LENR: Three Types of Nuclear Energy

A Restoration Power research paper for promoting cleanHME

By Aadhar R.P.B.A. Meijer, 03-16-2024

Executive Summary

There is a problem with the use of nuclear energy. The problem is that we both have good news and bad news. The good news is that we have succeeded in producing clean nuclear energy. We should celebrate! Hurray! Our energy problems are solved, but… the bad news is that it is difficult to explain. We have difficulty understanding what happens in these clean nuclear experiments free from radioactive waste. We have to know what to be happy with though, what to put faith in and where to invest our time and money in. In this paper we endeavor to defeat this difficulty and explain how and why it works. We need to understand what happens within atoms. For everyone to understand this subatomic process we hence discuss here a simpler model for the particles involved than the standard one used in nuclear physics.

In electrochemical experiments we found that nuclear energy is not there just from fusion or fission processes. There is a third process we need to discuss. The three ways to generate nuclear energy are to be set apart. There is nuclear energy from so-called hot or high energy fusion, from the uniting of light gaseous atoms, like it happens in the sun. The process is understood, but hard to copy on earth. Secondly there is nuclear energy from our well-known fission plants. In fission we have energy from splitting heavy atoms like uranium. That process works but is difficult to accept because it is producing radioactive waste and is hazardous; it went wrong several times. And thirdly, our breakthrough solution offered here, we have clean nuclear energy from a novel third approach called low energy nuclear reactions, or LENRs. These processes work at levels ranging from room temperature up to a 1000 degrees of Celsius.

The energy experiments of this third path proved to work when hydrogen gas under certain conditions is absorbed by a metal compound. It starts oscillating there at the subatomic level in between the metal lattice, producing nuclear energy. Therefore it is also called clean hydrogen metal energy, cleanHME, in the European Union. The mechanism discovered behind this third option implies a new scientific revolution. We need to discuss a new kind of energizing elementary particles of matter, operating in structures called quasiparticles (qps). In our research the qps appear to draw their power from stable natural waves of space energy called solitons. At different levels accelerating, thereby repeating structures of vital matter called fractals are created. It is the animating principle, the vital essence of our universe. One can observe fractal structures also in living organisms. With this generative principle the original expansion energy of the universe now appears to be working as a source of energy in our LENR experiments!

One in this new branch of science, named condensed matter nuclear science (CMNS), after more than thirty years of intensive research succeeded in producing a net gain of nuclear energy. That gain is clean and can reliably function with ordinary metals and normal hydrogen. And it can produce an amount sufficient for heating homes, powering vehicles and running our industry. Prototypes are being tested and the commercial production of HME appliances is planned for the coming years by several companies in the world. So it is time to be informed and agree about these matters.

1 The Complication of Nuclear Science

In order to comprehend the concept of nuclear energy, viz. of fission, fusion and clean nuclear energy, we have to understand what one is talking about in nuclear physics. What is the nature of this energy, where does it come from, how is it stored and released, and how is it associated with nuclear fusion or the formation of material elements? Missing this information the concept of clean nuclear energy is hard to understand.

To answer these primal questions, let us begin with how this reality of time-ruled energetic material elements came about. We will cut short a long story of scientific discoveries essential to our subject. You will know the essence of it. Today, the world is in crisis because we have difficulty to understand both each other and nature at large. We are the children born from the marriage of father time with mother nature. But we have divorced the two. We want to control both of them but have failed to do so in some very important respects. The world is running from crisis into crisis and our collective survival is at stake. Our present day crisis is for an important part an energy crisis. The problem we have with nuclear energy in that context is that we in fact have grown desperate. We tried and tried but could not make it directly work safely and clean without radioactive waste. We have difficulty understanding the subject in the first place. But there is good news. The problem is solved, both technically and theoretically. Even though it is hard to understand and agree about it, we managed to make it work. And now we have to discuss this matter of nuclear energy in simple and logical terms everyone can follow. New matters can be bewildering and give stress though. So we take it easy, let's go one step at a time.

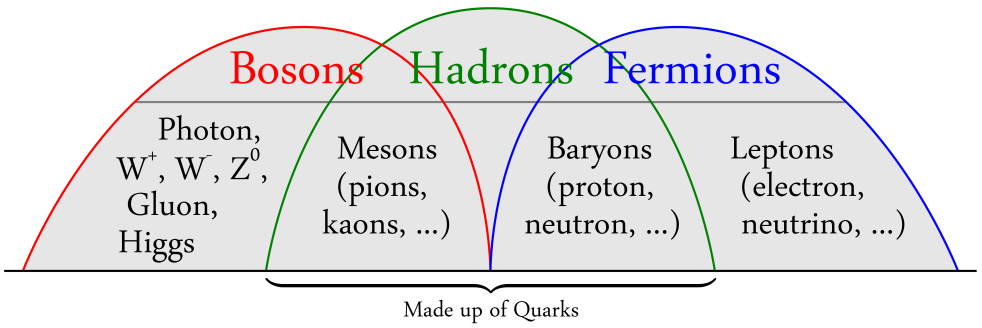


Fig. 1 The bewildering complexity of the basic categories of subatomic particles of the Standard Model. The definitions overlap each other. The hadrons are not elementary but composite particles which for that reason are not displayed in the table at page 7.
Source: Wikipedia C.C.

It is not directly clear what we are talking about when we discuss what is happening at the nuclear level of atoms in nature since the beginning of time. It concerns the actions of the smallest building blocks of matter, the elementary particles constituting the atoms, from which we wish to derive our nuclear energy. These subatomic particles are moving around always in interaction and this time phenomenon is called quantum mechanics in nuclear physics. The basic particles of action are called quanta because they consist of fixed amounts of energy. We are easily intimidated by the complexity of this branch of science. It proposes the so-called Standard Model[1]. Subatomic particles consisting of those elementary particles therewith are divided in several overlapping categories (see fig. 1) that make the system difficult to understand and remember[2].

But we can decide not to be intimidated by the Standard Model. So let us take a look at it. It is in fact easy when we restrict ourselves to its essence. Without the complicated scientific lingo one can say that there essentially are two types of elementary material particles that cannot be broken down into other particles. Big ones and small ones. The big ones constitute the atomic nucleus and the small ones occupy and define the space in and about the atom. Next to these two types of elementary material particles there are two other types of elementary particles. These are the ones connecting the material big and small ones. The connecting ones are not considered material

because they are just force carriers. They consist of those who bind the material ones and those of which one can say that they energize them. And that is all, the complete model. At page 7 there is a table displaying the known elementary particles this way.

The point missed with the original names is the function these particles have. Therefore we will not use all their confusing names in this paper, but restrict us to the basics by referring to their function. It is at the point of the energizing particles we have made progress, for at that point of the model we have found our clean nuclear energy. The step of discussing the known and possibly new subatomic particles associated with this process, we need to make though. The path we present in this research paper is the one at which most arguments of our present scientific theorizing appear to converge. Thus arriving at consensus, we have a most likely workable idea of how to describe and also practically deal with this novel clean form of nuclear energy.

2 The Big Bang Led to Space Expansion and Nuclear Fusion

Somewhere, so the facts of astronomy suggest after having measured electromagnetic frequencies, it all must have started about 13,8 billion years ago. At that moment the universe began with its process of nuclear fusion. This process, of creating all matter consisting of atoms and molecules, began with assembling or fusing their constituent elementary particles. So these had to be created first. There was a big bang, so one calls it, which was in fact more a big flash of light. That incident is held responsible for the primal energy that went into both the creation of the subatomic particles and the inflation of the universe from a timeless point. It was as if time, originating from that primal point connecting everything, as a fourth inside-out dimension with a lot of empty space was blowing up the balloon of our universe. There was a force of time blowing up a balloon that is described by a thin layer of three dimensional matter. And this still turns out to be happening today, so the astronomers assure us[32]. This space is named de Sitter space in theoretical physics. The push of this inflation formally is called the cosmological constant, a term indicated with the symbol lambda (λ, see fig. 2). This push plays a key role in our explanation for the clean nuclear energy effect we found.

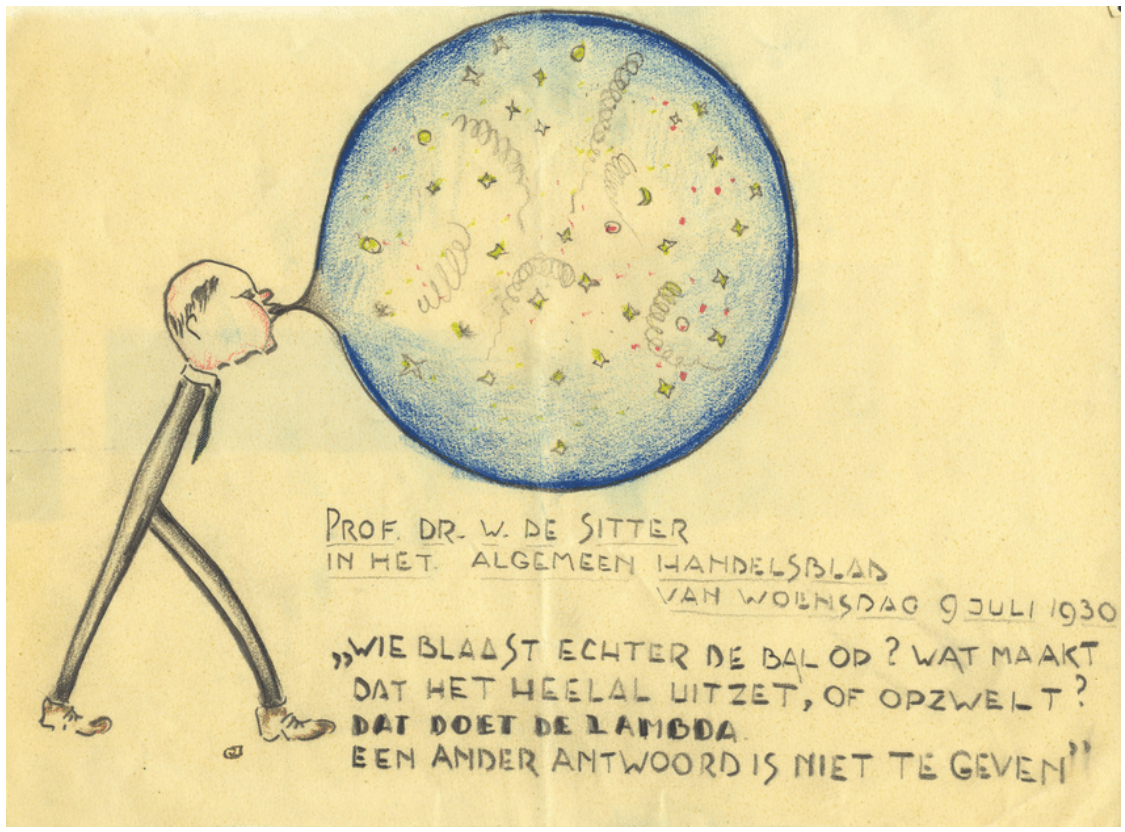


Fig. 2 Cartoon to an article in the Dutch newspaper Algemeen Handelsblad of juli 9, 1930: The astronomer Willem De Sitter, the father of the notion of empty space expansion, is portrayed as the cosmological constant lambda (λ) responsible for it. (Archive De Sitter, UB Leiden)

After light particles had exploded into existence, the natural process of nuclear fusion, or the evolution of our material universe, began. It meant that in a fraction of a second, time and space were created together with photons, light particles. It thus all started with the manifestation of these force carrying and connecting particles[3]. The primal birth of time and space had resulted in

photons. From this primal light particle the rest of the subatomic building blocks of matter originated.

These primeval light particles today still can be observed astronomically to operate in the cosmic background as a kind of radiation. They, as a proof of the Big Bang origin of the universe, arrive at earth in the form of cosmic rays consisting of those high frequency primal light particles. The particles can even be heard, with the help of a kind of astronomical microphone or listening horn. It is a kind of white noise one can see on a t.v. screen not tuned to a broadcasting station. The high frequency light particles are called gamma rays. These 13,8 billion years old photons are identical to the new photons we can observe in the form of sunlight and those that can be observed as an effect of our clean nuclear experiments.

3 The Source and Operation of Natural Clean Nuclear Energy

For billions of years the inflated and from then on continuously expanding universe was engaged in the creation or 'nucleosynthesis' of matter[5]. One can think of the following scenario. From the drive of that space expansion a generative principle of creation found its existence. That principle is responsible for the generation of a certain type of causal waves in the universe[11]. Restless space quanta moving in waves of energy at the subatomic level formed structures of a mathematical nature, like fractals (recursive, repeating patterns) and so-called solitons (waves keeping their form despite hindrances). This way hydrogen could have been created from the primeval photons that thus assembled into the elementary particles as described by the Standard Model. The hydrogen was formed together with a lesser amount of helium in a proportion of 3 to 1, with immediately thereafter (10 sec. - 20 min.) a very small fraction of 0,01% 'heavy hydrogen' (deuterium) with even smaller traces of lithium-7 and beryllium. The rest of the matter in the universe (about 2%), as far as we could measure from the star systems observed, consists of other heavier elements later on created by nuclear fusion[5].

The hydrogen atom, the leading particle in our clean nuclear energy story, consists of nothing but a single so-called proton, the most stable basic nuclear particle we know, and a smaller particle. The big proton had combined into a configuration called an atom with a much lighter and smaller subatomic particle named the electron, weighing 1836 times lighter. The proton and the electron teamed up because these particles have an opposite electrical charge. They got married so to say. The proton was charged plus, the electron minus. Together they could constitute the first stable basic primal element of nature: hydrogen. For that reason matter, consisting of the big and small elementary particles, is called electromagnetic[1]. Their polarity - or capacity to polarize - is responsible for the electric and magnetic material effects we observe in nature.

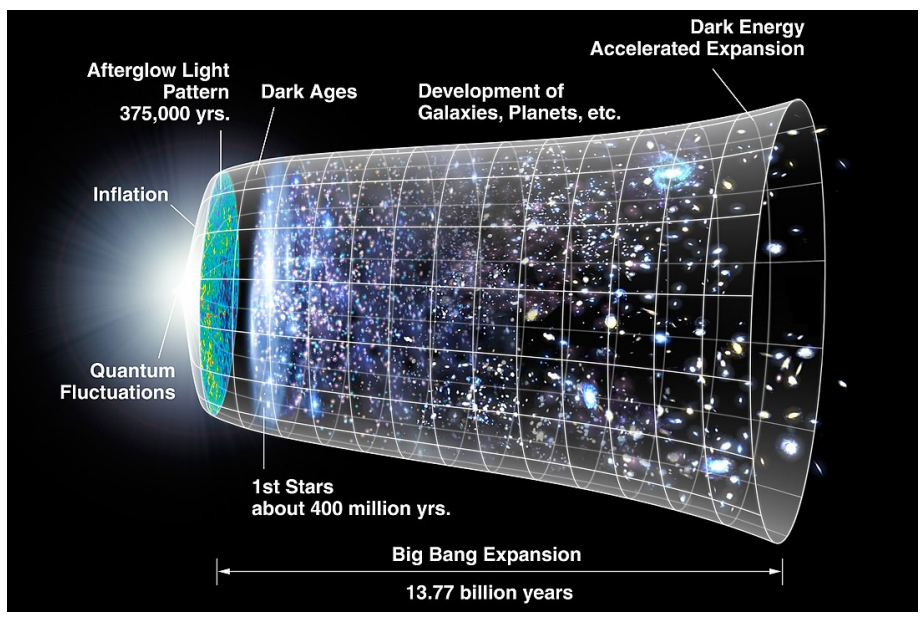


Fig. 3 The inflation and consequent expansion of the universe followed by a dark period upon which star formation began. Source: NASA/WMAP Science Team - Original version: NASA; modified by Cherkash

1 There is an exception, the small external space particle has no electrical charge, but is still material for having an internal so-called angular momentum called spin. They have a matter anti-matter polarity. It is a different kind of charge so to say in relation to the fourth dimension of time.

This all then took place as the result of the big flash phenomenon of time and space creation, this inside-out directed movement of universal expansion. Succinctly stated space from the force of its inflation, manifesting as a time phenomenon, by creating waves could lead photons to unite systematically into the basic building blocks of matter. From these basic subatomic particles the first gaseous and solid elements of matter must have evolved.

After that had happened, the gasses thus produced grouped together by the force of what one calls gravitational attraction, so astronomers concluded. Gravity is a kind of universal counterforce opposing the expansion of the universe. It led to an ever denser cloud of primeval gas. It took millions of years (about 400) for this to happen. It was a dark period that was observed as occurring after the photons had been converted (see fig. 3). That period ended when the hydrogen and helium gas started to merge. It grouped together to light up by separating their big and small subatomic particles again in the so-called plasma state of matter. It was a hot subatomic particle soup, of a certain density and heat, that thus was achieved by gravity. The stars formed that way then by the same operation of universal gravity turned into ovens baking heavier elements. These stars together with clouds of interstellar dust, consisting of the more solid heavier elements, clustered into the galaxies that constitute the material content of the universe we can observe through a telescope. It was quite a feat to get this all figured out scientifically. But now we know how nature evolved its primal matter and nuclear energy.

From then on, about 5 billion years ago, 7-8 billon years after the big flash, the so-called *dark energy dominated era*[6] began, according to the astronomers. From then on the expansion of the universe accelerated. The force of expansion manifested in an accelerated increase of space. The energy of expansion apparently no longer went that much into the formation of the basic particles and elements. Dark energy is the term hitherto used for describing the force behind this spatial acceleration that by astronomers was discovered in 1998. When something accelerates we may, from the second Law of Newton, say that there must be a force behind it. And this exactly is the force required for understanding the phenomenon of clean nuclear energy. That is why we take time to explain this evolutionary process of nuclear fusion resulting from space energy conversion. The outward push of space since the Big Bang is the force behind it. Our research conclusions about the clean nuclear energy found in the experiments point in the direction of the existence of such a force. We in fact have no other good explanation for the phenomenon of cleanHME excess energy.

This date of 1998 in science history marks the beginning of a fourth scientific revolution. The first was the one of Newton describing the mathematical principles behind the natural phenomena of motion. The second one was the revolution of Einstein who proved time itself to be relative, for it speeds up further away from a gravitational center. And the third revolution was the one of quantum mechanics of N. Bohr and W. Heisenberg. That revolution led to the realization of the Standard Model we discussed and will be discussing as for its adapted but simplified full form. The third revolution included the basic quantum principle of uncertainty in measuring the subatomic particle’s actions and positions.

Clean nuclear energy was discovered with certainty in the late eighties of the 20th century, and made public in March 1989. It was for the first time defended publicly - be it with great difficulties - by two expert electrochemists, professors called M. Fleischmann and S. Pons. This experimental discovery was the precursor of the fourth revolution that began with the astronomical discovery of universal space acceleration in 1998. Clean nuclear energy is its most shocking discovery. The concept of dark energy originally derived from it by astronomy, turned out to play an essential role. CleanHME most likely is nothing but a conversion of this dark energy. As for this energy gain in our experiments we hence rather speak of primal energy or time energy. The name for it depends on one’s perspective of theory. One can just as well say expansion energy or space energy. Fact is that once we can identify the mechanism of its conversion, as we do in our low energy nuclear reaction

(LENR) experiments, we no longer can speak of dark energy. Just as one cannot speak of a perpetuum mobile as soon as one has a working specimen that by its construction defines the source of the energy converted. A famous example of this peculiar process is the so-called Drebbel clock, a clock built by the Dutch engineer and inventor Cornelis Drebbel (1572-1633) that runs on atmospheric dynamics (fig. 4). This barometric clock, looking like a blown up, expanded clock, was patented in 1598 and back then known as a "perpetuum mobile". And indeed, that name applied for it kept moving on its own without any human input of energy. Today though the input of solar, wind or geothermal and also other environmental and spatial energy no longer justifies the use of such a term.

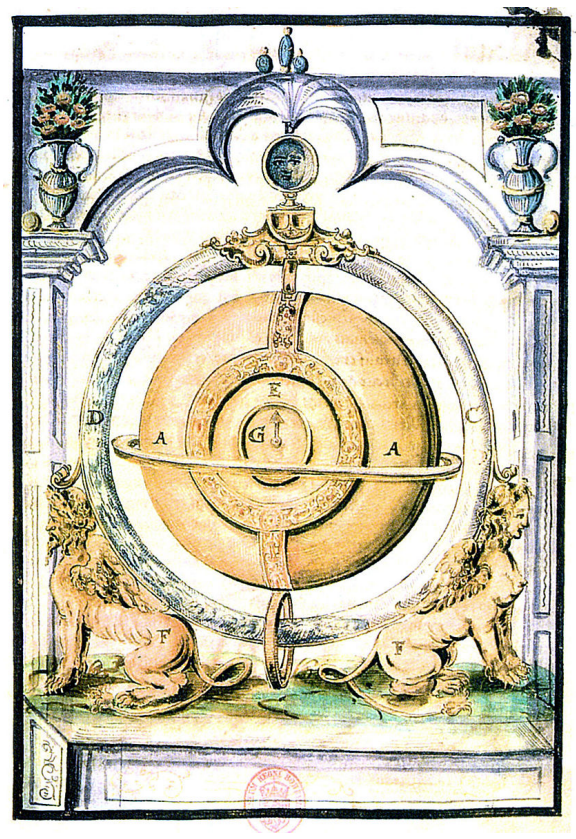


Fig. 4 A Drebbel Clock. It is a self-running barometric clock patented in 1598 and then known as "perpetuum mobile". It looks like a normal watch being blown up like a balloon.

Up to this point of dark energy scientists very well understand each other. Time though, as a standard notion of natural phenomena of material interaction, in regular science discourses is more considered an effect than a cause. One sees time phenomena, matter in action, but one with the naked eye does not recognize the cause of time, the operation of space expansion. Hence time, or space, expansion or else the natural acceleration of time coming from within as a cause of natural dynamic phenomena, is not directly considered. The balloon-like expansion of the universe since the big flash, synonymous with the birth and operation of time as an extra dimension, evidently led to these phenomena. Astronomers seeing that cause in their telescopes may know and understand this better than those who forget about it.

4 What Was Forgotten by Standard Nuclear Physics

Nuclear physicists and astrophysicists are scientists respectively studying the fusion processes of protons and the phenomenon of stars. They concluded that in order to fuse protons into heavier nuclei, neutrons are required. Neutrons and protons are together the big material subatomic particles of the Standard Model that form the nuclei of all atoms. Neutrons are the result of a combination, a ‘procreation result after an atomic marriage’, of a proton and an electron. They play a key role in the release of nuclear energy. So we need to discuss them too. Protons in our cosmogenesis with electrons are rolled into this one new, not very stable, neutral particle. It decays in about a quarter of an hour in isolation. The neutron serves as a kind of nuclear glue for the protons of atomic nuclei. But it is stable in association with protons. The stable state of the neutron is by this binding function achieved (see fig. 5). Deuterium, ‘heavy hydrogen’, with more protons fusing into a new nucleus forms elements heavier than hydrogen. This e.g. happened for the second primal element in creation called helium that has two protons in the nucleus.

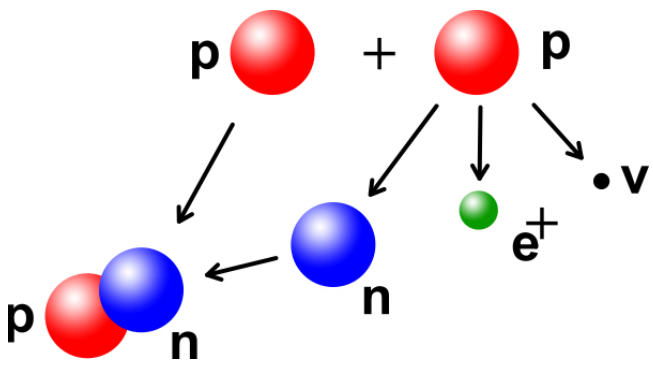


Fig. 5 Protons glued together by turning one of them into a neutron first in catching an electron (not indicated) and emitting a neutrino and positron (anti-electron). Thus sticking to the proton the neutron achieves stability, in this case forming the hydrogen isotope deuterium. Source: Wikimedia C.C.

This process of neutronization, or the creation of neutrons by electron-capture, requires energy. Input is required. And this is where nuclear science fell in disagreement not understanding matters any longer. In general it considers the demand of this input extreme at the level of supernova explosions. It hence rather in nuclear research considers the consequence of what can be observed, like a star producing heat. Despite knowing about the proton fusion in the sun making bound neutrons, not quite aware of this neutron formation it in the past got accustomed not to reason from a possible generative influence of the fourth dimension, the universal cause of time. This conservatism clouded its vision. The picture (fig. 5) e.g. was found in Wikimedia, but was not discussed in a Wikipedia article. It is typical. The causal effect of primeval space expansion in our cosmogenesis leading to materialization is not directly considered in the tradition. Despite the later astronomical discoveries pointing in the direction of the cause of all time phenomena, it hasn't been able to reason from that cause. After all, before 1998 the universal cause of fusion, the acceleration of expanding cosmic space, could not with certainty be considered from what could be seen in a space telescope. Apart from neutrons that could have been created by star explosions, nuclear science rather reasoned from neutrons already existing since the beginning of creation, And in conservatism it still does so in 2024. Evolution, also in science goes slowly. And so it happened that the energetic effect of spatial wave functions caused by natural expansion has been overlooked[7].

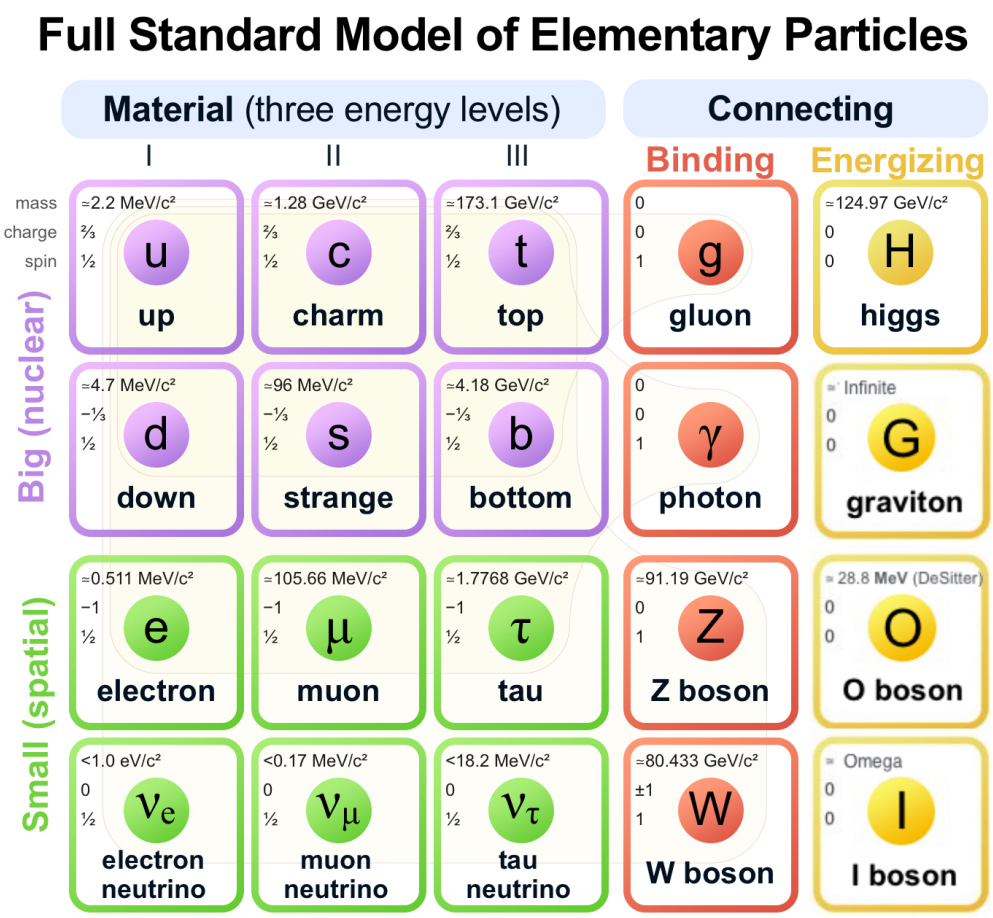


Fig. 6: Theorizing from space expansion and LENR observations one arrives at a completed or Full Standard Model of Elementary Particles with three extra energizing ones: the graviton, the out O boson and the in I boson. They operate from the fourth dimension of time and are in standard nuclear physics called scalar bosons. The big nuclear ones, in standard nuclear physics called quarks, only exist in combinations of three, thus forming the polarized proton (uud) and the neutralized neutron (ddu). Polarization with a positive proton charge and a negative electron, characterizes the first rows of the big and small material particles. (Image adapted from a Wikipedia version of the Standard Model)

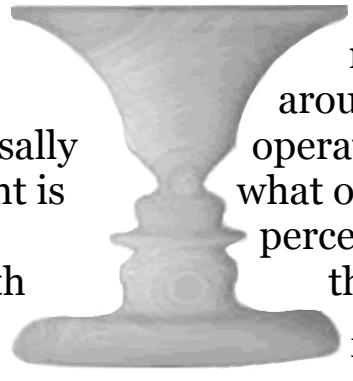
But nevertheless one could have known about it. In science history it was step by step discovered that protons may capture electrons and form free roaming neutrons at low energies. It happens far more easily than at first was supposed to happen exclusively in supernovae or in the big flash when the universe started. This neutron formation, observed in many experiments early in the 20th century, was considered an anomaly[29-3]. Free neutrons are supposed to be liberated - and not to be created thus - from fission processes and hot fusion processes (d-d and d-t, d = deuterium, t = tritium, hydrogen isotopes with 1 and 2 extra neutrons). An anomaly is a systematic difference between a measurement and a trend or a model prediction[7]. It is a strange fact, a paralogical offense of the logical rules. It was something that could not be and thus was not understood, and that, as a consequence, was forgotten time and again. Therefore the notion of the special force carriers energizing the small subatomic particles, is not automatically part of the Standard Model. Just as are soliton waves and fractal structures being caused by a certain field of space. In forgetfulness of the anomalies observed they are not known or non-existent. Or as a

psychoanalyst might say: in denial of father time we do not see his causal effect, even though we are that effect ourselves.

But, when we see LENRs work producing excess energy without sufficient nuclear products like radiation and transmuted elements (with a factor up to 10^8, see [33]), we have to consider the reality of an energizing agent. And so we can give this agent a place in an extended presentation of a Full Standard Model. See fig. 6, the yellow ones named out O (from 'outward') and in I (from 'inward')constitute the extension. The original particle table of the model has two open spaces for them at the level of the small spatial particles. The graviton also left out normally, was suggested to exist by what is known as String Theory. Filling up the three open places we now can say that the graviton in the thus achieved Full Standard Model is nothing but an energizing connecting particle operating at the 'down' level of the big nuclear particles (formally called the quarks). In permanent association with the 'up' level the big ones form the known nuclear particles of the protons (uud) and the neutrons (ddu).

Only one of these four energizing particles (displayed in yellow) is normally pictured because it has been measured with great difficulty. It is the so-called Higgs particle that gives mass (= equivalent to energy) to all other particles. Nuclear physics from the formal model for a long time had difficulty 'knowing' or measuring the effects of the activating particles mediating the force of our universal accelerated expansion. In 2012 though finally the Higgs particle was proven to be real, and thus also the quantum field of space belonging to it. Now seeing LENRs with great probability running on this energy giving or vitalizing effect, we may fill in the details of the different energizing particles, as we do with this Full Standard Model. Is has been expected that the Higgs particle would be part of a family of other energizing particles covering both the different big and small elementary particles, viz. the nuclear and the spatial[31].

Before the discovery of clean HME, nuclear physics could not acknowledge these energizing connecting particles, nor could a LENR wise neutron formation be confirmed. Not being able to measure them they could not be fit in the model. Time, natural expansion or empty space operating as a cause ('TaaC', Time as a Cause) and driving a 'dark' energy force essential for our evolution, became mere theory. Despite knowing about the facts, the material results, of the universal *syntropy* (negentropy) or the natural creation of matter since the primal flash, one talked about the *entropy* of an increasing material chaos or dissipation of natural energy. Solar energy hence was considered the result of entropy, the mass loss or decay of nuclear matter and not the other way around. One could not see fusion, the creation of matter, as the result of a causally operating extra dimension of space. Not to see things against one's better judgement is what one observes in Gestalt Psychology, a scientific understanding of human perception. You either see it this way or that way, e.g. a vase or two faces, but not both things at the same time. That is how paradigms or thought models work. And thus the either nuclear or chemical burning of fuel as a source of energy became the dominant notion and experimental expectation. The possible excitation from a so-called quantum field of space like the Higgs field was not considered, in spite of knowing space as having an energy content, as containing an active time-driven natural jitter of - virtual named - space quanta popping in and out of reality. This lowest energy level of the universe (ZPE, zero point energy level) is known to jitter or fluctuate at the nano level. And at that level of individual atomic particles accelerating it is also known to be capable of reaching, or focussing into, high values…



Nuclear fusion was, in sum, not understood as being generated by its natural cause, the expansion of the universe. This 'forgetfulness', this failure of nuclear physics to update its vision or, differently stated, to connect the dots in respect of in fact LENR anomalies, is what led to our present day energy crisis. The crisis thus is the result of our psychology, not because of our evil will

deserving the whip of war, or of a lack of intelligence. The paradigmatic conflict at its foundation constitutes a problem of consciousness demanding another approach. We have to see the two faces of connection that are constituted by the energizing in and out connecting particles we can find in the updated Full Standard Model. And thus, after half a century of studying experimental hot fusion, in spite of promises and enthused proclamations, that research did not result in any net gain of nuclear energy. Not even with the biggest setup called a tokamak[2] efficient fusion could be achieved. Bigger did not do better. Only the vase was seen, not the faces. Trying to copy with d-t hot fusion (fig. 12), what happens in the sun but actually not doing the p-p cycle of fusion (fig. 8) that happens in the sun, one did not succeed in a conversion of what we now, since 1998, may call the universal drive of primal cosmic expansion energy.

5 How Nuclear Energy Can Be Clean

Reasoning from what can be seen happening in nature, scientists concluded in the twentieth century that atomic energy, as 'the father of nuclear physics', the physicist Ernest Rutherford (1871-1937) called it in 1903, can be considered a consequence of two primal nuclear processes. It is the process of fusion and the one of fission. From the far less efficient chemical reaction of atoms also energy can be won.
Chemical binding energy can be released that way. It is far less efficient than a nuclear process of energy release because it has a lower energy density (see fig. 7). It carries much less energy. Burning fossil fuels or burning gasses of hydrogen and oxygen into water e.g. is of a much lower energy density, than drawing energy from LENR or from nuclear fission. And hydrogen, being bound to carbon and oxygen burning up with more oxygen, is not a sustainable source, for it depletes it. It either produces the greenhouse gas CO_2 heating up the globe, or else, in case of hydrogen alone burning into water, it never delivers more energy than we put in to make it.

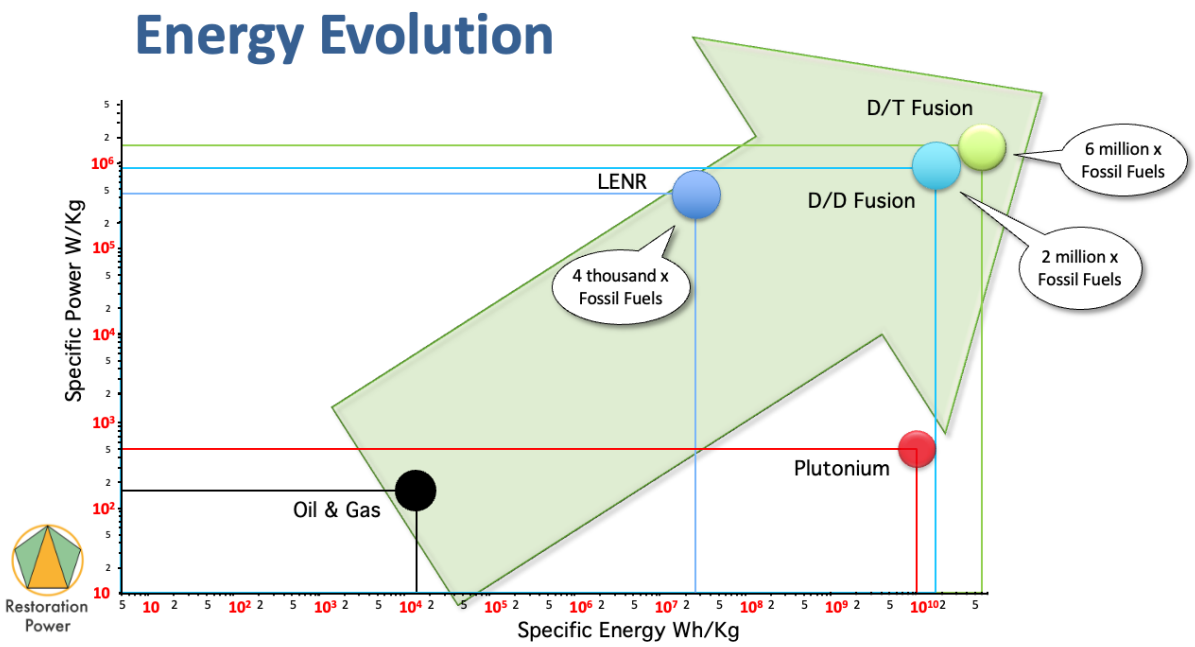


Fig. 7 The energy density for clean nuclear energy reaching 4000x the one of fossil fuels. Source: nasa.gov

Considering also the problems of the inconstancy of solar and wind energy and of the energy storage of that power and of more alternatives, nuclear science therefore looked at the sun and decided for trying to generate nuclear energy the way the sun produces its energy. Elements lighter than iron or nickel in theory could fuse or bind together and in the process produce energy. This can be so because getting a more compact nucleus results in an atomic kernel lighter than the protons and neutrons that constitute them taken separately. Mass lost means energy won. Atomic mass is converted into energy... Also elements heavier than iron or nickel, one knew, could be split

[2] A tokamak is a kind of huge metal magnetic donut built to confine a hydrogen plasma meant to create fusion by heating it.

into lighter ones, or could fission as it is called, and thus produce energy because of the nuclear binding energy released that way. It takes energy namely to bind neutrons and protons.

At this point one may run into problems of understanding though. It is a theoretical bottleneck. Think of this: if it takes energy to bind nucleons, then why would we have a gain of energy when we fuse them? What is the difference between binding protons and neutrons, and fusing them? The input of the so-called excitation energy for creating a reaction - the energy state higher than the normal ground state -, including the energy required to create the conditions for the nuclear fusion reaction to happen, is at best balanced by the output of nuclear binding energy. It can logically spoken at best be equal to the fusion output of mass loss converted into energy, according to the so-called laws of thermodynamics. Thus reasoning one with such an experiment as a standard - with one exception though, as we will discuss - would not be able to get more energy out of a closed system than one puts in. And in practice indeed much input is needed to experimentally make a form of nuclear fusion happen that delivers far less output (less than 1% in laser fusion e.g.).

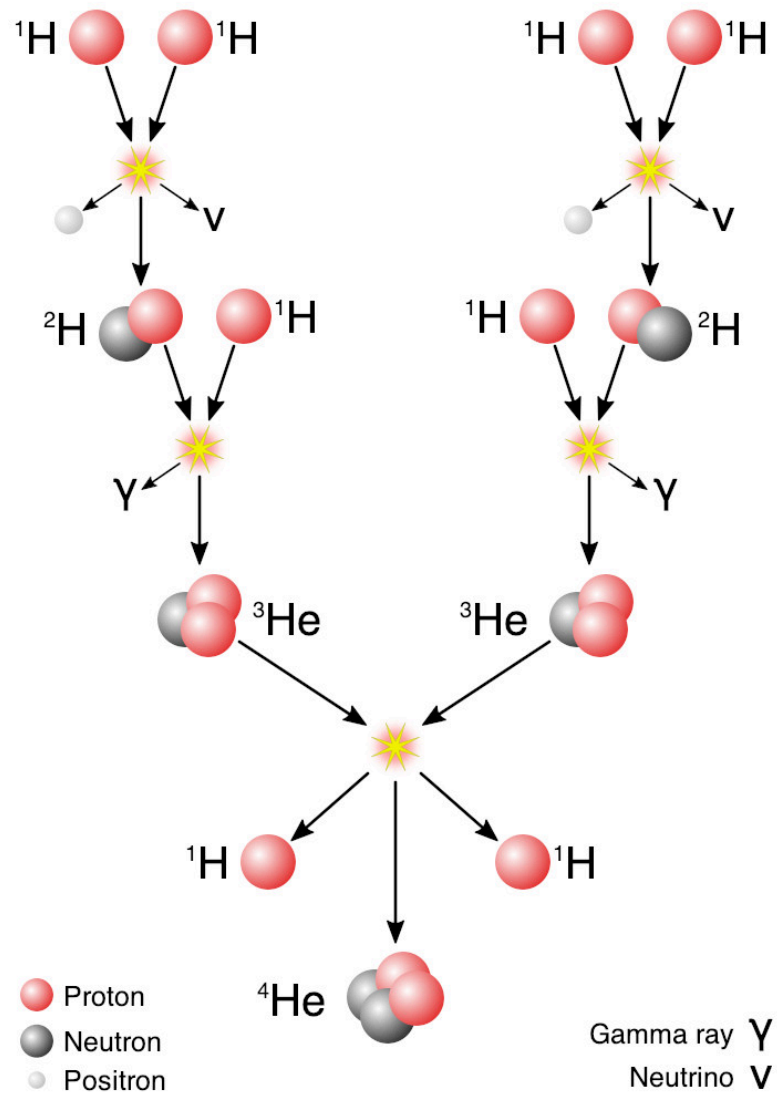


Fig. 8 The by Hans Bethe defended p-p cycle of solar fusion, the supposed main source of its heat. Note the neutron appearing in the second step. Source: Wikipedia C.C.

For fission processes there is a net energy gain though because a pulse of input is used for the sake of a controlled chain reaction output. We have a net gain of nuclear energy from the fission of naturally decaying heavy unstable radioactive elements, like enriched uranium and radium. Natural Radium from its own radioactive nature for instance is always warm because of it (300 watt/kg). The fission rate in a fission plant rather needs to be slowed down to prevent a destructive chain reaction leading to a melt down. To get results one controls by the brakes, so to say, and not by the gas handle. The nuclear fuel used in fission, like the heavy metal element uranium e.g., at its birth received its energy input from a supernova explosion, the death of a star.

But with this being so, reasoning from the vase paradigm one may wonder from where we have the input of energy for the sun to continuously operate. Or else, from where we do we have our clean nuclear energy process delivering proof of but reactive fusion processes? How can that take place experimentally in clean nuclear energy experiments, without having the radiation, isotopic shifts and transmutations to, as said, a degree that is normally expected from fusion processes? One cannot understand it this way. The energy normally expected from nuclear fusion is considered to originate from a self-confirming loop of fusion heat leading to more fusion heat, like one has in a nuclear bomb. But one very well knows that the sun doesn't work like a nuclear fission bomb nor like a fusion bomb. It is no bomb at all. The sun's core, within 24% of the radius generating 99%of solar fusion power, is a ball of plasma 15 million degrees Celsius hot, producing there also its heavier elements of carbon, nitrogen and oxygen, for closer to its center it is hotter and denser. While a fission reaction may be effective, the net result of nuclear fusion as said has to be negative. There is with a closed system like a tokamak no net gain of fusion energy without converting

energy from an external source. That was the conclusion of studying the results of the hot fusion research department. They only saw a net gain ignoring their own input into the system.

It is a bewildering conclusion though, even for the majority of clean nuclear energy researchers faithful to the experimental hot fusion hypothesis. One needs to repeat time and again that the negative net result found in experimental hot fusion is exactly what we also observe in the LENR experiments. In clean fusion experiments there are thus simply not enough fusion products to consider the nuclear fusion observed the heat source. The fusion observed is the result, and the energy observed is the cause of that fusion! What remains for the vase perspective to be achieved, is providing an explanation of the cause of the excess energy, one that was offered from the two faces perspective. We see with LENRs in fact steadily only a little fusion taking place, just like it happens in the sun. And it are not just the critical nuclear physicists saying this. *"LENR excess heat may not be entirely from nuclear reactions"*, so concluded e.g. the LENR researchers David Nagel and Roy Swanson in an article[24] in 2015. And Martin Fleischmann, the leading professor introducing the science of LENR in March 1989, from the beginning had stated even more clearly that *"It is evident that [recognized] reactions are only a small part of the overall reaction scheme and that other nuclear processes must be involved."* In 2018 *t*he Japanese researcher Jirotha Kasagi confirmed this and with his team declared that none of the nuclear reactions of the LENRs they studied could explain the excess heat observed[24]. And so, observing LENRs indeed as being successful in copying the sun's energy production, we have to turn to our primal 'faces' perspective. We have to return to the accelerated expansion of the universe as the conclusive explanation for the force behind the HME effect. A conversion of the primal energy of the cosmos is the most probable explanation.

The clean process of energy production in our LENR experiments evidently cannot be founded on the 'dirty' process, even though nuclear fusion can be part of it. Reasoning from the two faces paradigm clean nuclear energy cannot result from nuclear fusion. Hydrogen fusion is always not clean in compulsory producing gamma radiation, atomic transmutations (different elements like helium), positrons, neutrino's and isotopes (heavier versions of the same element like deuterium). Its excess heat has to be the result of another process. This stance has since 1989 been the essence of the skepticism of nuclear physics about the 'cold fusion' claims[33].

So, we may wonder then from the old model not 'knowing' the cause, how we ever can have energy from nuclear fusion of light elements like hydrogen? Despite the above mentioned one namely still believes in the hot fusion experiments and in heat from solar fusion. The sun is hot is it not? But not even the efficient p-d fusion, or deuterium burning, of a proton with heavy hydrogen (2-H, see fig. 8, second step), as happens in the sun, releases experimentally more energy than was needed to create the reaction. The deuterium, hydrogen with an extra neutron, that is needed for the experiments is garnered from seawater. By the p-d process it can be turned into helium. But this is only efficiently happening in the confinement of the sun, finding there sufficient density, concentration and temperature. But then we have another problem of understanding: the confinement there is achieved by the operation of gravity, a force that experimentally never proved to be causal as an energy source in any way. Leonardo DaVinci (1452-1519) in his studies already had concluded that gravity wheels do not yield energy. Gravity, apart from a waterfall running on the solar evaporation of water, is not an energy source.

And now we have to think differently about gravity not to lose track. Gravity as a static force of resistance cannot be causal to the excess energy of the sun generated there. By our experiments it was proven that gravity cannot be a cause of solar excess heat. Neither could fusion with a heat greater than that of the sun deliver the net gain of energy we are looking for. Still we are faced with a gain of excess energy in LENR experiments and in the sun that with its little bit of fusion power generated takes billions of years to use up its free hydrogen nuclei (protons). The sun's heat normally is explained by its enormous volume, not by its fusion power of mass conversion that is

found to be low. "*Despite its intense temperature, the peak power generating density of the core overall is similar to an active compost heap, and is lower than the power density produced by the metabolism of an adult human*" (Wikipedia) That the total mass of the sun would be responsible for its enormous heat does not mean that its heat all would be caused by the conversion of a minimal part of that mass. The input after all also requires energy. And so, given this uncertainty, we from our two faces perspective also have to take into account this third form of nuclear energy generation, nuclear physics hitherto has overlooked. Thus seen, the by soliton waves from the realm of quantum space excited energizing particles and their quantum field of space must be there. The extra energy found in the LENR experiments cannot be explained from just the old Standard Model theory.

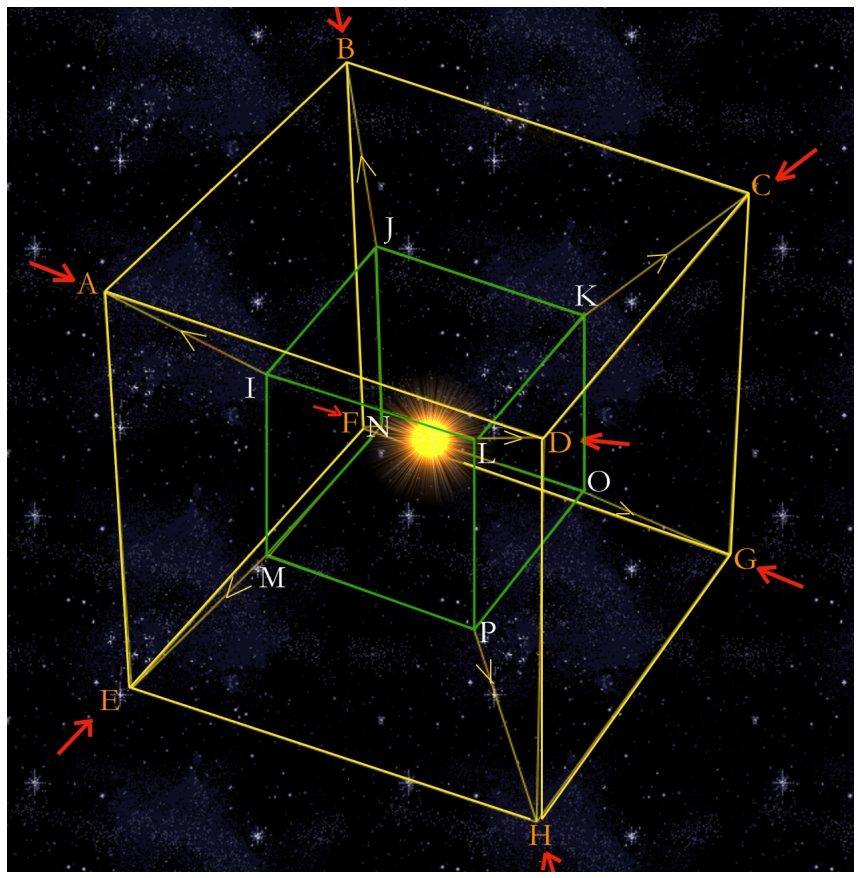


Fig. 9: 5-D reality: The little sun in the middle stands for point Alpha from where universal expansion began. From the green to the yellow cube we see the progress of time for an expanding 3-D cube representation of material reality in which time is the fourth dimension and point Alpha the remote cause of time of a fifth timeless point space dimension connecting everything. Gravity as negative time is represented by the red arrows.

Ergo, we have to consider the natural conversion of primal universal expansion energy, of what was considered dark energy thus far. With the proven inefficiency of nuclear fusion experiments and the notion that gravity cannot be the cause of the energy found, we have to conclude differently. We then may say that gravity as such can be understood as an opposition, a form of resistance offered by matter. When time is the positive version of the energy source, gravity automatically must be a negative form of time energy, a form of resistance against universal expansion (see fig. 9). This turns our vision of reality on its head. The universe works inside out from a flash in the beginning and gravity is the resistance against it. Gravity is not pushing us down to earth, no, the earth in expansion is pushing us up against our feet!

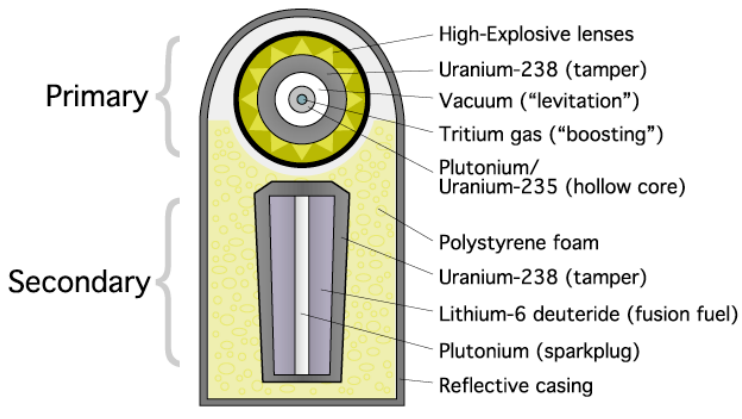


Fig. 10 Schematic of a so-called Teller-Ulam type of H-bomb: a nuclear fission bomb is used as a trigger for a hydrogen fusion reaction.
Source: Wikimedia C.C

Still, the old way missing this essential logic of causation, nuclear physicists experimenting as said believe in a net gain achieved by fusion. The main reason for this is that we after the second world war managed to build a fusion bomb (fig. 10). A fusion bomb is the result of a fission bomb used as a trigger for producing free neutrons to create a chain reaction (fig. 11) in which hydrogen is turned into helium in a huge nuclear explosion. Hydrogen fusion then for a moment boosts the fission explosion so to say.

But this process has nothing to do with what happens in the sun, even though it produces a light brighter than the sun by means of a form of fusion more efficient than the sun. This process of fusion concerns the d-t process, we mentioned before, it fuses the two

isotopes of hydrogen, deuterium having one extra neutron with tritium, having two extra neutrons. There is no tritium involved in the basic fusion cycles of the sun (called p-p and 'CNO'). The nuclear physicist Hans Bethe received the 1967 Nobel prize for the physics of it (see fig. 8). The element tritium required for the d-t process is very rare in nature. It is unstable, it is radioactive. Half of it decays into helium-3 in about 12,26 years. Nevertheless experimental hot fusion derives from the deuterium-tritium (d-t) hydrogen reaction, not expecting bound neutrons apart from deuterons or deuterium nuclei (alpha rays), but rather producing unbound ones ('ionizing radiation').

This type of experimental or military fusion, if you will, in a bomb produces ionizing free neutrons that create the chain reaction producing even more free neutrons until all hydrogen is used up in one go (fig. 11). One at first was afraid that maybe the H-bomb would ignite the entire earthly atmosphere, but calculations predicted the hydrogen density after the explosion to be too minimal for the reaction to continue and blow up the entire atmosphere. Efficient fusion, or a net energy gain, was achieved, but not an efficient containment and continuous control of its nuclear energy release.

6 The Cause and Consequence of Nuclear Heat.

The headstrong hope of the hot fusion experiments is in fact to achieve a controlled chain reaction, like one does in a fission plant (fig. 11). In fission one controls the nuclear decay of heavy radioactive elements with e.g. cadmium, as a suitable neutron absorber. One thus regulates the amount of free neutrons triggering the decay. Nuclear fission is a dangerous process that, in case of failing heat or neutron control, with a melt down of the radioactive metal will result in an ecological disaster polluting a large area for thousands of years with radioactivity. This happened several times in history like e.g. in Harrisburg (partially) in 1979 in the USA, in Chernobyl 1986 in Europe and recently in Fukushima in 2011, Japan.

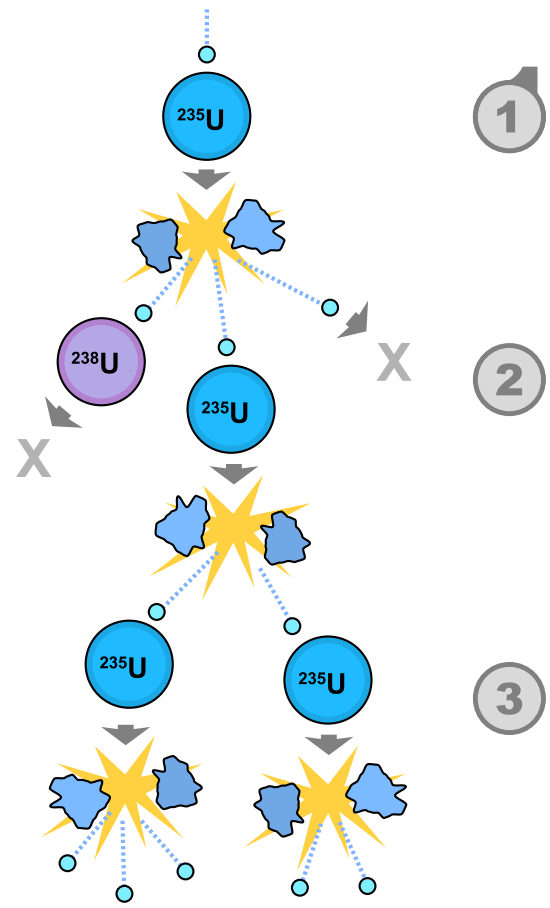


Fig. 11 How a nuclear chain reaction works with Uranium235 when one single nuclear reaction causes an avalanche of subsequent nuclear reactions, given sufficient fission material reaching a critical mass, Source: Wikipedia C.C.

Even when one succeeds in controlling matters the fission way, one ends up with highly radioactive nuclear waste that must be stored safely somehow. That is why nobody actually wants it. But it is nevertheless these days again supported in plans for the future because the hot fusion experiments not yet proved to be effective. Nuclear fusion as the path to follow was achieved in experimental reactors of different types, but it was never found to produce nuclear energy efficiently. As we saw, that couldn't be. And that is not surprising from the logic of fusion as stated above. In other words: *one mistakenly considers fusion a cause of the heat found, not understanding or copying what happens in the sun, while nuclear fusion evidently is a consequence of it, so cosmology and also the nuclear energy experiments prove it to be the case.*

The proof of the hydrogen bomb is not valid for proving hot fusion a proper path. Here is why. The hydrogen bomb, as stated, results in fusion because of the heat and neutrons created by a fission trigger. Creating heat experimentally though in a tokamak makes fusion happen as well, but does so far less efficiently: the fusion achieved that way cannot be one of a chain reaction like one controls in a fission plant. In

fission the natural decay can be controlled. In hot fusion experiments though the containment is problematic: one engages with very costly creating 1) a temperature exceeding the one of the sun and 2) a super strong magnetic containment field so as to realize the unnatural isotopic hydrogen d-t reaction chain. That chain pollutes the magnetic torus with energetic neutrons that make it radioactive (see fig. 12). The precious metal of the torus is thus wasted in the process (radioactive waste!). The deuterium used as fuel though is easy to obtain. But not so the tritium required for the maximum fusion output. Thus we in different respects happen to look at a dead end street of fusion not natural to the p-p cycle of the sun.

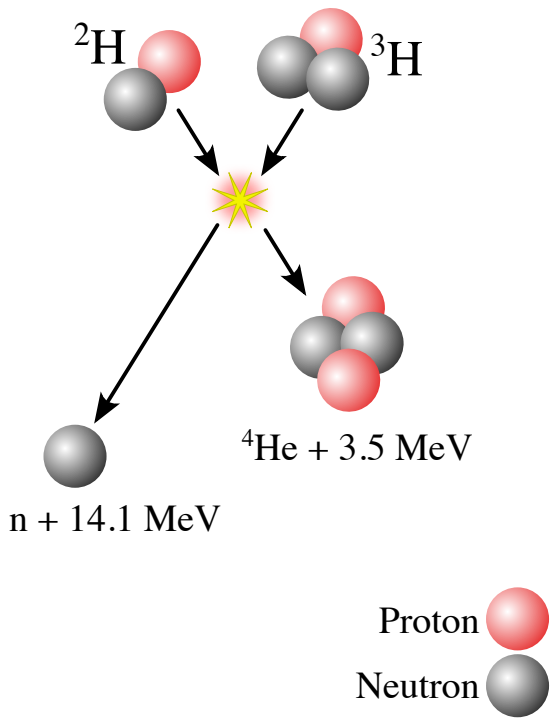


Fig. 12 A Hot fusion experimental D-T reaction chain producing neutrons and requiring a constant input to continue, a reaction different from the also input dependent p-p reaction chain of solar energy production.
Source: Wikipedia C.C.

To get this point of cause and effect and abandon the standard fusion vision, one needs to understand the difference between a *chain reaction* like in an explosion or a fission meltdown (see fig. 8), and a deuterium/tritium *reaction chain* like in a tokamak or the one of a proton-proton cycle in the sun (see fig. 8&11). They are entirely different processes (see fig.11&12). The sun evidently is not a hydrogen bomb unless it runs out of free protons changing into a supernova, nor is a tokamak explosive. A reaction chain requires a trigger for input, and a constant operation over a long period of time to produce energy at demand, while a chain reaction implies an incited dangerous avalanche of neutrons produced that needs to be controlled and/or shielded in order for the experiment to succeed and the experimenter to survive. That is why the bomb form of fusion is not valid for proving right the experimental form of fusion in a tokamak or a laser setup.

By hot fusion to be in control of a hydrogen chain reaction therefore turned out to be an illusion. One managed to inefficiently control a reaction chain leading to fusion. Not reasoning from the natural cause of elementary fusion, but considering oneself the cause, we in this department of nuclear physics in bewilderment appear to have been wasting our chances of collective survival. Now, in 2024, we seem to head for the destruction of the planet, by this unfortunate passion having run into a dead alley of research. Human self-annihilation is a subject of psychology, not of physics. It is not just an experimental failure, it is humanly spoken a destructive diversion in illusion, falsely taking pride in failures. It is a practice we have to put an end to. In an energy crisis like the world is running into in the early decades of the 21st century, we cannot afford such a psychologically driven diversion. With the hopeless efforts of trying to achieve net gain with the controlled hot fusion of hydrogen isotopes we find us on a stray path. Considered from the humanities, we have lost both our communication ability and our political and scientific mutual self-respect with it. Instead of endeavoring for the third option of clean nuclear energy, we are politically driven financing a military build-up. Not getting the point of this scientific fusion illusion of cause and effect, we in the third decade of the 21st century are investing in arms to curb the aggression resulting from political ‘communication problems’. Wishing to achieve a victory we engage in a mutually assured destructivity (MAD) of waging war against each other. In Europe and elsewhere in the world we, in defiance of all the progress we thought to have made, still engage in wars against each other. Instead of fighting together against the illusion we have in common, the constant error, we in illusion fight each other. We do so notably under the threat of nuclear warfare eventually, which is evidently also a path of nuclear energy engagement that runs dead, literally.

7 LENR: The Third Option Offering a Clean Nuclear Energy Gain

So the situation looks pretty grim: how for the love of God can one copy the sun's energy production missing the knowhow as offered in a paper like this? Such an endeavor will not succeed unless we understand the cause of the sun's heat. We cannot achieve this by following experimentally another non-solar process of nuclear fusion. Evidently the plan B for clean nuclear energy production, as was found experimentally, is called for. Another third experimental type of nuclear process, similar to what happens in the sun, comes to our rescue. In being 1) a clean process which does not produce free neutrons or other harmful radiation, but which 2) offers only heat and scarcely some bound neutrons, or isotopes and transformations of elements like hydrogen and helium, it constitutes what we sought for and may continue to go for.

From our research, finally having arrived at closure in 1) our notions about both the possible cosmic cause and about 2) the operating quantum mechanism behind this LENR-effect, we may celebrate to have defeated a devastating illusion. These two achievements constitute the essence of the natural conversion of primal energy, the energy of life and time itself. It opens new perspectives for all walks of life and branches of science from the humanities to the basics of natural science about space, time and gravity. It offers us a new world. From this research achievement we next may succeed in practically perfecting the process, step by step engineering appliances as it should be done. With this process, of by a spacetime driven nuclear process converting the primal universal energy of expansion, we are back on the path of progress. Being experimentally associated with but very little nuclear fusion, the promises of nuclear energy research since the fifties of the 20th century now have been fulfilled. Nuclear fusion in sum is a consequence and not the cause of excess heat. Space energy conversion is there for real and thus also must a new kind of force carrying particles be real for the Standard Model of elementary particles. When we soberly manage to accept the facts of our research findings, we finally can safely and economically put faith in the concept of nuclear energy. LENRs also work with normal metals like copper and nickel, and with normal hydrogen (called protium, without a neutron in the nucleus).

This third option of, for a net gain of nuclear energy, converting the time energy of universal expansion, is these days, as we already stated, called a Low Energy Nuclear Reaction or LENR (also a Lattice Enabled Nuclear Reaction, or a CANR, a Chemically Assisted Nuclear Reaction). One could also say a 'life enhancing nuclear reaction'. Because the primal basic energy of the universe is converted by it, it no longer is called dark but extra or excess energy. In this department of science the electrochemical process of it is called energy catalysis. The theories about the quantum mechanics of the process converge around the energizing effect of so-called quasiparticles (*qps*). It concerns a generative effect of unstable electron formations. The qps in high density (100kg/cm^3 related to a pressure of minimally 15000 atm.) are supposed to oscillate therewith in between the atoms of the with hydrogen absorbed lattices of compound metal nanoparticles. The conversion mechanism, one assumes, is driven by stable soliton waves from the realm of the quantum field of empty space. Solitons with certainty represent an aspect of the organizing principle of the Universe. In between the lattice of the reception metal the waves give rise to fractal structures, viz. self repeating structures accelerating on successively smaller scales. And that is what then results in the energizing effect of the LENR process[11].

The LENR effect is a proven real, replicable and scalable process, so may be concluded now after more than thirty years of intensive research[16 and 17.]. It is observed to operate at levels ranging from room temperature up to a 1000 degrees of Celsius (the hotter the better; it is not the pressure that makes the difference). Science with difficulty started on this path after its highly criticized so-called 'cold fusion' introduction in March 1989 in Utah USA. The term 'cold fusion', back then coined, was

a misnomer. Fusion could not be the cause of the heat found. The fusion symptoms or nuclear ash remnants produced could not explain the excess heat. But nevertheless, because the excess heat found initially was considered a consequence of nuclear fusion, great confusion and dissent was the result. Till today the fusion symptoms turn out to be a mere side effect (to a magnitude order of 8) of this third type of quantum mechanical nuclear energy production[33].

Fig. 13 Logo of the ISCMNS, the International Society for Condensed Matter Nuclear Science Source: website

The achievement of this insight resulted from the step by step evolution of a seemingly simple but in fact highly demanding electrochemical experiment. It was conducted in Utah, the USA, in the late eighties of the twentieth century. It was an endeavor, as said, theoretically triggered by anomalies observed in many, mainly gas-discharge, experiments during the early days of nuclear science. These trials during the century gradually, as it should, evolved into a science now called Condensed Matter Nuclear Science, CMNS (fig. 13). This science, these days modestly subsidized by e.g. the governments of America, Europe and Japan, constitutes an association of researchers called ISCMNS[8 and 9] consisting mainly of experimental physicists, chemical engineers and electrochemists. It is since 1989 supported and maintained by annual science meetings called ICCF, international conferences for 'cold fusion'[14 and 15]. The term 'cold fusion' as an honorary nickname was maintained despite having been corrected into LENR. In fact being uncertain of what one was dealing with, many names for the science have been proposed in its history. In the European Union it has been named clean HME, clean hydrogen metal energy[18].

The history of this new branch on the tree of science concerns the struggle to arrive at comprehension and recognition with the most likely theory and best experiment for the LENR effect discovered. Astonishingly, on top of that, moreover the effect was found to operate at the level of organic life in the form of biological transformations of chemical elements[19]. The study of this specific subject covers even more than 200 years of science history. The LENR subject clearly has not been the exclusive domain of electrochemists.

LENRs as a possibly viable process of energy generation were in her history early recognized by established scientific authorities. They were monitored and commented upon by renown prize winning theoretical physicists like Albert Einstein, Edward Teller, Richard Feynman and Julian Schwinger. The more experimental part of this struggle, which was covered by the electrochemists, concerns the development of the practical know-how for constructing a sufficient and reliable prototype of a workable apparatus. One has been working hard for a clean nuclear energy generator to convert from the formerly dark natural source of what we, as said, now may call 'time energy', 'space energy' or else 'primal energy'. The history and practice of this endeavor is not the subject of this paper though, it is extensively discussed in several textbooks[27,28 and 29].

8 Conclusion

In electrochemical experiments a new source of energy has been discovered in the form of low energy nuclear reactions, in LENRs. This third form of nuclear energy, next to the one of fusion and fission, derives from a form of energy which formerly was called dark. But now it has been identified as a source and is harnessed (see fig. 14) by an increasing number of commercial

enterprises. This led to the production of prototypes of applications[20,21 and 22]. The nature of this new form of nuclear energy may also be understood as energy originating from what physics calls the quantum field of space. The experimental observation of how this field operates leads to new insights concerning the Standard Model of nuclear physics and earlier fusion experiments. A new family of energizing connecting elementary particles must be assumed next to the already known Higgs particle. Nuclear fusion as achieved in experiments and as observed in the sun for that reason should be considered a consequence of this primal energy source. Nuclear fusion observed in LENRs evidently is not the cause of this hydrogen metal energy. The field of space, which may be assumed the cause, concerns a form of space which operates inside-out of matter in the form of a fourth dimension. We know this dimension as the one of time. It is a form of generative spacetime which in theoretical physics is called de Sitter space (as in fig. 2). It concerns a truly empty space filling up the universe like air fills up a balloon. Considered from this new time-as-a-cause thought model or TaaC paradigm, the operation of this field is responsible for two fundamental matters. Firstly, the generative quantum qp quasiparticle jitters of restless electron structures in LENRs. These energized structures, associated with soliton waves and fractals, are proven to be active at the nano level of by hydrogen saturated metal compounds. One therefore also speaks of clean HME or hydrogen metal energy. Secondly, the field is causal to the accelerated expansion of both the (physical) space of matter and the outer space of the universe, which has gravity as a ‘negative time’ counterforce. The inner and outer space of matter is, so to say, pressed against each other by it. It is there as the effective cause of the universal creation of matter since the ‘big bang’.

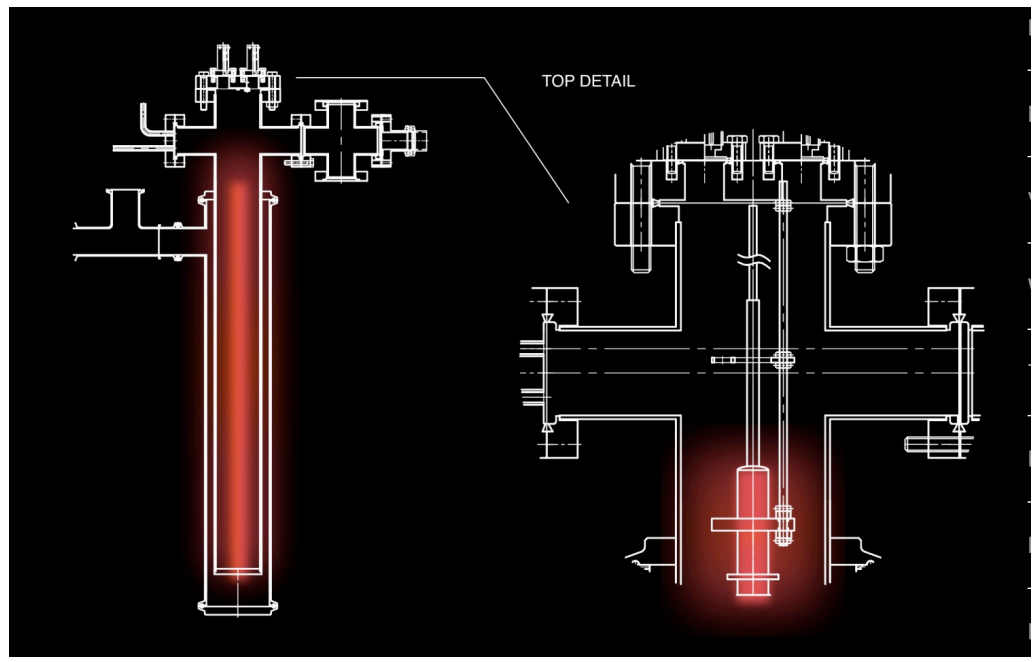


Fig. 14 A Japanese design for a 2kW LENR device prototype named Qhe Ikaros, built for industrial use, being projected for 2024. Height 63 cm, vol. 2l, weight 4kg, reactant metal: Ni & Cu, running on normal hydrogen as a (catalytic) ‘fuel'. Source: Clean Planet Co.

9 Epilogue

The realization of the noble but complex purpose of clean nuclear energy as a new energy source for the global community, requires conscious effort and investment of time and money, attention and goodwill. It evidently turns the present thought model, or paradigm, of physical, nuclear, cosmological and astrophysical science on its head. And it will have far reaching consequences for all other walks of human life. It implies a new, fourth scientific revolution. As hard as it seems to be scientifically, from the perspective of the humanities[26], one is traditionally equipped with reasoning from a remote cause. One from that perspective may recognize easily the eternal theme working behind it. Nevertheless it is not a small affair to arrive at both the required technical and humanities understanding. We have a new science called CMNS presenting us LENRs. And we have to realize the implementation for its common societal use. It is both a theoretical and practical challenge. It is both a social and political challenge, to meet with clean HME the purpose of preserving the planet and humanity at large. With this paper we hope to spur its endeavor.

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