained following procedures comprised of two main steps:

a) *preparation* of the "possibly active" material, usually by physical-chemical procedures, able to produce a particular microstructure;

b) *activation* phase.

Among gas phase experiments, the most studied materials were: a) Pd (the oldest) with its alloys (by us Pd-Y); b) Ni; c) Constantan (Cu-Ni-Mn). Nonetheless, we cannot yet exclude that several other transition elements and alloys might show a similar behaviour, if properly modified.

The surface of these materials, like Constantan, requires specific treatments to produce sub-micrometric structures, namely, to increase largely their surfaces (at the end, they have to be spongy-like).
If from one side we were able to fulfil point a) in a quite satisfactory way (thanks to 20 years of expertise); from the other side, we have been lacking simple and repeatable activation procedures b).

- **We had in the past experimental evidence that our "modified" Constantan wires require some long-time conditioning at high temperatures and/or current in H_2 atmosphere together with some "stress" to the material (remembering the "cold-work" procedures as by Japan Researchers) before producing measurable AHE. Anyway, no systematic studies were performed, just planned.**

- **The "modified wires" are 200 μm diameter wires of Ni_{44}-Cu_{55}-Mn_1 alloy (Constantan). Their surfaces are modified to obtain sub-micrometric structures (sponge/coral-like) by several cycles of high temperatures oxidations (in free air). The wires, afterward, are coated by multiple layers of liquid nitrates (dried and decomposed to oxides by high temperatures) comprised of Sr, Fe, K, Mn.**

- **Moreover, we observed that "our" High Peak Power Pulses (HPPP), with peak power as high as 10 kW/g and current flowing along the wire of Constantan (l=160 cm; weight=0.45 g) as large as >12 A ($J=40*10^3$ A/cm^2), width 10 μs, repetition rate up to 2.5 kHz, was able to activate the wire when the pulsing time procedure was lasting 5-8 hours and the mean power was of the order of 90W. We observed that the *activated state* lasted for several days after coming-back to DC conditions.**

- **Anyway, the pulsing procedure, although very efficient, is *quite difficult* to be performed by typical Researchers around the world, in the case of an *independent REPLICATION* of the experiment by a third part in his own Laboratory, at least for Academic purposes.**

- **Moreover, in the past (as before reported), the easy procedures in DC conditions were not fully understood and the control parameters were not enough well identified by us. Anyway, we got "promising indications" that even adopting *only DC* conditioning, for quite long times, could be possible to activate the wire.**

- **The aim of recent experiments was, among others, to identify some "turning point" for the activation, if any, and make the whole procedure reproducible/user-friendly even to a not fully-expert Researcher in the field.**

- **For the sake of control/calibrations, because using thermometry and not calorimetry about the AHE detection, several tests were made in vacuum and by He (the most similar to H_2 in respect to thermal conductibility). Some-times, further tests were made under Ar and He/Ar mixtures (higher int. temp.).**

- **In order to identify some possible turning point for the activation, due to current density and/or wire temperature, we made (tedious!) systematic studies. We had to change the power with close steps each other (practically, starting from 0, 1, 5, 10, 20 and later 10 W steps, up to about 130-140 W maximum). In other words, DC current <2100 mA, gas He or H_2 at few bars of pressures. *Overall main possible drawback: under-estimation of AHE values if the turning point of material activation will happen during the first experiment under Hydrogen gas*. The data of first loading data are usually used as "calibration" and considered as the zero reference, apart measurements by He.**

- ***Recently, with big surprise,* we realised that even the first cycle under He isn't a real blank because, during the pre-conditioning treatments of the wires (up to 2.8 A, about 900 °C) in free air, some hydrogen content in the liquid solution was decomposed and absorbed into the bulk. Such effect was evident in the measuring cycles when the power applied to the wire was over 120 W: Fig. 4, 5.**

Some, exemplificative, results (1)

There were made 2 main types of experiments with the aim to obtain some "control" of the procedure:

a) *increasing of activation*, i.e. values of AHE increase because the number of "proper" cycles;

b) some *decreasing of activation*, i.e. values of AHE, by high temperatures cycles under vacuum.

Both of them have peculiar aspects.

- **a) Made 4 cycles, identified as identified H_2#1-->H_2#4, at the beginning of the test, after He calibration (and previous vacuum at high temperatures for over 15 h). It was kept the same H_2 from the beginning, i.e. not "cleaning" it by vacuum and later-on adding fresh H_2 for refilling. Avoided in-determination due to possible water production (recombination of H_2 with oxides at the material surface): almost the same gas composition from the beginning of the experiment.**

Main result: it was observed a *continuous increasing of AHE* (in W, right side of the curve) and *continuous decreasing of R/Ro* (left side of the figure, i.e. the ratio of the resistance, R, normalised to the value Ro at the beginning of the experiment, under He gas at very low power). The performance (i.e. AHE) continuously improved from experiment H_2#1 to H_2#2→H_2#3→H_2#4: increased each time of conditioning.

The behaviour of resistance decreasing and AHE increasing were, qualitatively, the same historically observed using Palladium, since 1990.

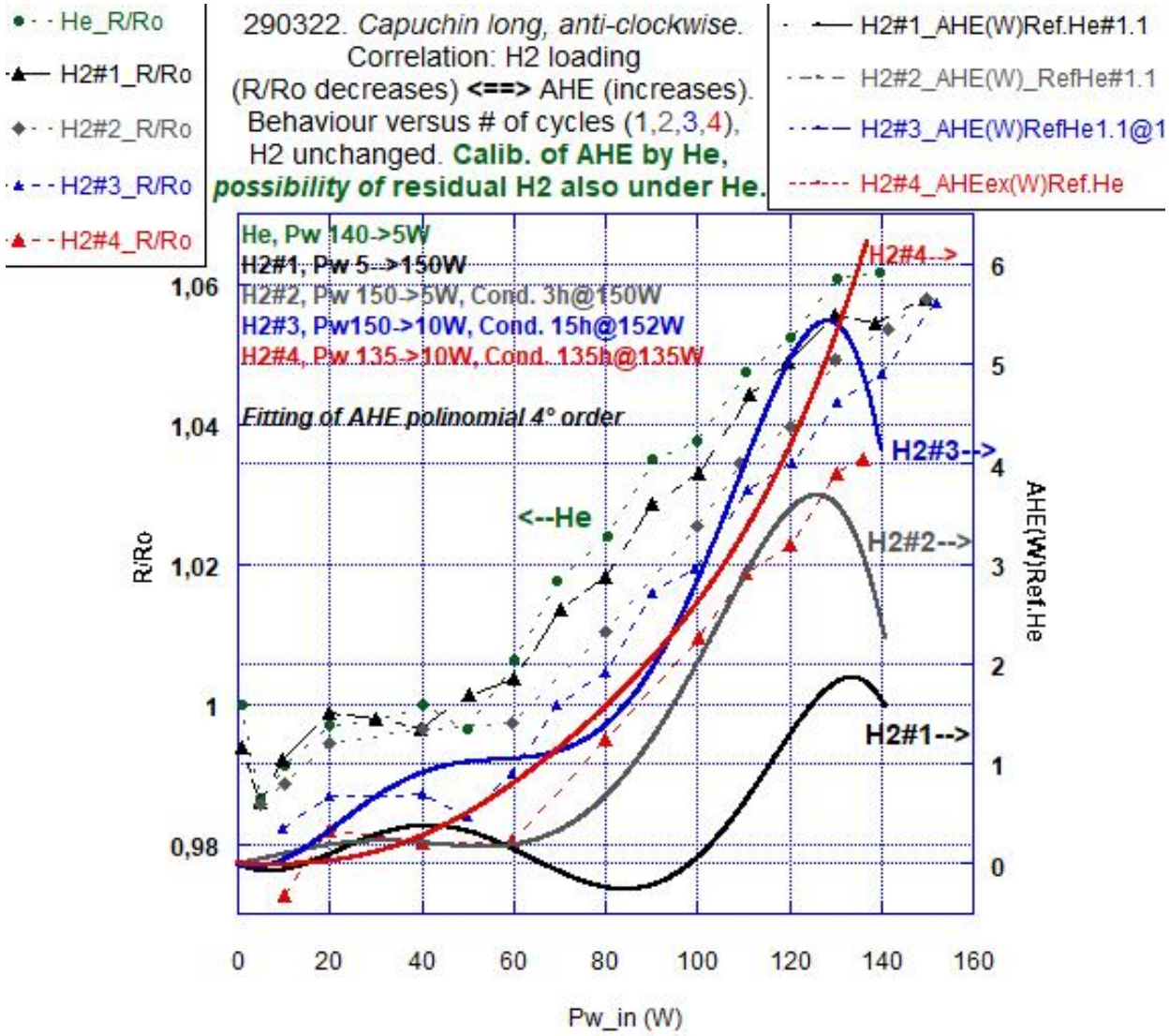

Fig. 4. Procedure of activation with increasing of conditioning time (3h, 15 h, 135 h) at high power.

Some, exemplificative, results (2)

b) After the test H_2#4 ended, it was made again dynamic vacuum at HT (730 °C, 15 h) and later added fresh H_2, at the same pressure of test H_2#1: Exp. H_2#5.

*** Observing H_2#5 results, we can argue that the vacuum cycle had the effect of decrease, in some operating points, the AHE in comparison with experiment H_2#4 (at input Pw >125 W). Main reduction of performances happened at the highest values of temperatures. Possible interpretations are: a) the wire's surface is "weaker" in respect to original treatments and not able to "keep" high values of AHE at highest temperatures; b) happened some bulk modification (diffusion) of local Cu-Ni composition due to prolonged vacuum condition at HT, considering also wire's small dimensionality (Φ=200 μm).**

*** Moreover, the attempt to recover the good performances of experiment H_2#4, by changing again the H_2 gas and allowing a conditioning time quite long (113 h) at quite high power (152 W), as performed in experiment H2#6, was not useful but even *reduced further the performances.***

- ***In conclusion, we are quite happy that the overall behaviour (in respect to AHE and R/Ro) of the low-cost material Constantan is quite similar to expensive Palladium and we have the possibility to use the huge amounts of information, worldwide produced in the field of Cold Fusion, since 1989.***

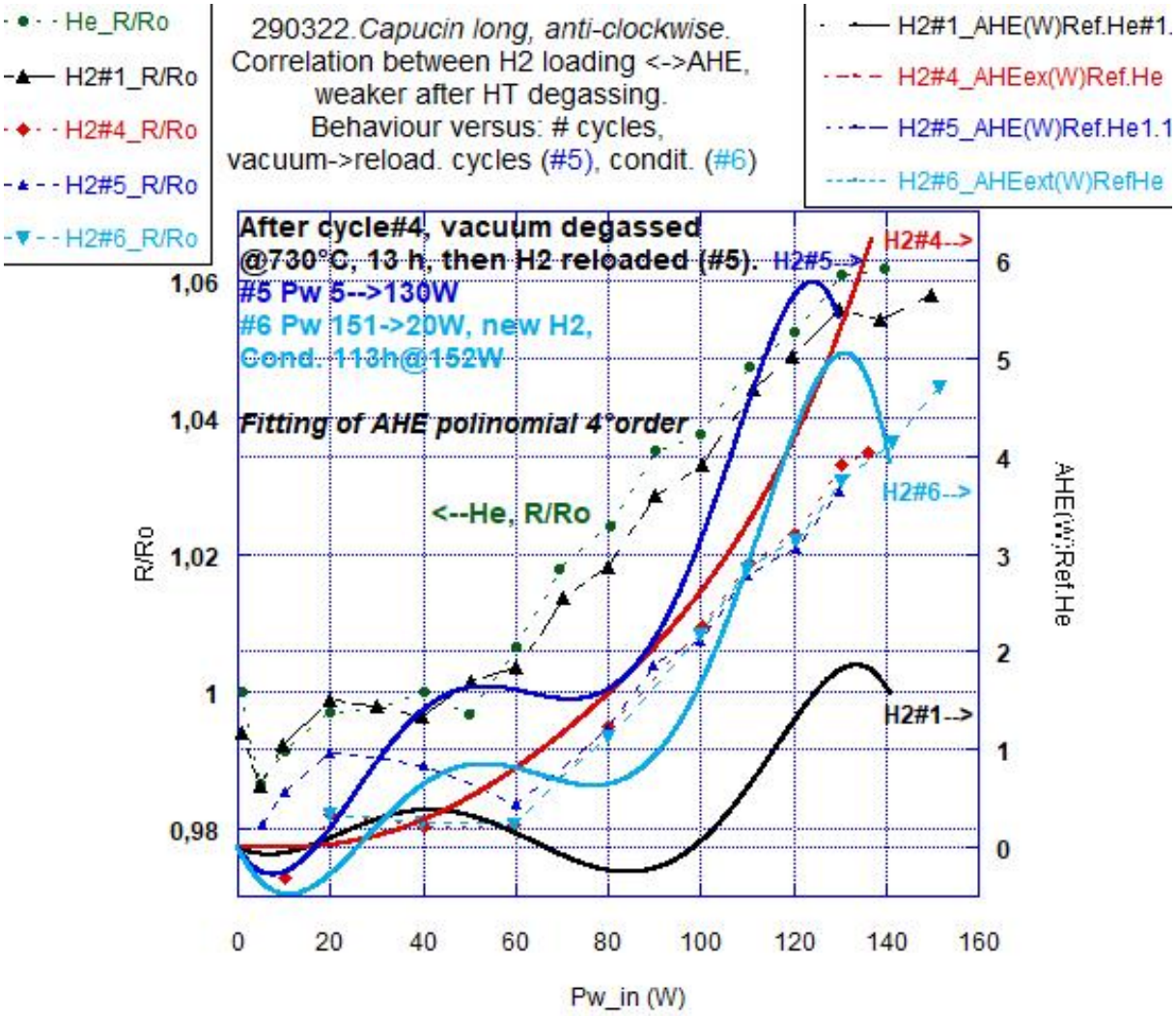

Fig.5 Behaviour of AHE and R/Ro, included cycles of vacuum degassing and refilling. Recovering of performances only partially achieved: AHE of H2#5, H2#6 are lower in respect to H2#4.

Some, exemplificative, results: isotopic effect (3)

(test 21 December 2021—10 March 2022)

- **For the first time, we *found a clear isotopic effect about Hydrogen and Deuterium,* at least after over 2 months of almost continuous operations under Hydrogen and several high power conditioning. Specific experimental run time period was: 21 December 2021-10 March 2022.**
- **In the previous times (since 2011) the isotopic effects, using Constantan wires after Hydrogen absorption, gave quite contradictory results and usually the values of AHE under Deuterium were lower in respect to Hydrogen one. Some-times even lower of calibrations: “negative gain”.**
- **We observed again that the amount of AHE depends on the previous "history" of the wire (like "*memory effect*", it can be "positive" or "negative" from the point of view of AHE amount).**
- **The maximum value of specific AHE detected, under D_2, was of the order of 20 W/g of Constantan, at around 500-600 °C of wire's temperature. Its weight is only 0.45 g, supposing that the effects of specific glassy sheaths (several g) and chemical coatings (<0.1 g) can be neglected.**
- **Considering such experimental results, it is quite difficult to suppose that the effects, starting from the specific experiments since July 2021 (results reported at ANV8, December 2021), are due just to some unpredictable errors. The most probable explanation is a “controlled” procedure.**

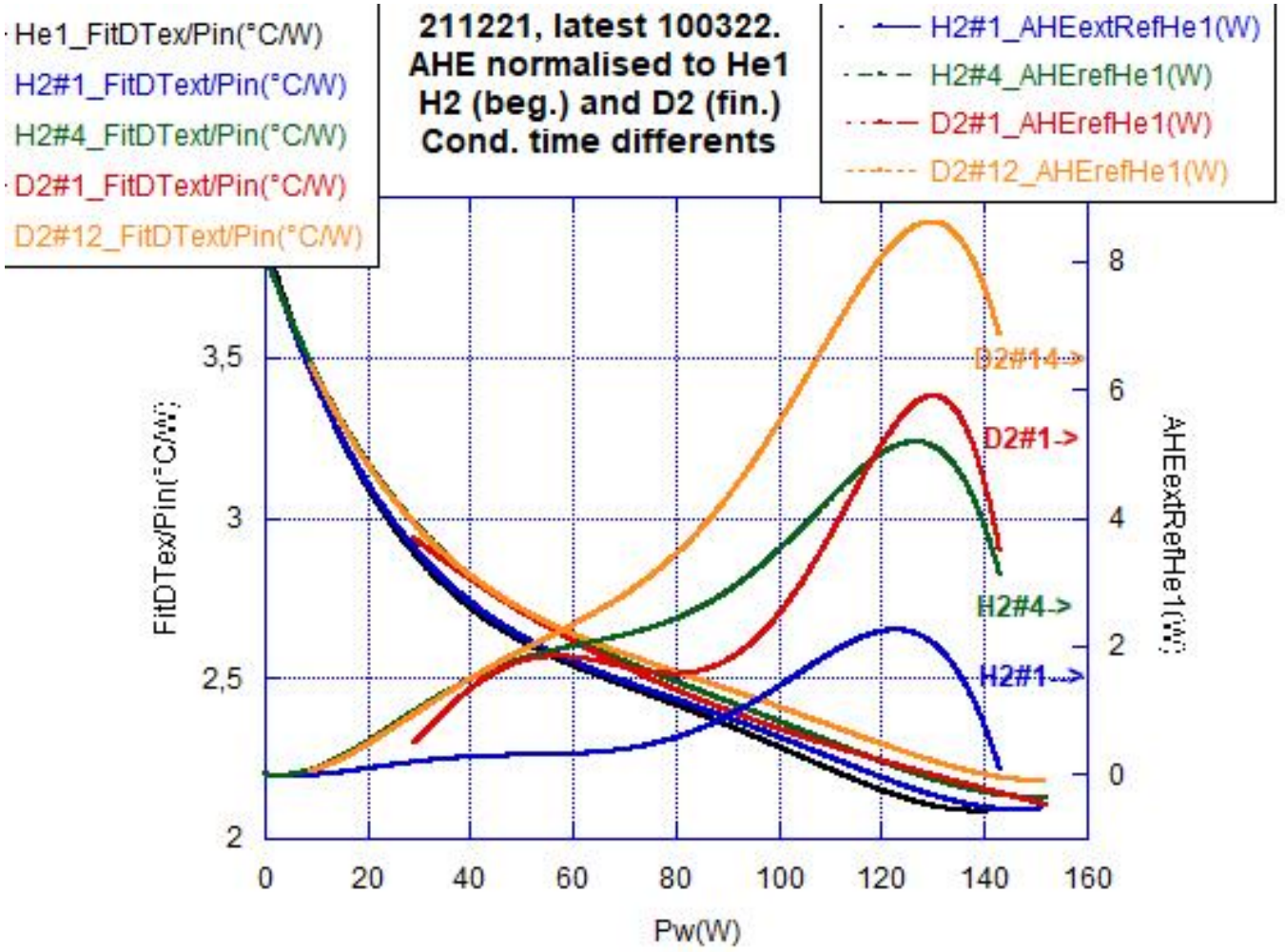

Fig. 6. Behaviour of AHE changing H_2 to D_2. Best results after 14 cycles of activation at high power, long times: over 9 W under D_2 (exp. D2#14) to be compared with 5 W under H_2 (exp. H2#4) in the specific experiment. The experiments by D_2 were made after H_2, so some positive aging effect is possible.

The SAV as co-factor to explain activation by long time electromigration.

- **Some of the results of positive effect due to very long time flowing of large current, i.e. large electromigration values, could be explained by the "exotic" phenomena of Super Abundant Vacancy induced by Hydrogen and/or Deuterium, the key-gas always used in all of the LENR-AHE experiments.**
- **Moreover, the fact that the AHE is largely increased because HPPP procedures, is another support to such hypothesis.**
- **Just for historical aspects, one of our best results obtained using Pd-Deuterium system (published on PLA, 1996), happened when we had, at the same time, *pulsed electrolysis and electromigration.***
- **In other words, the SAV can be added, as indirect but quite powerful procedure, to the candidates of the experimental evidence that large voltage drops along the wires are beneficial to obtain AHE: electromigration, NEMCA, "Preparata" effects.**

Superabundance Vacancy Formation in Metals Related to LENR

(JCMNS 29, 129-168, 2019, M. Staker, Loyola Univ.-USA)

- **Superabundant vacancies (SAV) form, as a new phase, in many metals and alloys including Ni, Pd, Pd-Rh Alloys, Pd-Ag Alloys, Ag, Rh, Pt, Au, Al, Cu, Cu-Ni Alloys, Ir, Mo, Fe, Nb, Cr, Co, Mn, Ti, Zr.**

- **They were discovered in 1993 by Yuh Fukai (Tokyo University, Japan) and his co-workers. They have been obtained by wet electrolysis, high temperature/high pressure gas via anvil compression, co-deposited electrolysis, solid state electrolysis (dry electrolyte), ion beam implantation, plasma-injection.**

- **Vacancies are produced by an innovative effect called *hydrogen-induced vacancy formation*.**

- **As the hydrogen activity (D/M or H/M ratio where M is metal) in metals and alloys increases, more vacancies are created and ordered since this is the state of lowest free energy for the metal. If obtained, they could increase, like positive-feedback. Such behaviour is observed in Fig. 4.**

- **Electromigration, the most known, contributes to the formation of SAV since it can boost the *local* D/Pd or H/Ni ratio. The D+ or H+ ions migrate (and contribute) in the direction of the current and since there is an attraction between the vacancies and the migrating ions, the *local* D/Pd or H/Ni ratio is enhanced as well as increasing *locally* the vacancy content.**

- **The same current that causes the electromigration can be used to measure the overall resistance of the PdD or NiH and yield the D/Pd or H/Ni ratio. By such simple methodology the Researcher knows when he has the correct conditions for the growing of a nuclear active environment (NAE, according to E. Storm definition): it was/is our usual procedure, since 1991, even we were not aware of such phenomenology.**
-

Evidence for bulk composition changing after long times treatments at HT-Vacuum

- **In some of the past experiments (since 2011), using Constantan, we observed that LONG times treatments of the wire at low pressures (<100 mb) or better vacuum and quite high temperatures (>750 °C), changed the resistivity of the material in an unpredictable way but always *increasing it*.**

- **Moreover, we operated the reactor usually at constant-current (i.e. the voltage applied is "free"): increasing of the resistance means increasing of power dissipated (Pw= I*V= I^2*R). Such condition, as possible drawback, can makes run-away of the system and the wires several times was found broken.**

- **Anyway, some times such condition gave some (useful!) increasing of AHE, although for not enough long time because the wire was easy to brake. *So, we usually avoided such dangerous condition.***

- **In the experiment of March 2022, the results about isotopic effect (i.e. AHE using Deuterium was better than using Hydrogen) was very satisfactory: we decided to de-load completely the wire from the Deuterium absorbed and then reload it again by proper gas pressure. Our aim was to restart the experiment with overall conditions as similar as possible to the beginning.**

- **We found that the de-loading was not effective and the wire temperature slowly increased (but the experiment was un-attended, overnight) of over 35 % of initial value. Anyway, we note that for safety, we used a current of polarization of just 930 mA that, at the initial test, give a maximum temperature of about 680 °C.**

- **In conclusion, after 15 hours of vacuum treatments, the wire temperatures increased up to 860 °C.**
- **The reasons were two:**

  a) large increase of resistance;

  b) RTC (i.e. Resistive Thermal Coefficient) moved from quite low values (typical of Constantan alloy) to values close to that of a typical metal.

***After such unexpected event we tried to reduce the resistance by proper Deuterium loading at high pressure and temperatures for long times (over 6 days). Usually, the Hydrogen and/or Deuterium loading DECREASES the wire resistance according to our long experience since 2011.**

***This time the Deuterium loading didn't affected the resistance ratio but, fortunately, further increased the AHE from the previous (good) values using Deuterium.**

***The results are shown in Fig. 7: it is put in evidence the large variation of Resistance (exp. D2#12) in respect to the similar one with Deuterium (D2#1) and large increasing of RTC. As "quality factor" of the experiment are shown the values of AHE: main interest in the present experiments.**

***Further details about the voltage drop, changing the input power and kind of experiment, are given in Fig. 8.**

As final cross-check, in Fig. 8 are reported the values of T_int and AHE versus the gas used*: *at the same temperatures, using He or Deuterium, ONLY Deuterium was effective to produce AHE.

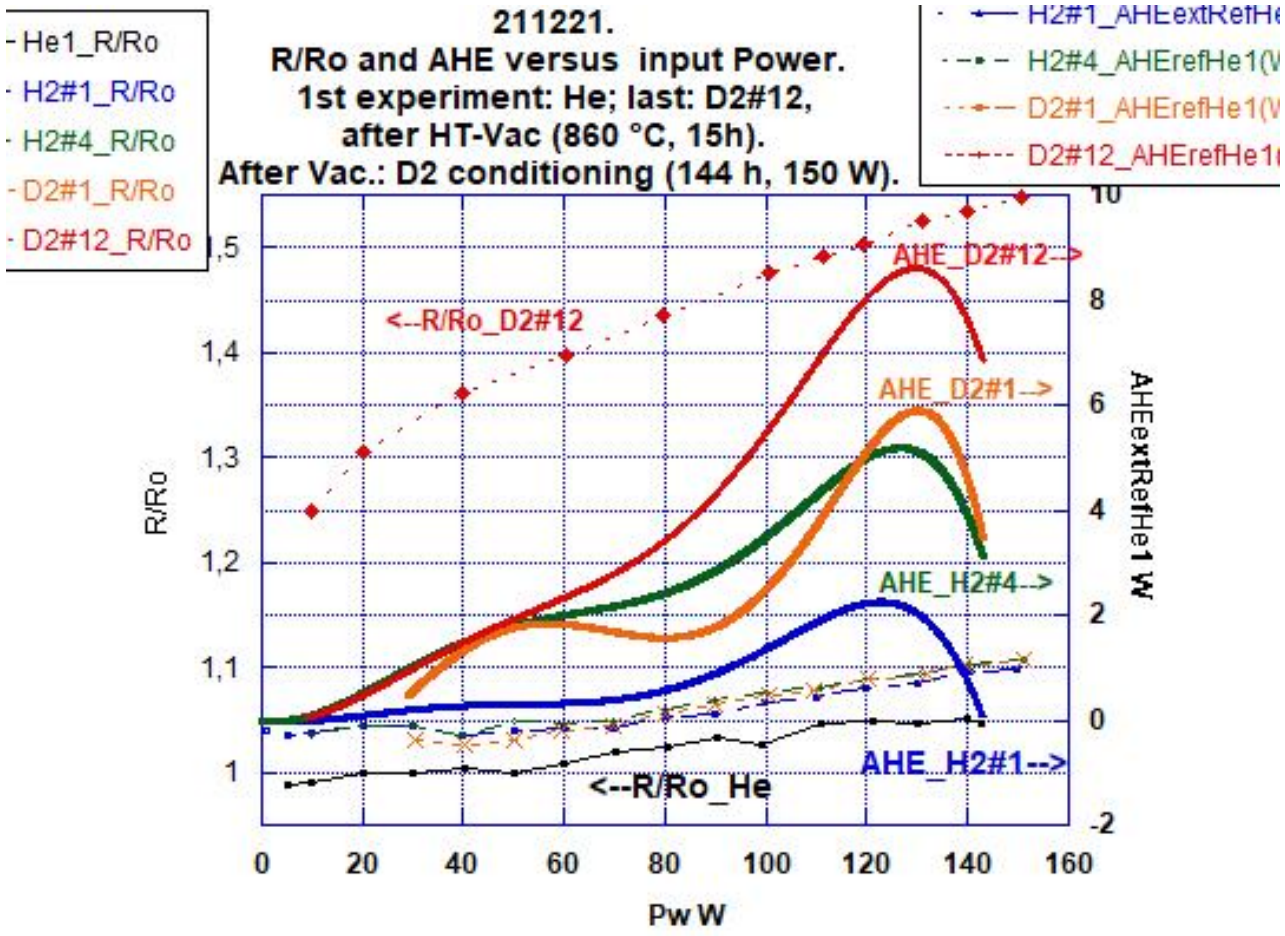

Fig. 7. After exp. D2#10, not shown, made dynamic vacuum at high temperature (initially 680 °C, later-on spontaneously increased up to 860 °C) for long times (15 h). The wire R/Ro increased, at about 100 °C, from 1.04 to 1.25. Moreover, the RTC (Resistive Thermal Coefficient) slope largely increased (from 5% to 25%) in respect to original behaviour: new bulk material?

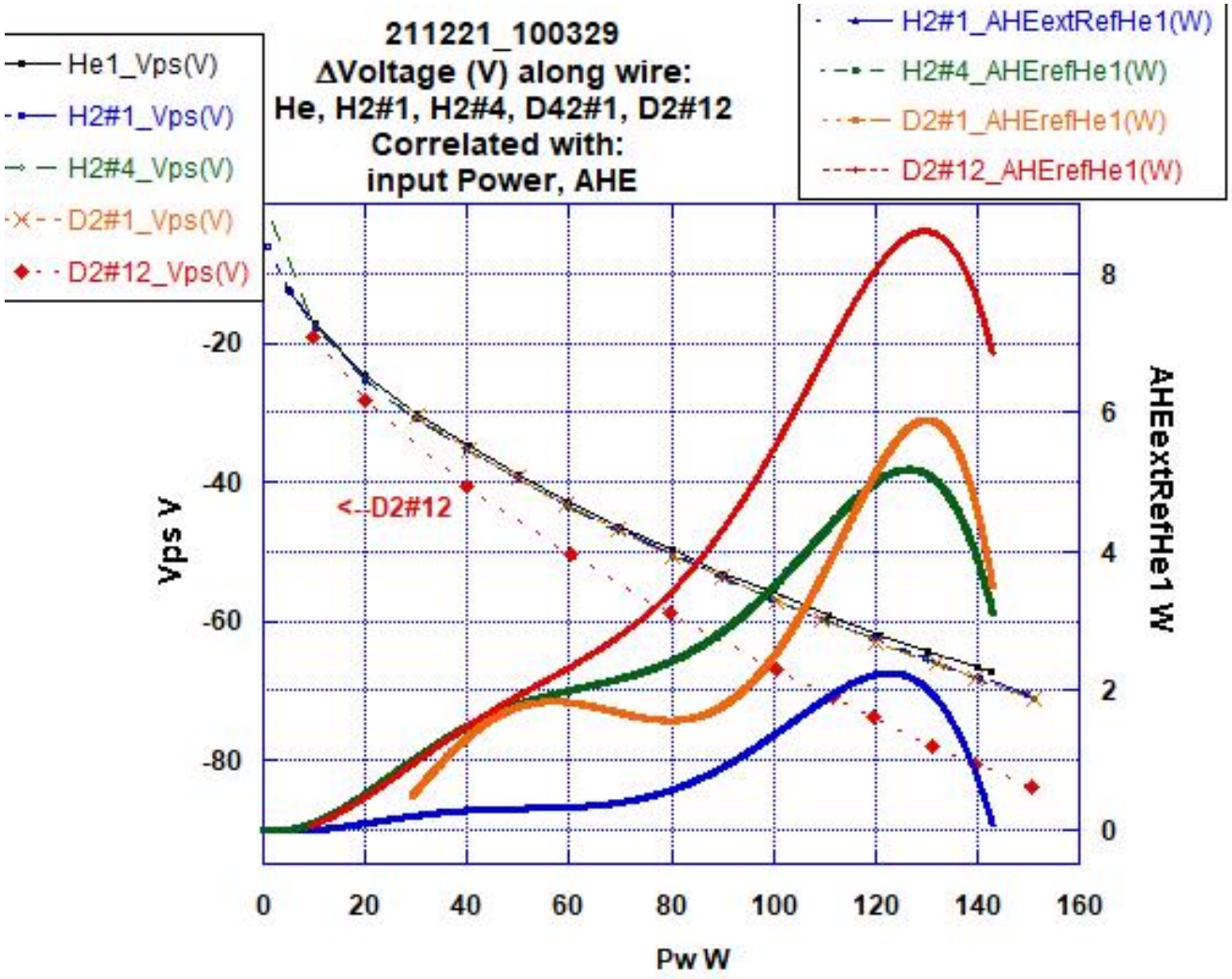

Fig. 8. Because the resistivity of Constantan increased after vacuum treatments at high temperatures for long time (D2#12, red colour), the Voltage drop along the wire, at constant input power, largely increased.

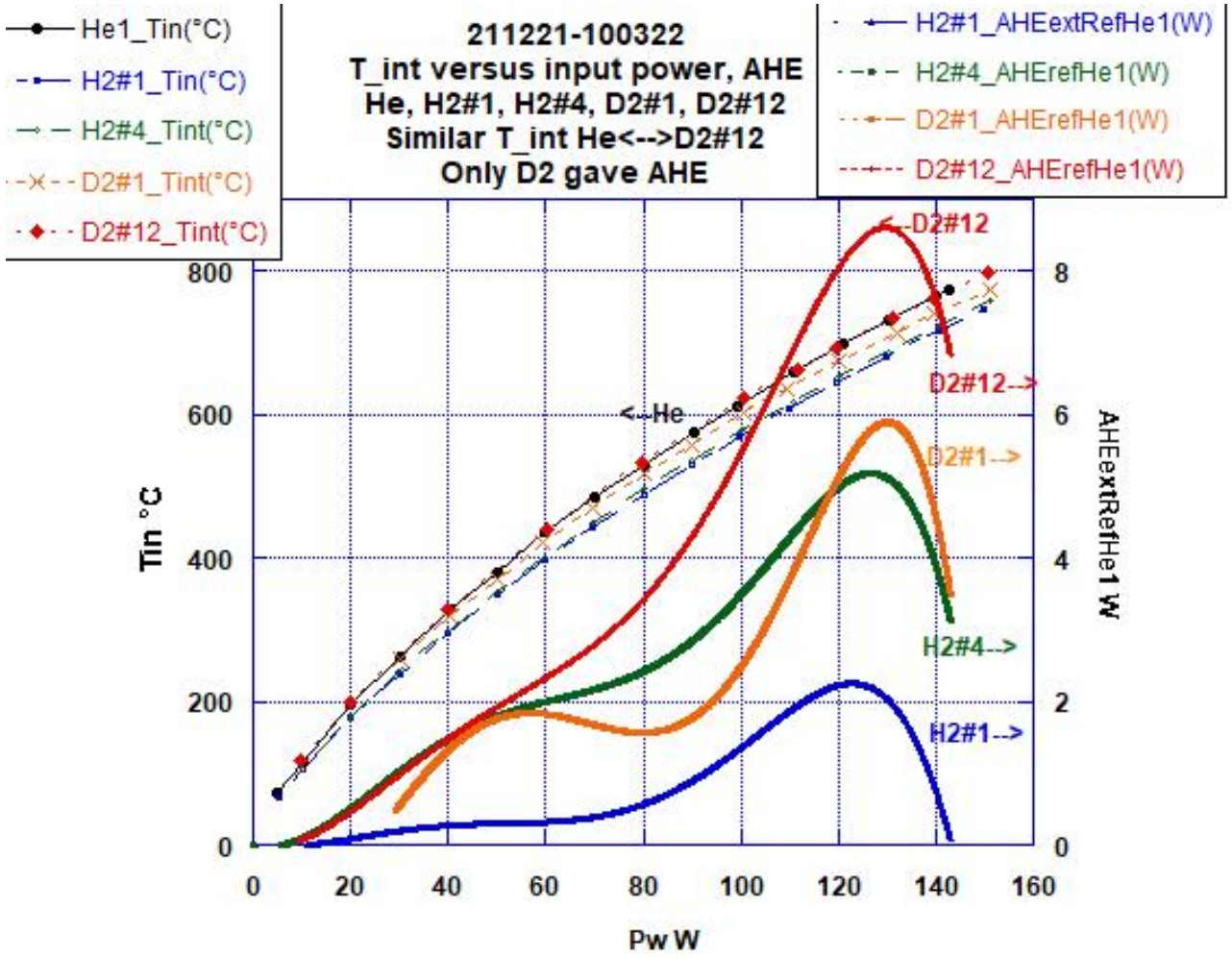

Fig. 9. Behaviour of internal temperatures changing gas and type of experiment. Quality parameter is AHE. In the specific, although the internal temperatures of experiment with He and D2#12 are very similar, ONLY in the case of Deuterium gas was detected AHE.

Conclusions and future plans.

- **The procedure of simple activation of, surface treated, Constant wires was reconfirmed. As expected, the phenomenon is quite complex and have origins both by the surface and bulk of the material. Its limit is the very-long time (up to weeks) of operation at high power to be effective.**
- **Also, the SAV phenomenology/procedure, hydrogen enhanced, was added as possible co-candidate to the explanation of the origin of AHE.**
- **Anyway, according to our opinion, the main/final actor, is the FLUX of proper gas (H, D) through suitable lattice that generates the AHE: found since 1989 from Researchers in USA, Japan, Italy.**
- **The flux, usually, is not spontaneous but forced, i.e. needs external energy.**
- **The final target is to find a procedure that minimize the external energy added: HPPP is a credible candidate, to be further properly optimized.**
- **The other operating points (and chemical-physical conditions/phenomena) of the experiment by us explored in the past (Child-Langmuir, Paschen/DBD, skin effect), could help in the developing of an energy-efficient operating reactor: practical use for every-day life.**

- **From the experiment 211221_100322 (shown in Fig. 7) and even some visual observation of old experiments about copper-like coating of of our glass reactor's surface, after the wire got treatments for long time at high temperature and low pressure, we guess that happened a selective evaporation of Cu after prolonged vacuum treatments at high temperatures.**

- **In other words, happened a chemical changing even of the bulk composition, from original $Cu_{55}Ni_{44}Mn_1$ to some new material Cu depleted: apparently, it has even better performances in respect to original Constantan regarding AHE.**

- **More systematic work is needed to find the *optimal amount of Cu* able to increase the AHE. Obviously, some amount of the original Constantan is always needed to allow dissociation from molecular Hydrogen and/or Deuterium to atomic one: starting point for all of the present experiments in the LENR-AHE field.**

Addendum: a possible, unconventional, model on matter.

(by Pietro Cerreoni)

Acknowledgments

- We are indebted to a Metallurgical Company in the **North-Eastern part of Italy (NEMC)** which, since 2011, provided some financial support and performed key experiments in their own Laboratories (by their Scientist and Technicians): independent cross-check of our most critical experiments was useful to increase our confidence on reported results.

- Since 2017 we initiated also a multiple collaboration with **NEMC** and **SIGI-Favier** (Italy-France), to design an original hybrid sheath obtained by crossing Glass and Alumina–Quartz fibres. Sheaths are used for wire's electric insulation. They can continuously operate up to 1200 °C. Thanks to a tailored geometry, may adsorb significant amounts of Atomic Hydrogen. They are porous, holes of micrometric dimension: *one of the key aspects of our experimental set-up.*

- **Innovatiogen Srl** (*follow-up of IFA*, Roma-Italy) provided us, from several years, some economical support about consumable of Laboratory and expenses for trips even abroad Italy because Conferences/Workshop/Meetings.

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Disclaimer

The work reported in this document is under the *full responsibility of the Authors* and do not represent necessarily the opinion of whole CleanHME project.

Addendum

A possible, unconventional, model on matter

(presentation, in Italian Language, by Pietro Cerreoni, ANV10 Workshop, 29-30 September)

10° CONVEGNO “Assisi Nel Vento”
C/O DOMUS PACIS ASSISI *29–30 Sett 2022*

POSSIBILE CORRELAZIONE TRA GRAVITA’ TEMPO E MATERIA

Pietro Cerreoni

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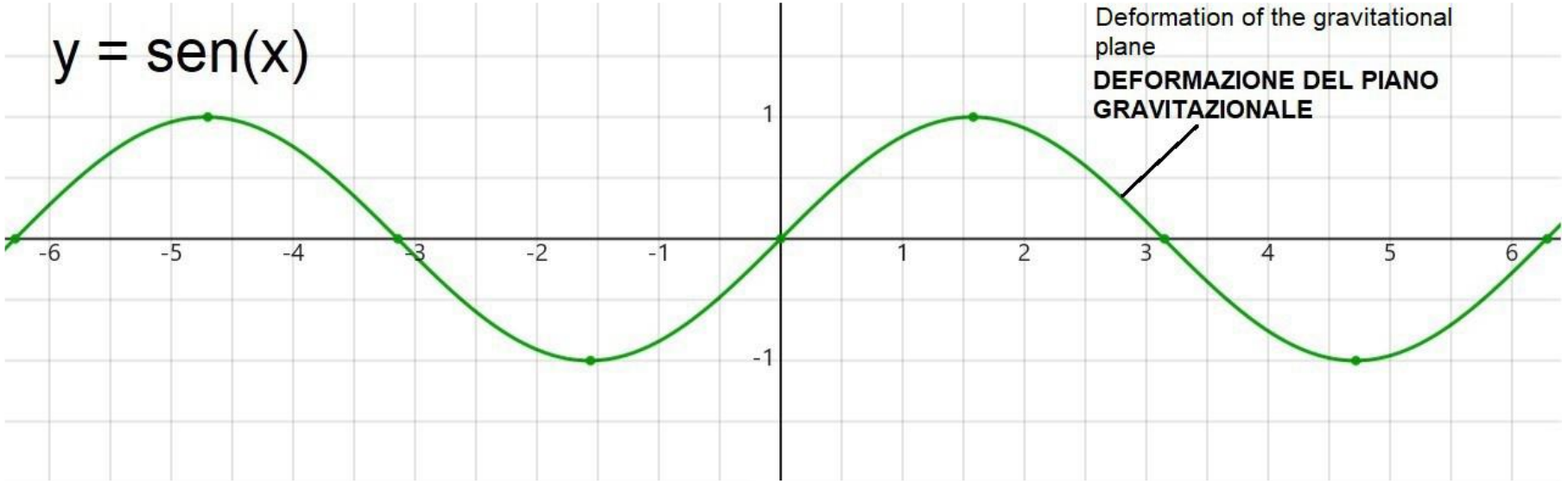
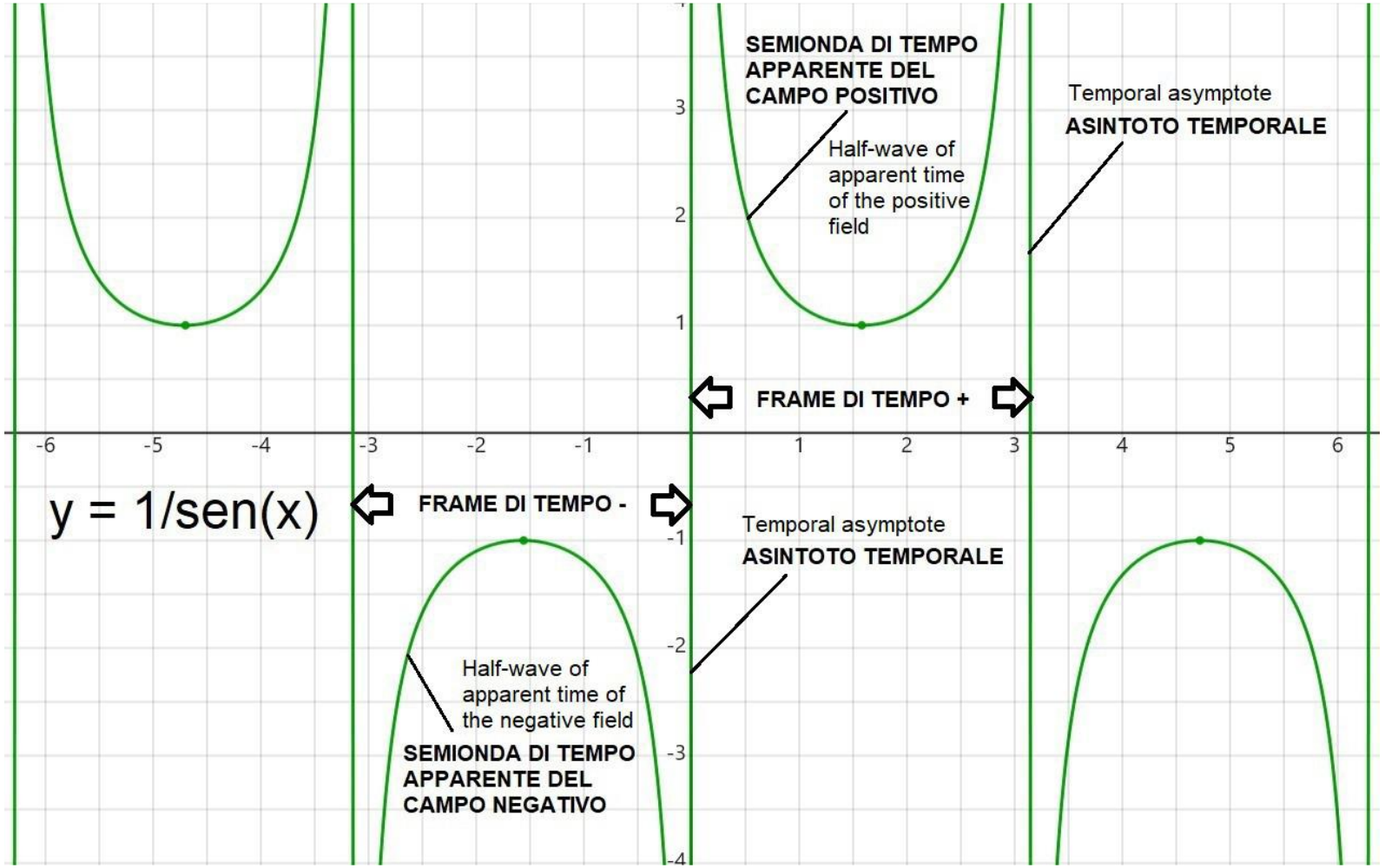
ONDA GRAVITAZIONALE

(VARIAZIONE DEL CAMPO GRAVITAZIONALE)

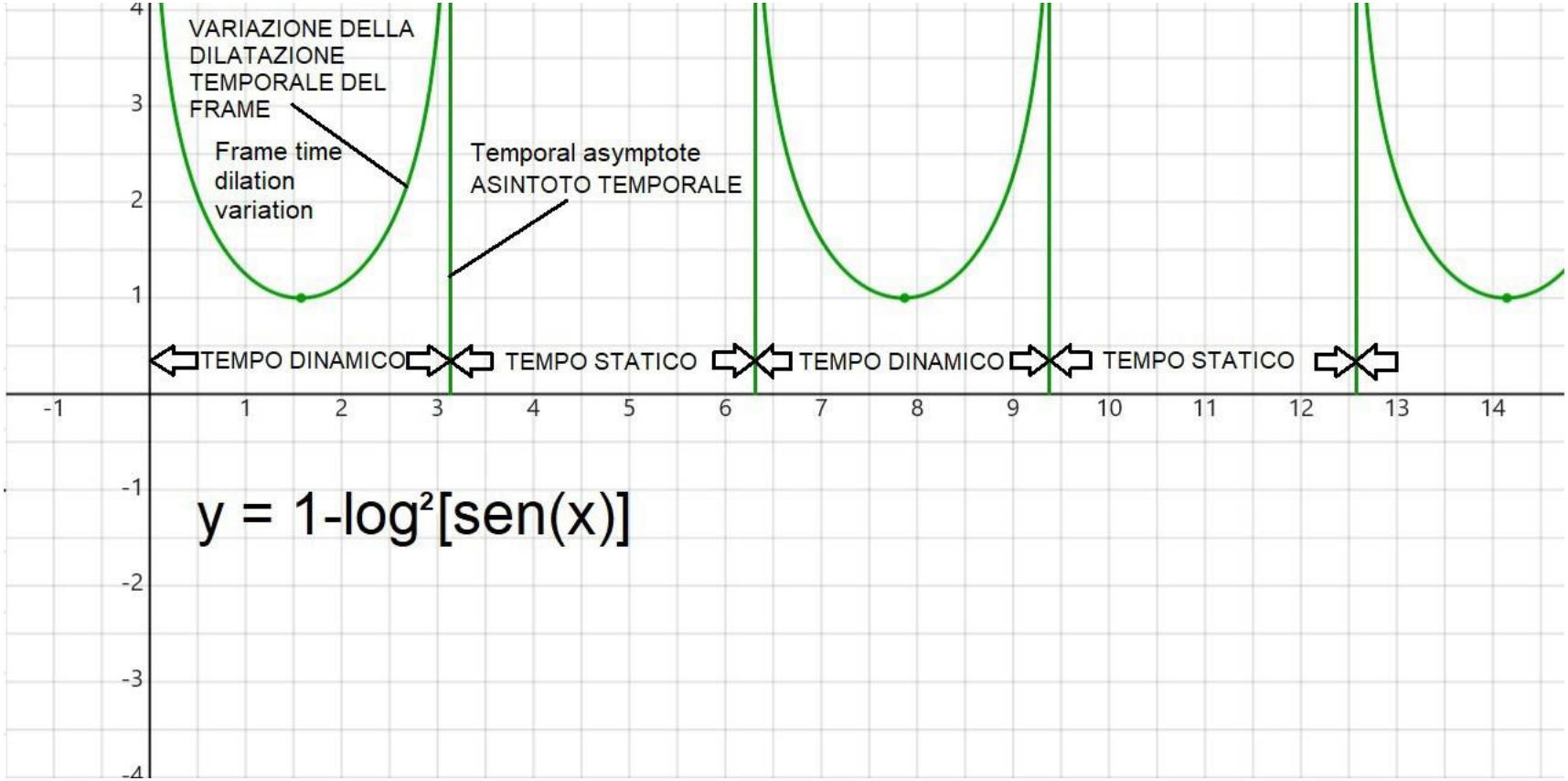


DILATAZIONE DELLO SPAZIOTEMPO

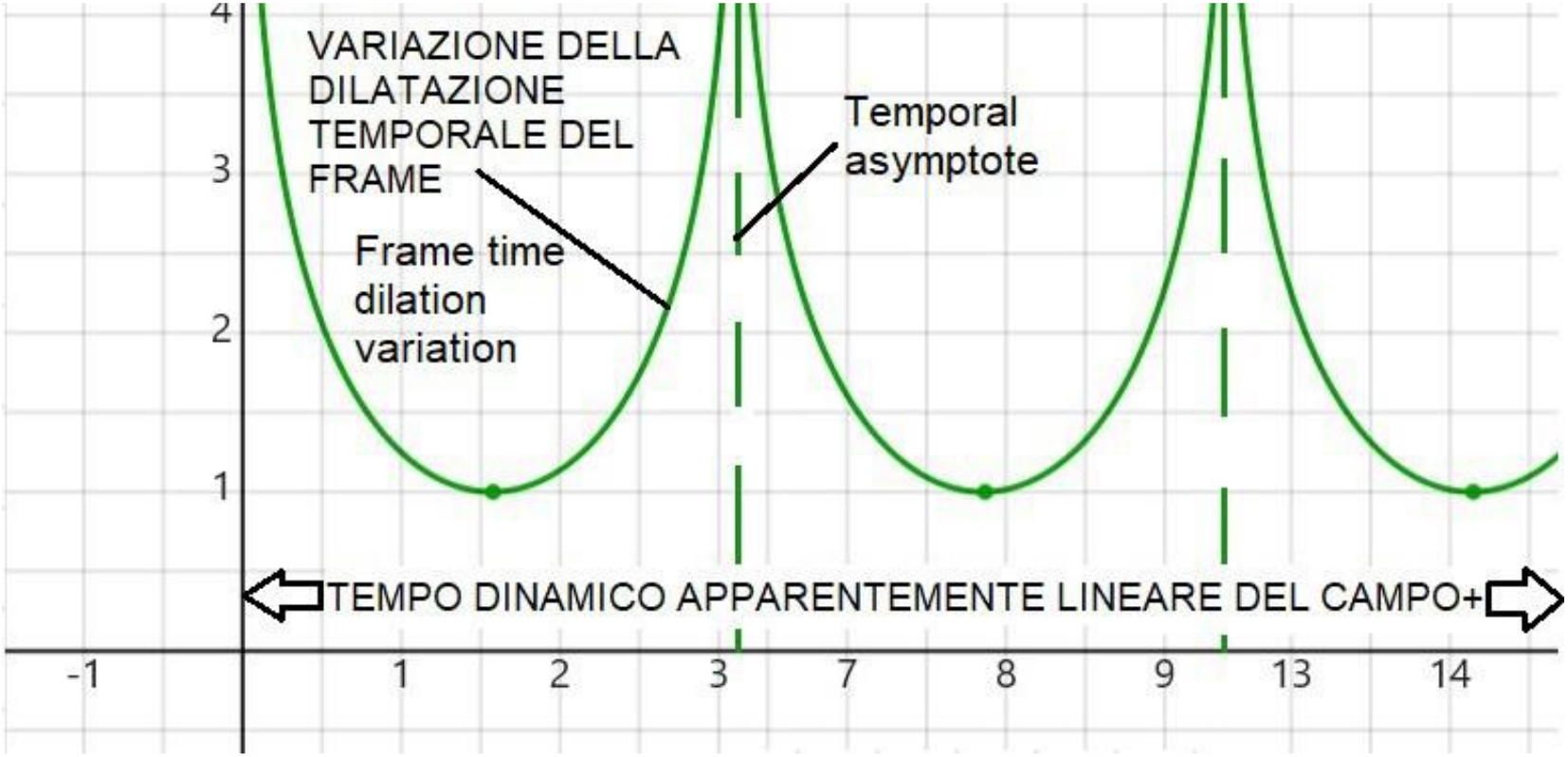
(DINAMICITA' DEL TEMPO)

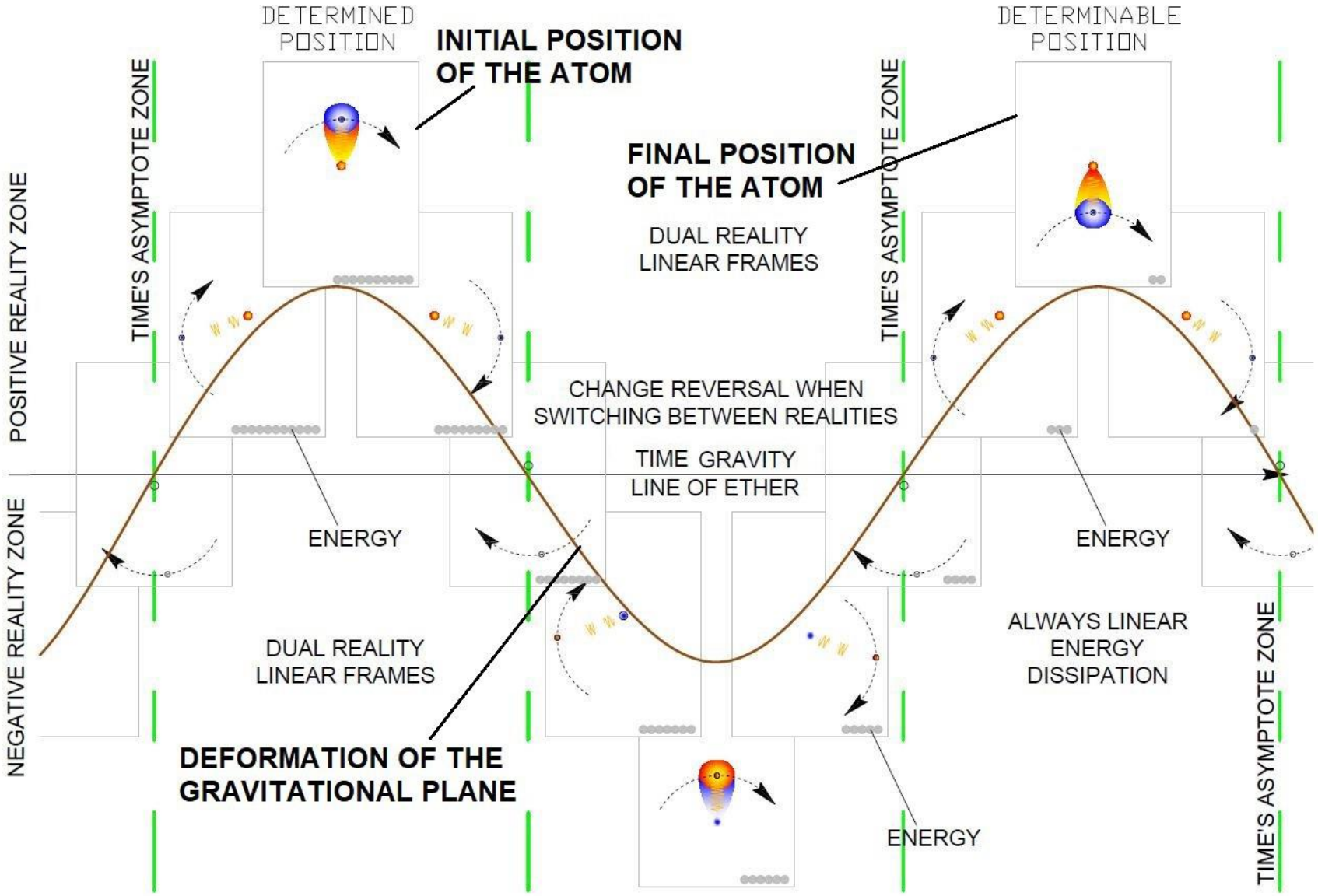


DILATAZIONE DELLO SPAZIOTEMPO NEL CAMPO POSITIVO

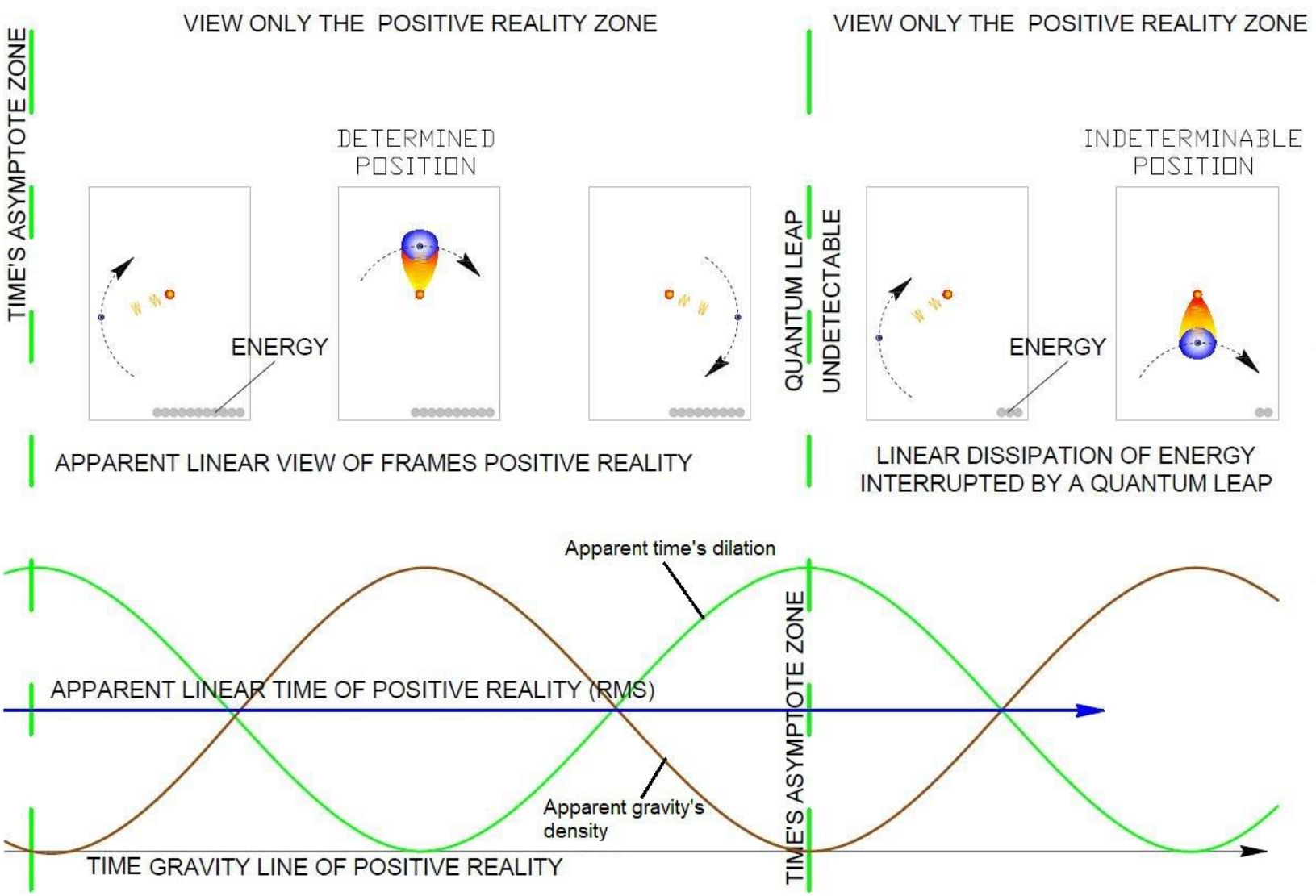


DILATAZIONE DELLO SPAZIOTEMPO APPARENTE NEL CAMPO POSITIVO





QUANTUM DETERMINATION IN DUAL REALITIES



QUANTUM INDETERMINATION IN POSITIVE REALITY

UN PARTICOLARE RINGRAZIAMENTO:

AL PROF. FRANCESCO CELANI

A VOI PER IL **TEMPO** DEDICATO ALLA VISIONE
DI QUESTA PRESENTAZIONE

GRAZIE!