# **ENERGY SCIENCE REPORT No. 5**

This Report was first published by the author in 1994 and was reissued later and made more generally available from Sabberton Publications as ISBN 0 085056 0217 in October 1996. It is now made available freely via this Internet facility. It concerns theory pertaining to the creation and properties of deuterons which, as present in atoms in heavy water, deuterium oxide, are involved in the experiments which gave birth to the notion of 'cold fusion'. The technology of that field is slow to develop and, though the author did plan to write a Part II Report as a sequel to this report, which is entitled POWER FROM WATER: COLD FUSION: PART I, this has not materialized. This Report nevertheless is an important contribution to the theory of the subject, also because it explains how the triton, the third isotope of hydrogen is created. It is worthy of study as an adjunct to the author's latest work, the book: The Physics of Creation, because the latter explains in updated detail how the proton itself, the primary isotope of hydrogen is created. For this reason it is given priority in updating this website by now adding progressively each of these ten Energy Science Reports as they are withdrawn from normal printed publication. It should be noted that the book just referenced is a substantial work and should not be confused with Appendix A of this Report, which has the same title. The latter featured as a 12 page Chapter 4 in the author's book GRA VITATION, published in 1975, which gives an early insight into what has now June 2003

## ENERGY SCIENCE REPORT NO. 5

# POWER FROM WATER: COLD FUSION: PART I

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# POWER FROM WATER: COLD FUSION: PART I

#### Introduction

This Energy Science Report draws attention to the revelance of theoretical work pursued by the author over many years before the advent of the now well-known 'cold fusion' discoveries reported

from Utah in 1989.

It will be followed by a Cold Fusion: Part II Report, which will be more specifically directed to the author's patented technology which is emerging from this theoretical base.

The object of this Report is to show how the 'cold fusion' scenario is destined to impact the whole field of fundamental physics, ranging from cosmology generally to the pursuit of energy generation techniques that are so fundamental that they can harness the still-latent and ever-present forces which brought about the creation of the universe.

These Energy Science Reports are all connected with that underlying groundwork in energy physics that the author has surveyed, driven by his interest in magnetism. Thus Energy Science Report No. 1 concerned 'Power from Magnetism' and described three of the author's experiments which point the way forward to what many term 'free energy'.

We are assuredly destined to see rapid strides in this technological field in the months and years ahead and we will enter the 21st century with a whole new vision of our energy future.

Only today, 15th April, 1994, as the author writes the first words of this report, a communication was received which draws attention to what is termed 'UDT' - Unidirectional Transformer - which Paul Raymond Jensen of Santa Barbara, California claims to have invented. When readers of my Energy Science Report No. 1 become aware of Jensen's 'UDT' and compare the transformer with that shown in Fig. 4 of that Report they will see how the solid-state 'free energy' ferromagnetic device can now emerge on the 'free energy' scene.

With the same prospect evolving on the magnetic reluctance motor using permanent magnets, as championed, for example, by New Zealander Robert G. Adams, this author has planned an Energy Science Report concerned with motor technology. However, here also, whilst currently in the throes of experimentation, it has come to light that a researcher named Frank F. Potter has, for many years, been urging university professors in U.K. to work on the prospect of tapping the energy field that powers a magnet. He has challenged them to do the calculations on specific field coupling involving magnets to prove the case one way or the other.

In spite of the interest engendered, the usual establishment reserve about the so-called 'perpetual motion' machine has kept the Potter issue private and not brought it into open forum. However, this author, having now heard of this, has responded to the challenge and has brought ahead of schedule 'Energy Science Report No. 4: The Potter Debate' which was completed on 10th April, 1994. That Report provides a mathematical basis which will help critics of the 'free energy' field to come to terms with what is now bound to disturb the world of those experts who know how to design electrical transformers and chokes but appear not to know how close they are to a new technology that can provide an energy bonanza.

The intervening Energy Science Reports Nos. 2 and 3 are captioned 'Power from Ice', and relate to experimental work on a thermoelectric energy converter in which the author is involved as inventor. These Reports exist only in confidential draft form at this time but that technology does spill over into something that will be said about the 'cold fusion' research, particularly in the Part II Report.

This introduction, therefore, explains how this text fits into the series of Energy Science Reports by which the author has chosen to update his published research findings prior to incorporation and consolidation in a more formal book form. The 'free energy' scene is now evolving so rapidly that it is better if such a book is written once the author has possession of his own working 'free energy' generator and can provide full test data on a practical system.

## The Black Hole Syndrome

This may seem an unusual heading for a text about 'cold fusion', but the physicists who believe in 'black holes' think as do physicists who do <u>not</u> believe in 'cold fusion'. This is a very relevant comparison as one can see from the following remarks.

1. All physics is built on observation of how electrical particles behave, whether individually or in aggregation as matter. The interaction forces between such particles control their coming together, whether to form atomic nuclei, molecules, composites, crystals or stars and planets.

2. Physicists tend to extrapolate their knowledge of experimental behaviour to realms far beyond the bounds governing the conditions of their experiments. They seek to probe territory they cannot reach, but always build with confidence on the certain founding knowledge derived from experiments on what they can see or what they can explore in a laboratory.

3. The neutron as a real particle has only been detected upon creation in the free state and it has a half-lifetime measured in minutes but physicists extrapolate and create 'neutron stars' in their imagination, stars which survive far longer than a few minutes! They cannot 'see' a neutron in an atom, such as in the deuteron, but they <u>assume</u> it is there because the deuteron has two atomic units of mass and one of charge. But, surely, one could better surmise that two anti-protons plus three positive beta-particles represent two atomic units of mass having one positive unit of charge. We know that atoms decay by shedding beta-particles and what we could suspect is that, if they shed an anti-proton and a positive beta-particle, so that would manifest itself as a short-lived 'neutron'! If, on this basis, there are no neutrons in an atomic nucleus such as the deuteron, then is it really surprising to find no neutron emission when we contrive to capture those positive beta-particles by free conduction electrons in the host metal cathode of a cold fusion cell? On the contrary, physicists go the other way and make their unwarranted quantum leap by recognizing that neutrons are able to form stars that have no electrical resistance to the crushing force of gravitation - even though those free neutrons in the laboratory show a substantial <u>negative</u> magnetic moment!

4. They cannot see a 'black hole', but they can imagine matter becoming so compact, as gravitational interaction forces become so strong as to out-weigh and preclude the intervention of electric forces between those charge constituents of the neutron. They are thereby <u>assuming</u> that gravitation is a force so fundamental that it transcends and displaces electric force from a primary role that is so evident in laboratory findings from atomic physics.

5. Those physicists can see in certain remote galaxies certain effects which suggest the coming together of electrical matter, which, by all the basic rules of physics, should not occur because electric forces resist nucleation. Their evidence is a strong gravity force, abnormally related to the mass of the visible body acted upon or a substantial redshift in the optical spectrum of atoms radiating from the nearby field zone. Their assumption is that the universe was born in a Big Bang where everything was overheated and had such energy content that all physical barriers could be overcome. Anything is possible in such a vision!

6. So, if excess heat is seen to emerge from a deuterated palladium cathode in a 'cold fusion' cell, that could suggest that 'nucleation' or fusion has occurred between deuterons, overcoming their mutual electric repulsion in that metal palladium. However, those who believe in 'black holes' are not inclined to believe in 'cold fusion' because they know that the 'black-art' assumptions needed to create the 'Big Bang' and the 'black hole' are not as easy to apply inside a lump of palladium on a laboratory test bench.

7. This 'disbelieving' body of physicists has other 'disbeliefs' as well. They rely on their 'practical' knowledge of gravity and measurement of G to calculate 'black hole' properties, but do not believe that there is a real 'aether' medium, the distortion of which generates that gravitational action. They believe in mathematical extrapolation and that means reliance on equations do not 'rupture' when under excessive stress, as does real matter or real 'aether'. What, indeed, is the tensile strength or the

compressive strength or the shear strength of what physicists call 4-space? What, one wonders, are its internal dimensions, the distances between its component parts? Without common ground on which to stand in talking about 'aether' or 'space-time', one cannot discuss with such physicists how it is that the 'crystal' structure of the aether itself determines the 'fine-structure constant' they use in their atomic physics. One cannot discuss with such physicists how it is that the sub-quantum motion underlying the Planck action quantum interacts with matter present to force a need for a dynamic balance, which in turn demands the presence of a discrete and unseen graviton population. One cannot therefore get such physicists to listen to the formal account by which G, the constant of gravitation, is derived in terms of that dynamic balance. And so it follows that one cannot put the case to such physicists that, where matter is very concentrated, as within an atomic nucleus in the mid-range of the periodic table, the aether is not too far from the stress limits that govern graviton creation conforming with G as measured in our laboratory.

8. It seems that there is no way in which one can lead a 'disbelieving' physics community out of their wilderness, even if one uses their own language and words with which they are familiar. All one can do is to destroy their beliefs with the mighty blow forthcoming from the reality of a technological breakthrough. Whether this comes from 'cold fusion' or from 'free energy' sourced in ferromagnetism matters not, so long as there is that technological breakthrough. What is needed is something that points to evidence of how protons and deuterons are created preliminary to their fusion to form heavier forms of matter and how Planck's action in the underlying aether spills out energy to feed that creation.

9. The 'black-hole' supergravity that can occur in very dense matter cannot be explained until one can explain gravity in normal matter and until one can further explain the factors which determine the value of the fine-structure constant. If, for example, Planck's constant were to change in a step function as a function of the mass density thresholds in very dense matter, related to the concentration of aether energy, so that would affect the interpretation of the so-called 'black hole' evidence.

10. If, in striving to sustain a dynamic balance, the aether responds in a dual dynamic action to the passage of electromagnetic waves, so this could affect energy deployment implicit in Maxwell's wave equations and it could explain why the aether medium appears non-dispersive. These possibilities are not even considered by physicists who insist on building only on their 'past experience' without looking at the foundations to see what might have been missed. So, we advance by the accident of discovery, and, it seems, 'cold fusion' is one such accident. It remains now to convince physicists generally that there is excess heat generated in a cold fusion cell and then they can begin to think of revising their theories. This they will do in their own way, mindless of the work of record that can help them in that task.

11. Inasmuch as this author began in this field by first making the magnetic case for a real aether, then by determining the structure of that aether and deducing the fine-structure constant and going on from there to explain the connection with gravitation and proton creation, so it seems appropriate to lead from that into the subject of this Report. 'Black holes' and an 'expanding universe' conceived by physicists who were unaware of how Nature's ongoing attempts at proton creation in space can progressively reduce the frequency of electromagnetic waves in transit, plus the illusions of Einstein, have made them deaf to what this author has been saying over the years. In spite of this the author will here try once again to introduce his theory of proton creation and with it the creation of neutrons and deuterons, all to give basis to the new physics essential to our understanding of what underlies 'cold fusion' and of that deeper source of 'free energy' from which protons and deuterons are created. The author will further show how gravity features in this act.

12. One could not advance a theory on the scale provided by this author without encountering numerous obstructions where one has to pause to explain why others who claim something different have gone wrong in their own endeavours. The 'cold fusion' issue has run into such problems.

However, here it has not been a question of theory. There is now too much theory and not enough fact and so it is that the author feels he can let his own theory pertaining to cold fusion stand the scrutiny of others in this contest before needing to consider its defence. No, the rival claims in the 'cold fusion' field are those of experimenters. Whilst there are the pioneers who persist experimentally in their onward research, there are the others who rely on their personal 'experience' of confirmatory tests which have failed. Thus, whilst the author makes no special claim for superior wisdom in this experimental field, he has a comment to offer on the latter topic. It is merely an observation that to get two like-polarity charges to come together in a metal conductor one needs a standing charge of opposite polarity set up in that metal. One way of creating this condition is by setting up a non-linear orthogonal configuration of the temperature gradient and the magnetic field in the metal. In attempting to use uniform temperature calorimeter test apparatus enclosing the cold fusion cell, researchers are choking off the possible catalyst temperature gradient that could well be needed to trigger deuteron fusion. That topic will be discussed in the Part II Report and, pending that, readers may see some mention of this in New Energy News: April 1994: 'Patents for Cold Fusion' pp. 3-5.

It is hoped that the above discourse will explain why 'cold fusion' is seen by this author as offering more than a technological route to a non-polluting new source of energy. Nor is it merely something that can affect attitudes by nuclear physicists in their particular discipline. It is, in fact, a route to something of far greater consequence in that it gives us an insight into the true forces of Creation.

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It is appropriate here to remind the reader that 'cold fusion' is very much concerned with whether, and if so, how, hydrogen nuclei, adsorbed into a host metal and having their atomic electrons exposed to the interplay with free conduction electrons in that metal, can fuse together to release energy. The mutual transmutations and transient behaviour of the nuclei of the hydrogen isotopes, the proton, the deuteron and the triton, is what concerns us in finding the answer to these questions.

#### The Triton Factor

One is not far from claiming the ultimate scientific achievement when one declares an ability to calculate the proton mass theoretically in terms of electron mass, based on showing how Nature creates that proton.

One should not then be surprised if the same theory explains other phenomena and leads to the precise derivation of other fundamental dimensionless physical constants, such as Planck's constant and the gravitation constant G.

Whilst the author has waited patiently for his work in this field to be appreciated and recognized by the world at large, to no avail so far, it has been personally satisfying to see how the same theory yields the solutions to lesser problems, such as those posed by the muon, the pion and the kaon or the neutron and the deuteron.

The key interest on which this research was founded was that of understanding the electrodynamic properties of these particles and relating the quantum of action of a real aether with the electrodynamics of the gravitons which determine the force of gravitation.

In the Appendices to this Report some of the relevant published papers are reproduced, so there is no point in discussing that work in the body of this text on 'cold fusion'. However, not reproduced elsewhere is an account presented in a book entitled 'GRAVITATION' which the author published in 1975.

The subject was that of showing how heavy electrons (the mu-mesons or muons) which account for

the primary energy action in the aethereal vacuum medium come together to create particles from which evolve protons and gravitons. Their action in creating protons is fully disclosed in the paper reproduced in APPENDIX D. The paper in APPENDIX E deals with the neutron and the deuteron and particular reference is made to Table II in that paper which shows how a deuteron alternates between three states, one of which is electrically neutral with a transiently-free -particle, a state which makes it particularly vulnerable to fusion with another deuteron.

Concerning gravitation, the author could further include 'The Theory of the Gravitation Constant', as published in Physics Essays, **2**, pp. 173-179 (1989), but as that will be appended to ENERGY SCIENCE REPORT NO. 6, the reader is invited to refer to that. However, a summary introduction is presented below as APPENDIX A, reproduced from pp. 44 to 52 of the author's 1975 book entitled 'GRAVITATION'. It provides a pictorial scenario showing how particle building can occur to develop the proton into the graviton needed to explain the derivation of G, the constant of gravitation.

From the viewpoint of 'cold fusion' this is relevant because one needs to be assured that a theory developed for the proton, the neutron and the deuteron is consistent with the physics needed to explain other phenomena and, as 'black holes' and gravitation have been mentioned, the link between protons and gravitation should be of interest. Knowledge of the graviton mass is essential if one is to calculate the value of G.

The underlying theory was extremely simple in that the energy formula for two electric charges in contact is a quadratic equation having two solutions for the same energy value if one of the charge energies is a variable. This is because the energy of a charge e is inversely proportional to its bounding radius. Therefore, given two particle energy quanta, each nucleated by the standard unit of charge, one finds that a third particle form is created with no energy requirement. In an energy-active world, the separation and recombination of such particles and the ongoing regeneration of new particle forms amounts to a creation process. The question then arises as to which particle forms win in the contest for survival and it is found that only those having special secondary resonance properties can enjoy a long life span.

In this contest for survival of particles, newly created by drawing on the pool of surplus energy, there are those which are created at very nearly the same mass by two different combination sequences. This gives them a dominant advantage but the only long term survivor in real matter is the proton.

This means that the heavier particles of matter are formed by taking protons and/or antiprotons as basic building blocks and combining the -particle constituents, the electrons and positrons of the quantum-electrodynamic field background.

The deuteron has to be an electron-positron-proton-antiproton composition of some kind, whereas the triton, the third isotope of hydrogen, can be of similar composition, but of more complex form.

The reason for this is the fact that the basic graviton has a mass greater than twice the proton mass but not as great as three times the proton mass. Therefore, a closely-bound structure will constitute the deuteron, whereas the triton will need to have its mass seated in two end regions standing apart and not closely-bound by a -particle linkage.

It was on these lines, that the theory of the deuteron and triton evolved, but the key to determining their actual structure was the evidence afforded by their precise mass and by their electrodynamic response properties as known from their magnetic moments. The same applied to the neutron, which, like the triton, had a third parameter to bring in as evidence, namely a measured lifetime.

Such data, when deciphered, showed that the deuteron, for example, was exchanging states by particle and anti-particle annihilation and recreation and that in some states it had a satellite system

or 'entourage' of 'free' -particles, meaning that they could migrate a very limited distance into a host metal containing such a deuteron.

For the neutron the lifetime became calculable but, as the theory evolved to build into a model of nuclear chain linkage as atoms of greater atomic number formed, so the neutron could not be seen as part of the atomic nucleus. It only exists in a free condition where it has that limited lifetime.

It is only very recently that the triton data has been deciphered and the theory has been proved very successful in interpreting the lifetime. Note that lifetimes are calculated on the basis of destructive bombardment by combinations of mu-mesons featuring in their quantum-electrodynamic dance in that aethereal field background.

The work on the triton has followed closely on the discovery that the proton and deuteron have an abundance relationship that is set by their interaction in this aethereal background field, as deuterons are primed to undergo fission to recreate protons, whilst protons merge by fusion to create deuterons.

The showing that the deuteron and the proton have a relative natural abundance that is determined by an ongoing physical process forms the subject of APPENDIX B, whereas the derivation of the lifetime of the triton is presented in APPENDIX C.

It is noted that the author has written many other papers that connect with the above theory and five, in particular, warrant mention and are commended for library reference to interested readers as they will not be included in this initial series of the author's ENERGY SCIENCE REPORTS.

They are:

(a) 'Meson Production based on	n Thomson Energy Correlation', Hadronic Journal, <b>9</b> , 137-140 (1986).
(b) 'An Empricial Approach to	Meson Energy Correlation',
	Hadronic Journal, 9, 153-157 (1986).
(c) 'The Physics of the Missing	g Atoms: Technetium and Promethium',
	Hadronic Journal, <b>10</b> , 185-192 (1987).
(d) 'Conservative Hadron Inter	actions exemplified by the Creation of the Kaon',
	Hadronic Journal, <b>12</b> , 101-108 (1989).

(e) 'A Theory of Pion Creation',

Physics Essays, 2, 360-367 (1989).

All these papers passed the test of referee scrutiny as did many papers giving groundwork for the above developments that were published in English by the Italian Institute of Physics in their Lettere Al Nuovo Cimento series in the five or so years before that periodical terminated publication at year-end 1985.

There will be those who read this text who stand ready to criticize because there is so much in physics that can affect one's views on particle behaviour. For example, the wave nature of the neutron is not something that may seem to fit easily into the picture presented above. However, in fact, it does, because that  $\beta$ -particle 'entourage' already mentioned (see Table I in Appendix E) is what exhibits the wave property.

The reader who is ready to discard the substance of this text on that account should first read the author's paper 'The Theoretical Nature of the Photon in a Lattice Vacuum' to be found at pp. 345-359

in 'Quantum Uncertainties' Series B: Physics Vol. 162 (1986) in the NATO ASI Series published by Plenum Publishing Corporation, New York.

Then the reader may refer to the author's paper: 'A Causal Theory for Neutron Diffraction', Physics Letters A, **119**, pp. 105-108 (1986), before looking up those many other background papers in Lettere Al Nuovo Cimento.

Indeed, for the reader who has a cosmological inclination, half an eye on the 'missing mass' problem, and believes that steady-state equilibrium by proton creation and decay is not compatible with the redshift indication of an expanding universe, the author's paper that warrants special scrutiny is: 'The Steady-State Free-Electron Population of Free Space' Lettere Al Nuovo Cimento, **41**, pp. 252-256 (1984).

## Conclusion

This Energy Science Report on Cold Fusion, in its Part I contribution to the 'Power from Water' theme, is intended to present some of the author's relevant background theory in the scientific paper form in which it has already been published elsewhere, though the paper on the proton-deuteron abundance ratio is new to this work.

As already stated, Part II will address other aspects bearing more directly on the technology of cold fusion, but this Part I material is an essential introduction to show why it is that the deuteron by its particle entourage can be partially embroiled in the electron-positron activity of free electrons in a metal host conductor. As already mentioned, one can see from the reference in APPENDIX E the situation where the core of the deuteron sits electrically neutral and bare of charge for moments in a fluctuating environment of charge, meaning that it is vulnerable to Coulomb barrier penetration by charged deuterons, so giving chance of fusion.

Also, it is hoped that what has been said will cause some physicists to realise that existing knowledge of fundamental physics has its limitations but that 'cold fusion' research could well give us the added stimulus leading to the needed insight into the forces at work in creating the hydrogen nucleus and so understanding Creation on its universal scale.

The reprinted papers forming APPENDIX D and APPENDIX E, are copied with the kind permission from the Editors of the Hadronic Journal.

26th April 1994

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## APPENDIX A

[The text here in the printed version of this Energy Science Report No. 5 was copied from pages 44-51 of the author's 1975 book 'GRAVITATION']

These pages can be seen in pdf format by using the following link:

## GRAVITATION pp. 44 to 51

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# APPENDIX B

# THE DEUTERON-PROTON RELATIVE ABUNDANCE

## Introduction

We begin by asking a question:

'Bearing in mind that the chemistry, meaning the chemical-bonding affinity, of heavy water is identical to that of ordinary water, would a human being be: (a) more healthy, (b) less healthy or (c) as healthy if the water intake to the body were to be heavy water rather than ordinary water?'

As we approach the 21st century our scientific knowledge should have an answer to this question, especially as we know physicists are trying to solve our energy problems by nuclear fusion processes which utilize heavy water.

Putting the above question rather differently:

'If a wealthy man were to create an environment in which he spent most of his time with no exposure to heavy water, meaning that all deuterium oxide or hydrogen deuteroxide is removed from the ordinary water supplied to that environment, could he expect to benefit healthwise and live longer?'

Perhaps, unknown to this author, the answer to these questions is to be found somewhere on university library shelves. The author, in giving limited consideration to this question, referred to a textbook in his own possession, the third edition (1957) of 'Physical Chemistry' by Walter J. Moore, Professor of Chemistry at Indiana, published in the original American edition by Prentice-Hall Inc. of New York.

An end-of-chapter question on page 249 reads:

'A normal male subject weighing 70.8 kg was injected with 5.09 ml of water containing tritium ( $9x10^9$  cpm). Equilibrium with body water was reached after 3 hr when a 1-ml sample of plasma water from the subject had an activity of  $1.8x10^5$  cpm. Estimate the weight per cent of water in the human body.'

The triton is the atomic nucleus of tritium, the third isotope of the element hydrogen, so, in a sense, one can infer from the latter exercise question that the body intake of very heavy water involving tritium will make the body radioactive and that cannot be good for one's health. Yet the very fact that this exercise question appears in a university textbook does suggest that water containing a concentration of tritium can be used in clinical testing. Our interest in the health implications of deuterium is therefore warranted. Deuterium is not radioactive but we still have a valid and unanswered question in wondering if heavy water is in any way damaging to health.

# Deuteron Fission and Fusion as a Natural Phenomenon

In that same 'Physical Chemistry' textbook and chapter 9, with its appended questions, we read on p. 244 about the 'energy production of stars'. Two nuclear processes are described as being alternative possibilities. One involves a process in which  $C^{12}$  and  $H^1$  fuse to produce  $N^{13}$  which in turn decays to  $C^{13}$  with the emission of a positron before experiencing further regenerative fusion and decay iterations with hydrogen and oxygen to yield ultimately He<sup>4</sup>. The other involves the fusion of two protons to produce a deuteron and a positron, also followed by the synthesis of He<sup>4</sup>.

It is said that the first of these, the carbon cycle, is the source of energy in very hot stars, whilst the second involving deuterons applies to somewhat cooler stars like our sun. Amongst the steps in the stellar carbon cycle there is one in which  $C^{13}$  combines with  $H^1$  to yield  $N^{14}$  before the latter combines with  $H^1$  to produce  $O^{15}$ .

Now, moving back to Earth and those end-of-chapter questions we read:

'According to W. F. Libby [Science, <u>109</u>, 227 (1949)] it is probable that radioactive carbon-14 (mean lifetime 5720 years) is produced in the upper atmosphere by the action of cosmic-ray neutrons on  $N^{14}$ , being thereby maintained at approximately constant concentration of 12.5 cpm per g of carbon. A sample of wood from an ancient Egyptian tomb gave an activity of 7.04 cpm per g of carbon. Estimate the age of the wood.'

The significance of this is that the physics of carbon-14 dating depends upon the transmutation of atomic nuclei and the probability of events involving exposure the atomic nuclei to bombardment by energetic stimuli. Now, in simply assigning a mean lifetime to a particular nuclear decay process the physicist can be hiding ignorance of something behind his presentation of empirical fact. He knows that there is decay and can measure the mean lifetime involved, but we are not in every case told why that decay occurs. Yes, we are told that the cosmic-ray neutrons create  $C^{14}$  from  $N^{14}$ , presumably by emission of a positron, but we are not told what it is that sporadically bombards the  $C^{14}$  once it is protected from exposure to the elements and which somehow triggers its eventual decay.

There is, quite clearly, something in our non-cosmic Earth environment that can activate nuclear fission and possibly nuclear fusion reactions. This may be that mysterious something we call the 'neutrino' but one really must wonder whether that term 'neutrino' is scientific 'mumbo jumbo' for what could be described as 'a sporadic intruding influence of an energetic interaction with an all-pervading field background'. The advancement of energy science may depend upon the development of a better understanding of that intruding influence, because it surely must account for nuclear energy transactions which can occur at normal temperatures as in that ancient piece of wood of the carbon-dating example.

It is not very satisfying to be told that, inasmuch as energy and momentum equations would not otherwise balance, there is need to recognize the existence of particles we call 'neutrinos' or the even enigmatic 'neutrons'. There was in pre-20th century science the firm belief in the existence of an aether medium which common sense suggested as that ever-present hidden underworld which could sustain electric field oscillations travelling through a vacuum. In a sense, the modern physicist has replaced that aether with a collection of imaginary particles, whether termed 'neutrinos' or described as being 'virtual' which are the unseen denizens of the vacuum state which we can refer to to 'take up the slack' created by gaps in our scientific knowledge. Yet, is the conventional picture of that virtual 'neutrino-inhabited' quantum sea correct?

Let us return to our problem and focus attention upon the transmutation of the hydrogen and

deuterium nuclei, meaning the process deemed to occur in the sun by which two protons fuse with release of energy and a positron (or so-called beta-plus particle) to become a deuteron. Also meant is the reverse process by which, given the right stimulus, a deuteron can convert into two protons by emitting an electron or so-called beta-minus particle. The latter possibility as a natural process is suggested by the observation that the <u>abundance ratio of deuterons to protons is the same for matter found in comets as it is for matter on Earth</u>.

What universal process determines this ratio and keeps it constant? Are we, instead, to believe that the ratio is one which evolves and so changes, in which case we should try to explain why the comet presents the same ratio as the Earth. Are we to believe that there was a Big Bang in which the ratio of protons to deuterons was fixed in an atomic soup which was stirred to a uniform and final mixture before the cometary matter and the Earth condensed from that common nebulous mixture?

In the absence of verifying laboratory tests we shall never know for certain the answer to these questions, but one can say that there is more than the glimmer of a solution if the abundance ratio actually measured can be deduced in the manner and style of the solution of those end-of-chapter questions in that textbook entitled 'Physical Chemistry'.

So, we now set our sights on explaining the proton/deuteron abundance ratio ducumented at page 9-65 of the 1967 second edition of the McGraw-Hill 'Handbook of Physics' edited by Condon and Odishaw. According to this reference work, in every ten million atoms containing hydrogen and deuterium there are 9,998,508 nucleated by protons and 1,492 nucleated by deuterons.

The conditions governing the fusion and fission of these atomic particles must involve the element of chance, in that a combination of events conducive to decay must occur as a probability function, bringing about actions involving energy in a form which can materialize or dematerialize in integer quanta we associate with decay particle products (those beta particles).

Note that we speak of 'decay' both for the fission and the fusion process as if decay can be a two-way or reversible operation. This has meaning only if the real form of the proton and the deuteron is that of a system which overall exhibits the stability of single-form existence but yet which, inherently, undergoes cyclic alternations of state, as between a ground state and one of greater energy.

Much more will be said about this subject in this and later work and by reference to the author's published papers, but the reader may here consider two basic facts known to the particle physicist. These are (a) that the deuteron exhibits a nuclear magnetic moment that is about 6/7ths of that expected in relation to its spin property and (b) that the proton exhibits properties suggesting it is composed of three charges, rather than a single charge. (See APPENDIX E and the Feynman reference in APPENDIX A).

The deuteron property implies that it has a state for one seventh of the time in which its positive charge becomes that of a satellite beta-plus particle that has been transiently displaced from the mass of its core, which thereby reacts as a neutral charge in its spin response during that limited transient period.

The proton property suggests a 'quark' composition which this author prefers to see as being that of a proton charge +e aggregated with a (+e, -e) charge pair in the form of a beta-plus and a beta-minus particle or, in the alternative, an antiproton charge (-e) aggregated with two beta-plus (+e) particles.

For the actual proton this implies alternation between two states in one of which the mass-energy is slightly greater than the norm of that of a bare proton charge standing in isolation and in the other of which the mass-energy is slightly lower than that norm.

For the deuteron, there are three alternative states, (a) one of lowest energy, the ground state, in

which two antiproton charges are aggregated with three beta-plus particles, (b) the neutral state, of greatest 'core' energy, where a (+e, -e) beta-particle charge pair sits between an antiproton charge and a proton charge in the near presence of a satellite (+e) beta-particle, and (c) the third energy state for which two proton charges are aggregated with an intermediate beta-minus particle with the (+e, -e) beta-particle charge pair in a satellite position.

These particle 'models' are justified on other grounds in APPENDIX E, but they serve here to give basis for our understanding that a system of protons in a suitable combination of states can serve collectively to permit a balanced energy transition involving the creation of the deuteron in its least energy state. Similarly, it is the transiently neutral state of the deuterons which permits their reaction in an energy balanced transition which regenerates the proton.

To formulate the resulting abundance ratio of  $H^1$ :  $H^2$  we write:

$$H^{1}/H^{2} = (S_{1}^{N}/(S_{2}^{n})(P_{1}/P_{2}) \dots (1)$$

In the above equation:

 $S_1$  is the factor signifying the incidence of state when a transition can occur involving the proton (this having the value 2 because there are two equally probable states).

 $S_2$  is the factor signifying the incidence of state when a transition can occur involving the deuteron (this having the value 7 because the deuteron is in its vulnerable neutral core state for one seventh of the time).

N is the number of protons that need to be subjected simultaneously to the transition stimulus of the energy fluctuations in the environmental field background in order to secure the energy balance conditions needed to assure a transmutation.

n is the number of deuterons that need to be subjected simultaneously to the transition stimulus of the energy fluctuations in the environmental field background in order to secure the energy balance conditions needed to assure a transmutation.

 $P_1$  is the net number of protons created by collective action in a transition event.

 $P_2$  is the net number of deuterons created by collective action in a transition event.

The evaluation of the four parameters N, n,  $P_1$  and  $P_2$  will be our task below, but, to show the power of the argument being pursued, it is of interest to recite the calculated values first. They are:

 $N = 35 n = 8 P_1 = 18 and P_2 = 16$ 

Putting these in equation (1) gives the result:

$$H^1: H^2 = 6705: 1$$

which corresponds to a deuteron abundance factor of 1491 parts per ten million compared with the observed factor of 1492.

This result is, at least in this author's opinion, a very significant scientific contribution.

It means that the physical processes that can occur in the oceans of the Earth can establish this equilibrium ratio as between the abundance of protons and deuterons to cause the heavy water content of the sea to be a natural physical quantity maintained at a constant value. One needs, of course, to apply the underlying theory to estimate the time constant of the exchanges leading to equilibrium. This is measured in thousands of years so that one can feel confident that a laboratory store of deuterium hydroxide or heavy water will not convert into normal water too readily.

More important, however, there are implications for the Big Bang theory of cosmic evolution and for energy generation by so-called 'cold-fusion' methods, if deuterons and protons can undergo mutual transmutation at the temperature of our environment. The abundance ratio could not be computed by theory in the way suggested unless such transmutations do occur and, it may be noted, none of those high energy neutrons which are deemed so important in high energy physics are involved in the processes discussed.

## The Significance of the Deuteron Algorithm

The reason for terming the formulation in equation (1) as an 'algorithm' is the author's way of saying that what has been discovered is the short-cut route for solving a problem which, by orthodox methods, would otherwise involve vast amounts of computer time. That is assuming that the route to a solution by computer methods has been devised and, as concerns the proton/deuteron abundance ratio, scientists seem not, as yet, to have appreciated that the problem is amenable to solution.

It is traditional in particle physics which involve hadronic mass calculations for problems to be approached by iterative techniques which take account of a vast number of interacting factors. This will be better understood when we come to discuss what it is that determines the proton/electron mass ratio. The algorithm we will use for solving that problem is the 'jewel in the crown' amongst the arsenal already mentioned. It has devastating implications for orthodox scientific doctrine founded on so-called 'quantum chromodynamics'.

However, as the scientific world knows from the hostility and resentment aroused against the claims of Professors Fleischmann and Pons for daring to imply that deuteron cold fusion had been discovered, there is readiness to scorn progress in science that challenges cherished beliefs.

Where the only product is an intellectual accomplishment expressed as an equation which presents the numerical value of what is a very fundamental dimensionless physical constant, then the wrath of the establishment scientist can reach its zenith. The modern computer allows one, by trial an error, to probe all combinations of numbers, if one is willing to indulge in exercises that are arithmetic in character rather than physically founded. It follows, by the doctrine that if something is possible it will eventually happen, that scientists assume the trial and error arithmetic exercise is at the root of any claim to have deduced a physical constant.

They lack credulity and show no tolerance when one makes a claim to explain the numerical value of a physical constant. What, they ask, is the merit of deducing the value of a quantity having a particular meaning in physics when the value of that quantity is already known to high precision from our experimental measurements? They argue, therefore, that to find acceptance one must, <u>before it is measured</u>, predict a numerical value of a constant having real physical meaning, so that eventual measurement of that quantity will deservedly command attention.

This is not a logical posture, given that there are a limited number of truly dimensionless fundamental constants in physics, all of which have been already measured to very high precision. It is not a logical posture because it means that we are denied the hope of ever allowing a simple algorithmic approach to confirm to us the discovery of insight into the factors which govern the constant of gravitation, Planck's constant and that proton/electron mass ratio already mentioned. It is, however, deemed acceptable to allow the supercomputer to try to decipher the mysteries of Nature

whilst feeding it with mathematically elegant instructions designed to test artistic notions of symmetry.

That said, the author challenges the reader to examine equation (1) and consider the skill needed to contrive its discovery and the choice of parameters had the author really probed the problem by exercising a computer.

Firstly, consider the simplicity of the equation and its symmetry as between the proton-deuteron transition of the numerator and the deuteron-proton transition of the denominator. Then consider the chances, with an arbitrary choice of integer numbers for  $S_1$ ,  $S_2$ , N, n,  $P_1$  and  $P_2$  of finding the correct solution and, after choosing an appropriate combination of integers, consider the scope for devising a plausible physical model giving meaning to the integers selected. Note that the author could have put the integer 9 for  $P_1$  and the integer 8 for  $P_2$ , if the basis of the formulation had not developed from direct physical analysis.

One may wonder what solution the trial and error computer search would have found had the objective been set for this general equation to give the right answer to within the one in thousand precision assuming any integer combination other than that presented above is to be regarded as valid. There are in fact many possibilities but then one confronts that formidable task of justifying in physical terms which combination applies and how each of the numbers chosen has a valid role in determining the proton-deuteron abundance ratio. In the absence of a tentative model to guide one's endeavours that is not a worthwhile pursuit.

Physicists are not loath to wasting time on such a project, judging by the attack on the theoretical value of the dimensionless quantity incorporating Planck's constant. This is a reference to  $\alpha^{-1}$ , the constant we know as having the value 137.035 9895(61). In 1970 a physicist named Wyler claimed a derivation for this constant as 137.036 082 by presenting a formula including the quantity  $\pi$  and the integer numbers 1, 2, 4, 5, 8 and 9. As is explained by Petley in his 1985 book 'The Fundamental Physical Constants and the Frontiers of Measurement', it was in 1971 that Robertson, Roskies and Prosen brought disrepute to such work by arbitrarily sythesizing values of  $\alpha^{-1}$  with the aid of a computer. Using a similar format to Wyler's equation, given some ground rules and arbitrary combination and choice of 11 integer numbers and further including , the computer found 6 values of  $\alpha^{-1}$  all closer to the measured value than was Wyler's value. The integers ranged up to 19 in value and one can but deplore this 'numbers game' exercise, as a means for suppressing genuine physically based endeavour by those who seek to solve the great mysteries of physical science. The fine structure constant  $\alpha$  concerns the action we associate with Planck's constant. It is at the very heart of the Energy Science to be discussed in these Reports.

It is with that background in mind that the author invites the reader to examine the algorithm presented in equation (1) and consider the problem of devising a physically meaningful result in such good accord with the measured value, if that accord were fortuitous.

However, for the benefit of the reader who seeks the truths of this situation, we will first summarize the process involved and then begin the analysis of the energy transactions which govern equation (1).

How is it that protons can transmute into deuterons and vice versa as an ongoing natural process, when the mass-energy of two protons exceeds that of the deuteron?

The reason is that, owing to vacuum energy fluctuations, both the proton and the deuteron are constantly experiencing changes of state in which they have slightly changed mass-energy.

It so happens that the highest energy state of the deuteron which applies for one seventh of the time

is one for which the energy is higher than twice the lowest energy state of the proton. The proton ground state applies for what is virtually half of any period of time. The other half is spent in its higher energy state and it flips cyclically between the two states halting very momentarily between these two states whilst in its 'bare proton' form. The presence of beta particles when in either of the two principal energy states account for the mass differences.

Accordingly, the deuteron to proton transformation occurs when the deuteron is in its highest energy condition. Conversely, the protons cooperate in creating a deuteron by action focused on the deuteron ground state.

The analysis by which these actions can be fully understood does, therefore, require the background study of the state composition of the proton and the deuteron.

For the purpose of this Report, it suffices here to refer to APPENDIX A in which the author discusses the three-part proton and APPENDIX E, which concerns the deuteron.

As to the proton, the 'bare proton' has a definite mass that is 1836.152 times the electron mass, as calculated in APPENDIX D, but, by reference to Feynman in APPENDIX A, we saw that the proton in its normal state behaves as if its charge is spread between three centres. In fact it is alternating between states, being at times a bare proton charge and at other times having close association with an electron-positron pair and even in another state becoming an antiproton coupled to two positrons - or rather beta-particles, because physicists prefer not to think of electrons and positrons as being nuclear constituents.

In its beta-particle association it has a mass increased in one state by a value very close to 0.25 electron mass units and decreased in the other least-energy ground state by very nearly 0.25 electron mass units. For the purpose of the calculations of the deuteron-proton transmutations the time spent in the intermediate 'bare proton' state, in order to keep the overall mass-energy balance at a mean value equal to that of the 'bare proton', is quite negligible.

The reader is here reminded that particle physicists picture the proton as comprising quarks as if it has three separate fractionally charged components. This author urges the reader to think in terms of a proton which changes form between three states in each of which its component charges are unitary at all times. This author is urging the reader to keep in mind that charges can be created and annihilated in pairs and that this is a property of the beta-particles known from quantum electro-dynamics. It needs little imagination to recognize that such charge transmutations occur inside protons and deuterons and that there could even be some polarity inversion or exchanges involved between beta-particles and protons when they are so closely bound together in atomic nuclei.

Physicists who believe in fractionally charged quarks are leaping into the unknown and making unwarranted assumptions. All the evidence points instead to transmuting forms of unitary charge particles which only appear on a statistical average to be fractionally charged. They are, in fact, exchanging energy with nearby charges and participating in vacuum field effects of pair creation and annihilation activity. Therefore, they exhibit behaviour reflecting their average condition. Of course, when they emerge from their bondage in the composite particle form they must appear as unitary charges, which explains why the so-called quark has never been isolated in any experiments.

Just as the physicist assumes that there is a neutron in the deuteron, so he has assumed that there are quarks in the proton. That is ill-founded assumption which can be remedied by understanding what is offered in this text as an explanation for proton-deuteron quantities which can be measured against the theory.

We now delve into the detailed analysis leading to the prime formula specifying the natural proton:deuteron abundance ratio.

# **Energy-Balance Criteria**

It will be argued that, for the simple particle structures involved in the deuteron and proton states, we can assume for close approximation purposes, that energy transactions between these two particle forms involve quantities corresponding to quarter units of the rest mass-energy of the electron.

Should the reader question this it may help to refer to another older textbook, this being 'Modern Physics' by Professor H. A. Wilson of the Rice Institute at Houston, Texas, reprinted in 1946 from the 1937 second edition (publishers Blackie & Son Limited, London).

It is at p. 261 in the chapter on Atomic Nuclei that Wilson begins to discuss the fact that the energy released in nuclear reactions, particularly those involving the lighter atoms, is nearly always in approximate multiples of 0.387 MeV. This is 0.757 units of electron rest-mass energy, but, for reasons that will later become apparent, we will assume that this corresponds to three of the quarter units just mentioned.

It seems quite logical, therefore, to look to the electron or the positron (that is, the beta particles associated with nuclear decay) as providing the 'glue' or binding energy holding the heavy charges (the hadrons) together in an atomic nucleus.

The deuteron when bombarded by very high energy from a radioactive gamma ray source breaks up by emitting two heavy particles, one being the proton. The other heavy particle is a neutral entity which we call the 'neutron'. The neutron is unstable and has a mean lifetime of about 15 minutes, breaking up into a proton and an electron. It follows from this that one could say that a deuteron comprises two protons and an electron. Remembering then that the proton is deemed to comprise three charged components it is not unreasonable to believe that, when it stands in isolation, it comprises a heavy positive charge in close association with an electron-positron pair or a heavy negative particle closely bound between two positrons. In this scenario the 'neutron' can be a neutral aggregation of an electron and one of these proton forms.

We come therefore back to the rather simple proposition that electrons and positrons exist in atomic nuclei and account for the binding energy which holds the protons and antiprotons together. There are no neutrons, as such, in atomic nuclei.

Now, based on Table II in APPENDIX E, it can be seen that we can state the highest and lowest energy states of the deuteron in terms of their 'proton' P unit composition and 'electron mass units' E. The latter are units of  $2e^2/3a$ , so that state A has energy 2P+3E-35E/8 because the deuteron, as such, incorporates three -particles. State C has energy 2P+E-18E/8, there being only one -particle in the deuteron core. The intermediate state B deuteron has an energy 2P+2E-25E/8, which is the highest. In contrast the proton has a least energy P+2E-9E/4 and a highest energy of P+2E-7E/4.

Consider now the action needed to produce ground-state deuterons from protons which have net energies of -E/4 or +E/4. The action we contemplate will involve no net energy exchange in the transmutation process, but may involve fluctuations of energy. Also, we will presume the decay of protons is conditioned at an energy level matching that at which protons are created, this is in their bare charge form with no satellite electrons or positrons. The proton input to the deuteron creation process must then involve an even number of protons involving equal participation of those with net +E/4 energies and -E/4 energies (meaning -7E/4 and -9E/4 interaction energies, respectively).

Our deuteron creation reaction will involve N three-charge protons creating x ground-state A deuterons plus y bare electrons or positrons and z residual protons in their bare charge state.

The rules governing a decay process of this kind are that the space occupancy by electron and positron charge and so their intrinsic energy content must be conserved, as must interaction energy

separately and the numbers of bare proton or antiprotons. Noting that the deuteron ground-state interaction energy is given by -35E/8 and that its electron/positron content is 3, so one can then write:

It requires simple algebra to find the solution for minimal residue, meaning z is minimum with N finite. It may be verified that the following combination of numerical values satisfies the three equations:

(x).	(y).	(z) .	. (N)
16.	. 22 .	.3.	. 35
32.	. 44 .	.6.	. 70

From this one finds the unique solution, which is that a trigger event involving 35 protons produces 16 ground-state deuterons. The protons can be in either of two states and at their transition through the bare state some will be tending to increase energy and others will be tending to decrease energy. This trigger event occurs when all 35 are in the same transient increasing energy state, meaning an event probability factor, the inverse of which is proportional to the numbers of protons in the equilibrium system. The latter factor is  $(2)^{35}$ .

The reverse process involves a vacuum field fluctuation supplying 0.511 MeV of energy as part of the trigger event by which deuterons in their transient highest energy B state are raised to the energy level at which they can transform into proton pairs. There is a governing requirement for other transient energy input in paired units of the electron rest-mass energy quantum E = 0.511 MeV and a need for charge parity by a transformation of the C state deuteron form into the ground-state A form.

Note that a neutral B-state deuteron core without its satellite beta-plus particle has a net energy of 2E-25E/8 or -9E/8. Therefore the addition to a group of 8 such deuterons of the mass energy carried by 9 beta-plus particles will correspond to an event which brings the energy into balance with that of 16 protons, suggesting that this could be the process by which deuterons transmute into protons.

The ongoing energy fluctuations in the electron-positron field will allow the energy of those 8 satellite beta-plus particles to redeploy into electron-positron pairs in the quantum-electrodynamic background which sources the 9 beta particles, as the positive charge transfers to the proton product. On balance only one 0.511MeV unit E of field energy is needed to simulate the deuteron-proton conversion.

The action described can, therefore, on energy balance criteria, create 16 protons from those 8 deuterons, but only if there is a net unit electron rest-mass energy input and a complementary reaction which can take up the surplus unit of positive charge.

Since the net core deficit energy of the C state deuteron is E less 9E/4 or -10E/8 and that of the A state deuteron is 3E less 35E/8, which is -11E/8, the transition of 11 C state deuterons to 10 A state deuterons with the shedding of two protons will occur with no energy residue. However, in this case the reaction product requires an <u>input</u> of one unit of positive charge.

It follows that, at least in theory, the state transitions of the deuteron could, in the normal ongoing QED field activity, give reason for expecting protons to emerge from natural fission of deuterons but the statistics of such an event are set by the chance combination of 8 of the B-deuteron states. Then 16 protons will emerge directly from those B-state deuterons and 2 protons will emerge from the very frequent C-state to A-state transitions. The event will mean that protons are created in batches

of 18 from these events.

Each deuteron is in the B-state for 1/7th of any period of time. This yields an event factor giving measure of deuteron population as  $(7)^8$  since 8 deuterons collectively are the target for the primary reaction.

Combining these results one finds that  $S_1$  and N in equation (1) are 2 and 35, respectively. Furthermore,  $P_1$  in equation (1) is 18. Similarly,  $S_2$  is 7 and n is 8 in equation (1) with  $P_2$  as 16.

The overall ratio of proton to deuteron in the equilibrium state can then be expressed by the contracted quantity  $9(16/7)^8$ , which is 6705 as a proton to deuteron ratio or 1491 deuterons per ten million protons.

As already stated above, this compares with an experimental abundance ratio assessment of 1492 per ten million.

# The General Parity Criteria

It is important to appreciate, when dealing with problems involving the background zero-point energy field, that the energy balance is the primary regulating factor. There can be energy fluctuations but, so far as the energy locked into the matter form is concerned, this is conserved in the overall picture of things.

Charge parity and the parity of space occupancy associated with electron-positron charge forms are less important to individual energy processes of the kind just described, though these too must be balanced on a collective less-local basis.

For example, an electron and positron can, together, be seen as a neutral charge entity and yet two space quanta are involved. Conversely, two space quanta can be occupied by charge of the same polarity, meaning that a given even number of space quanta can all be occupied, and then there can be a net charge out-of-balance.

If one says that 35 normal three-charge protons can transform into 16 deuterons plus 3 bare singlecharge protons, there is a net charge deficit of 16 units of charge e. However, we are also saying that the reverse event can occur in which batches of 8 plus 1 deuterons convert into 18 protons. Both batch processes are occurring together in the deuteron/proton environment and so, allowing for transient leptonic (electron-positron) activity in the QED field background (see section III of APPENDIX E) the charge condition balances overall. Similarly the space occupancy condition is a self-balancing process in our stable local field environment.

Should one ask whether a litre of heavy water will be transmogrified into normal water by the processes suggested above one must answer affirmatively. The real question is that of knowing the time scale involved.

Here one can estimate the time rate of these events by noting that an event time factor of the order of  $10^{-13}$  seconds characterizes the single electron transition in the quantum field background. It can decay at A and be recreated at B as if it jumps from A to B in that period.

The three-charge proton and state B deuteron decays discussed above centre on a pairing of two electron-sized charges in each of these particle forms. The governing frequency of the background field is that corresponding to a photon of energy equal to the rest mass energy of the electron. The chance factor for a single electron as target for an energy fluctuation is about 1 in 10<sup>7</sup>, meaning that

there are that many cycles of that electron Compton frequency in the  $10^{-13}$  second period of the electron lifetime.

Therefore, we can estimate that every  $10^{-6}$  seconds every proton and B state deuteron will be a candidate for transmutation. For there to be transmutation, however, the target particles have all to be in the same state and this is governed, for the proton, by that factor above of  $(2)^{35}$ . This means that, on average, a proton will withstand participation in the deuteron creation process for a period of (2) <sup>35</sup> microseconds, which is about 10 hours.

This period reduces to a few seconds for the converse process by which deuterons should transmute into protons in water that is nearly 100% deuterium oxide. It is only in the composition of the equilibrium mixture that the proton transmutation time rate applies for the reciprocal transmutations. Clearly, therefore, the question arises as to why heavy water does not convert into normal water on a time scale measured in minutes.

The answer to this is connected with the problem confronting the 'cold fusion' issue. When deuterons transmute into protons in the recognized way, energy has to be added by gamma radiation and the products are one proton plus one neutron. 'Cold fusion' has posed the question "Where are the neutrons?". It would seem that what happens in the world of very high energy collisions is not the same as events in the cool conditions of a medium at water temperature.

In the sea the process described above can occur to keep the equilibrium between the deuterium oxide  $D_2O$ , hydrogen deuteroxide HDO and hydrogen oxide  $H_2O$ . The charge imbalance is there

avoided by the recriprocal transmutation but one must assume charge fluctuations involving the atomic nuclei in exchanges with the background field. Possibly this activity has connection with the many reported energy anomalies found in experiments with water, particularly those involving electrolytic action.

In high energy physics of deuteron transmutation the charge issue is avoided by the action we term the 'neutron', which this author must assume is really a proton or antiproton neutralised by an accompaniment of electron(s) and/or positron(s).

However, we still ask the question "How long will it take before a kilogram of heavy water converts to a 50% mixture of heavy water and normal water?" Note that this question is put in terms of weight because the overall volume of the water would increase as deuterons change into protons. Furthermore, unless there is neutron emission, there would be release of hydrogen gas unless oxygen were to be absorbed. The answer must lie in the understanding of the source of the added positive charge taken up by the newly created protons. If this source is sluggish in providing that charge then the transmutation rate will be retarded. It may be measured in hundreds or thousands of years under normal environmental conditions or where water is sealed in a container. Equally, it may be a matter of days only where the heavy water is absorbed into a palladium host metal carrying electric current. Accordingly, one must wonder if the charge adjustments applicable where protons convert into deuterons and vice versa affect adjustments to the natural equilibrium ratio of protons to deuterons and see how this affects the 'cold fusion' deuteron transmutation process.

This Part I Report will not enter into speculations on the technological implications of the latter issue. The main point made in this contribution is that the ratio of protons to deuterons which occurs naturally is not an arbitrary consequence of disorder in the evolution of historical events. It is a fundamental physical constant determined by the same regulating factors which fix constants such as the proton/electron mass ratio.

## Footnote

In the paper which follows as APPENDIX C the deuteron features as a component of the triton and the decay of the triton is related to events by which the deuteron is itself affected by the mu-meson bombardment.

There is a fundamental difference in that action compared with the situation above. Whereas the beta-particles are really the target affected by those mu-mesons in the isolated proton and deuteron forms, when one considers these as part of larger atomic nuclei the decay action is dominated by mu-meson attack on a different and larger target which latches onto nucleons belonging to atomic nuclei having atomic mass number of 3 or more.

Though this may sound complicated, in the limited space available in this Report, the author has deemed it best to present this Appendix B and Appendix C as separate self-contained texts and it is hoped that the reader will be able to follow the logic of the separate presentations even though study of the author's other published work will be needed to fully comprehend the distinction.

The threshold between 2 and 3 nucleons has a dynamic 'gravity' balance connection with the 'graviton' mass developed in Fig. 7 as shown in APPENDIX A. The 'larger target' involved in proton creation, one larger than the electron or beta-particle, by 1843 in volume, is explained on page 40 of APPENDIX C and more fully on the second page of APPENDIX E. The relevance of the latter to the deuteron as a component of the triton is that it brings about the actual creation of a proton within the triton as a deuteron-proton composition. It is shown on pp. 42-43 that the mu-meson bombardment of that space lattice charge 'target' triggers the transient creation of a proton, on average, every 12.2 years. If this event occurs in the 3-or-more-nucleon core, so that may well involve a proton transfer and a nuclear transmutation. This is an action quite distinct from that described above where it was assumed that the two beta-particles in the proton or the B-state core deuteron were the 'target' for mu-meson attack.

# APPENDIX C

[The following paper was presented at a conference held by ANPA, the Alternative Natural Philosophy Association, in Cambridge, England during 9-12 September 1993. Though the title refers to the 'model proton' the main thrust of this paper concerns the triton and theoretical derivation of its lifetime.]

## THE MODEL PROTON IN A NON-COMBINATORIAL HIERARCHY

## Harold Aspden

The proton, as the primary form of matter, is at the creative equilibrium interface between matter and vacuum energy. Just as there is electron-positron pair creation and annihilation activity in the vacuum field, so there may be an underlying 'heavy' lepton (muon) activity in the universal field environment. This paper explores the relationship between the muon and the proton on the simple assumption that Nature is constantly trying to create protons but is normally restrained by energy equilibrium criteria.

The author's theoretical model is of long standing record, as outlined in **Physics Today, November 1984, p. 15**, and as acknowledged for its remarkable 'classically-derived' prediction of the proton-

# electron mass ratio in the paper reporting its measurement by Van Dyck et al, International Journal of Mass Spectrometry and Ion Processes, 66 (1985) 327-337.

The advance reported in this ANPA-15 paper concerns recent developments of this model which focus upon aspects of the deuteron and the triton. In particular, the model will be tested by deriving theoretically the 12 year lifetime of tritium on the assumption that it decays owing to interaction with that same heavy lepton field environment that creates the proton. This approach then affords insight into the exposure of the deuteron to that heavy lepton field activity. The quantitative aspects of the energy transactions involved are too remarkable to be attributed to coincidence.

The advantage to humanity which such research affords is linked to the prospect of success now emerging from research on cold fusion, inasmuch as the theoretical processes envisaged explain why no neutrons result from what is deemed to be deuteron fusion. The consequences concern an alternative natural philosophy having bearing upon the forces of creation in the universe and are important in that by theorizing about the derivation of the proton mass in relation to the electron there is spin-off which can cause physicists to revise their views on nuclear theory.

## 1. The Triton in Focus

Tritium is the third isotope of hydrogen. It is radioactive but decays by releasing a minute amount of energy - about one thirtieth of what is needed to create an electron. Its nucleus, triton, is an enigma in physics. A portion of the energy it releases somehow vanishes without trace and this phenomenon has been the basis of the neutrino hypothesis. The fusion of hydrogen in the sun is believed to be the source of energy which powers our existence on Earth, but the supposed related neutrino emission from the sun is itself a problem. There is just not enough solar neutrino energy intercepted by our Earth to balance the energy books representing the solar hydrogen fusion hypothesis.

It is submitted that the triton is the guardian of the secrets which govern our understanding of the cold fusion process encountered when deuterium is loaded into a cathode in a Fleischmann-Pons experimental cell.

The triton has a lifetime of 12 years. That is a very important clue and it has caused this author to focus on the assumption that the triton incorporates a ground-state deuteron, which is the seat of the decay action. This means that the deuteron itself is subject to radioactive decay processes but, as will be shown, this decay action involves a proton creation followed by proton decay. What may then emerge as a cold fusion product is a tritium nucleus or the reestablishment of the deuteron in its orginal form. In other words, the deuteron appears stable, but it can develop into a triton by a natural lifetime process, albeit with very much higher probability if another deuteron in close proximity is available to sacrifice a proton.

This proposal is not hypothetical. It is based on a theme developed in the author's earlier work, published long before the Fleischmann-Pons cold fusion discovery was announced. See, for example, the American Institute of Physics journal 'Physics Today', **37**, p. 15 (1984).

There the author drew attention to the P and Q scenario where a proton of energy P was attracted to an oppositely charged partner of energy Q. If each has a charge e bounded by a sphere of radius a determined by the J. J. Thomson formula ( $E = 2e^2/3a$ ), the total energy of the P and Q charge in surface contact is:

$$P + Q - 3PQ/2(P+Q)$$

For the binding energy term to be a maximum, P and Q must have a certain relationship. This is when 1+Q/P is the square root of 3/2. The reader may then verify that with P as 1836 the value of Q is 413, which is the combined energy of a pair of mu-mesons in electron units. Resulting from this

discovery the author has advanced elsewhere a theory of proton creation which explains how protons are built from the virtual muonic energy activity in the vacuum field. Note here that electron-positron creation and annihilation are ongoing activities in the vacuum field, the basis of quantum electrodynamics, and the mu-mesons are the 'heavy electrons' which hitherto have been seen in physics as having no role or function that could justify their existence in Nature. Their role is, of course, the most important of all, that of matter creation in the form of protons!

Now, we are, in the description which follows, to see how this same process of proton creation is at work within a deuteron or a triton.

The algorithm which the reader may keep in mind in the analysis which follows is the curious mathematical fact that 4Q, meaning four mu-meson pairs, if combined with the energy released by creating two (P:Q) systems from two bare P components, will be exactly that needed to create a new proton or antiproton P.

To prove this write:

$$P = 4Q + 3PQ/(P+Q) - 2Q$$

Then rearrange algebraically as:

$$P(P+Q) = 2Q(P+Q) + 3PQ$$

or:

$$3P^2 = 2P^2 + 4PQ + 2Q^2 = 2(P+Q)^2$$

which is the above relationship between P and Q as calculated from minimization of energy potential.

It follows, therefore, that if a particle containing two P nucleons is bombarded by the mu-meson vacuum energy background there is a condition where 8 mu-mesons will create a third P. This is tantamount to a fusion process occurring at room temperature which adds a nucleon to a deuteron.

Note that the energy is 'borrowed' partially from the vacuum as a vacuum energy fluctuation and partly provided by the degeneration of two nucleons in creating the two Q dimuon components. The system will 'restore' by causing a proton elsewhere, as in a nearby deuteron, to decay, but for a transient period there will be a very active energy situation which can give basis for much that is observed in cold fusion phenomena.

The remainder of this paper will develop the above theme by reference to the triton, and the verifying key which confirms what is said above is the resulting calculation of the 12 year mean lifetime for the transmutation just mentioned. This gives insight into the energy generation rate that can be expected in the cold fusion deuteron reaction. A deuteron will experience the mu-meson transmutation described on an average that is set by the triton 12 year lifetime. Since the deuteron is in the required ground state condition 2 parts in 7 of any period of time probable deuteron transmutation lifetime by this process is 42 years. However, one cannot exclude secondary nuclear reactions triggered by the excess energy transients of the above process. [Note: the 2 part in 7 factor is derived in the author's paper *The Theoretical Nature of the Neutron and the Deuteron*, Hadronic Journal, **9** 129-136 (1986). APPENDIX E of this Energy Science Report.]

Note that the deuteron ground state is one in which the deuteron structure has two antiprotons sitting amongst three beta-plus particles, represented by  $(e^+:P^-:e^+:P^-:e^+)$ , and the process we are to consider is one where attack by 8 mu-mesons causes the outer beta-plus particles to become dimuon Q

charges as a newly created P charge is nucleated from a nearby vacuum lattice charge. The latter will be understood from the following detailed description.

## The Constant Vacuum

In the Winter 1992 issue of 21st Century one reads of an interview with Martin Fleischmann and his Italian theoretician colleague Giuliano Perparata on the eve of the Third Annual Cold Fusion Conference.

This was an interview which revealed that we could expect a backlash from the criticism levied at the pioneer work on cold fusion. It has aroused retaliation which will take the form of an attack on the weaknesses of much that has become accepted in theoretical physics. The following two quotations from that interview will serve to set the scene for the subject developed in this paper:

'There is something seriously adrift with modern theory. There is a lot of work to be done, lots more to be discovered.'

'Preparata pointed to the hyperfine structure constant, alpha, which relates the electrostatic and electro-magnetic fields and is crucial in physics. "I often ask myself," he said, not really joking, "What if the fine structure constant were like the Dow-Jones index and constantly shifted up and down? Then there could be no science and no rationality .... If it were not for constants such as the fine structure constant and the speed of light, then our universe would not exist.'

Here then is a statement that should cause physicists to wonder and reason as to why the textbooks of science do not discuss the way in which Nature determines that fine structure constant and thereby is able to build our universe. The derivation of the value 137.0359 which is  $\alpha^{-1}$ , where  $\alpha$  is  $2\pi e^2/hc$ , e being the electron electrostatic charge, h Planck's constant and c the speed of light, is crucial to everything that is fundamental in physics. Next, in order of fundamental importance, there is the understanding which can come from the theoretical derivation of  $\beta$ , the proton-electron mass ratio, as 1836.152.

In a 1985 book entitled 'The Fundamental Physical Constants and the Frontier of Measurement' published under the auspices of the Institute of Physics in U.K. B. W. Petley of the National Physical Laboratory describes the theoretical attempts to derive these dimensionless constants and states at page 161:

'No doubt the theoretical attempts to calculate and will continue - possibly with a Nobel prize winning success.'

Now, the reader may wonder how this concerns the triton and cold fusion. Well, perhaps Martin Fleischmann and Giuliano Preparata are unaware of the connection via this author's work, but its very essence is a vacuum medium that bombards us with action and is a seat of events that trigger photon creation, thereby determining, and proton creation which determines. The Physics Letters, **41A**, pp. 423-424 derivation of was published in 1972 and the theoretical derivation of was published by the Italian Institute of Physics under the title: 'Calculation of the Proton Mass in a Lattice Model for the Aether', in Il Nuovo Cimento, **30A**, pp. 235-238 (1975).

The first paper derived in terms of a resonance in a fluid crystal structure of the vacuum and the analysis involved knowledge of the lattice cell dimensions. The underlying research had already at that time solved the problem of gravitation and revealed that a virtual pair of mu-mesons had association with each cell and were the building blocks for hadronic matter including protons. Of particular relevance to the calculation of the proton-electron mass ratio in free space is the way in which, as a rare occasion governed by statistical chance, nine mu-mesons come together at the seat

of a vacuum lattice charge to create a proton.

Here then is Nature's arsenal by which it can act, even from within our bodies, to bombard matter with mu-mesons. These are energy quanta which act in concert to strike the body blow which converts a tritium atom into helium 3 and a deuterium atom into tritium, in the process creating a new nucleon in an act seen as fusion but by promoting the decay of one elsewhere. Indeed, we confront a scenario where Nature is constantly trying to create protons throughout space but it only succeeds where the energy equilibrium as between the sub-quantum vacuum underworld and matter has become unbalanced. Generally speaking, if a new proton is created an old one somewhere nearby must decay. Therefore, if the nuclear chemistry suggests that an intruder proton moves to fuse with the deuteron so creating a tritium nucleus, the real event is probably one where the mumeson attack on the deuteron has caused a proton to appear as a nucleon whereupon the energy equilibrium bookkeeper has 'ordered' the demise of that intruder proton.

This may seem fantasy speculation, but the reader should be mindful of the power of the author's published research by which those and constants were derived. The calculations matched the part-per-million precision of the measured values and were in exact accord.

We can, therefore, proceed to study the triton with confidence and our objective, as with corresponding published work on the neutron, for example, is no less than the aim to confirm the theory by simultaneously deriving values for the magnetic moment, the mass and the lifetime of the triton.

The reader can share in the author's pleasure of discovery by working through this exercise, because the triton, rather curiously, lends itself to straightforward analysis.

It is necessary to engage in some preamble to explain the factors involved but to keep the focus on the objective the argument will advance directly to the calculation of these three values and the reader is asked to keep in mind that the ultimate objective is the calculation of the triton lifetime. The deuteron component of the triton stands as the target and so much of what is discussed is addressed at the deuteron transmutation as if it has the same lifetime in its ground state.

## The Triton's Vital Statistics

The triton has a structure supporting three units of nucleon mass presenting an overall unit of positive charge e. Its mass is slightly less than that of three protons. Indeed, we should begin by working out precisely how much the measured mass differs from that of three protons as that provides the value we need to compare with the one derived theoretically.

We will work in terms of mass expressed in terms of electron rest mass as a number ratio.

The author's data reference is the 2nd Edition of the McGraw-Hill, Condon and Odishaw Handbook of Physics (page 9.65).

Atomic mass of proton plus electron:	1.00782519
Atomic mass of triton plus electron:	3.01604971
Unit atomic mass in electron units:	1822.888

This latter value was found by dividing the first atomic mass into 1837.152..., which is the proton mass incremented by one electron unit.

If we now multiply the first-listed atomic mass by 3 and subtract the second-listed atomic mass, the result is 0.007426 and multiplication by the unit atomic mass in electron units gives 13.54. This, therefore, is the measured mass difference as between 3 protons plus two electrons and the triton.

It follows that the triton has a mass that is 11.54 electron mass units below the combined mass of three protons. Our task is to find the model form of the triton which allows us to calculate this mass discrepancy.

The other items of data we need to extract from the same data source (page 9.93) is (a) the triton lifetime of 12 years, (b) the half-spin unit of angular momentum (presumed to be same as the proton) and (c) the magnetic moment stated in nuclear magnetons to be 2.9789.

It is, however, better for us to avoid reliance on data that is based on indirect measurement and take note of the direct measure of the triton nuclear magnetic moment presented as a ratio in terms of the proton magnetic moment effective in the same reacting environment. This ratio, as quoted from the Dover 1966 text of 'Atomic Physics' by Harnwell & Stevens, is:

## 1.06666

The task ahead is then to guide the reader through the analysis by which the three measured numerical dimensionless values just presented as the triton's credentials are duly derived by pure theory.

## The Magnetic Moment of the Triton

It is appropriate here to refer to the author's paper entitled *'The Theory of the Proton Constants'*, Hadronic Journal, **11**, pp. 169-176, 1988.

On page 174 of this paper the gyromagnetic ratio of the proton is deduced theoretically as being 2.792847367, which compares with the measured value of 2.792847386(63) and so is quite precise, it being computed from a proton modelled on a structured resonant state.

This, in effect, is the proton's own magnetic moment expressed in terms of nuclear magnetons and so one can see that the 2.9789 triton magnetic moment above is derived from the measure 1.06666 and the independent measure of the proton's gyromagnetic properties.

Now, when we have regard to the fact that the triton's magnetic moment is measured as a frequency ratio as between the reaction of a triton and a proton in the same magnetic field, there is the curious feature that the two frequencies have what appears to be a perfect integer ratio, namely 16:15, which is the near-unity ratio factor 1.06666.

This causes one to wonder whether the interfering wave modulation which would develop harmonic interactions somehow locks the response of the triton onto a condition that is exactly set by this 16/15 ratio, even though the true triton magnetic moment with no proton reaction present is virtually that of three nuclear magnetons.

With this doubt, there is little purpose in trying to derive the precise quantity 2.9789 and it suffices for our purposes to justify, if only as an approximation, the triton magnetic moment as being 3 nuclear magnetons.

The interesting point to then take into account is that amongst all atomic nuclei the triton is unique as having by far the largest magnetic moment in relation to its nuclear angular momentum. The ratio is 6:1, whereas  $Ag^{108}$ , which sits between the two stable isotopes of silver, has a half-life of 2.4 minutes and comes closest with an exceptionally high ratio factor of magnetic moment to angular momentum of 4.2.

What is it, therefore, that gives the triton the magnetic moment of 3 nuclear magnetons based on a single half-spin unit of angular momentum?

The simple answer which is now suggested is that the triton comprises three nucleons two of which are protons and one of which is an antiproton. They all react magnetically in opposition to a magnetic field and so the two protons 'spin' one way and the antiproton spins the opposite way. The magnetic moments add to 3 units and the 'spins' add to a single half-spin unit of angular momentum.

This then explains the magnetic moment property and, further, we have now an insight into the structure of the triton.

## The Structure of the Triton

Once the structure of the triton has been pictured in our minds then we can proceed with the confirming analysis by calculating the triton's mass discrepancy and its lifetime.

The interesting feature seen already is that we have not pictured the triton as comprising one proton plus two neutrons. Keep in mind the no-neutron syndrome of cold fusion! Three protons will not hold together even in a quasi-stable aggregation. This is why physicists have taken the easy course and assumed that it consists on two neutrons plus one proton with some kind of glue that introduces a negative mass binding energy.

Such assumption has led them down a blind alley. We need to add something such as beta-minus or beta-plus particles or be bold enough to imagine a stable entity including antiprotons. The truth can only be found by discovering the structure which gives the right answers for the three measured parameters presented above.

Discovery in this pursuit needs inspiration and intuitive analysis and it is here that the author must lead the reader directly to the solution and then show how the calculated properties prove that it has to be the correct structure of the triton.

The triton does, in fact, comprise two protons plus one antiproton, and our only concern now is to understand the 'binding' that holds the three nucleons together but keep the proton and antiproton far enough apart so that they do not fuse and mutually annihilate one another.

Now, here we are guided by the fact that independent analysis of the nature of the deuteron has shown that in its prevalent state it comprises two protons bound together by an intermediate betaminus particle, otherwise termed a positron. This is fully explained in the previous reference, the author's paper *'The Theoretical Nature of the Neutron and the Deuteron'*, Hadronic Journal, **9**, pp. 129-136 (1986). The less prevalent ground state comprises an in-line configuration of three positive beta particles separated by two antiprotons.

We may be further guided by earlier work reported by the author in his book '*Physics without Einstein'*, published in 1969 by the author under the trade name Sabberton Publications. On pages 147-152 of that work there is a description of nuclear bonds, which the author termed chains, which took the form of an alternating sequence of beta-plus and beta-minus particles and which linked adjacent hole-cum-charge sites in the vacuum lattice which locked onto the atomic nucleus and caused it to form a shell structure. Indeed, this theme was further elaborated in the author's paper entitled '*The Chain Structure of the Nucleus'*, published in 1974, also by same publisher.

The data there presented show that a charged meson can attach itself to a charged nucleon to release sufficient energy to account for its own mass-energy and further the total energy of a chain spanning between two vacuum lattice hole-cum-charge sites. Furthermore, there is a balance of mass-energy or mass deficit which one calculates as being some 12 electron mass units.

In these circumstances, and having regard to the fact that we are trying to account for a triton mass deficit of 11.54 electron units, the author sees no point in going further than the assertion that the

triton has a single beta particle chain linking the antiproton and the proton pair, the latter regarded as being seated at an adjacent lattice site in the vacuum lattice system.

The beta particle chains are deemed to be very much a part of the structure of large atomic nuclei. Each chain has up to 170 such particles corresponding to the fact that the vacuum lattice spacing is 108 times the beta particle radius. There are two of the author's papers of easy reference as background to this subject. They are: '*Aether Theory and the Fine Structure Constant*, Physics Letters, **41A**, pp. 423-424, (1972) and '*Theoretical Evaluation of the Fine Structure Constant*', Physics Letters, **110A**, pp. 113-115 (1985).

As will be seen from those papers there is a factor 1843 derived from a resonance closest to a zero potential condition and representing the volume of a vacuum lattice charge in relation to a beta particle. Indeed, the derived value of the fine structure constant was given in the form:

 $\alpha^{-1} = 108\pi(8/1843)^{1/6} = 137.0359$ 

The fact that the space occupied by the vacuum lattice charge can, given enough energy input, develop into 1843 beta particles from which a proton form can condense is crucial to the creation of the nuclear chains, but the action of creation of a proton depends primarily upon the mu-mesons that do the work.

The concept of space conservation in charge particle transmutations is consistent with energy conservation, bearing mind that the pressure or energy density within the charge of the vacuum lattice particle is in equilibrium with the 'gas-type' pressure set up by the mu-meson pairs that, on average, populate each cubic lattice cell of side dimension 108 beta-particle radii. Thus the number of beta particle charge volumes that equals this cube volume is a measure of a factor N which is relevant to the inverse chance of a 'hit' as the annihilation and random position recreation of a mu-meson recycles at the standard (Compton electron) frequency associated with vacuum energy charge pair creation activity.

To evaluate some numbers, note that the lattice charge has a Thomson radius that is larger than the beta particle charge radius by a factor 12.26, which is the cube root of 1843. The energy of the lattice charge is therefore 1/(12.26) or 0.08156 electron units. The number of electron charge volumes in the unit cubic cell of the vacuum is  $(108)^3$  divided by 4/3 and so is 9,324,644. Dividing this by 1843 we find that there are 5059.49 lattice charge volumes of energy 0.08156 electron units in each cubic cell of the vacuum, which is 412.666 electron mass units of energy. This is double a mass energy a little below 207, thereby representing the combined mass energy of a virtual mu-meson pair that is the energy in each cell.

The fundamental derivation of the 108 cell dimension parameter and the 1843 factor, the subject of the author's primary analysis of vacuum energy discussed in the above-referenced 1972 Physics Letters paper, therefore leads to the theoretical derivation of the mu-meson energy quantum. It tells us the energy content of the vacuum state.

The triton, when created, lives amongst this activity and its rather special structure makes it vulnerable to decay owing to the bombardment by those mu-mesons. The core target for that bombardment is not the antiproton or the two proton nucleons in its composition. The target is the vacuum lattice charge to which the triton is attached. The deuteron, however, is also subject to such attack and here, too, the real target is a lattice particle in its near vicinity.

An isolated proton or a deuteron does not need to develop a fixed association with a lattice charge because its mass has not exceeded a critical level above which the dynamic quantum 'Zitterbewegung' behaviour needs a collective balance by a graviton system. The phenomenon of gravitation is dependent upon the inertial reaction of vacuum particles in the form of gravitons which

have a mass-energy of 2.587 GeV, an energy value having an effective mass between two and three proton masses. This is fully explained in the author's works. See, for example, *'The Theory of the Gravitation Constant'*, Physics Essays, **2**, pp. 360-367 (1989).

However, when the proton or deuteron is part of a water molecule the nuclear chain structure of the oxygen atoms will provide the lattice location in the vacuum field system. This is why the cold fusion events we see with free deuterons in a palladium host metal are not, so far as we can judge, occurring in water.

When atomic nuclei exceed the mass of two protons they do, of necessity, share in a collective action requiring dynamic balance by a multiple graviton system and that action requires that their combination as a structured nuclear entity spreads itself over a multiplicity of vacuum lattice sites. The triton, therefore, has to have a nuclear beta particle chain able to bridge two lattice sites and it probably has two protons in close proximity that straddle the lattice charge of one site whereas the antiproton nucleon constituent is seated at the other lattice charge site. Tritium is, of course, radioactive whether in the molecular stucture of water or not and so it warrants respect and caution from a health viewpoint.

# The Triton Lifetime

This structure already discussed now leads us to the calculation of the decay property of the triton. To proceed we restate part of the commentary in the introduction.

In order to set up the nuclear bond in the form of a chain of beta particles a meson charge has to develop as a charge attracted to the proton. This meson charge is termed a Q charge and its energy is that of the unit cell energy, approximately 413 electrons as already explained. Two opposite polarity charges e, having energy E in electron units represented by P and Q and conforming with the J. J. Thomson formula:

$$E = 2e^2/3a,$$

where a is charge radius, will, when attracted so as to be in surface contact at their charge radii, have a combined energy E' which is given by:

$$E' = P + Q - 3PQ/2(P+Q)$$

This formula is basic to proton creation and was mentioned by the author in Physics Today, **37**, p. 15 (1984), so we are not introducing something new at this stage in developing the theory of the triton.

In fact P and Q are in equilibrium as an optimum energy condition for which the negative term is a maximum when P is 1836 and Q is 413.

The point of interest is that E' can be calculated to be 92.7 electron mass units below the value of P.

In other words, given that there are two protons well separated by the diameter of the vacuum lattice charge (or a beta particle in the case of a deuteron), we can see how such a system, which features in the triton composition, can deploy twice the energy of 92.7 electron mass units to assist in a nuclear transmutation. This sums to 185.4 electron mass units.

We then note that the stimulus of 4 pairs of virtual mu-mesons, each of 412.7 electron mass units will suffice with the 185.4 electron mass units to create a proton of 1836 electron mass units. In fact, the energy equation is rigorous in providing exactly the amount of energy needed, which is why the decay of a triton yields so little energy that the result has remained a puzzle to scientists.

The scenario of interest is then the action by which the triton can be the seat of a process by which a proton is created within the triton itself so as to force a transmutation.

The condition we are considering is a coincidence event when 8 mu-mesons hit the lattice charge in the same vacuum cycle. If the result is the creation of a proton then the recovery of the equilibrium of the vacuum/matter interaction will involve the demise of a proton in matter nearby.

The task in determining triton lifetime is simply that of determining proton creation probability in a vacuum lattice site charge within matter.

## **Proton Creation Probability**

As already shown, it takes 8 virtual muons to trigger the action leading to the creation of a proton. The question is how to bring 8 muons together for this purpose. There is an active virtual muon pair in each cell of the vacuum medium, that is for each lattice charge (-e), the latter being neutralized, so far as we can sense in our matter frame, by a positive continuum background.

If the positive virtual muon  $\mu^+$  enters the lattice charge it will momentarily, in the relevant action cycle, render that charge neutral by converting it to some neutral paired charge form. Therefore, to get 8 muon energy quanta to combine in some way, we need to have 8 lattice charges in close proximity in a state in which either all are transiently neutral or, alternatively, 7 are neutral and one is charged to a double unit level, as by being transiently primed by the addition of  $\mu^-$ .

Now, the chances of one lattice charge being primed by either muon in its cell are 2 in 5059. There are 256 combinations of chance simultaneous priming of 8 such lattice charges in each action cycle. The follwing tabulation shows the virtual muon polarity combinations as distributed amongst the various mixed states.

Only the first two entries under S in this table represent states that can satisfy the merger requirements by creating neutral energy quanta with a single nucleating charge. Thus there are 9 chances in the 256 for the conditions to meet the proton creation trigger requirement. In other words, in every action cycle at the Compton electron frequency we have 9 chances in  $(5059)^8$  of proton creation referenced on a particular lattice charge.

 $\begin{array}{c}S \ .. \ \mu^+ \ . \ \mu^- \\ 1 \ ... \ 8 \ ... \ 0 \\ 8 \ ... \ 7 \ ... \ 1 \\ 28 \ .. \ 6 \ ... \ 2 \\ 56 \ ... \ 5 \ ... \ 3 \\ 70 \ ... \ 4 \ ... \ 4 \\ 56 \ ... \ 3 \ ... \ 5 \\ 28 \ ... \ 2 \ ... \ 6 \\ 8 \ ... \ 1 \ ... \ 7 \\ 1 \ ... \ 0 \ ... \ 8 \end{array}$ 

This gives us a 'lifetime' in the sense that the attempt to create a proton can influence a decay process which sheds a proton, as already explained.

That lifetime is:

 $(5059)^{8}/9(1.235 \times 10^{20})$  seconds or 12.2 years

The mean lifetime reported for the triton is 12 years and so this result is a quite remarkable

application of the author's theory.

#### Discussion

Given the above solution to the mysteries of triton decay, it needs little imagination to probe the possibility that a deuteron, in its prevalent state, as two protons sitting on diametrically opposed sides of a central beta-minus particle, could become subject to the stability of a nearby vacuum lattice charge and experience similar proton infusion. In this case, the deuteron would become a triton, whereas in the triton the proton infusion into the two-proton component destroys the beta particle nuclear chain and severs the link with the antiproton component, which thereby becomes involved in a decay which replenishes the virtual mu-meson population of the vacuum.

The deuteron proton infusion process would be accompanied by the demise of a proton elsewhere, but what we would see with two deuterons in close proximity would appear to be one deuteron shedding a proton and a beta minus particle and the other deuteron acquiring a proton and shedding a beta plus particle, which overall amounts to an act of fusion. Two deuterons merge to create a proton and a triton by shedding energy as the two beta particles annihilate one another.

To account for the nucleation of the Q charge forms the less prevalent deuteron ground state composition having five component charges is the best basis for the transmutation under discussion. The central beta particle binds the two proton forms whilst the outer beta particles transform into Q charges to release the extra energy needed to convert the 8 mu-mesons entering the lattice charge target into a proton.

One can develop this theme by investigating the expected excess heat generation rate that could come from the 12 year decay rate for the deuteron ground state and one may further wonder how that process might be accelerated.

However, the main conclusion reached in this work is that there is basis for understanding the cold fusion reaction and the focal issue here is the interpretation of the process by which the triton is naturally radioactive at room temperatures. It is believed that the account presented here will help with that understanding.

## APPENDIX D

[This is the author's paper *The Theory of the Proton Constants* which can be seen as reference <u>1988b</u> on this website.

## APPENDIX E

[This is the author's paper *The Neutron and the Deuteron* which can be seen as reference <u>1986d</u> on this website.]